

COVID-19 Pandemic and its Implication on Hand Hygiene Status by Alcohol-based Hand Sanitizers Among Healthcare Workers in Jimma University Medical Center, Ethiopia

Desta Assefa (✉ desta4best@gmail.com)

Jimma University <https://orcid.org/0000-0002-4154-1263>

Tsegaye Melaku

Jimma University

Bodena Bayisa

Jimma University

Sintayehu Alemu

Jimma University

Research

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Abstract

Background: Pandemic corona virus disease (COVID-19) is a global health crisis of our time. *The consistent practice* of hand hygiene, especially by proper use of alcohol-based hand *sanitizers* in health facilities and community is *a cardinal step* in combating it. This study was designed to assess self-reported level of knowledge, attitude and compliance to WHO recommended hand hygiene status by alcohol-based hand *sanitizers* among *healthcare* workers during a *COVID-19 pandemic* in Jimma University Medical Center, Ethiopia.

Methods: Questionnaire-based descriptive cross-sectional study was conducted between April and June 2020. Data were analyzed using SPSS version 21 with significance level at $p < 0.05$.

Results: From a total of 96 volunteer study participants (27nurses; 21pharmacists, 15academicians, 13medical laboratory technicians, 7physician, 7dental doctors, 6midwives) 61 were males. Their mean age was 28.69 ± 4.048 years. Alcohol-based hand sanitizers were used by 95.8% respondents to prevent spreading of COVID-19. The majority (93.8%) of the respondents had good knowledge; 74% had a good attitude and 76% had good hand hygiene practices by alcohol-based hand sanitizers. They got information about this technique mainly from mass media 71(74%) and training (40.6%). 84.5% respondents were facing challenges during alcohol-based hand sanitizer use due to it is unavailable 66(68.8%), expensive 50(52.1%), forgetting 11(11.5%), experiencing and/or fearing health-associated risks (skin irritation(28.1%), skin dryness(62.5%), ocular irritation(11.5%), etc).

Conclusion and recommendation

The majority of respondents had good knowledge; but the attitude and adherence to standard guidelines need improvement. The hospital should catalyze behavioral change, provide emollient containing hand sanitizers and educational courses to achieve and sustain improvements.

Background

Corona virus disease (COVID-19) has been identified as the cause of an outbreak of respiratory illness in Wuhan, Hubei Province, China in December 2019 and January 2020. On March 11, 2020, the WHO declared COVID-19 a global pandemic. It is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that may *cause* various symptoms such as fever, severe respiratory distress, cough and chest radiographs showing invasive *pneumonia* infiltrates in both lungs^{1,2,3}.

Since its emergence, this pandemic has demonstrated the capability to spread rapidly in the world and causing a global health crisis of our time such as devastating social, health outcome, economic and political crises that will leave deep scars. Its' impact will vary from country to country and will most likely increase poverty and inequalities at a global scale^{4,5,6}.

Current evidence indicates that human-to-human transmission of SARS-CoV-2 is through respiratory droplets or contact. Contact transmission occurs when contaminated hands touch the mucosa of the mouth, nose, or eyes. The virus can also be transferred from one surface to another by contaminated hands, which facilitates indirect contact transmission. The infected persons can transmit the virus even when they have no, or only mild, symptoms^{3, 7, 8}. Consequently, preventing the spread is extremely important to reduce the general burden of the disease. Currently the WHO is recommending social distancing, appropriate use of all personal protective equipment (masks, goggles and others) and hand hygiene (HH) practices to prevent COVID-19 virus transmission⁷.

Practicing HH which includes the use of alcohol-based hand sanitizer (ABHS) or hand washing with soap and water is a simple and yet effective way to prevent the spread of COVID-19 in healthcare settings^{9, 10}. Unless hands are visibly soiled, ABHS is recommended by WHO over hand washing with soap and water in most clinical situations. This may be due to ABHS related wide microbiological spectrum, time and cost effectiveness, availability at the point of care, improved skin tolerance and better compliance. The ABHS should contain at least 60% **ethanol or 70% isopropanol to kill COVID-19 virus**^{11, 12, 13, 14}.

