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LETTER TO EDITOR

BUILDING HEALTH SYSTEM RESILIENCE DURING COVID-19 CRISIS

Membangun Resiliensi Sistem Kesehatan Selama Krisis COVID-19

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Coronavirus is a type of virus that causes long-term health threats because coronavirus can adapt to new environments through mutations and recombination which is relatively simple (Li, 2016). Whereas in 2019, a new type of coronavirus was founded and known as the COVID-19 pandemic (Guarner, 2020). The COVID-19 pandemic has resulted not only in the high number of infected people and the number of deaths but also in the social, cultural, and economic fields (Uddin *et al.*, 2020). To reduce the impact of the crisis recurrence, it is necessary to reduce risks and build resilience systems (United Nations Secretariat for International Strategy for Disaster Reduction, 2012). One of the resilience systems that can deal with disasters, especially the coming crisis is a health system resilience (Kruk *et al.*, 2015). Health system resilience is the ability of health workers, all institutions, and communities to prepare and respond to crises effectively by considering the experience of previous crises (Nuzzo *et al.*, 2019).

Health system resilience works in a disaster, a crisis, or pandemic. The World Health Organization has created the International Health Regulations (IHR) Joint External Evaluation (JEE) tool in 2016. JEE is an important tool to assess the capacity of a country in dealing with infectious disease outbreaks and public health emergencies. The successful JEE can support the establishment of health system resilience (World Health Organization, 2019). Although JEE has begun to develop, health facilities are still experiencing vulnerabilities in facing public health emergencies. The JEE does not explicitly assess how health care facilities overcome obstacles such as travel distance, high medical costs, and distrust of public (Nuzzo *et al.*, 2019). Therefore, it takes a more detailed explanation regarding supporting factors to build health system resilience.

Kruk et al. (2017) mentioned health system resilience framework can overcome the outbreak. Health system resilience framework has several supporting factors, such as awareness, diversity, self-regulation, integration, and adaptation (Kruk *et al.*, 2015). The implementation of health system resilience was one of the attempts to support Liberia to rise from the Ebola crisis (Kruk *et al.*, 2015). According to Ling et al. (2017), an analysis of the implementation of health system resilience in the case of Ebola in Liberia refers to the health system resilience framework of Kruk et al. (2017) in which mentioned the coordination between participating actors and the community improved.

Participating actors in Liberia were also aware of enhancing disease surveillance and tracking. Actors who took over the health system in Liberia were self-regulated and aware of the outbreak by raising public awareness of th outbreak threats, giving greater autonomy to the local country health team. While governments and community leaders play

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a role in providing more health services to meet the community's needs.

The success of health system resilience due to Ebola can be used as a reference for dealing with the future crisis. In other words, health system resilience is important for every country during the COVID-19 pandemic. The Department for International Development UK has made a policy brief about principles of health system resilience for handling the COVID-19. The principles consist of flexible system development for medical supplies, priority for COVID-19 healthcare services, cooperation with local communities, effective communication at all levels and involvement of supporting officers in handling COVID-19. Others include well-provided facilities to support the acceleration of resource flows in all healthcare services, quick health information tracking, and expansion of partnerships and effective networks (Department for International Development, 2020).

Health system resilience can protect human life during and after a crisis. Besides, health system resilience can make more effective services and stronger methods to deal with future crises. According to Legido-Quigley et al. (2020), Japan, Singapore, and Hong Kong tried to build health system resilience to face the COVID-19 outbreak by learning from the previous crises, such as SARS-CoV, H5N1 Avian Influenza, and H1N1 influenza. They implemented appropriate measures in national security and governance structures, took steps to support the availability of healthcare services and give funding for healthcare services, and developed existing management plans and structures.

Nevertheless, these countries had deficient health system resilience in confronting the COVID-19 outbreak. For example, they lacked coordination in providing services, access and provision of medical equipment, ineffective communication, and low public confidence in the government. In short, health system resilience during crisis exists when there is more integration of services in healthcare systems and across sectors, less false news and incorrect information, and higher public confidence in the government that ensures the crisis management.

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ORIGINAL ARTICLE

COMMUNITY KNOWLEDGE, ATTITUDES, AND BEHAVIOR TOWARDS SOCIAL DISTANCING POLICY AS A MEANS OF PREVENTING TRANSMISSION OF COVID-19 IN INDONESIA

Pengetahuan, Sikap, dan Perilaku Masyarakat terhadap Kebijakan Jaga Jarak sebagai Cara Pencegahan Penularan COVID-19 di Indonesia

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ABSTRACT

Background: Corona virus disease 2019 (COVID-19) caused by SARS-CoV-2 recently became a global pandemic, affecting countries, such as Indonesia, worldwide. Social distancing is one of the mitigation strategies recommended to reduce the risk of morbidity and mortality caused by COVID-19. Community compliance with social distancing is a part of the pandemic control.
Aims: This study identified knowledge, attitudes, and behavior towards the prevention of SARS-CoV-2 transmission through social distancing during the COVID-19 pandemic among the Indonesian community.
Methods: This descriptive study used a cross-sectional design, distributing closed questions in an online questionnaire randomly to 34 provinces in Indonesia on social media networks and by email. This study successfully collected data from 1,102 respondents from 29 provinces in Indonesia. The data were analyzed descriptively by calculating frequency, percentage, and cross-tabulation.
Results: This study successfully identified 99%, 59%, and 93% of respondents with good knowledge, positive attitudes, and good behavior towards social distancing, respectively. Among the respondents who had good knowledge, 58.85% showed positive attitudes and 93.3% good behavior. The vast majority of respondents who had positive attitudes showed good behavior (96.7%).
Conclusion: The Indonesian community had good knowledge, attitude, and behavior towards social distancing as a way to prevent the virus transmission. This strongly supports the use of such a disaster mitigation strategy in controlling the COVID-19 pandemic in Indonesia.

Keywords: attitudes, behavior, COVID-19, knowledge, social distancing.

ABSTRAK

Latar Belakang: *Corona Virus Disease 2019 (COVID-19) yang disebabkan oleh SARS-CoV2 saat ini menyebar ke seluruh dunia, termasuk Indonesia. Social distancing merupakan salah satu mitigasi yang dianjurkan untuk mengurangi risiko bencana, seperti penyebaran dan kematian yang disebabkan oleh COVID-19. Kepatuhan masyarakat terhadap kebijakan social distancing adalah bagian untuk mengontrol pandemi ini.*
Tujuan: *Penelitian ini mengidentifikasi pengetahuan, sikap, dan perilaku terhadap pencegahan penyebaran SARS-CoV-2 melalui kebijakan social distancing selama pandemi COVID-19 pada masyarakat Indonesia.*
Metode: *Penelitian deskriptif ini menggunakan desain cross-sectional secara acak menyebarkan pertanyaan tertutup di kuisioner online ke 34 provinsi di Indonesia melalui jejaring media sosial dan surat elektronik. Penelitian ini berhasil mengumpulkan 1,102 responden dari 29 provinsi di Indonesia. Data dianalisis secara deskriptif dengan menghitung frekuensi, persentase, dan tabulasi silang.*
Hasil: *Penelitian ini menunjukkan bahwa mayoritas responden memiliki pengetahuan yang baik (99%), sikap positif (59%), dan perilaku baik (93%) terkait social distancing. Diantara responden yang memiliki pengetahuan yang baik juga menunjukkan sikap yang positif (58,85%), dan perilaku yang baik (93,3%). Responden yang memiliki sikap positif juga menunjukkan perilaku yang baik (96,7%).*

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Kesimpulan: *Masyarakat Indonesia memiliki pengetahuan, dan perilaku baik juga sikap positif terhadap social distancing yang sangat berperan pada pengendalian penularan COVID-19. Hal ini sangat mendukung mitigasi bencana pandemi COVID-19 di Indonesia.*

Kata kunci: *sikap, perilaku, COVID-19, pengetahuan, social distancing.*

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INTRODUCTION

The corona virus pandemic emerged when the virus was spread from person to person over a short period and in a sustained way. By December 2019, in terms of the clinical severity of pandemic disease, the corona virus disease 2019 (COVID-19) pandemic was rated from moderate to very high. The economic impact, an ignorant society, and the absence of targeted therapy and vaccination can affect the progress of a pandemic disease. Therefore a pandemic disease plan is needed as community mitigation to delay the disease peak, decrease stress on the health care system, protect critical infrastructure, and reduce the overall number of cases to decrease morbidity and mortality. Social distancing is one non-pharmaceutical intervention that can inhibit the virus spreading from infected case to susceptible case by arguing physical distance between people or decreasing congregation in the community in places, such as schools or workplaces (Ahmed, Zviedrite and Uzicanin, 2018).

