Utilization of Alcohol-based Hand Sanitizers and Associated Health Risks Among Healthcare Professionals Amid COVID-19 Pandemic: A Cross-sectional Study

Desta Assefa H/mariam (destaassefa24@yahoo.com)
Jimma Institute of Health Sciences: Jimma University https://orcid.org/0000-0002-4154-1263
Tadesse Gudeta
Jimma University

Research

Keywords: alcohol-based hand sanitizers, COVID-19, health care professionals, health risks, utilization

Posted Date: March 18th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-297207/v1

Abstract

Background: Alcohol-based hand sanitizer is a crucial and widely used product to avert the rapid spreading of corona-virus disease (COVID-19). However, frequent apply of alcohol-based hand sanitizer mainly at the point-of-care can cause health risks and shortages in and outside the healthcare facilities. The present study was designed to assess the utilization of alcohol-based hand sanitizers and the incidence of associated health risks among health care professionals in COVID-19 pandemic times.

Method: A descriptive cross-sectional study was conducted at the Jimma University Medical Center, Ethiopia, between April 01 and June 27, 2020. The collected data were analyzed and described using IBM SPSS Statistics software version 21.

Results: Ninety-six health care professionals with 28.69±4.048 years of mean age participated in the study. 95.8% of them practiced alcohol-based hand sanitizers to avert COVID-19 virus transmission in the healthcare setting and community. But they were challenges to practice hand hygiene with alcohol-based hand sanitizers. The common problems were alcohol-based hand sanitizers unavailability 66(68.8%), costly 50(52.1%), and skin damage 8(8.3%). Most of them experienced health risks such as skin dryness 60(62.5%), skin irritation 27(28.1%), ocular irritation 11(11.5%), cough 11(11.5%), and others. These health risks resulted in that 9(9.4%) of them did not practice hand hygiene by alcohol-based hand sanitizers (p-value = 0.999).

Conclusion: To prevent COVID-19 virus transmission by alcohol-based hand sanitizers, health care professionals faced different challenges, such as access to alcohol-based hand sanitizers and reported health risks. Therefore, the regulatory and public health bodies should promote local production of alcohol-based hand sanitizers with careful follow-up, and its health risks management plan should gain attention.

Background

The outbreak of the novel and new disease called coronavirus disease (COVID-19) is causing a massive global health crisis. It also affects all sectors. This respiratory illness is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The main symptoms explicitly linked to COVID-19 are shortness of breath, cough, fever, chills, and fatigue. In March 2020, the World Health Organization declared this outbreak a pandemic [1-5].

Since its emergence, the COVID-19 virus has been rapidly spreading throughout the world. It transmits from human-to-human primarily through respiratory droplets (>5-10 μm in diameter) and contact routes. Contact transmission occurs when the mucosa of the mouth, nose, or eyes is touched by infected hands. Droplet transmission occurs when a person is in close contact (within 1 m) with someone with COVID-19. It causes the risk of mucosae or conjunctiva exposure to potentially infective respiratory droplets [1,5-8].

Till today there is no COVID-19 treatment option in the market. Only vaccine and preventive techniques are of utmost importance to prevent further spread in public and healthcare settings. So, currently, physical distancing, hand hygiene (HH) practices, proper use of all personal protective equipment (masks, goggles, and others) are an integral part of the response to the COVID-19 prevention [1,5].

Appropriate HH practice is the commonly used method to prevent transmission of COVID-19 virus through contaminated hand direct or indirect contact. It can be performed by handwashing using soap and water or using alcohol-based hand sanitizers (ABHSs). If there is visible contamination on the hands, handwashing using soap and water is preferred. Most of the time, if soap and water is not readily available or there is no visible contamination on the hands, the CDC recommends ABHS products in community andhealth care settings [8-12].

The ABHS can exist in liquid, gel, or foam containing 60- 95% ethanol or ≥70% isopropyl alcohol. Relatively, it has a broad microbiological spectrum, time efficiency, better availability at the point of care, and improved skin tolerance. So ABHS is the most effective intervention for HH than handwashing with soap and water [11,13,14].

