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Table of Contents
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Relationship between understanding of COVID-19's infographics and the efforts to prevent COVID-19 transmission

Rahmat Bakhtiar,[1*] Hilda,[2] Krispinus Duma,[1] and Riries Choiru Pramulia Yudia[1]

[1]*Department of Public Health, Faculty of Medicine, Universitas Mulawarman, Samarinda, Indonesia*
[2]*Department of Nursing, East Kalimantan Health Polytechnic of the Ministry of Health, Samarinda, Indonesia*

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Pandemic

ABSTRACT The prevention of disease transmission is an effective cost-strategy in controlling COVID-19. The scenario of the control of COVID-19 in Samarinda City consists of 3 phases, namely initial, advanced, and recovery. The outcome of the advanced phase is flattening the transmission curve of the COVID-19 pandemic, with an increased proportion of patients in recovery, and an increased culture of preventing disease transmission in society. This study aimed at knowing the influence of the understanding of COVID-19 infographics on the efforts to prevent COVID-19 transmission at the advanced phase. A survey was conducted via social media from April 21st to April 30th, 2020. The preventive actions for the disease transmission as the dependent variable in this study were social distancing, wearing a mask, washing hands, and efforts to enhance the body's immunity, while the independent variable was the understanding of COVID-19 infographics updated daily. The results of the study showed that the proportion of the population who understood the infographics well was 79.5%, the community participation in practicing social distancing (81.6%), wearing a mask (50.9%), washing hands as frequently as possible (74.3%), and the efforts to strengthen the body's immune system (73.6%) with a consistency level of 55.12%. The lowest rate for the activity of social distancing was visiting elders or the people suffering from comorbidities with 54.71%. A good understanding of infographics could increase adherence to the recommendations of social distancing. The implementation of social distancing, wearing a mask, washing hands as frequently as possible, and the efforts to improve the body's immune system need to be done consistently to prevent the COVID-19 transmission and as a result, the potential transmission could be minimized to optimize the recovery phase and anticipate the possible second wave of the COVID-19 pandemic.

1. Introduction

The COVID-19 pandemic was declared as an international public health emergency and has resulted in epic global deaths and human damage.[1,2] As a country with community transmission, COVID-19 in Indonesia is spreading without any detection of the source of the infection.[3] The situation related to COVID-19 in Indonesia shows an increased number of cases and the flattening of the epidemic curve has not been seen yet, however, the proportion of recovery cases is increasing.[4] Since the first case was identified on March 18th, 2020, the COVID-19 case numbers in East Kalimantan province have tended to increase. Currently, there are 85 cases confirmed positive cases of COVID-19 and 448 Patients Under Investigation (PDP) dominated by the Gowa cluster transmission.[4,5]

The development of the COVID-19 case numbers in Samarinda City until the end of April 2020 showed that the total confirmed cases were 10 deceased patients, 25 PDP, and 1,036 Patients Under Monitoring (ODP).[5] The increased rate of COVID-19 cases in Samarinda City was estimated to reach its peak at the end of May 2020.[6,7] Despite the low number of cases, it is estimated to increase because Samarinda is surrounded by district areas with local transmissions, such as Kutai Kartanegara and Balikpapan, and provinces with a high number of cases, such as East Java, South Sulawesi, and South Kalimantan. Anticipating the increased incidence, the COVID-19 Task Force team in Samarinda City implemented the 3-phase mitigation strategy, namely the initial phase,

*Correspondence: r.bakhtiar@fk.unmul.ac.id
Departement of Public Health, Faculty of Medicine Mulawarman University, Jl. Krayan Kampus Unmul Gunung Kelua Samarinda Kalimantan Timur 75119, Indonesia

advanced phase, and recovery phase. The strategy of the advanced phase is as follows: increasing the sensitivity towards PDP, optimizing the rapid testing, conducting both self-isolation and isolation in the quarantine facilities, applying lockdown in the local areas, preparing hospitals as a buffer of emergency healthcare, conducting a program of intensive communication with the stakeholders, and educating the community related to the preventive actions against COVID-19 transmission[6].

The increased knowledge of the dynamics of COVID-19 transmission and the efforts to prevent infection with the Severe Acute Respiratory Syndrome-Coronavirus 2 (SARS-Cov2) disease are the effective methods in controlling COVID-19 transmission.[8-11] The entire and massive education is conducted by using social media.[12] The City Health Office along with the Public Information Management Officer of Samarinda City conducted a community outreach with social media-based health education, including WhatsApp (WA), Facebook, and Instagram, and made area mapping based on the potential risks of transmission.[6] The people of Samarinda, one of the fastest-growing cities in Kalimantan, are increasingly demanding access to good quality healthcare information. Even though 98.19% of the people in Samarinda have Smartphones, only 22% of them have actively accessed the COVID-19 information from the Samarinda Health Office channels.[13] This study aimed at knowing the preventive actions against disease transmission based on the education of COVID-19 infographics.

2. Method

The COVID-19 infographic was used by the COVID-19 control team in Samarinda city to spread the information concerning COVID-19 to the society. The information of the COVID-19 infographics consists of the risk of transmission in each region, the total number of patients confirmed positive for COVID-19, the total recovered people, PDP, ODP and the information related to the education on preventing the COVID-19 transmission. These infographics can be accessed via social media as follows: Facebook: SAMARINDASIAGA @samarindasiaga112, @diskominfo.samarinda, @pemkot.samarinda, Instagram: SAMARINDASIAGA112, and the COVID-19 Call Centre at #112.

We conducted a cross-sectional study. All people in Samarinda city who actively access the COVID-19 information every day via their Smart phones, including WA/Facebook/Instagram, are the population of this study. The questionnaire was distributed by the city health officials who announced that the COVID 19 situation in Samarinda had entered an advanced phase for 3 weeks between April 10 and April 31, 2020. The percentage of people ≥ 18 years old who actively accessed the information related to COVID-19 was 22%. It means that the *p*-value was 0.02 and the q-value was 0.78. The limit of error (d) was 0.05. Thus, the required total sample was 242 respondents.

The questionnaire in the Google form was distributed to the society for 10 days after the COVID-19 control team declared that the situation of the COVID-19 pandemic in Samarinda City had entered an advanced phase. This study used a questionnaire that could be accessed via the following link: https://forms.gle/UzAwGaKHqzfuuUsa9. The questionnaire consisted of demographic data, understanding of COVID-19 infographics, the practice of washing hands, keeping a safe distance, wearing a mask, and strengthening the body's immune system. The researchers consulted about the constructs of the study with the experts for their professional judgment and input. The validity test was conducted with 15 respondents using the Google form with a response rate of 80%. The result of the validity test to 15 questions was 0.562 - 0.797. The reliability test was conducted using the internal consistency approach aiming at knowing the consistency between items or parts of the survey questionnaire. This study used Cronbach's alpha formula (Cronbach's coefficient α) and it resulted in (r) of 0.64.

The independent variable in this study was the understanding of the infographics as an early warning system issued periodically by the Department of Communication and Informatics of Samarinda City. Meanwhile, the dependent variable in this study was the preventive efforts by the community consisting of practicing social distancing, washing hands, wearing a mask, and the efforts to strengthen the

body's immune system. The understanding of the infographics was in the form of the interpretation of colors, numbers, the relevancy of information, and the respondent's interpretation toward the potential risks in each village.

The researchers used a (1 – 5) Likert scale ranging from 1-none of the time, to 3-some of the time, and 5-all of the time. Each dependent variable was classified into two groups, namely appropriate with recommendations and not appropriate with recommendations for the preventive actions against disease transmission, by using a cut-off point in the median score. Alternatively, the researchers evaluated the consistency level toward the preventive actions against disease transmission. Even though the approval based on individual information was not required for this study, all data were handled as an unidentified dataset to protect the respondents' privacy and confidentiality. The data analysis described the respondents' characteristics based on the region at risk with univariate analysis, and bivariate analysis using a Chi-squared test (χ^2).

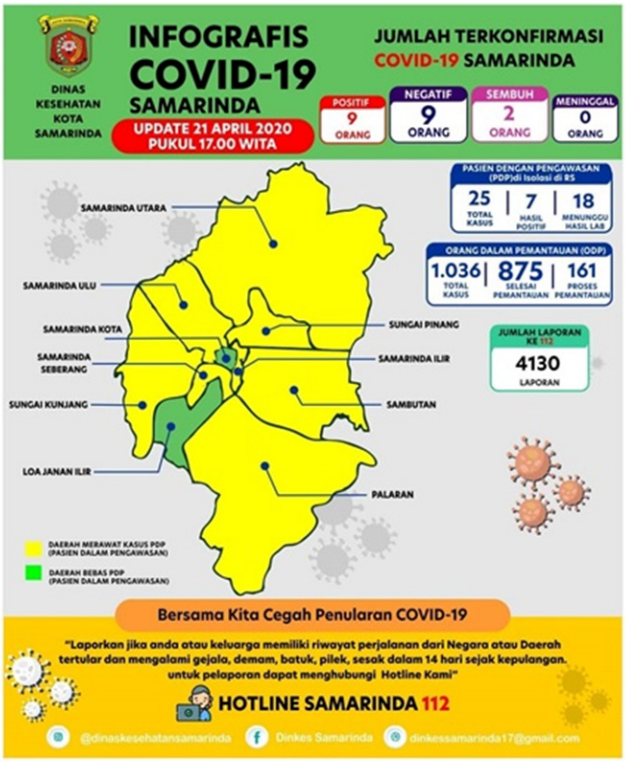
3. Result

The total response from a digital questionnaire sent via a link for 10 days starting from April 21 – April 30, 2020, showed that the total number who responded was 242 respondents. The excluded data were as follows: 6 respondents filled out the form incompletely and 2 questionnaires were filled out by children at the age of below 18 years old so that the total respondents enrolled in this study was 234 respondents.

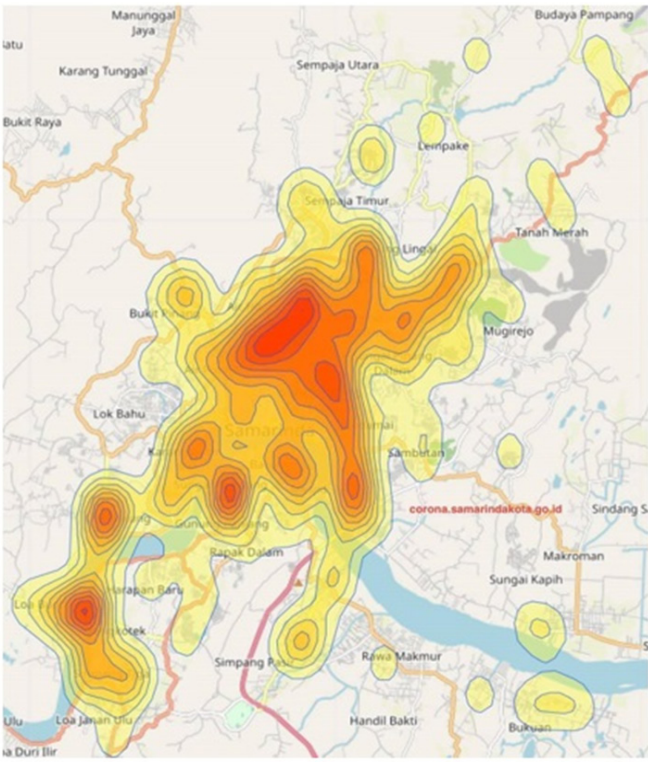
The Samarinda local government used

Table 1. The respondents' characteristics

Respondents' Characteristics		Status of Domicile (N=234)				Total	%	p-value
		High Risk	%	Low Risk	%			
Age	<20 y.o.	18	7.7	13	5.6	31	13.2	0.239
	20 – 30 y.o.	62	26.5	30	12.8	92	39.3	
	31 – 40 y.o.	26	11.1	30	12.8	56	23.9	
	41 – 50 y.o.	20	8.5	17	7.3	37	15.8	
	> 50 y.o.	11	4.7	7	3.0	10	7.7	
	Mean ± SD score for age: 32.29 ± 11.7 y.o. (min:18 max:75)							
Gender	Male	51	21.8	30	12.8	81	34.6	0.391
	Female	86	36.8	67	28.6	153	65.4	
Education	Elementary/Junior High school or equivalent	2	0.9	4	1.7	6	2.6	0.733
	High School or equivalent	43	18.4	24	10.3	67	28.6	
	Associate Degree (D3)	10	4.3	9	3.8	19	8.1	
	(D4)/ Bachelor Degree (S1)	58	24.8	42	17.9	100	42.7	
	Master (S2)/ Ph.D. (S3)	24	10.3	18	7.7	42	17.9	
Occupation	Civil Servant/honorary	29	12.4	26	11.1	55	23.5	0.202
	Entrepreneur	27	11.5	24	10.3	51	21.8	
	Private Employee	14	6.0	6	2.6	20	8.6	
	University Student/Student	36	15.4	15	6.4	51	21.8	
	Others	31	13.2	26	11.1	57	24.3	
Ethnicity	Javanese	66	28.2	48	20.5	104	48.7	0.772
	Buginese/Makassarnese/Torajans	30	12.8	18	7.7	48	20.5	
	Banjarnese	14	6.0	15	6.4	29	12.4	
	Dayaknese	5	2.1	2	0.9	7	3.0	
	Others	22	9.1	14	6.0	36	15.3	
Frequency of being outside the home	≤ 7 times/ week	86	36.8	55	23.5	141	70.3	0.424
	> 7 times/ week	51	21.8	42	17.9	93	39.7	
The consistency of following the recommendation for the COVID-19 prevention	Consistent	25	10.6	23	9.9	48	20.5	0.392
	Not Consistent	112	47.6	74	31.9	186	79.5	



(a)



(b)

(c)

Figure 1. The COVID-19 Infographic on the Third Week of April 2020. (a) The information of daily case development. (b) The information for the region at high-risk COVID-19 transmission in Samarinda city. (c) The education on preventing COVID-19 transmission.

Table 2. The distribution of the understanding of COVID-19 infographic during the advanced phase of COVID-19 in Samarinda City

Variables	(N=234)			
	Yes	%	No	%
The Understanding of the COVID-19 Infographic	166	79.5	48	20.5
Complying with Social Distancing recommendation	178	86.1	56	23.9
Complying with the recommendation of Wearing a Mask	119	50.9	115	49.1
Complying with the recommendation of Washing Hands	164	74.3	60	25.6
Complying with the recommendation of Strengthening the Body's Immune System	172	73.6	66	26.5

Table 3. The understanding of COVID-19 infographics during the advanced phase of COVID-19 in Samarinda City

No.	Knowledge of Infographics	(N=234)			
		Yes	%	No	%
1.	Color Display	204	87.17	30	12.83
2.	Numeral Display	168	71.79	66	28.21
3.	The Relevancy of Information	96	41.02	138	58.98
4.	The Interpretation of Regions at risk	163	69.65	71	30.35

Table 4. The illustration of the practice of social distancing during the advanced phase of COVID-19 in Samarinda City

No	The practice of social distancing during the COVID-19 pandemic	(N =234)			
		Yes	%	No	%
1.	Keeping a distance of 1.5 meters away from one another	196	84.61	38	15.49
2.	Avoiding crowd and unnecessary activities	153	65.38	81	34.62
3.	Not conducting or restricting a meeting with elders/people with comorbidity	106	45.29	128	54.71
4.	No shaking hands/hugging/kissing hands or cheeks when meeting other people	220	94.01	14	6.99
5.	Staying and working at home	185	79.05	49	20.95
6.	Using public transportation	208	88.88	26	11.12
7.	Conducting group meetings	213	91.02	31	8.98

Table 5. The analysis of the relation of the understanding of infographics with the efforts to prevent COVID-19 transmission

Independent Variables	Dependent Variables	P-Value	OR	95% CI	
				Lower	Upper
Knowledge of Infographic	Social Distancing	0.000[a]	0.23	0.123	0.496
	Washing hands	0.185[b]	-	0.853	3.106
	Wearing a mask	0.658[c]	-	0.394	1.616
	Strengthening the Body's Immune System	0.307[d]	-	0.331	1.305

[a]Significant result (p<0.05); CI, confidence interval; OR, odds ratio

infographics to describe the development of COVID-19 and to raise awareness of how people can participate to limit the spread of COVID (Figure 1 (a-c)

The proportion of the population who still did activities outside the home more than 7 times in a week was 30.3%, and the consistency in complying with the recommendations for preventing COVID-19 transmission was 20.5% (Table 1).

Table 2 shows the respondents who had understood the COVID-19 infographic (79.5%), complied with Social Distancing recommendations (86.1%) and the recommendation of washing hands as frequently as possible with soap and flowing water (74.3%), tried to strengthen the body's immune system (73.6%), and followed the recommendation of wearing a mask (50.9%).

The percentages for the respondent's understanding of the infographics were as follows (Table 3): the meaning of the colors (87.7%), the

interpretation of the numerals (71.79%), the understanding on the relevancy of information in the infographics (41.02%), and the interpretation of regions at risk (69.65%).

Referring to Table 4, most practices of social distancing have been done by the community to follow the government's recommendations. However, the rate for the habit of being in a crowd and doing unnecessary activities was still high (34.62%) as well as meeting with elders and people with comorbidity (54.71%)

Results from the bivariate analysis are shown in Table 5 indicating a relationship between the understanding of COVID-19 infographics and practices of social distancing (OR 0.23, *p*=.000).

4. Discussion

The control of a disease with a high rate of transmission, such as COVID-19, requires a comprehensive intervention.[8,11,14] The WHO recommended avoiding community-level mobilization approaches that entail limiting large gatherings of people and use existing digital platforms for teleconsultations and to disseminate information and alert communities.[15] Informing populations about the health risks posed by COVID-19, as well as measures they can take to protect themselves, is essential in mitigating the disease spreading and reducing the likelihood that people will become infected.[16] The Samarinda Health Office provides and constantly updates information about COVID-19 and its spread, and has also recommended which health measures should be taken at the individual and collective levels in order to prevent COVID-19 infection and avoid further transmission. Because it is easily shared, infographics are an innovative and attractive method of visually communicating information in a colorful and concise way.[17]

The implementation of social distancing is the core component of the responses towards the COVID-19 pandemic.[18,19] Several practices related to social distancing are aimed at reducing the probability of new infection by minimizing the physical contact between individuals.[20] Even though the risk for the severity level of COVID-19 disease is different, each individual can possibly become infected and spread the virus. The provision of accurate, timely, and frequent information in a language that people understand enables populations to make better decisions, and adopt positive behaviors to protect themselves and their family from the COVID-19 pandemic.[21]

In this study, it could be seen that a good understanding of COVID 19 infographics increased the willingness to comply with social distancing recommendations. Social distancing in some ways could decrease the COVID-19 transmission in the population of sub-groups by minimizing the physical contact between infected individuals and healthy individuals, or between the population group with a high transmission rate and the population group with the low transmission rate.[18]

The COVID-19 infographics provide information related to a mapping of the regions at risk. This information helps to make someone feel that there was a disease transmission near his/her domicile and try to keep a distance away from other people, especially the people they do not know. The risk of transmission after contact with an individual infected with COVID-19 increases with the closeness and duration of contact.[22] Some epidemic experts agreed that small-scale social restrictions, such as in a neighborhood/village, have played an effective role in preventing the spread of disease in that area.[14]

Even though the local government of Samarinda did not implement the policy of large-scale social restrictions, the activities of the community outside their home experienced an extreme decline (Table 1). This illustration is in line with a survey conducted by East Kalimantan Community Mobility Report between April 4 – May 16, 2020, showing the increased number of the practice of staying at home (15%), the decline in the activity at the workplace (22%), the activity of shopping in the supermarket, pharmacy, and recreational activities (40%).[23] The enthusiasm of looking for information on COVID-19 infographics changes people's habit to be more solitary, careful, and compliant with the government's recommendations in the aspects of preventing COVID-19 transmission. The decrease of people's mobility along with keeping a safe distance and maintaining clean and healthy living behavior as

well as wearing a mask have been proven effective to decrease new cases of COVID-19 infections.[24]

In this study, there were still people who did not keep a safe distance away from other people when going outside the home and were still gathering with others. The researchers thought that this behavior was mostly related to their occupation and the activities that are not relevant to the policy on physical distancing, such as traditional markets or shops/stalls managed by people. To minimize the transmission, people can perform their activities in a short time in those places and frequently wear a mask and wash their hands as soon as they go home.[16]

The distinct coordination and comprehensive implementation of social distancing at the initial phase of the outbreak was very effective to slow down the virus transmission. Even so, the implementation of social distancing in some regions considered the number of cases, the mortality rate, and social politics.[19]

A study in China illustrated that the virus can stay on surfaces for 6-8 hours. If someone touches the virus staying on the surface by accident and then touches his/her eyes, nose, and mouth, the virus will go directly to the lungs as the targeted organ.[25] The rate of indirect transmission from hands contaminated with SARS Cov2 virus was very high. Cleaning objects that are often touched by people at home or in public places using antiseptic regularly will reduce the chance for the virus to stay longer on the surface.[25,26]

This study showed that a good understanding of infographics did not significantly influence the recommendation of washing hands using soap. In this study, it was shown that not all respondents did the recommendation to wash hands due to their physical and economic limitations and the low availability of clean water supply outside the home. Hands that are contaminated with the virus may transfer the virus to the face. Mouth and eyes unwittingly become the *port de entry* for the virus transmission.[27] The consistency of washing hands was not seen yet due to the frequency of people's activity outside the home. Therefore, most people appear to be bored by washing hands repeatedly. The unwillingness to wash hands frequently and safeguard themselves by washing hands at home can increase the potential of virus transmission. The practice of washing hands effectively with soap can kill bacteria or viruses; moreover, always keeping our hands dry is a part of effective handwashing practice. Research has shown that the practice of washing hands 6 to 10 times in a day can decrease the risk of being infected with COVID-19.[28]

Masks are simple, cheap and potentially effective safeguards against COVID-19 transmission.[29] There is evidence that wearing a mask by individuals in the households or during contacts with a sick patient, or among attendees of a mass gathering is particularly beneficial as a preventive measure against infection.[30,31] A study on influenza illustrated that wearing a surgical mask could prevent the spread of the droplets that cause infection and possible virus contamination in the surrounding area.[27] The feeling of being safe if wearing a mask is pseudo-safety if people do not comply with other preventive actions, such as washing hands and physical distancing because people still can touch their face behind the mask and their eyes.[30,32]

This study showed that a good understanding of the infographics did not significantly influence the practice of wearing a mask. This finding might be caused by the increasing level of assumption in the community that there are no COVID-19 cases anymore in Samarinda. Some reasons to explain not wearing masks by people were feeling uncomfortable, feeling that it is impossible to be infected, having no mask, and wearing a mask only when meeting unknown people outside the home. Also, wearing a mask is considered as impolite when talking, especially with people they already know. Even so, the consistency of wearing a mask in this study was still relatively high (>50%). People also feel protected from both air pollution and COVID-19 when wearing a mask.

Keeping the body's immune system strong is an important method in preventing viral infection and disease transmission. Clean and healthy living behavior such as getting enough rest, consuming balanced nutritious food, managing stress, doing exercises, and avoiding cigarette smoke, can strengthen the body's immune system.[8,33,34.] Some

studies illustrated that sunlight exposure in the morning could stimulate the production of vitamin D that plays a role in absorbing calcium and phosphorous.[35,36] Besides, vitamin D also functions to reduce the overactive immune system, so the amount of white blood cells increases and it can prevent the coronavirus from entering the body. This study showed that a good understanding of infographics did not significantly influence the recommendation of keeping the body's immune system strong during the COVID-19 pandemic.

We argued that some people who live in high incidence areas do not consider themselves at risk, underestimate the seriousness of the condition and may not see themselves as capable to perform the preventive behaviors. Changing people's behavior is simply not as easy as just informing them of the risks.[37] Misinformation related to COVID-19 can potentially contribute to more severe health problems, ongoing transmission, and difficulties controlling the disease outbreak. Lack of access to technology or good Internet connectivity is also an obstacle to continue seeing the infographics, especially for people from rural areas or disadvantaged families.[17] One of the weaknesses of this study was that we only measured the understanding of infographics as the dependent factor, even though people were getting information and education about prevention of COVID-19 transmission from other sources not only from the infographics. Secondly, the levels of knowledge and the actions related to the protocol of preventing disease transmission were measured based on the respondents' perceptions and responses to the survey, not real observed actions.

5. Conclusion

We believe that increasing understanding of infographics concerning COVID-19 will increase efforts to improve adherence to the recommendations for social distancing. The implementation of social distancing, wearing a mask, washing hands as frequently as possible, and the efforts to take care of the body's immune system need to be done consistently to prevent the COVID-19 infection and the potential transmission could be minimized to optimize the recovery phase and anticipate the possible second wave of COVID-19. The protocols of preventing disease transmission will need to be maintained until an effective and safe vaccine becomes available.

Conflict of interests

The authors stated that all of them have no conflict of interests in this paper.