COVID-19 was first reported in Wuhan, Hubei, China in December 2019, and on March 11, 2020 the World Health Organization (WHO) declared that COVID-19 had become a pandemic disease worldwide (Bedford *et al.*, 2020). Reported cases of COVID-19 were found in 203 countries around the world by the beginning of April 2020, with a total of 937,976 confirmed cases and 47,279 deaths. By April 2020, Indonesia showed a high number of confirmed cases and deaths in the COVID-19 outbreak, and a mitigation strategy was necessary to control the pandemic (American Library Association, 2020).

Coronavirus has previously caused two pandemics, namely the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) in 2002–2003, in China, and the Middle East Respiratory Coronavirus Syndrome (MERS-CoV) in 2012–2013, in Saudi Arabia. The causative agents in both cases belonged to the coronavirus group, specifically the Betacoronavirus genus, which is transmitted through zoonosis. The current COVID-19 pandemic is the third pandemic caused by SARS-CoV-2, which is phylogenetically a part of the Betacoronavirus genus (Li et al., 2020; Prompetchara, Ketloy and Palaga, 2020). The main transmission route of SARS-CoV-2 is through direct contact or consumption of the natural SARS-CoV-2 host, e.g., bats, and intermediate hosts, e.g., pangolins, snakes, and others (Hoffmann et al., 2020; Shereen et al., 2020). However, recent references indicated that bats, as natural hosts of SARS-CoV-2, are capable of infecting human cells without requiring an intermediate reservoir. The transmission of SARS-CoV-2 can occur from humans to other humans, especially among family members and friends who are in close contact with patients with COVID-19 or people infected with COVID-19 but without symptoms (Guo et al., 2020; Shereen et al., 2020) Research into a vaccine and drugs for SARS-CoV-2 is still underway; thus, a strategy is needed to prevent the process of transmission among humans. Social distancing is one of the community actions that can prevent disease transmission by reducing contact between people who can spread the virus (Maharaj and Kleczkowski,

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2012). Social distancing is one of the mitigation strategies recommended by the WHO for the world community during the SARS-CoV-2 pandemic (Guo et al., 2020). Social distancing is an essential part of pandemic control in reducing the possibility of the virus spread. Such a policy was once applied to an influenza pandemic in 2009. A simulation study of agent-based influenza showed that small changes in behavior can have a significant effect on transmission patterns during epidemics (Pawelek, Salmeron and Valle, 2015). Further research on agent-based models argued that social distancing can control epidemics if it starts quickly and continues for a long time (Kelso, Milne and Kelly, 2009).

The Indonesian government have also urged people to practice social distancing during the COVID-19 pandemic. Social distancing can reduce the mortality and morbidity of the disease, but the benefits of social distancing greatly depend on the understanding of individuals in the community (Reluga, 2010). The Indonesian government implemented policies related to social distancing, such as issuing commands to study and work from home, stay at home, and avoid contact, prohibiting activities in large numbers, and limiting operating hours in public places. Such social distancing is expected to reduce and control the spread of the coronavirus during this pandemic period. However, the big problem with this policy is that most of the Indonesian community have disobeyed this policy. The Indonesian community have still done other activities outside the home, been on vacation to various places, and returned to their home towns (Saifulloh, 2020). These phenomena might be caused by a lack of public knowledge and low concern about social distancing. Previously the Chinese government asked the public not to make a journey to Wuhan city, or elsewhere. The lockdown of Wuhan and several other cities in China has been seen to effectively inhibit the high rate of transmission of COVID-19 cases to other provinces (Guan et al., 2020).

Therefore, this study aimed to identify the knowledge, attitudes, and behavior of the Indonesian community towards social distancing as a means of preventing COVID-19 transmission.

METHODS

This study was descriptive, using a cross sectional survey of the adult population in Indonesia. Data were collected through an indirect online questionnaire from March 10–20, 2020. These questionnaires, using closed questions and multiple-choice, were distributed to 34 provinces in Indonesia but only answered by 1,146 respondents in 29 provinces. The variables of this study were knowledge, attitudes, and behavior, and for each variable there were 10 items connected with using social distancing as one of the pandemic control strategies. Knowledge was measured by whether the respondents could identify the causes of the disease and transmission, general symptoms, risks and the prevention of COVID-19. Attitudes were measured according to the awareness of social distancing at work and worship, as well as learning from home. Behavior was related to carrying out prevention activities such as washing hands, avoiding touching the face, following cough and sneeze etiquette, wearing masks, and using disinfectant to prevent COVID-19.

The questionnaires consisted of three sections, concerning knowledge, attitudes, and behavior, each containing 10 related items, in addition to socio-demographic items such as province. The respondents provided information on age, educational level, occupation, and marital status. The questionnaires were purposed as a self-managed questionnaire, according to the standard protocols for questionnaire design

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and testing. The overall fields, concerns, and response options in the questionnaires were related to social distancing.

Knowledge and behavior measurement used the Guttman scale, and the Likert scale was used for attitude measurement. Data were analyzed with descriptive analysis by calculating the frequency, percentage, and cross-tabulation.

RESULTS AND DISCUSSION

Respondent Characteristics

The study collected 1,146 questionnaires filled out online. After filtering, the data obtained from only 1,102 questionnaires could be processed.

Respondents came from 29 provinces out of 34 provinces in Indonesia. Most of them (40.47%) were from East Java Province. One-third of the respondents were aged 26–45 years (47.91%). Based on education level, 54.72% of the respondents were bachelor's, master's, and doctoral graduates. As many as 39.11% of the respondents were students/bachelor graduates/unemployed, and 36.84% worked as civil servants or for the Indonesian National Armed Forces. In terms of marital status, 50.09% of them were unmarried/single. The socio-demographic characteristics of the respondents are shown in Table 1.

Table 1. Respondents' Socio Demographic Characteristics

Category	Frequency (n)	Percentage (%)
Age Range		
12-25 years old	488	44.28%
26-45 years old	528	47.91%
46-65 years old	86	7.80%
Educational attainment		
Junior High School	25	2.27%
Senior High School	394	35.75%
Associate Degree	80	7.26%
Bachelor, Master and Doctoral Degree	603	54.72%
Occupation		
Civil Servant/Indonesian National Armed Forces	406	36.84%
Housewives	57	5.17%
Entrepreneurs	68	6.17%
Farmers/Fishermen	5	0.45%
Private employees	135	12.25%
Students/College students / Unemployed	431	39.11%
Marital Status		
Married	529	48.00%
Single	552	50.09%
Divorced/Widowed /Widower	21	1.91%
Province		
Nangroe Aceh Darussalam	214	19.42%
North Sumatera	13	1.18%
West Sumatera	16	1.45%
Riau	2	0.18%
The Riau Islands	5	0.45%
South Sumatera	4	0.36%
Bengkulu	1	0.09%
Lampung	5	0.45%
Banten	14	1.27%
The Special Capital Region of Jakarta	40	3.63%
West Java	35	3.18%
Central Java	79	7.17%
The Special Region of Yogyakarta	21	1.91%

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Category	Frequency (n)	Percentage (%)
East Java	446	40.47%
Bali	8	0.73%
West Nusa Tenggara	4	0.36%
East Nusa Tenggara	1	0.09%
West Kalimantan	16	1.45%
Central Kalimantan	89	8.08%
South Kalimantan	5	0.45%
East Kalimantan	3	0.27%
North Sulawesi	2	0.18%
West Sulawesi	5	0.45%
Central Sulawesi	20	1.81%
Southwest Sulawesi	2	0.18%
South Sulawesi	45	4.08%
Maluku	2	0.18%
North Maluku	1	0.09%
Papua	4	0.36%
Total	1,102	100.00%

This study used online questionnaires, so it only reached respondents who have access to technology and understand how to fill out questionnaires online. Although this presented a limitation to this study, online questionnaires are quick and convenient to use. In the future, another study could use hard-printed questionnaires to reach other respondents who cannot use technology.

