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## Table of Contents

### Volume 4(1) April 2021

- 1-7 The COVID-19 pandemic and its impacts on sub-urban society in Yogyakarta, Indonesia: A qualitative study  
***Bayu Fandhi Achmad, Shalmanuary Nisya Allquarismy, Siska Pratiwi, Yohannes Aruna Kertiyasa, Dewanggani Kirana, Dhyanti Mutiasari, Vineshankar Ravichandar, Yosafat Budiharjo Santoso Simanungkalit, Dionisia Setya, Farah Nabila Firry, Syaiful Ghozali, Wahida Yuyun Suciati***
- 8-15 Barriers to health protocol adherence during exercise among youth in the COVID-19 pandemic era  
***Fitrawan Silvano, Amila Yashifa, Daniel Simada Pandapotan Saragih, Claudia Gunawan, Anindyaningtias Inas Wuragil, Resa Paksi Mandariska, Supriyati***
- 16-20 Implementation of e-SEKOCI (The Online Class of Sekolah Komplementer Cinta Ibu) in counselling midwives and pregnant women during COVID-19 pandemic  
***Rizka Ayu Setyani, Sumardiyono***
- 21-28 Relationship between anxiety and insomnia in clinical clerkship students during COVID-19 pandemic  
***Maria Sekartaji, Muhammad Irsan, Resty Puspita Sari, Muhammad Adnan, Labitta Pachira Aquaira, Shabrina Rifka Farahiya, Firdaus Hafidz***
- 29-36 Improving pregnancy care during the COVID-19 pandemic for pregnant women as vulnerable groups through assistance at the primary health care facility  
***Kurniati Puji Lestari, Muhamad Jauhar***
- 37-42 Clinical findings in determining referral criteria for coronavirus disease (COVID-19) patients at a makeshift isolation center of Bekasi, West Java  
***Stefi Geovani Valentin Hayon, Florentina Priscilia, Hariri***
- 43-55 School reopening: Evidence-based recommendations during COVID-19 pandemic in Indonesia  
***Raden Yuli Kristyanto, Lily Chandra, Hermawan Hanjaya, Mohamad Saifudin Hakim, Dian Kesumapramudya Nurputra***
- 56-65 A review of Internet-based approaches for health promotion programs related to the COVID-19 pandemic and wellness education  
***Carissa Wityadarda, Gusti Ayu Sinta Deasy Andani, Rina Rostarina***

- 
- 66-72 Retinal involvement of coronavirus disease (COVID-19): A systematic review  
*Mohammad Eko Prayogo,<sup>1</sup> Angela Nurini Agni, Tri Wahyu Widayanti, Supanji, Firman Setya Wardhana, Muhammad Bayu Sasongko, Cita Shafira Amalia, Ni Putu Yena Yossiana Devi, Roihan Mohamad Iqbal, Vania Permatahati*

# The COVID-19 pandemic and its impacts on sub-urban society in Yogyakarta, Indonesia: A qualitative study

Bayu Fandhi Achmad,<sup>1,\*</sup> Shalmannuary Nisya Allquarismy,<sup>2</sup> Siska Pratiwi,<sup>3</sup> Yohannes Aruna Kertiyasa,<sup>3</sup> Dewanggani Kirana,<sup>3</sup> Dhyanti Mutiasari,<sup>3</sup> Vineshankar Ravichandar,<sup>3</sup> Yosafat Budiharjo Santoso Simanungkalit,<sup>3</sup> Dionisia Setya,<sup>3</sup> Farah Nabila Firry,<sup>3</sup> Syaiful Ghozali,<sup>2</sup> Wahida Yuyun Suciati<sup>2</sup>

<sup>1</sup>Department of Basic and Emergency Nursing, Faculty of Medicine, Public Health and Nursing; Universitas Gadjah Mada, Yogyakarta, Indonesia.

<sup>2</sup>Student at School of Nursing; Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.

<sup>3</sup>Student at School of Medicine, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.

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**ABSTRACT** Indonesia is the country which has the most COVID-19 cases in South East Asia. The COVID-19 pandemic is causing serious psychological, social, and economic impacts particularly on the sub-urban society. This study aimed to explore the impacts of the COVID-19 pandemic on sub-urban society in Yogyakarta, Indonesia. This study used a hermeneutics phenomenological approach. that enrolled seven participants who reside in the sub-urban area of Yogyakarta province in June 2020. Semi-structured interviews were conducted with participants through Whatsapp mobile application and analyzed using interpretive phenomenological methods. Results showed that the impact of the COVID-19 pandemic can be summarized into three themes. First, the impacts include negative emotions that arise due to psychosomatic symptoms, fear of losing loved ones, stereotypes and anxiety concerning contracting COVID-19 infection; Second, limited social interaction in the community and strict travel restrictions; and third, job and income losses including layoffs from work and fear of not being able to meet family basic needs. The COVID-19 pandemic is causing several serious impacts involving psychological, social, and economic concerns that are disrupting the sub-urban society. Individual coping and family support are needed in the current situation.

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## 1. Introduction

The current Coronavirus Disease-2019 (COVID-19) was first reported in Wuhan, China, in December 2019 and shortly afterward, it was transmitted widely around the whole world. In 2020, the World Health Organization (WHO) declared the status of COVID-19 as an international pandemic.<sup>1</sup> The relative ease of the transmission of the virus combined with the absence of previous immunity and vaccination against COVID-19 have made this current viral outbreak as one of the most severe pandemics and fatal diseases in all of human history.<sup>2</sup>

\*Correspondence: [bayu.fandhi.a@ugm.ac.id](mailto:bayu.fandhi.a@ugm.ac.id)  
Department of Basic and Emergency Nursing, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

Since it was first reported, almost 70 million COVID-19 cases have been confirmed and it has caused over 1.5 million casualties around the world. Indonesia is the country which has the most cases in the South East Asia (ASEAN) region and is ranked 24<sup>th</sup> worldwide having almost 600 thousand positive cases and more than 18 thousand casualties.<sup>3</sup> This very dire circumstance has driven a worldwide public health campaign in order to slow the transmission of the virus, which recommends several suggestions for public health safety: including to increase hand washing, to reduce face touching, to wear masks in public areas and to maintain physical distancing. It is also highly recommended to restrict or prohibit activities involved in the functioning of educational institutions, such as schools and universities, places for communal objectives, public transportation, in

addition to other places where many people may gather, including sports and music events<sup>4</sup>

Patients infected with COVID-19 often complain of respiratory and gastrointestinal disorders with symptoms ranging from a mild self-limiting disease to severe illness requiring intensive care, such as pneumonia, acute respiratory distress syndrome, septic shock, and even systemic multiple organ failure syndrome. The source of transmission of the virus comes from patients who have been previously infected. In addition, asymptomatic infected patients can increase the transmission, since they consider themselves as healthy individuals, and can have limitless contact with others.<sup>5</sup>

Moreover, the COVID-19 pandemic has caused several psychological, social, and economic impacts on the society. In an early study investigating the immediate psychological response during COVID-19 epidemic among the general population in China, 53.8% of participants rated the psychological impact of the outbreak as moderate or severe.<sup>6</sup> The psychological impact can be influenced by age, gender, marital status, having children, and the composition of the household.<sup>7</sup>

In general, psychological disorder symptoms experienced by the society of Indonesia are anxiety, sadness, anger, fear, boredom, and despair.<sup>8</sup>

Social distancing applied by the government has its function to limit the viral transmission, even though this strictly enforced program has caused an even more stressful situation, especially for the societies which have high social interaction history and culture such as Indonesians. Generally, the social distancing can increase the negative psychological effects, including confusion, anger, and post-traumatic distress. Further duration of social distancing, infection fears, boredom, frustration, lack of information, and fear of financial loss have emerged and continues to increase the risk of negative psychological outcomes.<sup>9</sup>

Subsequently, other impacts which are experienced by the society are related to financial instability due to unemployment and closed opportunities, because the supply side has been damaged, while economic growth, and tourism levels with the badly needed ticket and commodity

sales of the traveling sector have been reduced.<sup>10</sup> In particular, within these populations, which are the most economically vulnerable groups, there is a high rate of stress which raises the need for special attention among health professionals.<sup>11</sup>

Therefore, our study aimed to understand impacts of the COVID-19 pandemic on sub-urban society in Yogyakarta, Indonesia through semi-structured interviews and to analyze the data using interpretative phenomenological methods. We hope our study can provide a better understanding of the society's psychological, social and financial needs for government officials, researchers and health professionals to better target their actions during this pandemic and expand the research in the area of appropriate interventions for Indonesian society.

## 2. Method

### 2.1 Research design

The research design used in this study was the hermeneutics phenomenological approach. Interpretative Phenomenology Analysis methods were used to qualitatively analyze the impacts of the COVID-19 pandemic on sub-urban society in Yogyakarta, Indonesia.

### 2.2 Study subjects

We determined the participants in this study by applying purposive sampling. Inclusion criteria in this study were: those respondents who were (1) residing in the sub-urban area of Yogyakarta province, (2) family members who are the main support or breadwinner, (3) married and have other family members in the house, and (4) over 18 years old. Exclusion criterion was the ones who were working as civil servants. We involved a total of seven participants who fit the criteria.

### 2.3 Interview outline

We determined the interview outline by consulting relevant literature and seeking experts' opinions. The main interview questions posed to the participants were the following: (1) How do you feel about COVID-19?; (2) What has changed in your social life?; and (3) What are the impacts of COVID-19 pandemic on your financial burden and your family?.

## 2.4 Data collection

The data collection was conducted through semi-structured interviews with the participants. First, we communicated the purpose and significance of the study to the participants in advance and then scheduled for the interview time at their convenience. The study subjects were allowed to withdraw consent at any time. Moreover, the researchers guaranteed the participants that the data recorded were kept strictly confidential and considered private. The researchers remained neutral in collecting the data and established a good relationship with the participants. The researchers implemented several techniques, namely unconditional acceptance, active listening, and clarification to promote the authenticity of the data and to avoid bias.

The data collection was conducted in June 2020 through communicating with the participants via private message through *WhatsApp*. This method was applied with the consideration when the data collection was conducted, since Indonesia was implementing Large-Scale Social Restriction (lockdown), hence it was impossible to meet in person. Additionally, the implementation of the *WhatsApp* application was chosen since this application is considerably the most popular mobile application in the society in the research location. Furthermore, *WhatsApp* can maintain confidentiality so that participants are free to express their opinions. Besides these considerations, *WhatsApp* has encrypted data so that data security is more guaranteed.

## 2.5 Data analysis

Within 24 hours of each interview, the *WhatsApp* chat was copied and analyzed by Interpretative Phenomenology Analysis methods. The researchers (1) read the materials repeatedly and thoroughly, (2) implemented taking notes initially upon content of words, sentences, and languages which were used by the participant, (3) developed the emerging theme, (4) anticipated the relation between the emerging themes, (5) moved on to the next participant, and (6) found the pattern raised among the cases/participants.

In order to ensure the process was rigorous and

trustworthy, this study proposed four criteria. These include credibility, transferability, dependability, and confirmability. Strategies to address credibility included prolonged engagement with the participant and member check. As an application of transferability, the results of this study are general, and they can be used as a reference for other studies with the characteristics of the population living in suburban areas. To ensure dependability, the researchers wrote all of the research activities in a detailed audit trail. Confirmability was done by analyzing the findings and comparing them with other quantitative and qualitative research.

## 2.6 Ethical review

This study was reviewed and approved by the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada in Yogyakarta, Indonesia with the ethics code KE/FK/0432/EC/2020. The authors can assure that there is no academic misconduct such as plagiarism, data fabrication, falsification, nor repeated publication.

## 3. Result

In this study, the researchers enrolled 7 participants consisting of 5 males and 2 females between the ages of 36 and 55 with an average age of  $44.29 \pm 6.73$  having the range of educational background of junior high school to associate's degree. All of the participants are married and have families. The participants have various occupations, from entrepreneurs, private employees, security staffs, to laborers who earn less than Rp 4,000,000.00 per month. Table 1 outlines the baseline characteristics of the participants.

We explored the psychological, social and financial experiences of participants by applying the hermeneutic phenomenological approach. The researchers found three main themes which are summarized below. Exemplar quotes for each theme are displayed in Table 2.

### 3.1 Theme 1: Negative Emotions

Most participants ( $n = 5$ ) experienced anxiety and fear of the COVID-19 pandemic. This anxiety was based on the fact that participants have occupations



**Table 1.** Baseline characteristics of participants (n = 7)

| Characteristics                  | N (%)                      |
|----------------------------------|----------------------------|
| Gender                           |                            |
| Male                             | 5 (71.42%)                 |
| Female                           | 2 (28.58%)                 |
| Age                              | 44.29 (6.73); 43 (36 – 55) |
| Education                        |                            |
| SMP (junior high school)         | 1 (14.29%)                 |
| SMA (senior high school)         | 5 (71.42%)                 |
| Diploma III (associate's degree) | 1 (14.29%)                 |
| Occupation                       |                            |
| Entrepreneur                     | 1 (14.29%)                 |
| Private employee                 | 2 (28.58%)                 |
| Security staff                   | 1 (14.29%)                 |
| Labor                            | 3 (42.84%)                 |
| Marriage and offspring           |                            |
| Married with children            | 7 (100%)                   |

Result is presented in mean (SD); median (range) for age

requiring them to meet with many people thereby increasing the risk of exposure to the virus, in addition to the stereotype that neighbors who had tested positive for COVID-19 will be a threat to the whole community. Moreover, the social and electronics media in Indonesia continuously reported the negative news about the expanding COVID-19 pandemic, thus it also caused further sources of fear in the society. Psychosomatic symptoms suffered by one of the participants were clinical manifestations of an acute anxiety disorder due to the COVID-19 pandemic.

### 3.2 Theme 2: Social Interactions

The participants (n=2) experienced limitations in establishing social interactions where socializing regularly in groups is a common pastime, which they usually do on a daily basis. The participants realized that to prevent transmission of the COVID-19 virus, they were expected to stay at home and avoid traveling and socializing without urgent matters.

### 3.3 Theme 3: Financial Burden

Several participants (n=3) dealt with the burden in their occupations and loss of income due to the COVID-19 pandemic. Their roles as heads of the family and the breadwinners provided a massive psychological impact. They complained that they were laid off from work, causing financial problems

to the family. Furthermore, the Indonesian economic crisis due to the pandemic resulted in an increase in inflation and higher prices of many household items and consumable goods.

## 4. Discussion

Considering the negative effects of school closure The COVID-19 pandemic brings serious impacts on the society in Indonesia. Based on the results of the study, it was found that there were three main issues which were experienced by the participants in dealing with the pandemic, namely negative emotions, limited social interactions, and difficult financial burdens. Negative emotions in this study were divided into two issues, which were anxiety due to COVID-19 exposure and fear of contracting COVID-19. Negative emotions of the society were seen from the occurrence of anxiety disorders such as GERD. Based on a recent survey regarding emotional reactions during COVID-19 isolation in Indonesia, it was found that anxiety was the most commonly occurring impact which was experienced by the society in Indonesia.<sup>8</sup> Research has shown that negative emotions will develop keener perceptions towards COVID-19 which eventually increase family protective behavior.<sup>2</sup>

Furthermore, in Indonesia, a kind of stereotype was also formed that a neighbor who was proven to be a COVID-19 positive was a source of threat on the society, hence this neighbor must be avoided, and eventually they would build up a significant fear to not go outside their house. Negative stereotypes have been proven to cause harmful impacts, such as avoiding behavior, hostility, social isolation, and the loss of humanity in the society.<sup>12</sup> An educational effort is needed from the healthcare centers which can reach out to families and the society to avoid social prejudice and discrimination.<sup>13</sup> The implemented education may be in the form of public and private discussion regarding incidence, prevention, management, and vaccination as an effort to eliminate stigmatization in the community.<sup>12</sup>

Moreover, the stereotype of patients with COVID-19 is caused by excessive reporting by the mass media coverage in Indonesia. This will not only cause burnout but also lead to more anxiety. In



**Table 2.** Themes identified through interviews with participant (n=7)

| No | Theme              | Subtheme                               | Quotations*  |
|----|--------------------|--|--|
| 1  | Negative emotions  | Anxiety caused by COVID-19 exposure    | <ul style="list-style-type: none"> <li>• "I experience a little feeling of psychosomatic reactions because of the large number of news regarding COVID; my GERD and anxiety disorder are often relapsed." (R1)</li> <li>• "As a durian fruit seller, every day I interact with many people. I'm actually also worried of getting exposed to this virus." (R2)</li> <li>• "Nowadays, social media and television continuously share news regarding COVID pandemic, so that it makes me and my family more worried." (R3)</li> </ul> |
|    |                    | Fear of exposed to COVID-19 infection. | <ul style="list-style-type: none"> <li>• "Actually, I'm afraid if my wife gets exposed to COVID virus, because she suffers from diabetes mellitus which makes her very vulnerable." (R4)</li> <li>• "My neighbor who lives only 500 meters from my house is a COVID-19 positive, so it makes me and my family feel afraid to go outside of our house." (R5)</li> </ul>   |
| 2  | Social Interaction | Limitation in social interaction       | <ul style="list-style-type: none"> <li>• "Now, we cannot be free anymore in social interaction. All social activities must be limited and be very careful" (R3)</li> <li>• "What we experience is the limitation to do activity outside and have to refrain from going outside if it's not important" (R1)</li> </ul>  |
| 3  | Financial Burden   | Occupation and income loss             | <ul style="list-style-type: none"> <li>• "What I experience as the head of the family is from the financial side. I got laid off because of this COVID pandemic, so I cannot meet the needs of my family." (R5)</li> <li>• "During the COVID-19 pandemic, I have not been working for 3 months..." (R6)</li> <li>• "The one causing stress is economic situation. We used to have a job, now we have nothing to do, and everything becomes pricey, whereas we have to meet our needs..." (R7)</li> </ul>                           |

\* Translated from Bahasa Indonesia

developing countries, mass media and social media are the main sources of information, which greatly influence the perceptions and behavior patterns of public health.<sup>14</sup> Furthermore, the characteristics of secondary education possessed by most rural societies have caused failure in comparing fake news on social media with factual news, thus they assume that factual news is news that is exposed on social media.<sup>15</sup>

Several participants in this study have occupations which require them to interact with others. This situation creates a dilemma for them, since on the one hand, they are afraid of being exposed to the virus and spreading it to their family, yet on the other hand, they must also work to meet their family's needs. Recommendations for working online are not always successful in rural areas of Indonesia. Limited network access and lack of ability to operate online systems are obstacles among the middle class. Additionally, the occupational

resistance to work from home might be a result of traditionalism, lack of trust, type of occupation, and the level of common knowledge as well.<sup>16</sup>

The COVID-19 virus is transmitted through person-to-person interactions, thus social distancing is an effort to prevent the spread of COVID-19 domestically and globally.<sup>17</sup> Social distancing has been proven to significantly decrease the numbers of daily confirmed-cases and daily casualties due to COVID-19 in 10 highly infected countries.<sup>18</sup> It is also highly recommended to restrict or prohibit the activities involved in the functioning of educational institutions, such as schools and universities, places for communal objectives, public transportation, in addition to other places where many people may gather, such as sports and music events. At the same time, restriction upon social interactions is not always an easy issue, especially in the societies which have a highly interactive social culture. This situation can trigger further stress which ultimately

affects the people's immune response to viruses such as COVID-19. This issue requires more support from government officials, health agents, and researchers. Accordingly, they can take these facts into their consideration for public-policy making and better direct their actions during the pandemic, as well as encourage studies to better understand these characteristics.<sup>11</sup>

The COVID-19 pandemic and the implementation of lockdowns in various countries have been proven to cause public economic shock waves. This makes many members of a society, especially the lower middle class, become a group that is vulnerable to bankruptcy. It is further explained that education, family income, government positions, and location of residence are factors which influence one's financial disturbances.<sup>19</sup> Individual coping and family support are needed in the current situation where many people are still losing their jobs and income. The workers need economic innovations through more creative work methods; thus, their business enterprises can continue to run and earn appropriate income.<sup>20</sup>

## 5. Conclusion

This study provides a comprehensive and in-depth understanding of the psychological, social, and financial impacts of the COVID-19 pandemic on sub-urban society in Indonesia through a hermeneutics phenomenological approach. The societies' perceived emotions were mostly anxiety and fear of being exposed to COVID-19 infection. The most substantive problem to deal with is the financial burden where the economic crisis is still causing a wave of lay-offs and loss of income. This problem causes extreme financial vulnerability for many members of the society. This study provides fundamental data for government officials, health professionals, and researchers to better target their actions during the COVID-19 pandemic and expand the focus of future research in the area of appropriate interventions for Indonesian society.

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# Barriers to health protocol adherence during exercise among youth in the COVID-19 pandemic era

Fitrawan Silvano,<sup>1</sup> Amila Yashifa,<sup>1</sup> Daniel Simada Pandapotan Saragih,<sup>1</sup> Claudia Gunawan,<sup>1</sup> Anindyaningtias Inas Wuragil,<sup>1</sup> Resa Paksi Mandariska,<sup>1</sup> Supriyati<sup>2,\*</sup>

<sup>1</sup>Undergraduate Program of Medicine, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

<sup>2</sup>Department of Health Behavior, Environmental, and Social Medicine, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

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COVID-19  
Physical activity  
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**ABSTRACT** Physical inactivity is one of the non-communicable disease risk factors. This study discusses how the Coronavirus Disease-2019 (COVID-19) has increased the leisure time, including among youth. The health promotion to improve the physical activities of youth is needed. This study aimed to analyze the level of compliance among Indonesian people particularly the young adults towards health protocol during exercise and conduct an intervention accordingly. This study used an action research design, with consecutive sampling. Respondents were Indonesian youth who exercise outside of their home during the COVID-19 pandemic. A total of 361 Indonesia youth aged 18-25 years old, who exercise during the pandemic inside and/or outside the home, and willing to answer the questionnaire completed the online questionnaire. The questionnaire was developed from the six health protocols' criteria from the Ministry of Health of the Republic of Indonesia. Data analysis used chi squared tests. Furthermore, a short video was developed according to the main research findings and published on Instagram TV as a health intervention to the respondents. The results showed that the level of compliance among Indonesian youth toward health protocol during exercise was low (24.1%). Moreover, only 35.3% respondents applied physical distancing and 48.7% respondents wore masks during at low-moderate intensity exercise. There was no significant association between gender, exercise intensity, and perception of the health protocol and the compliance of health protocol during exercise. In addition, the audience response toward video campaign about health protocol during exercise was good with more than 1,000 views, 166 likes and 50 comments. This study concluded that health promotion media that were developed based on the needs assessment results were effective to reach the target audiences.

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## 1. Introduction

The Coronavirus Disease-2019 (COVID-19) pandemic which has spread across Indonesia since February 2020 has caused most people to do nearly all activities at home, leading to a decreased frequency of physical activity. The time spent for only sitting and resting is known to be increased more than the usual.

In comparison with sedentary lifestyle, routine exercise and physical activity are beneficial in preventing various diseases, particularly the non-communicable diseases such as obesity, diabetes

mellitus, coronary heart disease, and they also help in reducing stress and preventing depression.<sup>1</sup> Exercise is also fundamentally important during the COVID-19 pandemic. Exercise that is done routinely for 2-3 times per week, in the duration of 15-30 minutes can maintain immunity and prevent depression which can aid in preventing further complications of COVID-19 disease.<sup>2</sup>

The Indonesian government has issued a physical distancing policy aimed at people who engage in any activities outside the home. According to the Ministry of Health of Indonesia, physical distancing while exercising has the same objective with any outside of the home activities in general, which is to reduce contact between individuals thus stopping or slowing the rate of disease transmission, including

\*Correspondence: [Supriyati@ugm.ac.id](mailto:Supriyati@ugm.ac.id)

Department of Health Behavior, Environmental, and Social Medicine, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Jl. Farmako, Sekip Utara, Yogyakarta 55281, Indonesia

COVID-19. The government policy in Indonesia related to health protocols in sports or exercise has also been explicitly regulated in *Kepmenkes* RI No. HK.01.07/Menkes/382/2020, in line with the recommendations of the Indonesian Sports Medicine Specialist Association or *Persatuan Dokter Spesialis Kedokteran Olahraga* (PDSKO), stating that people who are doing exercise or sports outside the home or users of a fitness and/or sport center facilities are required to actively wash their hands, apply physical distancing, and continue to use face masks when performing low to moderate intensity exercise.<sup>3-8</sup>

One study demonstrated the usefulness of social media in transferring resource materials and collaborative learning, hence increasing the enthusiasm and dynamicity of the learning process.<sup>9</sup> Another study also provided an overview of current trends regarding how technology is affecting higher education, as the increased use of video as a teaching media is occurring in higher education and affects the lecturers, students, and universities as a whole.<sup>10</sup> Hence, developing health promotion media that can potentially be delivered through social media is important to develop as the health promotion interventions targeted to adult youth.