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Current prevalence, characteristics, and comorbidities of patients with COVID-19 in Indonesia

Dionita Rani Karyono,[1] Anggi Lukman Wicaksana,[2,3*]

[1]Unit for Collaboration, Alumni and Community Service, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.
[2]Department of Medical Surgical Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.
[3]The Sleman Health and Demographic Surveillance System (HDSS), Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

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ABSTRACT Indonesia is currently fighting against a novel coronavirus disease, known as COVID-19. Current information of COVID-19 is crucial for healthcare providers. This study aimed to explore the current prevalence, characteristics, and comorbidities of patients with COVID-19 in Indonesia. We obtained data of the confirmed cases of COVID-19, characteristics and comorbidities from the official website of Indonesia COVID-19 Task Force. The data were extracted, explored and discussed to respond to the research aims. Up to June 3rd, 2020, it was reported there were 28,233 confirmed cases of COVID-19 in Indonesia. The current prevalence of COVID-19 case was 0.11‰ and transmission was distributed to all provinces in Indonesia. Almost one-third of the COVID-19 infections were in the age group of 31-45 years (29.3%) but the highest mortality rate occurred in elderly people (17.68%). Overall, males slightly dominated and contributed only 6.84% to the mortality rate. Cough (76.2%), history of fever (50.4%), and current fever (47.1%) were the most common symptoms among the patients with COVID-19. For comorbidities, patients with COVID-19 had higher numbers of hypertension (52.1%), diabetes (33.6%), and other cardiovascular diseases (20.9%). Those three comorbidities led the greater proportion of deaths among other comorbidities. The COVID-19 pandemic is still a new challenge for Indonesia.

1. Introduction

Chinese authorities recognized the novel type of Severe Acute Respiratory Syndrome, Coronavirus Disease 2019 (SARS-CoV-2 or COVID-19) from a group of pneumonia cases in Wuhan City, Hubei Province, China, on January 7th, 2020. This COVID-19 is a new strain of coronavirus that infects humans and mostly causes respiratory problems or sudden deaths. On January 30th, 2020, the Director General of the World Health Organization (WHO) announced the COVID-19 outbreak as a public health emergency of international concern (PHEIC), with transitory suggestions given for all nations.[1] On February 28th, 2020, the WHO raised the hazard evaluation for COVID-19 from "high" to "very high" status. Then, on March 11th, 2020, COVID-19 was declared a pandemic.[2]

In Indonesia, on April 13th, 2020, the President announced that the COVID-19 pandemic was a non-natural national disaster and needed urgent response. The Ministry of Health of Indonesia voted unanimously to establish the Indonesian COVID-19 Task Force as a national response for the COVID-19 outbreak. Confirmed and suspected cases have been reported from all regions in Indonesia, starting from the day of the first identified COVID-19 case and continuing to the current date.[3] The updated data and COVID-19 situation assessments are distributed through the official COVID-19 Task Force website, mass media and government institutions. On the

*Correspondence: anggi.l.wicaksana@ugm.ac.id
Department of Medical Surgical Nursing, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

national level, the Ministry of Health of Indonesia has published national guidelines to control and eliminate the COVID-19 outbreak.[4] All areas in Indonesia are following the COVID-19 protocol and apply hand hygiene, physical distancing, using a mask, lockdown, and some provinces instituted home confinement.[5] The COVID-19 situation is daily updated by the Indonesian authorities. To date, there is a fluctuating trend about the COVID-19 cases in Indonesia but most of the COVID-19 cases are indicating an increasing trend. This trend of COVID-19 cases results in the increased numbers of deaths.[3] All healthcare workers need to be aware of the current situation of COVID-19 cases in Indonesia. Accordingly, this study aimed to identify the current prevalence, characteristics and comorbidities of confirmed COVID-19 cases in Indonesia.

2. Method

This study used a narrative and explorative approach to identify the current prevalence, characteristics and comorbidities among patients with COVID-19 in Indonesia.

2.1 Data sources

Researchers extracted information from the dataset of patients with COVID-19 on the website of the Indonesian COVID-19 Task Force, Ministry of Health of Indonesia (https://covid19.go.id/peta-sebaran) until June 3th, 2020. It is an open-access dataset about the daily numbers and updates of clinical information related to COVID-19 in Indonesia.[3]

2.2 Variable definition

This study focused on discussing about the prevalence, characteristics and comorbidities among patients with COVID-19 in Indonesia. The COVID-19 cases are defined as cases of COVID-19 infection confirmed through positive result of polymerase chain reaction test.[4] The prevalence is the recent number of confirmed COVID-19 cases that were reported in the Ministry of Health of Indonesia databases. Demography characteristics in this study are referring to the reported dataset regarding the age, gender, and symptoms of the confirmed patients with COVID-19. The comorbidities refer to present or previous diseases that are simultaneously present among the confirmed patients with COVID-19. The reported comorbidities among patients with COVID-19 were hypertension, diabetes, cardiovascular diseases, chronic obstructive pulmonary diseases, other respiratory problems, kidney diseases, asthma, cancer, tuberculosis, liver diseases and immune related diseases.

2.3 Statistical analysis

We applied descriptive statistics using a Microsoft Excel spreadsheet to extract and present the dataset into three components: the prevalence, characteristics, and comorbidities among patients with COVID-19 in Indonesia. The data were presented in numbers and proportion. The detailed datasets of patients who were recovered and the numbers of deaths were also reported.

3. Result

3.1 The prevalence of COVID-19

The confirmed cases of COVID-19 as of June 3rd, 2020 were reported as 28,233 positive cases. The total population in Indonesia is 255,182,144[4] so the current prevalence of COVID-19 in Indonesia was 0.11‰. The COVID-19 cases were spread across all 34 provinces in Indonesia and the detailed information about COVID-19 distribution is available in Figure 1. Jakarta, East Java, and West Java have the most cases of COVID-19 in Indonesia.

The data in the Indonesian COVID-19 Task Force, from the Ministry of Health of Indonesia are daily updated and displayed through the official website. Among the information in the dataset, there were 93.7% (n = 26,454) and 98.1% (n = 27,696) of data by age and gender, respectively. Only 6% (n = 1,694) and 2.3% (n = 649) of available data were presented in the database of COVID-19 by symptoms and comorbidities, respectively.

3.2 Characteristics of patients with COVID-19

The detailed data of COVID-19 cases by age are available in Table 1. The majority of COVID-19 cases occurred in the age group of 31-45 years (29.3%) and it was followed by the age group of 46-59 years

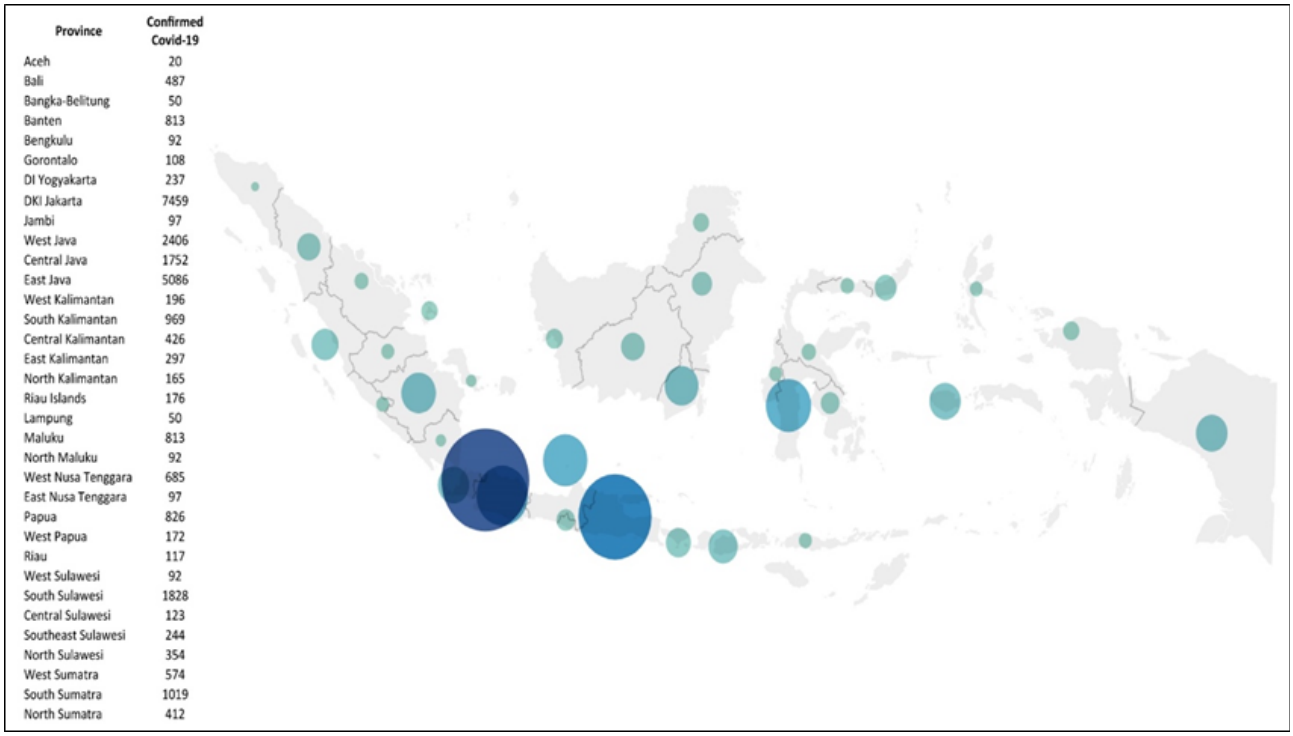

Figure 1. Current distribution of COVID-19 cases in Indonesia

Table 1. Total numbers of COVID-19 cases by age in Indonesia (n = 26,454)

Age (year)	Proportion (%)	Number of cases	Proportion (%)	Recovery	Recovery rate (%)	Proportion (%)	Deaths	Mortality rate (%)
0-5	2.3	608	1.5	118	19.42	0.9	14	2.35
6-17	5.5	1,455	4.5	354	24.36	0.6	10	0.66
18-30	20.7	5,476	20.7	1,630	29.77	3	48	0.87
31-45	29.3	7,751	31.7	2,497	32.21	12	188	2.42
46-59	27.3	7,222	27.2	2,142	29.66	39.9	635	8.79
≥ 60	15	3,942	14.4	1,134	28.77	43.8	697	17.68

Table 2. Total numbers of COVID-19 cases by gender in Indonesia (n = 27,696)

Gender	Proportion (%)	Number of cases	Proportion (%)	Recovery	Recovery rate (%)	Proportion (%)	Deaths	Mortality rate (%)
Males	54.6	15,123	58	4,783	31.62	62.1	1,035	6.84
Females	45.4	12,574	42	3,463	27.54	37.9	631	5.01

Note: n, number of COVID-19 cases.

(27.3%). The recovery rate was dominated by the age group of 31-45 years (32.21%) and it was followed by the adult groups. Additionally, the highest proportion of deaths was identified among the elderly (43.8%). The mortality rate indicated a similar trend in which the elderly contributed to the highest rate (17.69%).

In terms of gender, the COVID-19 virus infected more males (54.6%, n = 15,123) than females (Table 2). The males had a recovery rate of 31.62% and mortality rate of 6.84%, relatively higher than females.

The most common symptoms among patients with COVID-19 in Indonesia were cough (76.2%), history of fever (50.4%), current fever (47.1%), and shortness of breaths (41.6%) (Figure 2). Most of the patients had complaints in the respiratory system. The rest of them had complaints in the musculoskeletal and gastrointestinal systems.

3.3 The comorbidities among patients with COVID-19

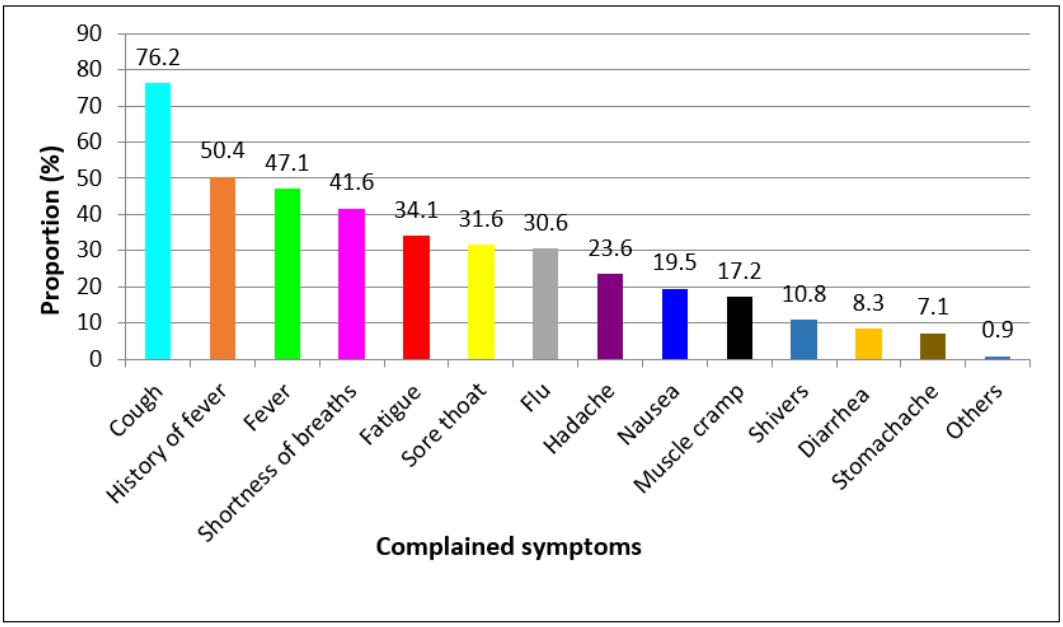

Figure 2. The proportion of COVID-19 cases by its symptoms (n = 1,694)

Table 3. The comorbidities of COVID-19 in Indonesia (n = 649)

Comorbidity	Proportion (%)	Number of cases	HASQ (%)	Number of HASQ	Recovery (%)	Number of recovery patients	Death (%)	Number of deaths
Hypertension	52.1	341	4.1	14	28.7	98	19.2	65
Diabetes mellitus	33.6	220	2	4	16.3	36	15.3	33
Cardiovascular diseases[a]	20.9	137	1.8	2	8.9	12	10	13
Chronic obstructive pulmonary diseases	15.1	99	0.3	1	11.1	11	3.7	5
Other respiratory problems	9	60	0.9	1	5	3	3.2	2
Kidney diseases	4.9	32	0	0	0.8	0	4.1	1
Asthma	3.1	20	0.6	1	1.8	0	0.6	1
Cancer	2.3	15	0.2	1	1.1	0	1.1	1
Tuberculosis	1.8	12	0.3	1	1	0	0.3	1
Liver diseases	1.2	8	0	0	0.9	0	0.3	1
Immune related diseases	1.2	8	0	0	0.6	0	0.6	1

Note: HASQ, hospital admission and self-quarantine; %, percentage; [a] except for hypertension

The detailed data of comorbidities among patients with COVID-19 are available in Table 3. The top three comorbidities were hypertension (52.1%), diabetes mellitus (33.6%), and other cardiovascular diseases (20.9%). The data of other cardiovascular diseases refer to a number of heart diseases, including heart attack, stroke, heart failure, and others, except for the hypertension. Patients with COVID-19 who have mild symptoms are not hospitalized, and they usually do self-quarantine or confinement at home. The duration of hospitalization which is as long as self-quarantine is usually about 14 days. The rates for hospital admission and self-quarantine (HASQ) were varied in which hypertension, diabetes, and other cardiovascular diseases accounted for 4.1%, 2%, and 1.8%, respectively. Among the patients with COVID-19, the three comorbidities: hypertension, diabetes, and other cardiovascular diseases were leading in terms of the numbers of treated patients, recoveries, and deaths, compared to other

comorbidities.

4. Discussion

This study provides information on current prevalence, characteristics, and comorbidities of patients with COVID-19 in Indonesia. The prevalence of COVID-19 in Indonesia was relatively lower than cases in Belgium, UK, Spain, USA, Italy, and France and it has spread out to all provinces. The finding of the mortality rate of patients with COVID-19 in Indonesia was similar with the estimated United Nations report, with 10 deaths per 1,000 infections. Globally, mortality rate was about 70 deaths per 1,000 infections[6] which was relatively higher than the mortality rate in Indonesia.

The DKI Jakarta and East Java provinces were the epicenter of COVID-19 cases between March and June 2020 in Indonesia. In addition, the first case of COVID-19 in Indonesia was found in DKI Jakarta. The higher number of COVID-19 cases was related to the high mobility of the population. A previous survey in 2019 indicated that 1.2 million people visited DKI Jakarta everyday.[7] Jakarta, the capital city of Indonesia, is located in the DKI Jakarta province, and is the main hub of the nation's economy. In Jakarta city, population density is very high (138 people in km^2) and this allows the COVID-19 to spread more epicly.[7,8] Meanwhile, on June 26th, 2020, the Indonesian COVID-19 Task Force announced that the East Java province had become the new epicenter of COVID-19 transmission. They also reported that the sudden outbreak of COVID-19 and its rapid spread in Surabaya could be due to the lack of awareness among residents of Surabaya concerning COVID-19 preventive protocols.[9]

Patients in the productive age (18-59 years old) have dominated the incidence of COVID-19 in Indonesia. Adult people are actively working and engaging in many daily activities. As a result, it was easy for them to be infected when they did not strictly adhere to the protocols of COVID-19 control.[10] A previous study in China identified that COVID-19 mostly infected elderly people because they are lacking in their immune system as the result of the aging process.[11] Furthermore, most elderly people had multi-morbidities that made them more vulnerable to the COVID-19 infection.[11] The elderly have been identified as a high-risk group for COVID-19 infection.[11] In Indonesia, the percentage of elderly patients with COVID-19 was 15%, however, the mortality rate in older Indonesian people with COVID-19 was the highest compared to the other age groups.[3] This finding was consistent with the previous research in the UK, which indicated the highest mortality rate occurred among persons with advanced age, with more than 200 patients on average. In comparison, the age group below 60 years old showed an average mortality rate that was less than 100 patients.[12] Thus, elderly patients with COVID-19 should have priority in medical care due to their vulnerability state.[13]

We observed more cases of COVID-19 in Indonesia that were men than women. Several studies indicated similar findings in which more men were infected with COVID-19 than women.[11,12,14,15] The men's mortality rate was slightly higher than for women. Women are known to be more resilient in terms of viral infection. This is associated with the X chromosome protection and estrogen hormones, which have an essential role in the adaptive immunity mechanisms.[16] The X chromosome involves several genes that are associated with the immunological process, such as multiple cytokine receptors, genes involved in T-cell and B-cell activities, and transcriptional and translational regulatory factors.[16] In addition, women have more estrogen receptors which protect the body and assist the immune system, including T cells, B cells, macrophages, neutrophils, dendritic cells, and natural killer cells.[16,17]

Cough and (current or history of) fever were the most common complained symptoms among the confirmed cases of COVID-19. The finding was similar to earlier studies.[11,18,19] Sharma *et al.* explained that symptoms of COVID-19 mostly began with dry cough, fever, fatigue and myalgia in the first four days. Then, dyspnea and purulent cough followed as the next naturally occurring symptoms until the 6^{th} day.[20] When COVID-19 infects the body, the viruses can enter and destroy the apical side of lung epithelial cells in the alveolar space by attaching to the angiotensin converting enzyme (ACE-2). The ACE-2 is commonly found in the apex of nasal, oral, nasopharyngeal membranes and oro-pharyngeal

mucosal and alveolar epithelium, endothelial cells in heart, blood vessels, renal tubules, and small intestine enterocytes.[21]

In Indonesia, the highest comorbidity among patients with COVID-19 was hypertension and then it was gradually followed by diabetes, other cardiovascular diseases, and chronic obstructive pulmonary diseases (COPD). These phenomena were similar with the previous reports in China and the UK.[12,22,23] Hypertension was identified as a predominant factor of COVID-19 infection. There were many assumptions that people with unstable blood pressure commonly had more renin angiotensin aldosterone system (RAAS) inhibitors such as the ACE-2 which are related to increased COVID-19 susceptibility.[24,25] In several studies, COVID-19 patients with hypertension were associated with poor health outcomes, longer hospital stay, and ICU admission. Moreover, COVID-19 patients with hypertension had two times higher risk for death. Among other comorbidities, hypertension was recognized as the leading cause of death among patients with COVID-19.[26]

COVID-19 patients with diabetes rank as the second largest number of comorbidities.[27-29] Diabetic patients are a high-risk group for COVID-19 infection.[29,30] The researchers have identified that poor glycemic control was related to the poor outcome of patients with severe COVID-19.[27] Similar to hypertension, COVID-19 patients with diabetes had a higher risk of extended hospital stay and ICU admission. Roncon *et al.* reported patients with diabetes had almost three times higher risk for ICU admission (OR 2.79; 95% CI: 1.85-4.22) and death (OR 3.21; 95% CI: 1.82-5.64).[27] These findings highlighted that diabetes is one of the high-risk factors for severe COVID-19 infection that needs more attention and medical care.[30]

In China and the UK, COPD commonly occurred among patients with COVID-19, just as in the findings in Indonesia.[12,23] In China, confirmed COVID-19 patients with COPD had a higher mortality rate. The majority of COVID-19 patients with COPD had various comorbidities, which may also be related to the higher mortality.[31] In addition, respiratory failure in COVID-19 patients with severe COPD is the leading cause of death and it requires ICU intervention. To date, the specific mechanism of COPD that increases COVID-19 severity and mortality is unknown and further research is needed to identify the possible mechanisms linking COVID-19 with increased severity and higher risk of death.[32]

The limitations of this study were related to the number of prevalence, availability of dataset, and numbers of comorbidities among patients with COVID-19. The prevalence of COVID-19 cases in Indonesia is dynamic because the Indonesian authorities will daily update the case numbers. The current prevalence may potentially differ day by day according to the updated new cases. The reported characteristics in this study only focused on age, gender, and complained symptoms. This reporting was due to the availability of datasets that were published in the Indonesian COVID-19 Task Force's homepage. Accordingly, the reported numbers of comorbidities among patients with COVID-19 only represented the estimated numbers out of the total cases of COVID-19 due to the limited available data and the possibility of underreporting in some areas of Indonesia.

5. Conclusion

This report provided information about the current prevalence, characteristics, and comorbidities among patients with COVID-19 in Indonesia. The presented data indicated that the COVID-19 pandemic is a new challenge for this country. All healthcare providers could use this information to become better updated and more aware during the COVID-19 outbreak. In identifying the nation's greatest concerns, the mortality rate was higher among elderly patients with COVID-19 and COVID-19 patients with hypertension, diabetes, and other cardiovascular diseases.

Conflict of interests

The authors declare that there is no conflict of interest.

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Perceptions of a COVID-19 education public service announcement in Nunukan Regency, North Kalimantan: A qualitative study

Tiara Putri Leksono,[1*] Avinindita Nura Lestari,[2] Reyfal Khaidar,[3] Yuga Putri Pramesti,[4] Syarmila Sari,[5] Lutfan Lazuardi[6]

[1]*Department of Medicine, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia*
[2]*Department of Medicine, Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia*
[3]*Department of Medicine, Faculty of Medicine, Universitas Islam Negeri Syarif Hidayatullah Jakarta, Jakarta, Indonesia*
[4]*Department of Nutrition, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia*
[5]*Department of Islamic Economic Law, Faculty of Syariah, Universitas Islam Negeri Ar-Raniry, Banda Aceh, Indonesia*
[6]*Department of Health Policy and Management, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Indonesia*

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PSA
Qualitative study

ABSTRACT The North Kalimantan Province is considered the frontier, outermost, and least developed area in Indonesia. One of the districts with inadequate human resources is Nunukan Regency. As a result, indigenous people may be at risk to get limited information about the COVID-19 infection. Our study aimed to understand how one group of people in Nunukan Regency expressed reactions, interest, and impressions about the COVID-19 information transmitted in Bugis and Toraja versions of audio public service announcements (PSAs) released by the Health Empowerment and Education Project (HEUProject). The study was a qualitative research and used purposive sampling with seven participants from two sub-districts in Nunukan Regency. We conducted seven semi-structured, qualitative interviews. The data were analyzed qualitatively and thematically, then further interpreted and presented descriptively. Additionally, to see the variety of participants' answers concerning information transmission through PSAs, we analyzed the data using Tableau software 2020 version and presented the relative frequency of words with visual infographics called Word Clouds. The data were divided into three thematic questions: the immediate reaction, the behavioral reaction, and the impression after hearing the PSA. The study findings of the participants' immediate reactions involved following the advice on the PSAs audio, for instance, maintaining physical distance and washing their hands frequently. Most of the participants in this study have the willingness to hear, ability to understand, and also feel interested about the useful content in the audio format that apparently improves their awareness of COVID-19 information. Overall, it is immediately apparent that the language, transmission of messages, and information found in the HEUProject's COVID-19 educational PSA were understood and engaged the participants in a way that helped explain the pandemic situation. Our study supports the national usage of disease prevention with this type of media approach that could be used in public places in the future and may minimize any language gap.

1. Introduction

North Kalimantan is the youngest province in Indonesia and located in the border area, or commonly called the 3T area (*Tertinggal, Terdepan dan Terluar*) -- frontier, outermost, and least developed region. It also has 11 regional languages which become daily languages in each district.[1,2] One of the districts in North Kalimantan which does not have adequate human resources is Nunukan regency.[3] Recently in 2019, according to the ethnic background, most inhabitants are from South Sulawesi consisting of ethnic groups such as Toraja and Bugis.[4] The common

*Correspondence: tiara.putri.l@mail.ugm.ac.id
Department of Medicine, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Jl. Farmako, Sekip Utara, Yogyakarta 55281, Indonesia

health issues are the lack of hygiene and health awareness, due to the lack of health facilities and also health professionals.[3]

Relating to COVID-19 as a national emergency, indigenous populations experience a risk of socio-economic marginalization as they have limited capacities and opportunities to cope and adapt with limited or no access to technologies.[5,6] In this case, community engagement is important because it focuses on COVID-19 messages tailored to the relevant national and local context.

Public service announcements (PSA) are promotional materials that address issues that are considered a general public concern in an attempt to increase public awareness of specific issues and in many instances, also try to influence public behaviors. Recently, the number of PSAs to promote healthy behaviors have become increasingly popular, including PSAs focused on health education.