Respondents' Knowledge

Knowledge is the consciousness of the human self-gained directly from life. An individual's knowledge comes from a process of learning attitude and behavior through teaching and training as influenced by the educational level of the individual or their community and includes the input of media that are designed to provide information to the public (Kast and Rosenzweig, 2003).

Health behavior is influenced by many factors, including knowledge, expectations of attitude change and behavior change. Knowledge is gained from an individual's own experience or that of others. Knowledge causes someone to obtain additional information through the use of common sense (Notoatmodjo, 2012). Individuals who have information will be able to determine how to react and make decisions when encountering a problem (Ahmadi, 2013).

The implementation of social distancing strategies should be recommended as a way of mitigating the COVID-19 pandemic all over the world. Epidemiological studies with various models have shown that social distancing can reduce the number of respiratory tract infection cases in diseases such as influenza. Droplets produced by coughing and sneezing are the primary sources of influenza transmission, thus social distancing can reduce the risk of person-to-person transmission that can occur at a distance of 3–6 feet (Ahmed et al., 2018).

This study showed that the majority of the respondents (99%) had good knowledge of the use of social distancing to prevent COVID-19 transmission (Table 2). Since most of the respondents were either bachelor's, master's, or doctoral graduates, this is not surprising. However, this is one of the limitations of this study in that it only reached the community who understand technology. These findings are in accordance with what is stated in the Handbook of Health Economics. Many experts in the fields of economics, epidemiology, and public health have determined the relationship between health and education. This relationship does not depend on whether health is identified as health status or health behavior but it is clear that well-educated people are

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healthier and always engage in healthier behavior (Cowell, 2006).

Factors that influence the attainment of knowledge include educational level, the type of information, culture, and experience (Kapur, 2018; Sukanto, 2000). This study was conducted by online survey and the majority of respondents had completed higher education, so they were able to acquire any information about social distancing that was provided by the internet through social media more easily and quickly. All this may have influenced the level of knowledge found in this study.

Health literacy refers to managing individual behavior with regard to healthcare, disease prevention, and health promotion, with the health status of being sick, being at risk, and getting healthy. Health cognition is significant in enhancing the prevention and control of infectious diseases. Health knowledge and behavior are important components of health cognition. Health information can improve personal knowledge of infectious diseases and support the development of positive behaviors towards social distancing as a means of preventing and controlling infectious diseases. Health advancement relies on health information, which depends on health knowledge. Health information effectively includes information about infectious diseases. School health information programs not only provide students with knowledge and encourage appropriate behavior towards infectious diseases but also benefit the school community more widely. Therefore, health information education must strengthen the community's health cognition and improve personal knowledge, too (Wang *et al.*, 2018).

An individual's knowledge of social distancing is expected to affect their attitudes and actions towards the social distancing policy to prevent the transmission of SARS-CoV-2 as the agent of COVID-19. This is consistent with the research conducted by Saunders-Hastings et al. (2016), which found that by enhancing knowledge of pandemic disease transmission, various interventions can strengthen the effectiveness of individual strategies to prevent a pandemic.

Table 2. Distribution of Indonesian Knowledge, Attitude, and Behavior Related to Social Distancing.

Components	Frequency (n)	Percentage (%)
Knowledge		
Good	1,096	99%
Sufficient	6	1%
Total	1,102	100%
Attitude		
Positive	646	59%
Negative	456	41%
Total	1,102	100%
Behavior		
Good	1,029	93%
Sufficient	73	7%
Total	1,102	100%

Respondents' Attitudes

Human attitude is a predictor of normal behavior, although other factors such as environment and personal confidence may affect it. It means that attitude will determine actions, but sometimes attitude is not reflected in action. Consideration of whether something is good or bad will impact personal action. According to Anwar (1988), social attitudes are generated by social interaction. Through social interaction, individuals display a certain attitude towards a psychological object encountered. Various factors can influence attitudes, e.g., personal experiences, culture, information, educational institutions or religious institutions, as well as emotional factors within individuals. Attitude alteration occurs when data can be understood, accepted, and approved (Anwar, 1988).

This study showed that 59% of the respondents had positive attitudes towards

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social distancing as a non-pharmaceutical prevention of COVID-19 transmission in Indonesia (Table 2). The respondents' educational and occupational attainment, such as bachelor graduate or civil servant, influence their positive attitudes towards social distancing. Community attitudes towards COVID-19 prevention in this study support Sarwono's study (2007), which stated that attitude change could be achieved when individuals gain additional information about an object through persuasion and modification by the environment. Information in this context refers to that concerning what the importance of social distancing is. Anwar (1988) stated that knowledge has an important role in defining and enhancing an attitude. That is to say, knowledge will build up an attitude, as shown in Herman's study (Herman et al., 2015).

Social distancing is one of the pandemic strategies against COVID-19 urged by the World Health Organization and recognized by China and other countries during the COVID-19 pandemic. By providing a lot of information about infection and disease, it is expected that the community will become aware of and comply with all government regulations aimed at reducing the morbidity rate.

Attitude is a tendency that has not been accompanied by concrete actions towards behavior (Glass *et al.*, 2006). Attitude is assumed to be an evaluative predisposition that significantly determines how individuals act, but the real attitudes and actions are often very different (Ajzen and Fishbein, 2000). The real action is determined not only by attitude, but also by various external factors (Glass *et al.*, 2006).

This study showed that the majority of the respondents had a good attitude, meaning they were aware of the importance of social distancing. Attitude has three main components, i.e., awareness, feelings, and behavior (Robbins, 2007). Saying that "social distancing is important" is an evaluative statement. This opinion is a cognitive component of attitude, which determines the level of attitude (affective component). Feelings are emotional segments (feelings of an attitude) reflected in statements, such as "I will do social distancing," and they can produce final behavior. The behavioral components of an attitude aim to change behavior so as to adjust to a particular condition (Robbins, 2007).

Attitudes are more likely to be stable and able to reflect behavior when the evaluative implications of the initial information are related to behavior. Two factors can influence the formation of an attitude. First, people can easily receive information (knowledge). Second, thinking about a problem can increase the tendency to form an attitude (Albarracín et al., 2001).This study is in line with the theory that most respondents have good knowledge about social distancing so they have good attitudes and behaviors in the discipline of doing social distancing.

Respondents' Behaviors

Behavior refers to personal action and reflection produced by the synchronization of the anatomical, physiological and psychological systems (Pawelek et al., 2015). There are three domains related to human behavior, namely the cognitive, affective, and conative domains. Elements of behavior consist of visible knowledge (cognitive) and attitude (affective), behaviors (psychomotor) and real action (action). The variety of behavior patterns and the process of its occurrence are important for all individuals, and can be influenced by pressure, motivation, and external support (Pawelek et al., 2015).

This study identified 93% of the respondents had good behavior towards social distancing for preventing the outbreak of COVID-19 in Indonesia (Table 2). Correspondence between information

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and initial attitude will guide how individuals behave in the future. Previous research revealed that attitudes would produce better behavior if attitudes and behavior correspond to target, context, time, and action. Other studies have also established that attitudes can produce good behavior when individuals rely on information that is relevant to the decision being made (Glass et al., 2006).

Health behavior is influenced by internal factors, including knowledge, perception, emotions, and motivation, and external factors (the physical and non-physical environment). Cognitive knowledge is a very important domain for the formation of an individual's behavior. Knowledge of social distancing will underlie attitudes towards taking preventive actions and influence behavior (Darker et al., 2010). According to this study, the Indonesian community had good knowledge of social distancing as well as good attitudes and behaviors with respect to social distancing during the COVID-19 pandemic.

A previous study showed that many conventional aspects of human behavior depend on cultural norms so different cultures may respond with many alternative actions. The discovery of a new infectious disease may increase motivational pressures and change the level of behavior, depending on various factors such as the current information about a disease (knowledge) (Lewnard and Lo, 2020; Pawelek et al., 2015). There were 29 provinces participating in the present study, but despite having a diverse culture, the Indonesian community mostly showed good behavior towards social distancing.