Following the outbreak of COVID-19, the popularity of ABHSs in healthcare and community settings is increased. But, different studies done before COVID-19 outbreak showed that overall compliance is poor in developing countries, and it is hard to promote HH by using WHO multi-strategy^{15, 16}. And also improper use of ABHS can result in development of antimicrobial resistance. So, situational analysis of HH structures, resources, promotion and practices within healthcare facility is needed to facilitate the development of an action plan for strengthening the facility's HH program. So, this study focused on assessing the self-reported level of knowledge, attitude and compliance with WHO recommended HH status by ABHS among healthcare workers (HCWs) during COVID-19 pandemic in Jimma University Medical Center (JUMC), Ethiopia

Methods

Study setting and design:

A descriptive cross-sectional study was conducted between April and June 2020 in JUMC. JUMC is one of the oldest hospitals in Ethiopia and the only teaching and referral hospital in southwest Ethiopia. It has 800 bed capacity and a catchment population of over 15 million people. More than 400,000 patients can be served at emergency, outpatient departments and various inpatient units per budget year.

Study population, sample size and sampling method:

The study populations were HCWs (clinical nurses, pharmacists, academicians, medical laboratory technicians, physicians, dental doctors and midwives) working in JUMC. They were all HCWs who were on duty in the months of data collection. All volunteers that agreed to participate in the study and had served health institute for a minimum of one year were included in the study. The study participants were ≥ 18

years of age. Due to data collection was paper based and it can be the means of COVID-19 virus transmission, the respondents were only 96 HCWs.

Data collection:

It was done with pretested, structured and self-administered questionnaires. The questionnaires were delivered to the respondents when they were at work area and collected soon after filled.

Data quality assurance:

The necessary correction was made on the questionnaires that need correction accordingly and invalid questions were removed before the actual data collection. All filled questionnaires were checked regularly for clarity, completeness and validity individually.

Statistical analysis:

The collected data were entered, tabulated and the results described using appropriate descriptive statistical tests with IBM SPSS version 21. The level of significance was set at 5% ($p < 0.05$).

Knowledge, attitude and HH practice of the respondents were assessed and described using qualitative terms of self-evaluation. Awareness of the respondents was assessed and categorized as knowledgeable and not knowledgeable. Those who agreed to the fact on the WHO guidelines on HH in health care and responded $\geq 50\%$ correctly were considered as knowledgeable¹⁵. For attitude description, terms like strongly agree, agree, neutral, disagree and strongly disagree were used and those who agreed and strongly agreed to the facts and responded $\geq 50\%$ correctly were considered as good attitude¹⁷. For evaluation of compliance to five moments on WHO guidelines (before patient contact, before clean/aseptic procedures, after risk of body fluids, after patient contact and after contact with patient surroundings) always, often, sometimes, seldom and never were used. Practicing always and responding $\geq 50\%$ correctly were considered as compliant/ good practice¹⁸.

Ethics approval:

It was obtained from the Ethics and Research Committee of the hospital. Verbal consent was obtained from the respondents prior to administration of questionnaire.

Operational Definition

Academician:

Health professionals giving health services in JUMC and academic activity in Jimma University

Knowledge is defined as having adequate understanding about hand washing.

- **Knowledgeable:** earning score of 50% and above on the knowledge questions
- **Not knowledgeable:** earning score less than 50% on the knowledge questions

Practice is defined as an act of performing given procedure(s) according to a set standard¹⁸.

- **Good practice:** study participants who responded to the practice questions $\geq 50\%$ in line with the recommended hand washing practice
- **Poor practice:** study participants who responded to the practice questions $< 50\%$ in line with the recommended hand washing practice

Attitude is defined as belief of the respondents towards the facts on the WHO guidelines on HH in health care.

- **Good attitude:** who agree and strongly agree to the facts and responded $\geq 50\%$ correctly the attitude questions
- **Poor attitude:** who responded $< 50\%$ correctly the attitude questions

Results And Discussion

General characteristics of enrolled healthcare workers

Taking into account a non-response rate, due to COVID-19 pandemic period and transmission ways, 96 questionnaires were adequately filled and returned by 96 volunteer HCWs. Among the participants, the majority of respondents were clinical nurses 27(28.1%); followed by pharmacists 21(21.9%), academicians 15(15.6%), medical laboratory technicians 13(13.5%), physicians 7(7.3%), dental doctors 7(7.3%) and midwives 6 (6.3%). Their mean age was 28.69 ± 4.048 years (*table 1*).