Therefore, this study aimed to analyze the level of Indonesia young adults' compliance towards health protocols during exercising outside of home and conduct health promotion media as the intervention.

## 2. Method

### 2.1 Study design, sample selection, and data collection

This study used an action research design, comprising the steps: 1) identify problem, 2) make an outline of action plan, 3) carry out action plan, 4) observe how plan works out, and 5) reflect upon situation. Respondents were Indonesian young adults who exercise during the COVID-19 pandemic and fulfill the inclusion criteria. The sampling method was consecutive sampling, with the following inclusion criteria: 1) aged 18-25 years; 2) Doing sports outside the home; 3) Willing to become a respondent by completing an online questionnaire by a specified deadline. There were no exclusion criteria applied in

this study. This study used all samples who fulfilled the inclusion criteria. Data collection was done through an online questionnaire that was opened for the public with a duration of 4 days and distributed via social media platforms such as Instagram, LINE messaging application, and WhatsApp messaging application. Respondents were enrolled voluntarily, as optimally as possible from the authors' colleague network. The questionnaire was developed by the researchers based on the six health protocol criteria from the Ministry of Health of the Republic of Indonesia. There were 11 questions about perceptions of the health protocol during exercise outside the home, and the compliance towards health protocol during exercise outside. Additionally, this study considered gender as one of the independent variables.

### 2.2 Data analysis and ethical consideration

The descriptive and associational analysis were done in this study. Respondents who fulfilled the criteria were then divided into two groups, compliant and non-compliant, based on the fulfillment of health protocol criteria from the Ministry of Health Indonesia. Uni-variate analysis was used to describe each variable such as gender, location of exercise, type of exercise, duration of exercise, intensity of exercise, wearing masks, doing physical distancing, 6-step hand washing, sharing of exercise equipment, and adherence to the official Health protocols. Bivariate analysis used chi-squared tests to identify the association between the respondents' perception on health protocol (classified into good and bad perceptions), gender (classified into male and female), and intensity of exercise (classified into low-moderate and high) towards the compliance of health protocol during exercise outside the house in the pandemic era (classified into compliant and non-compliant). This study was approved by the Medical and Health Research Ethic Committee of the Faculty of Medicine, Public Health, and Nursing UGM (Ref. no. KE/FK/0902/EC/2020).

### 2.3 Video campaign as an action

Since this study used an action research design, an intervention was developed after the data analysis and discussion. The video campaign was developed by the researcher team according to the results of

the survey and was focused on the importance of physical activities during the COVID-19 pandemic and the importance of physical distancing along with the physical activities. Those messages were chosen because the survey results showed they were the biggest problems related to the health protocol adherence during exercise among youth. There were 2 videos created, with 1.5 minutes duration for each video. Furthermore, both of the videos' interactive campaign was published through Instagram TV (social media). The videos were published to the targeted audiences by using the research team's Instagram accounts for a set period of time.

### 3. Result

#### 3.1 Respondents characteristics

A total of 416 people completed the online survey, but as many as 55 respondents did not meet the inclusion criteria. Therefore, the final research respondents were 361 young adults. The respondents' characteristics are shown in the following Table 1.

The majority of the respondents were female (60.7%), and most of them live on the island of Java (81.5%). Most respondents were 23 years old (35.5%). Even though the questionnaire had been targeted specifically for people who exercise outside the home, one third of subjects tended to exercise inside the house (38%), while the rest tended to exercise outside the house. Data about exercising at home were only displayed in the characteristics of respondents and no further analysis was performed.

#### 3.2 The level of compliance with health protocol during exercise

This study showed that the level of compliance among Indonesian young adults toward health protocol during exercise was low (24.1%). Respondents who exercised outside the house were included in the analysis of exercise intensity and compliance to health protocol. Percentages of respondents' responses on each criteria of health protocol during exercise are shown in Table 2.

Most of the respondents did the low to moderate intensity exercise (70.5%). Fit physical condition

**Table 1.** Respondents Characteristics

| Variable                 | n   | %    |
|--------------------------|-----|------|
| Gender                   |     |      |
| Male                     | 142 | 39.3 |
| Female                   | 219 | 60.7 |
| Age                      |     |      |
| 18 years old             | 7   | 3.1  |
| 19 years old             | 7   | 3.1  |
| 20 years old             | 8   | 3.6  |
| 21 years old             | 26  | 11.6 |
| 22 years old             | 55  | 24.6 |
| 23 years old             | 79  | 35.5 |
| 24 years old             | 28  | 12.5 |
| 25 years old             | 14  | 6.3  |
| Region                   |     |      |
| Java                     | 294 | 81.5 |
| Outside Java             | 67  | 18.5 |
| Exercise location        |     |      |
| Inside house             | 137 | 38   |
| Inside and outside house | 108 | 29.9 |
| Outside house-indoor     | 27  | 7.5  |
| Outside house-outdoor    | 89  | 24.7 |

assurance was high, around 98.2% confirmed they were in fit condition before exercising outside the house. In addition, most of them (81.7%) did not share exercise equipment. The compliance to the WHO 6 steps for hand hygiene before and after exercise was excellent (87.1%). Moreover, most of respondents (92.4%) took a shower and changed clothes after exercising outside the house. On the other hand, compliance to mask-wearing was not satisfying. There were only (48.7%) wearing a mask during low to moderate-intensity exercise. Also, 12.1% wore a mask and 17.4% did not wear a mask at high-intensity exercise. The assessment of the type of exercise and physical distancing practice showed that there were only 35.5% who did the physical distancing appropriately. Overall, only 24.1% followed all the 6 aspects of the health protocol during exercise outside the home as recommended by the Indonesian Ministry of Health.

#### 3.3 The association between gender, exercise intensity, perception on health protocol and compliance with health protocol during exercise

Several participants (n=3) dealt with the burden in their occupations and loss of income due to the COVID-19 pandemic. Their roles as heads of the family and the breadwinners provided a massive psychological impact. They complained that they



**Table 2.** Respondents' compliance with health protocol during exercise by criteria

| Variable   | n   | %    |
|--|-----|------|
| Making sure you are in fit condition before exercising outside the house |     |      |
| Yes  | 220 | 98.2 |
| No   | 4   | 1.8  |
| Not sharing equipment  |     |      |
| Yes  | 183 | 81.7 |
| No   | 41  | 18.3 |
| WHO 6 steps hand hygiene before and after exercise outside the house     |     |      |
| Yes  | 195 | 87.1 |
| No   | 29  | 12.9 |
| Wearing a mask during exercise outside the house                         |     |      |
| Wearing a mask at low to moderate-intensity exercise                     | 109 | 48.7 |
| Wearing a mask at high-intensity exercise                                | 27  | 12.1 |
| Not wearing a mask at high-intensity exercise                            | 39  | 17.4 |
| Not wearing a mask at low to moderate-intensity exercise                 | 49  | 21.9 |
| Taking shower and changing cloth after exercising outside the house      |     |      |
| Yes  | 207 | 92.4 |
| No   | 17  | 7.6  |
| Physical distancing  |     |      |
| Indoor (gym)   |     |      |
| >2 meters  | 7   | 50   |
| <2 meters  | 6   | 42.8 |
| Unanswered   | 1   | 7.2  |
| Walking  |     |      |
| >5 meters  | 12  | 37.5 |
| <5 meters  | 19  | 59.4 |
| Unanswered   | 1   | 3.1  |
| Running/jogging  |     |      |
| >10 meters   | 44  | 51.1 |
| <10 meters   | 40  | 46.5 |
| Unanswered   | 2   | 2.4  |
| Cycling  |     |      |
| >20 meters   | 16  | 6.4  |
| <20 meters   | 27  | 61.4 |
| Unanswered   | 1   | 2.2  |
| Others   | 48  |      |
| Overall  |     |      |
| Yes  | 79  | 35.3 |
| No   | 145 | 64.7 |

**Table 3.** Association between gender, exercise intensity, perception on health protocol and the compliance with health protocol during exercise

| Independent Variable          | Compliant |      | Non-Compliant |      | P     | PR (95% CI)         |
|-------------------------------|-----------|------|---------------|------|-------|---------------------|
|                               | n         | %    | n             | %    |       |                     |
| Gender                        |           |      |               |      |       |                     |
| Male                          | 25        | 46.3 | 90            | 52.9 | 0.436 | 0.766 (0.415-1.416) |
| Female                        | 29        | 53.7 | 80            | 47.1 |       |                     |
| Exercise intensity            |           |      |               |      |       |                     |
| Low-moderate                  | 36        | 66.7 | 122           | 71.8 | 0.496 | 0.787 (0.408-1.518) |
| High                          | 18        | 33.3 | 48            | 28.2 |       |                     |
| Perception of Health Protocol |           |      |               |      |       |                     |
| Good perception               | 51        | 94.4 | 147           | 86.5 | 0.145 | 2.660 (0.766-9.234) |
| Poor perception               | 3         | 5.6  | 23            | 13.5 |       |                     |



Figure 1. Screenshot of the video campaign

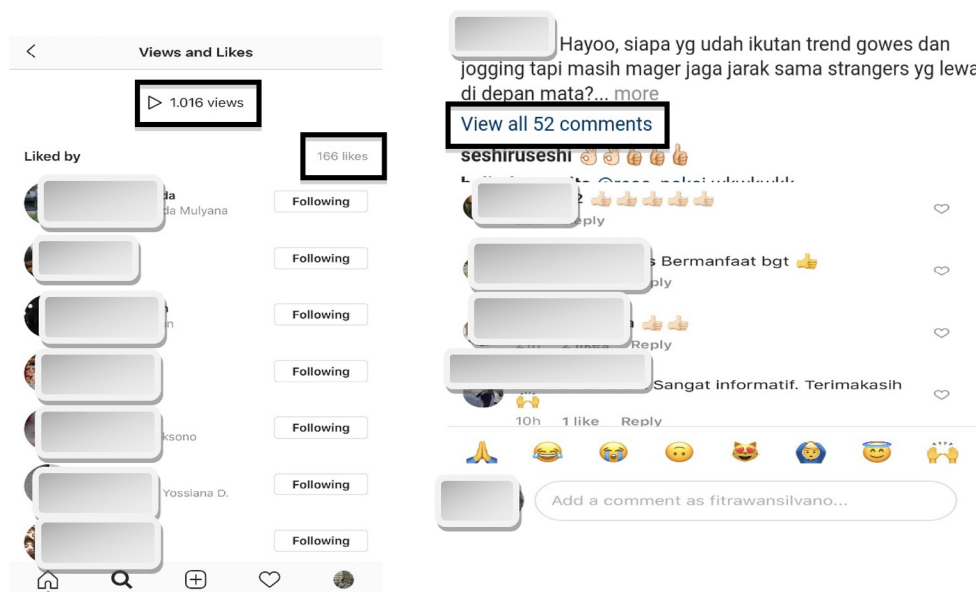


Figure 2. Number of video campaign’s viewers and likes, as well as example of audience comments

were laid off from work, causing financial problems to the family. Furthermore, the Indonesian economic crisis due to the pandemic resulted in an increase in inflation and higher prices of many household items and consumable goods.

### 3.4 Response of Indonesian young adults on the video campaign

This study showed that physical distancing (35.3%) with appropriate distance according to type of exercise (50% at the gym, 37.5% on walking,

51.1% on running, and 36.6% on cycling) and mask wearing at low-moderate intensity exercise (48.7%) were the two least complied criteria adhered to by respondents. Thus, an interactive video was created on the health protocol during exercise outside the home in the COVID-19 pandemic era to increase the young adults' awareness and aimed at highlighting those two criteria (Figure 1). The "Instagram TV" was chosen as the communication channel platform, due to its current popular trend among Indonesian young adults.

Within 24 hours after the video was first uploaded, the responses of the viewers in the form of likes and comments are shown in Figure 2. The video got 1,016 viewers, 166 likes, and 52 comments. Most of the comments were complimenting the video, such as "this video is easy to understand", "it is very informative", "the video motivates me to exercise again", "good video", "thumbs up" etc.

#### 4. Discussion

The level of Indonesian young adults' compliance toward health protocol (the 6 aspects of health protocol during exercise outside the home as recommended by the Indonesian Ministry of Health) was low (24.7%). There were only 48.7% who wore a mask at low to moderate-intensity exercise and only 35.5% did the physical distancing appropriately. There was also no significant association between gender, exercise intensity, perception on health protocol and the compliance with health protocol during exercise.

Based on the inclusion criteria from this study, the range of participants' age (18-25 year) relates to the respondent's exercise routine and the respondent's ability to consider and obey health protocols. People less than 20 years old are the most frequent participants doing sports regularly and this decreases dramatically after he/she became more than 20 years old.<sup>11</sup> The ability of respondents at this age to think complexly, see through various points of view, understand social values, and regulate emotions in a stable manner will also help in understanding health protocols.<sup>12</sup>

Although the government has provided various policies regarding health protocols in dealing with

the COVID-19, the incidence of the COVID-19 patients in Indonesia is still high, and this study showed that the level of young adults' compliance was low. A study explained that it was caused by cognitive biases, which are classified into several classifications, namely optimism bias, emotional bias, and the Dunning Kruger effect, the major bias for Indonesians. The last type of bias explains that Indonesians feel they know and understand how to deal with a pandemic better than the government. So, a more thorough knowledge and understanding about health protocols during pandemic is needed by the public.<sup>13</sup>

According to this study, women tended to be more obedient in implementing health protocols than men, although it was not statistically significant. This was supported by research which stated that women tended to be more obedient than men, even though the study also explained that the finding was not statistically significant.<sup>14</sup> Other studies also explained that there was greater tendency for men to break the rules.<sup>15</sup>

It was also found in this study that respondents who did low-moderate intensity exercise tended to obey health protocols better than respondents with high intensity exercise, even though it was not statistically significant. Doing exercise requires energy and muscle performance, while the use of masks causes obstruction of air flow to the respiratory tract, thereby increasing the perception of exertion, reducing muscle performance, and increasing lactate concentration when compared to training without mask. Therefore, the use of masks during exercise was often neglected.<sup>16</sup> High intensity training was also related with the "open window" theory. This theory explained that high intensity training induces suppression of the immune system. This window period may allow for an increase in susceptibility to upper respiratory illness, especially for the COVID-19. So, moderate intensity training is more recommended because it can improve the immune system.<sup>17</sup> In addition, the COVID-19 patient may be asymptomatic for several days and hence, high-intensity exercise may be more dangerous.

This study also explained that there was no significant association between the perceptions



on health protocols with participant compliance in implementing them. One study examining the relationship between high understanding and low level of compliance by using the application of the SSC (Surgical Safety Checklist) on medical personnel, explained that almost all medical personnel understood SSC, but only 57.2% of these medical staff carried out the complete SSC. So, the high level of understanding did not guarantee a high level of citizen compliance.<sup>18</sup>

In addition, the evaluation of the small health promotion intervention by using videos that were published through Instagram TV showed that the messages had reached the target audiences. Reach is one of the health promotion media evaluation components according to the RE-AIM (reach, effectiveness, adoption, implementation, and maintenance) framework. RE-AIM was developed as a formative evaluation program, including for the health promotion interventions.<sup>19</sup> Audiences who were targeted in this small health promotion intervention gave appreciation to the messages that were delivered, and forwarded the messages to their friends and colleagues. Even though the number of respondents were 361 young adults but the viewer count of the video was 1,016 viewers within 24 hours, and the messages got 166 likes and 52 comments within 24 hours. A video campaign was chosen as the intervention (action) in this study. An interactive video as the campaign media was more effective to increase participants' understanding when compared to paper-based media.<sup>10</sup> Besides, the messages were published to the audiences at the right time. This study was performed in August 2020 when the number of the COVID-19 patients in Indonesia were increasing after the 'new normal' regulations were applied. Most people tended to do the new normal behavior with the recommended safety principles. At that time, the information concerning how to do exercise outside with safety protection was needed.

Health promotion interventions should be designed according to the needs assessment results.<sup>20</sup> These results will help health promotion experts to design the appropriate program, key messages, as well as determine the specific target and time for delivering the health promotion messages. The video campaign in this study was designed according to the

survey results, i.e. the key messages, communication channels, and the media campaign.

This study had some limitations. First, the questionnaire was used without trial. This study could not provide the validity and reliability of the questionnaire. Secondly, the survey in this study was conducted online in a narrow time period.

## 5. Conclusion

The percentage of Indonesian young adults aged 18-25 years old who comply with all six criteria of the official health protocol during exercise outside the home in the COVID-19 pandemic era was low, especially for the physical distancing and mask wearing at low-moderate intensity exercise. There was no significant association between the perception on health protocol, gender, and intensity of exercise towards the compliance of health protocol during exercise in the COVID-19 pandemic era. The health promotion interventions that were designed according to the needs assessment results could reach the target audiences. Therefore, Instagram TV is an alternative communication channel for spreading health information targeted to youth during the COVID-19 pandemic.

## Conflict of interests

There is no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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# Implementation of e-SEKOCI (The Online Class of Sekolah Komplementer Cinta Ibu) in counselling midwives and pregnant women during COVID-19 pandemic

Rizka Ayu Setyani,<sup>1</sup> Sumardiyono<sup>2</sup>

<sup>1</sup>Student of Public Health Doctoral Program, Universitas Sebelas Maret, Surakarta, Indonesia

<sup>2</sup>Public Health Doctoral Program, Universitas Sebelas Maret, Surakarta, Indonesia

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Pregnant woman

**ABSTRACT** Pregnancy classes are vital for successful communication, information, and health education in maternity services. However, their implementation should be postponed during the COVID-19 pandemic to prevent COVID-19 transmission in pregnant women who are classified as a vulnerable group, especially if they had a history of pregnancy with non-communicable diseases. Therefore, we implemented e-SEKOCI (The Online Class of Sekolah Komplementer Cinta Ibu) which aimed to provide counselling and mentoring of pregnant women using social media WhatsApp group, Zoom Cloud meeting, Instagram, or YouTube. The implementation of e-SEKOCI began in March 2020 with 150 pregnant women in Indonesia. We also worked with teaching volunteers consisting of midwives and midwifery lecturers. In e-SEKOCI classes, expectant mothers were taught complementary midwifery care, such as mom and baby massage, prenatal and postnatal yoga, and self-hypnosis. Besides, pregnant women could also conduct online consultations with midwives about their pregnancies. Most of the participants said they were satisfied with e-SEKOCI, which included 80% in the health education program and 94% in the pregnancy consultation program. As many as 70% of participants prefer the WhatsApp group as a means of implementing e-SEKOCI. In conclusion, e-SEKOCI was effective as a media of midwife counselling for pregnant women, especially during the COVID-19 pandemic. The use of WhatsApp group media was recommended because it was easier to use and cost-effective.

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## 1. Introduction

Pregnant women especially those with non-communicable disease (including hypertension and diabetes) are considered to have an increased risk of developing COVID-19. Therefore, it is important that they take precautions to protect themselves from COVID-19, and report possible symptoms (including fever, cough, or difficulty breathing) to their healthcare provider.<sup>1</sup>

Another problem is the presence of 'fake' news that is not clearly true. Limited access to healthcare during the COVID-19 pandemic, makes pregnant women get information from inaccurate sources.<sup>2</sup> Some of them are also trying to find out for themselves the truth of the news. Accordingly, this

condition of course adds to the anxiety of pregnant women that impacts their mental health.<sup>3,4</sup>

All pregnant women and their newborns have the right to high-quality care before, during, and after childbirth, including mental health care.<sup>5</sup> However, due to the COVID-19 pandemic, access to maternity services has been limited, including the implementation of maternity classes. The policy from Ministry of Health, calls for immediate health service restrictions to prevent the transmission of COVID-19. This is done especially in Public Health Centers.<sup>6,7</sup>

Technological advances are expected to be the solution to this situation during the COVID-19 pandemic.<sup>8</sup> Providing counselling, information, and education from midwives to pregnant women can still be done by utilizing modern technology on social media.<sup>9</sup> Therefore, we offer an innovation project e-SEKOCI (Online Class of Sekolah Komplementer Cinta Ibu) as a substitute for pregnant women's classes that are usually carried out directly. We utilize social media WhatsApp, Instagram, and zoom to

\*Correspondence: [rizkaayusetyani@respati.ac.id](mailto:rizkaayusetyani@respati.ac.id)  
Midwifery Study Program Bachelor Program, Faculty of Health Sciences, Universitas Respati Yogyakarta, Jl. Raya Tajem Km. 1,5 Maguwoharjo, Depok, Sleman, Yogyakarta, 55282, Indonesia

hold web seminars and online consultations. This project is a media for counselling midwives and pregnant women in providing proper education, especially during the COVID-19 pandemic. Pregnant women also do not need to worry because although they cannot come to the Public Health Center, they can still do consultations online. This study aims to evaluate the application of e-SEKOCI during the COVID-19 pandemic.

## 2. Method

The Online Class of Sekolah Komplementer Cinta Ibu (*e-SEKOCI*) was the development of a pregnant women's class program in collaboration with the Public Health Centers in Indonesia. We were advocating for the Public Health Centers to socialize the program to the target of pregnant women. Additionally, we invited midwives as teaching volunteers in *e-SEKOCI*.

The program started in March 2020 until now after getting ethical clearance (number: 127.3/FIKES/PL/III/2020). We provide informed consent to participants before the start of this program. There are 150 participants of pregnant women who have been registered with *e-SEKOCI*. We conduct *e-SEKOCI* promotion directly through Public Health Centers and online through social media to enroll participants. The implementation of *e-SEKOCI* included: providing

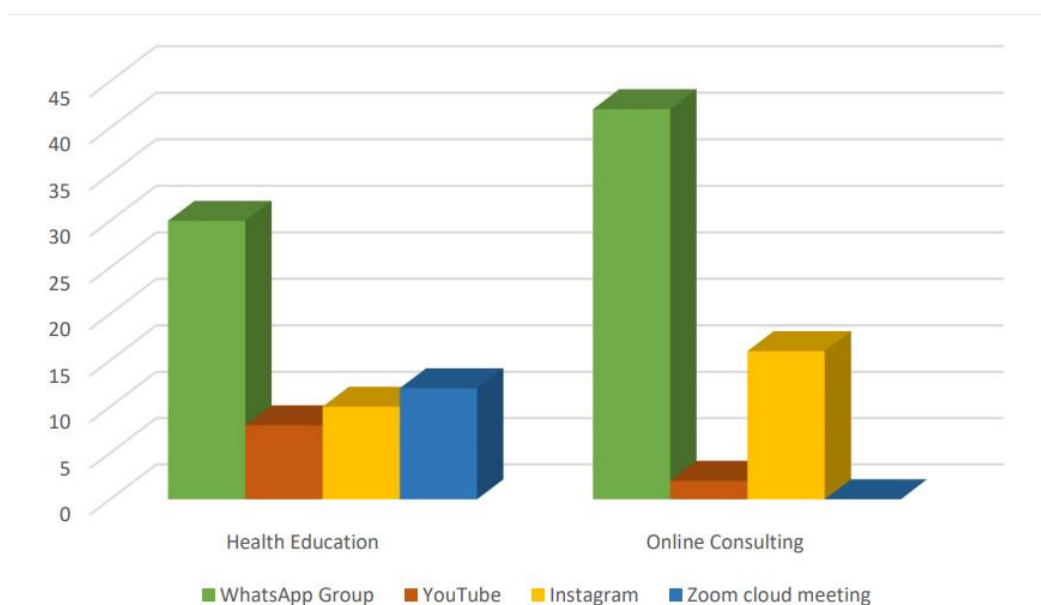
health education every month using social media WhatsApp group, Zoom Cloud meeting, Instagram, or YouTube; and pregnancy consultation via WhatsApp chat. Participants could access these online services for free.

Program evaluation was done every three months. This was a quantitative study and the data were collected with a satisfaction questionnaire. Variables measured were health education program satisfaction, online consulting program satisfaction, and social media usage preferences. Analysis of data was done univariately and presented as percentages in the tables.

## 3. Result

### 3.1. The characteristic of the *e-SEKOCI* participant

The number of pregnant women who participated were 150 participants spread throughout Indonesia. We collected data of the pregnant women, including age, education, occupation, and pregnancy status. In Table 1, the characteristics of pregnant women (*e-SEKOCI* participants) are displayed. The average age of them was 27.31 years, with 96% having a senior high school and university education, 28.67% worked as a housewife, and 57.33% currently having their first pregnancy.