Based on the Theory of Planned Behavior (TPB), intention is the best predictor of behavior (Barley and Lawson, 2016). Intention develops after an individual evaluates a change in behavior. This evaluation is influenced by attitudes, subjective norms and behavior control. Society needs more than information to make behavioral changes. Public awareness of the importance of social distancing is influenced by various factors, including how much self-control people possess, which will be important for achieving a change in behavior (Barley and Lawson, 2016).

Health behavior depends on assumed intentions. Intention becomes a direct antecedent (the forerunner) of behavior (Ajzen, 2002). It depends on attitudes towards behavior, subjective norms, and perceived behavior control in accordance with the TPB. Banerjee (2020) proved that the intention of healthy Singaporean lifestyle behavior is positively related to attitudes, subjective norms, descriptive norms and behavioral control, in addition to the determinants of interpersonal communication and the mass media. Behavioral control based on the TPB originates from the Theory of Self-Efficacy proposed by Bandura, who derived it from Social Cognitive Theory (SCT). Reciprocal determinism is a central concept in SCT, which argues that behavior is the result of influences generated from within and outside, such as environmental factors (Bandura, 1986). This is in line with the results of this study that showed that the respondents who had good knowledge also had positive attitudes and good behavior.

In addition, powerful behavioral forces arise from the presence and behavior of other individuals. Behavior is influenced by individuals' perceptions of how other people think they should behave in a particular situation as well as of observation of how others behave. For example, it is reasonable to expect handshaking in some contexts because handshaking is a core expectation for social interaction and is perceived as normal on occasions such as a graduation ceremony. Moreover, given the novelty of the SARS-CoV-2 at this moment and the lack of reported cases, it is likely that most

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of the respondents were uncertain about the actual degree of risk faced, the importance of prevention behaviors, and the extent to which no handshaking would reduce risk. The optional handshaking instruction did nothing to reduce the ambiguity about the behavioral choice. When the appropriate behavioral response is ambiguous, and the objective guides to behavior are not available, individuals observe the behavior of others to infer the appropriate action. Thus, seeing handshaking during graduation ceremonies may have made people think that handshaking is the right action, thereby increasing pressure on mutual handshaking (Chaiklin, 2011).

The social forces in the situation combine to create a response conflict. Although the public health guidance to reduce disease transmission encourages individuals to avoid shaking hands, the social and situational demands of the graduation ceremonies encourage the opposite behavior, thereby rendering an optional handshake policy ineffective (Robinson *et al.*, 2009).

The cross-tabulation between knowledge and attitude showed that of the respondents who had good knowledge, more than half (58%) had a positive attitude. It means that the Indonesian community have good knowledge and a positive attitude. In terms of attitude and behavior, it indicated that almost all of the respondents who had a positive attitude (96.7%) also had good behavior. This means that the Indonesian community has a positive attitude with good behavior. Furthermore, the results of cross-tabulation between knowledge and behavior indicated that nearly all of the respondents who had good knowledge (93.3%) had good behavior. Overall, this study showed that the Indonesian community had good knowledge along with good behavior (Table 3).

Given that the role of knowledge showed a positive influence on behavior, this is also relevant to Bannet's Theory in Swan and Stepp (1979). This theory suggests that the behavior of those surrounding an individual will influence their behaviour, based on knowledge, attitudes and worth acceptance. Thus, behavior related to social distancing as a means of infectious disease prevention in the community always relies on knowledge of infectious disease prevention that has been broadcast through health information or health promotion. Furthermore, the results of this study, in accordance with Herman's study (2015), showed that knowledge of health and motivation to obtain information about the infectious disease could improve the prevention and control of the infectious disease (Herman *et al.,* 2015).

The knowledge–attitude–behavior model modifies human health-related behaviors by dividing changes into three continuous processes, i.e., knowledge acquisition, belief generation and behavior formation (Liu *et al.,* 2016). The knowledge–attitude–behavior model considers that knowledge is essential for effecting changes in behavior, and, thus, individuals can obtain knowledge and skills through learning (Liu et al., 2016).

This is the first study in Indonesia to identify knowledge, attitude and behavior towards social distancing. This study explained that a positive attitude results in good behavior. Attitude is an action of positive or negative tendency related to psychological objects. Real attitude shows the connotations of the suitability of reactions to certain stimuli, which in everyday life are emotional reactions. According to Thurston (1928), attitude as an action of a positive or negative tendency is associated with psychological objects. Actual attitudes show the connotation of the suitability of reactions to certain stimuli which in everyday life are emotional reactions to social stimuli. Attitude is the

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readiness to react to objects in a particular environment as a recognition of the objects. Therefore, conducting social distancing requires the community's readiness.

Table 3. Cross-Tabulation between Knowledge, Attitude, and Behavior towards Social Distancing in Indonesia.

Knowledge	Attitude				Total
	Negative		Positive		
	n	%	n	%	
Sufficient	4	66.7	2	33.3	1,102
Good	452	41.2	644	58.8	
Attitude	**Behavior**				**Total**
	Sufficient		Good		
	n	%	n	%	
Positive	21	3.4	625	96.7	1,102
Negative	52	11.4	404	88.6	
Knowledge	**Behavior**				**Total**
	Sufficient		Good		
	n	%	n	%	
Sufficient	0	0	6	100	1,102
Good	73	6.7	1,023	93.3	

Attitude is one of the variables that influence intention. Attitude towards behavior is one of the strong determinants of a weak intention to behave. A positive attitude towards behavior will increase the intention to behave and recognition of the behavior. Conversely, a negative attitude toward behavior will reduce the intention to behave and recognition of the behavior (Huda et al., 2012). This finding is consistent with the results of this study which showed that the Indonesian community had a positive attitude along with good behavior. Indeed, the influence of attitude on behavior is reinforced through intention. In addition to perceived behavior control, a positive attitude influences strong intention to perform social distancing in the community. A study by Jannuzzi et al. (2020) showed attitude and subjective norms together explain 30% of the variability in intentions. Jannuzzi et al. defined attitude as a psychological construct, a mental and emotional entity that inheres in, or characterizes a person. It is an individual's predisposed state of mind regarding a value, precipitated through a responsive expression towards oneself. A subjective norm is the perceived social pressure to engage or not to engage in a behavior. It is necessary to include motivational strategies and targeted strategies to strengthen attitude and subjective norms in designing an intervention (Ferreira and Pereira, 2017).

CONCLUSION

This study concluded that, in general, the Indonesian community had good

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knowledge, positive attitudes, and good behavior towards social distancing to prevent the transmission of the COVID-19 pandemic in Indonesia. We suggest that these could inhibit the spread of COVID-19 in Indonesia, and, thus, the pandemic will be rapidly brought under control.

CONFLICT OF INTEREST

The authors state that there is no conflict of interest for this article.

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LETTER TO EDITOR

CHALLENGES OF STAY-AT-HOME POLICY IMPLEMENTATION DURING THE CORONAVIRUS (COVID-19) PANDEMIC IN INDONESIA

Tantangan Implementasi Kebijakan Tetap Di Rumah Selama Pandemi Virus Corona (COVID-19) di Indonesia

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The coronavirus disease 2019 (COVID-19) has been labelled as a global pandemic disease by the World Health Organization. The number of infections in Indonesia rose significantly to 8211 cases, and 689 coronavirus deaths were reported on April 24th, 2020 (CNN Indonesia, 2020). We knew that the Indonesian Government has made numerous strategies to control the spread of infection in our community, but implementation plans were limited in addressing the challenges of stay-at-home policy. These challenges may include economic impact due to COVID-19, struggles for work-from-home, and leaders' ability to influence the society.

Economic Impact due to COVID-19

On March16th, 2020, the Ministry of Administrative and Bureaucratic Reform announced new regulations for controlling the spread of COVID-19 in the community. These regulations explained about the instructions to stay-at-home or work–from-home during the COVID-19 outbreak (Ministry of Administrative and Bureaucratic Reform, 2020). All employees were encouraged to work from home unless they had to be in public areas for reasonable excuses.