Health care professionals (HCPs) are at the frontline of combating this highly contagious infectious disease during this COVID-19 pandemic era and have the likelihood of acquiring this disease. So they highly and regularly use ABHSs in the community and at the point-of-care. The frequent or prolonged use of ABHS can facilitate the absorption of it through dermal or inhalation routes. So the frequent or improper use of it may lead to health risks to users and shortages in and outside the healthcare facilities [15-20]. Therefore, the regulatory agencies should be concerned about its potential health risks and supply.

Independent studies on the safety of topical ABHS applications are needed. It may be due to industry bias in many studies and a lack of scientific studies in a resource-limited environment. By conducting the investigations concerning the epidemiology of health risks by topical application of ABHS in a real-life setting, the authors provide at least some scientific evidence. Therefore the present study aimed to explore the self-reported utilization and incidence of health risks caused by ABHSs among HCPs at Jimma University Medical Center (JUMC), Ethiopia.

Methods

Study setting, design, and period

A hospital-based descriptive cross-sectional study design was conducted between April 01 and June 27, 2020. The study was conducted at JUMC. JUMC is one of the oldest public hospitals, the only teaching, and referral hospital in the southwestern part of Ethiopia. With an 800-bed capacity, it provides service for inpatient, outpatient attendants, emergency cases, and deliveries coming to the hospital from the catchment population of over 15 million people. During the COVID-19 pandemic, JUMC has been giving healthcare services to the communities in this hospital. The number of patients seeking care has been increasing during this pandemic. So, the hospital has been providing COVID-19 prevention materials for its staff.

Study population, sample size, study variables, and sampling method

The study populations were HCPs, such as clinical nurses, pharmacists, academicians, medical laboratory technologists, physicians, dental doctors, and midwives working in JUMC during the study period. The HCPs that were on duty during the months of data collection and agreed to participate in the analysis were the study participants. The sample size was only 96 HCPs since data collections were paper-based, and it could be the means of transmission of COVID-19 viruses. It increased the unavailability of study participants on duty and refusal.

Eligibility criteria

The volunteer HCPs who served at a health institute for a minimum of one year and working in JUMC during the study period were eligible to participate in the study.

Data collection tools and procedures

Data collections were done with pretested, structured, and self-administered questionnaires. The questionnaire included questions prepared to evaluate the HCPs' demographics, HH practice, availability, use, and health risks of ABHSs. It was developed by using various standard references [8,11,15,35]

The data collectors were four trained, healthcare professionals. The training was given to data collectors on the research objectives and the contents of the checklist for data collection. Data collection was done by self-administered questionnaires to the respondents at their working area. Then the questionnaire was immediately collected after being filled out.

Data quality assurance and analysis

A pretest was performed, using expert opinion before data collection. Then actual data was collected using a standard questionnaire and a regular check for clarity, completeness, and validity individually and coded. The collected data was entered and analyzed using IBM Statistical Package for Social Sciences (SPSS) version 21. The level of significance was set at 5% ($p< 0.05$).

Ethics approval

The Jimma University Institutional Review Board issued ethical approval before the commencement of the study. The Institutional Review Board reviewed the document, waived the requirement for written formal consent documents, and allowed investigators to obtain verbal informed consent. The data collectors then clarified all relevant details (purpose, risks, benefits, alternatives to participation, etc.) for study participants before the administration of the questionnaire and allowed them to ask questions. Then a verbal agreement was obtained from the volunteers, and data collected. The collected data were kept confidential. The data was only available to the principal investigator and co-author.