Table 1: General profile of study participants

Variables		n (%)
Age (years)	18-24	8
	25-35	82(85.4)
	> 35	6
Sex	Male	61 (63.5)
	Female	35 (36.5)
Religion	Orthodox	44 (45.8)
	Protestant	36 (37.5)
	Muslim	15 (15.6)
	Other	1
Marital status	Married	52 (54.2)
	Single	44 (45.8)
Current education level	Degree	67 (69.8)
	Master/Specialist	27 (28.1)
	PhD	2
Years spent in healthcare setting	< 5 Years	73(76)
	5 -10 Years	19(19.8)
	> 10 Years	4

Knowledge of respondents about hand hygiene by alcohol-based hand sanitizer

Outbreak of COVID-19 is a global health crisis of our time and become the greatest challenge faced since World War II. Current evidence indicates that the COVID-19 virus is transmitted through respiratory droplets or contact. Due to no drug or vaccine has been found, WHO recommended different prevention techniques^{2,19}. So in the present study, the study participants were using hand washing using water and soap 93(96.9%), ABHS 92(95.8%), non-pharmaceutical equipments (such as mask, goggles) 78(81.3) and social distancing 87(90.6%).

The HH by either ABHS or hand washing using water and soap is more critical. Commonly, most study participants relatively preferred ABHS¹⁵. According to this study, the majority (90(93.8%)) of the respondents had good knowledge about HH by ABHS to prevent spreading of COVID-19 (*table 2*). This

result agrees with studies conducted in Dubti Referral Hospital, Northeastern Ethiopia (2018)²⁰ and in Lagos University Teaching Hospital, South-West Nigeria (2011)¹⁷.

Table 2: Knowledge of respondents on hand hygiene by alcohol-based hand sanitizer to prevent COVID-19

Statement about hand hygiene by ABHS	Responses n (%)	
	Knowledgeable	not knowledgeable
HH is necessary even if gloves are used when touching patients.	88(91.7)	8(8.3)
When hands are visibly dirty, ABHS alone cannot be used for HH.	79(82.3)	17(17.7)
Removal of dirt can increase the effectiveness of ABHS	82(85.4)	14(14.5)
Both hands should be dried before using ABHS	85(88.5)	11(11.4)
The minimal time needed for ABHS to kill COVID-19 virus on your hands is 20 seconds.	75(78.1)	21(21.9)
Using ABHS for HH is less time-consuming, at least as efficient, and convenient than hand washing with soap and water	70(72.9)	26(27.1)
Poor adherence to HH practice is a primary contributor to COVID-19	84(87.5)	12(12.5)
ABHS causes skin dryness more than hand washing with water & soap	74(77.1)	22(22.9)

Knowledge of respondents on alcohol-based hand sanitizer storage condition

Due to the environmental condition affects the quality, safety and effectiveness of ABHS, the WHO recommends standard storage conditions¹⁵. According to this study results less than 75% of the study participants know the recommended storage condition.

Figure 1: Knowledge of respondents about alcohol-based hand sanitizer storage condition

Generally, this study demonstrated that most of the study participants got information about the use of ABHS to prevent COVID-19 and its storage condition from the mass media 71(74%); followed by books and published journals 33(34.4%), discussion with co-workers 26(27.1%), presence of posters for HH in work area 14(14.6%) and seminars conducted occasionally at hospital level 11(11.5%).

Potential risk factors related to lack of knowledge

In the current study, univariate (binary logistic regression) analysis indicated that HCWs knowledge about HH by ABHS was not statistically associated with difference in sex (COR 0.552; 95% CI 0.105-2.894; P=

0.482) and years spent in healthcare setting (COR 0.618; 95% CI 0.068-5.580; P =0.668). Multivariate analysis showed that HCWs who took training on COVID-19 prevention techniques had more than three times knowledgeable than untrained (AOR 3.65; 95% CI 0.41-32.56; P= 0.246) (*table 5*).

Attitude of respondents towards hand hygiene by alcohol-based hand sanitizer

In the current study, almost majority 71(74%) of the respondents had a good attitude towards their knowledge and practicing HH mainly by ABHS and requirement of ABHS for them in their work area. Similar finding has been reported by a study done in a tertiary hospital, South West Nigeria (2011)¹⁷. This positive attitude towards HH by ABHS exhibited by the respondents may be attributed to their knowledge of the consequences of poor HH on transmission of COVID-19 virus.