Among 273 million of Indonesians instructed to stay-at-home, a major impact may strike the Indonesian economy beyond the spread of the COVID-19 itself (World Population Review, 2020). As a developing country, Indonesia has 760 thousands of self-employed workers who should continue to work outside their home (Abdila, 2020). Although some self-employed workers can create a functional working space at home, they still need financial security which perhaps cannot be as much as when they work outside. Meanwhile, this social distancing regulation has affected many people especially who have to work outside, and thus they become unemployed for a lot of reasons (Nikola, 2020). It was reported 1.9 million of Indonesian people have lost their jobs due to weak management crisis during this pandemic (Shalilah, 2020).

Therefore, addressing the economic impact of COVID-19 could be done through stay-at-home practice. In addition to this, incentives and rewards shall be prepared to protecteconomic activity (Fenichel, 2013). Lately, Indonesian Government also provided social security program for those affected by COVID-19. The Government released Family Hope Program (Rp. 37.4 trillion), Social Assistance for Staple Food (Rp. 2.2 trillion), Village Fund (Rp. 21 trillion), Cash Labor-Intensive Program (Rp. 16.9 trillion),

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and Pre-Employment Card Program (Rp. 360 billion). These programs were expected to assist the community to manage the economic impact due to COVID-19 (Secretariat of the Republic of Indonesia, 2020).

Struggles for Work-From-Home

During the COVID-19 pandemic, many employers have recommended their staffs to work-from-home. Some employees are happier to work at home as they have already been familiar with multimedia technology to effectively communicate with other employees and employers. Zaenudin (2019) explained that there were still 36% of Indonesians who could not use technology. Additionally, a previous study by Flores (2019) reported that more than half of employees realized that fostering collaboration with co-workers during work-from-home can be challenging since they have difficulties in separating work-life and home-life.

Leaders' Influence

The Indonesian Government has already taken numerous strategies to combat COVID-19, such as contact tracing, rapid tests, and adequate treatments. These strategies worked better particularly at regional level than central government level. The central government was indecisive with the situations and made decisions too late, and thus the COVID-19 spreaded so fast (The Jakarta Post, 2020). Consequently, leaders who can make a quick and firm decision with regards to tackling the COVID-19 pandemic. Karakostas and Zizzo (2016) studied factors related to compliance and authority power. They found that pressures from the management could increase the compliance rate by up to 70%. Power could advance the compliance culture among the society.

Overcoming Challenges of Stay-At-Home Policy

Nowadays, people have become more and more aware of their health, but icoordination that goes beyond our communities has to be strengthened. The importance of stay-at-home policy has to be reinforced even though it might become challenges during the coronavirus (COVID-19) outbreak.

Stay-at-home policy implementation has become more complex, but the Government still has chances to manage this policy more effectively. Theory of Compliance Management mentions three C's that support this compliance culture, e.g.,communication, confirmation, and correction. These key components have benefits to boost compliance in maintaining daily activities (Lestari *et al.*, 2015). This 3Cs concept can also be used for managing the implementation plans of stay-at-home policy.

Raising public awareness of COVID-19 health issues is not easy as the society may differently interpret the importance of stay-at-home policy for their own health. Therefore, people were urged to follow the Government's advice and instruction about COVID-19 (Abdi, 2020).

Based on its theory, effective communication shall begin at the top-level management (Bussmann *et al.*, 2019; Hu *et al.*, 2012). Many leaders have their own personal traits and they are not necessarily admirable. Indonesia needs more charismatic, knowledgeable, and enthusiastic leaders to deliver informative speeches as a proactive approach to avoid negative impacts of miscommunication and increase the community compliance as well. The public figures can work with people in the community and influence their health

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behaviours to achieve the desired goals (Nikoloski, 2015; Supriyanto *et al.*, 2020). For example, Tri Rismaharani, a charismatic leader from Surabaya City, East Java, can effectively communicate with the society to follow the government advice as trusted information sources. She also tried to reduce stress by providing certain facilities for low-income communities (Yasmin, 2020).

Confirmation of the continuous monitoring program could be done to equally support preventive, promotive, curative, and rehabilitative measurements. For instance, Indonesia Ministry of Health conducted COVID-19 monitoring program in which all societies could see tracing progress and the government work on https://covid-monitoring.kemkes.go.id/ (Indonesian Ministry of Health, 2020). Meanwhile, in Taiwan, planning, monitoring, and evaluation programs were done to control public attitudes and beliefs towards false information via conventional media (newspapers, radios, TVs) and modern media (internet) as communication and dissemination tools. Besides, these conventional and social media were in use to increase public awareness and participation in health. The Taiwanese Government routinely shared transparency data on health issues and updates of the situations on media (Hsu *et al.*, 2017).

Further, correction involves noticing any changes and providing effective complaint management strategies can be taken to evaluate the stay-at-home policy implementation (Lestari *et al.*, 2015). The assessments by Indonesian Government can be planned and coordinated to ensure that the policy is effective to combat COVID-19.

The COVID-19 pandemic has persistently affected all biological, psychological, social, and cultural aspects. The COVID-19 case fatality rate is higher than the flu (Wahyuni, 2020). Until now, there have been still no medicines proven to treat the disease (Gallagher, 2020). Many people were so overwhelmed by the abundance of stressing information from social media and internet, which poses a major threat to public mental health. They responded differently from feeling low mood, anxiety, panic attacks and sleep deprivation (Elvira, 2020; Dong and Bouey, 2020). The World Health Organization (2020) provided guidelines to support and prevent people from developing mental health issues, for example, supporting each other to respond the impact of stress due to economic loss during the pandemic. On the other hand, motivation or willingness to comply with the policy was the most important factors for successful policy implementation (Weske *et al.*, 2018).

From what have been explained throughout this article, it can be concluded that compliance with stay-at-home policy management involves the role of top management level and exerts incentives to public. Trusted information and supports are required to maintain the society's mental health and well-being.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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LITERATURE REVIEW

CRITICAL PREPAREDNESS, READINESS, AND RESPONSES TO THE COVID-19 PANDEMIC: A NARRATIVE REVIEW

Kesiagaan, Kesiapan, dan Tanggapan Kritis Pandemi COVID-19: Tinjauan Naratif

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ABSTRACT

Background: COVID-19 was declared a pandemic by the World Health Organization (WHO). Countries around the world took action to slow the spread of the disease and avoid overwhelming their health systems. The WHO issued interim guidance on critical preparedness, readiness, and response actions against COVID-19 to help countries prepare for and respond to the pandemic.
Aim: This study reviewed how Australia, Singapore, Sri Lanka, and the United Kingdom implemented the actions and priority areas of work as described in the interim guidance issued by the WHO under two disease transmission scenarios, namely the “no cases” and “sporadic cases” scenarios.
Methods: A non-systematic narrative review was conducted using relevant documents available from governmental websites. The data generated by this search were compiled, and the information was synthesized using the terminology from the WHO interim guidance on critical preparedness, readiness, and response actions against COVID-19. The study focused on the actions and priority areas of work given by the WHO interim guidance under scenarios of “no cases” and “sporadic cases.”
Results: The study found that there were differences in how each country implemented the strategic actions and priority areas of work identified by the WHO interim guidance. The key differences included the timeliness of emergency response plan activation and the kinds of case management strategies used, such as contact tracing, the management of asymptomatic contacts, isolation, quarantine, and the selection of individuals for laboratory investigation. In addition, there were differences in the availability and implementation of business continuity plans.
Conclusion: Political and health authorities worldwide need more robust mechanisms for preparing and coordinating responses to contagious diseases of a similar nature to COVID-19. The occurrence of even one case should trigger the implementation of stringent measures designed to prevent transmission and initiate the actions and priority areas of work as stated in the WHO interim guidance for COVID-19.

Keywords: pandemics, emergency response, health policy, COVID-19, emergency preparedness.