Results

Demographic characteristics

Of 96-study participants, most of them were male 61(63.5%). Their mean age was 28.69±4.048 years. Most of the study respondents were clinical nurses 25 (26%), followed by pharmacists 21 (21.9%) *(Table 1).*

Table 1: Demographic characteristics of study participants enrolled

Variables	Frequency (%)
Age (years)	
18-24	8
25-35	82 (85.4)
> 35	6
Religion	
Orthodox	44 (45.8)
Protestant	36 (37.5)
Muslim	15 (15.6)
Other	1
Current education level	
Degree	67 (69.8)
Master/specialist	27 (28.1)
PhD	2
Year(s) spent in a healthcare setting	
< 5 Years	73 (76)
5 -10 Years	19 (19.8)
> 10 Years	4
Job category	
Academician	15 (15.6)
Pharmacist	21 (21.9)
Medical laboratory technologist	13 (13.5)
Nursing	25 (26)
Medical doctor	7 (7.3)
Dental doctor	7 (7.3)
Midwifery	6 (6.3)
Others	2 (2.08)

According to the present study, the study participants were providing health services for the communities at different healthcare service units. *(Figure 1)*

Legends: *ICU: Intensive care unit, OPD: Outpatient Department*

The COVID-19 pandemic prevention techniques practice among health care professionals

As the HCPs are among the largest groups most at risk of getting COVID-19, they were practicing different prevention techniques to prevent transmission to staff, between staff, between staff and patients/visitors, and in the community (*Table 2*). Of the study participants, 39 (40.6%) of them have taken training on COVID-19 prevention techniques.

Table 2: COVID-19 prevention techniques practice by health care professionals in Jimma Medical Center

s.№	COVID-19 prevention techniques used	Frequency (%)
1.	Handwashing with soap and water	93 (96.9)
2.	Physical distancing	87 (90.6)
3.	Non-pharmaceutical equipment	78 (81.3)
4.	Alcohol-based hand sanitizers	92 (95.8)

Alcohol-based hand sanitizers and challenges of practicing among health care professionals

The present study demonstrated that following the outbreak of COVID-19, 80 (83.3%) respondents carry ABHSs in their pocket when they go to the healthcare facility. They preferred using ABHSs due to they know that it is the most effective 45 (46.9%), easily available 26 (27.1%), provided by health facility 5 (5.2%), not costly 4 (4.2%), and other reasons 16 (16.7%).

The present study showed that unavailability of ABHSs 66 (68.8%), costly 50 (52.1%), forgetting 11 (11.5%), skin damage 8 (8.3%), unpleasant taste 3 (3.12%), wearing glove 3 (3.12) and others were the main reasons for not appropriately practicing HH by ABHSs.

1. Availability of alcohol-based hand sanitizers

According to the present study, due to the reported substandard ABHSs products in the market, getting the product with approved quality was becoming a major problem. The respondents mostly purchased from pharmacy 50 (52.1%), shop 11 (11.5%), another area 1, and obtained from their institution 34 (35.4%).

2. Self-reported experienced health risks of alcohol-based hand sanitizers

As HCPs are the frequent users of ABHSs, especially after the outbreak of COVID-19, the prevalence of health risks of ABHSs was examined. *(Table 3)*

Table 3: Types of alcohol-based hand sanitizers used and self-reported health risks experienced by health care professionals

Experienced health risks		Types of ABHSs and number of users (%)					
		Ethanol-based, 65 (67.7%)		Isopropanol based, 10 (10.4%)		Denatured ethanol based, 32 (33.3%)	
		No	Yes	No	Yes	No	Yes
skin irritation	No	20	11	62	24	49	15
	Yes	49	16	7	3	20	12
skin dryness	No	11	20	33	53	22	42
	Yes	25	40	3	7	14	18
unpleasant residual	No	26	5	71	15	52	12
	Yes	52	13	7	3	26	6
Ocular irritation	No	27	4	78	8	58	6
	Yes	58	7	7	3	27	5
Cough	No	25	6	77	9	59	5
	Yes	60	5	8	2	26	6
GI disturbance	No	31	0	82	4	61	3
	Yes	61	4	10	0	31	1
Confusion/ headache	No	30	4	85	1	62	2
	Yes	64	4	9	1	32	0
Splashing	No	29	2	85	1	63	1
	Yes	64	1	8	2	30	2