The Health Empowerment and Education Project (HEUProject), a health-startup based in Bandung, made an initiative to create a downloadable audio as a PSA and text of COVID-19 education which was further translated into various local languages in Indonesia.

The present study aimed to understand how one group of people in Nunukan Regency, North Kalimantan expressed immediate reactions, and their behavior reactions: willingness to hear, knowledge improvement, interest, value, awareness about the content and their impressions about the information found in the Bugis and Toraja versions of the audio PSAs released by the HEUProject.

2. Method

2.1 PSA by HEUProject

In 2020, the HEUProject, a start-up based in Bandung, as a part of its National Campaign with COVID-19 Volunteers consisting of medical students in Indonesia along with the Ministry of Education and Culture and Rumah Bahasa (Language House), released a COVID-19 education PSA campaign[7] that aimed to increase public literacy and awareness through a downloadable audio and script that can be played in public places.

Ethnologically, Indonesia consists of various ethnic groups with as many as 300-700 languages in total.[8] This PSA was translated into various local dialects in Indonesia, and as many as 36 local languages, including Bugis and Toraja language.

2.2 Location, time and duration of activities

This study was located in the sub-districts of Sebatik Tengah and Tulin Onsoi, Nunukan regency, North Kalimantan, Indonesia. The information collection was conducted between June 6-l2, 2020, when each participant was engaged between one to two hours for a semi-structured interview.

2.3 Study sample, data collection and data analysis techniques

This study used purposive sampling. There were seven participants in this research from two sub-districts in the Nunukan Regency. Inclusion criteria were as follows: (1) the people who understand Bugis and Toraja language, (2) live at the place where research was conducted, and (3) willing to be interviewed.

Seven semi-structured, qualitative interviews were conducted for prospective evaluation. Participants' ages ranged from 29 to 69 years old. The last education background in senior high school was noted in four persons, and the others were a junior high school, a bachelor and an elementary study background. In terms of occupation, four participants are farmers and two of them have another job as a housewife and head of RT (Rukun Tetangga or Community Association), and two other participants are a priest and a traditional market trader. The subject characteristics are listed below in Table 1.

The study participants were required to listen to the HEUProject's COVID-19 PSA before having the interviews. Participants #1-#3 were given the PSAs with Toraja language version and the rest heard the Bugis language version. Of the seven study participants, some indicated that they had previous exposure to this COVID-19 education via television or YouTube.

All interviews were audio-recorded and transcribed verbatim. The data were analyzed by

Table 1. Participants characteristics

Participant	Age (years old)	Occupation	Last Education
1 (P1)	69	Farmer	Junior High School
2 (P2)	45	Priest	Bachelor
3 (P3)	43	Farmer and housewife	Elementary
4 (P4)	53	Head of RT and farmer	High School
5 (P5)	48	Traditional market trader	High School
6 (P6)	50	Farmer	High School
7 (P7)	29	Traditional market trader	High School

Table 2. The result summaries of the thematic questions

No	Thematic question	Result
1.	Immediate reaction	The participants would be more careful for COVID-19 prevention (physical distancing, wearing mask and washing their hands more often).
2	Behavioral reaction	The participants wanted to know more, interested about COVID PSA, and also thought the PSA was helpful.
3	Participants' impression	The participants' impression was good. Almost all participants were convenience with the language of the PSA and the message of the PSA was understandable to the participants.

qualitative-thematic methods, then interpreted and presented in the form of a description or narrative. The responses were classified to draw a conclusion that referred to the ad theory and source of the literature based on the theme discovered. Additionally, to see the variety of participants' answers about: a) impression of message, b) important message noted, and c) comfort in information transmission through PSAs, we analyzed the data with Tableau software 2020 version and presented the relative frequency of words in the form of visual infographic called a Word Cloud.[10]

3. Result

The data results were divided into three thematic aspects, which were the immediate reactions after hearing the PSA; the behavioral reactions after hearing the PSA, including their willingness to hear, the improvement in personal knowledge regarding COVID-19, the interest in message conveyed, the COVID-19 content's value and care or awareness about the education of the disease; and the participant's impression of the information transmission through audio, involving the convenience in delivering PSA content, the impression of the PSA content and the important messages captured by participants. The result summaries of those aspects are shown in Table 2.

3.1 Immediate reactions after hearing the PSA

Based on the results of the semi-structured, qualitative interviews, it was found that all of the respondents' reactions were consistent with the educational content of the PSA, after hearing information about COVID-19 awareness. Four out of seven respondents, which were P2, P3, P4 and P7, said that they wanted to do physical distancing. Two respondents, P5 and P6, stated that they wanted to wash their hands more often before having contact with other people, touching things, and eating. Not only that, they were willing to wear a mask if they went outside. The first respondent (P1) said that he would be more careful and follow the recommendations that had been given. The people knew the importance of following the announcement to prevent COVID-19 transmission. The following responses were the statements from two of the respondents:

"After this, if I meet my friend, I **don't want to get too close**, I **won't shake hands and hug my friends**. If I go out I will **wear a mask** and **reduce the use of public**

transportation."

(Participant #3, Farmer and housewife, Elementary education background)

"Yes, we have to **wash our hands**, with flowing water."

(Participant #5, Traditional Market Trader, High School education background)

3.2 The behavioral reaction after hearing the PSAs

Assessing the behavior reaction of the participants included several aspects: willingness to hear, improvement in their knowledge, interest in content, and awareness/caring in the disease education.

3.2.1. Willingness to hear

Majority of participants wanted to know about this COVID-19 educational PSA, while one participant (P5) said he/she already knew about this content from another media previously. The following responses were the statements from two of the respondents:

"Yes, **I would like to know**, if it is for our goodness to maintain our health, right?"

(Participant #6, Farmer, Senior High School education background)

"**We already know** from the news, right? I've also heard on YouTube about COVID-19 in Bugis language. Yes, indeed we are really scared of this virus. Me, if I touch money from the buyer, I'll directly wash my hands."

(Participant #5, Farmer, Senior High School education background)

3.2.2 **Improvement in personal knowledge regarding COVID-19**

The majority of participants admitted that they got a lot of knowledge about COVID-19 after they heard the PSA. One participant (P7) stated that he already knew much about COVID-19 from other media sources, particularly television or YouTube.

"Yes, **I got to know about COVID and how to prevent it**, like washing hands and referral hospital for COVID. I do not easily believe it is a hoax."

(Participant #1, Farmer, Junior High School education background)

"Actually, what the speaker said was something **I've already heard in the news previously**, whether on TV or YouTube."

(Participant #7, Traditional Market Trader, Senior High School education background)

3.2.3 Interest in message conveyed

All of the participants were interested in the messages conveyed. Most participants felt the message transmission was compelling. They loved how the audio was transmitted in their language, especially for Bugis language. However, for Toraja language, some of the participants preferred to use the common means of communication, which was Bahasa Indonesia.

"The content was well delivered, **I'm interested in listening**, I suppose **original Bugis people would definitely love** to hear this audio record."

(Participant #5, Traditional Market Trader, Senior High School education background)

"For me, I'm interested in the way of delivering the content, but if nomads who have left Toraja in a long time, I think they will forget the Toraja language and **will be more interested if using Bahasa**."

(Participant #1, Farmer, Junior High School education background)

3.2.4 The COVID-19 content's value

All of the respondents said the content of the message was useful for them. It was both helpful since it was also improving their knowledge, and they liked the language used.

"Ya, useful because it's improving my knowledge."

(Participant #2, Priest, Bachelor education background)

"**Useful**, yesterday my niece also told me about

COVID-19 in Bugis language. Well, that's **the real Bugis language** like that."

(Participant #4, Head of RT and Farmer, Senior High School education background)

3.2.5 Care or awareness about the education of the disease

When it came to preventing the transmission of COVID-19, all the study participants were concerned about the educational messages about COVID-19.

"Yes, we have to **care**, we have to follow the recommendations issued by the government like in the audio record's content."

(Participant #1, Farmer, Junior High School education background)

3.3 Participants' impression of information transmission through audio

Assessing the impression of the participants included several aspects: the convenience in delivering PSA, impression of the PSA content, and the important messages that participants could capture.

3.3.1 The Convenience in Delivering PSA Content

Most of the respondents said this content of the PSA delivered was convenient. The language was pleasant to hear because it was their own traditional language. Therefore, it was easy to understand. Meanwhile two participants, the sixth and seventh participants said that they just barely understood the language because the Bugis language has many types and they said the speaker was less fluent in speaking Bugis.

All the respondents' answers were analyzed using Tableau and the results are presented as a Word Cloud which is shown in Figure 1. The most frequent word for assessing the convenience of delivering PSA content was "*nyaman"* (convenience).

"Yes, it is **convenient** and easy to understand, that is my daily language, it is used more in Toraja and easy to understand."

(Participant #2, Priest, Bachelor education background)

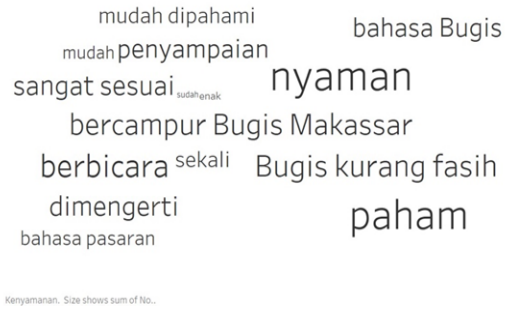

Figure 1. Word Cloud of Participants' Convenience in PSA Delivery

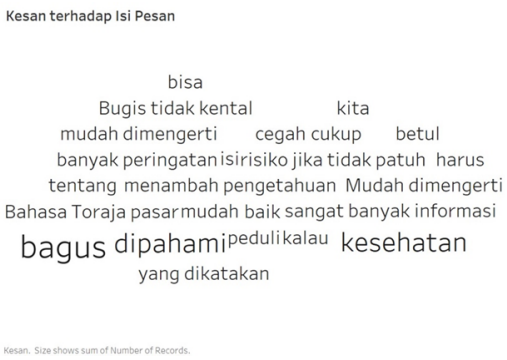

Figure 2. Word cloud of impression of the PSA's Content

"I **understood**. However, it seems mixed with the Bugis Makassar language, but it is understood enough. Additionally, the Bugis language has a lot of variation."

(Participant #6, Farmer, High School education background)

3.3.2 Impression of the PSA Content

Four out of seven respondents, which were P1, P2, P6, and P7 said their impressions were good, either because the PSA was easy to understand, gave a lot of warning about health, or the PSA content improved their knowledge about the disease. The third respondent said the PSA contained a lot of information and was easy to understand. The fourth respondent said the content was understandable, but the pronunciation of the Bugis language was unclear. The fifth respondent said if we cared about health we had to do the prevention.

All the respondents' answers were analyzed using Tableau and the results are presented as a

Word Cloud which is shown in Figure 2. The most frequent word for assessing the impression of the PSA content was "*bagus"* (good).

"For me it's **good**, the message of the PSA **can be understood**. Because the language used is Toraja daily language, not the formal one. Easy to understand."

(Participant #1, Farmer, Junior High School education background)

"Actually, I understand the content, but the Bugis pronunciation is **unclear**. Oh, the Bugis language has many types, there are Makassar Bugis, Enrekang Bugis, etc... Well, maybe this Bugis is the common one to be used in society. And also, now, Bugis is rarely used, except for elderly people, but children and people at my age usually use Bahasa."

(Participant #4, Farmer and Head of RT, High School education background)

3.3.3 Important Message Captured by Participants

Three out of seven respondents, mainly P2, P5, and P7 said that the messages they captured were the importance of hygiene, washing hands, and wearing a mask if going outside. Two respondents, the fourth and sixth respondents said the message they captured was the importance of physical distancing. The first participant (P1) said the message he captured was similar to the ones in television news, but transmitted in Toraja language was what makes it different. The third participant (P3) stated that the message he captured was about the development of COVID-19 in the world.

All the respondents' answers were analyzed using Tableau and the results are presented as a Word Cloud which is shown in Figure. 3. The most frequent words for the important messages captured by participants were "*jaga jarak"* (physical distancing) and "*cuci tangan*" (hand washing).

"The speaker said we have to wash our hands, wear a mask, physically distance ourselves, and then if we want to buy some food, it's better to take it away. Alternatively, it's better to cook it by ourselves at home."

(Participant #7, Traditional Market Trader, High School education background)

"The message content is just similar with what the previous news always said, but this is in Toraja languages."

(Participant #1, Farmer, Junior High School education background)

3.4 Photos and figures

(a)

(b)

Figure 3. The Nunukan Regency. (a) Semi-structured, qualitative interview. An interview and a participant used mask and physically distanced themselves. (b) The Road view in the community field.

4. Discussion

As stated in the previous section, the subjects of this study were seven participants and were selected according to the inclusion criteria. Indeed, this study provided clear evidence of COVID-19 educational PSA's success in reaching some people in Nunukan

regency as an example of indigenous populations with limitations in access to technology. However, the results of the current study indicated positive feedback as a form of their perceptions and even though they had different answers about their understanding, their reactions show the same values.

The study findings of the participants' immediate reactions included following the advice on the PSAs audio, for instance, maintaining physical distance and washing their hands frequently. This was consistent with the research that demonstrates the attitude toward an advertisement, which was further discussed in the ad theory of commercial advertisement, that explained PSAs may exert a significant positive impact on issue attitude.[8] This is possible since people transfer their feelings to the media.[8] Moreover, according to the research of psychological and behavioral responses to the COVID-19 pandemic, there was increased level of anxiety resulting in avoidance behaviors among people.[11] This shows their immediate reactions which reflected a higher tendency for fear for their health safety.

Moreover, the content analysis of PSAs by Paletz et al. revealed depictions of cooperation among citizens as an overriding theme as well as including individual awareness. This leads to the basis of solving many societal problems.[12] Reflecting on the emergency health situation, a 2007 study on a previous influenza pandemic revealed individual-level characteristics such as age, sex, and educational status played a role in reported precautionary actions.[5] This was reflected in the interview sessions where most participants in this study had the willingness to hear, to understand – despite one participant already knowing the content from another source. Besides, the participants also feel interested about the useful content in audio format that apparently improved their awareness of COVID-19 information.

Our study results showed that the audience impressions were highlighted on the use of local language, including the speaker. Three participants who heard the audio in Toraja language found it very convenient, especially for the health messages due to the usage of daily language so that they captured the content more easily. Similarly, the rest of participants who heard audio in Bugis language gave the evaluation for the speaker's fluency, even though they gave the same positive content feedback on overall content. These results are associated with the World Health Organization's bulletin[9] that focuses on bridging the language divide in health, highlighting that language could be a barrier to accessing relevant and high quality information and delivering appropriate health care.[13] In public health, the linguistic aspect can create a disconnect between those providing health information and those who need that information which then can affect everyone.[13]

PSAs are considered to be a method of empowering community activities. The benefit is that we can amplify our ideas about current issues quickly, economically, and effectively.[14,15] In addition, PSAs can be played in various places including public facilities in *3T* areas, such as in worship places or in the district centers through their loudspeakers. Besides that, by using PSAs, we can raise people awareness on a massive scale and encourage people to change their behavior to prevent COVID-19 transmission and take better care of themselves.[14,15]

A good PSA has certain provisions which include that it should have limited duration with a length of about 1 minute and a limited number of words of 125. Therefore, the message that can be delivered is also limited and must be able to deliver the content of PSA directly without any 'small talk'. Basically, PSA is a non-commercial announcement and the time it plays cannot be in a random way, so it is often played during prime time and not in the middle of the night.[14]

To our knowledge, this was the first study that evaluated the effectiveness of PSA in health-related topics in Indonesia. The strengths of our instruments include how the information was transmitted in local languages to support health promotion, could be widely transmitted and playable in any setting. This study could become a basis to conduct more campaigns and/or research in health promotions involving multimedia. Moreover, it could become a model to apply a similar mode of health communication in the future.

5. Conclusion

Overall, it was immediately apparent that the language, transmission of message, and information found in the HEUProject's COVID-19 educational PSA were understood and engaged by participants in a way that helped explain the pandemic situation. This was apparent in their positive behavioral reactions and impressions towards preventive measures during the pandemic. Our study results support the national campaign with this new media approach that could be used in public places, especially in the frontier, outermost, and least developed regions of Indonesia (*3T*). In this case, even though our focus area, Nunukan's regency, is far from the capital of Indonesia, its population should have the same awareness and knowledge about COVID-19.

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Conflict of interests

The author(s) declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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The development of GAMA Swab sampling chamber for walk-through sampling in patients with COVID-19 at Gadjah Mada Hospital

Hera Nirwati,[1*] Dwi Aris Agung Nugrahaningsih,[2] Siswanto,[3] Mahatma Sotya Bawono,[3] Titien Budhiaty,[3] Setyawan Bekti Wibowo,[4] Raden Sumiharto[5]

[1]Department of Microbiology, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Department of Pharmacology and Therapy, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[3]Universitas Gadjah Mada Academic Hospital, Yogyakarta, Indonesia
[4]Department of Mechanical Engineering, Vocational School, Universitas Gadjah Mada, Yogyakarta, Indonesia
[5]Department of Computer Science and Electronics, Faculty of Mathematics and Natural Sciences, Universitas Gadjah Mada, Yogyakarta, Indonesia

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ABSTRACT Collecting swab samples from the nasopharynx and oropharynx of patients with COVID-19 is essential in detecting SARS-CoV-2. This procedure potentially produces sufficient droplets. Since SARS-CoV-2 is transmitted through droplets, swab sampling has to be done carefully to prevent the risk of transmission to healthcare workers or the cross-contamination to the environment. The GAMA Swab Sampling Chamber (GSSC) is a positive-pressure chamber designed for collecting swab samples involving the healthcare worker positioned inside, while the patient is outside the chamber. The chamber is designed to minimize the risk of aerosol exposure to the healthcare worker due to leakage or when opening or closing the door. Accordingly, the healthcare worker does not need to use complete personal protective equipment (PPE) as they do when collecting swab samples without the chamber. After several tests to check the safety and the chamber's function, the GSSC was used at Gadjah Mada Hospital. This chamber had been used to swab 51 asymptomatic patients, 72 suspected patients, and 284 voluntary persons for ten weeks. The results of reverse transcription-polymerase chain reaction (RT-PCR) examination of all samples from asymptomatic patients were negative, while 2 of 72 suspected patients (2.8%) and 4 of 284 voluntary persons (1.4%) had positive RT-PCR results. The use of GSSC can simplify the swab sampling, also reduces the need for PPE usage and a negative pressure isolation room which are limited in the current pandemic situation.

1. Introduction

On March 12, 2020, The World Health Organization (WHO) declared the Coronavirus Disease 19 (COVID-19) as a new global pandemic in the world. COVID-19 is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).[1] This virus has quickly spread throughout the world. By July 2, 2020, 215 countries and territories reported having patients with COVID-19, with a total of 10,829,468 cases. Of these cases, 6,048,749 people were reported recovered, and 519,397 of them died. Presently, the United States, Brazil, and Russia are the top three countries with the largest number of COVID-19 cases in the world.[2]

In Indonesia, COVID-19 was first reported on March 2, 2020, in Jakarta. Since then, the virus has spread quickly throughout the country. July 2, 2020, there were 59,394 cases of COVID-9, with 26,667 cases recovered and 2,987 deaths. In Yogyakarta, 320 confirmed cases were reported, with 269 cases recovered, and eight deaths.[3]

One effective strategy in managing COVID-19

*Correspondence: hera.nirwati@mail.ugm.ac.id
Department of Microbiology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Jl. Farmako, Sekip Utara, Yogyakarta 55281, Indonesia

is test, track, and trace. Real-time reverse transcriptase-polymerase chain reaction (RT-PCR) results of nasopharyngeal and oropharyngeal swabs typically have been used to confirm the clinical diagnosis.[4] With an increasing number of suspected and symptomatic individuals to be tested, there is a need for a safe and efficient screening system. The process also needs a large laboratory capacity for RT-PCR testing. To overcome this problem, the Indonesia government has increased the capacity of RT-PCR testing. As of July 2, 2020, RT-PCR tests have been conducted on 849,155 samples, with 59,394 people who tested positive.[3]

Collecting nasopharyngeal and oropharyngeal swabs from patients with COVID-19 is a procedure that potentially produces sufficient droplets for accurate testing results. Since SARS-CoV-2 is transmitted through droplets, swab sampling has to be done carefully to prevent the risk of transmission to healthcare workers or the cross-contamination to the environment. The healthcare worker must use personal protective equipment (PPE) to protect themselves. This procedure also has to be done in a negative pressure room to prevent environmental contamination.

The sampling process often faces the obstacles of limited PPE stocks. Also, the availability of a negative pressure room is limited because not all hospitals and laboratories have one. In response to this problem, the research team developed the GAMA Swab Sampling Chamber to be used for a safe and efficient swab sampling system.

2. Method

2.1 Development of the GAMA Swab Sampling Chamber

The GAMA Swab Sampling Chamber (GSSC) was a positive pressure chamber designed for collecting nasopharyngeal and oropharyngeal swabs from the patients with COVID-19 with the healthcare worker positioned inside while the patient was outside the chamber. The positive pressure chamber was designed to minimalize the risk of aerosol exposure to the healthcare worker due to leakage or when opening or closing the door.

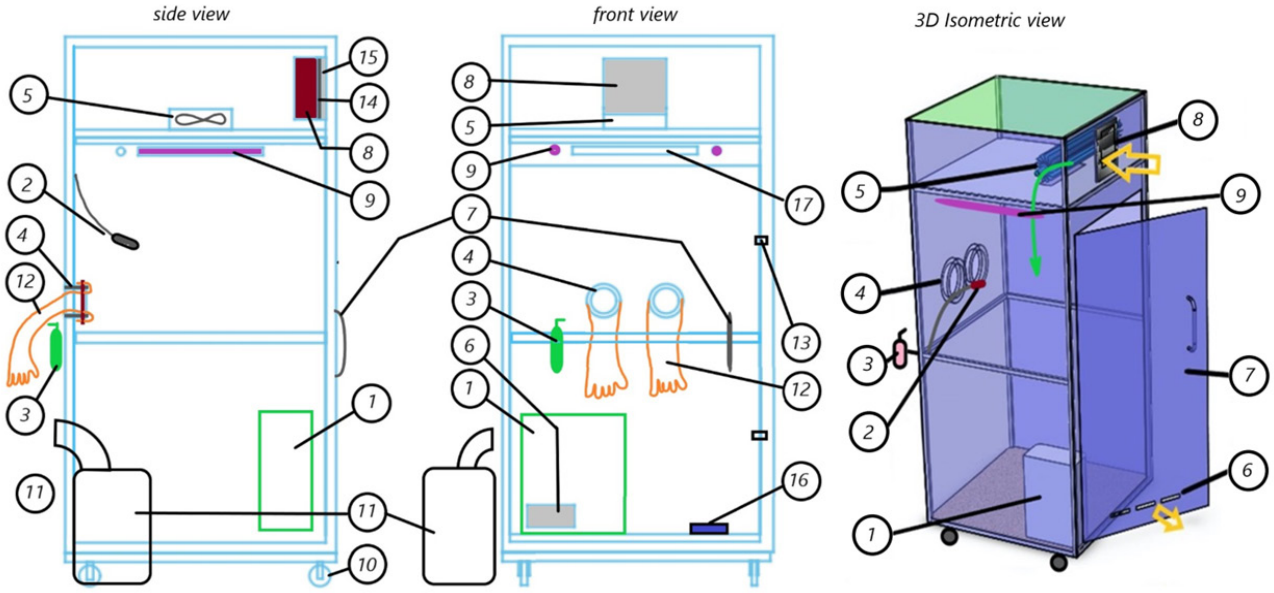
The size of the chamber was 1.2 m x 1.2 m x 1.2 m and wide enough to be used by healthcare workers of various sizes. The chamber was mobile and designed to be easily moved using the attached wheels. To make a strong construction but light in weight, the chamber was built using rust-resistant aluminium material with a 5 mm acrylic wall. The chamber was designed with transparent walls, one of which had a pair of long gloves for a healthcare worker to use to take the nasopharyngeal and oropharyngeal swabs for COVID-19 testing using the RT-PCR method.

The safety aspect of the healthcare worker and the environment was a priority when developing this chamber. In addition to being pressurized positively, this chamber was equipped with a HEPA filter to keep the air circulation and exhaust system safer. The HEPA H14 filter, which has 99.995% efficiency in filtering material less than 0.3 microns, was chosen.[5]

Additionally, the chamber was equipped with an air cooler to make the healthcare worker comfortable inside the chamber. There was a microphone attached to the acrylic plexi-glass wall to communicate with the patient or person outside the chamber. There was also a spotlight for lighting. The construction was designed to have a limited indentation in order to be cleaned easily. The chamber had a disinfection system with a UV light and H_2O_2 dry misting system. The dry misting system was used to disinfect the surface of the chamber facing the patient's side during patient turnover. The UV light was used to sterilize the entire chamber after use. The construction scheme of the chamber is described in Figure 1.

2.2 GAMA Swab Sampling Chamber testing

Some testing was done to ensure that the chamber can be operated following the medical equipment standardization. Construction and airflow testing using either numerical simulations or experimental testing had been done. We examined the air capacity that passes through and the pressure difference that occurred between inside and outside the chamber (Figure 2). Initial testing was conducted using the Computational Fluid Dynamics (CFD) technique simulation to estimate the capacity requirements and size of the air ducts according to the standards. Simulations were done at the same time to see the direction of the airflow and pressure distribution with the simulation configuration using the eddy viscosity



Annotation
1. Air cooler
2. Microphone
3. Handrub
4. Swab hole
5. Positive pressure fan
6. Filter exhaust
7. Door handle
8. HEPA filter
9. UV light
10. Wheels
11. Disinfectant (dry mist)
12. Gloves
13. Door lock
14. Polypropylene filter
15. Aluminium
16. Disinfection pedal
17. Spotlight

Figure 1. GAMA Swab Sampling Chamber construction scheme

k-ε turbulence equation. For the experimental testing, measurements were made for different pressure conditions using a magnehelic gauge and impermeability testing by using fogging smoke inside the chamber.