Table 3: Attitude of respondents towards hand hygiene by alcohol-based hand sanitizer

Attitudes	Response, n(%)					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
You have sufficient knowledge about HH	5	6	3	48(50)	34(35.4)	
You work in a health facility where HH is encouraged	4	3	7	56(58.3)	26(27.1)	
You feel competent on using ABHS in accordance with WHO recommendations	5	8	15(15.6)	48(50)	20(20.8)	
You believe that you are the front-line professional to create awareness on HH practice	3	5	12(12.5)	49(51)	27(28.1)	
You believe that you are one of the most accessible HCWs to patients	2	11(11.5)	12(12.5)	45(46.9)	26(27.1)	
The frequency of HH required does not make it difficult to carry out ABHS as often as necessary.	8	41(42.7)	16(16.7)	26(27.1)	5	
There is no time pressure for not to attend HH courses	5	21(21.9)	17(17.7)	36(37.5)	17(17.7)	
Your HH practice can be further improved	4	8	12(12.5)	50(52.1)	22(22.9)	
If ABHS is provided, it is not difficult for you to use it even if ABHS	residual is not pleasant	3	16(16.7)	13(13.5)	48(50)	16(16.7)
	irritates your skin	2	25(26)	11(11.5)	41(42.7)	17(17.7)
	is not easy to use	5	7	8	54(56.2)	22(22.9)

Potential risk factors related to poor attitude

According to this study results, univariate or multivariate statistical analysis (accordingly) showed that study participants differences in sex ($p=0.96$), age ($p=0.39$), years spent in healthcare setting ($p=0.57$) and current education level ($p=0.35$) did not have a statistically significant association with their attitude towards HH by ABHS (*tablet 5*). Even if it is not statistically significant the respondents considered as knowledgeable had better attitude towards ABHS use than not knowledgeable (COR 0.676; 95%CI 0.118-4; $P= 0.676$).

Compliance of respondents to WHO recommended alcohol-based hand sanitizer practices:

Following the WHO current recommendation, HH is the most effective and simple technique to prevent the spread of COVID-19 in healthcare settings¹⁵. This study showed that most of the HCWs were using both hand washing using water and soap and ABHS 62(64.6%); followed by hand washing using water and soap 23(24%) to keep their HH. Relatively ABHS is preferred than hand washing using soap and water because they believe that ABHS is most effective 45(46.9%), easily available 26(27.1%) (i.e. supply from health facility) 5(5.2%), low cost 4(4.2%) and the others don't know the reason 16(16.7%). This finding is in line with different study^{14,15}.

Compliance for ABHS use of the WHO identified five essential moments in a single care sequence by HCWs who work with patients in any health care setting anywhere in the world generally needs a great concern^{21, 22}. According to this study, majority 73(76%) of the study participants were compliant to the five moments of HH recommended by the WHO. This should be due to improved HCWs awareness of COVID-19 infection control techniques. This study finding shows more compliance to ABHS use than with other study conducted in University of Gondar teaching hospitals²³ and in a tertiary university hospital in Istanbul²⁴. This variation might be due to sample size, study time and outbreak of COVID-19.

Table 4: Compliance of respondents to hand hygiene using alcohol-based hand sanitizer

Compliance evaluation: When to use ABHS?	Frequency of use, n (%)				
	Always	Often	Sometimes	Seldom	Never
Before touching a patient	70(72.9)	11(11.5)	15(15.6)	-	-
Before clean/aseptic procedure	70(72.9)	14(14.6)	9(9.4)	1	2
After body fluid exposure risk	80(83.3)	9(9.4)	6(6.3)	-	1
After touching a patient	82(85.4)	7(7.3)	6(6.3)	-	1
After touching patient surroundings	80(83.3)	8(8.3)	6(6.3)	1	1

Most of the study participants 63 (65.6%) are compliant to ABHS duration of hand rub recommended by the WHO (20-40 seconds)¹⁵. The others were noncompliant to the WHO recommendation (<20 sec= 29(30.2), >40 sec= 4(4.1)).

Potential risk factors related to poor compliance to hand hygiene by alcohol-based hand sanitizer

Compliance to HH by ABHS did not statistically vary with respondents' age, taking training, current education level (*table 5*). In univariate analysis, non-compliance with HH was not associated with sex (COR 1.101; 95% CI 0.413-2.935; P= 0.848). This finding agrees with study conducted in tertiary university hospital in Belo Horizonte, Brazil (2015)²⁵. This might be due to not adequate number of samples is used.

In multivariate analysis, there is a statistical association between compliance to the five moments of HH recommended by WHO and attitude towards HH by ABHS (AOR 2.974; 95% CI 1.093 -8.093; P= 0.033). As a result, those who had a positive attitude on HH had more than 2 times more compliance than a negative attitude. But there is no difference in compliance due to knowledge of ABHS use and compliance to practicing it accordingly (COR 0.286; 95% CI 0.053-1.526; P= 0.143). This result does not agree to study conducted in Central Gondar zone public primary hospitals in which knowledgeable study participants are 6.74 times more compliant than those who have poor knowledge²³. The difference might be due to sample size issue and study time (COVID-19 pandemic).