**Figure 1.** The intensity of *e-SEKOCI* programs



**Table 1.** The characteristics of the *e*-SEKOCI participants

| Characteristic                      | Respondent<br>(n = 150) |             |
|-------------------------------------|-------------------------|-------------|
|                                     | Mean                    | n (%)       |
| Age (mean with standard deviation)  | 27.31 ± 4.680           |             |
| Education level (n%)                |                         |             |
| Elementary school                   |                         | 2 (1.33%)   |
| Junior high school                  |                         | 4 (2.67%)   |
| Senior high school and university   |                         | 144 (96%)   |
| Occupation (n%)                     |                         |             |
| Government employee                 |                         | 28 (18.66%) |
| Non-government employee             |                         | 40 (26.67%) |
| Entrepreneur                        |                         | 39 (26%)    |
| Housewife                           |                         | 43 (28.67%) |
| Pregnancy status (n%)               |                         |             |
| Primigravida (1st pregnancy)        |                         | 86 (57.33%) |
| Multigravida (2nd – 4th pregnancy)  |                         | 56 (37.33%) |
| Grandmultigravida (≥ 5th pregnancy) |                         | 8 (5.34%)   |

Source: Primary data (2020)

**Table 2.** The satisfaction of the *e*-SEKOCI program

| Variable                               | Evaluation (n = 150) |                    |
|--|----------------------|--------------------|
|  | Satisfied (n%)       | Not satisfied (n%) |
| Health education program satisfaction  | 120 (80%)            | 30 (20%)           |
| Online consulting program satisfaction | 141 (94%)            | 9 (6%)             |

Source: Primary data (2020)

**Table 3.** Social media usage preferences

| Social media       | Preferences (n = 150) |
|--------------------|-----------------------|
| WhatsApp group     | 105 (70.00%)          |
| YouTube            | 22 (14.67%)           |
| Instagram          | 20 (13.33%)           |
| Zoom Cloud meeting | 3 (2.00%)             |

Source: Primary data (2020)

### 3.2. Implementation of the *e*-SEKOCI program

Overall, the implementation of *e*-SEKOCI (The Online Class of Sekolah Komplementer Cinta Ibu) followed the schedule and targets. Health education programs in *e*-SEKOCI (The Online Class of Sekolah Komplementer Cinta Ibu) were offered every month through social media. Figure 1 is a social media display of SEKOCI including Youtube (<https://www.youtube.com/channel/UCws-aG9dk9qCOimS6Z2x0Hg>), Instagram (<https://www.instagram.com/sekolahkomplementercintaibu/?hl=id>), and WhatsApp group.

We cooperated with volunteer teachers (midwives and midwifery lecturers) in the

implementation of the *e*-SEKOCI program. Materials presented related to maternal and child health; complementary alternative medicine and therapy in midwifery (massage, yoga, acupressure, hypnotherapy, and herbs). Besides, we implemented the online consultation program with a scheduling system through the social media WhatsApp.

Based on the results of the survey with pregnant women who are participants in *e*-SEKOCI, this program, can be an alternative in monitoring pregnancy despite physical distancing. However, not all health services can be done online, such as physical examinations. Also, not all pregnant women have social media and only some can take advantage

of it.

### 3.3. The satisfaction of the e-SEKOCI program

In Table 2, most pregnant women participants were satisfied with the e-SEKOCI program, including the health education program (80%), and the online consulting program (94%).

Social media used in e-SEKOCI was adjusted to the type of material to be delivered, including WhatsApp group, Instagram, YouTube, and Zoom Cloud meeting. Table 3 describes social media usage preferences. Based on the survey results, pregnant women who are e-SEKOCI participants as much as 70% prefer to use the WhatsApp group in accessing the e-SEKOCI program. They said that, WhatsApp group is the easiest and cheapest when used.

## 4. Discussion

The e-SEKOCI program can be an alternative in monitoring pregnancy despite physical distancing. In this program, there are health education and online consulting that make it easier for pregnant women to get correct information related to their pregnancy. The class of pregnant women is very important in providing counselling, information, and education from midwives to patients. This is one of the integrated antenatal care programs, namely counselling.<sup>10</sup> Pregnant women who take classes during pregnancy can access all information related to the development of their fetus and can reduce discomfort, and anxiety during pregnancy.<sup>3,11</sup>

The use of technology in maternal and child health services must be done, especially in the COVID-19 pandemic. Limited direct access to clinics, Public Health Centers, or hospitals today should not reduce the quality of health services provided.<sup>12,13</sup> Some previous studies have used tele-health, health applications, or social media as a means to provide these health services.<sup>14</sup> In this study, we use social media WhatsApp group, Instagram, YouTube, and Zoom Cloud meetings in the implementation of education and health consultation.

The use of social media is influenced by the knowledge and facilities owned by users such as Internet networks, and the ability to purchase

Internet quota. A person's level of understanding is also influenced by their age and education.<sup>9</sup> Among the social media used in e-SEKOCI, WhatsApp group is the most in-demand social media. This is because pregnant women e-SEKOCI participants feel that the WhatsApp group is easiest to use and requires only a little Internet quota. In WhatsApp, group features can also fully access videos, text, and voice notes. However, live streaming material delivery cannot be done such as in YouTube, Instagram, and Zoom Cloud meeting.

This study has an impact on the implementation of health services during the COVID-19 pandemic.<sup>15</sup> The resulting direct output is that pregnant women still get access to proper counselling, information, and health education from health workers and monitoring during pregnancy. While the outcome of this program is the improvement of the quality of health of pregnant women with a good understanding of maternal and child health, including reduced discomfort and stress during pregnancy.

## 5. Conclusion

The e-SEKOCI (The Online Class of Sekolah Komplementer Cinta Ibu) became a class program for pregnant women in demand during the COVID-19 pandemic. The implementation of health education adds to the knowledge of pregnant women, especially about maternal and child health. Besides, pregnant women are also satisfied with the existence of online consultation services. We recommend that this program be continued indefinitely not only during the COVID-19 pandemic. The use of social media can take into account the abilities and desires of participants. WhatsApp can be a good choice because it is easier to use and cost-effective.

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## Conflict of interests

In this project, there is no conflict of interest. Funding came from the Ministry of Research and Technology / National Agency for Research and Innovation, who were not involved in the technical planning, implementation, and follow-up of the program.

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# Relationship between anxiety and insomnia in clinical clerkship students during COVID-19 pandemic

Maria Sekartaji,\* Muhammad Irsan, Resty Puspita Sari, Muhammad Adnan, Labitta Pachira Aquaira, Shabrina Rifka Farahiya, Firdaus Hafidz

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

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## KEYWORDS

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Insomnia  
Clinical clerkship student  
COVID-19

**ABSTRACT** During the COVID-19 pandemic, there has been an increase in anxiety disorders among the general population, including those clinical clerkship students who are associated with health care services. There has been limited studies conducted regarding this important topic, especially during the COVID-19 pandemic. This study aimed to know the prevalence of anxiety and insomnia, as well as the correlation between them, in clinical clerkship students during the COVID-19 pandemic. An online survey was conducted using a cross-sectional approach with 229 clinical clerkship students from batch 2015 at the Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada. This study used the Insomnia Severity Index (ISI) and General Anxiety Disorder-7 (GAD-7), administered using Google Forms. Data were analyzed using chi-squared tests. We collected 101 responses. There were 41.6% male respondents and 58.4% female respondents with ages ranging from 21 to 26. The results show 26.7% (95% CI: 8.1-35.4%) of students experienced anxiety and 44.6% (95% CI: 34.9-54.3%) of students experienced insomnia throughout the COVID-19 pandemic. There is a correlation between anxiety and insomnia among clinical clerkship students during the COVID-19 pandemic. Clinical clerkship students with an anxiety disorder have 2.62 times greater risk of experiencing insomnia ( $p < 0.001$ ). The correlation between insomnia and anxiety during COVID-19 pandemic is vital because clinical clerkship students are directly involved in health care services and they could risk the safety of patients. Thus, it is important to conduct the proper course of actions to reduce the risk of mental health problems during pandemic conditions. Also, further research is needed to have a better understanding of the impact of the pandemic reactions on learning performance.

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## 1. Introduction

The Coronavirus Disease 2019 (COVID-19) is a worldwide crisis which first emerged from Wuhan, Hubei Province, China.<sup>1</sup> The number of cases in Indonesia had reached 174,796 by the end of August 2020 since the first case was announced on March 18<sup>th</sup>, 2020.<sup>2</sup> This condition affects many sectors in Indonesia including social, economy, education, tourism, and health, which endured massive impact because of the lack of preparedness within the health system.<sup>3</sup> This event also happens to have a huge impact on the majority of human population and has produced unprecedented changes in our life.<sup>1,3</sup>

Anxiety is a feeling of excessive worry which can

be characterized by restlessness, fatigue, difficulty in concentrating, irritability, tension, and sleep disturbances. This disorder usually occurs when someone is facing something new or is in the search for self-identity.<sup>1,4</sup> The COVID-19 outbreak has led to higher anxiety levels in the general population. Several factors associated with such conditions are the virus infection itself, having infected family members, and close contact with identified patients. Other factors regarding the psychosocial condition include working as a healthcare professional and lack of emotional support which also increase a person's anxiety level.<sup>5</sup>

The occurrence of anxiety has been associated with insomnia in several studies.<sup>6,7,8</sup> Both are problems which are often found in college students and young adults in general. Insomnia is a sleep disorder that can be characterized by difficulty starting or maintaining sleep or waking up too early and unable to return

\*Correspondence: [maria.sekartaji@mail.ugm.ac.id](mailto:maria.sekartaji@mail.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 sleep. It can cause significant disruption in social, educational, academic, behavioral, or other aspects of life.<sup>1,4</sup>

Medical students, both in undergraduate and clinical clerkship programs, are reported having an increased anxiety due to COVID-19 pandemic.<sup>9</sup> A study revealed that anxiety levels in medical students associated with healthcare services were significantly higher than the medical staff and community population. It was possibly because they lack experience in controlling infectious disease in high-risk environments, the fear of medical errors, physical and emotional exhaustion due to a high-pressure health care system, rapid changes in medical information and procedures, self-perception of risk to themselves, the impact of pandemic on lifestyle, fear of inadequate medical equipment such as masks and gloves, long working hours, and separation from families.<sup>10</sup> However, since before the COVID-19 pandemic, medical students already have high rates of mental health problems and they are less likely to seek support.<sup>9</sup> Those who are in clinical clerkship program, especially, have a higher rate of anxiety due to more responsibilities in patient safety.<sup>11</sup> Therefore, it is important to raise public awareness on this critical topic.

To the best of our knowledge, there has been limited studies conducted regarding this important topic, particularly during the COVID-19 pandemic. Studies identified while conducting this research, were mostly describing or reporting increased mental health burdens among the general public during the pandemic; or anxiety, insomnia, and depression among medical students before the pandemic. Considering the serious effects of anxiety and insomnia on clinical clerkship students' professional and academic life, we conducted this study to know the prevalence of anxiety and insomnia, as well as the correlation between them, in clinical clerkship students during the COVID-19 pandemic.

## 2. Methods

We used data from a cross-sectional study among 229 clinical clerkship students of batch 2015 at the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada. The questionnaire was distributed via

Google Forms in social media platforms including Line, WhatsApp, and Instagram, which could be accessed within the time period of August 28<sup>th</sup> to August 30<sup>th</sup>, 2020. This study used a questionnaire that could be accessed via the following link: <http://bit.ly/DampakCovidKoasUGM>. The questionnaire consisted of demographics such as initials, gender, age, clinical rotation group, location, and whether the respondents were undergoing any anxiety or depression treatment. Other sections consisted of questions using standardized measurements of insomnia and anxiety, with the Insomnia Severity Index (ISI) and General Anxiety Disorder-7 (GAD-7) surveys. The researchers had consulted regarding the constructs of the study with the experts for their professional judgment and input to increase the validity and reliability of these methods.

The independent variable in this study was anxiety found in medical students of batch 2015 affected by the COVID-19 pandemic. Whereas, the dependent variable in this study refers to the insomnia triggered or worsened by the anxiety. The researchers used the Insomnia ISI and GAD-7 to measure both of these variables. The ISI score was interpreted as absence of insomnia (0-7), subthreshold insomnia (8-14), moderate insomnia (15-21), and severe insomnia (22-28); with excellent reliability and validity among university student<sup>12</sup>. GAD-7 score was categorized into minimal (0-4), mild (5-9), moderate (10-14), and severe (15-21). A score of  $\geq 10$  held a possibility of clinically diagnosed GAD, and is reliable and valid to use among university students<sup>13</sup>. Referring to the score, in this study we simplified our finding into 'No Insomnia' and 'Insomnia' with cutoff point of 8 in ISI, and 'No Anxiety' and 'Anxiety' with cutoff point of 10. We described the relationship between anxiety and insomnia in clinical clerkship students during the COVID-19 pandemic using a chi-squared test ( $\chi^2$ ). Significant value was set as  $p < 0.05$ .

## 3. Result

From 229 students we approached, 106 agreed to respond but 5 failed to complete all the forms required. Therefore, a total of 101 clinical clerkship students of batch 2015 were included in this study. There were 42 (41.6%) male respondents and 59 (58.4%) of female respondents with ages ranging from 21 to 26. There was no significant difference in

**Table 1.** The prevalence of anxiety and insomnia by gender

| Gender      | Anxiety   | No anxiety | p-value | Insomnia  | No insomnia | p-value |
|-------------|-----------|------------|---------|-----------|-------------|---------|
| Male (42)   | 8 (29.6%) | 34(45.9%)  | 0.213   | 16(35.6%) | 26(46.4%)   | 0.369   |
| Female (59) | 19(70.4%) | 40(54.1%)  |         | 29(64.4%) | 30(53.6%)   |         |
| Total       | 27(26.7%) | 74(73.3%)  |         | 45(44.6%) | 56(55.4%)   |         |

**Table 2.** General Anxiety Disorder-7 (GAD-7) score distribution (N = 101)

| Anxiety Level      | Frequency | Percent |
|--------------------|-----------|---------|
| Minimal/No anxiety | 47        | 46.5    |
| Mild Anxiety       | 27        | 26.7    |
| Moderate Anxiety   | 18        | 17.8    |
| Severe anxiety     | 9         | 8.9     |

GAD Score: Minimal/No Anxiety= 0-4, Mild Anxiety = 5-9, Moderate Anxiety = 10-14, Severe Anxiety = 15-21

**Table 3.** Insomnia severity index score distribution (N=101)

| Level                        | Frequency | Percent |
|------------------------------|-----------|---------|
| No Insomnia                  | 57        | 56.4    |
| Subthreshold Insomnia        | 33        | 32.7    |
| Clinical Insomnia (Moderate) | 10        | 9.9     |
| Clinical Insomnia (Severe)   | 1         | 0.9     |

ISI Score: No Insomnia= 0-7, Subthreshold Insomnia= 8-14, Moderate Insomnia = 15-21, Severe Insomnia = 15-21

**Table 4.** The association between anxiety and insomnia

| Group      | Insomnia   | No Insomnia | PR* (95% CI)    | p-value |
|------------|------------|-------------|-----------------|---------|
| Anxiety    | 22 (81.5%) | 5 (18.5%)   | 2.62(1.79-3.85) | <0.001  |
| No anxiety | 23 (31.1%) | 51 (68.9%)  |                 |         |

\*Prevalence ratio; CI, confidence interval

the prevalence of anxiety and insomnia by gender (Table 1). In the time of sampling, among the 101 samples, 47 were enrolled in 10 weeks term of 'major' department (Internal Medicine, Surgery, Obstetrics/Gynecology, and Pediatrics), 50 in 4 weeks of 'minor' department (Forensic, Dermato/Venereology, Anaesthetic, Psychiatry, Public Health, Neurology, Ophthalmology; Ear, Nose & Throat), and 4 having off week.

The prevalence of anxiety and insomnia among the students was 26.7% and 44.6%, respectively. The mean GAD-7 score was  $6.24 \pm 5.26$  (maximum = 20), with the spread of score categorization explained in Table 2.

On the other hand, the mean ISI score was  $7.69 \pm 6.09$  (maximum = 25), with the spread of score categorization explained in Table 3.

Table 4 shows that there was a correlation between anxiety and insomnia on clinical clerkship

students during the COVID-19 pandemic. Of 28 students with anxiety, 22 (79.3%) had insomnia and only 5 (20.7%) had no insomnia. Thus, clinical clerkship students with anxiety have a 2.62 times greater risk of experiencing insomnia (Prevalence risk 2.62 (1.79-3.85),  $p = .000$ ).

#### 4. Discussion

Our study found that 26.7% of clinical clerkship students suffered from anxiety and 44.6% of clinical clerkship students experienced insomnia, and of those who suffered anxiety, they were 2.62 times more likely to have insomnia. This number of 26.7% of respondents having anxiety is lower than the Asian prevalence of 35.2%, but concordant with the global prevalence of 27.5%.<sup>14</sup> Anxiety itself is a topic that has been less discussed among medical students, than the more popular study topics such as depression. Even anxiety can be debilitating,

and since it has been less recognized and studied, it can go undetected and untreated.<sup>14</sup> Insomnia is another important parameter to explore, because it is associated with quality of life in many studies.<sup>15,16</sup> Research found that it is one of the most common sleep disorders, with prevalence between 10% and 40% across studies.<sup>17,18</sup> Prevalence of sleep disorders among young adults is increasing globally and in adolescents aged 13–16, prevalence of insomnia was reported to be as much as 11%.<sup>19</sup>

Students with insomnia experience more problems with physical and psychological health. Improving sleep quality has been shown to decrease the incidence of chronic diseases such as major depressive disorders, psychosis, addictions, cardiovascular, metabolic and inflammatory disease risks.<sup>20</sup> One of the most robust associations between sleep disruption and emotional functioning involves how the role of anxiety and insomnia increases the likelihood of developing a mood or anxiety disorder.<sup>21-23</sup>

Anxiety is a 'normal' emotion that is experienced by everyone, as a response to some general stress or threat. It could be seen as a state of alarm and activation of fight-and-flight response to danger, real or perceived, both physiologically or psychologically. Anxiety is also a trait that is attached as a person's character feature, likely reflecting a long time maladaptive response to stress; as varying genetic background, developmental and early life experiences, shape a person's perception of experiencing stress. There is no hard distinction of what 'abnormal' anxiety is as a state of mind, but pathological anxiety differs in the sense of fear that is irrational, as a response to a threat that is not always really present or actively threatening to guarantee an immediate danger. (24,25)

Whether the anxiety is rational or not, state or trait, features of anxiety appear as signs of alertness and arousal, which could lead into changes of sleep-wake patterns. Sleep arousal is essential to maintain a nervous system state that favors survival during a stressful event. As a response to stress, it has been described by having hormonal, behavioral, and autonomic components. While still working in a close relationship, different components of the

stress system respond to different kinds of stress. For example, a physiological stressor like hypoxia will be responded to by an autonomic-nervous (AN) system, which differs from the response to a complex environmental danger like emotional stress that involves the corticotrophin releasing hormone (CRH) system. (25)

Both acute and chronic stress have prominent effects on sleep which are regulated by the hypothalamic-pituitary-adrenal (HPA) axis and generally the sympathetic nervous system. Exposure to stress is known to disrupt the sleep structure and sleep-wake regulation, as patients with insomniac complaint show increased activity of HPA activity and sympathetic tone increase. The nature of both the HPA and AN systems will stimulate each other. This feed-forward mechanism is susceptible to dysfunction, because it can retain an arousal state despite being out of the stressful situation. It is proposed that this dysfunctional state can lead to anxiety and depressive disorders, creating a loop of disruption. (25) To answer the question about which one is more likely to come before the other?: Reports shows that anxiety occurs before insomnia in as many as 43.5% of chronic insomniac cases, while in 38.6%, it happens in parallel; and in 18% cases, insomnia appears before anxiety. In clinical cases, it is concluded that anxiety problems as a part of psychiatric history, are correlated to the severity and chronicity of insomnia experienced. (26)

In terms of public health, insomnia co-morbid with anxiety gives rise to more complications and greater burdens than does each disorder alone and treating anxiety improves co-morbid insomnia symptoms.<sup>23, -27,28</sup> While treating clinical insomnia and anxiety is not without medication, there are efforts that students can attempt to prevent and deal with them. Simple self-administered behavioral changes like maintaining a good sleep hygiene, making a sleep journal and peer-counselling can be done if seeking formal therapy is not available yet.<sup>28</sup> Maintaining anxiety levels by doing hobbies, routine exercise, and regulating a healthy diet are also recommended. During the pandemic situation, it is even advised to retreat from too much media and news especially regarding COVID-19, if they disturb you in some way.

29

According to the data we have gathered, this is the first study conducted to observe the correlation between anxiety and insomnia that happens within the clinical clerkship student population during COVID-19 pandemic. The pandemic situation has hit everyone in the general population. It affects not only personal and public health, but also social relationships, education, and importantly economic conditions. Emergency guidelines to reduce the impact of the pandemic as a wide-scale disaster, that are endorsed by the government, include restrictions of gatherings and closing of educational institutions, and have created great changes in all people's life.<sup>29</sup> These measures add additional stress to the people's own fear for their health, mazy social media, lack of physical and mental health knowledge, and lack of physiological coping methods, which can negatively impact the public mental health greatly.<sup>29-30</sup>

Medical students in the clerkship program especially have another academic challenge during the pandemic. Clerkship programs that were designed to involve bed-side teachings, emergency setting, and hands-on training have been greatly shifted into online learning, which cannot replace real-time, real-patient interactions to practice what they learned in pre-clinical settings.<sup>31</sup> This pandemic is undoubtedly an unexpected problem that none of the clerkship students were prepared for appropriately. As they train and prepare for their board examination to qualify as a competent doctor, these changes of study methods affect their practical preparedness to be a medical doctor, in this time of high demand for competent medical workers.

How to prepare these medical students to reach their competency, is another concern needing to be considered by the academic institutions, lecturers, and medical students. In the traditional curriculum, proficiency is measured mostly by records or logs of case findings, skills, and real patient clinical examinations. All of them require the normal circumstances when students are able to be sent to a type C or B hospital in a more peripheral region, where they can take part in ward care or an emergency setting. A standardized online curriculum had to be established, including the hours needed, mechanism of either synchronized and asynchronized methods, and enough practical learning. Hands-on training is

essential for competency, and the clerkship course cannot be abandoned. Students can be divided into smaller groups and shorter shifts for their bedside learning. By mixing these experiences with online alternatives for meetings, we should be able to maintain the precaution measures. We also need to consider the possibility of expanding the number of training hospitals within the less COVID-19 hit area. Extensive considerations still need to be taken. Many questions arise such as: Do these hospitals have enough patients, or supervisors; do they have clear protocols to protect the students; et cetera.

As discussed before, the board exam to ensure medical doctors' competency is one of the academic aspects that influence the stress level of the students. In our country, this exam has been delayed once and modified into a written exam only, without the clinical exam.<sup>32</sup> For the earlier batch of students, this mean a delay in graduation, and also changes in practice. We need to prepare also for the next period of exam, since it will be taken mostly by the students that have been impacted by the pandemic longer – at least for several more months. This brings up the valid question: Is the same exam method able to be applied to these students whose clerkship program was spent mostly online? We need to consider alternative methods like using a from-home but still real-time exam, using levelled short cases, essays, and options that are able to measure clinical skills that should have been honed during the clerkship.

To compare with other countries, final year medical students, across Europe and United States, have been recruited to become the frontliners of health care by 'bypassing' board exam, either to have an accelerated exam and being dispatch right into the national health system under a provisional licensure. This approach is also done with graduating residents in Canada, giving them opportunities to work within their competence before taking the earliest exam possible.<sup>33</sup> While maintaining the supply of doctors, the utmost important safeguard to do is then to protect them with proper personal protective equipment (PPE). If these kinds of policies are to be done in Indonesia, there are several conditions that need to be considered. The first is because these 'new personnel' are somehow still medical students and not registered doctors yet under the law, their



status at the hospital is questionable. The questions arise: Are the faculty responsible to supply their PPE, or are they under the ministry support like internship doctors, or under the hospital own expenses? And the next question is, are they actually competent enough to work independently?

Our study has some limitations. First, we used a self-reporting survey rather than using face to face interviews that can gather more information than questionnaires as a standalone. This survey was conducted online and in a narrow time range, which can possibly hinder the data because of the limited Internet access, and disability to reach a wider range of respondents. Hence, we were also only able to have minimal measurements in a relatively small population, so the results may not reflect the general population well. As a cross-sectional study, we can only estimate and correlate anxiety and insomnia as episodes, and were not able to do longitudinal and in-depth observations. Thus, the interpretation of this study is very limited, and a larger and retrospective or prospective study in the future is required to verify the results.