There were also some tests to check the cubicle's tightness and the function of the chamber. The cubicle's tightness was tested by observing the smoke flow from inside the chamber. The functional tests were done by clinicians actually swabbing the simulated patients.

2.3 Location of GAMA Swab Sampling Chamber

The GAMA Swab Sampling Chamber is dedicated to walk-through outpatients sampling. In order to be utilized optimally, the chamber is located in an open space outside the Emergency Department of Gadjah Mada Hospital. Because it is located outdoors, the patient queue can be arranged with a safe distance. Sunlight exposure helps in ensuring the remnants of aerosols can be disinfected by UV in the sunlight to minimize the cross-contamination to the environment.

2.4 Swab sampling

The procedure that the patient must follow for taking nasopharyngeal and oropharyngeal swabs: (1) register at Gadjah Mada Hospital, (2) fill in the patient registration link, (3) get a queue schedule, (4) follow the sampling instructions in the GAMA Swab Sampling Chamber, and (5) get the results via email or WhatsApp. Patients with positive RT-PCR results will be informed and referred for further examination at the Respiratory Clinic of Gadjah Mada Hospital.

2.5 The usage of the GAMA Swab Sampling Chamber

The GAMA Swab Sampling Chamber was used first on April 24, 2020. The data of patients using this chamber were documented in the hospital register. Then, the nasopharyngeal and oropharyngeal swabs were sent to Microbiology Laboratory, Faculty of Medicine, Public Health

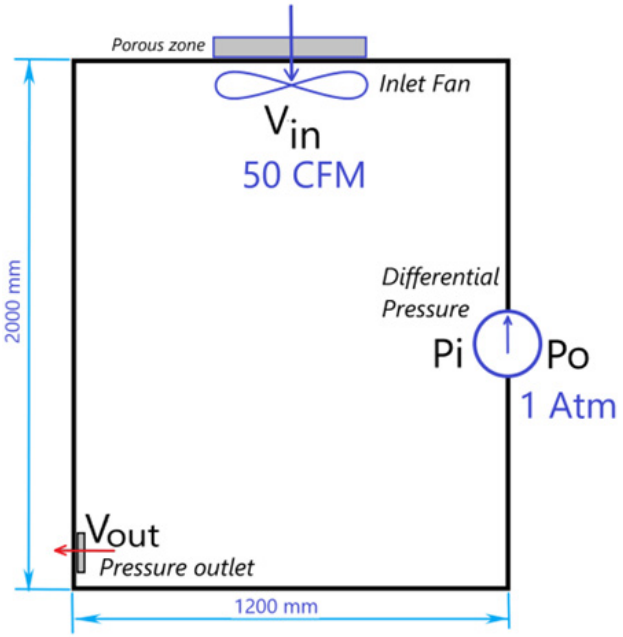


Figure 2. GAMA Swab Sampling Chamber testing scheme

and Nursing, Universitas Gadjah Mada for RT-PCR testing. The results of the RT-PCR tests were documented in the register in the Clinical Pathology Laboratory of Gadjah Mada Hospital.

2.6 Ethical approval

The Medical and Health Research Ethics Committee, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia approved this study with letter number KE/FK/0680/EC/2020.

3. Result

The GAMA Swab Sampling Chamber was built in eSVe FabLab Vocational School Universitas Gadjah Mada with aluminium for the frame and 5 mm acrylic for the walls. The chamber was designed with transparent walls, one of which had a pair of long gloves for a healthcare worker to use to make nasopharyngeal and oropharyngeal swabs. This chamber was equipped with a HEPA filter, microphone, spotlight, water cooler, UV, and dry mist disinfectant (Figure 3a).

The results of the flow simulation, showing airflow's source through the HEPA filter at the top, then lead and was concentrated at the bottom of the chamber (Figure 3b). The effect of using a HEPA filter caused the airflow capacity to be 50 cubic feet per minute (CFM) so that the clean air exchange capacity reached 23 air changes per hour (ACH). Meanwhile, the effect of the flow entering the chamber caused the pressure in the chamber to be higher. The results of the pressure distribution showed that there was an average pressure difference of 12.13 Pa, which was consistent with experimental testing using magnehelic differential pressure gauges. The measurement results showed a pressure difference in the chamber and outside air of around 12 Pa (Figure 3c).

The cubicle's tightness was tested by observing the smoke flow from inside the chamber (Figure 3d). Observations show that the smoke flows only through the outlet channel area. Meanwhile, functional tests were conducted by swab-collecting clinicians, and the results showed that the equipment inside the chamber was easy to use and comfortable, as shown in Figure 3e.

Swab sampling service with this chamber at Gadjah Mada Hospital has been conducted starting on April 24, 2020. The nasopharyngeal and oropharyngeal swabs are taken from asymptomatic patients, suspected patients, and voluntary persons in outdoor area in front of Emergency Department Gadjah Mada Hospital (Figure 4). Until July 3, 2020, swab sampling has been done on 407 patients, consisting of 51 asymptomatic patients, 72 suspected patients, and 284 voluntary persons. The results of RT-PCR showed 4 of 284 voluntary persons (1.4%) and 2 of 72 suspected patients (2.8%) had positive RT-PCR results, while all asymptomatic patients had negative results (Table 1).

4. Discussion

In the process of oropharyngeal and nasopharyngeal swabs collection, a limited number of patients were diagnosed due to the considerable time required for wearing and removing PPE and environmental decontamination. For this reason, several types of screening centers have been developed to enable rapid swabs collection. The prompt screening and swabs collection are essential at

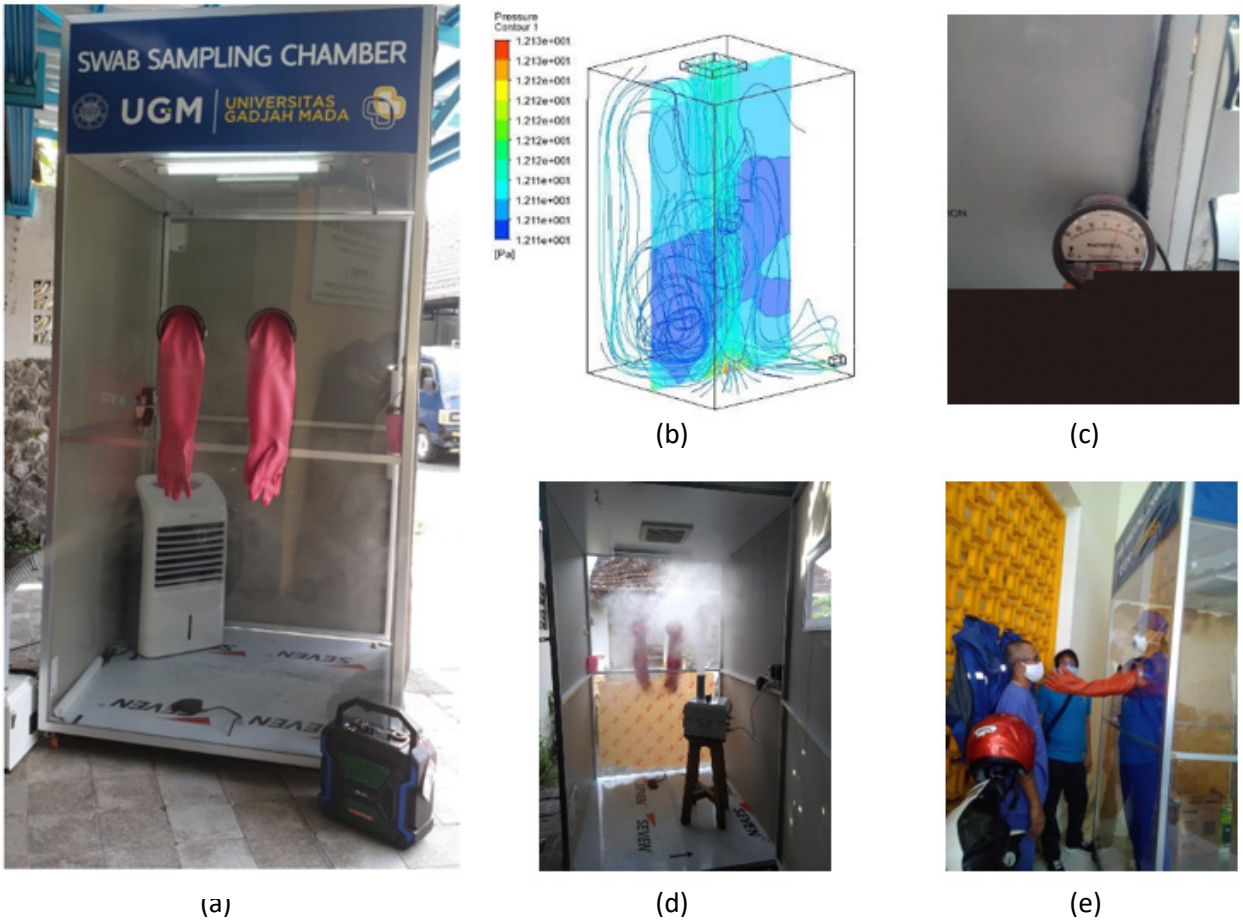


Figure 3. GAMA Swab Sampling Chamber, (a) prototype, (b) flow simulation, (c) pressure difference measurement, (d) impermeability test and (e) functional test

the screening centers, but the safety of health workers and patients is the top priority. Cross-contamination should also be minimized during oropharyngeal and nasopharyngeal swabs collection process.[6]

The use of a sampling chamber for collecting COVID-19 patient swabs is one of the solutions that has proven to be effective and efficient. The use of a sampling chamber in South Korea has been shown to provide significant benefits because it can do swab sampling quickly and in large quantities, saves the use of PPE and prevents the spread of aerosol contamination due to sampling.[7–9] A similar sampling chamber was also used at Stanford University Hospital, USA, during the influenza pandemic several years ago.[10]

Gadjah Mada Hospital, as one of the COVID-19 referral hospitals in Yogyakarta, has the capacity of 107 beds intended for caring for patients with COVID-19. Gadjah Mada Hospital also provides a specialized COVID-19 clinic for outpatient services. With an increasing number of suspected and symptomatic individuals to be tested, there is a need for a safe and efficient screening system. COVID-19 services at Gadjah Mada hospitals are supported by a trained swab sampling team consisting of an ear, nose and throat specialist, clinical microbiology residents, and general practitioners. The Gadjah Mada Hospital has provided GAMA Swab Sampling Chamber specifically for asymptomatic and suspected patients as well as voluntary person swab sampling.

The GAMA Swab Sampling Chamber is developed based on the chamber used in the walk-through (WT) screening center in South Korea. This chamber is designed to provide a

Figure 4. Swab sampling service with a GAMA Swab Sampling Chamber in Gadjah Mada Hospital

Table 1. RT-PCR results for COVID-19 patients whose samples were taken at the GAMA Swab Sampling Chamber

Groups	Number of samples n	Positive result n (%)	Negative result n (%)
Asymptomatic patient	51	0 (0)	51 (100)
Suspected patient	72	2 (2.8)	70 (97.2)
Voluntary person	284	4 (1.4)	280 (98.6)
Total	407	6 (1.5)	401 (98.5)

The samples were taken from April 24, 2020 until July 3, 2020 (ten weeks)

rapid screening, have a minimal risk of infection, and reduce excessive use of medical supplies like PPE. The risk of infection may be reduced by limiting the exposure to patients or direct contacts between the patients and healthcare workers. The WT screening center in South Korea used a negative and positive pressure chamber. In the WT screening center using a negative pressure chamber, the patients stayed inside the disinfected chamber, while the healthcare worker is outside the chamber, disallowing a direct contact between the two. In the positive pressure chamber, the health care worker stays inside the chamber while the patient stays outside; thus, direct contact between the two is avoided. This strategy has been successfully applied to the COVID-19 outbreak in South Korea.[7]

The GAMA Swab Sampling Chamber is a positive pressure chamber with the healthcare worker positioned inside with the patient outside the chamber. Collecting a swab with a positive-pressure chamber provides advantages because there is no need to clean the chamber after sampling the patient so that the process can be done faster. The time for swab sampling with this chamber is around 15-20 minutes. A similar duration of time was reported in the use of a sampling chamber in South Korea. In the WT screening center in South Korea, sampling

with a negative pressure chamber takes about 20 minutes per patient, while sampling with a positive pressure chamber requires a shorter time, which is 15 minutes per patient.[7]

A swab sampling process is a procedure that potentially produces droplets. Accordingly, it is essential to ensure that droplets do not contaminate the surrounding environment or become a potential for cross-contamination between patients. To overcome this risk, the GAMA Swab Sampling Chamber is equipped with an H_2O_2 dry mist disinfectant, which is used to disinfect the surface of the chamber facing the patient. Thus, any droplets attached to the surface of the chamber or gloves can be safely removed. Analysis of 22 related studies showed that human coronaviruses such as SARS coronavirus, Middle East Respiratory Syndrome (MERS) coronavirus, and endemic human coronavirus (HCoV) can survive on the surface of inanimate objects such as metals, glass, plastics for up to 9 days. Nevertheless, these viruses can be inactivated by disinfection of the surface of the object using ethanol 61-71%, H_2O_2 0.5%, and Na hypochlorite 0.1% for 1 minute.[11]

Research showed that exposure to H_2O_2 vapor (HPV) created by changing 35% w/w liquid H_2O_2 into HPV in several viruses, namely FCV (strain 255) as a representative of human norovirus, Purdue strain of Transmissible Gastroenteritis Virus (TGEV) as representatives of the SARS virus (severe acute respiratory syndrome), human adenovirus type 1 (hADV-1), AIV (A/chicken/Maryland/2007 [H9N9]), and SwIV (A/swine/Minnesota/2010 [H3N2]) resulted in evidence that HPV can kill the viruses tested. The results of that research supports the use of H_2O_2 dry mist in this sampling chamber.[12]

In the sampling process, droplets may be flying in the air. The sampling chamber is placed in open space, so that the exposure of ultraviolet (UV) from the sunlight can inactivate the formed droplets to avoid environmental contamination. Based on the wavelength, UV light can be classified into three bandwidths, UV-A (320-400 nm), UV-B (280-320 nm), and UV-C (200-280 nm). UV-A is the main ultraviolet component of sunlight that reaches the ground. While UV-B only has the effect of killing weak germs, only a small portion of UV-B reaches the earth's surface because most of it is absorbed by the atmosphere. UV rays that are commonly used for disinfection are UV rays whose wavelengths are below 320 nm. Unfortunately, the majority of UV rays that reach the ground are UV-A, with only little UV-B, and very little UV-C. Based on this pattern, it can be said that UV rays that reach the ground are less effective as a germicidal agent.[13,14] Therefore, the sampling chamber equipped with a UV-C light source, which is turned on every day after the swab removal procedure was added. UV-C is used for the disinfection of viruses and other germs on the surface of the chamber. UV-C is very damaging to cells because their nucleic acids absorb it. Microbes are susceptible to light at wavelengths around 253.7 nm because the maximum wavelength absorbed by DNA molecules is 260 nm. Also, the effectiveness of UV-C has been proven in viruses in the air carried by aerosols. For example, a very low dose UV (2 mJ/cm^2) with a 222-nm wavelength deactivates more than 95% of the H1N1 virus in the air.[15,16]

The use of the sampling chamber is still limited to collecting samples of standing patients and cannot be done on patients lying down. Although limited to standing patients, the use of this sampling chamber provides great benefits because it facilitates the sampling process of patients with COVID-19 so that large numbers of patients can be tested in a short time, thereby reducing the PPE use and the need for a negative pressure isolation room.

5. Conclusions

The use of the GAMA Swab Sampling Chamber can simplify the process of collecting swab samples from patients with COVID-19, so that the sampling for a large number of patients can be done in a short time. The use of this chamber also reduces the need for PPE usage and a negative pressure isolation room which are limited in the current pandemic situation. The GAMA Swab Sampling Chamber can be used

for a safe and efficient swab sampling system, even though it is still limited to patients in the stand-up position.

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Conflict of interests

The authors declare that there is no conflict of interest.

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User acquisition and profile of COVID-19's health education website: A descriptive study

Avinindita Nura Lestari,[1*] Tiara Putri Leksono,[2] Reyfal Khaidar,[3] Ekky Novriza Alam,[4] and Lutfan Lazuardi[5]

[1]Faculty of Medicine, Universitas Islam Bandung, Bandung, Indonesia
[2]Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[3]Faculty of Medicine, Universitas Islam Negeri Syarif Hidayatullah Jakarta, Jakarta, Indonesia
[4]Information System Department School of Industrial Engineering, Telkom University Bandung, Indonesia
[5]Department of Health Policy and Management, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Indonesia

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User
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ABSTRACT A health start-up in Bandung, Indonesia made initiatives to educate people about COVID-19 prevention through downloadable scripts and audio in the form of Public Service Announcements provided in 19 local languages through the website called HEUP or Health Empowerment and Educational Project. This study aimed to know the characteristics of profile users accessing the HEUP website containing health promotion material through a descriptive observational approach. Data came from Google Analytics which collects traffic from the main website. We examined the audience data, consisting of demographics and geographical distribution. Additionally, we observed the acquisition data which helped us see the website traffic. A significant difference was found in this study in the age group, while the gender group did not have any substantial difference, with only 8% disparity. By geographical distribution, 60% of top users were located in cities, especially in Java Island. Direct traffic, interestingly, made up almost 86% of all traffic. Twitter ranked at the top for the social media traffic in our case. In conclusion, it is necessary to promote credible information in COVID-19 preventive measures and help maintain the accessibility of information.

1. Introduction

On December 31st, 2020, the World Health Organization (WHO) China Country Office reported a pneumonia of unknown cause from Wuhan city, China.[1] A week later, the etiology was identified as a new type of Coronavirus, named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV). Later, it was called Coronavirus Disease 2019 (COVID-19) by the WHO on February 11, 2020.[2]

People are exploring health information by seeking the information via the Internet. They seek information from various websites disseminating health information online, with likely consequences for the health care system.[3] The Internet is a large source of health information and has the capacity to influence its users. Another phenomenon that exists is the digital divide, which has also been studied in Indonesia. From a survey by Lim in 2011, and Wattegama and Soehardjo in previous years, 85% of the respondents owned a mobile phone and only 27% of the mobile phone owners accessed the Internet.[4] It showed that not all of Indonesia's population used the gadget effectively. Surprisingly, less than half of our population used the Internet. Based on Global Connectivity Index, Indonesia had a population of 260 million according to the United Nations, and 93.4 million of whom were Internet users.[5] Meanwhile,

*Correspondence: avininditanl@gmail.com
Faculty of Medicine, Universitas Islam Bandung, Jalan Tamansari No.20, Bandung, Jawa Barat, Indonesia, 40116

over time, the Association of Internet Service Providers in Indonesia (APJII) 2018 survey showed that the 2018 national Internet penetration rate was 64.8%, showing growth from the previous year of 54.68%.[6]

Digital divide is not only defined by the matter of Internet accessibility, or we could say, a single dimension. There are more variables to it. Some dimensions that we should look for include: 1) the subjects (e.g. divide between individuals, countries, etc.); 2) different characteristics among the subjects (e.g. income, geography, age, etc.); 3) the ways of connecting (mere access or effective adoption), and 4) tools (e.g. phones, Internet, digital-TV, etc.).[7] To know how important information was received in a community, we considered collecting demographic data and data traffic were of primary importance. By collecting these data, we could see if individual digital divide occurs, such as gender, age, and geography. Thus, our target population were people who were willing and had access to visit the HEUP or Health Empowerment and Educational Project website for improving their knowledge on COVID-19 health promotion.

Reflecting on the content of the health messages, it needs to convey accurate information in a way that is understood by the public, particularly the COVID-19 preventive measures, since there is currently no vaccine or specific antiviral treatment. Additionally, the prevention behaviors noted in this study could be applicable worldwide.[8]

While there has been a lot of information spreading in social media, television, radio, and we were fortunate enough to have the access through our fingertips. This is not usually the case with underprivileged people with little access to technology. In Latin America, the current tariff structure has an inhibiting effect on service consumption by the poor[8], whereas they also have the same risk from being infected or of infecting people with COVID-19 just as we do. Uniquely in Indonesia, in every street corner there are many mosques/small churches/local gathering places with their loudspeaker on. HEUP, a health startup based in Bandung, saw this as an opportunity and made initiatives to educate people about COVID-19 prevention through downloadable scripts and audio in the form of Public Service Announcements (PSA). As per June 2020, HEUProject had released the downloadable scripts and PSA in Bahasa and 19 different local languages.[9] We saw the PSA as a good instrument for health promotion because the WHO has also pointed out ways of bridging the language divide in health, highlighting that language could be a barrier to accessing relevant and high-quality information, and for delivering appropriate health care.[10]

Accordingly, reflecting on the multiple dimensions of the digital divide, this study aimed to know the characteristics of profile users accessing the website for HEUP's downloadable educational script regarding COVID-19 via demographic data and website traffic.

2. Method

This study used a descriptive observational design conducted during the Sounds of Nusantara Project by the HEUProject. The study was conducted using secondary data. The data were taken from Google Analytics as a third party application that helped record traffic of HEUProject's website from 23rd March-7th April 2020 to get descriptive characteristics of users assessing the website at covid19.heuproject.com. The data used consisted of demographics (age and gender) and geographical distribution, particularly cities. Not only examining the audience data, we also observed the acquisition data that helped us in seeing website traffic. There were no ethical concerns since the data inputs were all anonymous.

The data were divided into several categories according to the purpose of the analysis, including user data, location, reference sources, and social media reference sources. The purpose of the analysis stage was to find a correlation between user users, location and reference sources that lead users to access the website. Google Analytics can help filter data as needed, such as filtering website visitor data from social media (for example Twitter, Instagram, and Facebook). The results of the screening process are shown in Table 3. The process and analysis results are described in the next section.

Table 1. The top 10 list of Users based on Cities

Group	User detail		
	Users	New users	Session(s)
Total	9,788	9,504	12,444
Jakarta	2705	2559	3375
Bandung	1861	1761	2377
Depok	832	790	1010
Surabaya	630	605	747
Makassar	420	409	521
Batam	247	221	292
Semarang	225	212	292
Medan	197	184	234
Surakarta	193	181	225
Brighton	190	190	190

3. Result

By April 7th, 2020, 2 weeks after the launching of the downloadable script and PSA, according to Table 1, there were 9,788 users who assessed the website distributed over 231 cities worldwide. The top cities were mainly located in Java Island. Surprisingly, the traffic also reached out to another city outside of Indonesia, which was Brighton.

Regarding Figure 1, based on the data we acquired, the percentage of men (54%) that accessed the web of COVID-19 education was more than women (46%). Moreover, the data showed that the primary age group that accessed this site was in the range of 25-35 years old (33.5%), followed by groups of range 18-24 years old (27,5%), and then by 35-44 years old (15.5%). A small percentage under 10% was identified in both groups of ages 55-65 and >65 years old.

As depicted in Figure 2, the age group distribution of users was calculated by 12,444 sessions. Table 2 displays information about the ways viewers reached the website, or in this case, the website traffic. Among 9,788 users, as many as 8,425 users directly accessed the web, while a significant amount of nearly a thousand users accessed through social media platforms. Website referral access was done by 351 users and the rest were done by organic search. Among 977 users, as presented in Table 3, Twitter traffic reached the top rank by 569 users and 689 sessions.

4. Discussion

4.1 Geographical distribution by cities

In terms of users, based on data from the Association of Internet Service Providers in Indonesia (APJII), Indonesia's Internet penetration in urban areas has a figure of 74.1% for Internet users and 25.9% for Internet non-users. From the same survey, in all regions of Indonesia, the highest contribution of Internet use was from Java as much as 55.7%, followed by Sumatra as much as 21.6%. Nearly 11% of users are spread across Sulawesi-Maluku-Papua and no more than 7% for each in Kalimantan, Bali and Nusa Tenggara. There was a significant difference when compared to rural areas, where Internet users are around 61.6% and not internet users are 38.4%.[6] This was reflected in the results of the study shown in Table 1, where 6 out of top 10 cities were from Java Island in Indonesia. Surprisingly, Makassar was in the 5th rank of top cities by the number of users.

The setting and population in Indonesia, which is an archipelago country with numerous ethnic and linguistic groups make the health promotion system become more complex and trickier in terms of health promotion messages. Additionally, the political decentralization structure in the health system can affect the method of health promotion.[11] We found that our study also illustrates these differences and thus it serves as a lesson learnt for such a case of digital divide.