The present study demonstrated that lack of ABHS and increasing in cost were identified as the most common reasons for not using ABHS as their preferred technique to prevent spreading of COVID-19. This finding is in line with study conducted in Ruth K.M. Pfau Civil Hospital, Karachi (2019)²⁶; but higher than in study conducted in a tertiary university hospital in Istanbul (2014)²⁴. The difference might be due to high consumption of ABHS in the healthcare setting and community during the study period to due to the outbreak and rapid prevalence of COVID-19 pandemic.

Compliance and self-reported health associated risks of alcohol-based hand sanitizer

According to this study most study participants had been using (alone or alternatively) ethanol based alcohol 65 (67.7%); followed by denatured ethanol 32(33.3%) and isopropanol based 10(10.4%). During their use, most of them experienced different health associated risks; commonly 60(62.5%) skin dryness, 27(28.1%) skin irritation, 18(18.8%) unpleasant taste, 11 (11.5%) ocular irritation, 11(11.5%) Cough, 4(4.2%) gastro-intestinal disturbances and 5 (5.2) others. This results agrees with study conducted in tertiary university hospital in Belo Horizonte, Brazil (2015)²⁵. These risks become one of the reasons for not adhering to the WHO recommended five essential moments to use ABHS by 8 (8.5%) respondents.

Table 5: Factors related to lack of knowledge, poor attitude and practice of hand hygiene

Variables	Knowledge		COR (95%CI)	p-value	AOR (95% CI)	p-value
	knowledgeable	Not knowledgeable				
Sex	male	58	3	1		
	female	32	3	0.55(0.11-2.89)	0.48	
Years spent in healthcare setting	<5	68	5	0.62 (0.07-5.58)	0.66	
	≥5	22	1	1		
Training*	yes	38	1	1		
	no	52	5	0.27(0.03-2.44)	0.25	3.65(0.4-32.56) 0.25
Attitude		Good attitude	Poor attitude			
Sex	male	45	16			
	Female	29	9	1.03(0.40-2.65)	0.96	
Age	18-30	58	23	0.39(0.08-1.86)	0.24	2.06(0.40-10.5) 0.39
	>30	13	2	1		
Years spent in healthcare setting	<5	55	18	1.34(0.48-3.77)	0.57	
	≥5	16	7	1		
Training*	Yes	31	8	1		
	No	40	17	0.61(0.23-1.59)	0.310	
Current education level	Degree	47	20	0.49(0.16-1.47)	0.20	1.73(0.55-5.44) 0.35
	Masters & above	24	5	1		
Compliance		Compliant	Non-complaint			
Sex	male	46	15			
	female	27	8	1.10(0.41-2.94)	0.85	
Age	18-30	60	21	0.44(0.09-2.11)	0.31	

	>30	13	2				
Training*	Yes	28	11				
	No	45	12	1.47(0.57-3.79)	0.42		
Years spent in healthcare setting	<5	51	22	0.11(0.01-0.83)	0.03	8.00(0.99-64.08)	0.05
	≥5	22	1				
Current education level	Degree	47	20	0.27(0.07-1.0)	0.05	2.98(0.78-11.34)	0.11
	Masters & above	26	3				

Legends

- Age and current education level do not fulfill the assumption to analysis knowledge of HCWs due to inadequate sample size
- *= training taken on techniques to prevent COVID-19 virus transmission

NA: Not applicable (Only variables with p values < 0.25 on univariate were put into multivariate regression model), COR: corrected odds ratio, AOR

Conclusion

Out of 96 respondents most of them were using ABHS to prevent and control COVID-19 virus transmission. The majority of them had good knowledge and good attitude towards their using of ABHS to prevent spreading of COVID-19 disease. This study demonstrated that there is no strong evidence of a difference in HCWs sex, years of experiences and obtaining training and their knowledge and attitude towards using ABHS for HH. But study participants considered as knowledgeable had a good attitude towards ABHS and HCWs who took training on COVID-19 prevention techniques had more than three times knowledgeable than untrained. Most of the respondents were adherent to the using of ABHS at the five-moments recommended by the WHO. There is statistically significant difference in years spent in the healthcare setting and their compliance to ABHS use. But lack of ABHS and increasing in its cost were the most common reasons for not using ABHS as needed. Additionally reported skin irritation, unpleasant taste and skin dryness as the health associated risks of ABHS may be related to poor compliance.