## 5. Conclusion

Many medical students are having anxiety during their clinical clerkship in the pandemic situation, which correlates with their insomniac sleep pattern. Our opinion is that the pandemic situation not only affects anxiety prone medical student as normal citizens, but also from the academic perspective. Measures have to be taken especially by academic institutions and educators to consistently construct a safe-guarding and empowering environment for medical students in their clerkship program during the pandemic situation, in order to reach the goals of the clerkship itself while still maintaining safety protocols. Such actions are vital because clinical clerkship students –albeit limited, are directly involved in health care services and any human error could risk the safety of the patients.

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## Conflict of interests

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

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# Improving pregnancy care during the COVID-19 pandemic for pregnant women as vulnerable groups through assistance at the primary health care facility

Kurniati Puji Lestari, Muhamad Jauhar\*

Department of Nursing, Health Polytechnic of Ministry of Health Semarang, Semarang, Indonesia

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**ABSTRACT** Since it was found in December 2019, the novel Coronavirus Disease 2019 (COVID-19) has spread from Wuhan, China, to many other countries. A rapid increase of newly found cases was observed, and finally, in March 2020, the World Health Organization declared that Coronavirus Disease 2019 (COVID-19) is a global pandemic. As one of the vulnerable groups, pregnant women need to avoid COVID-19 transmission and maintain pregnancy health during the pandemic. This study aimed to improve pregnant women's self-management during the COVID-19 pandemic in the working area of the Padangsari Primary Health Care Services, Semarang City. The research method used an experimental design with a pre-posttest without a control group. A Smartphone application, namely "SEHARI," was used to share the module and video about pregnancy health guidelines; furthermore, various activities of this study included online classes for pregnant women via a WhatsApp group, pregnancy care behavior surveys, and evaluations. The offline activity was done in 1 meeting for 90-120 minutes, while online activities were done as needed. This study's target population was 22 pregnant women in Puskesmas Padangsari Semarang City's working area selected by purposive sampling. A questionnaire was used that measures mother's behavior while engaging in pregnancy care and pregnancy examination screening. The validity and reliability tests showed that the instrument was valid and reliable to improve self-management of pregnant women during the COVID-19 pandemic in the working area. Bivariate data analysis of the independent variable's effect on the dependent variables used paired and independent t-tests to measure the self-management of pregnant women. The results showed that 50% of pregnant women fulfilled nutritional needs well, 59.1% of pregnant women did tetanus immunization, and 59.1% did pregnancy examinations and visits. Despite being a vulnerable group, pregnant women must continue their antenatal care during the pandemic with a strict health protocol. Specially designed online classes and Smartphone application can be used as media to deliver the essential health messages so that pregnant women can still monitor their pregnancy health and have a way to bridge the existing programs in primary health care.

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## 1. Introduction

The Maternal Mortality Rate (MMR) is one indicator of public health and the development of a nation in every country, including Indonesia. The MMR describes the number of deaths in women due to pregnancy disorders or their management during pregnancy, childbirth, and the puerperium (excluding accidents or incidental cases) without considering the length of pregnancy per 100,000 live births. MMR is also used to monitor mortality during pregnancy,

associated with health status, education, and services during pregnancy and childbirth.<sup>1</sup> Therefore, MMR's sensitivity and its association with health services improvement indicate the success of the health sector development and still represents a significant concern of both central and local governments.<sup>2</sup>

Pregnancy is a process that begins with conception and ends with labor. The pregnancy term increases estrogen and progesterone, which can affect the mothers' and their baby's condition. Moreover, these conditions can be observed through increased blood flow to the uterus, breast, vagina, cardiovascular system, urinary tract, respiration, integument, and endocrine system.

\*Correspondence: [muhamadjauhar@poltekkes-smg.ac.id](mailto:muhamadjauhar@poltekkes-smg.ac.id)  
Department of Nursing, Health Polytechnic of Ministry of Health Semarang, Jl. Tirto Agung, Pedalangan, Banyumanik, Semarang 50268, Indonesia



Meanwhile, pregnant women need to develop a good understanding and adaptation according to the changes that occur during the pregnancy. Therefore, lack of information about physiological changes due to pregnancy may cause the mother to experience difficulties in the early detection of high-risk pregnancy.<sup>3</sup>

Besides, the high-risk pregnancy is sometimes caused by a lack of understanding of reproductive health related to the low level of education, social and economic status, and the lack of utilization of health service facilities. Sufficient knowledge of high-risk pregnancies will encourage pregnant women to get regular prenatal checks. Moreover, pregnant women also need to understand the needs of nutrition, personal hygiene, and sleep rest to prevent pregnancy complications and maintain health status. Another factor that affects pregnancy is the age of the pregnant woman. Mothers who are pregnant during the reproductive period will have a lower risk during pregnancy than mothers who are pregnant below or above the reproductive age.<sup>4</sup> Various programs or interventions need to be designed and implemented to reduce MMR.

Various ways to reduce MMR can be done through preventive and promotive measures with a continuous community empowerment approach. One strategy that can be conducted is health education for pregnant women about monitoring of pregnancy health status, including pregnancy danger signs; ways of dealing with pregnancy complaints; adapting to changes in pregnancy; childbirth; postpartum care; baby care; myths; related infectious diseases; issuing birth certificates and baby's health.<sup>5</sup> Several previous studies have explained that health education can increase pregnant women's knowledge about pregnancy screening and monitoring. Moreover, a good understanding or experience will also support good efficacy and self-management.<sup>6</sup>

Community empowerment related to MMR aims to increase the active participation of health cadres, health workers' allies in the community and accelerate problem-solving concerning maternal and child health in the community.<sup>7</sup> Health cadres act as pregnancy health promoters responsible for providing health education, monitoring maternal

and child health, recording and reporting baby births, while mobilizing people to adopt a clean and healthy lifestyle, and making referrals if necessary.<sup>8</sup> Therefore, these assistance activities need to be done from pregnancy to childbirth. Several previous studies stated that community empowerment efforts through optimizing health cadres' role increased the knowledge, attitudes, and behavior of pregnant women about pregnancy self-management. Nurses must meet the needs of pregnancy health education through community empowerment, especially during the COVID-19 pandemic.<sup>9</sup>

Based on the previous coronavirus pandemic cases, namely SARS-CoV and MERS-CoV, pregnant women are the vulnerable group that needs more attention during the crisis. Nurses must ensure that pregnancy checks are done regularly by following strict health protocols. To date, only a few studies explain the transmission of COVID-19 from mother to the baby during pregnancy or childbirth, the puerperium, and breastfeeding. However, it is necessary to prevent virus transmission based on established health protocols. A possible preventable negative impact is a preterm delivery in pregnant women with COVID-19 infection.<sup>10</sup>

Based on the Indonesian Obstetrics and Gynecology Association (POGI) report in 2020, 18 cases of pregnancy with COVID-19 infection occurred in the third trimester, with similar clinical findings were obtained in pregnant women as in non-pregnant adults.<sup>11</sup> Furthermore, fetal distress and preterm delivery were found in some cases. In two instances, cesarean delivery was performed, and testing for SARS-CoV-2 was found to be negative in all infants examined. According to the *Korea Herald* (9/3/2020), eight pregnant women who contracted COVID-19 were placed in Daegu and Busan's isolation rooms. One pregnant woman in Daegu gave birth, and the baby was confirmed negative for COVID-19.<sup>12</sup> Based on this situation, there is no data and evidence that the transmission of COVID-19 occurs through mother to fetus during pregnancy or childbirth.

According to the World Health Organization (WHO) in 2020, the clinical symptoms of COVID-19 reported by pregnant women are similar to those in other patients. Furthermore, out of the 147

pregnant women, 8% had severe clinical symptoms, and 1% was in critical condition.<sup>13</sup> The clinical signs that appeared included fever (78%), cough (44%), muscle aches (33%), general weakness (22%), shortness of breath (11%), and sore throat (22%). It will be more suspicious if pregnant women have a history of traveling to affected areas within the last 14 days or have had contact with people who have been confirmed positive of COVID-19. Therefore, pregnant women are expected not to panic and should be always aware and make efforts to prevent the transmission of COVID-19.<sup>10</sup> The instability of pregnant women's physical and psychological conditions will affect their health during pregnancy, childbirth, and the puerperium. Accordingly, immediate efforts are needed to minimize this impact by assisting pregnant women.

Assistance is a process of providing health aids by assistants to clients in identifying needs, solving problems, and encouraging the growth of initiative in the decision-making process to obtain sustainable client independence.<sup>4</sup> The activities of assisting pregnant women that have been done consist of disseminating independent pregnancy screening and monitoring applications; health education about the COVID-19 health protocol for pregnant women and management pregnancy through pocketbooks and videos; and referral to health facilities to help the pregnant women. Moreover, assistance activities involve primary health nurses, people in charge of maternal and child health programs, maternal and child health survey workers, and health cadres. This community service activity aimed to improve pregnant women's self-management during the COVID-19 pandemic in the working area of the Padangsari Primary Health Care Services, Semarang City.

## 2. Methods

Community service activities were conducted for eight weeks consisting of the preparation, implementation, and evaluation stages. The preparatory stage (weeks 1 to 3) consisted of developing a proposal for the activities, preparing the health education media (videos, books, and Smartphone applications), obtaining permission from the health department

and primary health care services, and conducting the preliminary studies. The reliability test results showed that the questionnaire on pregnant women's self-management was reliable with Cronbach's alpha value of 0.639. The validity and reliability tests of the media used demonstrated content validity with scientific expert consultation. The implementation stage (weeks 4 to 6) consisted of: 1) a pregnancy care behavior survey through an online questionnaire; 2) establishing an online class for pregnant women through a WhatsApp group (pregnant women, nurses, health survey workers, and health cadres); 3) socializing education modules/books and videos of prevention and monitoring of pregnancy health during the COVID-19 pandemic through face-to-face and online meetings; and lastly, and 4) socializing the use of Smartphone applications for screening, monitoring, and independent pregnancy care. The resource persons were pregnant women, nurses, health survey workers, and health cadres. The total number of resource persons was 22 people. The evaluation phase and the preparation of follow-up plans were done online from the 7th to the 8th week.

All activities were conducted in June-July 2020 at the Padangsari Primary Health Care Services, Semarang City, in face-to-face and online activities. Face-to-face activities were done in 1 meeting with a duration of 90-120 minutes integrated with the class schedule for pregnant women at the health center. This activity's target population was 22 pregnant women in the working area of Padangsari Primary Health Care Services Semarang City selected by purposive sampling. The instrument used was a questionnaire on maternal behavior during pregnancy care developed by Rahmadina in 2016, modified to a Google form and an independent pregnancy examination questionnaire using a Smartphone application based on the 2016 Maternal Child Health Book by the Indonesian Ministry of Health. The data analysis of the study used an SPSS computer program. Univariate data were presented as means with standard deviation (SD) and tabled to show each variable and respondents' characteristics with minimum-maximum and 95% confidence interval (CI). Bivariate data analysis of the independent variable's effect on the dependent variable used paired and independent t-tests to measure the self-

**Table 1.** Characteristics of pregnant women based on the age of the last child, age of pregnant women, height, weight before pregnancy, and weight after pregnancy (n = 22)

| Variable                     | Mean   | SD    | Min -Max    | 95% CI             |
|------------------------------|--------|-------|-------------|--------------------|
| Last child age               | 1.73   | 2.931 | 0-9 th      | from 0.43 to 3.03  |
| pregnant women age           | 27.59  | 5.161 | 16-38 years | from 25.3 to 29.88 |
| Height of pregnant women     | 154.73 | 6.057 | 145-167 cm  | 152.04-157.41      |
| Body weight before pregnancy | 55     | 12.66 | 38-83 Kg    | 49.39-60.61        |
| Body weight after pregnancy  | 59.31  | 14.81 | 44-88 Kg    | 52.75-65.88        |

CI, confidence interval; min-max, minimum-maximum; SD, standard deviation

management of pregnant women. Paired t-test was used to determine the impact of self-management of pregnant women before and after treatment. An unpaired t-test was performed to test for differences between the intervention group and the control group.

### 3. Result

Based on Table 1, the mean age of the last child was 1.73 years with SD 2.931. The lowest age was 0 years (childless), and the highest age was nine years. The mean age of pregnant women was 27.59 years, with SD of 5.161. The lowest age of pregnant women was 16 years, and the highest was 38 years. The mean of pregnant women's height was 154.73 cm with SD 6.057, with the shortest height was 145 cm, and the highest was 167 cm. Before pregnancy, the mean body weight was 55 kg with SD 12.66. The lowest body weight before pregnancy was 38 kg, and the highest was 83 kg. After pregnancy, the mean body weight was 59.31 kg with SD 14.81 and the lowest body weight after pregnancy was 44 kg, and the highest was 88 kg.

Table 2 shows that half of the pregnant women have blood type A, namely ten participants (45.5%). Half of the pregnant women have a college education background, with as many as nine (40.9%). Half of the pregnant women are housewives, with as many as 11 (50%). Half of the pregnant women do not have income, namely nine (40.9%). Most pregnant women are currently in their first pregnancy (primigravida) with as many as 15 people (68.2%).

Examination of pregnancy during the pandemic COVID-19 consists of breast care, nutrition fulfillment, tetanus toxoid immunization, and prenatal care at a health care facility. Table 3 shows that half of the pregnant women performed breast

care correctly, with 11 participants (50%). Half of the pregnant women fulfilled the nutritional needs well, with as many as 11 (50%). Most pregnant women did tetanus toxoid immunization, with as many as 13 (59.1%). Most pregnant women performed pregnancy examinations well, with as many as 13 (59.1%). Most of the pregnant women did antenatal care well during the COVID-19 pandemic, with as many as 12 participants (54.5%).

### 4. Discussion

COVID-19 is an infectious disease caused by a new type of coronavirus that was not previously identified in humans, namely *Severe Acute Respiratory Syndrome Coronavirus 2* (SARS-CoV-2). The clinical manifestations that appear in the patients are acute respiratory disorders such as fever, cough, and shortness of breath with a mean incubation period of 5-6 days. Complications that may follow the disease progression include pneumonia, acute respiratory syndrome, kidney failure, and even death. This virus first appeared in Wuhan, Hubei Province, China, in January 2020 and has now spread to almost all countries in the world in a short time, including Indonesia.<sup>13</sup> Based on this, the WHO declared the problem as a public health emergency affecting the world and considered it a pandemic.<sup>12</sup> Indonesia reported its first case of COVID-19 in March 2020 and has experienced an increasing number of patients every day until 2021.

The Indonesian Ministry of Health reported that by October 2020, there were 295,499 confirmed positive cases and 10,972 deaths. There was an increase of 4,317 actual positive cases and 116 circumstances of death every day.<sup>14</sup> Efforts are needed to prevent and control the spread of COVID-19 infection so that the increase in morbidity

**Table 2.** Characteristics of pregnant women based on blood type, education, occupation, income, and pregnancy (n = 22)

| Variable                                | f  | %    |
|---|----|------|
| <b>Blood type</b>                       |    |      |
| A                                       | 10 | 45.5 |
| AB                                      | 3  | 13.6 |
| B                                       | 2  | 9.1  |
| O                                       | 7  | 31.8 |
| <b>Education</b>                        |    |      |
| Graduated elementary school/ equivalent | 8  | 36.4 |
| Graduated High School/ equivalent       | 5  | 22.7 |
| Graduated College                       | 9  | 40.9 |
| <b>Jobs</b>                             |    |      |
| Labor                                   | 6  | 27.3 |
| Lecturer / teacher                      | 3  | 13.6 |
| Housewives                              | 11 | 50   |
| Merchants                               | 1  | 4.5  |
| Entrepreneur                            | 1  | 4.5  |
| <b>Income (monthly)</b>                 |    |      |
| No income                               | 9  | 40.9 |
| < regional minimum wage (Rp. 2,715,000) | 9  | 40.9 |
| ≥ regional minimum wage (Rp. 2,715,000) | 4  | 18.2 |
| <b>Pregnancy</b>                        |    |      |
| 1st                                     | 15 | 68.2 |
| 2nd                                     | 4  | 18.2 |
| 4th                                     | 3  | 13.6 |

and mortality can be reduced. Every society is faced with the reality of preparing to live side by side with COVID-19. Therefore, the community as the frontline to prevent and control COVID-19 infection must be able to identify vulnerable and high-risk groups such as the elderly, people with comorbidities, toddlers, and pregnant women.<sup>15</sup>

Pregnant women are one of the groups who are more vulnerable to COVID-19 exposure. When pregnant, the mother's immunity decreases, so they can more easily become infected. Furthermore, another concerning reason regarding the mother's health is that there are changes to pregnancy health services and essential nutrition programs for pregnant women during the COVID-19 pandemic, leading to the increase of morbidity and death risk in mothers. Based on the 2015 inter-census population survey, the MMR in Indonesia was 305 per 100,000 live births, meaning two mothers in Indonesia die every hour. With the spread of COVID-19 transmission, the challenges in reducing maternal mortality are even higher. Therefore, it needs more attention and efforts from all parties, including public

awareness and compliance, in realizing this goal. Pregnant women can make some effort to prevent COVID-19 infection.<sup>16</sup>

In general, the efforts that pregnant women can do during pregnancy are performing proper hand washing for at least 20 seconds; using an alcohol-based hand sanitizer with an alcohol content of at least 70% if water and soap are not available; avoid touching the eyes, nose, and mouth with hands that have not been washed; avoiding contact with people who are sick as much as possible; wearing a mask; staying at home especially when feeling ill or if sick, immediately go to a suitable health facility; restricting outside activities; disinfecting surfaces or objects that are often touched; consulting a specialist doctor if there are complaints, and continuously looking for accurate information.<sup>13</sup>

Pregnant women as a vulnerable group must understand the management principles of COVID-19 during pregnancy, including early isolation; standard infection prevention procedures; oxygen therapy; avoiding excess fluids; giving empiric antibiotics by considering secondary risks due to bacterial infection; health screening as needed; monitoring fetal and uterine contractions; early mechanical ventilation of progressive respiratory distress; delivery planning based on an individual approach or obstetric indications; and a multidisciplinary team-based approach.<sup>10</sup> Moreover, prenatal care demands in mothers have to be supported by various techniques while still paying attention to strict health protocols. One modification of this approach is the development of teleconsultation.

Teleconsultation in online classes is expected to be an alternative solution so that pregnant women can still conduct pregnancy checks and care without worrying about being exposed to COVID-19. Online pregnancy classes provide online consultation facilities with health workers such as doctors, midwives, and nurses so that pregnant women can consult about screening and pregnancy care during the COVID-19 pandemic. Modification of online pregnancy classes is supported by using an Android-based Smartphone application that contains pregnancy screening forms, electronic-based pregnancy monitoring manuals during the



**Table 3.** Overview of the implementation of pregnancy care during the COVID-19 pandemic (n = 22)

| Variable                             | f  | %    |
|--------------------------------------|----|------|
| Breast care                          |    |      |
| Good                                 | 11 | 50   |
| Poor                                 | 11 | 50   |
| Nutrition fulfillment                |    |      |
| Good                                 | 11 | 50   |
| Poor                                 | 11 | 50   |
| Tetanus toxoid immunization          |    |      |
| Good                                 | 13 | 59.1 |
| Poor                                 | 9  | 40.9 |
| Pregnancy examination                |    |      |
| Good                                 | 13 | 59.1 |
| Less good                            | 9  | 40.9 |
| General pregnancy examination status |    |      |
| Good                                 | 12 | 54.5 |
| Less well                            | 10 | 45.5 |
| Total                                | 22 | 100  |

COVID-19 pandemic, and health education videos on health protocols and new habits adaptation for pregnant women.<sup>12</sup>

Online consultation media are now widely used by the public, supported by government policies on the recommendation to stay at home during daily activities and allow calls from a safe distance. Information technology is the mainstay of society to meet the needs for health service access, including maternal and child health services. The previously announced policy to minimize community visits to health care facilities is a supporting factor in using the teleconsultation channel for pregnant women. Besides, the community's ability to access Smartphones and the increasing use of mobile technology are opportunities in developing teleconsultation.<sup>17</sup> Several studies have stated that online pregnancy classes effectively increase the knowledge and skills of mothers in conducting pregnancy examinations and care.<sup>18</sup>

Furthermore, it was found that as many as 89.5% of pregnant women who participated in the pregnancy class completed their visit 4. There was a significant effect on the pregnancy class on increasing knowledge and skills.<sup>11</sup> This result is also supported by research, which found that there were statistically significant differences in the practice of preventing the high risk of pregnancy between the intervention and control groups.<sup>12</sup> Moreover,

pregnant women who take online pregnancy classes show improvement in practice, communication, cooperation, monitoring of health status, self-care, and a healthy lifestyle. Pregnant women who take antenatal classes have good knowledge about the danger signs of pregnancy.<sup>19</sup> Pregnant women who attended pregnancy classes via text messaging had a higher mean antenatal care score with more than six visits, and increased participation in syphilis and HIV screening.<sup>20</sup>

Pregnant women who participate in the pregnancy class are 2.2 times more likely to get adequate antenatal care, 2.7 times more likely to use midwives for childbirth, and 2.8 times more likely to give birth in health care facilities compared to other non-health facilities.<sup>21</sup> Based on the analysis, the pregnancy class provided media to promote the efforts in reducing maternal mortality and high-risk pregnancies. Pregnant women who join the pregnancy class showed increased knowledge, attitudes, and behavior about high-risk pregnancies and tended to complete their pregnancy visits. Knowledge and attitudes about antenatal care increased significantly in pregnant women who followed text message-based pregnancy programs. Furthermore, text messages or Smartphone apps are very efficient in providing the required pregnancy care information to reduce health financing, increase understanding, insight, and information needs during pregnancy care.<sup>1</sup>

Based on our study results, it can be concluded that pregnant women who participate in the online pregnancy class can understand the importance of pregnancy examinations and care. Pregnancy class is an approach that can be used to learn about pregnancy health and increase mothers' knowledge and skills about pregnancy examination and maintenance.<sup>22</sup> Implementation of pregnancy classes could increase safety during pregnancy and childbirth. Furthermore, online pregnancy classes can minimize access and geographic difficulties and especially provide security for mothers during pregnancy.<sup>21</sup> This model's implementation needs full support from all family members since they are responsible for monitoring the pregnancy. Online pregnancy classes can increase the coverage of pregnancy visits and can minimize all risks and

pregnancy complications as early as possible.<sup>23</sup>

Furthermore, health workers must modify interventions, media, and methods so that access to health services, especially pregnancy, can be reached during the COVID-19 pandemic to ensure that the pregnancy is well monitored. Pregnant women as a vulnerable group must be protected from the risk of exposure to COVID-19 by restricting health care facility visits. However, the condition of pregnancy must also be monitored. Therefore, it is essential for all parties, especially families and communities, to address this problem. It is expected that pregnant women will be able to properly prepare for labor when the pregnancy health is well monitored. Accordingly, there is a need to collaborate with all health workers, pregnant women, and cadres.

## 5. Conclusion

Based on these activities' results, results show that pregnant women have performed pregnancy examinations and care properly, including breast care, nutritional fulfillment, immunization, and other general pregnancy examinations. The development of online pregnancy classes can be integrated with the pre-existing maternal and child health programs in primary health care facilities. Modification of online pregnancy classes is needed to guarantee the safety and security of pregnant women during the COVID-19 pandemic and to ensure that the risks and complications of pregnancy can be prevented.

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## Conflict of interests

There is no conflict of interest to declare.

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# Clinical findings in determining referral criteria for coronavirus disease (COVID-19) patients at a makeshift isolation center of Bekasi, West Java

Stefi Geovani Valentin Hayon,<sup>1\*</sup> Florentina Priscilia,<sup>1</sup> and Hariri<sup>2</sup>

<sup>1</sup>General Practitioner, Makeshift COVID-19 Isolation Center of Bekasi District, Bekasi, Indonesia

<sup>2</sup>Epidemiologist, Bekasi District Health Office, Bekasi, Indonesia

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Early warning signs

**ABSTRACT** Coronavirus disease (COVID-19) has become a pandemic concern with the clinical manifestations range from asymptomatic to severe organ failure. Early contact tracing and isolation are important keys to slow the infection spread within communities. Clinical triage and early recognition of warning signs on admission are needed to classify patients based on clinical severity. Due to the limited capacity of hospital settings for COVID-19 patients, a makeshift isolation center is needed for all confirmed and suspected cases with mild or no symptoms who will be provided with basic medical care, frequent monitoring, and rapid referrals. During observations, the physician needs to raise early alertness of the patient who is at risk to develop a poor outcome. This study reports five cases of patients who came with mild or no symptoms at initial presentation and developed into worsening disease progression after several days of observation. These patients developed shortness of breath, fatigue, abdominal disturbances, and chest pain. These findings were supported by the physical examinations that showed a decrease in blood oxygen saturation. Similarly, with the Centers for Disease Control and Prevention (CDC) criteria for the early warning signs, these patients were referred to the hospital-based isolation setting that could provide more advanced and optimal management. This study describes clinical manifestations of COVID-19 patients to decide the ideal time for referral.