4.2 Age and gender

Our study results show that the most frequent age group that accessed the HEUP site was the range of 25-35 years old, which was stated previously in a research by Hargittai showing significant differences in online skills, particularly by age, and also described that people in their teens and people in their 20s are quicker than people in their 30s and 40s.[12] Moreover, a study of 605 respondents by Puspitasari and Ishii in Indonesia in 2015 found that more educated and younger people accessed the Internet more often although the study was centered in big cities and did not include geographical (rural-urban) variables in the survey distribution.[4]

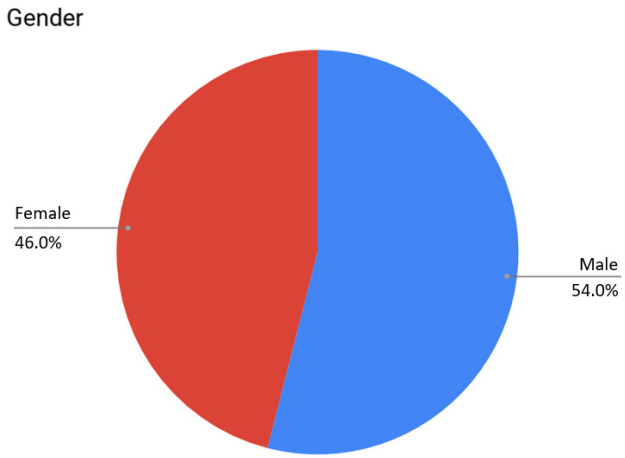

Figure 1. Gender distribution of 12,444 user sessions

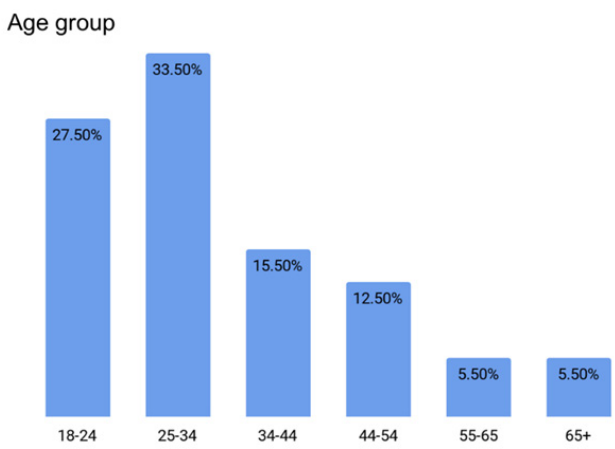

Figure 2. Age group distribution of 12,444 user sessions

Table 2. Website traffic generated by user

	Number of users
Direct	8,425
Social	977
Referral	351
Organic search	66
Total	9,788

Table 3. Social media traffic of the website

Social Network	Users	New Users	Sessions
Twitter	569	555	689
Instagram Stories	200	195	207
Instagram	138	133	146
Facebook	72	70	80
YouTube	1	0	2
Total	977	953	1,124

The study findings of the gender group did not show any significant difference, with only 8% disparity. This is consistent with the research that showed there is no influence of gender on whether people are able to efficiently navigate the content of the Web and how long they take to do so. On average in comparison, women completed 4.19 tasks compared to men's 4.26 average success rate. The average total time spent on the five tasks for women was 14.6 minutes whereas for men it was 12.9 minutes. Neither of these differences were statistically significant, suggesting that there is no influence of gender on whether people are able to efficiently navigate the content of the Web and how long they take to do so.[13]

Reflecting on the importance of young people as Internet users, it is also stated that Indonesia Broadband Plan includes a national digital literacy program to improve Internet and communication technology (ICT) literacy on the national level to promote adoption and meaningful use of broadband.[13] Recently, however, the Indonesian government removed the school subject of information technology from the new curriculum in 2013.[14] Promoting ICT skills may be the key to narrowing the digital divides that exist in Indonesia. It is recommended that future policy should consider the advantages of improving ICT literacy.

4.3 Website traffic

There are several methods of website acquisition conducted by visitors that created traffic. Direct traffic comes when visitors manually enter the website URL or have the page bookmarked and this traffic made up most of the users' traffic. In our case, it made up 86% of all traffic. Another different type is referral traffic. The difference lies in that these come from recommendations from a different site other than search engines for a specific website. As a user clicks on the hyperlink in a website that further takes them to a different page of the website, it is considered as the referral visit.[15] Another result is generated from organic search. The term 'organic search' encompasses a search generating results without

paid advertisements. The results of this search are listed on the search engine result page and appear when they are relevant to the keywords since they are generated by popularity and common usage.[16]

The utilization of referral sources can also be based on the category of the website. Social media websites can generate traffic, called the social traffic. These kinds of traffic, interestingly, made up almost 26 percent of all traffic. The utilization of referral sources can also be based on the category of the website. When websites use social media such as Facebook, Twitter, YouTube, and other similar sources to pull in traffic, the traffic generated is regarded as social traffic.[16] In this study, we can see that Twitter ranked at the top for social media traffic.

The online conversation about health is made possible by two factors. The first one is the availability of social tools, and the second one is the motivation among people to connect.[17] Turning to Twitter and COVID-19, there is a relevant illustration from a prior infodemiological study in South Korea in February 2020 that collected Coronavirus Twitter data from 43,382 users and 78,233 conversations. The study found that the spread of information among people who used the word 'Coronavirus' was faster. This highlighted the positive role of individuals and groups that further directed public attention to the pandemic crisis. Tweets containing medically framed news articles were found to be more popular than tweets that included news articles adopting non-medical frames.[18]

Our study reflects that there are still disparities in accessing information between cities located in the island of Java and the rest of the country. To engage a wider audience, such important information, especially in the terms of public health promotion, should be collectively broadcasted. We found data that showed the age group of 25-35 years old has the potential to reach out to more people about the content of information.

5. Conclusions

Most users accessing the website were 25-35 years old and located in Java Island. This implies that individual digital divide exists among the users. The way which the users assessed the information was via direct traffic or entering the URL manually and Twitter ranked the highest for social media traffic. Dissemination of information was lacking in organic search aspects. This means that it should be necessary for any health information provider to ensure good promotion and user engagement as well as the content to ensure the information can be disseminated widely. The website creator could take measures on how to increase search engine optimization reflecting on the low level of organic search traffic. We also can see the potential of the 25-35 years old age group to promote the information on the Internet. By promoting these messages, this can help maintain and increase the accessibility of information.

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Conflict of interests

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Impact of COVID-19 on primary care visits: Lesson learnt from the early pandemic period

Sholahuddin Rhatomy,[1,2*] and Thomas Edison Prasetyo[3,4]

[1]Sport and Adult Reconstruction Division, Department of Orthopaedics and Traumatology, Dr Soeradji Tirtonegoro General Hospital
[2]Department of Surgery, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[3]Soeradji Tirtonegoro Sport and Research Unit, Dr Soeradji Tirtonegoro General Hospital, Klaten, Indonesia.
[4]Internship Medical Doctor of Puskesmas Bayat, Klaten, Indonesia

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ABSTRACT In Indonesia, primary healthcare facilities play important roles in disease control and prevention. Changes in healthcare seeking behavior during the COVID-19 pandemic, especially to primary care, might have impacts to the overall public health status. This comparative epidemiology study aimed to investigate the changes of healthcare seeking behavior in primary care settings during the early pandemic period. Weekly number of visits to a primary healthcare facility in Klaten, Indonesia was examined from the 1st week of 2018 –through the 25th week of 2020. The selected period affected early by COVID-19 in 2020 was defined (early pandemic period) and compared to the same corresponding period in 2019 (comparison period). The total number of patient visits, number of visits by age, gender, clinical decisions, patient status and diagnostic categories were obtained, compared, and analyzed. Mean differences and prevalence ratio of a specific diagnostic category between the two periods were calculated. The lowest period was from weeks 14 – 21, 2020, which we identified as the early pandemic period. Comparing the early pandemic period to the comparison period, we found that there was 46.3% decrease of total number of visits. The decline was especially apparent for children aged 0-9 (71%), females (46%), registered patients (49%), and outpatients (48%). Most of diagnostic categories also saw declines. Unfortunately, patients with hypertension also saw notable decline in mean differences and prevalence ratio albeit not desirable. In conclusion, some declines in the number of visits were not desirable including decreasing hypertension visit. This trend might negatively impact public health status afterward. Proper countermeasures are needed to control the ongoing trend. Further studies regarding the impact of COVID-19 on treatment seeking behavior is needed to plan effective countermeasures.

1. Introduction

Coronavirus disease 2019 (COVID-19) is a disease caused by the transmission of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). It was declared a pandemic by the World Health Organization (WHO) on March 11, 2020 and a national public health emergency by the President of Indonesia, Joko Widodo on March 31, 2020.[1,2] As of July 12, there have been 75,699 confirmed cases and 3,606 total deaths in Indonesia.[3] These numbers are still increasing daily.

The transmission of SARS-CoV-2 is faster than the first coronavirus, the causal agent of Severe Acute Respiratory Syndrome (SARS), due to several reasons. Viral loads in the nose and throat were found to be higher for SARS-CoV-2. Additionally, infected people might show only few to no symptoms. This phenomenon was not observed in SARS, in which no reported transmission occurred before the development of symptoms.[4–6] Bertolino et al.[7] reported that COVID-19 symptoms were fever in 76-99% cases, cough in 70%, shortness of breath 46%, and 80% had other mild symptoms, although

*Correspondence: doktergustomrhatomy@yahoo.com
Sport and Adult Reconstruction Division, Department of Orthopaedics and Traumatology, Dr Soeradji Tirtonegoro General Hospital. Jl. Dr. Soeradji Tirtonegoro No.1, Dusun 1, Tegalyoso, Kec. Klaten Sel., Kabupaten Klaten, Jawa Tengah 57424

the authors stated that the data were obtained from a hospital setting. Therefore, the WHO has strongly advised the public to take several precautions including hand and respiratory hygiene, physical distancing, and staying home.[8]

As the number of confirmed cases increased exponentially, reports from USA[9–11], Canada[12], Norway[13], Italy[14], Austria[15], Greece[16], Turkey[17], India[18,] and Hongkong[19] suggested sharp declines in the number of patients looking for medical care, both in outpatient and emergency department (ED) settings. This has raised some concerns, especially when serious conditions such as stroke or acute coronary syndrome, also have decreased.[12,15,18,19] A big data analysis was conducted by the Centers for Disease Control and Prevention (CDC-P), USA, comparing the number of visits to ED from a subset of hospitals in 47 states during the early pandemic period (week 14-17, 2020) to a comparison period (week 14-17, 2019). They found that the number of visits for conditions including nonspecific chest pain and acute myocardial infarct decreased. This trend might suggest people tended to delay care for serious health issues, which eventually can lead to additional morbidity and mortality. It is important to note that, compared to the previous year, the number and ratio of visits for cardiac arrest and ventricular fibrillation increased.[11] While most of the studies and reports focused on decline in ED visits, a study by Kutlu et al.[17] addressed the effect in dermatology clinic setting. It was found that the number of outpatient dermatology clinic visits decreased significantly in the early period of COVID-19 outbreak. Interestingly, acne was still at the top of diagnoses before and during the pandemic despite severe warnings and enforcement of staying home. Irritant contact dermatitis also increased, suggesting improper use of hand hygiene. This epidemiological information is essential to synthesize accurate health messages to the public.

In Indonesia, primary healthcare facilities play important roles in disease control and prevention. The national health system encouraged the public to seek treatment in the primary care settings before further specialized care. This process is continuously monitored by the Social Security Administrator of Health (*Badan Penyelenggara Jaminan Sosial* [BPJS] *Kesehatan*). Therefore, a large number of Indonesians depend on the primary care to receive their treatments. Changes in healthcare seeking behavior during this pandemic, especially to the primary care, might translate to changes of the overall public health status.

Our target population was from Bayat, Klaten, Central Java. According to latest official data from 2019[20], Bayat had a total population of 65,148 within 18 subdistricts, with 1 public primary healthcare facility and 3 private clinics, 5 medical doctors, 22 midwives and 22 nurses. Majority of adults worked in agriculture or trading sectors. To date (July 8th, 2020), in Klaten regency, there were 167 cumulative confirmed COVID-19 cases. Among them, 133 have recovered, 27 were still in isolation, and 7 died. Bayat has contributed the highest number of cumulative cases.[21] In order to decrease the transmission, the Klaten governor has taken some countermeasures such as continuous monitoring of cases, health promotions through social media, public announcements and restrictions.[21]

Currently, we found no epidemiological study in Indonesia which assessed the trends of healthcare facility visits during the pandemic. In this novel study, we aimed to investigate the changes of primary care visits in the early pandemic period. Further, we examined differences in age groups, gender, clinical decisions, patient status and the diagnostic categories. We hypothesized that there would be a decrease in the total number of visits, as well as decreases in each group.

2. Method

2.1 Study design

This study was a novel epidemiologic study investigating the total number of visits, number of visits by age, gender, clinical decisions, patient status and diagnostic categories in a public primary care facility (*Pusat Kesehatan Masyarakat* [Puskesmas]) at Bayat, Klaten City, Central Java, Indonesia. Data were collected retrospectively from the online integrated information management system (*Sistem Informasi Manajemen Puskesmas* [SIMPUS]) of Puskesmas Bayat from July, 10-13th 2020. The online system is compulsory and widely used in Indonesian

healthcare system using diagnostic codes from the International Classification of Diseases, 10th revision (ICD-10).

2.2 Data collection

Weekly number of Puskesmas visits were retrospectively counted from the 1st week of 2018 – 25th week of 2020. In our study, the first week of a year was defined as a full 7 days from the first Sunday. Hence, in 2018, the first week started at January 7th. We would then select a weekly timeframe with the lowest total number of visits in 2020 (the early pandemic period) and compared it with the same weekly period in 2019. For this study, patients who receiving treatment outside the Puskesmas were excluded (e.g. home visits).

From the selected period, the number of visits from each patient age, gender, status (new or registered) and clinical decisions (outpatient, external or internal referral) were recorded. In addition, visits for specific diagnostic categories were compared using mean differences and prevalence ratios. The difference in mean visits per four weeks during the early pandemic and the comparison period was calculated for each diagnostic category as follows:

$$Mean\ difference\ per\ four\ week = \left(\frac{visits\ in\ category\ (early\ pandemic\ period) - visits\ in\ category\ (comparison\ period)}{total\ week\ in\ the\ period} \right) \times 4$$

The prevalence ratio (PR) for each diagnostic category was calculated as follows:

$$PR = \frac{\frac{visits\ in\ category}{total\ visits}\ (in\ early\ pandemic\ period)}{\frac{visits\ in\ category}{total\ visits}\ (comparison\ period)}$$

2.3 Diagnostic categories

SIMPUS could readily show 20 top diagnostic categories for a desired timeframe. As a novel study, we limited the analysis to these top categories during the selected timeframes. It was known that some diagnoses made by physicians could be inputted into one or more diagnostic categories or subcategories in the system. Any doubts regarding similar diagnostic categories were resolved by discussion with the coding officers and physicians of Puskesmas Bayat whether the clashing categories could be combined into one bigger category. If eligible, the combined categories were given a new label.

2.4 Data management

The data were all inputted, tabulated and analyzed using the SPSS 25.0 statistical system (IBM Corporation, USA).

3. Result

Figure 1 shows the weekly number of Puskesmas Bayat visits in years 2018, 2019 and 2020. As for year 2018 and 2019, the trend was linear. Note that the deep bottom of year 2018 (23rd week) and 2019 (22nd week) was due to the Eid al-Fitr and national leave days.

In 2020, a strong downtrend occurred from the 12th – 13th week of 2020. In week 14, the graph started to plateau, although a much weaker downtrend can still be seen until week 21. The nadir was in weeks 17th and 20th, each with the total of 282 visits per week. However, the decrease was greater in the 20th week compared to last year (54.9%). Afterward, the number of visits increased although until our most recent data at week 24, it was still 29.9% below the corresponding week in 2019.

To quantify the early effects of COVID-19 on the number of Puskesmas visits, we defined an eight-week period in which the weekly numbers were at the lowest, which was week 14 – 21 (March 29 – May 23, 2020). This “early pandemic period” was compared to the corresponding eight-week period in the previous year (March 31 – May 25, 2019). The early pandemic period saw a 46.3% decrease of overall visits compared to 2019 (2,727 vs. 5,074 visits).

Figure 2 breakdowns the visits by age, gender, final clinical decisions, and patient status. To summarize, all age group saw diminishing visits, especially in younger groups, which were children aged 0-9 years (71%), adolescents aged 10-19 years (63%), and young adults aged 20-44 (50%). Decrease

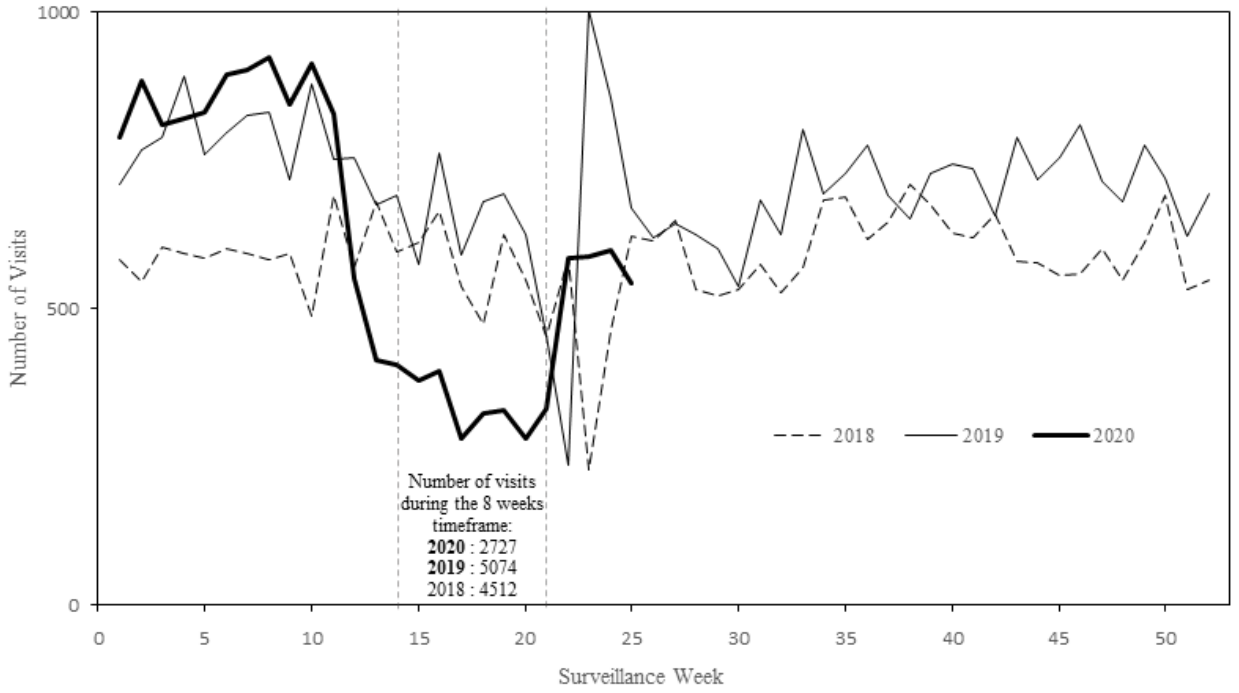

Figure 1. Weekly number of Puskesmas Bayat visits from January 4, 2018 to May 23, 2020. The vertical dashed lines delineate the eight-week periods, the early pandemic period (March 29 to May 23, 2020) and the comparison period (March 31 to May 25, 2019)

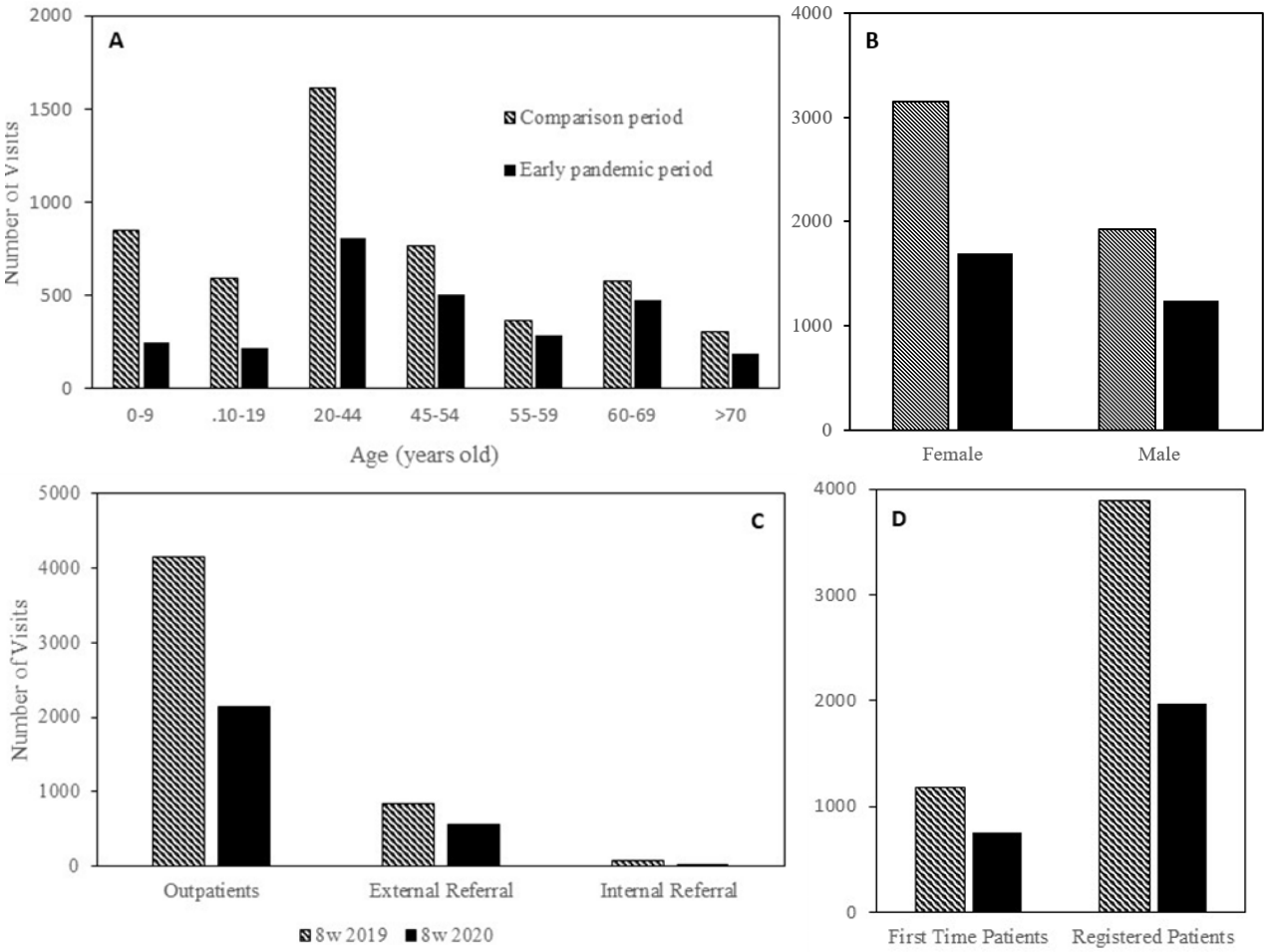

Figure 2. Puskesmas Bayat visits on March 29 – May 23, 2020 (early pandemic period) and March 31 – May 25, 2019 (comparison period) by age group (A), gender (B), final clinical decision (C), and patient status (D). The data are taken from SIMPUS.

Table 1. Diagnostic categories adjustment process

No.	Similar or vague diagnostic categories				Discussion result	Adjusted diagnostic category
	Category 1	Category 2	Category 3	Category 4		
1	Essential (primary) hypertension	Renovascular hypertension	-	-	Both were used for the same diagnosis	Essential hypertension
2	Acute upper respiratory infection, unspecified	Acute nasopharyngitis [common cold]	-	-	Both were used for the same diagnosis	Acute upper respiratory infection
3	Dyspepsia	Gastritis, unspecified	Other gastritis	-	Both were used for the same diagnosis	Discomfort related to stomach
4	Supervision of normal first pregnancy	Antenatal screening	-	-	They were combined because it could be used interchangeably	Supervision of pregnancy
5	Dermatitis, unspecified	Other dermatitis	-	-	Both were used for the same diagnosis	Dermatitis
6	Need for immunization against tuberculosis [BCG]	Need for immunization against measles alone	Need for immunization against other combinations of infectious diseases	Need for immunization against tetanus alone	These categories were combined.	Immunization
7	General examination and investigation of persons without complaint and reported diagnosis	General medical examination	-	-	Both were used for the same diagnosis	General medical examination
8	Fever, unspecified	Other specified fever	-	-	These categories were combined	Fever
9	Counselling related to sexual attitude, behavior and orientation	-	-	-	This was inputted for patients seeking counselling in general, without any medical examination.	Counselling in general

was also seen in both genders. However, female visits showed more decline (46%) than males (36%). In the early pandemic period, visits of registered patients declined by 49%, while new patients decreased by 37%. As for final clinical decisions, the number of outpatients declined by 48%, external referrals by 33% and internal referrals by 71%.

Among the top 20 diagnostic categories in the included weeks of the two periods, there were some similar or vague categories. We discussed these potential biases with the officers and physicians and made adjustments. The adjustment process is shown in Table 1, and was followed by data analysis.

It was found that positive mean difference per four weeks only occurred in two diagnostic categories (Table 2.), immunization (mean increase

Table 2. Mean difference of visit per four week and prevalence ratio for specific diagnostic category

Diagnostic category	Mean difference of visit per four weeks	PR
Acute upper respiratory infection	-619	0.39
Myalgia	-255	0.69
Essential Hypertension	-230	0.77
Discomfort related to stomach	-135	0.90
Headache	-98	0.99
Cough	-92	0.52
Fever	-88	0.81
Supervision of pregnancy	-61	1.01
Necrosis of pulp	-49	0.71
Dermatitis	-37	1.29
Diarrhea and gastroenteritis of presumed infectious origin	-31	0.88
General medical examination	-14	1.37
Non-insulin-dependent diabetes mellitus without complications	-4	1.54
Counselling in general	31,5	4,52
Immunization	41	5,04

Data are obtained from SIMPUS. The observed periods are March 29 – May 23, 2020 (early pandemic period) and March 31 – May 25, 2019 (comparison period). PR = prevalence ratio.

in 41 visits per 4 week) and counselling in general (32). The sharpest declines were observed in acute respiratory infection (-619), myalgia (-255), essential hypertension (-230), discomfort related to stomach (-135), headache (-98), cough (-92) and fever (-88). Other notable declines were supervision of pregnancy (-61), necrosis of pulp (-49), dermatitis (-37) and diarrhea and gastroenteritis of presumed infectious origin (-31).