Recommendation

This study recommends that to prevent the spreading of COVID-19 virus, efforts to improve HCWs knowledge, attitude and adherence to the WHO guidelines for hand hygiene is needed. So hospital should catalyze behavioral change, provide educational information by mass media, posters and organizing training and developing guidelines with a worldwide perspective to achieve and sustain improvements.

Additionally, as most of the respondents were experiencing skin damage, the hospitals should prepare and supply ABHS containing appropriate emollients locally according to the WHO guideline or the respondents should use emollient containing ABHS to reduce these risks and increase compliance. This very important COVID-19 control approach should be monitored regularly to keep healthcare quality and patient safety.

List Of Abbreviations

ABHS: alcohol-based hand sanitizer, COVID-19: Corona virus disease, HH: hand hygiene, HCW= healthcare worker, JUMC: Jimma University Medical Center

Declarations

Consent to participate:

Verbal consent was obtained from all study participants.

Conflict of interest and consent for publication:

There is no potential conflicts of interest exist with respect to the research, authorship, and publication of this article.

Availability of data and materials:

The data used to support the findings of this study are available from the corresponding author upon request.

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Authors' contributions:

All authors participated in all activities (designing, analyzing and writing the manuscript). They all read and approved the final manuscript.

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Figures

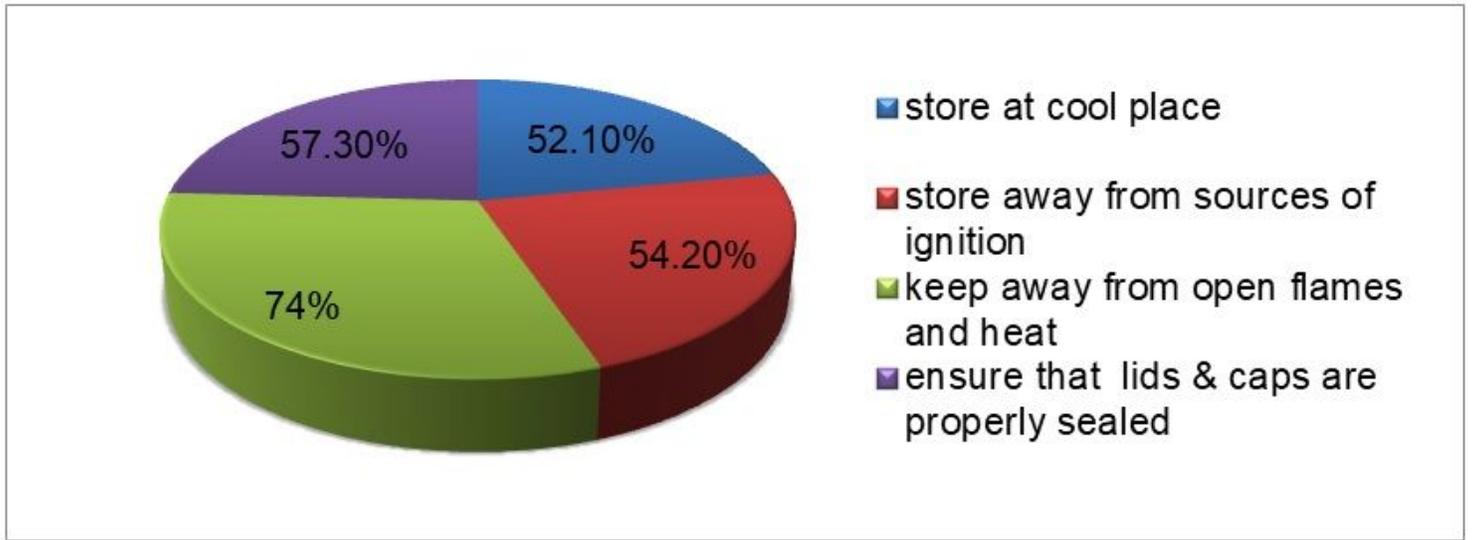


Figure 1

Knowledge of respondents about alcohol-based hand sanitizer storage condition Generally, this study demonstrated that most of the study participants got information about the use of ABHS to prevent COVID-19 and its storage condition from the mass media 71(74%); followed by books and published journals 33(34.4%), discussion with co-workers 26(27.1%), presence of posters for HH in work area 14(14.6%) and seminars conducted occasionally at hospital level 11(11.5%).