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## 1. Introduction

Severe acute coronavirus 2 (SARS-CoV-2) is a novel pathogen identified as an enveloped ribonucleic acid (RNA) betacoronavirus. This pathogen causes coronavirus disease (COVID-19) and was confirmed to spread through respiratory droplets when talks, coughs, or sneezes. The clinical manifestations range from asymptomatic to severe organ failure, infecting especially the lungs, brain, intestines, and heart.<sup>1</sup> The organ failure is caused by a hyperinflammatory process due to massive cytokine release and lymphohistiocytosis, called a “cytokine storm”. The host immune response to the SARS-CoV-2 results in an excessive inflammatory reaction, since there is an increase in cytokine and various immune cells which damage vascular, capillary, alveolar, and organs. This

condition of COVID-19 progression will also give a symptom of hemodynamic instability that results in the development of hypoxia.<sup>2,3</sup>

COVID-19 has spread globally and become a pandemic. Until February 2021, SARS-CoV-2 has infected 113 million people around the world causing more than 2 million deaths.<sup>4</sup> In Indonesia, the cases were still increasing in September 2020. The total cases reached around 200,000 people at the highest peak.<sup>5</sup> As the cases continued to rise, most of the hospitals were overwhelmed due to the limited number of available beds. Responding to this condition, the local government, especially where the cases were locally transmitted, released an official statement to create a makeshift isolation center. Whether it is hospital-based or in non-hospital based health facilities, this isolation center is a key factor for successful transmission control. A comparative study by Dickens *et al.* (2020) found that the institution-based isolation made contact rates

\*Correspondence: [stefi.geovani.v@mail.ugm.ac.id](mailto:stefi.geovani.v@mail.ugm.ac.id)  
Makeshift COVID-19 isolation center, Bekasi District, Indonesia



reduced approximately 75% in the household and by 90% in the community, whereas contact rates in home-based isolation were reduced by 50%. A similar finding in a study by Chen *et al.* (2020) described how the isolation centers in Wuhan were established for all infected and potentially exposed individuals. These isolation centers provided triage, basic medical care, frequent monitoring, rapid referrals, in addition to essential living and social engagements for the wellbeing of those isolated. From this system, the risk of within-household transmission was reduced significantly.<sup>6,7</sup> The crucial part of these makeshift isolation centers is the effective and efficient triage to classify the patients based on their recent condition. Due to the emergency setting, the lack of adequate resources to evaluate a patient's disease progression objectively might be a challenge during isolation since there is commonly no laboratory or radiology examination for this setting. The physician needs to make a clear judgement based on daily clinical findings and know when to refer a patient before any deterioration happens. Based on the World Health Organization (WHO) algorithm for COVID-19 triage and referral, mild cases are referred to community care and an isolation center. If the condition becomes deteriorated, the patients should be referred to the higher level of facilities. The WHO recommends criteria for referral based on physician judgements and local capacity. The criteria is respiratory failure, altered mental status, shortness of breath, respiratory rate >30 times/minute, systolic blood pressure < 90 mmHg, organ failure and oxygen saturation SpO<sub>2</sub> <94%.<sup>8</sup> This study aims to describe the clinical manifestations of COVID-19 patients who were observed and needed to be referred from makeshift isolation settings. Moreover, it provides simple referral criteria based on clinical manifestations in a makeshift isolation center for COVID-19 patients.

## 2. Case illustration

The first patient is a 39-year-old male who was referred from a local primary health care in Bekasi, Indonesia to a makeshift COVID-19 isolation center. He came with the main symptom of productive cough for 3 days before admission accompanied by a sore throat, myalgia, and headache, but the physical

examination found no abnormality. The patient claimed that he had no contact with suspected or confirmed COVID-19 patients; otherwise, he worked at a public service office where he was required to have contact with many people and worked the night shifts 5 days a week. The patient had a history of hyperuricemia and was undergoing treatment with allopurinol. One day after the admission (4<sup>th</sup> day of symptom onset), he complained of worse cough, excessive sweating, fatigue, and anorexia. By the physical examination, the blood pressure was 150/90 mmHg, respiratory rate 20 times/minute, heart rate 92 times/minute, and oxygen saturation 98% in room air. The next day (5<sup>th</sup> day of symptom onset), he felt the same symptoms with the addition of chest pain, shortness of breath, nausea, and abdominal discomfort. The physical examination showed a sub-febrile body temperature of 37.2°C, blood pressure 110/80 mmHg, respiratory rate 24 times/minute, heart rate 90 times/minute, and decreased oxygen saturation within the range 93%-95% on room air, with increased effort of breathing and bilateral rhonchi at the basal field of the lungs. He was confirmed with positive SARS-CoV-2 by reverse-transcription polymerase chain reaction (RT-PCR) test one day before the symptoms occurred. The patient was referred to the hospital after 2 days of observation (6<sup>th</sup> day of the confirmed case).

The second patient is a 40-year-old male who was referred from a company health clinic in Bekasi, Indonesia with no symptoms and comorbidities. He was confirmed positive with SARS-CoV-2 by RT-PCR test one day before admission. The company doctor suggested the patient to be isolated at the makeshift isolation center for COVID-19 of Bekasi. On the day of admission and 1<sup>st</sup> day of observation, he had no symptoms and physical examination results were in the normal range. On the 2<sup>nd</sup> day of observation (3<sup>rd</sup> day of the confirmed case), he felt chill, hard to fall asleep, myalgia, and dry cough but the physical examination found no abnormality. The next day (3<sup>rd</sup> day of observation / 4<sup>th</sup> day of the confirmed case), he complained about persistent symptoms with loss of appetite, worsening cough, and fever. By the physical examination, the physician found febrile body temperature within a range of 37.5°C and 37.8°C, blood pressure was 120/80 mmHg, respiratory

**Table 1.** Baseline characteristic for each patient

|                                 | PATIENT 1 |        |        | PATIENT 2 |        |        | PATIENT 3 |        |        | PATIENT 4 |        |        | PATIENT 5 |        |        |
|---------------------------------|-----------|--------|--------|-----------|--------|--------|-----------|--------|--------|-----------|--------|--------|-----------|--------|--------|
|                                 | Adm.a     | Obs.b  | Ref.c  | Adm.a     | Obs.b  | Ref.c  | Adm.a     | Obs.b  | Ref.c  | Adm.a     | Obs.b  | Ref.c  | Adm.a     | Obs.b  | Ref.c  |
| Fever                           | +         | -      | -      | +         | +      | +      | +         | -      | -      | +         | +      | +      | +         | +      | +      |
| Cough                           | +         | +      | +      | +         | +      | +      | +         | +      | +      | +         | +      | +      | +         | +      | +      |
| Shortness of breath             | -         | +      | +      | -         | +      | +      | -         | +      | +      | -         | +      | +      | -         | +      | +      |
| Sore throat                     | +         | +      | +      | -         | -      | -      | -         | -      | -      | -         | -      | -      | -         | -      | -      |
| Fatigue                         | -         | +      | +      | -         | +      | +      | +         | +      | +      | -         | +      | +      | -         | +      | +      |
| Muscle ache                     | -         | -      | -      | +         | +      | +      | -         | -      | -      | -         | -      | -      | -         | -      | -      |
| Loss of appetite                | -         | +      | +      | -         | +      | +      | +         | +      | +      | -         | +      | +      | -         | +      | +      |
| Sleep disturbance               | -         | -      | -      | +         | +      | +      | -         | -      | -      | -         | +      | +      | -         | -      | -      |
| Nausea and vomit                | -         | +      | +      | -         | +      | +      | -         | +      | +      | -         | +      | +      | -         | -      | +      |
| Chest discomfort                | -         | +      | +      | -         | +      | +      | -         | +      | +      | -         | +      | +      | -         | +      | +      |
| Confusion                       | -         | -      | -      | -         | -      | -      | -         | +      | +      | -         | -      | -      | -         | -      | -      |
| <b>PHYSICAL EXAMINATION</b>     |           |        |        |           |        |        |           |        |        |           |        |        |           |        |        |
| Blood pressure (mmHg)           | 130/90    | 150/90 | 110/80 | 120/80    | 120/80 | 100/60 | 110/80    | 110/80 | 110/80 | 110/80    | 110/80 | 110/80 | 130/80    | 130/90 | 140/90 |
| Heart rate (times/minute)       | 80        | 92     | 90     | 80        | 70     | 96     | 80        | 80     | 92     | 114       | 124    | 113    | 82        | 90     | 105    |
| Temperature (°C)                | 36.5      | 36.6   | 37.2   | 37.7      | 37.8   | 37.9   | 36.1      | 36.1   | 36.1   | 36.5      | 36.5   | 36.5   | 36.2      | 37.1   | 38.1   |
| Respiratory rate (times/minute) | 20        | 20     | 24     | 20        | 24     | 29     | 28        | 28     | 30     | 24        | 60     | 65     | 20        | 24     | 30     |
| Blood oxygen saturation (%)     | 98        | 98     | 93     | 98        | 96     | 92     | 97        | 97     | 94     | 98        | 90     | 90     | 98        | 94     | 90     |

<sup>a</sup>Condition on admission<sup>b</sup>Condition during observation<sup>c</sup>Condition on referral

rate 24 times/minute, heart rate 70 times/minute, oxygen saturation 96% on room air, and normal lung sounds. The symptoms worsened with the difficulty of oral feeding and recurrent vomiting. On the 6<sup>th</sup> day of observation (7<sup>th</sup> day of the confirmed case), he felt extreme fatigue, chest pain, shortness of breath, and nausea. The physical examination showed that the body temperature was 37.9 °C, blood pressure 100/60 mmHg, respiratory rate 29 times/minute, heart rate 96 times/minute, and decreased oxygen saturation 92% in room air. The patient was referred to the hospital after 6 days of observation (7<sup>th</sup> day of the confirmed case).

The third patient is a 62-year-old female who was referred from the local primary health care in Bekasi, Indonesia to the COVID-19 makeshift isolation center of Bekasi with symptoms of general weakness, dry cough, anorexia, and epigastric pain on the 6<sup>th</sup> day of the confirmed case. These symptoms occurred 6 days before admission and got worse over time. She was confirmed SARS-CoV-2 by RT-PCR on the same day when the symptoms occurred. The patient had a history of pulmonary tuberculosis and hypercholesterolemia. On the day of admission, the physician found general weakness with a normal body temperature (36.1°C), normal blood pressure (110/80) mmHg, respiratory rate 28 times/minute, heart rate 80 times/minute, and oxygen saturation 97% in room air. Five hours after admission, she complained of chest pain, shortness of breath, nausea, and vomiting. The physician directly examined and found altered mental status, increased respiratory rate 30 times per minute, persistent oxygen saturation 95% on room air, and full rhonchi on the bilateral lung. The patient was immediately referred to the hospital on the day of admission (6<sup>th</sup> day of the confirmed case).

The fourth patient is a 44-year-old male who was referred from the local primary health care in Bekasi, Indonesia to the COVID-19 makeshift isolation center of Bekasi with symptoms of dry cough and history of fever 3 days before confirmed. These symptoms had occurred for 7 days. The patient had no history of illness. On the day of admission, the physician found continuous cough and normal body temperature (36.5°C), elevated blood pressure (140/90) mmHg, respiratory rate 24 times/minute, heart rate 114

times/minute, and oxygen saturation 98% on room air. The next day, he complained about shortness of breath, loss of appetite, worsening dry cough, and hard to fall asleep. The physician directly examined and found increased respiratory rate of 60 times per minute and persistent oxygen saturation 90% in room air. The patient was immediately referred to the hospital on the next day of admission (5<sup>th</sup> day of the confirmed case).

The fifth patient is a 56-year-old male who came with the main symptom of productive cough for 6 days before admission accompanied by fever. The patient had a history of hypercholesterolemia. One day after the admission, he complained of shortness of breath, fatigue, loss of appetite, nausea, and vomiting. In the physical examination, the blood pressure was 130/90 mmHg, body temperature of 37.1°C, respiratory rate 24 times/minute, heart rate 92 times/minute, and oxygen saturation 94% in room air. He was confirmed positive with SARS-CoV-2 by RT-PCR test one day after the symptoms occurred. The patient was referred to the hospital after 1 day of observation (5<sup>th</sup> day of the confirmed case) with decreased oxygen saturation to 90% and increased respiratory rate to 30 times/minutes.

The patients' baseline characteristics are described in Table 1, indicating the main symptoms include fever, cough, shortness of breath, sore throat, fatigue, muscle ache, loss of appetite, sleep disturbance, nausea and vomit, chest discomfort, and confusion. In addition, the patients' basic physical examinations are summarized for blood pressure, heart rate, temperature, and blood oxygen saturation which were examined regularly at the makeshift isolation center that has limited medical resources with no laboratory and radiology facilities. Based on those symptoms and clinical signs, the attending physicians could immediately figure out the warning signs for referral.

### 3. Discussion

This is a case series of five COVID-19 patients from a makeshift isolation center of Bekasi, Indonesia that were selected consecutively. Written informed consent was obtained from the patients for publication of study and they understand that their names and initials will not be published. The median

age of the patients was 40 years old similar to a descriptive study conducted in Indonesia by Karyono *et al.* (2020) (n=26,454) that showed the highest proportion of COVID-19 cases was in the age group of 31-45 years (29.3%). Another case series in the Indonesian population reported by Tenda *et al.* (2020) also had median age of 42 years old. Male patients were predominant in this study in accordance with Karyono *et al.* (2020) that described how COVID-19 infected more males (54.6%, n=15,123) than females.<sup>9,10</sup> A systematic literature review showed that the proportion of males was significantly higher in the critical or deceased group compared to the noncritical group.<sup>11</sup>

All patients came with a history of fever and developed a cough on admission that are primarily exhibited in COVID-19 patients with mild cases suitable to be treated at a makeshift isolation center based on the WHO algorithm for COVID-19 triage and referral.<sup>1,4,12</sup> During the observations, other symptoms that mostly developed were loss of appetite, nausea and vomiting, chest discomfort, and shortness of breath with a decrease of blood oxygen saturation. Based on these findings, we suggest them as the initial warning signs to consider a referral decision as recommended by the Centers for Disease Control and Prevention (CDC).<sup>13</sup> The warning signs are trouble of breathing, pain, or pressure in the chest, mental confusion, inability to stay awake, bluish lips, or white face. In our cases, all of the patients developed shortness of breath and chest pain while one patient also developed confusion. The decrease of blood oxygen saturation was consistent with the recent WHO algorithm of referral criteria. Based on those findings we suggest increasing the awareness of poor prognosis that might happen during observation in order to best know when to make a referral. A meta-analysis study found that patients who came with shortness of breath/dyspnea were more likely to develop into critical condition and had worse outcomes such as death.<sup>11</sup> In our study, most of the patients did not complain about shortness of breath at the initial presentation, but we found that the blood oxygen saturation decreased. This condition might happen due to hypoxemia caused by SARS-CoV-2 that possibly has an idiosyncratic effect on the chemoreceptors of the carotid body.

Normally, hypoxemia condition sends a signal to the medulla oblongata to increase the respiratory center's output by activating the phrenic nerve and diaphragm. However, in COVID-19 patients, this signal is disrupted and fails to respond.<sup>13</sup> Shortness of breath suggests poor lung function and lacking oxygen. Therefore, when the patient is found to have difficulty in breathing or no fever, it is necessary to be alert for further deterioration of the patient's condition.

The disease progression for each patient was notably similar that showed predominantly worsening on the 6<sup>th</sup> day after the onset of symptoms. Based on an observational study by Chen *et al.* (2020), the disease progression during this time could be explained by uncontrolled viral replication<sup>7</sup> and increased inflammatory response including CRP, ferritin, and pro-inflammatory cytokines which indicate the presence of a cytokine storm.<sup>2</sup> The clinical features of this cytokine storm are the development of damaged tissues and organs since there are high immune responses, including fever, progression to pneumonia with symptoms of decreased oxygen saturation, liver damage, acute kidney, anemia, and impaired hematopoietic function. These conditions need special attention to be prepared for a referral to hospital-based isolation setting for the advanced medical treatment.<sup>15</sup>

We acknowledge that our study had some limitations. First, the study population was small and might not represent the vast clinical manifestations of COVID-19. Second, this study had limited data about the ancillary tests because the center does not have a comprehensive laboratory and radiology department for further assessment about patients' overall condition and prognosis.

#### 4. Conclusion

From this case series, we describe the conditions of COVID-19 patients and suggest a comprehensive clinical observation for those who are admitted to a makeshift isolation center. Early warning signs based on clinical manifestations such as shortness of breath, fatigue, abdominal disturbances, and chest discomfort followed by decrease of blood oxygen saturation during isolation should be alerted



for referral criteria in COVID-19 patients with mild cases. Despite having limited medical resources, we can consider clinical signs and symptoms to assess the disease progression within 7-10 days related to the pathophysiology of a cytokine storm for the same duration. These findings can help the attending physicians to consider a referral to better health facilities.

### Conflict of interests

This study did not receive specific grants from funding agencies in the public sector, commercial, or non-profit section.

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# School reopening: Evidence-based recommendations during COVID-19 pandemic in Indonesia

Raden Yuli Kristyanto,<sup>1,4\*</sup> Lily Chandra,<sup>2</sup> Hermawan Hanjaya,<sup>2</sup> Mohamad Saifudin Hakim,<sup>3</sup> Dian Kesumapramudya Nurputra<sup>1,2,4\*</sup>

<sup>1</sup>Department of Child Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

<sup>2</sup>COVID-19 Working Task Group, Bhayangkara Police Hospital, Yogyakarta, Indonesia

<sup>3</sup>Department of Microbiology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

<sup>4</sup>Dr. Sardjito General Hospital, Yogyakarta, Indonesia

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**ABSTRACT** Since the first Coronavirus Disease 2019 (COVID-19) case was reported, it has run amok and caused global changes. It has affected human lives in almost every aspect, including education. In response to COVID-19, governments and policy-makers decided to shift the educational activities into online learning and institute school closure. As of March 2020, many countries worldwide have implemented school closure, including Indonesia. Large scale social distancing and stay-at-home policies have begun to negatively impact society's physical and mental health. As people start to adapt to the first wave of the COVID-19 pandemic, policy-makers and the government need to consider how to reopen the schools and its system to keep students and staff safe. School reopening is an important step toward loosening the lockdown. Schools play a crucial role in preserving children's well-being. The objective of this review was to give a recommendation to facilitate school reopening. Research articles were gathered and assessed based on the themes of the articles. Forty articles were found reflecting SARS-CoV-2 and school reopening. Findings were adapted and modified according to Indonesian situations during the SARS-CoV-2 pandemic. Indonesia is currently preparing the first steps toward school reopening. For schools to be reopened, there are several health measurements that need to be considered. A good collaboration between various authorities and stakeholders is essential in school reopening so that children's safety and disease mitigation strategies remain stable. This review presents insights and recommendations for every element involved in school safety including the government, schools, teachers, parents and students including what each needs to do to prepare in advance for the up-coming decision to reopen schools.

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## 1. Introduction

The newly identified strain of Coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has made its severe health impact worldwide.<sup>1</sup> Coronavirus Disease 2019 (COVID-19) is transmitted via respiratory droplets and by direct contact with infected persons or by contact with contaminated objects and surfaces.<sup>2</sup> Wildly contagious, various systemic manifestations, and fast clinical deterioration are several challenges faced in handling patients with COVID-19. Due to

\*Correspondence:

[ryulikristyanto@gmail.com](mailto:ryulikristyanto@gmail.com), [dian.k.nurputra@ugm.ac.id](mailto:dian.k.nurputra@ugm.ac.id)

Department of Child Health, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Farmako Sekip Utara, 55281, Yogyakarta, Indonesia

the widespread transmission of COVID-19 found in almost every province in Indonesia, the Indonesian government decided to temporarily close all schools according to the transmission patterns in every region. The policy is not only intended to protect children from COVID-19, but it also helps to prevent SARS-CoV-2 transmission among children, their families and community.<sup>3</sup> However, the school closure policy imposes several risks which need to be considered. Prolonged school closure can affect children's development and psychological well-being as well as cause several unwanted economic effects.<sup>4</sup>

To date, after three months of school closure, in regard to educational and economic aspects, the Ministry of Education and Culture of Indonesia

decided to take a measured step toward reopening schools in early July 2020. The new policy was commendable for addressing each regional government, school administration, and parents' preparedness to reopen the schools. However, the picture of the policy is too general. It lacks a deep understanding and appears to disregard the present prediction of possible in-the-field problems. Several aspects, including the increasing number of new COVID-19 cases, uneven dynamics of additional new cases throughout most regions in Indonesia, and suboptimal tracing, reporting, and mitigating of COVID-19 cases, are important to be considered. Accordingly, our review provides and offers further evaluation and consideration of additional education system measures, risks, and impacts which are needed in preventing and lowering the transmission risks of COVID-19, once schools are in the process of reopening. All findings are summarized in several easy-to-use checklists. Hence, the government is expected to weigh the risks and benefits of every policy which will be made or planned, respectively.

## 2. Method

### 2.1 Search Strategy

A literature review was performed to assess the recommendation of school reopening during the "New Normal" era. Electronic search from databases such as PubMed, Embase, Science Direct, and Google Scholar was completed and articles were assessed and selected from the search. The following are the search criteria: 'school reopen' or 'school reopening' or 'school closure' or 'school' or 'children' or 'child' AND 'COVID-19' or 'pandemic' or 'quarantine' or 'psychology' or 'mental health' or 'development' or 'recommendation'. Forty papers were selected to be reviewed. Articles gathered are ranging from 1994-2020, with seven papers ranging from 1994-2019, and thirty-four papers are recent studies from 2020. The literature was reviewed by the authors, resulting in the selection of those appearing in this paper.

Among the reviewed articles, risk assessment protocols and recommendations were extrapolated and modified in accordance with situations in Indonesia. Thus, this comprehensive approach can give an update for the newly adapted strategies for

school reopening in Indonesia.

## 3. Result

Although school closure policy has been addressed as one of the disease mitigation strategies, new obstacles have emerged. Evidences and recommendations have reported negative effects regarding children's development, education, and psychology. Prolonged school closure brought tremendous impact to parent's economic status. On the other hand, reopening school policy without judicious judgement might eventually lead to other more harmful effects. Evidences and recommendations are reported as follows.

### 3.1 The negative effects of school closure

#### 3.1.1. The negative effects on children's development and education

From the children's developmental point of view, it is undeniable that schools are considered to be one of the most systematic and scientific institutions to stimulate and facilitate their development. Education at school is one of the fundamental needs of children especially in fulfilling their right to education<sup>5</sup>. The core educational values consist of improving children's academic and life skills ranging from basic physical, social, and character building through developmentally appropriate psychological, intellectual, and spiritual aspects. During this modern era, the family remains the mainstay in children's character development, which will continue in formal education at school to improve cognitive and behavioral aspects.<sup>6</sup> Aside from a place to study, school is also a place for children to make friends with others of the same age. Indeed, children may still be able to study at home but a gap exists.<sup>7</sup> Meanwhile, social interaction during studying, direct contact type of playing and communication with other children of the same age are still necessary in social skill improvement and remain important for the optimal development in children.<sup>5,8</sup> Therefore, school closure during this COVID-19 pandemic could potentially disturb this fundamentally essential education in children. Prolonged use of electronic media also has detrimental effect on child development, such as obesity, sleep disturbance, preoccupation with the

online activities, decreased interest in offline or “real life” relationships, unsuccessful attempts to decrease gadget use, and withdrawal symptoms.<sup>9</sup>

### **3.1.2. The negative effects on children’s psychology**

It is in almost all children’s nature every day to enjoy outdoor activities and to play with other children of the same age. This daily interaction results in a higher probability of children contracting and transmitting the virus. Children’s lack of understanding in the importance of staying at home, school closing, and maintaining social distancing will result in children having difficulty to obey these rules. The older children might try to understand ‘what is going on’ during this dangerous time of school closure. However, younger children will have questions and doubts regarding the need for staying at home, school closing, and social distancing will eventually arise. Furthermore, this lack of understanding in younger children will result in discomfort and frustration while obeying the rules.<sup>10,11</sup> Isolation and lack of social interaction with their peers will lead to psychological stress in children and teenagers.<sup>12,13</sup> Prolonged boredom could lead to children and teenagers leaving home to play somewhere unsafe and to gather in large groups, which is known to be unfavorable in preventing transmission of COVID-19.<sup>14</sup>

### **3.1.3. The negative effects on economical aspect**

Shifting of traditional education media into online education media needs parents’ preparedness, especially in providing and using electronic devices appropriately, as well as spending extra expenses for stable Internet connection. If the government does not help to provide equal facilities in fulfilling children’s education needs, prolonged school closure could eventually lead to a wide disparity in learning opportunities and a significant gap in accessing education outcomes between wealthy and impoverished families.<sup>4,15,16</sup>

For the impoverished family, schools and playfields might be the only place for their children to play and study. This happens because their parents need to work and the residential area might not be sufficient in providing a safe and good social environment. With the recent school closure policy, children from impoverished families could suffer

more set-backs in education and developmental aspects because of insufficient social environment and lack of parental support.<sup>17,18</sup>

The COVID-19 pandemic also results in a global economic recession which in turn disrupts a family’s income. This dilemma further adds to parents’ distress and might also lead to new conflicts between parents and their children. The worst scenario which needs more attention is the higher probability of child abuse<sup>17</sup>. Studies in developed countries showed that many parents need to leave their job in order to take care of their children during school closure time in a pandemic. This unemployed status will affect both the family’s income and the availability of human labor at the workplace.<sup>19–21</sup> In Indonesia, many children are nurtured not only by their parents but also by their family relatives or by paid caregivers. This cultural consideration makes it harder in determining the effects from school closure on parents’ work and economical status.