Table 4: Statistic association between types of alcohol-based hand sanitizers used and commonly experienced health risks

Experienced health risks	Types of alcohol used in ABHS					
	Ethanol-based 65(67.7%)		Isopropanol based 10(10.4%)		Denatured ethanol 32(33.3%)	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value
skin irritation	1.68(0.67-4.25)	0.27	0.90(0.22-3.78)	0.89	0.21(0.20-1.28)	0.15
skin dryness	1.14(0.47-2.77)	0.78	0.69(0.17-2.85)	0.61	1.49(0.62-3.54)	0.37
unpleasant residual	0.77(0.25-2.39)	0.65	0.49(0.11-2.12)	0.34	1.0(0.34-2.97)	1
Ocular irritation	1.23(0.33-4.55)	0.76	0.24(0.05-1.11)	0.068	0.56(0.16-1.99)	0.37
Cough	2.88(0.81-10.31)	0.10	0.47(0.9-2.55)	0.38	0.37(0.10-1.31)	0.12

Discussion

The COVID-19 incidence has become a health threat to the general population worldwide. Since the outbreak, due to no antiviral therapy discovered yet, the use of preventive strategies became enforced worldwide to fight and stay safe from COVID-19. Therefore WHO strongly suggested different types of ABHSs for frequent hand hygiene [2,21-26]. The findings of the current study corroborate this recommendation of the WHO. But binary logistic regression analysis indicated that there is no significant association between preferring ABHSs and taking formal training on COVID-19 prevention techniques (AOR 0.741; 95% CI 0.196-2.793; P= 0.658). It should be due to the study participants were health care professionals, and during the study time, great attention was given to the prevention of the COVID-19 pandemic.

During the COVID-19 incidence, the enormous demand for and consumption of ABHSs created major challenges to get and use ABHSs for HH as a primary prevention technique [27,28]. In accordance with the results of the present study, ABHS unavailability, cost, forgetting, and skin damage were the main reasons for not performing HH by ABHSs. Especially the unavailability of ABHSs was the main reason for not performing HH by ABHSs in the community and healthcare settings. Binary logistic regression analysis indicated that the ABHSs unavailability contributes more than four times to not practicing ABHSs (AOR 4.118; 95% CI 0.878-19.318; P= 0.073). The finding in this study was in line with other studies conducted in the Central Gondar Zone in five public primary hospitals (2019) [29]. Despite allowed local production of ABHS by the WHO [8], substantial shortages should be due to regular use of ABHS such as at the five-moments in the clinical setting.

The safety of improper and frequent usage of ABHS should regain attention because of their ever-increasing use as the main HH agent for COVID-19 prevention worldwide [32]. According to the findings of the present study, 79 (82.3%) study participants were experienced different health risks. Skin dryness, skin irritation**,** and ocular irritation *were commonly reported (Table 3).* These findings have supported the findings reported from studies conducted by G. Kampf, H Loffler (2003) [32], Lachenmeier DW (2008) [30], Santos C (2017) [31], Jairoun AA (2020) [28] and A. Mahmood *et al* (2020) [20]. These findings indicated that these risks were associated with the frequency and improper use of ABHS or lack of emollients in the product.

The finding of the present study reported skin dryness and skin irritation as the most health risks experienced. It should be due to topical-application of ABHSs, and the most prone organ for adverse effects appears to be the skin, which comes into direct contact with the agent. However, there is no statistically significant association between experienced health risks and types of ABHS used. *(Table 4)* These skin risks can be improved by locally preparing and supplying or using ABHSs containing appropriate emollients according to the WHO guideline. The use of emollients in facilitating skin barrier regeneration is widely accepted even by affected individuals [32,33]. So, the HCPs should use moisturizers containing ABHSs to increase compliance, maintain healthcare quality, and skin safety during the fight against COVID-19.