During the early pandemic period, some increasing prevalence ratio included immunization (PR = 5.04), counselling in general (4.52), non-insulin-dependent diabetes mellitus without complications (1.54), general medical examination (1.37) and dermatitis (1.29). On the other hand, diagnostic categories with the smallest proportion were seen in acute upper respiratory infection (0.39), cough (0.52), myalgia (0.69), necrosis of pulp (0.71), essential hypertension (0.77) and fever (0.81).

4. Discussion

Our primary finding was that during the selected 8-week interval, total number of visits were markedly lower than the same 8-week period in 2019. This finding was especially true for children, adolescents, young adults, females, previously registered patients, outpatients and internal referrals. In the COVID-19 pandemic, people with mild conditions were discouraged from going to healthcare facilities to reduce transmission risk. The public were advised to seek treatment only if certain danger signs were apparent.[11,17,22] In Bayat, Puskesmas used public posters which had messages discouraging visiting Puskesmas. The officers also told people not to come to any health facility unless it was really needed. During the early pandemic, all public programs were postponed except home visits to patients with severe disabilities, such as hemiplegic post-stroke patients. Puskesmas did not admit inpatients in this period.

We found that immunization and counselling activities increased compared to last year, suggesting that there might be growing concern about personal health during COVID-19 pandemic. Concordant to the finding, the number of general medical examinations were also more prevalent than the previous year (PR = 1.37) as more people demanded health checkups.

The strongest decline was acute upper respiratory infection, both in mean difference and prevalence ratio. While the condition was generally accepted as a mild condition, this major decline might raise questions whether the public was reluctant to disclose information regarding their symptoms, as they had been continuously informed about the symptoms of COVID-19 including cough, fever, and shortness of breath.[7] The argument was supported

by the relatively sharp decline in cough and fever diagnostic category, both in mean difference and prevalence ratio. Further study is needed to address these reluctance issues.

Ideally, patients with milder conditions would be decreasing in frequency and/or prevalence ratio. On the other hand, several conditions should prompt the patient to seek treatment, including chronic conditions with the risk of worsening or complications, and acute life threatening conditions such as acute myocardial infarction, stroke, and severe shortness of breath. Thus, it was expected that these conditions would observe little to no change in the mean number of visits for but increasing prevalence ratio.

Hypertension and diabetes mellitus are known as common chronic diseases with complex pathophysiology that are faced daily in primary healthcare settings in Indonesia. If these conditions are not treated adequately, the intermediate or long term prognoses are poor. Moreover, both are significant comorbidities for many other diseases including COVID-19.[23–25] In this study, we found that the number of diabetes mellitus visits had shown minimal decrease in the four week average, yet the prevalence ratio surged 1.54 times higher than the comparison period. This was desirable as it indicated that the patients were still willing to come for follow-ups. However, patients with hypertension did not seem to follow the ideal scenario, as the 4 weeks mean difference was negative (-230) and the prevalence ratio was low (0.77). An actionable plan is therefore needed to control these trends.

Popular platforms such as Twitter, Instagram, Facebook and other social media have numerous roles in the pandemic. They are being used to monitor the progression of COVID-19 pandemic, to announce public policies and restrictions, to disseminate medical information or health advice, to deliver remote health care, and even to describe the geographic spread of COVID-19 which has been proven very effective.[26–31] In Klaten, the government used its official website and Instagram to deliver health messages, policies and monitor progressions.[21] We suggest that they should design an appealing public health poster to encourage people with chronic diseases, specifically hypertension, to see their physicians with masks, face shield and appropriate hand hygiene. As the impact of COVID-19 and sociocultural characteristics of people are varied across regions, we presently need region-based studies for each region and identification of appropriate platforms to effectively influence people's health behavior.

Since our epidemiology study only reported data from primary care setting, acute life threatening conditions were not prevalent and were not recorded in the top 20 diagnosis categories. From the experience of one of the authors as a general practitioner, some patients who came to the ED after the early pandemic period suffered complications from their underlying chronic diseases, saying that they did not take the medicine they usually took, because they were too scared to go to healthcare facilities.

Other results were expectable. Myalgia, discomfort related to stomach, headache, necrosis of pulp, dermatitis, and diarrhea were mostly mild in primary care settings, thus the number of visits were declining. It is interesting to note that in spite of the declining number of visits, dermatitis was more prevalent than the comparison period (PR = 1.29). Kutlu et al. [17] had similar findings in Turkey, in which irritant contact dermatitis were in their top 5 diagnoses during the early pandemic period. They suggested that this was probably due to irritating disinfectants for hygiene.

Some results of our study were very similar to the CDC recent big data report.[11] The decline in children visits was the most pronounced, with 71% in our study versus 72% in CDC report. Although in other age groups, their study used different cutoffs, from their graphs we could visually conclude that the younger groups were decreasing the most. Very similar results could be seen in gender groups, for which male and female visits decreased by 36 and 46%, respectively, in our study, as compared to 37 and 45% in the CDC report. These results implied that public reaction was probably similar despite differences in sociocultural systems.

Our study had several limitations. First, since this was a novel study, the total number of patients was small and therefore might not be representative of the

overall population of Indonesia. Second, analysis of diagnostic categories relied on the top 20 diagnostic categories and might not be adequate to represent overall changes of mean visits and prevalence ratio. It is noteworthy that for specific diagnostic categories in this period of interest, we used mean difference per 4 weeks, because the magnitude of change per 1 week might be too small to appreciate in such a low volume setting. Third, the setting of our study was limited to a primary healthcare facility. We did not examine other settings such as secondary and tertiary facilities, or emergency departments.

5. Conclusions

We highlighted that patients with essential hypertension might be too discouraged to receive their usual treatments. In this circumstance, local governments should be advised to publish more public education promotions in social media regarding the need of routine treatment for patients with hypertension. Further studies with bigger data, different geographical areas, and healthcare settings are needed to spot trend changes and thus aid in planning the proper countermeasures for these changes.

Conflict of interests

The author(s) declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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Ocular involvement of coronavirus disease (COVID-19): A systematic review of conjunctival swab results

Indra Tri Mahayana,[1] Natalia Christina Angsana,[2] Muhammad Zhafran Ayyasy,[2] Anastasya Sondang Hutajulu,[2] and Suhardjo[1]

[1]Department of Ophthalmology, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Ophthalmology Research Unit, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

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Conjunctivitis
Ocular manifestation

ABSTRACT Coronavirus disease (COVID-19) is a pandemic disease which is caused by the latest discovered coronavirus. Conjunctivitis is allegedly the first presentation of COVID-19 since it can spread by aerosol contact with the conjunctiva. The present study aimed to systematically review the employment of conjunctival swab with Real-time Polymerase Chain Reaction in detecting SARS-CoV-2. The research is a systematic review of the published scientific literature on findings of conjunctival swab of COVID-19 from PUBMED database and other additional sources (i.e: Google Scholar). The search method was done using "COVID-19 OR coronavirus OR SARS-COV2, AND conjunctivitis, AND ocular manifestations, AND conjunctival swab" as keywords. Inclusion criteria were any papers that related to the entered keywords and have conjunctival swab as a reported outcome. Letters, reviews, and editorials describing other studies reporting COVID-19 and conjunctival swab were excluded. Only four research papers were found and included in the literature review. From the four current research papers, positive SARS-CoV-2 results were yielded from 0-5.26% of conjunctival swab specimens. In conclusion, although the presence of the SARS-CoV-2 virus on the ocular surface remains unclear, the prevention of infection transmission through an ocular surface is mandatory by wearing goggles (or shield), mask (N-95 recommended) and gown.

1. Introduction

Coronavirus disease (COVID-19) is a communicable disease caused by the novel coronavirus and might cause mild to moderate respiratory symptoms and can be more serious in elderly and people with underlying diseases (chronic respiratory disease, cardiovascular disorder, diabetes mellitus, and cancer).[1] The pandemic COVID-19 began on December 31, 2019 with an outbreak of pneumonia-like illness in Wuhan, China.[2] COVID-19 has affected 210 countries and territories around the world. On April 13, 2020, the number of coronavirus cases reached 1,920,250 with 119,413 deaths. The largest number of cases have occurred in the USA amounted to 584,862 cases with 23,555 deaths.[3] On January 7, 2020, the disease was recognized as a novel coronavirus (nCoV) and on 11 February 2020, the WHO officially named it as Coronavirus Disease 2019 (COVID-19) and the original virus was previously named as SARS-CoV-2 (2019-nCoV severe acute respiratory syndrome-related coronavirus 2) by the Coronavirus Study Group of the International Committee on Taxonomy of Viruses. [4]

A few reports have been evaluated for the manifestation of SARS-CoV-2 in tear fluid.[5] Experience from health workers in Wuhan revealed that despite being fully dressed in N95 protective, viral infections still occurred with unilateral conjunctivitis as the first symptom, followed by the development of fever a few hours later.[2] An ophthalmologist (Dr. Li Wenliang) at Wuhan Central Hospital was infected by an asymptomatic glaucoma patient in early January

*Correspondence: indra.tri.m@mail.ugm.ac.id
Department of Ophthalmology, Faculty of Medicine Public Health and Nursing, Universitas Gadjah Mada, Jl. Farmako, Sekip Utara, Yogyakarta, Indonesia

which caused his death a month later. Without eye protection, the virus allegedly can be transmitted by aerosol contact with conjunctiva and cause infection.[6] Infection caused by 2019-nCoV has been characterized as a lower respiratory syndrome manifesting as pneumonia and/or acute respiratory distress. However, there are still many gaps in our knowledge concerning the global epidemiology of 2019-nCoV, particularly the route of transmission of COVID-19, especially through ocular surface, which has not yet been fully explained. The present study aimed to systematically review the employment of conjunctival swab Realtime Polymerase Chain Reaction (RT-PCR) in detecting SARS-Cov-2.

2. Method

2.1 Literature research

A systematic literature search was conducted during the period of April 2020 using PUBMED database and other additional sources (i.e: google scholar). Search strategies were performed to identify literature pertaining to the following search terms: *COVID-19* OR, *coronavirus* OR *SARS-COV2*, AND *conjunctivitis*, AND *ocular manifestations*, AND *conjunctival swab.* No date nor language restrictions were applied.

2.2 Data extraction and synthesis

Papers were examined in terms of the instruments, patient selection, and COVID-19 diagnostic protocol used in the study. Inclusion criteria were any papers that related to the entered keywords and have conjunctival swab as a reported outcome. Letters, reviews, and editorials describing other studies reporting COVID-19 and conjunctival swab were excluded (Please see Figure 1). Only four articles were eligible for analysis after identified through the database searches.

2.3 Statistical analysis

Total of subjects, mean age, and sex proportion of each study were descriptively analyzed. A comparison of the percentage of positive results of nasopharyngeal swab versus conjunctival swab was analyzed using chi-square tests. The nasopharyngeal swab is the collection of specimens from nasal midturbinate

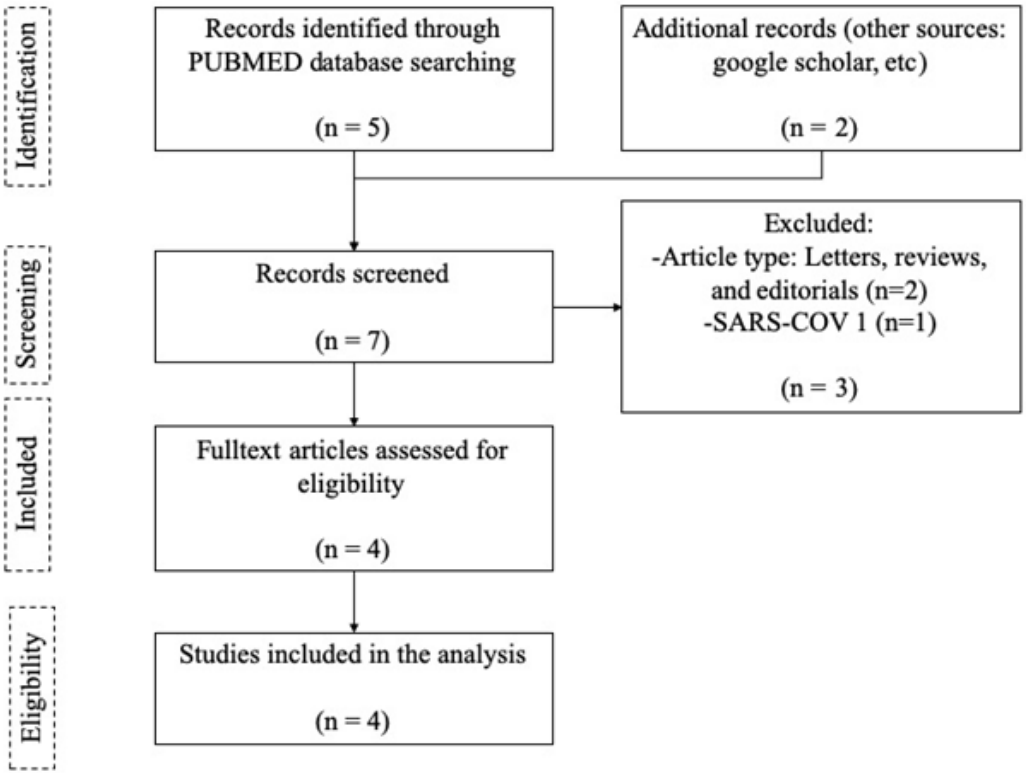

Figure 1. PRISMA chart of systematic review

Table 1. Characteristics of the current research findings

Study No.	Author and Title	Methods	Total subjects	Mean age	Sex proportion
1.	Xia et al. (2020) [4]: "Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection"	RT-PCR of conjunctival swab (to collect tears and conjunctival secretions)	30	54.50±14.17	Male: 70%
2.	Wu et al. (2020) [5]: "Characteristics of Ocular Findings of Patients with Coronavirus Disease 2019 (COVID-19) in Hubei Province, China"	RT-PCR from conjunctival swabs	38	68	Male: 65.8%
3.	Zhou et al. (2020): "Ophthalmologic evidence against the interpersonal transmission of 2019 novel coronavirus through conjunctiva"	RT-PCR from conjunctival swabs	67	35.7 ±10.6	Male: 37.31%
4.	Deng et al. (2020): "Ocular Dectection of SARS-CoV-2 in 114 Cases of COVID-19 Pneumonia in Wuhan, China: An Observational Study"	RT-PCR from conjunctival swabs	114	61.4±16.7	Male: 54%

Note: RT-PCR, Real-time Polymerase Chain Reaction; COVID-19, coronavirus disease 2019.

Table 2. Effectiveness of nasopharyngeal and conjunctival swab in detecting SARS-CoV-2

Study No.	Author	Positive Nasopharyngeal swab (%)	Positive Conjunctival Swab (%)	*P*
1.	Xia et al. (2020)	26/30 (86.67)	1/30 (3.33)	<0.001
2.	Wu et al. (2020)	28/38 (73.68)	2/38 (5.26)	<0.001
3.	Zhou et al. (2020)	63/67 (94.03)	3/67 (4.47)	<0.001
4.	Deng et al. (2020)	90/114 (78.95)	0/114 (0)	<0.001

A case of COVID-19 was defined according to novel coronavirus pneumonia (NCP) criteria (clinical + PCR results).

and anterior nares specimen. Conjunctival swab technique is used to obtain conjunctival specimens (tears and conjunctival secretions from lower eyelid fornix) from patients.

3. Result

Table 1 shows a summary of the current research findings related to conjunctival swab to find the appearance of SARS-CoV-2 on the ocular surface by RT-PCR. A study by Xia et al. (2020) aimed to evaluate the presence of SARS-CoV-2 in tears and conjunctival secretions. SARS-CoV-2 results were found only in pneumonia patients with conjunctivitis but not found in patients without conjunctivitis. Therefore, this indicated that ocular surface is not a common transmission route although the risk of transmission could not be eliminated. [4] Wu et al. (2020) revealed only 5.26% yielded positive SARS-CoV-2 results from conjunctival swab although 12 of 38 patients (31.6%) had ocular manifestations consistent with conjunctivitis (conjunctival hyperemia, chemosis, and increased secretions). These findings are consistent with previous studies on severe acute respiratory syndrome.[5]

Zhou et al. (2020) found that only 1of 63 patients revealed a positive PCR result of conjunctival swab and moreover, patients with conjunctivitis yielded a negative result.[8] This was in line with results from Deng et al. that revealed 0 positive conjunctival swabs RT PCR out of 114 patients SARS-CoV-2. [9]

4. Discussion

The present systematic review revealed very low results of SARS-CoV-2 nucleotide were found from conjunctival swab. However, patients who come to the ophthalmology clinic or the emergency room with conjunctivitis and have associated risk factors (traveling to high-risk areas or contact with people who have returned from those areas or those known to be infected) can transmit 2019-nCoV infection even before they experience other signs and symptoms of infection.[7]

A prospective interventional case series study revealed that SARS-CoV virus was not found in tear secretions of SARS patients in the Prince of Wales Hospital, Hongkong. The study result showed that 17 patients were confirmed positive after being tested with paired convalescent sera. Among these 17 patients, there were 5 samples from nasopharyngeal aspirate and stool specimens that tested positive using RT-PCR, but there were no tear swab and conjunctival scraping specimens which were positive. The authors concluded that the study of conjunctival swabs and conjunctival scraping was not valuable for diagnosing SARS-CoV.[10] However, RT-PCR itself has a high specificity but low sensitivity that can make high false negative rates despite the presence of the virus. One study compares the viral load on nasopharyngeal swab compared to tears collected by Schirmer tear strips collection. It was found that patients with positive COVID-19 results on nasopharyngeal swab showed negative results from tear specimen. [11] Therefore, conjunctival swab has no superiority compared to nasopharyngeal swab.

Therefore, the exact route of transmission of SARS-CoV-2 remains unclear, although in this pandemic condition, it is suggested that high alertness is still mandatory regarding aerosol to mucosal virus transmission (through conjunctiva). It it important to apply preventive measures especially thorough hand washing, using personal protective equipment, eye protection (goggles) or face shield (face mask), not to touch the mucous membranes (eyes, nose, or mouth) and avoiding unnecessary direct contact.[2] The American Academy of Ophthalmology recommendations include the use of an N-95 mask and goggles. [7]

5. Conclusion

The present systematic review revealed very low results of SARS-CoV-2 nucleotide were found from conjunctival swabbing. This finding suggests that the virus might not be retained in or spread through the conjunctival tissue. However, the prevention of infection transmission is still mandatory, especially thorough hand washing, and not touching the eyes, nose, and mouth when in a risky location. Control of spreading to health workers can be done by using personal protective equipment in the prevention and control of COVID-19 infections such as the use of an N-95 mask and goggles or shield and not touching the mucous membranes (eyes, nose or mouth) because spreading is associated with transmission through aerosol contact with the conjunctiva.

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Prevention of weight gain during self-isolation in COVID-19 pandemic era: A narrative review

Harry Freitag Luglio Muhammad

Department of Nutrition and Health, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta

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ABSTRACT COVID-19 is a disease that has affected millions of people worldwide and made a significant impact on health, social life, and economy. One of the strategies to prevent the spread of this virus is through self-isolation. Although this strategy is efficient to prevent a drastic spread of the disease, there are some consequences related to this measure, including social, psychological, and economic impacts. In this review, the author proposes the possibility that this measure could increase the global prevalence of obesity. This might be due to a reduction in total physical activity because of limitations in outdoor activities, increased binge eating because of psychological stress or boredom, and tendency to eat ultra-processed foods and beverages because of limitations in shopping ability. Obesity itself is reported to be one of the risk factors for the severity of COVID-19 infection. Reports from United Kingdom and the United States of America revealed that those with higher body mass index had a higher risk to be treated at an intensive care unit. Therefore, prevention of a significant weight gain might be important to reduce the risk of fatality due to COVID-19. While the global prevalence of obesity is increasing worldwide, it might be important to address this issue at this point in time. Lastly, this review also provides some suggestions to ameliorate the weight gaining effect of self-isolation during the COVID-19 pandemic.

1. Introduction

Individuals living with overweight and obesity are increasing worldwide. The World Health Organization (WHO) reported that the prevalence of obesity in 2016 tripled from the number of people in 1975. In 2016, it was estimated that 1.9 billion individuals in the world were either overweight or obese. This number represents 39% and 13% of individuals who are overweight and obese, respectively.[1] In Indonesia, the prevalence of overweight and obesity is also increasing by 19.1% to 35.4% between 2007 and 2018.[2] Obesity is associated with increased incidence of non-communicable diseases such as heart diseases, type 2 diabetes mellitus, cancer, and stroke.[3]

Despite the great attention to the role of obesity in non-communicable diseases, it is recently reported that obesity was associated with greater severity of viral infection, especially Coronavirus Disease 2019 (COVID-19) infection. Originating from Wuhan, China, this virus has infected over 9 million individuals worldwide and claimed more than 500,000 lives (updated July 5, 2020).[4] In the initial reports, having old age was associated with an increased risk of disease severity. Interestingly, it is reported that individuals with higher body mass index (BMI) were more likely to have a severe response to COVID-19 infection. It is estimated that from most of the active cases, 98% were mild and only 2% are serious or critical.[4]

On May 1st 2020, The Intensive Care National Audit and Research Center reported demographic data of COVID-19 confirmed patients admitted to critical ill wards across the United Kingdom.[5] Of those 7542 patients, 73.3% were either overweight or obese with BMI higher than 25 kg/m^2. In addition

*Correspondence: harryfreitag@ugm.ac.id
Department of Nutrition and Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Jl. Farmako, Sekip Utara, Yogyakarta 55281, Indonesia

to reports from the UK, other data from New York, United States of America have been recently reported,[6] showing that among 3,615 individuals who were reported positive of COVID-19, 21% and 16% were reported to be overweight and obese, respectively. Among patients with age less than 60 years old, being obese with BMI between 30-34 kg/m^2 was associated with 2 times higher risk of requiring acute care and 1.8 times more risk to be in critical care compared to those with BMI less than 30 kg/m^2. The risk significantly increases when a person's BMI is higher than 35 kg/m^2.[6]

There are several proposed mechanisms linking obesity and severe response to COVID-19 infection, and one of them is increased inflammation. Obesity is associated with increases in both systemic and adipose tissue inflammation. This occurs through increased leptin production, infiltration of immune cells, reduction of proportion in anti-inflammatory mitochondria, and excessive production of pro-inflammatory cytokines.[7] As a result, markers of systemic inflammation such as tumor necrosis factor (TNF)-alpha, Interleukin (IL)-6, and high sensitivity-C reactive protein (hs-CRP) are increased in individuals with obesity.[7-9] The COVID-19 viral infection is thought to amplify the magnitude of inflammation state leading to a 'cytokine storm', which in turn will lead to the severity of this disease.[10]

Keeping normal adiposity is essential during the COVID-19 pandemic. However, the mechanisms underlying the interaction between obesity and COVID-19 is not the main focus of this review. As a response to this pandemic, the majority of governments all over the world recommend or strictly regulate their citizens' movements. Transportation across countries has been prohibited, while work and school learning are commonly done at home. This effort is aimed to reduce the transmission of the COVID-19 virus which in turn can prevent further outbreaks at the same time. However, the limitation of the movements of the citizens by social distancing and self-isolation has some consequences including the risk of weight gain. Several studies have indicated that self-quarantine related to the COVID-19 pandemic was associated with weight gain.[11-13] This review aimed to propose selected factors that could contribute to weight gain during self-isolation. Because obesity has a negative impact on an individual's response to COVID-19 infection, suggestions were made to prevent such weight gain during the self-isolation period. The objective of this review is to propose a scenario in which self-isolation methods being used by major governments to prevent the spread of COVID-19 spread are causing widespread weight gain. In addition, the author also suggests several options to prevent the weight gain during this critical pandemic period of time.

2. Method

This review is divided into two sections. The first proposes mechanisms on how self-isolation could potentially induce weight gain. The second section of this review evaluates options to prevent weight gain during self-isolation. In this review, the author only provides a narrative review in which publications were not collected systematically. As reliable sources, reports from scientific publications were collected as well as organization reports from official websites.

3. Result

Despite the importance of self-isolation on the prevention of the spread of COVID-19 cases, this measure has had several consequences. The limited movement, increased free-time, psychological stress due to the inability to socialize physically or job loss, and limited options of food might lead to weight gain during self-isolation. To the author's knowledge, there are no reports regarding weight gain during this pandemic period of time.

- **Limited movements**

  Being physically active is necessary to obtain ideal body weight and the prevention of cardiovascular diseases. A recent report showed that 27.5% of adults worldwide had insufficient physical activity.[14] The trend of this prevalence was unchanged between 2001-2016.[14] Different from global physical activity data, the prevalence of insufficient physical activity among adults in the South East Asia region was lower (14.7%).[15] Interestingly, the same report also showed that work-related physical activity has the highest proportion of physical activity

compared to other components (transportation and recreational physical activity). In 2016, the author and colleagues conducted a cohort study in the city of Yogyakarta, Indonesia.[16] This study involved as many as 503 adult men and women living in 5 districts in the city for at least 2 years. Subjects were followed from 2016. From this data, it was shown that the percentage of work-related physical activity was 64% of the total activity, followed by household activities (20%), transportation (10%), and recreation (6%) (data not shown).