## **3.2 The negative effects of schools reopenings**

### **3.2.1 Risk of SARS-CoV-2 infection in children**

It is assumed that children are less likely to contract SARS-CoV-2 infection since the children’s age group constitute only 1-2% of total COVID-19 patients.<sup>22,23</sup> However, there is a possibility that the reported numbers in previous studies are not representative of the actual numbers of children cases. One study in China found that about 86% of patients with SARS-CoV-2 remained undiagnosed during the early stage of this global pandemic.<sup>24</sup> Most pediatric patients with SARS-CoV-2 infection presented only with mild complaints and some were even asymptomatic. Meanwhile, polymerase chain reaction (PCR) tests from nasopharyngeal swabs have been performed only in pediatric patients with moderate to severe symptoms.<sup>25</sup> This pattern could lead to an underestimation of pediatric patients infected with SARS-CoV-2.

Severe disease manifestations such as in Acute Respiratory Distress Syndrome (ARDS) and severe multiorgan dysfunction have been reported.<sup>26,27</sup> Based on a case report by the Indonesian Pediatric Association (IDAI), there were several COVID-19



pediatric cases in Indonesia that presented with severe disease manifestations and led to fatalities.<sup>28</sup> Evidence suggests that in mild symptomatic and asymptomatic pediatric patients with COVID-19, systemic inflammation resembling Kawasaki disease could be found. Some cases progressed into hyperinflammation shock and eventually resulted in fatalities.<sup>29-32</sup> The WHO is currently investigating the emergence of SARS-CoV-2 infection in children with symptoms resembling Kawasaki disease. These facts are in contrast to the current incorrect considerations for school reopening which assume that COVID-19 infection in children is always presented with mild symptoms or even may be harmless.

### 3.2.2 Risk of SARS-CoV-2 transmission in children

It has also been incorrectly proposed that pediatric patients with SARS-CoV-2 are less likely to transmit the disease since they usually present with asymptomatic to mild symptoms as well as less viral load. However, on the contrary, evidence suggests that the viral load found in children are equal compared to adults.<sup>33</sup> Furthermore, there is no difference between virus replication rate in culture medium taken from children's swab tests compared to adults' swab tests.<sup>34</sup> Therefore, children are not any less likely to transmit the disease, even though they might have milder symptoms as compared to adults.

During the previous SARS pandemic, virus transmission occurred once clinical manifestations developed and reached its peak once symptoms worsened. The mitigation strategy using thermal scanning with a thermometer was useful in containing disease transmission during the previous SARS pandemic. Unfortunately, during SARS-CoV-2 pandemic, this mitigation strategy is less effective since significant transmission could happen from asymptomatic, presymptomatic or mildly symptomatic children.<sup>35</sup> While adult patients with COVID-19 have the potential to spread the virus to 2-3 people, a recent case report study in China stated that an infected young person could transmit the disease to seven other teenagers.<sup>36</sup> The transmission could occur before any fever or other clinical manifestations were reported. Other studies also suggest that 40% of SARS-CoV-2 transmission

occurred before manifestations of any clinical symptoms.<sup>37</sup>

Transmission of COVID-19 disease occurs via droplets excreted from the positive patient's respiratory tract during talking, sneezing, or coughing. The droplets will circulate in free air for around nine minutes before slowly coming down to the surface of an object.<sup>38</sup> It will survive for 4-72 hours on the surface.<sup>39</sup> Therefore, contaminated objects and surfaces frequently touched by children at school can be a potential medium for SARS-CoV-2 transmission.

Evidence also suggests SARS-CoV-2 transmission via aerosol (droplet nuclei)<sup>40</sup>. Aerosol is relatively smaller compared to droplets and is generated during medical procedures, such as, nebulization, intubation, and dental procedures.<sup>39</sup> It has been proposed that droplet nuclei are also produced during coughing and speaking. Coughing produces more concentrated droplets than speaking.<sup>41</sup> Nevertheless, the louder a person talks, the more droplet nuclei that are excreted. They could survive for 8-14 minutes in the air of confined space.<sup>42</sup> Studies have found traces of SARS-CoV-2 RNA derived from droplet nuclei which circulated in the free air of confined spaces.<sup>43,44</sup> This evidence indicates that both infected teachers and students, who remain mildly symptomatic or asymptomatic, can transmit the virus via droplets and aerosols produced during talking. It also indicates that the droplet nuclei of SARS-CoV-2 can circulate for a long period of time in the atmosphere in closed classrooms lacking ventilation. Therefore, the one meter apart seating plan inside the classroom may be less useful than at first believed in preventing SARS-CoV-2 transmission.<sup>38</sup>

Studies have shown that SARS-COV-2 RNA was detected in children's feces in a longer period compared to that of nasopharyngeal swabs.<sup>45,46</sup> SARS-CoV-2 was also isolated from a fecal sample taken from an asymptomatic pediatric patient.<sup>47</sup> Isolated virus remains alive during sample collection indicating that fecal oral transmission could occur.<sup>48</sup> This route of spreading will lead to a possibility of disease transmission at schools via contaminated feces in unhygienic toilets at schools, poor hand hygiene behavior, and also unhygienic and

contaminated food at school.<sup>49</sup>

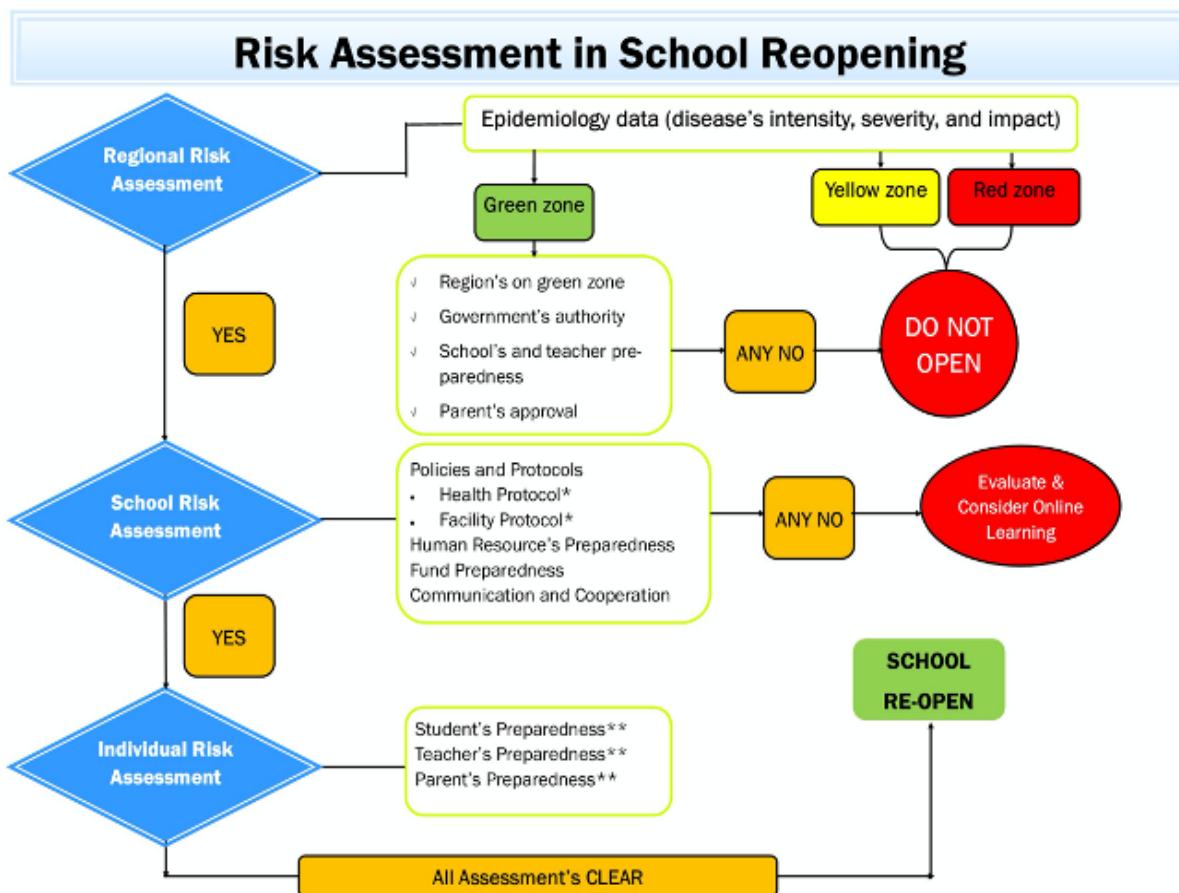
Studies evaluating COVID-19 transmission in school facilities showed inconclusive results. A study in Ireland on close contact tracing from six COVID-19 positive cases related to school opening found that there was no single confirmed case at school areas.<sup>50</sup> Meanwhile, in New South Wales, Australia, close contact tracing from 18 positive COVID-19 cases showed additional two positive confirmed cases at school areas.<sup>51</sup> These varying results are probably due to the fact that the PCR examination was performed only in children with a history of close contact with COVID-19 patients, diverse health protocols at every school and countries, and incomprehensive laboratory examination in screening students at school.

Several reports from other countries showed the occurrence of disease transmission at school areas or rapid increase of new cases after school reopening. Most schools were reopened in France in May 2020.

However, they were closed again within one week after seventy new cases were reported. It is believed that those 70 patients already had the disease before entering school.<sup>52</sup> This pattern indicates that it is highly important to ensure that teachers and students are completely free from the virus before going back to school to minimize disease transmission. A report from Israel states the need to periodically evaluate students' and teachers' disease's status after school reopening.<sup>53,54</sup> Meanwhile, in South Korea, the plan for school reopening at Buncheon was postponed after a new cluster of confirmed COVID-19 cases was found.<sup>55</sup> Collectively, school reopening policy is dynamic, depending on the numbers of new cases and disease transmission patterns in the community.

#### 4. Discussion

Considering the negative effects of school closure and reopening that are previously mentioned, accordingly, we formulated several risk assessments,



**Figure 1.** Risk Assessment in School Reopening

modified from several guidelines which are needed to be considered in order to ensure safety once the reopening process begins (Fig.1).

#### **4.1 Regional risk assessment**

In the beginning, Indonesia has had quite low PCR test capacity even though it has steadily increased to the ratio of 2,315 tests per 1 million citizens. Due to limited resources and the narrow window of time, only the PCR cost of a small select number of people who fall under the category to be clinically monitored and patients under supervision could be covered by the Indonesian government. As a consequence, it has resulted in uneven coverage and inconsistent testing. The government policy stated that only people with severe or moderate symptoms with COVID-19 cases are to be tested with PCR. Even though it was not recommended due to its high false negative results, antibody based measurements, or rapid diagnostic tests (RDT) were provided by the government for those with mild symptoms or contact without symptoms of the disease. Hence, it is difficult to establish the precise number of currently infected cases.

Effective reproductive number ( $R_t$ ) can be used as a parameter to assess the effectiveness of mitigation measures implemented in a local region. The  $R_t$  numbers will decrease in response to strict mitigation measures.<sup>56</sup> However, when tracing and diagnostic testing are not performed thoroughly, this then leads to undetectable SARS-CoV-2 infection, and the  $R_t$  value will be less than its actual number.<sup>57</sup> Hence, procurement of PCR testing facilities and extending the criteria for subjects to do the PCR testing are the most important efforts to do by the Indonesian government as a precondition to school reopening. If combined with an intensive contact tracing, this 'umbrella approach' will help to attain the precise number of infected cases.

Determining the impact of COVID-19 is necessary for the government to accurately plan their containment measures. COVID-19 impact can be divided into 3 classifications, in which every classification has its own assessment, including disease intensity, severity and impact on the health system.<sup>58</sup>

#### **4.1.1 Disease intensity**

1. Proportion of confirmed cases as compared to all cases tested for PCR. All cases that undergo PCR testing, whether symptomatic suspected cases, asymptomatic, and close contact cases are included. A low proportion indicates improved conditions.
2. Proportion of confirmed symptomatic suspect cases compared to all symptomatic suspect cases that were tested for PCR. Higher numbers represent better case identification methods.
3. Proportion of respiratory tract symptoms in suspected cases tested for PCR compared to all cases with respiratory tract symptoms. This number reflects an adequate PCR test capacity.
4. Proportion of confirmed COVID-19 cases according to age groups. After school reopening, if there is a surge of confirmed COVID-19 cases in the school age group, viral spreading in the school area is highly suspected.
5. Proportion of close contact that is traced down and quarantined, compared to all close contact cases.
6. Proportion of close contact cases tested with PCR compared to all close contact cases.

#### **4.1.2 Disease severity**

1. Total death cases.
2. Total confirmed death cases.
3. Proportion of confirmed death cases of COVID-19 compared to total death cases in the period.
4. Total confirmed or suspected cases admitted to the hospital.
5. Total confirmed or suspected cases admitted to ICU/ HCU.
6. Proportion of total confirmed death cases compared to total confirmed cases of COVID-19.
7. Proportion of confirmed death cases of COVID-19 according to age groups compared to confirmed cases according to age groups.
8. Proportion of severe respiratory distress cases of confirmed cases compared to all severe

respiratory distress cases.

9. Proportion of severe respiratory distress cases in confirmed cases according to age compared to all severe respiratory distress cases according to age.

All those parameters' data could be gathered from respected health care facilities. They have to be carefully measured and used as basis of prediction by local authorities to mitigate the possible reemerging cases if and when the school does open.

#### 4.1.3 Impact on health system

1. Confirmed cases among health care workers.
2. Confirmed death cases among health care workers.
3. Sick health care workers that are on quarantine or self-isolation.
4. Proportion of beds occupied for suspected or confirmed cases in the hospital compared to allocated beds for COVID-19 cases.
5. Personal protective equipment (PPE) availability.

Mitigation on aforementioned factors of the current health system may give a hint on the capacity of certain regions to overcome the secondary outbreak during and after school reopening.

#### 4.2 School risk assessment

In addition to the regional risk assessment, several considerations at the school level should be made. School risk assessment has to be performed once the regional risk assessment has been completed. The Pennsylvania Department of Education had recommended phases of the school reopening plan according to its new safety policy post COVID-19 pandemic.

1. Red phase: closed schools remain closed if new cases are still reported in the region. Remote learning is recommended via online, both through digital and non-digital platforms. Additional student services such as a school meal programs at boarding schools should be provided as feasible.
2. Yellow phase: as the number of new cases remain stable and additional cases per day are lessened, closed schools will be reopened

based on several requirements. During this yellow phase, stay at home policies are lifted and large-scale social restrictions are loosened.

3. Green phase: outbreak parameters and the severity of outbreaks can be controlled. Most restrictions are eased, large-scale social restrictions are widely loosened although social and physical distancing measures are still applied. During the green phase, large group social activities are executed based on the 'new normal' policy. Schools within the green phase can be reopened based on several considerations.<sup>59</sup>

Several school reopening requirements should be met based on the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) recommendations. Essential requirements are protocols and policies for school reopening, health facility preparedness, human resource preparedness, funding, and communication and cooperation for school reopening. These requirements are proposed to maintain a safe and conducive learning environment while minimizing disease transmission. Based on these recommendations, several adjustments at schools are required in accordance with the New Normal policy post COVID-19 pandemic.

Summary recommendations of school reopening policies and school facilities preparedness which need to be reviewed are listed as follows (Figure 2 and 3). The higher number of "yes" answers on the checklist may indicate the readiness of the school to initiate the reopening process. On the contrary, more "no" answers may suggest that the school needs to consider other alternatives in establishing its curriculum and education process.

#### 4.3 Individual risk assessments

Human resources (students, teachers, and parents) play a pivotal role to provide a safe and conducive learning environment at schools during the New Normal Era of post COVID-19 pandemic. All parties have to share the same vision, awareness, and understanding concerning SARS-CoV-2 infection. Once actions are taken based on the same shared fundamental approach, schools are ready for reopening based on the following individual risk

|  |  |                       |                       |
|--|--|-----------------------|-----------------------|
| SCHOOL NAME:                           |  |                       |                       |
| SCHOOL REGION/PROVINCE:                |  |                       |                       |
| Red zone                               |  | Yellow zone           | Green zone            |
| <b>HEALTH PROTOCOL RISK ASSESSMENT</b> |  |                       |                       |
| <b>QUESTIONS</b>                       |  | <b>YES</b>            | <b>NO</b>             |
| 1.                                     | Can students wear masks properly?  | <input type="radio"/> | <input type="radio"/> |
| 2.                                     | Can students wash their hands or use hand sanitizer when needed?   | <input type="radio"/> | <input type="radio"/> |
| 3.                                     | Do teachers and personnel always wear masks at school?   | <input type="radio"/> | <input type="radio"/> |
| 4.                                     | Can teachers and school personnel perform and practice hand hygiene properly?                                  | <input type="radio"/> | <input type="radio"/> |
| 5.                                     | Can teachers and school personnel maintain safe social distance (at least 2ms apart) during school activities? | <input type="radio"/> | <input type="radio"/> |
| 6.                                     | Does school have an emergency health protocol when there's a sick child around?                                | <input type="radio"/> | <input type="radio"/> |

Figure 2. Health policies checklist for school reopening

|  |   |                       |                       |
|--|---|-----------------------|-----------------------|
| SCHOOL'S NAME:                           |   |                       |                       |
| SCHOOL REGION/PROVINCE:                  |   |                       |                       |
| Red zone                                 |   | Yellow zone           | Green zone            |
| <b>FACILITY PROTOCOL RISK ASSESSMENT</b> |   |                       |                       |
| <b>QUESTIONS</b>                         |   | <b>YES</b>            | <b>NO</b>             |
| 1.                                       | Can schools provide hand washing facilities (water and soap; hand sanitizer) at school areas?                                 | <input type="radio"/> | <input type="radio"/> |
| 2.                                       | Can schools provide several hand washing/disinfection stations at school areas?   | <input type="radio"/> | <input type="radio"/> |
| 3.                                       | Does school have enough space to apply desk-distancing?   | <input type="radio"/> | <input type="radio"/> |
| 4.                                       | Can school perform routine disinfection at school?  | <input type="radio"/> | <input type="radio"/> |
| 5.                                       | Does school have sufficient air ventilation both in classrooms and other school areas?  | <input type="radio"/> | <input type="radio"/> |
| 6.                                       | Does school have preventive health measures applied at the school's cafeteria?  | <input type="radio"/> | <input type="radio"/> |
| 7.                                       | Can a school provide basic health care facilities when there's a sick child around?   | <input type="radio"/> | <input type="radio"/> |
| 8.                                       | Can school provide health promotion messages about COVID 19 infection and prevention suitable for children at school's areas? | <input type="radio"/> | <input type="radio"/> |

Figure 3. School facilities checklist for school reopening

assessments (Figure 4, 5, and 6).

Just as the previous checklists could be used to mitigate and assess a school's readiness before reopening, individual checklist assessments for students, parents and teachers could be used not only for preparation but also for evaluation during reopening process. Several changes on the number of "yes" and "no" answers could be expected during the

reopening process and may be used to mitigate and decide whether the reopening could be continued or halted temporarily.

**4.4 Alternative strategies and recommendations**

Indonesian schools are currently facing a paramount obstacle to conduct their education activities. Both safety and education quality have to be



| STUDENT CHECKLIST |   |                       |                       |    |
|-------------------|---|-----------------------|-----------------------|----|
| Student's Name:   |   | School:               |                       |    |
| Grade:            |   | Age:                  |                       |    |
| QUESTIONS         |   |                       | YES                   | NO |
| 1.                | Do students know and understand about COVID 19 (disease and transmission)?          | <input type="radio"/> | <input type="radio"/> |    |
| 2.                | Can students implement a wear mask at school, hand washing, and social distancing?  | <input type="radio"/> | <input type="radio"/> |    |
| 3.                | Does a student have any comorbid disease (asthma, autoimmune, or chronic disease)?  | <input type="radio"/> | <input type="radio"/> |    |
| 4.                | Are student's data (identity, parents' contacts, emergency contact number) updated? | <input type="radio"/> | <input type="radio"/> |    |
| 5.                | Can students participate in both online and offline teaching?                       | <input type="radio"/> | <input type="radio"/> |    |

Figure 4. Student checklist as risk assessment in school reopening

| PARENTS CHECKLIST |  |                       |                       |    |
|-------------------|--|-----------------------|-----------------------|----|
| Parent's Name:    |  |                       |                       |    |
| Child's Name:     |  |                       |                       |    |
| Age:              |  |                       |                       |    |
| Education:        |  |                       |                       |    |
| Occupation:       |  |                       |                       |    |
| QUESTIONS         |  |                       | YES                   | NO |
| 1.                | Do parents know and understand about COVID-19 and health measures need to be implemented for their child/children?   | <input type="radio"/> | <input type="radio"/> |    |
| 2.                | Have parents implemented health preventive measures at home (wearing masks, hand hygiene, disinfection, good sanitation)?  | <input type="radio"/> | <input type="radio"/> |    |
| 3.                | Do parents have specific strategies/ are parents being cautious about their child/children doing outdoor activity, going to the supermarket, and going back to school? | <input type="radio"/> | <input type="radio"/> |    |
| 4.                | Have parents planned a safe route and mode of transportation for their child/children to commute to school?  | <input type="radio"/> | <input type="radio"/> |    |
| 5.                | Can parents establish good communication and teamwork with teachers to support both online and offline class?  | <input type="radio"/> | <input type="radio"/> |    |
| 6.                | Can parents provide good facilities (gadget, safe and conducive environment, stable internet connection) for both offline and online classes?                          | <input type="radio"/> | <input type="radio"/> |    |
| 7.                | Can parents keep close monitor on students' health measures during COVID-19?   | <input type="radio"/> | <input type="radio"/> |    |
| 8.                | Do parents have access to the nearest health care facility or pediatrician if their child is sick?   | <input type="radio"/> | <input type="radio"/> |    |

Figure 5. Parents checklist as risk assessment for school reopening

| TEACHER CHECKLIST   |                       |                       |
|---|-----------------------|-----------------------|
| Teacher's Name:   |                       |                       |
| Age:  |                       |                       |
| School:   |                       |                       |
| Home room teacher for:  |                       |                       |
| Specific major taught:  |                       |                       |
| QUESTIONS   | YES                   | NO                    |
| 1. Do teachers know and understand about COVID 19 (disease and transmission)?   | <input type="radio"/> | <input type="radio"/> |
| 2. Are teachers able to innovate and compile study materials both for offline and online class (effective and adequate online class)? | <input type="radio"/> | <input type="radio"/> |
| 3. Do teachers have sufficient gadgets and tools for online class? Can teachers use gadgets and the internet for online class?        | <input type="radio"/> | <input type="radio"/> |
| 4. Can teachers keep close monitor on students' health measures during COVID-19?  | <input type="radio"/> | <input type="radio"/> |
| 5. Can teachers establish good communication and teamwork with parents to implement both online and offline class?                    | <input type="radio"/> | <input type="radio"/> |
| 6. Can teachers be a communicator between school and parents in regard to student's education during COVID 19 pandemic?               | <input type="radio"/> | <input type="radio"/> |
| 7. Can teachers keep evaluating and updating about the newest regulation on COVID 19 and its impact on education?                     | <input type="radio"/> | <input type="radio"/> |

**Figure 6.** Teacher checklist as risk assessment for school reopening

guaranteed for the young students to survive in the current pandemic situation. Accordingly, various preparations and compliances to school facility preparedness for school reopening have to be performed. This approach is not only intended to protect the students, but also all staff working at schools. Implemented strategies should consider children's needs holistically, including biomedical, social and psychological perspectives.