ABSTRAK

Latar Belakang: *Virus Corona 2019 (COVID-19) dinyatakan sebagai pandemi oleh Organisasi Kesehatan Dunia (WHO). Negara-negara di dunia mengambil langkah untuk memperlambat penyebaran dan mencegah sistem kesehatan yang tak terkontrol. WHO mengeluarkan pedoman sementara tentang kesiagaan, kesiapan, dan tanggapan kritis COVID-19 untuk membantu tingkat kesiagaan dan kesiapan.*
Tujuan: *Penelitian ini mengulas bagaimana Australia, Singapura, Sri Lanka, dan Inggris mengambil tindakan dan area prioritas kerja seperti halnya dijelaskan di pedoman sementara yang dikeluarkan oleh WHO pada dua tahap pertama skenario penularan penyakit.*
Metode: *Penelitian ini merupakan tinjauan naratif non-sistematis. Dokumen yang relevan yang tersedia di website dipilih. Data yang digeneralisasi disatukan, dan informasi disintesa dalam kerangka kerja kesiagaan, kesiapan, dan tanggapan kritis COVID-19. Selanjutnya, skenario “tidak ada kasus” dan “kasus yang sporadis” dianalisis berdasarkan tindakan dan area prioritas kerja yang tercantum dalam kerangka kerja tersebut.*
Results: *Penelitian ini menemukan adanya perbedaan dalam pendekatan pelaksanaan tindakan dan area prioritas kerja strategis, misalnya pengerahan dan ketepatan melaksanakan rencana tanggap darurat, variasi dalam strategi pengendalian kasus seperti pencarian jejak kontak, pengendalian kontak tanpa gejala, isolasi, karantina dan pemilihan pihak yang terlibat dalam uji laboratorium. Selain itu, perbedaan terdapat pada ketersediaan dan pengerahan rencana keberlanjutan bisnis.*

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Kesimpulan: *Kewenangan kesehatan dan politik di seluruh dunia membutuhkan mekanisme yang kuat untuk kesiagaan, tanggapan, dan koordinasi penyakit menular dengan ciri yang serupa. Bahkan kejadian satu kasus harusnya mendorong adanya pengukuran pencegahan transmisi yang tak terkendali serta menginisiasi tindakan dan area prioritas kerja sebagaimana tercantum dalam pendoman semnetara WHO.*

Kata kunci*: pandemi, tanggap darurat, kebijakan kesehatan, COVID-19, kesiagaan darurat.*

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INTRODUCTION

Coronavirus is a virus with pandemic potential that can cause severe acute respiratory distress and considerable human fatalities, leading to public health emergencies (Fineberg, 2014). COVID-19 is a new coronavirus that recently occurred in late December 2019 in Wuhan in the Hubei province of China in December 2019. On January 30th, 2020, the World Health Organization (WHO) declared a Public Health Emergency of International Concern, and a pandemic status was declared on March 11th, 2020 (WHO, 2020d). The WHO has worked tirelessly to help the affected countries increase their capacity to prepare for and respond to the pandemic by consulting with scientists, public health decision makers, the media, and civil society representatives (WHO, 2020a).

The COVID-19 pandemic has spread rapidly to countries beyond China and has required robust measures to be put into place to prevent its further transmission. The WHO has made many recommendations regarding risk communication and community engagement; active case-finding strategies; quarantine and isolation; disease surveillance; public health measures including hand hygiene, respiratory and cough etiquette, and social distancing; activities to prevent and control infection; laboratory testing; and clinical management. The WHO has defined four transmission scenarios for COVID-19: No cases, sporadic cases, clusters of cases, and community transmission. The interim guidance issued by the WHO helps countries to develop their preparedness, readiness, and response actions against COVID-19. Many countries have enacted a combination of measures to delay the onset of patient surge and reduce community spread (WHO, 2020c).

The transmission of COVID-19 can be slowed or stopped, allowing countries more time to increase the capacity of their health and laboratory systems to better manage the pandemic (WHO, 2020c). The WHO guidance on critical preparedness, readiness, and response actions for COVID-19 discusses several strategies that countries can implement to slow the spread of the disease and prevent their health systems from becoming overwhelmed. Australia, Singapore, Sri Lanka, and the United Kingdom (UK) were selected for review in this study on the basis of their locations in different geographical regions, their relative distances from the initial epicenter of the disease, and the authors' familiarity with the health systems of each country.

The WHO guidance on critical preparedness, readiness, and response actions for COVID-19 describes a number of actions in different priority areas of work, namely emergency response mechanisms; risk communication and public engagement; case finding, contact tracing, and management; surveillance; public health measures; infection prevention and control; laboratory testing; case management strategy; case management recommendations according to case severity and risk factors; and societal response.

Differences in the actions taken by individual countries in the priority areas of

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work will have a negative impact on transmission control and disease management (WHO, 2020b). Further exploration of these areas will make it possible to identify efficient and effective strategic approaches for each priority area and will improve future preparedness and response planning.

The COVID-19 pandemic has had a significant impact on the economies of all countries, and it will have an even greater economic impact on developing economies in the short run (Atkeson, 2020). Therefore, business continuity plans should be implemented to minimize the economic damage caused by the pandemic.

The aim of this study was to review how Australia, Singapore, Sri Lanka, and the UK have implemented the actions and priority areas of work as given by the WHO interim guidance on COVID-19 under two transmission scenarios, namely “no cases” and “sporadic cases.”

METHOD

We conducted a non-systematic narrative review of the policy documents, policy guidelines, and public notices that were issued by the governments and other key policymakers of the UK, Australia, Singapore, and Sri Lanka between December 2019 and April 2020, and which were available on official governmental websites under the heading of COVID-19. The major government websites reviewed in this study were those operated by the Australian Department of Health, the Ministry of Health in Singapore, the Ministry of Health and Indigenous Medical Services in Sri Lanka, and the UK Department of Health and Social Care. All documents that were published in English were included in the review.

The research team made lists of the key documents and guidelines relating to strategies of critical preparedness, readiness, and response actions as categorized and defined in the WHO interim guidance for COVID-19. The search strategy used the terminology for actions and priority areas as given by the WHO interim guidance (WHO, 2020c). The literature search was conducted between March 19th and April 8th, 2020.

After thoroughly studying all of the websites, the research team extracted and organized in chronological order all of the key findings and phrases that pertained to the actions and priority areas of work as defined in the WHO framework. The results for each country were synthesized by individual experts using codes developed by the research team, and the final results were reviewed by all participants in a series of online conferences. Because the research team began its literature search during the early stages of the pandemic, there was limited formal scientific literature available. The team focused on the actions taken by each country that were described in detail on the governmental websites. The research team conducted a non-systematic narrative review of the relevant documents by using the website addresses assigned to each government document. The data were synthesized on the basis of the actions and priority areas of work for two transmission scenarios defined by the WHO, namely “no cases” and “sporadic cases.” This was done because each country was in a different phase of transmission at the time of the study, and because each country’s primary aim had been to prevent patient surge and community spread. The first two phases of transmission were also selected because it is of paramount importance that preventative actions be taken in a timely fashion during them.

The study considered two transmission scenarios, namely “no cases” and “sporadic cases.” A country was considered to be in the “no cases” scenario from the time at which the first COVID-19 patient was reported in China to the time at

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which the first COVID-19 patient was reported in that country. The first case could either be imported or locally detected. A country was considered to be in the "sporadic cases" scenario from the time at which one or more cases (imported or locally detected) were reported to the time at which there were clusters of cases found, as defined by time, geographic location, or common exposure. Since different countries used different criteria to define the endpoint of the sporadic transmission scenario and the starting point of the cluster transmission scenario, the endpoint of sporadic transmission was identified using country-specific information, namely 100+ reported cases, epidemiological case mapping, and pre-defined color coding.

RESULTS AND DISCUSSION

In terms of their economic status, Australia, Singapore, and the UK are considered to be high-income while Sri Lanka is classified as an upper-middle-income country (The World Bank, 2019). In addition, the curative health systems of Australia, Singapore, and the UK are better developed than that of Sri Lanka. However, Sri Lanka has a well-developed primary health system with a health unit system in community health services that can be quickly deployed in a public health emergency (Perera and Perera, 2017).

As shown in Table 1, each country took steps during the "no cases" and "sporadic cases" scenarios that were in line with the actions and priority areas of work as defined by the WHO framework. The following discussion is organized by thematic areas, and the responses of each country under both transmission scenarios are presented along with comments by the research team members.