The higher proportion of physical activity from work puts individuals at risk of becoming physically inactive during the self-isolation period. This is because currently there are many professions that are done at home, or so-called, work from home. Understanding the risks can help individuals know the dangers of weight gain and the importance of improving their lifestyle during isolation and thus preventing weight gain.

- **Psychological stress and boredom**
  Psychological stress could also rise due to COVID-19 and several reasons might underlie this issue including lack of social interaction (physically), job losses due to lockdown, or health concerns. Stress itself is an important determining factor for binge eating disorder or BED.[17] BED is a condition in which individuals have recurrent eating episodes usually involving eating a large amount of food at one time. In addition, BED is characterized as an eating episode accompanied by the feeling of inability to control the eating behavior.[17] During prolonged stress, the hypothalamus-pituitary-adrenal (HPA) axis is hyperactive leading to cravings for caloric dense foods and beverages. In this condition, individuals have an increased preference for palatable foods to reduce the negative effect of stress, which is called the 'comfort food' hypothesis.[18]

  In addition to stress, some people might find it challenging to adjust to doing all daily activity from home leading to reduced normal activity and plenty of spare time. This situation could lead to boredom, another physiological phenomenon that is rarely being studied. Different from stress, this condition could also increase the possibility of increased food-seeking behavior, leading to overconsumption. The connection between boredom and eating behavior has been studied recently.[19,20] Moynihan et al. [21] showed that the state of boredom was positively associated with caloric consumption. One of the explanations was through an increased desire for snack consumption.

- **Cooking at home and limited shopping options.**
  Due to the so-called lockdown, some might experience a problem finding alternatives for healthier foods. In this period of time, not everyone can have easy access to fresh products such as vegetables and fruits. The majority of individuals, especially in the city, might have to rely on processed and instant foods such as noodles and canned meat/fish. It was also found that there is an increasing trend of consuming frozen products such as meatballs and nuggets. Those foods are relatively high in calories with less essential nutrients such as vitamins and minerals. Even though the food supply system was not affected by the outbreak, people are less likely to buy fresh products in bulk, and instead are buying foods which have high economic value and longer shelf life.

Consuming ultra-processed food has been reported to increase the risk of overweight and obesity. In Spain, The University of Navarra Follow-Up (SUN) cohort study followed individuals for 8-9 years. This study revealed that those people with higher consumption of ultra-processed food had 26% relatively higher risk for becoming overweight and developing obesity in comparison to those with lower consumption of ultra-processed food[22]. There were several factors that might explain the influence of ultra-processed food consumption and obesity. First, ultra-processed food increases calorie intake, especially from sugars and fat. Second, consumption of these type of foods potentially reduces consumption of essential micronutrients such as vitamins and minerals. Third, ultra-processed foods have relatively lower fiber in comparison to

Table 1. Example of ultra-processed foods and beverages

Beverages	Snacks others	Meal
Carbonated drinks	Sweet or savory packaged snacks	Breakfast 'cereals', 'cereal' and 'energy' bars
Energy drinks	Ice-cream, chocolate, candies (confectionery)	Ready to heat products including pre-prepared pies and pasta and pizza
Milk drinks, 'fruit' Yoghurts and 'fruit' drinks	Margarines and spreads	Meat and chicken extracts and 'instant' sauces
Infant formulas, follow-on milks, other baby products;	Cookies (biscuits), pastries, cakes, and cake mixes	Health' and 'slimming' products such as powdered or 'fortified' meal and dish substitutes
Cocoa drinks	Mass-produced packaged breads and buns	Poultry and fish 'nuggets' and 'sticks', sausages, burgers, hot dogs, and other reconstituted meat products, and powdered and packaged 'instant' soups, noodles and desserts.

their fresh counterparts[22]. The examples of ultra-processed foods can be found in Table 1 based on NOVA[23].

4. Discussion

There are several strategies that can be used to prevent weight gain during the self-isolation of the COVID-19 pandemic. These strategies are proposed based on the three main reasons for weight gain during self-isolation.

- **Home exercise**

  Home exercise has been previously reported to induce weight loss in a sustainable manner. Jakicic et al.[24] showed that home exercise for 18 months was associated with a reduction of body weight among overweight women. Those who reduced more weight at the end of the program had the greatest exercise time duration (at least 200 minutes per week). This data revealed that having a regular exercise routine at home is beneficial for weight loss as well as prevention of weight gain.

  The effect of home exercise is even better than group exercise at the fitness center for weight loss. Perri et al. [25] compared the response to home-based exercise with group-based exercise among women with obesity for 12 months. At the end of the intervention, this study showed that subjects with home-based exercise had higher participation in comparison to group-based exercise. In addition, subjects who regularly did home-based exercise had higher weight loss compared to group-based exercise.

  To date, there are several exercise options available. Although home DVD exercise is no longer in fashion, there are abundant options for no-equipment home exercise at Internet platforms such as YouTube and Instagram. Also, several applications (apps) for personal trainers or exercise programs on mobile phones are widely available. The effectiveness of exercise apps on a mobile phone to increase leisure-time physical activity has been reported.[26] Data on the effect of exercise apps on weight loss have been compiled and one meta-analysis showed that although the apps can influence weight reduction, the effect is rather small.[27]

- **Stress prevention and mood improvement foods**

  Foods have long been reported to influence individuals' moods. There are several nutrients that have been reported to influence cognitive function and influence mood. Tryptophan is one of the essential amino acids found in food and has a role in the biogenesis of neuropeptide signals, namely serotonin.[28] Serotonin is associated with improved moods since a lower serotonin level could reduce mood states.[29] Tryptophan is rich in several nuts and seeds such as cashew, walnuts, almond, sesame, and soybeans.[28] The beneficial effect of nut consumption on mood in a randomized controlled trial has been previously reported.[30] Accordingly, it is suggested that consuming nuts and seeds as a snack option

might be beneficial to improve a person's mood during self-isolation.

Omega 3 has recently been suggested to also improve mood and prevent depression.[31] This theory was initiated by several studies that reported that individuals with depression or anxiety had significantly lower omega 3 and higher omega 6.[32,33] Several studies have reported that, despite the variation of results due to different characteristics of subjects, omega 3 supplementation could improve some of the clinical measures of stress or depression.[31] One of the mechanisms linking this fatty acid is that omega 3 may maintain the HPA axis, which in turn could prevent disruption of a person's emotional state. The author recommends regular consumption of fish, especially fatty fish, which are high in omega 3 fatty acids.

- **Home prepared meals with fresh or frozen vegetables**

  It is important to restrict the consumption of ultra-processed food whenever possible. Preparing fresh produce as a part of a healthy meal is necessary. However, when the condition is impossible to obtain fresh vegetables, self-preparing frozen vegetables might be an option. Several vegetables and foods such as broccoli, cauliflower, corn, green peas, carrot, spinach, blueberries, and strawberries can be stored frozen. It was previously reported that the frozen storage of those foods still maintained similar micronutrients quantity than the fresh ones.[34] Consumption of vegetables and fruits is important as one of the ways of prevention of obesity and its related diseases

.5. Conclusion

In summary, the author points out the importance of awareness that individuals might have increased risk of weight gain during self-isolation. This is because, until now it is unclear when the pandemic will stop and restrictions of human movement alleviated. Thus, it is important to keep a healthy lifestyle including practicing a home exercise program, avoiding binge eating, consuming foods that could improve our mental health, and avoiding ultra-processed foods and beverages whenever possible. Health promotion for our community in this time should focus not only on how to prevent disease spread, but also to improve everyone's well-being as well as prevent upcoming diseases after the pandemic is over.

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Conflict of interests

None declared.

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Coronavirus outbreaks including COVID-19 and impacts on medical education: A systematic review

Kelly,* Lie Rebecca Yen Hwei, Gilbert Sterling Octavius

Faculty of Medicine, University of Pelita Harapan, Karawaci, Tangerang, Banten, Indonesia

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ABSTRACT Since the beginning of 2020, the world has been affected by the novel coronavirus COVID-19 pandemic. The virus' infectious nature pushed all sectors to implement social distancing measures in an effort to limit its transmission, including the education sector. We searched PubMed and Science Direct on June 12th and found 24 papers that are relevant to our review. After the World Health Organization announced that COVID-19 is a global threat, various countries took a variety of measures to limit the disease spread such as social distancing, self-quarantine, and closing public facilities that hold large gathering, including universities and schools. Hospitals started to prioritize services for COVID-19 cases. Medical education programs are also affected by this disease, but not continuing in-person classes outweighs any benefit from traditional teaching methods. The previous Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) pandemics have shown ways to shift medical education to online platforms. In the current pandemic, online meetings are being used to hold lectures, classes, laboratory practices, and clinical skills classes. For clerkship students, online platforms might not be feasible because this eliminates patient-doctor relationships, but it appears for now to be the only option. Some institutions have involved medical students in the frontlines altogether. We encourage all parties to constantly evaluate, review, and improve the efforts of continuing medical education, especially during this pandemic. Further research is needed to evaluate students' performance after adopting e-learning and to discover the best methods in medical education in general and clerkship education in particular.

1. Introduction

At the beginning of December 2019, there was the first unknown case of pneumonia with unknown origin in Wuhan, the capital city of Hubei.[1] The pathogen was identified as a novel enveloped RNA beta coronavirus that has been named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) which has a phylogenetic similarity to SARS-CoV.[2,3] The World Health Organization (WHO) declared SARS-CoV-2 as a pandemic on the 30th of January 2020 and naming it officially COVID-19 on the 11th of February 2020.[4] Indonesia reported its first and second cases on March 2nd, 2020.[4,5] As of June 3rd, 2020, the Government of Indonesia had announced 28,233 confirmed cases of COVID-19, 1,698 deaths and 8,406 recovered cases from 418 districts across all 34 provinces.[6]

This pandemic has affected Indonesia in almost all sectors ranging from financial and investment business to aviation, tourism, hotels, restaurants, shipping, and education sectors.[7,8] Indonesia's Ministry of Education decided that all physical learning activities would be done from home on March 9th, 2020 in order to break the chain of transmission.[9]

School closure was meant to reduce the transmission and the number of cases by promoting physical distancing. However, this was based on influenza pandemic settings and it was unclear whether the school measures are effective in coronavirus outbreaks such as Severe Acute Respiratory Syndrome (SARS), Middle East

*Correspondence: tjhai.kelly@hotmail.com
Faculty of Medicine, Pelita Harapan University, Jl. Jend. Sudirman No.20, Bencongan, Kec. Klp. Dua, Tangerang, Banten 15810, Indonesia

Respiratory Syndrome (MERS), and most specifically, COVID-19 for which the transmission dynamics appear to be different.[10] A systematic review in 2014 done by the UK Department of Health found that during the influenza pandemic, school closures resulted in greater reductions in the peak number of cases more than in cumulative attack rates and according to modelling studies, are likely to have the greatest effect if the virus has low transmissibility with a reproductive number less than 2.[11]

Learning from home or e-learning means that all teaching and learning activities will be done electronically with the help of the internet. This means that professors and lecturers will have to adapt and change their way of teaching to suit the environment of e-learning while students will have a new role to become proactive, independent learners, and problem solvers.[12] This includes the medical students, both pre-clerkship and clerkship students.

In this unprecedented time, almost all sectors are uncertain on how to act including the medical education field. We are now in a dire need more than ever to prepare future physicians as this global pandemic hits and yet practical, ethical, and logistical challenges exist as medical students may potentially spread or acquire the virus during training, thereby endangering both themselves, their family, or other patients.[13]

In most parts of the world, medical students are advised to stay at home and do their part by physical distancing while some countries have recruited their final-year students for hospital-based roles so that they can serve as frontline clinicians.[14-16] In America, the American Association of Medical Colleges (AAMC) has instructed medical schools to suspend student clerkships and recommended that medical students should not be involved directly in in-patient care activities unless there is a critical health care workforce needed.[17]

For some pre-clerkship students, adjusting to e-learning might seem rushed but not out of place. Their learning routines can be replaced with the advantages of digital technology since lectures can be delivered via online platforms, small-group discussions are convened easily, and materials uploaded and downloaded at ease.[13] However, these adjustments might fall short on general examinations if they are conducted online as well, which means that there is no way to check and ensure whether integrity was upheld.[18] There are also increased challenges in terms of the use of email, sense of isolation, and struggles with establishing boundaries between work and home which may have an adverse effect on students' and staffs' wellbeing.[13]

The bigger issue exists within the clerkship learning environment. During the clerkship phase, medical students are required to learn directly from their patients with supervision. Learning in this method marks a shift from the learning in the lecture halls and textbooks to hospital settings and real-world patients with whom medical students will work one day in the future. This means that the clinical portion of medical education will remain focused on hospitals, physician offices, patients' homes, and other settings while the most pivotal aspect of teaching in these settings occurs in the apprenticeship model.[19] This model cannot be replaced by learning from home which would revert the apprenticeship model back to the pre-clerkship way of teaching and learning.

Many universities and teaching hospitals are uncertain on how to best provide medical education during these tough times, including in Indonesia. However, this was not the first coronavirus outbreak that has happened since there was SARS in 2003[20,21] and MERS in 2012[22,23] which also affected the way medical students learn. Since there is little information on how to best deal with the COVID-19 pandemic in terms of teaching and learning for medical students, both those in pre-clerkship and clerkship, we did a systematic review to answer the following questions: "What are the effects of learning from home for both undergraduate medical students and clerkship students during COVID-19" and "What can we learn from previous coronavirus outbreaks in terms of medical education?"

2. Method

The authors (K, LR, GS) searched PubMed with database-appropriate syntax: ""Middle East Respiratory Syndrome Coronavirus"[mh] OR "Middle East Respiratory Syndrome*"[tw] OR

"MERS-CoV"[tw] OR MERS [tw] OR "Middle Eastern Respiratory Syndrome*"[tw] OR "MERSCoV*"[tw] OR SARS [tw] OR "Severe Acute Respiratory Syndrome"[mh] OR "Severe Acute Respiratory Syndrome" OR coronavirus[mh] OR Coronavirus Infections[mh] OR coronavirus*[tw] OR "COVID-19"[tw] or "2019-nCoV"[tw] or "SARS-CoV-2"[tw]) AND (Medical Education[mh:noexp]). The search was conducted on the 12th of June 2020 and the review was done in accordance with Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines.[24]

Because there is a lack of class I or grade A evidence on this topic, we did not exclude any study designs nor papers such as letters to editors, editorials, perspectives and reviews. Article selections were limited to those available in English as full-paper only. Further selection was determined via our Population, Intervention, Comparison, and Outcome (PICO) in which population included undergraduate medical students and clerkships only. All other stages of medical education including residence and fellows as well as other fields of medical specialties such as veterinary were excluded. Interventions included any impacts and innovations towards medical education during this pandemic. Comparison was done with what has been done during MERS and SARS outbreaks while Outcome was defined as the outcome that entails the interventions towards medical students and co-assistants.

After screening for duplicates in the two databases and removing them, all three authors (K, LR, and GS) independently scanned titles and/or abstracts while applying the PICO as the selection criteria. All three authors had to agree to include each particular paper in order for that article's full paper to be screened. When there was consensus, those articles together with the selected abstracts or articles would be chosen for full-text screening. Again, individual assessment was done by each author and any conflicts were resolved internally by strictly referring back to our assessment criteria. The included articles were then processed for qualitative analysis.

3. Result

We found 2,127 papers on COVID-19 and medical education (799 from PubMed and 1,328 from Science Direct), 2,755 papers on MERS and medical education (409 from PubMed and 2346 from Science Direct),

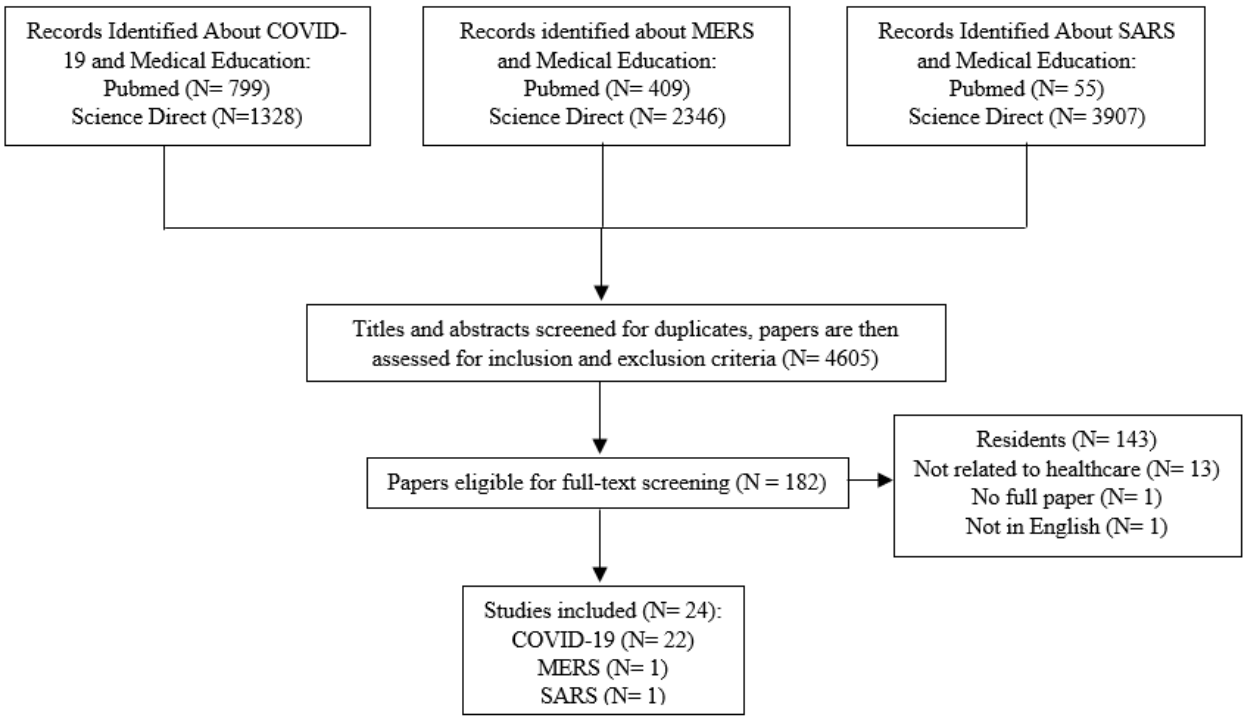

Figure 1. Flow-diagram of search strategy

Table 1. Characteristics of studies included

Authors	Study type	Pandemic situation	Target population	Results/Conclusions
Sahi et al[25]	Commentary	COVID-19	Medical students and clerkship students	Medical education cannot halt every time there is a threat (pandemic).
Ashokka et al[26]	Commentary	COVID-19	Medical students and clerkship students	A paradigm shift (e-learning) might already be happening.
Singh et al[27]	Cross-sectional	COVID-19	Medical students only	51% prefer physical classes over e-classes.
Kanneganti et al[28]	Editorial	COVID-19	Clerkship students only	Virtual Continuing Medical Education (vCME) is an important strategy in the prolonged campaign against COVID-19.
Almarzooq et al[29]	Editorial	COVID-19	Clerkship students only	Program-specific virtual learning platforms have the potential to play an important and useful role.
Akers et al[30]	Commentary	COVID-19	Clerkship students only	The current situation necessitates an adaptation for all involved academically.
Calhoun et al[31]	Editorial	COVID-19	Clerkship students only	Rotations are cut short and adjusted accordingly.
Sahu P[32]	Commentary	COVID-19	Medical students only	Faculty members should embrace technology and pay careful attention to students' learning experiences.
Lapolla et al[33]	Editorial	COVID-19	Medical students and clerkship students	Medical board exams were changed and resulted in fast-tracking of doctors.
Tabari et al[34]	Letter to Editor	COVID-19	Medical students only	Three cycle model might help restructuring medical education curriculum.
Franchi T[35]	Letter to Editor	COVID-19	Medical students only	There is a more fundamental emotional experience that cannot be achieved by learning anatomy via online.
Longhurst et al[36]	Descriptive Article	COVID-19	Medical students only	It is hoped that adaptations will lead to lasting positive changes.
Gonzalez-Zamora et al[37]	Editorial	COVID-19	Medical students only	Further studies are required to assess acceptance, effectiveness and impact of the educational tools used.
Brand P[38]	Commentary	COVID-19	Medical students and clerkship student	Well-being should be considered as well.
Wang et al[39]	Commentary	COVID-19	Medical students and clerkship student	Medical students and clerkship students might return in advance if situations permit.
Hofmann et al[40]	Commentary	COVID-19	Clerkship students only	Support for conducting virtual COVID rounds.
Shih et al[41]	Commentary	COVID-19	Medical students only	E-learning provides feedback to clinical teachers on how undergraduate medical students acquire knowledge best.
Roskvist et al[42]	Commentary	COVID-19	Medical students only	The challenge is defining how much learning can be undertaken online, and how much clinical exposure is still necessary.
Rafeh et al[43]	Editorial	COVID-19	Clerkship students only	Student participation is facilitated and encouraged in learning virtually.
Singal et al[44]	Editorial	COVID-19	Medical students only	Traditional cadaveric dissection has already been partially encroached by technological advances before this pandemic.
Pitt et al[45]	Commentary	COVID-19	Medical students and clerkship student	Educational innovations are needed in unprecedented times like this.
Gill et al[46]	Commentary	COVID-19	Medical students and clerkship student	Medical schools and postgraduate training organisations will need to be flexible, responsive, and creative in how they adapt to educating.
Park et al[47]	Review	MERS	Medical students only	Medical schools should maintain constant communication with teaching hospitals and consult with health authorities and experts.
Sherbino et al[48]	Perspective	SARS	Clerkship students only	Consider the impact on future education before the next storm arrives.

and 3,962 papers on SARS and medical education (55 from Pubmed and 3,907 from Science Direct). After duplicates were removed, 4,605 papers were then scanned according to the inclusion and exclusion criteria and about 182 papers were included for full-text screening. In the end, 24 papers were included in this study after screening each paper's suitability according to PRISMA guidelines (Figure 1). All the studies included are shown in Table 1.

4. Discussion

4.1 The impact of COVID-19 pandemic on medical education

COVID 2019 emerged in Wuhan at the end of December 2019 and the disease spread quickly affecting other parts of the China. Wuhan authorities announced the city's lockdown on the 23rd of January 2020 to slow down the transmission and not long after, the other cities followed suit. In the following weeks, the disease became a worldwide outbreak and the WHO announced that it is a global threat. While China with its aggressive action has succeeded in reducing the number of new cases, some countries namely Iran, Italy, and US have yet succeeded.[32] To further limit the spread of COVID-19 and avoid overburdening the healthcare system, several countries have implemented various forms of lockdown.[25,38] Other measures have been put into action, such as social distancing, self-quarantine or isolation, closing public facilities, including institutions, museums, places for large gatherings, which included universities and schools.[32] The Centers for Disease Control and Prevention (CDC-P) recommended cancellation of large conferences and limitation of regular meeting sizes.[29] Over 91% of students all around the world are affected by the closing of education institutions in their countries.[36] In total, there are more than 900 million learners who have been affected.[49] In response to the emerging healthcare crises, many medical faculties and hospitals changed their regulations. They prioritize healthcare services for COVID-19 cases by expanding the intensive care units (ICU) capacities and allocating healthcare professionals to handle COVID-19 cases. Most non-essential operations are postponed, routine follow-up or visits are either postponed or done through video call, and hospital stall are encouraged to work from home.[38]

Several countries took different measures in continuing medical education. The American Association of Medical Colleges (AAMC) released guideline recommendations to suspend any clinical activities for a minimum of two weeks, and strongly suggest that medical students should not be involved in patients' care.[30] In Italy, the total number of COVID-19 cases is increasing rapidly, passing China with the most case related deaths in March, 2020. The Italian government took specific measures by changing the rules of the Italian medical board examination, resulting in almost 10,000 medical students who were able to directly contribute in the healthcare services without taking the postgraduate examination.[33]

Since the institutions that provide medical education are deeply affected by the pandemic, medical educators are in need to find new ways to keep the students engaged in their education. Some universities have shifted face-to-face classes to online education to provide various courses and programs, and some have replaced the live clinical exposure to the virtual one.[26,32] This adjustment might be difficult for both students and instructors, and therefore might impede the progress of medical education.