According to the present study, 9 (9.4%) of respondents who experienced health risks do not practice HH by ABHS due to experienced risks (p-value = 0.999). The association between experienced health risks and not practicing ABHS for HH was insignificant. It should be due to the users' belief that, relative to other HH maintaining measures, ABHSs are most effective (advantages outweigh its risks), better tolerated, and often associated with better acceptability. These results corroborate the findings reported by different studies [15,34,35,36].

Strength and limitation of the study

The present study provided evidence to support the development and implementation of an action plan for preventing ABHSs health risks and proper use of standard products. Furthermore, the data can be used for further study by the scientific communities. A limitation of this study can be noted that the number of study participants was not adequate to distinguish statistically significant results. Besides this, the questions were self-evaluation and most susceptible to bias. In real-life scenarios, what the study participants respond cab be different from what they practice.

Conclusion

ABHSs were used by most HCPs to minimize transmission of COVID-19 to staff, between staff, between staff and patients/visitors, and in the community. They prefer ABHSs due to it is most effective, easily available, provided by their health facility, and other reasons. They mostly purchased ABHSs from pharmacies and shops. During the COVID-19 pandemic time, HCPs were getting challenges to get ABHSs and practice it as primary COVID-19 prevention technique due to the unavailability of ABHSs, costly, forgetting, skin damage, unpleasant taste, and others to practice HH by ABHSs. ABHSs enormous demand and regular use are leading to substantial shortages in the supply and an increase in its cost. As HCPs are frequent users of ABHSs, HCPs experienced different health risks; mainly like skin dryness, skin irritation, ocular irritation, cough, and others. Therefore, while its benefits outweigh its health risks, the range of harm caused to the skin by ABHS cannot and should not be overlooked.

Recommendation

Currently, ABHSs are heavily consumed in the community and healthcare settings to ensure adequate patient care and HCPs safety. Therefore, the present study recommends that the shortage of ABHSs can lead to fraudulent production and sales of poor quality and even dangerous products. Therefore, the regulatory and public health bodies' effort to ensure the availability and quality of ABHSs to meet the demand during this pandemic time was needed. Additionally, the prevalence of health risks should be investigated, and the management plan should gain attention. So, the findings of the present study can be used by interested researchers and other interested bodies to have a better outlook for understanding the issues.

Operational definition

Hand hygiene: removal or killing of transient microorganisms from the hands

Health care professional: a person who is qualified and allowed by regulatory bodies to provide a healthcare service to clients (patient)

Health risk: an adverse event due to a specific condition

Utilization: the action of making practical and effective use of something

Abbreviations

ABHSs: alcohol-based hand sanitizers; **COVID-19**: Coronavirus disease; **HCP**: healthcare professional; **HH**: hand hygiene; **JUMC**: Jimma University Medical Center

Declarations

Ethics approval and consent to participate: Formal verbal consent was obtained from Jimma University Institutional Review Board. During the study period, all study participants were asked for voluntarily participation in the study using formal verbal consent.

Competing interest: No potential conflict of interest

Consent for publication: The authors declared they agree to publish the manuscript.

Authors' contributions: Both authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Funding: Nil

Acknowledgments: not applicable.

Authors' contributions: Both authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