Several preparations should be made by schools and the government to ensure that the upcoming strategies implemented for school reopening are based on considerations to fulfill children basic needs and to prevent further transmission of the pandemic. However, schools and the government are also expected to provide alternative learning strategies similar to the well-organized remote learning opportunities currently available online. Various recommendations are crucial in order to evaluate both the health benefits and side effects of online learning such as:

1. Online learning activities with gadgets should be effective, concise, and interactive, considering screen time and its limit in children. The 20-20-20 rule is recommended to prevent eye strain caused by prolonged screen time.
2. Learning modules, target, and curriculum need to be modified effectively and be timely in order to meet learning objectives in shorter online learning duration.
3. Online learning modules should be innovative and creative, consisting of opening, main body, and closing with interactive games being put in between sessions. Learning modules are made to facilitate student's autonomy.
4. Learning modules are made as a combination of online and offline learning.
5. Outcomes from online learning are evaluated based on learning objectives in accordance with the New Normal situation.

## 5. Conclusion

Schools are required to identify and mitigate disease transmission risk and to prepare school reopening regulations based on health regional authorities. Good cooperation between various authorities and stakeholders are essential in preventing further community disease transmission and in preventing the emergence of new clusters of transmission. The Indonesian Health Authorities are expected to be aware that other measurements are needed outside of the important health protocols to prevent the emergence of new cases once schools have reopened.

## Conflicts of interest

Authors declare no potential conflict of interests.

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# A review of Internet-based approaches for health promotion programs related to the COVID-19 pandemic and wellness education

Carissa Wityadarda,<sup>1</sup> Gusti Ayu Sinta Deasy Andani,<sup>1,2</sup> Rina Rostarina<sup>1,3,\*</sup>

<sup>1</sup>Biomedical Sciences, Faculty of Medicine Padjadjaran University, Bandung Indonesia

<sup>2</sup>Physiology Department, Faculty of Medicine Jenderal Achmad Yani University, Cimahi, Indonesia

<sup>3</sup>Central of Health Training, Public Health Office West Java, Indonesia

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Self-efficacy  
Self-management

**ABSTRACT** COVID-19 pandemic continues to have significant impacts in various sectors of society worldwide, including Indonesia. One major impact of COVID-19 occurs in the health information sector especially with social distancing regulations that inhibit people to access health care providers. This has led to several other problems such as behavior alteration involving unhealthy lifestyles and misleading information. Due to the limitations of social interaction, health care providers have proposed various methods to provide health promotions related to COVID-19 and wellness education that are accessible by the whole society with or without Internet access. This study aimed to review the current strategies of health information systems to increase knowledge about COVID-19 and overall wellness by implementation of Internet-based programs. This review is based on secondary study conducted with online search engines. Some previous studies showed that online training has improved knowledge significantly. Other research also described how the success of a community education program depends on adequate motivation and access to proper information. Three main factors that cause the failure of community education are lack of self-efficacy, lack of information, and distraction without proper supervision. Lack of information is due to difficulty to gain Internet access in some areas and for some populations. In conclusion, Internet-based approaches can be implemented for health promotion programs related to COVID-19 and wellness due to the massive growth of the Internet use in Indonesia.

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## 1. Introduction

The novel Coronavirus Disease 2019 (COVID-19) is caused by the pathogen identified as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).<sup>1</sup> COVID-19 has caused a pandemic with 115 million confirmed cases worldwide, including over 2.5 million deaths based on recent World Health Organization (WHO) data as of March 3, 2021.<sup>2</sup> This condition causes a major problem on a multi sector basis, including the health and information sectors which should be benefiting by the digitalization era.<sup>3</sup> Difficulties in accessing information continue to worsen with 'work from home' and 'online class' policies which are not applicable for everyone.

Policies aimed at preventing the spread of disease also limit people from gaining the direct information that they used to get from their school or health care providers.<sup>4</sup> Moreover, the lack of information for these populations can seriously impact their overall health status including stress-induced home environment, alteration of dietary intake, physical inactivity, and less social interactions.<sup>5,6</sup>

Wellness education as an essential part of health promotion that is also negatively impacted during the COVID-19 pandemic is actually one of the key elements that needs to be done on a daily basis. One solution to face this challenge is using e-wellness programs that were used even before the COVID-19 pandemic. The improvement of wellness knowledge is proven to be effective to gain the basic information in maintaining overall health.<sup>7,8</sup> For example, Guerrero in 2020 found that an intervention of educating parents about physical activity can increase

\*Correspondence: [rostarinarina@gmail.com](mailto:rostarinarina@gmail.com)  
Central of Health Training, Public Health Office West Java, Indonesia, Jl. Pasteur No.31, Pasir Kaliki, Kec. Cicendo, Kota Bandung, Jawa Barat 40171

the pupils' physical activity which correlates with their overall family fitness. Moreover, other online interventions to promote a healthy lifestyle such as diet and stress management are also beneficial to increase community understanding toward healthy lifestyles.<sup>9</sup>

Digitalization is often associated with the ease of accessing information and the use of gadgets. The user population of Smartphones in Indonesia particularly is categorized as the fourth largest active user group around the world, with over 250 million people in total.<sup>10</sup> Almost 171.26 million out of Indonesia's total population of over 260 million are active Internet users.<sup>11</sup> About 33% of Indonesia's population access the Internet regularly through their mobile devices and this number is likely to increase to 36% by 2023.<sup>11</sup> Specifically, Muller in 2016 stated that Indonesians also rank third in the number of social media users in the Asia-Pacific region with 59% actively involved in social media.<sup>11</sup> Those data demonstrate that there is an excellent opportunity for the Internet-based health promotion programs related to COVID-19 and wellness. This opportunity was further explained by the APJII and Pusat Kajian Komunikasi Universitas Indonesia (PusKaKom UI) in their 2015 survey that found 49% of Internet users were in the age range of 18-25 years and 33.8% in the age of 26-35 years. Most of the people in this age category are typically more educated and productive members of society.<sup>3</sup> Thus, they can be expected to have more influence on society.

This digital development gives both positive and negative impacts in society. When various information is widespread freely on the Internet, then we first need to filter and process before adapting and passing it on to others. The problem is many people have the wrong assumption about the accuracy of the free articles that can be read online without first checking the facts and immediately re-share it with a bigger audience. This causes the negative content and misleading information to be continuously spreading sporadically. One example is the misinterpretation of the study conducted by Oren *et al.*, in 2020, which caused major confusion about chloroquine in disease management.<sup>12</sup> Some misinterpretations of face masks, such as the material, how to use and when to wear also became

an example of how information was not well-distributed among society.<sup>13</sup>

Information systems are fundamental for public education related to wellness and other health promotion programs during the COVID-19 pandemic. Accordingly, we summarized various methods used in Internet-based approaches of health promotions from e-programs and e-wellness education. These are designed to better cope with COVID-19 public health problems such as misleading information about COVID-19 and inactive lifestyle as a result of the lockdown during the pandemic. We then aimed to answer the study objective about which approaches were best suited and expected to be successfully implemented to society with or without Internet access.

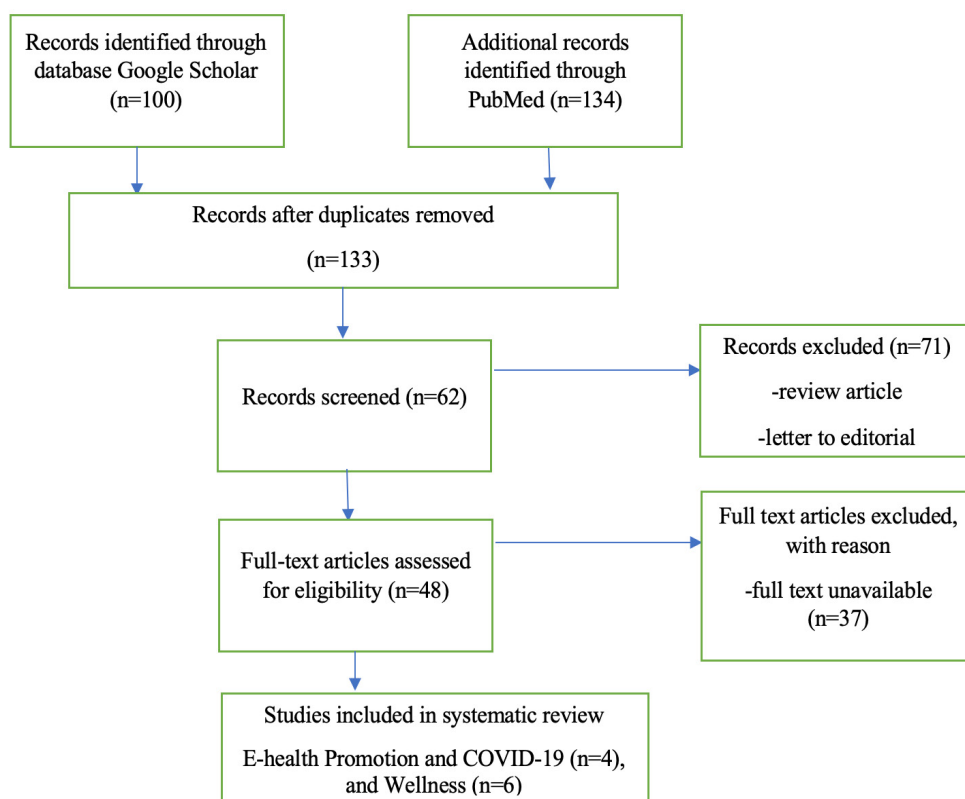
## 2. Method

This review was conducted using the online search engines: PubMed and Google Scholar. Inclusion criteria for studies in this review were: articles about health promotion programs related to wellness intervention and COVID-19 informative knowledge. Exclusion criteria were: studies before 2010, review articles, and editorial notes. Exposure: research focus on health promotions related to healthy lifestyle and COVID-19. Outcomes: Studies that showed the impact of health promotions toward knowledge during COVID-19 pandemic; wellness interventions towards knowledge and behavior before the pandemic. Types of studies included in this review: Experimental studies and observational studies. Keywords of research: health promotion, COVID-19, wellness intervention, and knowledge.

## 3. Results

Based on the data from previous study, we defined two main results regarding these topics. First, we describe various data about health promotion strategies during the COVID-19 pandemic to overcome the transmission of the disease. Furthermore, we provide the data from various studies about wellness interventions as a part of health promotion programs.

Through the findings on the Tables 1 and 2 below, we propose the possible mechanisms of



**Figure 1.** Preferred Reporting Items for Systematic Reviews and Analyses (PRISMA) chart of systematic review.

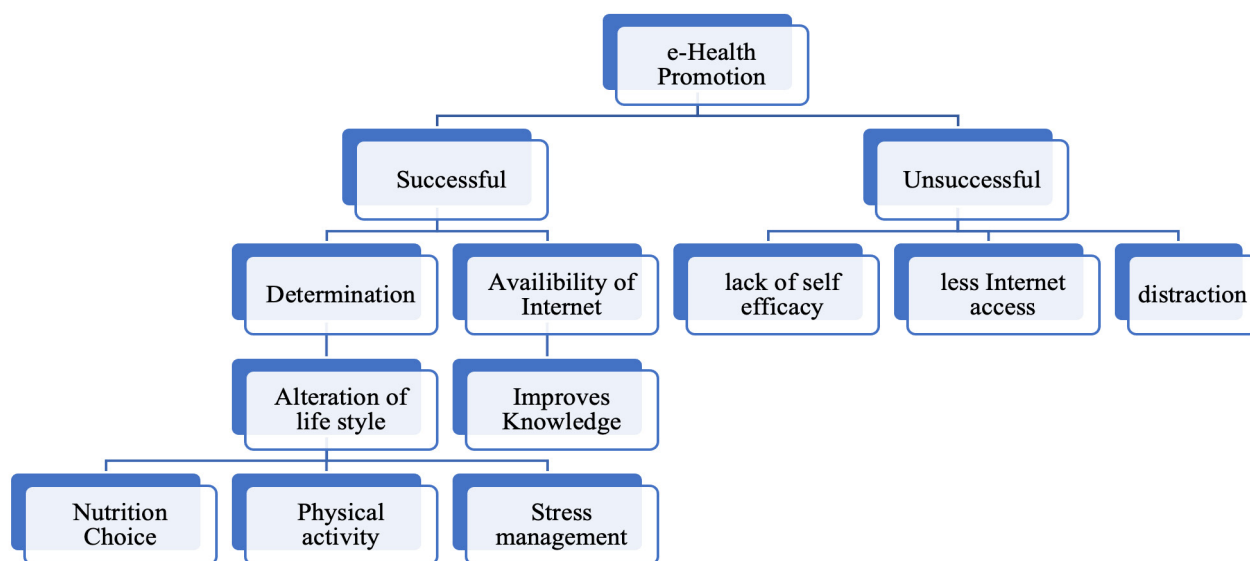
how Internet-based health education outlined in Figure 2 can promote a successful implementation through the determination of the participants, availability and capability of Internet access and time of intervention. Meanwhile, the major distractions of e-health promotion depend on the motivation of the participants, inability to access the Internet, lack of ability to operate the application, and distraction from family/working environment.

### 3.1 E-health promotion program during COVID-19

As shown in Table 2, social media is also beneficial to share proper information and avoid the spread of hoax or false news. Ahmed in 2020 conducted a social network and content analysis on Twitter about the 5G conspiracy theory related to COVID-19. This study showed that 65.2% (n=152) of tweets still have positive mindset against the conspiracy compared to only 34.8% who accommodate misleading information about the 5G conspiracy. It showed that the 'viral' #5GCoronavirus hashtag did not represent the overall beliefs of people towards the conspiracy theory.<sup>14</sup>

Lin in 2020 conducted a survey about attitudes, knowledge, and anxiety levels of people in China towards COVID-19. Results showed that most of the participants have good knowledge about COVID-19 events though there was a knowledge gap about some signs and symptoms of COVID-19 infections. The study also informed that younger people are more likely to have anxiety which was indicated by stress tests, State-Trait Anxiety Inventory: STAI-S and STAI-T. The author suggested the importance of public communication to change people's knowledge and attitudes, especially mental health promotions during infectious disease outbreaks.<sup>15</sup>

Schillinger in 2020 conducted a study called The SPHERE Continuum Model to show that social media can influence public health concerning a contagion, inoculant, vector, media for surveillance, disease control and mitigation, and treatment.<sup>16</sup> Those notions are also supported by a study conducted by Vandormael in 2020 about the use of the Gorilla™ platform to demonstrate and measure changes in behavioral intent towards five hygiene practices in



**Figure 2.** The proposed mechanisms of e-Health promotion determination based on successful and unsuccessful interventions.

their online participants. The secondary outcome of that program was to measure the knowledge about behaviors that can prevent the spread of COVID-19.<sup>17</sup>

Digitalization also provides the ease for people to do social interaction and information exchange without meeting in person. One of the methods was conducted by Meinert in 2020 with the ADAPT-CAFÉ program that make it possible for older people, their families and peers to improve their well-being and health during and after the pandemic.<sup>18</sup>

### 3.2 Wellness intervention

Lifestyle intervention as a part of health promotions such as described in Table 2 have greater impact on women populations especially women with special circumstances. For instance, Kazumi in 2020 conducted a study which highlighted the diet treatment with lifestyle modification intervention that showed a significant improvement on their subject's knowledge including eating habits, knowledge about Polycystic ovary syndrome (PCOS), and physical activity. Moreover, the bonding between healthcare service providers and their participants increased their satisfaction towards healthcare providers, and their overall experience with  $p < 0.05$ .<sup>7</sup> We concluded that their satisfaction result is based on the criteria of their target PCOS participants included in the study.

Since our article aims to highlight health promotions, we found that the study by McNamara in 2008 had shown both online and offline e-health promotions have the same effect on promoting healthy lifestyle. Yet, this finding indicated there was improvement in their participants' knowledge but not weight reduction and activity level in the long term.<sup>19</sup> Those two factors are difficult to follow if the intervention is only based on online methods since not everybody is equal in all measures such as internet availability, weight scale, and level of distraction which are confounding factors in real life situation. Meanwhile, the successful participants included in McNamara's study had higher willingness and motivation to improve their body image.

Meanwhile, Woerden in 2014 and Anderson-Bill in 2011 have shown different results from McNamara in 2008.<sup>19-21</sup> It was because of the difference and more convenient application applied in the newest study.<sup>19-21</sup> Woerden in 2014 has shown that online training with the self-reporting method had an increase of fiber intake, improvement of physical activity scale, and improvement of self-stress control. Moreover, Ebert in 2016 supported Woerden's findings in 2014 by providing data that online Internet-based and mobile-based stress management (iSMI) can reduce their participants' overall stress.<sup>8,20</sup>



**Table 1.** The example of social media application in health knowledge during COVID-19

| Author                   | Subjection  | Study Population  | Time of the study        | Method  | Result(s)  |
|--------------------------|---|---|--------------------------|---|--|
| Ahmed <sup>14</sup>      | Social platform analysis toward conspiracy theory related to COVID-19 and how to deal with misinformation                               | N= 233 tweeter feeds with #5GCoronavirus hashtag              | 7 days                   | Social network analysis and content analysis on Twitter       | Total of 233 tweets that screened 34.8% (n=81) provide misleading information about 5G conspiracy. Meanwhile, 65.2% (n=152) of tweets still have positive mindset against conspiracy.  |
| Lin <sup>15</sup>        | Population based survey including attitudes, knowledge, and anxiety levels of people in China towards COVID-19                          | N= 2,446 residents of mainland China over the age of 18 years | 1 month (30 days period) | Cross sectional research                                      | Almost 86.7% of respondents skeptical of being infected. Meanwhile, other groups in survey have a perception to be already infected with 67%. A knowledge gap in the signs and symptoms of COVID-19 infections, namely runny nose (54.5%), diarrhea (66.4%), headache (68.9%), and sore throat (77.5%) was found. The mean and standard deviation (SD) for the total knowledge score was 20.3 (SD ± 2.9) |
| Vandormael <sup>16</sup> | Measure primary and secondary outcomes related to COVID-19 hygiene that reduce the chances of being infected or spreading with COVID-19 | Gorilla™ platform is used to recruit online participants      | -                        | Multi-site, parallel group, randomized controlled trial (RCT) | As our primary outcome, we will measure changes in behavioral intent toward five hygiene practices: social distancing, washing hands, cleaning household surfaces, not sharing eating utensils, and not stockpiling essential goods. As a secondary outcome, we will measure knowledge about behaviors that can prevent the spread of COVID-19.  |
| Meinert <sup>17</sup>    | Provide a tool for older people and their families and peers to improve their well-being and health during and after pandemics.         | Elderly with their relatives                                  | -                        | Case study  | Real time development of ADAPT-CAFÉ program.   |

Finally, the successful results of e-wellness education as shown in Table 2 have shown a good potential result to combat the inactive lifestyle during the COVID-19 pandemic with special terms such as convenient web applications, well designed programs, Internet access, and willingness of participants. Although, these findings must be followed by future study to confirm the results especially during the COVID-19 conditions.

#### 4. Discussion

This systematic review revealed that the use of the Internet as media to promote health information and wellness education can be successfully implemented through the 171.26 million out of 260 million active Internet users in Indonesia. Despite the high number of active Internet users in Indonesia, the Internet penetration rate of Indonesian is only 53.7 percent, which was lower than any other Asia-Pacific country in June 2019.<sup>11</sup> These data show that almost half of the Indonesia population does not have Internet access to gain proper information in health-related

**Table 2.** The relevant studies of wellness intervention in health promotion study populations

| Author                        | Subjection   | Study population  | Time of the study              | Method | Result(s)  |
|-------------------------------|--|---|--------------------------------|--------|--|
| Kazemi <sup>(7)</sup>         | Pulse based diet and Therapeutic Lifestyle Changes                                   | Woman, age: 18-35<br>N= 30 in the pulse-based diet and N= 31 in the TLC diet groups | 16 weeks                       | RCT    | There is an increasing knowledge in healthy eating, Polycystic ovary syndrome (PCOS) knowledge, activity level, healthcare satisfaction, feelings and experiences about intervention, and health concerns, respectively ( $p < 0.02$ ), decreased weight ( $r < -0.35$ ) and homeostatic model assessment of insulin resistance ( $r = -0.18$ ) correlated with increased scores of PCOS knowledge; adherence to intervention correlated with increased scores. Conclusions of the study: Both interventions improved Health Related Quality of Life (HRQoL) scores in women with PCOS without pre- of active living ( $r = 0.39$ ) and healthy eating ( $r = 0.53$ ; $p < 0.03$ ) |
| McNamara <sup>(19)</sup>      | Online Weight Training   | N= 79 students (58 men and 21 women)  | 16 weeks                       | RCT    | Both online and offline training have improved knowledge $p < 0.05$ .  |
| Ebert <sup>(8)</sup>          | Internet-based stress management intervention (iSMI)                                 | N=263<br>188 women and 75 men<br>97 women with iSMI                                 | 7 weeks and 6 months follow up | RCT    | iSMI group has greater reduction in perceived stress at 7 weeks ( $d = 0.96$ , 95% CI: 0.70 to 1.21) and to the 6-month follow-up ( $d = 0.65$ , 95% CI: 0.40 to 0.89).  |
| Woerden <sup>(20)</sup>       | Web based tool for general health and mental well-being of healthcare                | N=1,313<br>1,048 women and 265 men  | 20 weeks                       | RCT    | Self-reported pre-post data on their general health status improved in 35.3% ( $n = 122$ , $p = 0.001$ ); mental health status improved in 33% ( $n = 110$ , $p = 0.02$ ); reported fruit and vegetable consumption (7 day recall) increased ( $p = 0.001$ ); average time spent on vigorous exercise increased from 40.6 minutes/week to 67.6 minutes/week ( $p = 0.001$ ).   |
| Anderson-Bill <sup>(21)</sup> | Web-based Guide to Health (WB-GTH); Nutrition, physical activity, and weight watcher | N= 963<br>Women 803   | 8 days                         | RCT    | Participants with high self-efficacy tend to have gained self-regulation towards nutrition choices and physical activity $p < 0.001$ .   |

study. This problem is due to the accessibility gap and the content of the material. These conclusions can be found in the previous studies that are described in Tables 1 and 2.<sup>15,19</sup> One of the solutions to overcome the problem of knowledge gap among the society is to provide more accessible information in both online and offline platforms. The online platforms that are mostly used in Indonesia include Instagram, Twitter, Facebook, TikTok, and WhatsApp.<sup>11</sup> On the other hand, offline methods such as conventional television programs might be a solution to influence more participants to be involved in health programs.<sup>22</sup> Mass media campaigns aired both on television and

online can actually promote either negative and positive attitudes toward dietary habits and physical activity.<sup>21,23</sup>

The impact of mass media campaigns both online and offline can influence people both by direct and indirect pathways throughout the population behavior. Most programs, both e-health promotion and wellness education, can directly influence cognitive and emotional responses of watchers and even provoke a decision-making process at the individual level. This statement was demonstrated in previous studies by Anderson in 2011, Ebert in 2016, and Woerden in 2014 that showed an improvement

of knowledge and behavior through their e-wellness programs.<sup>8,20,21</sup>

One example of negative impact of mass media campaign is the high rate of advertisement of junk food which can alter the food decisions of households to choose more fattening food. Conversely, the anti-smoking campaign such as the information of negative impact of smoking can change people's perspective of smoking.<sup>24</sup> The indirect pathway of mass media campaigns can also influence the behavior of target populations. Some issues both online and offline can increase the interaction of interpersonal discussion. For instance, the study of Ahmed in 2020 shown that some people might potentially consider that COVID-19 is a part of the 5G conspiracy as a result of the lack of evidence-based information.<sup>14</sup> On the other hand, Vandormael in 2020 tried to focus on spreading trustworthy information by providing reliable resources of health promotion program using online health videos to promote hygiene information as a way to stop the transmission of the COVID-19.<sup>16</sup> Furthermore, the influence of e-health promotion programs can impact the knowledge and the behavior of society. For example, the alteration of knowledge and attitude can be influenced by watching 'stay at home' promotions during COVID-19 which have divided people into several groups who either support the campaign and who do not. The debate might improve the interaction of individuals to improve their knowledge from different perspectives and promote stakeholders to create a health policy to prevent any misleading information. The successful health campaign can be defined by some elements such are the message of the campaign, the content of the material, the stakeholders, the influencers, and the participation of the population.<sup>22,23</sup>

When considering the target consumers of soap operas,<sup>25</sup> the COVID-19 pandemic situation has led to increased time to watch shows on both television and the Internet. The health promotion programs actually can be inserted before or in the middle of these soap operas and serial television shows to provoke more audience to be influenced by the content of health promotion programs. The successful intervention using mass media for Internet-based health programs such as described by Anderson-Bill in 2011 in Table 2 can be mixed

with other programs including advertisements or influencer endorsements of healthy life styles by Youtuber favorites or even celebrities.<sup>21</sup> A challenge that offers rewards such as money, incentives or even scholarship programs could increase the enthusiasm of young people especially women to participate and be successful in the health promotion campaigns.<sup>4</sup> A national healthy diet and indoor exercise program can also be applied in the plot of the story in the Internet serial soap operas, short story movies and online television shows with wide audience base.