4.2 The importance of continuing medical education

Changes are often challenging, but the consequences of not continuing medical education will outweigh any benefit of not continuing the effort altogether. Postponing clinical rotations will later impair clinical training experience, because this will lead to an overload of clerkship students next year in order to catch up with the altered curricula.[25] Delaying medical education will also postpone medical students' graduation, thereby impeding their process to pursue the next step in their education and career. For final year students, the certainty of graduation is critical because we cannot overlook the possibility of a medical workers shortage in the unforeseen future of this pandemic. While it is important to continue medical education, academic medical centers should also consider the effectivity of methods used in order to align with the adjusted medical curriculum

timeline as well as infection control measures.[26]

4.3 What we can learn from past pandemics or epidemics

Similar to the current pandemic, past coronavirus epidemics have changed medical education. Reflecting back on the SARS epidemic in 2003, clinical clerkships and electives were halted in Chinese and Canadian medical schools after 16 medical students in Hong Kong were infected by SARS following a visit to an infected patients' room. Education was continued by means of online problem-based learning.[36]

From one medical school experience in Korea during the MERS epidemic in 2014, some actions were taken to ensure students' safety, minimize loss of learning, and reduce anxiety and concern of staffs and students. Because of the high risk of MERS infection among students, the clerkship rotations were discontinued. Several precautions were implemented, such as frequent handwashing and sanitizing, taking daily temperature, and using masks. Lectures and classes were held with the use of a previously installed remote lecturing system linking the hospital and the main campus. The instructors delivered the lectures in the hospital classroom while the students attended the classes at the main campus. The lectures were video-recorded so students were able to watch the lectures and at the same time this lecturing system allowed instructors and students to be as interactive as if they were in the same classroom.[47]

4.4 Medical undergraduates' education

Learning for medical undergraduates/pre-clinical students has shifted from classroom to e-learning until an undefined date and time. During this time, learning has to be remote and are in technology-enabled formats.[45] Online platforms such as Zoom™ Microsoft Teams™, Skype™, Google Classrooms™, Google Meetings™ and Whatsapp™ have been widely used to convert classroom lectures and group discussions to online discussions.[25,27,29,36] Maintaining discussions are often done by encouraging students to communicate via chat-boxes and microphones.[27,41]

On the other hand, the shift from laboratory practice to online learning is trickier, because this limits students' access to cadavers, models, microscopic slides, and specimens. In anatomy, human cadaver studies are deemed to be the most effective method to understand human anatomy.[50,51] During the pandemic, anatomic studies have been shifted to online discussions and practical sessions (dissecting cadaver) have been substituted by 3D virtual resources and digitalized cadaveric resources (cadaveric images and videos).[36] These technologies are promising but might not be adequate to replace actual specimens, which help students to appreciate spatial orientation, visualization and normal variation of the human body anatomy.[36,44] Clinical skills labs which simulate clinical settings are also affected. While the traditional face-to-face discussion is not feasible, written materials, video tutorial and online discussions are still being utilized.[41]

Online learning also involves several setbacks. Online formats require uninterrupted Internet connection and gadget compatibility, which might be challenging for students and academic centers that are located in rural areas or have limited resources.[36,39] In addition, academic centers and educators might not be ready to adapt to the new technology required and this might hinder the effort of maintaining quality education.[25,39]

Although challenging, certain aspects of online learning might be superior to classroom learning. During online learning, students have more freedom to study at their own pace and in a personally preferred environment.[25] Many students also feel more confident to ask or discuss with their lecturers via online platforms, thus helping them to be more active in learning activities.[28,41] A single-center mixed methods study by Singh et al. on medical education with a total of 208 correspondents showed that many students feel that the interaction with teachers is better (27%) or as good as (27.8%) the regular classroom.[27] Online learning is also boundless by distance and time, and therefore more students worldwide have the opportunity to access and share different types of knowledge through online contents.[35,37]

4.5 Clerkship programs for medical students

On the other hand, clerkship programs have suffered

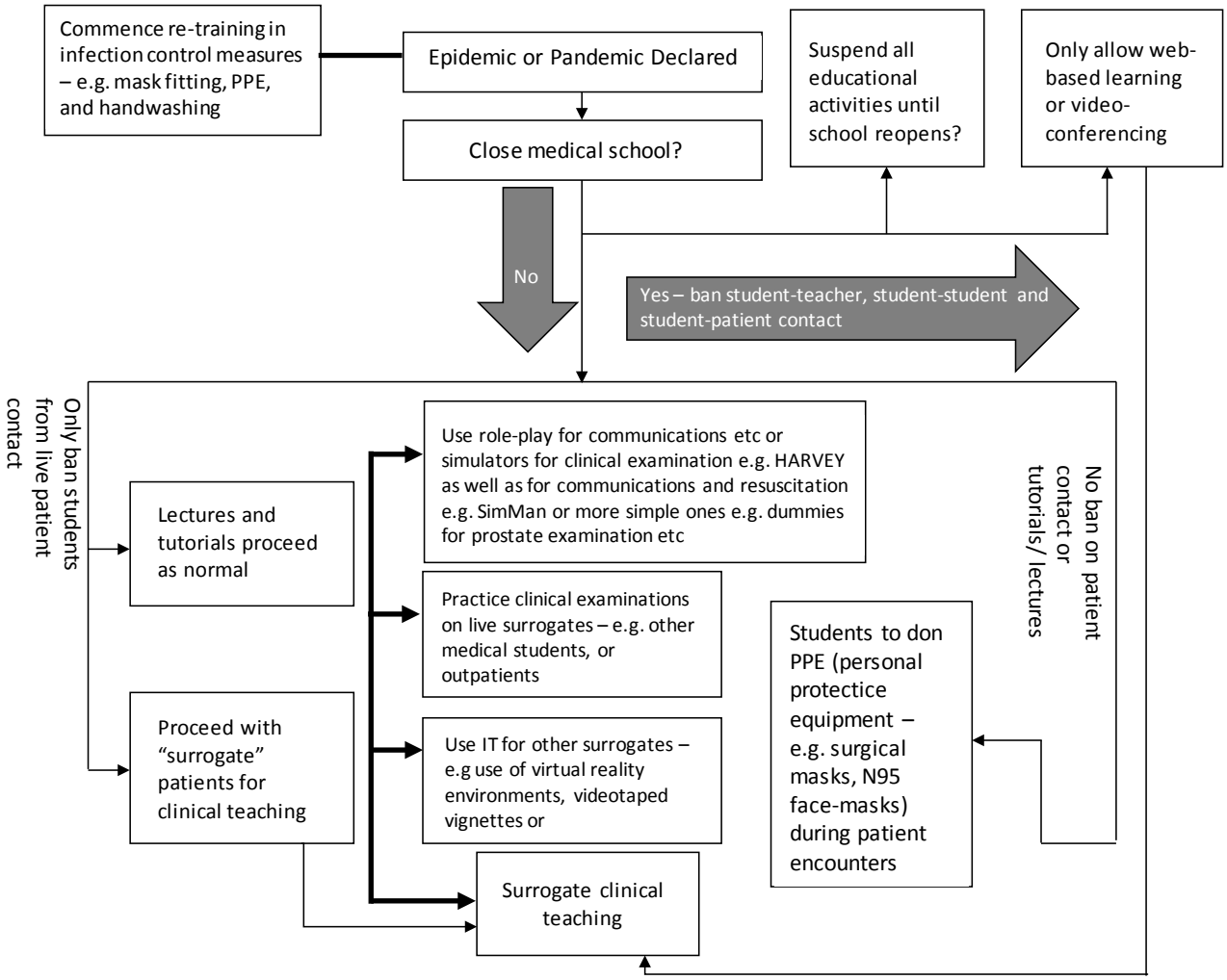

Figure 2. Decision tree for utilising different teaching methods during a pandemic or epidemic.[53]

greatly. Clerkship programs consist of bed-side teaching, emergency settings and surgery training that allow first-hand experience with patients. This is an integral part of medical education that cannot be easily replaced by online platforms. Similar to undergraduates, clinical learning has often reverted to online learning.[42] Surgical trainings are very limited now since only essential personnel are allowed in operating rooms and the content has often been converted into video lectures, virtual grand rounds, and other online educational networks.[43,49] However, an innovation in bedside teaching has been done by using Zoom™ and gadgets to live-stream bedside rounds involving patients with COVID-19 with satisfying feedback.[40]

Although innovative, online clerkship programs cannot replace the conventional bedside teaching because it is designed to allow students to experience real time interaction with patients and deepen their understanding. This is also valuable for their application of residency in the future.[30] Future research on the most effective methods of clerkship education should be done in order to allow students to still experience these encounters with real life patients.

4.6 Medical students' involvement in the community as part of medical learning

There is a question whether medical students' contribution in the community will benefit all parties or do just the opposite. Undergraduate medical students can be involved by educating their family[39] and community using the online platforms[45,52] in order to clarify any misinformation. While this

benefits the community, it also encourages students to apply their public health knowledge and therefore indirectly help to stop the spread of the disease.[52]

Involving final year medical students in the healthcare system has also been considered. Sahi et al. and Miller et al. indicated that with adequate protective measures and possible remuneration, medical students' involvement will benefit other medical workers and patients during the pandemic.[14,25] Their involvement can also be considered as a substitution credit for their studies and thus part of continuing their education.[14] Some institutions, such as Aalborg University in Denmark [38] and University of Auckland[42] involved the final year medical students in the healthcare system as essential health workers. In Italy, the high demand of medical workers led the government to fast-track final year medical students' graduation by terminating board examinations and practical training.[33]

However, many studies suggest that medical students are not essential workers, hence should not be involved in direct patient care. Semi-structured interviews with last-year medical students who are handling infected patients by Tabari et al. show that many of them are not prepared to face the unexpected problems during their service learning. These include psychological distress, crises management, and public health education issues.[34] The increasing number of patients is also parallel with the increasing demand of personal protection equipment (PPE), therefore hospitals might not have enough PPE and testing kits for their own healthcare workers, let alone medical students.[14] For these reasons, the risks of poor outcomes from adding medical students to the frontline might outweigh the benefits. Ultimately, involving students in direct healthcare should not only be considered based on hospitals' needs for more healthcare forces, but also stakeholders' ability to provide adequate PPE, testing kits, ensure safety, and prioritize students' education above anything else.

4.7 Future Considerations

The medical field ultimately depends on the cultural view of each generation. The older belief holds that going to work even though they are sick and overworked is altruistic and compassionate. However, in this pandemic where being even asymptomatic might facilitate viral transmission to other patients forces everyone to consider the effects of these potential actions, even though it may be done with good intentions.

Other important aspects to consider are the need to develop a standardized testing and clerkship protocol as well as residency programs which ultimately will be the front-liners. Universities need to be agile and flexible in order to adjust some parts of their strategies in order to free up their final year students to help with this pandemic by allowing them to graduate earlier as stated above.[13] Figure 2 shows a decision tree that might help educators and professors on deciding the correct pathway to continuing their education programs.[53]

5. Conclusion

Change is inevitable. Institutions around the world have collaborated with students and educators on continuing medical education despite many limitations. We believe that adjustments are not impossible as e-learning has been done many times in the past and now is supported by advanced technology. This review discusses the broad spectrum of basic medical education that has been affected and presents various methods that are used around the world. Students' involvement in the community as part of medical education is also an important aspect and should be considered by weighing the benefits. While some of the medical students struggle to develop skills to help them be more competent in public health education, crisis management techniques, and mental health care, medical students can be educators in their communities by developing educational materials and videos, in which they can promote positive behaviors that can prevent the spread of the COVID-19 pandemic.

Data on students' performance and knowledge after e-learning compared to graduates with traditional learning methods are lacking; therefore, more research should be done in the future concerning these important aspects. In addition, further research on clinical students' education during this pandemic is urgently needed. With all

of that said, academic institutions, educators and students should maximize facilities and innovate ways to maintain the quality of medical education. We encourage all parties to consistently evaluate, review, and improve the efforts of continuing medical education.

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Conflict of interests

None declared.

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COVID-19 eye infection: Recommendations for ophthalmologist and patients

Datu Respatika,[1,2*] Indra Tri Mahayana,[1,2] Dwi Puspita,[3] Guiddo Ilyasa,[3] Agus Supartoto[1,2]

[1]Department of Ophthalmology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia
[2]Sardjito General Hospital, Yogyakarta, Indonesia
[3]Ophthalmology Research Unit, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

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Transmission
Ophthalmologist

ABSTRACT Coronavirus disease (COVID-19) is a public health emergency of international concern as declared by the World Health Organization on 30 January 2020. Currently, COVID-19 is spreading rapidly worldwide, with no proven treatment nor vaccination, thus infection control measures are paramount. The severity of the majority of COVID-19 cases is mild to moderate, with fever as its most common symptoms, followed by dry cough and fatigue. COVID-19 initially reported to be transmitted from bats but then evolved into human-to-human via droplets. Coronavirus has been detected in tears and conjunctival secretions, but there is still a controversy about whether the virus can be transmitted through tears. However, the ocular transmission might be transported through a lacrimal duct to nasopharyngeal mucosa and then cause an infection. Because the nature of close contact in doctor-patient interaction during ophthalmologic practice, strict measures must be taken to minimize the impact both on the patients and health care workers.

1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection have been reported worldwide, since the first case was identified in December 2019, in Wuhan, China. The novel coronavirus disease 2019 (COVID-19) has now spread over the countries and has become a global pandemic. The situation reports – 14 from WHO was mentioned that, up until 14th June 2020, 7,690,708 cases were reported globally, where most cases (3,711,768) were situated in the Americas.[1] Coronavirus has an incubation period of 2 to 14 days and usually has mild to moderate severity, with fever as its most common symptoms, followed by dry cough, and fatigue.[2, 3] COVID-19 can cause many complications, such as acute respiratory distress, shock, and arrhythmia.[3]

In January 2020, an ophthalmologist in China was infected with coronavirus that transferred from an asymptomatic glaucoma patient.[3] It shows the possibility of potential transmission through droplets, aerosolized material, and tears. Some reports also have mentioned that the SARS-CoV-2 was detected in tears and conjunctival secretion. However, the transmission of COVID-19 through tears remains controversial.[4] Ophthalmologists may be infected either through droplets or direct contact with the patients. The other possible transmission was through aerosol contact. Thus health care workers should do proper infection control measures to minimize exposure and cross-contamination.[3] The comprehensive facts about SARS-CoV-2 epidemiology and characteristics are necessary for ophthalmologist to understand the outbreak.[5] By better understanding of the transmission of SARS-CoV-2, hopefully, we could gain better insights on facing this pandemic.

2. Method

A thorough and in-depth exploration through PubMed and Scopus databases for publications on COVID-19 manifestation in ophthalmology from January 2020 to June 2020 was conducted by 2 authors (DR, ITM).

*Correspondence: datu.respatika@ugm.ac.id
Department of Ophthalmology, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Jl. Farmako, Sekip Utara, Yogyakarta 55281, Indonesia

Due to diversity of clinical and methodological among the articles, our review is presented in a narrative form. The following terms were included in the search of articles: SARS-COV2, COVID-19, ophthalmology, coronavirus, outbreak, ocular transmission, epidemiology, recommendation. All types of review articles and clinical guidelines were included in this review, while case reports and case series were excluded from this review.

3. Result

3.1 Transmission of coronavirus

The whole genome sequences of SARS-CoV-2 reported to be 75–80% identical to SARS-CoV and shown express the similar host receptor with SARS-CoV, in which angiotensin-converting enzyme 2 (ACE2) receptor.[5-8]

3.2 Recommendation on environmental control

Cleaning the surrounding by using a disinfectant, such as povidone-iodine, chlorhexidine, alcohol solutions with at least 70% concentration of alcohol, hydrogen peroxide, citric acid, and many more is recommended to minimize the spreading of the virus.[2,3]

3.3 Recommendation for outpatient setting

Reducing the number of patients in clinics and conduct voice/virtual call for consultation is recommended.[2,9] Measuring patient's temperature, asking a screening questionnaire about history of traveling, and also history of close contact with a confirmed or suspected case of COVID-19 will help to recognize the patient at risk.[2, 3] Keep the waiting room as empty as possible, with a distance of 2 meters between patients, was also important.[10] Last but not least, reducing contact time and speaking between ophthalmologists and patients would ultimately avoid the risk of SARS-CoV-2 infection.[3,9,11]

3.4 Recommendation for inpatient setting

Rapid test for COVID-19 screening were mandatory before hospitalizations. Positive COVID-19 patients who need immediate eye care were admitted to an isolation wards.[12] Examination that occupies ophthalmological instrument that stored in clinic, must be performed after the outpatient clinic finished all needed examination.[2]

3.5 Recommendation for surgical settings

Elective surgery must be postponed, and only emergency and urgent cases that may proceed.[2, 9] All protocols were mimics to the protocols for inpatient's settings.[12] Confirmed COVID-19 cases, need to be reassessed for the surgery, and postponed until the PCR result is negative.[3] Personal Protective Equipment (PPE) is required for all the operating room staff.[9] Local anesthesia is preferable to prevent aerosolization of the SARS-CoV2 virus.[2,9] A recommendation regarding the surgery and outpatient clinics was listed by American Academy of Ophthalmology (AAO) in https://www.aao.org/headline/alert-important-coronavirus-context.

4. Discussion

4.1 Transmission of coronavirus

SARS-CoV-2 belongs to a novel *Betacoronavirus* of *Sarbecovirus* subgenus in the Coronaviridae family. It is an enveloped single-stranded RNA virus in which its genome resembles the SARS and MERS.[7, 13] A study reported that the whole genome sequences, SARS-CoV-2 was 75–80% identical to SARS-CoV.[8] Moreover, several studies showed that the SARS-CoV-2 express the similar host receptor with SARS-CoV, in which angiotensin-converting enzyme 2 (ACE2) receptor.[5-7] The infection coronaviruses can be done by two processes, in which binding to the host cell by spike (S) protein and S protein priming by cellular serine protease TMPRSS2.[14] This is suggesting that both viruses exhibit similar route of transmission.

The transmission of SARS-CoV-2 from human-to-human occurred in the family settings, community, and hospital or clinics. Most of the transmission occurred via respiratory droplet, aerosolized, and contact transmission.[6, 15] Thus, transmission the SARS-CoV-2 is likely happen through ocular surface. Several eye specimens were studied, among them, the expression of ACE2 and TMPRSS2 were positive in human conjunctiva, limbus, cornea, and pterygium tissues.[16, 17] This is suggesting that SARS-CoV-2 transmission might be happen via ocular

surface. First, the coronavirus host receptor ACE2 was identified on several eye specimens.[18, 19] Second, the eyes possess an open microenvironment that vulnerable for droplets and aerosolized transmission. Third, the interconnection of the ocular mucosal immune system to the nasolacrimal lymphoid tissue.[5]

4.2 Eye care recommendations for ophthalmologists

4.2.1 Environmental control

Coronavirus may contaminate the environment (frequently touched objects and surfaces) and ophthalmic equipment, thus proper decontamination through routine cleaning using a disinfectant that is recommended by CDC, such as povidone-iodine, chlorhexidine, alcohol solutions with at least 70% concentration of alcohol, hydrogen peroxide, citric acid, and many more.[2, 3] Due to this, it is also recommended that health care workers wash their hands using an alcohol-based solution or the combination of alcohol and chlorhexidine.[3] As coronavirus droplets also may contaminate the air, the air ventilation in the waiting area should be improved. The use of High-efficiency particulate air filter (HEPA) is useful to augment the rate of air change in the waiting room.[2]

4.2.2 Outpatient setting

Reducing the number of patients appointments is recommended for every clinics include ophthalmology clinics.[2] Consultations through a video call or voice call should also be prioritized if possible. The doctor can determine the condition of the patients, and if the patients require further consultation and test.[9] The patient's temperature needs to be examined before entering the outpatient ward. Re-scheduling the appointment is necessary, if the patients exhibit a fever and the eye condition was non-urgent. The screening questionnaire regarding the history of traveling to affected areas during the incubation period, close contact with a confirmed or suspected case of COVID-19, and history of acute respiratory symptoms were performed for every patients.[2, 3] If they are negative to all the questions, they are allowed to enter the clinic. The suspected patients needing same-day consultation will be escorted to the isolation room.[2] The patients that diagnosed with acute conjunctivitis need to postpone their appointments for at least 14 days in some clinics.[3]

The respiratory droplets sized >5 µm that produced by breathing, talking, sneezing, coughing can travel approximately at least 1 meter and can be inhaled into the lungs.[20] The waiting room should be kept as empty as possible, with a distance of 2 meters between patients.[10]

When examines ophthalmic outpatients, the ophthalmologist needs to wear primary personal protection with disposable cap, surgical mask, and gown. Direct ophthalmoscopy, intraocular pressure measurement with non-contact tonometry, lacrimal irrigation, and probing, as well as ophthalmic laser therapy were included as a high-risk procedure. The gloves, N95 respirator, and goggles or face shield were highly recommended when performing those procedures.[4, 21] In order to avoid cross-infection, the ophthalmic examinations for patients with confirmed or suspect of SARS, MERS, or CoVID-19, should be completed within the quarantine ward with full protection[22, 23].

Contact time and speaking between ophthalmologists and patients should be minimized. Proper distance should be maintained whenever possible. Patients should also be told not to touch any equipment in the clinic, unless unavoidable. Any procedure involving corneal and lacrimal apparatus examination should be avoided if possible. The ophthalmologist should also use a protective barrier for slit lamp and avoid the use of non-contact tonometry (NCT) because NCT is said to be a possible source of micro aerosol, thus the use of I-Care tonometry or Goldmann applanation tonometry with disposable tips are preferable.[3, 9, 11]

4.2.3 Inpatient setting

It is recommended to admit only urgent cases, while follow the infection prevention protocol. Hospitalisations were preceded by rapid test for COVID-19 screening. The nasopharyngeal swab was performed in the patient with history of traveling to affected areas, close contact with a confirmed or suspected case of COVID-19, and history of acute respiratory symptoms. The positive COVID-19 cases

were admitted to an isolation ward, along with confirmed COVID-19 cases.[12] In the inpatient settings, the examination should be done at the bedside as much as possible. However, if the examination must be done in the outpatient clinic, the inpatients should wait in a separate waiting room with no or minimal interaction with other patients. To prevent inpatients from different wards waiting together, the implementation of allotting separate time slots can be done.[2]

4.2.4 Surgical settings

All elective and routine surgery should be postponed, and only urgent and non-deferred procedure that may be done.[2, 9] Because most of patient who underwent the surgery will be treated as inpatients, all the preparation protocols were matched to the inpatient's settings.[12] In addition, before the surgery, patients should be screened for the possibility of contracting COVID-19 infections.[10] If the patient is confirmed having COVID-19 disease, then the patient should be reassessed whether the surgery can be postponed until the PCR result is negative.[3] However, if the situation does not allow to postpone the surgery, patients' vital signs should be closely monitored, ultimately elderly patients above 65 years old, or those with comorbid diseases such as respiratory disease, cardiovascular disease, or immunocompromised patients. For COVID-19 negative patients, it is recommended that the procedure is ambulatory to prevent hospital stays. However, if not possible the hospital should have a non-COVID ward to prevent nosocomial infection.[9]

All the operating room staff should use proper PPE. It is recommended that every operating room staff use an N95 mask and if it's not possible for the staff to exit the operating room. The operator should use a disposable plastic visor mask rather than goggles, as the latter tend to impair vision due to condensation. Other protective equipments that should be used are disposable apron, disposable head and shoe covers, and double gloves. The amounts of personnel in the operating room should be minimized, and the staffs' circulation should be diminished as much as possible.[9]

Whenever possible, general anesthesia should be avoided to prevent aerosolization of the SARS-CoV2 virus due to intubation.[2, 9] Any surgical procedure that may cause aerosolization of the virus such as ocular surface irrigation with serum, drills, electrical cutting, and coagulation, should be avoided if possible.[11] Sight-threatening conditions that needed surgery should be carried out right away. American Academy of Ophthalmology (AAO) has been released a recommendation regarding the surgery and outpatient clinics that listed in https://www.aao.org/headline/alert-important-coronavirus-context.

4.2.5 Primary health care setting

World Health Organization propose the principles role of primary health care in COVID- 19 response as follows: (1) immediately recognize and manage possible cases; (2) prevent the transmission of virus to health-care workers and their relatives; (3) support the delivery of necessary health care services; (4) enhance surveillance for COVID-19; and (5) educate and involve the community in the COVID-19 detection and prevention.[24] As mentioned above, reducing the number of patients appointments is recommended for every clinics including primary health care.[2, 25] A telehealth approach could be done through a video call or voice call. The condition of the patients could be determined by the doctor, and if further consultation and test are required, the patient could visit the primary health care.[9, 25] It is important to identify the value of coordinated response from primary health for facing the pandemic COVID-19.[26] The conjunctivitis is reported as a common eye condition that might occurred in COVID-19 patients.[27] Therefore, eye protection is a mandatory safety measurement that needs to be wear while examining the patients.

4.3 Eye care recommendations for patients

Hospital visitation during COVID-19 pandemic need certain strict protocols. All patients in the outpatient setting should go through body temperature examination and triage questions before entering the clinics.[20] The clinical characteritisc of COVID-19 were varying, from asymptomatic to anosmia or fatigue, fever, dyspnea, cough, and myalgia.[28, 29] Thus, patients with those symptoms need to be suspected as COVID-19 patients. For patients with urgent ophthalmology appointment with no respiratory

illness symptoms, no fever and no COVID-19 risk factors should do standard precautions.

Standard precautions such as hand hygiene, cough etiquette, and use of PPE. Patient will also be asked to speak minimally, and not to speak during slit lamp biomicroscopic examination.[30] For patient with urgent ophthalmology appointment with respiratory illness symptoms, but no fever and no COVID-19 risk factors should be given. And placed in a surgical mask. For patients with urgent ophthalmic problem with high risk for COVID-19, the patient should be sent to the ER or other hospital facility that is equipped to evaluate and manage COVID-19.[30]

Urgent ophthalmology cases that are stated above are cases where there is a high risk of visual loss without treatment. Such as exudative age-related macular degeneration; severe diabetic retinopathy; acute retinal detachment; advanced or rapidly progressive glaucoma; severe, active uveitis; serious ocular oncology conditions; retinopathy of prematurity; globe rupture or other severe trauma; or serious ocular infections.[31]

5. Conclusion

COVID-19 infection is a global public health threat. It is mainly transmitted through droplets and direct contact. However, the possible transmission through tears or conjunctival secretions cannot be deterred. In ophthalmologic practices, where there is close contact between patients and doctors, infection control is strictly needed. It aims to ensure that healthcare workers and patients are safe. Providing patients with face masks, promoting cough etiquette and hand hygiene is important. Proper use and removal of personal protective equipment, hand hygiene, and self-awareness by health care workers are important to avoid hospital-related transmission during practice. The primary health care also essential for managing the COVID-19 through several roles, such as: identify and isolate probable cases, minimize triage burden at hospital, enhance effective communication in community, and deliver the education to the community.

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