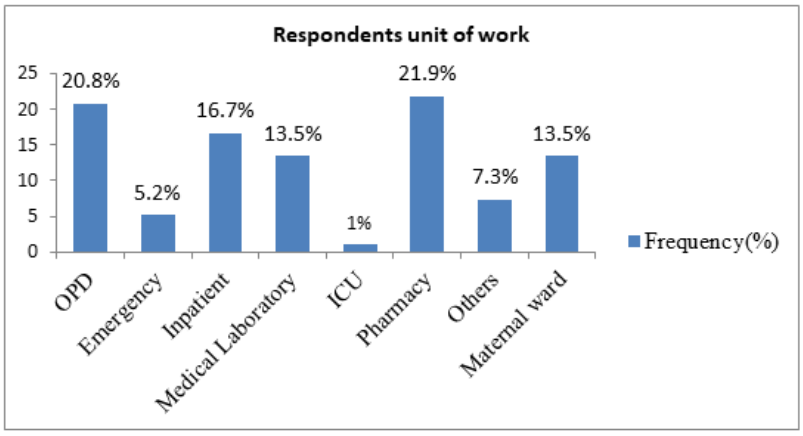
References

1. Kampf G, Todt D, Pfaender S. E.Steinmann. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect. 2020;104:246–51.

2. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. Int J Antimicrob Agents. 2020;55(3):105924.
3. Li Q, Guan X, Wu P, Wang X, Zhoe L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N Engl J Med. 2020;382(13):1199–207.
4. COVID-19 pandemic. https://www.undp.org/content/undp/en/home/coronavirus.html. Accessed August 5, 2020.
5. Coronavirus disease 2019 (COVID-19). https://www.mayoclinic.org/diseases-conditions/coronavirus/symptoms-causes/syc-20479963. Accessed July 27, 2020.
6. Ong SWX, Tan YK, Chia PY, Lee TH, Ng OT, Wong MSY, et al. Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. JAMA. 2020;323(16):1610–2.
7. Transmission of SARS-CoV-2: implications for infection prevention precautions. https://www.who.int/news-room/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-prevention-precautions. updated July 9, 2020. Accessed August 7, 2020.
8. Interim recommendations on obligatory hand hygiene against transmission of COVID-19. https://www.who.int/publications/m/item/interim-recommendations-on-obligatory-hand-hygiene-against-transmission-of-covid-19. updated April 1, 2020. August 7, 2020.
9. Derek K, Chu EA, Akl S, Duda, et al. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis. The Lancet. 2020;395(10242):1973–87.
10. Operational planning guidance to support country preparedness and response. updated May 22. 2020. https://www.who.int/publications/i/item/draft-operational-planning-guidance-for-un-country-teams. Accessed August 7, 2020, 2020.
11. WHO guidelines on hand hygiene in health care: first global patient safety challenge clean care is safer care. Geneva, Switzerland: World Health Organization; 2009. https://apps.who.int/iris/bitstream/handle/10665/44102/9789241597906_eng.pdf;jsessionid=52F093414E240C988D697A9AA9BF98C6?sequence=1. Accessed August 5, 2020.
12. Hand hygiene recommendations. https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html. Accessed November 21, 2020.
13. Edmonds SL, Macinga DR, Mays-Suko P, et al. Comparative efficacy of commercially available alcohol-based hand rubs and World Health Organization-recommended hand rubs: formulation matters. Am J Infect Control. 2012;40(6):521–5.
14. Yip L, Bixler D, Brooks DE, Clarke KR, Datta SD, Dudley S Jr, Komatsu KK, et al. Serious Adverse Health Events, Including Death, Associated with Ingesting Alcohol-Based Hand Sanitizers Containing Methanol - Arizona and New Mexico, May-June 2020. MMWR Morb Mortal Wkly Rep. 2020;69(32):1070–3.
15. Risk Assessment for Use of Alcohol-Based Handrubs in Healthcare Facilities. https://www.safetyandquality.gov.au/sites/default/files/2019-10/generic_alcohol-based_handrub_whs_risk_assessment_form.pdf. Accessed 28 July 2020.
16. Kampf G, Scheithauer S, Lemmen S, Saliou P, Suchomel M. COVID-19-associated shortage of alcohol-based hand rubs, face masks, medical gloves, and gowns: proposal for a risk-adapted approach to ensure patient and healthcare worker safety. J Hosp Infect. 2020;105:424–7.
17. Berardi A, Perinelli DR, Merchant HA, Bisharat L, Basheti IA, Bonacucina G, et al. Hand sanitisers amid COVID-19: A critical review of alcohol-based products on the market and formulation approaches to respond to increasing demand. Int J Pharm. 2020;584:119431.
18. Pires D. F. Bellissimo-Rodrigues, D. Pittet. Ethanol-based handrubs: Safe for patients and health care workers. *American Journal of Infection Control*.2016; *44: 858-9*.
19. Santos C, Kieszak S, Wang A, Law R, Schier J, Wolkin A. Reported Adverse Health Effects in Children from Ingestion of Alcohol-Based Hand Sanitizers — United States, 2011–2014. MMWR Morb Mortal Wkly Rep. 2017;66:223–6. DOI:http://dx.doi.org/10.15585/mmwr.mm6608a5.
20. 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. 2020;48(9):1062–7.
21. Ali S, Noreen S, Farooq I, Bugshan A, Vohra F. Risk assessment of healthcare workers at the frontline against COVID-19. Pak J Med Sci. 2020;36(COVID19-S4):COVID19–99.
22. COVID-19: protecting health-care workers. *The Lancet*. 2020;395(10228):922. updated March 21, 2020.
23. Treatments and a vaccine for COVID-19. The need for coordinating policies on R&D, manufacturing and access. http://www.oecd.org/coronavirus/policy-responses/treatments-and-a-vaccine-for-covid-19-the-need-for-coordinating-policies-on-r-d-manufacturing-and-access-6e7669a9/. Accessed August 04, 2020.