Other examples of exercise programs such as simple gymnastic movements, indoor walking, or a dance in the middle of the program both on the Internet and television could overcome the sedentary lifestyle that happens as an effect of the 'stay at home' rule during the pandemic. Nowadays, online platforms such as YouTube and TikTok have significant influence on youngsters. The health promotion content in China on the TikTok platform has the most viewed status by the audience. We concluded that TikTok or YouTube can be used to spread the health messages towards online audiences. Furthermore, a short dance challenge on the TikTok application might even have some contribution to increase physical activity.<sup>26</sup> The diet trend also can be influenced by the plot story of soap operas, advertisements, or celebrity endorsements. Thus, we as health practitioners should contribute to create and promote those programs to be easily implemented in the community-based sector by following the trendy platforms. Beside using trendy platforms as promoters of a health campaign for youngsters, Meinert in 2020 provided an example of how researchers also created a platform that was more user-friendly among elderly people to promote virtual social interaction between the elderly and their relatives to promote a healthy lifestyle during the pandemic.<sup>18</sup>

Mental health is also negatively affected by the COVID-19 pandemic. Lin in 2020 found that anxiety levels of populations in China are increased during the pandemic.<sup>15</sup> Yet, online program could be used as a tool to promote stress management among the society impacted by the pandemic situation. For example, Ebert in 2016 found that self-guided iSMI is an effective online program that can

decrease the stress among participants.<sup>8</sup> This finding provides an excellent example that online stress interventions can be a solution to overcome mental health problems that might be increased during the COVID-19 pandemic without direct contact between health practitioners and society which can help stop the transmission of COVID-19.

Due to COVID-19 related health problems that have affected most of society, proper integrative methods are needed. We suggest another option beside e-program and television-based programs, which is the adaptation concept of utilizing health information by cadres with a modification by the recruitment of millennial cadres that are expected to help disseminate health information in the surrounding environment. This method has been implemented since the establishment of the Integrated Service Post or '*Pos Pelayanan Terpadu*' (*Posyandu*) in 1986 by involving women volunteers in the surrounding areas of a community.<sup>27</sup> The advantage of recruiting millennial cadres is that they tend to be more agile, up-to-date concerning new information, and have relatively more time to devote to this work because they are not too involved in household affairs. This approach is also supported by the 'work from home' program during the pandemic which gives them flexibility in time management.<sup>28-31</sup>

The utilization of this millennial cadre and online application could also support government programs such as the *PeduliLindungi* launched by Ministry of Communication and Information Technology. *PeduliLindungi* is aimed to track a user's contact history with a gadget base which will be useful if someone is suspected of being exposed to COVID-19.<sup>31</sup> Millennial cadres with the assistance of health cadres and influential people are expected to be human messengers to socialize *PeduliLindungi* and COVID-19 protocols, and provide proper information related to COVID-19. They will have access to the COVID-19 Response Acceleration Task Force in related areas to gain the right information. Millennial cadres will be the right person to get confirmation about the various information spreading in the community to attenuate any hoax deployment. They are also tasked with reporting suspicious cases in their working area. In addition, it is hoped that the millennial cadres will motivate and supervise people

to be more disciplined in maintaining a healthy lifestyle and applying the COVID-19 protocols in daily life.

In the case of recruiting millennial cadres as a part of surveillance, rewards and work motivation are very important for any organization, as these can be used to direct the staffs towards achieving the goals of the organization. Asaari in 2019 showed that there are positive and significant relationships between rewards and motivation.<sup>32</sup> Another study by Nuraya in 2017 concluded that the working environment and salary have significant influence on motivation and motivation can significantly influence a person's job satisfaction.<sup>33</sup> Those data describe a realistic view about the importance of budget funds for multi-sectoral workers related to COVID-19 management.

## 5. Conclusion

In conclusion, the Internet-based information health system has a potential impact in spreading health related information such as COVID-19 understanding and wellness education to the society. The implementation of Internet-based health promotion programs was found to be an effective method to overcome misleading information. In addition, online methods also can be used as a solution to educate and to promote healthy eating, exercise, and stress management. Internet-based methods not only require the accessibility of Internet, gadgets, platforms, and participation of certain stakeholders and influencers, but also need good quality of the content which is presented to the society. Beside the positive effects of digitalization, we have been concerned about the knowledge gap and accessibility of the Internet users in Indonesia. Thus, we suggest not only the use of television programs but also the integrative method of excellent online programs and utilization of millennial cadres for certain population categories to spread the proper health information without dependency on Internet access.

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# Retinal involvement of coronavirus disease (COVID-19): A systematic review

Mohammad Eko Prayogo,<sup>1</sup> Angela Nurini Agni,<sup>1</sup> Tri Wahyu Widayanti,<sup>1</sup> Supanji,<sup>1</sup> Firman Setya Wardhana,<sup>1</sup> Muhammad Bayu Sasongko,<sup>1</sup> Cita Shafira Amalia,<sup>2</sup> Ni Putu Yena Yossiana Devi,<sup>2</sup> Roihan Mohamad Iqbal,<sup>2</sup> Vania Permatahati<sup>2</sup>

<sup>1</sup>Department of Ophthalmology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

<sup>2</sup>Ophthalmology Research Unit, Faculty of Medicine Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia

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**ABSTRACT** COVID-19 has wide-ranging manifestations which involve various organs. Although COVID-19 is known to affect mainly the respiratory system, many patients suffered from ocular manifestations following SARS-CoV-2 infection, especially conjunctivitis. However, there was some evidence of broader ocular involvement, which could involve the retinal layer. This review aims to analyze the possible explanation of retinal involvement in COVID-19 and whether comorbidities increase the risk of retinal involvement in COVID-19. We conducted a systematic literature search during September 2020 using the PUBMED database and other additional sources (e.g., Google Scholar). There was no year of publication nor language restrictions. Six papers are used in this literature review: two studies reported retinal lesions in COVID-19 patients, one study detected SARS-CoV-2 RNA in retinal biopsies and three studies proposed possible mechanisms of retinal involvement in COVID-19. Ocular structures express ACE-2, such as the aqueous humor, pigmented epithelium, and retina. This is supported by the finding of SARS-CoV-2 nucleic acid in postmortem patients. Retinal involvement in COVID-19 patients includes hyperreflective retina lesions, subtle cotton wool spots, and microhemorrhage. However, these findings do not necessarily indicate the specificity of retinal involvement. Diabetes mellitus may be associated with disease severity in patients with COVID-19. Some evidence of retinal involvement in SARS-CoV-2 infection involves the detection of retinal lesions, the expression of ACE-2 in the retina, and the role of comorbidities.

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## 1. Introduction

Coronavirus Disease 2019 (COVID-19), detected for the first time in late 2019 in Wuhan City, Hubei Province, China, had infected more than 26,121,999 and killed 864,618 people worldwide by September of 2020.<sup>1</sup> COVID-19 is an infection caused by the Severe Acute Respiratory Syndrome-related Coronavirus 2 (SARS-CoV-2). SARS-CoV-2 is an enveloped, non-segmental, positive-sense RNA virus belonging to the *Coronaviridae* family.<sup>2</sup> After it rapidly spread worldwide, the World Health Organization (WHO) declared COVID-19 as a Public Health Emergency

of International Concern on January 30th, 2020 and then announced the disease as a global pandemic on March 11<sup>th</sup> 2020.<sup>3</sup>

The SARS-CoV-2 infection shows various manifestations, ranging from asymptomatic to Acute Respiratory Distress Syndrome (ARDS), and even death, especially when comorbidities such as diabetes mellitus (DM) and hypertension are present.<sup>4,5</sup> Symptoms that are generally found in patients with COVID-19 are fever (>90%), dry cough (60-85%), anosmia and/or ageusia (60-80%), dyspnea (53-80%), nausea/vomit or diarrhea (15-39%), and myalgia (15-44%).<sup>6-13</sup> The complications of COVID-19 infection involve the dysfunction of various organs such as lungs, heart, brain, liver, kidney, and hemostatic function. These organ dysfunctions manifest as myocarditis, cardiomyopathy, ventricular arrhythmia,

\*Correspondence: [mohammad.eko.prayogo@ugm.ac.id](mailto:mohammad.eko.prayogo@ugm.ac.id)  
Department of Ophthalmology, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada. Jl. Farmako, Sekip Utara, Yogyakarta

acute cerebrovascular disease, encephalitis, and arterial/venous thrombo-embolization.<sup>6, 14-17</sup>

Ocular manifestations of COVID-19 infection have been reported, but these are rare and often went undiagnosed. Conjunctivitis, as one of the well-known ophthalmic involvements of COVID-19, has a prevalence of 32%. Conjunctivitis was reported to occur mostly in patients suffering from severe infection with systemic symptoms.<sup>18,19</sup> However, there were some possibilities that other eye structures may also be involved. A study by Marinho *et al.* (2020) reported changes in the retina of COVID-19 patients with ophthalmic involvement which manifested as microhemorrhages and cotton wool spots.<sup>20</sup> Ocular manifestations on COVID-19 patients may correlate with the mechanism of viral entry into human cells.

SARS-CoV-2 infection is mediated by the binding of coronavirus spike protein to the cellular angiotensin-converting enzyme 2 (ACE-2) and by serine protease TMPRSS2, which promotes spike protein priming.<sup>21</sup> The ACE-2 are expressed by lung cells (epithelial cells), heart cells, gut, kidney, and bladder.<sup>22</sup> The increase in ACE-2 expression in those organs might be elicited by the use of DM and hypertension drugs such as ACE-2 inhibitors (ACEIs) and angiotensin II receptor blockers (ARBs).<sup>23</sup> Some evidence of ACE-2 expression in conjunctiva and the cornea allowed for the detection of SARS-CoV-2 in the tears of infected patients.<sup>18</sup> These findings support the pathogenesis of conjunctivitis as one of the ocular manifestations of COVID-19 infection. However, there are still limited explanations regarding severe ocular manifestations of SARS-CoV-2 disease, especially those involving the retina which may lead to vision loss. This review aims to analyze the possible pathogenesis of retinal dysfunction in COVID-19 patients and the correlation of the retinal changes with co-morbidities such as DM and hypertension.

## 2. Method

### 2.1 Literature search

A systematic literature search was conducted during September 2020 using the PubMed database and other additional sources (e.g. Google Scholar) with the following search terms: "COVID-19" OR, "coronavirus" OR "SARS-CoV-2", AND "retina". There

were no year of publication nor language restrictions.

### 2.2 Data extraction and synthesis

The articles were examined and the data were extracted into a table to identify COVID-19 diagnostic protocol, patient selection criteria, and ocular manifestations especially those involving the retina. We included original articles, editorial, and letters to editors due to the scarcity of publications regarding retinal manifestations in COVID-19.

### 2.3 Statistical analysis

We descriptively analyzed the total and median or range of age of subjects in Table 1.

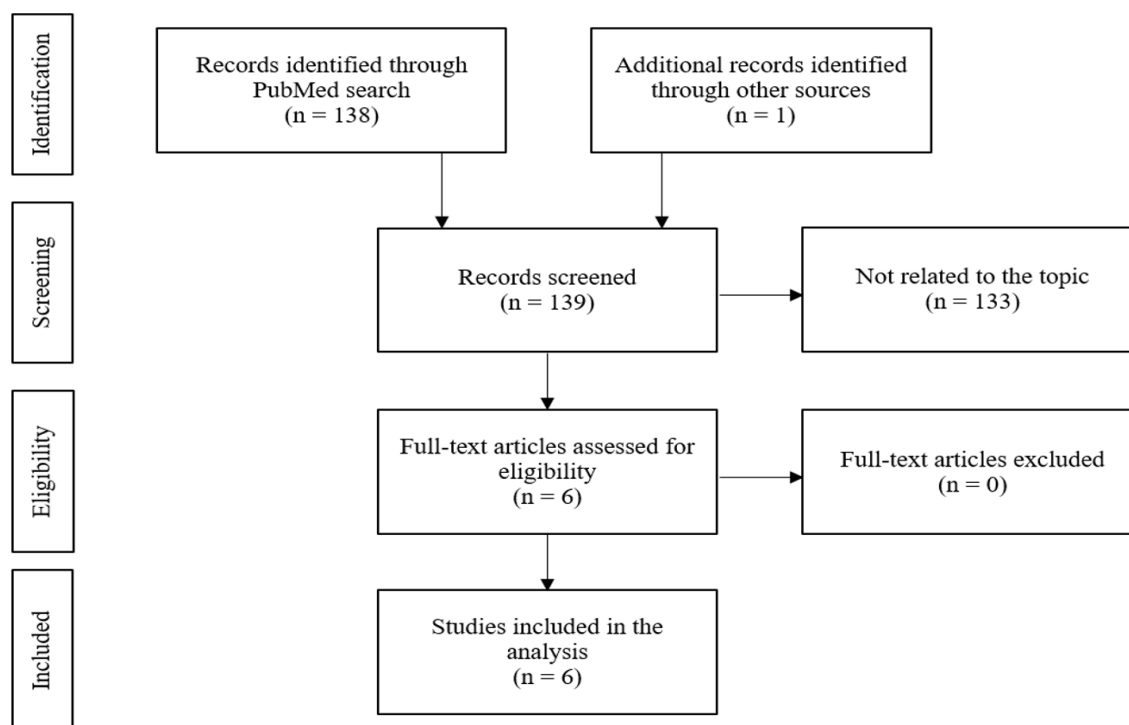
## 3. Results

Table 1 summarizes the most recent studies regarding retinal involvement in SARS-CoV-2 infection. A study by Marinho *et al.* (2020) found that all COVID-19 patients showed hyper-reflective lesions at the level of ganglion cell (GC) and inner plexiform (IP) layers more prominently at the papillomacular bundle in both eyes. Four patients (33.3%) presented subtle cotton wool spots and microhemorrhage.<sup>20</sup>

Landecheo *et al.* (2020) found five patients with unilateral elliptical cotton wool spots and one case bilateral, including one patient who did not develop pneumonia. In cases that required orotracheal intubation, there were no cotton wool spots at the moment of funduscopy examination, 58 days after diagnosis. All patients received a daily prophylactic dose of low molecular weight heparin between the COVID-19 diagnosis and the funduscopy evaluation.<sup>24</sup>

Casagrande *et al.* (2020) found that in three out of 14 eyes, SARS-CoV-2 RNA was detected in the retina of deceased COVID-19 patients. These results were obtained from the analysis of three different sequences (*RdRp* gene, *E* gene, and *Orf1* gene).<sup>25</sup>

Raony and Saggiaro (2020) proposed that DM may be associated with COVID-19 severity. DM might increase the risk of retinal lesions in patients with COVID-19 (e.g., lesions in GC and IP layers), with the involvement of CD147 and proinflammatory cytokines.<sup>26</sup> Vavvas *et al.* (2020) stated that reported



**Figure 1.** Flow diagram of the systematic review according to PRISMA guidelines.

optical coherence tomography (OCT) findings from *Marinho et al. (2020)* may not be related to COVID-19 and may represent normal retinal vessels.<sup>27</sup> *Aiello et al. (2020)* proposed that due to RAAS protein expression in different ocular tissues, SARS-CoV-2 may be responsible for other possible ocular manifestations as retinal vasculitis.<sup>28</sup> Table 2 summarizes the proposed pathogenesis of retinal manifestations in COVID-19 from each study.

#### 4. Discussion

Coronaviruses consist of four structural proteins; spike (S), membrane (M), envelope (E), and nucleocapsid (N). The interaction between the spike protein and ACE-2, which was identified as a functional receptor for SARS-CoV-2, is the entry mechanism of the virus into the host cell. ACE-2 expression is high in the lung, heart, ileum, kidney, and bladder.<sup>4</sup> However, some ocular structures are found to also express the ACE-2, including the aqueous humor, the pigmented epithelium, and the retina.<sup>28</sup>

There are reports regarding findings of SARS-CoV-2 in the conjunctival secretion, which then

manifested as conjunctivitis. However, there is limited evidence of the expression of spike protein/ACE-2 receptor interaction in the conjunctiva and retina.<sup>28</sup> A study conducted by *Casagrande et al. (2020)* showed evidence of SARS-CoV-2 nucleic acid detection in the human retina in postmortem patients.<sup>26</sup> It was also identified that the binding of the spike protein/ACE-2 receptor was promoted by serine protease TMPRSS2. However, the expressions of ACE-2 and TMPRSS-2 were found to be low in the human retinal cells.

In contrast to ACE-2, the transmembrane glycoprotein CD147 was expressed at moderate-high levels in the human retina especially in the retinal GC layer which has recently been reported as a novel invasive route for SARS-CoV-2. This protein mediates the breakdown of the blood-retinal barrier in the hyperglycemic state, which then may facilitate the invasion of SARS-CoV-2 into the retinal cells.<sup>26</sup> This may explain the increased risk of retinal involvement in COVID-19 patients with DM.

In this systematic review, one study suggested COVID-19 patients with comorbidities had a poorer

**Table 1.** Summary of the current research findings

| No. | Author                                | Publication date | Article type         | Journal                                 | Total subjects | Median or range of age (years) | Method                  |
|-----|---------------------------------------|------------------|----------------------|---|----------------|--------------------------------|-------------------------|
| 1.  | Marinho <i>et al.</i> (20)            | 12-5-2020        | Correspondence       | Lancet                                  | 12             | 25-69.                         | OCT                     |
| 2.  | Landecheo <i>et al.</i> (24)          | 30-7-2020        | Original article     | Journal of Internal Medicine            | 27             | 59.8                           | OCT and OCT angiography |
| 3.  | Casagrande <i>et al.</i> (25)         | 29-5-2020        | Original article     | Ocular Immunology and Inflammation      | 14             | 77±13.9                        | RT-PCR                  |
| 4.  | Raony and Saggiore de Figueiredo (26) | 25-6-2020        | Letter to the editor | Diabetes Research and Clinical Practice | n/a            | n/a                            | n/a                     |
| 5.  | Vavvas <i>et al.</i> (27)             | 9-7-2020         | Editorial            | The Royal College of Ophthalmologists   | n/a            | n/a                            | n/a                     |
| 6.  | Aiello <i>et al.</i> (28)             | 18-5-2020        | Review               | The Royal College of Ophthalmologists   | n/a            | n/a                            | n/a                     |

Note: n/a, data not available. OCT: optical coherence tomography; RT-PCR: real-time reverse transcriptase-polymerase chain reaction.

**Table 2.** Summary of the proposed pathogenesis of retinal manifestations in COVID-19

| No. | Author                                | Proposed pathogenesis of retinal manifestations in COVID-19  |
|-----|---------------------------------------|--|
| 1.  | Marinho <i>et al.</i> (20)            | Hyper-reflective lesions at the level of ganglion cell and inner plexiform layer can be associated with CNS manifestations of SARS-CoV-2 infection.  |
| 2.  | Landecheo <i>et al.</i> (24)          | Diabetic retinopathy is associated with a renin-angiotensin-aldosterone axis imbalance. SARS-CoV-2 downregulates the ACE-2 receptor that might play a crucial role in inducing retinal ischemia.   |
| 3.  | Casagrande <i>et al.</i> (25)         | Since the ACE-2 receptor is expressed in the retina, SARS-CoV-2 is very likely to infect the retina. However, the detection of SARS-CoV-2 in retinal cells by <i>in situ</i> hybridization or viral replication was not performed.   |
| 4.  | Raony and Saggiore de Figueiredo (26) | Expression of ACE-2 and TMPRSS2 in human retinal cells is low. However, diabetes mellitus medications can overexpress ACE-2 in several organs. The breakdown of the blood-retinal barrier in a hyperglycemic state may cause invasion of retinal cells by SARS-CoV-2 in diabetic patients.                               |
| 5.  | Vavvas <i>et al.</i> (27)             | Vavvas <i>et al.</i> clarified Marinho <i>et al.</i> that cotton wool spots are not necessarily a manifestation of COVID-19. Cotton wool spots can represent retinal nerve fiber layer myelination, which is a normal finding. They suggest that OCT findings from Marinho <i>et al.</i> may not be related to COVID-19. |
| 6.  | Aiello <i>et al.</i> (28)             | Renin-angiotensin-aldosterone system (RAAS) proteins are expressed in ocular tissues such as aqueous, the pigmented epithelium, and the retina. These expressions might play a role in SARS-CoV-2 infection and could manifest as anterior or posterior uveitis, iridocyclitis, vitritis, or retinal vasculitis.         |

Note: ACE-2: Angiotensin-converting enzyme 2; OCT: optical coherence tomography; TMPRSS2: Transmembrane serine protease 2.

prognosis compared to COVID-19 patients without comorbidities. The most prevalent comorbidity associated with increased severity of COVID-19 is DM. Patients with DM have impaired immunity, hence increasing the risk of SARS-COV-2 infection. Huang *et al.* (2020) conducted a systematic review and meta-analysis to investigate the association between

DM and poor prognosis of patients with COVID-19 pneumonia.<sup>29</sup> The results showed that DM was associated with a poor outcome, including a higher mortality rate, severe COVID-19, ARDS, and disease progression. It was also found that DM is a single risk factor that leads to poorer outcomes for younger people without hypertension. Guo *et al.* (2020)



showed that patients with COVID-19 pneumonia and DM were more severe in organ damage, inflammatory factors, and hypercoagulability. These conditions would most likely progress into a poorer prognosis.<sup>30</sup>

Diabetic retinopathy was the most common complication in DM patients, manifested as microangiopathy in the retinal layer. This was associated with inflammation in the retinal vasculature. Inflammatory cytokines such as Interleukin 6 (IL-6), Interleukin 8 (IL-8), and tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) were increased in patients with DM. Chemokines such as monocyte chemoattractant protein-1 (MCP-1), and macrophage inflammatory protein-1 $\alpha$  (MIP-1 $\alpha$ ) were also reported to be elevated in diabetic patients. These cytokines play a role in increasing the severity of diabetic retinopathy.<sup>31</sup> It was reported that elevation of proinflammatory cytokines such as TNF- $\alpha$  and IL-6 were also found in COVID-19 patients, a condition known as a 'cytokine storm', and was associated with the severity of COVID-19 disease.<sup>32</sup> This finding suggested that the cytokine storm might play a role in creating lesions in the retina manifested as cotton wool spots.<sup>20,24</sup> However, this study had insufficient evidence to analyze the association between diabetic COVID-19 patients with diabetic retinopathy pathogenesis. Henceforth, it is necessary to conduct further studies regarding the association between SARS-CoV-2 infection and diabetic retinopathy.

Patients with DM were often associated with hypertension. Pharmacotherapy such as ACE inhibitors (ACEIs) and angiotensin II receptor blockers (ARBs) are frequently used to control hypertension. Both ACEIs and ARBs may lead to overexpression of ACE-2 receptors in patients taking these drugs.<sup>33</sup> Soro-Paavonen *et al.* (2012) conducted a study in which diabetic patients with vascular complications treated with ACEIs showed increased ACE-2 activity, but the mRNA level was not measured.<sup>34</sup> The expression of ACE-2 receptors has been associated with SARS-CoV-2 infection in which the patients would be susceptible to COVID-19 disease. The higher the receptor's expression, the more likely SARS-CoV-2 would enter the cells and hence promote a cytokine storm. This raises the concern that diabetic patients treated with ACEIs or ARBs may lead to a higher risk of

infection and increased morbidity and mortality.<sup>35</sup> It could also involve overexpression of ACE-2 receptors in the retina, in which SARS-CoV-2 would be able to bind and enter retinal cells. Furthermore, systemic inflammation that occurs in COVID-19 infection may also lead to retinal lesions. Though there are still some questions regarding the benefits and harm of ACEIs and ARBs among diabetic COVID-19 patients, good diabetes management itself, such as blood glucose level control, would be necessary for treating these patients. Further studies are recommended to investigate the correlation between ACEIs and ARBs given to diabetic patients and the overexpression of ACE-2 receptors in the retina.

## 5. Conclusion

Although COVID-19 manifests mainly in the respiratory system, we cannot rule out the possibility of the SARS-CoV-2 invasion to other organs. Some evidence exists of retinal involvement in SARS-CoV-2 infection and its possible pathogenesis, however, more data are needed. There was a possible role of comorbidities and its treatments such as ACEIs and ARBs in increasing the risk of retinal involvement in COVID-19 infection, though this possibility still needs to be investigated further.

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