Emergency Response Mechanisms

There were differences in the activation of emergency response mechanisms by each country. Only Singapore activated its emergency response mechanisms during the "no cases" scenario. We attribute the swift response of Singaporean authorities to Singapore's high level of population exchange with China, its role as a global travel hub and resulting susceptibility to the importation of communicable diseases, and its previous experience in dealing with tropical infections, influenza, and SARS (Lin et al., 2020). We recommend further exploration of the factors that can affect a country's level of alertness and speed in activating emergency response mechanisms. The other countries considered in this study might have been slower to respond to COVID-19 because of their geographical locations and their lower degree of interconnectedness with China. There is a need for international authoritative agencies to develop a mechanism to alert countries to the potential risk that a pandemic poses based on their locations, the movement of their populations, and their interconnectedness with other countries.

Risk Communication and Public Engagement

There were also differences in how each country communicated risk to the public. While all countries communicated risk to institutional health care staff when the COVID-19 outbreak had reached an alarming level, only Sri Lanka and Singapore communicated risk to travelers, who are potential agents of disease transmission. All countries implemented multifaceted communication campaigns during the "sporadic cases" scenario. The differences in how each country implemented risk communication may be related to the different strategies that each country used. Singapore and Sri Lanka may have prioritized addressing public

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health concerns and mitigating the projected surge in patients over other considerations, such as economic impact and maintaining the strong appearance of their own curative health sector.

Case Finding, Contact Tracing, and Management

All countries practiced case finding, contact tracing, and management. During the “no cases” scenario, Sri Lanka took additional steps to manage potential contacts. With the exception of the UK, all countries implemented strong public health measures—including quarantine—during the “sporadic cases” scenario. It appears that Sri Lanka was less concerned with maintaining individual rights and freedoms than with achieving its target of containing the outbreak. Sri Lanka’s strong bureaucratic and public management capacities may have contributed to its stringent level of contact management.

All countries considered in the study had a different response to case management. The differences in their responses may be the result of differences in their local contexts, socio-economic situations, levels of resources and experience, and the degree of political support for case management. Further study is needed to examine the factors underlying the disparate responses and the relative effectiveness of different approaches to case management.

Surveillance

All four countries activated their national surveillance systems during the “no cases” scenario. In addition, Singapore activated its sentinel surveillance system. While Australia, Singapore, and Sri Lanka extended their surveillance systems to trace and notify asymptomatic contacts, there is no evidence that the UK conducted contact tracing. The differences observed here might be the result of differences in the responsiveness of each country’s authorities and health system and differences in how much each country values freedom of movement and compliance with health guidelines. There is a need to implement a uniform surveillance system across the globe to retrieve information in a more timely and reliable fashion.

Public Health Measures

Prior to the later phase of the “sporadic cases” scenario, Australia and the UK adopted a non-persuasive approach to implementing public health measures, relying on effective risk communication to encourage self-isolation and social distancing. The public health response was more proactive and robust in Singapore and Sri Lanka in the "no cases" scenario, perhaps as a result of these countries’ governments being less oriented toward individual freedom. In addition, Singapore and Sri Lanka’s previous experience in controlling tropical diseases with a similar nature to COVID-19 contributed to their strong public health response to COVID-19 (Ooi et al., 2012). The different levels to which public health measures were implemented in each country may have negatively affected efforts to control the borderless COVID-19 pandemic. Further study is required to understand the rationale behind th different approaches.

Infection Prevention and Control

During the “no cases” scenario, all of the countries considered in this study raised the awareness of health staff toward COVID-19, but no country adequately prepared for the pandemic by stockpiling essentials, such as respiratory support systems and personal protective equipment (PPE).

The health systems of Australia, Singapore, and the UK sought to protect the elderly, a vulnerable group, by implementing special practices for the

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prevention and control of COVID-19 during the "sporadic cases" scenario. No such action was taken by Sri Lanka. This difference between Sri Lanka and the other three countries might be the result of Sri Lanka having lower awareness of the disease's spread and progression, less focus on the elderly by the health system, and an extended family social structure. The results of this review found that there was an insufficient supply of respirators and PPE and a lack of inclusive policies that spelled out specific measures targeting vulnerable populations.

Laboratory Testing

Early in the "no cases" scenario, Sri Lanka and Singapore used laboratory confirmation of suspected cases to detect the spread of COVID-19. This approach is described as the intensive measure of onward transmission (Bedford et al., 2020).

Although laboratory confirmation guidelines were given in all four countries, there were operational differences in the testing of asymptomatic cases. This difference led to speculation of how to test the cases by the public, healthcare workers, academics, and local and international decision makers. The WHO advised that intensified testing should be used to control the COVID-19 outbreak, and it stressed the importance of considering how laboratory services could be strengthened, distributed, and expanded to combat future pandemics of a similar nature. Health managers should ensure that all available resources in the system are coordinated and channeled to accomplish this. Future work should compare the relative economic benefits of early laboratory testing and case management.

Case Management Strategy

In accordance with the recommendations of the WHO, all four countries had triage protocols in place at the points of entry to the health system. Case management strategies and guidelines were prepared, and referral systems were adapted from existing emergency preparedness plans.

As a result of climate change and globalization, the pandemic spread of infections is inevitable. As such, global health systems should be alert to the emergence of even a single case of a disease. In the "no cases" scenario, none of the countries considered in this study increased the capacity of their health sector in response to the higher demand expected to result from the COVID-19 pandemic. However, Sri Lanka established a referral center for COVID-19 patients and allocated centers across the country—including the National Institute of Infectious Diseases Hospital in the capital city—to treat infected patients.

Case Management Recommendations by Case Severity and Risk Factors

The case management strategies of Singapore and Sri Lanka offered institutionalized care for mild to moderately ill patients, while health authorities in the UK provided institutionalized care only in severe cases. Australia and Sri Lanka adopted different strategies to isolate, or cohort, asymptomatic contacts. We found great heterogeneity in the pandemic case management strategies of the four countries. This may be due to context-specific factors, such as the robustness of the existing health systems, each country's past experiences with similar diseases, and the willingness of the public to comply with health interventions.

Societal Response

To minimize the impact of a pandemic on the economy, it is essential to prepare business and industry. However, business continuity measures were not adopted during the "no cases" scenario by any of the countries considered here.

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Because public health measures affected the routine operations of businesses and industry during the "sporadic cases" scenario, each country's government downplayed the economic impact of these measures. Although high-income countries have their own business continuity plans, low-income countries lack comprehensive plans of this kind. The results of this review, therefore, highlight the importance of helping low- and middle-income countries to develop business continuity plans and pool the risks related to business.

CONCLUSION

Since the WHO first declared a public health emergency on January 30th, 2020, health systems worldwide have had to engage with the actions and priority areas of work as outlined by the WHO interim guidance on critical preparedness, readiness, and response actions for COVID-19. Because China was the site of the first reported case of COVID-19, Australia, Singapore, Sri Lanka, and the UK have experienced different transmission scenarios and have responded differently with respect to their actions and priority areas of work.

As described in the WHO interim guidance, the "no cases" and "sporadic cases" scenarios for a particular country cover the span of time from the first reported case in China to the emergence of cases in that country."

The study found differences in the individual countries' strategies for implementing the actions in each priority area of work as defined by the WHO interim guidance for COVID-19. There was particular variation in the speed at which emergency response plans were activated and the kinds of case management strategies that were used, including contact tracing, the management of asymptomatic contacts, isolation, quarantine, and the selection of individuals for laboratory investigation. In addition, countries differed with respect to the availability and implementation of business continuity plans.

Given the massive scale of this pandemic, we suggest that political and health authorities worldwide need to have in place strong mechanisms to prepare for and respond to similar diseases in a coordinated way. The occurrence of even a single case of such a disease should trigger stringent measures to prevent its transmission and result in the implementation of the actions recommended by the WHO interim guidance, including technical advising, the management of resources (especially PPE), and the development of case management strategies, laboratory facilities, and internationally aided business continuity plans.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

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Table 1. Actions during “No Cases” and “Sporadic Cases” Scenarios for each WHO Priority Area of Work.