24. Hand sanitizer toolkit. Information for compounders, drug manufacturers and other facilities. https://www.usp.org/covid-19/hand-sanitizer-information. Accessed August 2, 2020.
25. Hand. hygiene recommendations. https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html.Updated May 17, 2020. Accessed 30 July 2020.
26. 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. 2020;10;742:140561. DOI:10.1016/j.scitotenv.2020.140561.
27. Coronavirus (COVID-19). update: FDA continues to ensure availability of alcohol-based hand sanitizer during the COVID-19 pandemic, addresses safety concerns. https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-continues-ensure-availability-alcohol-based-hand-sanitizer-during. updated April 27, 2020. Accessed August 5, 2020.
28. Jairoun AA, Al-Hemyari SS, Shahwan M. The pandemic of COVID-19 and its implications for the purity and authenticity of alcohol-based hand sanitizers: The health risks associated with falsified sanitisers and recommendations for regulatory and public health bodies. Res Social Adm Pharm. 2020 Apr 20. https://doi.org/10.1016/j.sapharm. 2020.04.014.
29. Engdaw GM, Andualem Z. Hand hygiene compliance and associated factors among health care providers in Central Gondar zone public primary hospitals, Northwest Ethiopia. Antimicrob Resist In. 2019;8:190.
30. Lachenmeier DW. Safety evaluation of topical applications of ethanol on the skin and inside the oral cavity. J Occup Med Toxicol. 2008;3:26. doi:10.1186/1745-6673-3-26. Published 2008 Nov 13.
31. Santos C, et al. Reported adverse health effects in children from ingestion of alcohol-based hand sanitizers-United States, 2011–2014. Morbidity and mortality weekly report. March. 2017;3(8):223–26. 66(.
32. Kampf G, Loffler H. Review. Dermatological aspects of a successful introduction and continuation of alcohol-based hand rubs for hygienic hand disinfection? J Hosp Infect. 2003;55:1–7.
33. Cavanagh G, Wambier C. Rational hand hygiene during COVID-19 pandemic. J Am Acad Dermatol. 2020;82(6):e211.
34. Graham M, Nixon R, BurrellLJ, Bolger C, Johnson PDR, Grayson ML. Low rates of cutaneous adverse reactions to alcohol-based hand hygiene solution during prolonged use in a large teaching hospital. Antimicrob Agents Chemother 2005;49:4404–5.
35. Alcohol-based handrub risks/hazards. https://www.who.int/gpsc/tools/faqs/abhr2/en/. Accessed August 5, 2020.
36. Singh M, Pawar M, Bothra A, Choudhary N. Overzealous hand hygiene during the COVID 19 pandemic causing an increased incidence of hand eczema among general population. J Am Acad Dermatol. 2020;83(1):37–41.

Figures



Legends: *ICU: Intensive care unit, OPD: Outpatient Department*

Figure 1

Respondents healthcare service unit in Jimma Medical Center amid COVID-19 pandemic