Action Areas			Australia	Singapore	Sri Lanka	United Kingdom
A) Priority areas of work	1. Emergency response mechanisms	No cases	Activated prevailing emergency response mechanisms.	Activated prevailing emergency response mechanisms.	Activated prevailing emergency response mechanisms.	Activated prevailing emergency response mechanisms.
			No documented evidence of a comparatively early emergency response mechanism.	Implemented a comparatively early emergency response mechanism.	No documented evidence of a comparatively early emergency response mechanism.	No documented evidence of a comparatively early emergency response mechanism.
		Sporadic cases	Activated an enhanced emergency response plan.	Activated an enhanced emergency response plan.	Activated an enhanced emergency response plan.	Activated an enhanced emergency response plan.
			Enacted a country-specific legal framework.	Enacted a country-specific legal framework.	Enacted a country-specific legal framework.	Enacted a country-specific legal framework.
			Established a specific funding framework for activities related to COVID-19.	Established a specific funding framework for activities related to COVID-19.	Established a specific funding framework for activities related to COVID-19.	Established a specific funding framework for activities related to COVID-19.
			Established multi-stakeholder decision-making committees.	Established multi-stakeholder decision-making committees.	Established multi-stakeholder decision-making committees.	Established multi-stakeholder decision-making committees.
	2. Risk communication and public engagement	No cases	Alerted and informed health care staff.	Alerted and informed health care staff.	Alerted and informed health care staff.	Alerted and informed health care staff.
			No documented evidence of engaging with vulnerable groups.	Targeted communications to reach vulnerable groups in the community.	No documented evidence of engaging with vulnerable groups.	No documented evidence of engaging with vulnerable groups.
			No documented evidence of addressing high-risk groups at entry points.	Communicated risk to high-risk groups at entry points.	No documented evidence of addressing high-risk groups at entry points.	No documented evidence of addressing high-risk groups at entry points.
		Sporadic cases	Implemented a national-level strategy for communicating with the public and the healthcare sector.	Implemented a national-level strategy for communicating with the public and the healthcare sector.	Implemented a national-level strategy for communicating with the public and the healthcare sector.	Implemented a national-level strategy for communicating with the public and the healthcare sector.
			Adopted a wide range of communication methods to reach a broad audience (e.g. electronic and print mass media	Adopted a wide range of communication methods to reach a broad audience (e.g. electronic and print mass media	Adopted a wide range of communication methods to reach a broad audience (e.g. electronic and print mass media	Adopted a wide range of communication methods to reach a broad audience (e.g. electronic and print mass media

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Action Areas		Australia	Singapore	Sri Lanka	United Kingdom
		and social media) and multi-sectoral guidelines for infection prevention and control.	and social media) and multi-sectoral guidelines for infection prevention and control.	and social media) and multi-sectoral guidelines for infection prevention and control.	and social media) and multi-sectoral guidelines for infection prevention and control.
3. Case finding, contact tracing, and management	No cases	Engaged in active case finding.	Engaged in active case finding.	Engaged in active case finding.	No documented evidence of active case finding.
		Formulated case definitions.	Formulated case definitions.	Formulated case definitions.	Formulated case definitions.
		Implemented programs targeting outbound travelers.	Implemented programs targeting outbound travelers.	Implemented programs targeting outbound travelers.	Implemented programs targeting outbound travelers.
		No documented evidence of mechanisms for contact tracing and management.	No documented evidence of mechanisms for contact tracing and management.	Initiated mechanisms for contact tracing and management.	No documented evidence of mechanisms for contact tracing and management.
	Sporadic cases	Updated and refined their case definitions.	Updated and refined their case definitions.	Updated and refined their case definitions.	Updated and refined their case definitions.
		Strengthened their case-finding strategies.	Strengthened their case-finding strategies.	Strengthened their case-finding strategies.	Strengthened their case-finding strategies.
		Published guidelines on how to isolate cases.	Published guidelines on how to isolate cases.	Published guidelines on how to isolate cases.	Published guidelines on how to isolate cases.
		Initiated mechanisms for contact tracing and management, extended contact tracing and isolation to the community level, and imposed quarantine.	Initiated mechanisms for contact tracing and management, extended contact tracing and isolation to the community level, and imposed quarantine.	Initiated mechanisms for contact tracing and management, extended contact tracing and isolation to the community level, and imposed quarantine.	Initiated mechanisms for contact tracing and management, extended contact tracing and isolation to the community level.
4. Surveillance	No case	Alerted their existing national surveillance system.	Alerted their existing national surveillance system.	Alerted their existing national surveillance system.	Alerted their existing national surveillance system.
		No documented evidence of activating the sentinel surveillance system.	Activated the sentinel surveillance system.	No documented evidence of activating the sentinel surveillance system.	No documented evidence of activating the sentinel surveillance system.
	Sporadic cases	Continued the formal surveillance system specific to COVID-19.	Continued the formal surveillance system specific to COVID-19.	Continued the formal surveillance system specific to COVID-19.	Continued the formal surveillance system specific to COVID-19.

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Action Areas		Australia	Singapore	Sri Lanka	United Kingdom
		Extended the surveillance system to trace and notify asymptomatic contacts.	Extended the surveillance system to trace and notify asymptomatic contacts.	Extended the surveillance system to trace and notify asymptomatic contacts.	No documented evidence of extending the surveillance system to trace and notify asymptomatic contacts.
5. Public health measures	No cases	No documented evidence of public health measures such as hand hygiene, respiratory hygiene/cough etiquette, and social distancing.	Published official correspondence to initiate public health measures such as hand hygiene, respiratory hygiene/cough etiquette, and social distancing.	Published official correspondence to initiate public health measures such as hand hygiene, respiratory hygiene/cough etiquette, and social distancing.	No documented evidence of public health measures such as hand hygiene, respiratory hygiene/cough etiquette, and social distancing.
	Sporadic cases	Predominantly imposed public health measures through public empowerment and individual discretion rather than law enforcement.	Imposed public health measures using law enforcement.	Imposed public health measures using law enforcement.	Predominantly imposed public health measures through public empowerment and individual discretion rather than law enforcement.
		Formulated and disseminated workplace-specific public health measures.	Formulated and disseminated workplace-specific public health measures.	Formulated and disseminated workplace-specific public health measures.	Formulated and disseminated workplace-specific public health measures.
		Imposed social distancing measures.	Imposed social distancing measures.	Imposed social distancing measures.	Imposed social distancing measures.
		Provided information on the use of face masks.	Provided information on the use of face masks.	Provided information on the use of face masks.	Provided information on the use of face masks.
		Implemented mechanisms for telephone triaging.	No documented evidence of telephone triaging.	No documented evidence of telephone triaging.	Implemented mechanisms for telephone triaging.
		Implemented an environmental cleaning and disinfection plan.	Implemented an environmental cleaning and disinfection plan.	Implemented an environmental cleaning and disinfection plan.	Implemented an environmental cleaning and disinfection plan.
		No documented evidence of large-scale environmental disinfection.	No documented evidence of large-scale environmental disinfection.	Performed large-scale environmental disinfection.	No documented evidence of large-scale environmental disinfection.
6. Infection prevention and control	No cases	Informed health staff about standard and airborne precautions for aerosol-generating procedures.	Informed health staff about standard and airborne precautions for aerosol-generating procedures.	Informed health staff about standard and airborne precautions for aerosol-generating procedures.	No documented evidence of informing health staff about precautions for aerosol-generating procedures.

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Action Areas			Australia	Singapore	Sri Lanka	United Kingdom
		Sporadic cases	Revised recommendations for COVID-19 infection prevention and control as the pandemic progressed. Published recommendations for COVID-19 infection prevention and control practices that targeted vulnerable populations.	Revised recommendations for COVID-19 infection prevention and control as the pandemic progressed. Published recommendations for COVID-19 infection prevention and control practices that targeted vulnerable populations.	Revised recommendations for COVID-19 infection prevention and control as the pandemic progressed. No documented evidence of publishing recommendations for vulnerable populations.	Revised recommendations for COVID-19 infection prevention and control as the pandemic progressed. Published recommendations for COVID-19 infection prevention and control practices that targeted vulnerable populations.
	7. Laboratory testing	No cases	Issued testing protocols for laboratory investigation of symptomatic cases admitted to the hospital. No documented evidence of testing asymptomatic contacts.	Issued testing protocols for laboratory investigation of symptomatic cases admitted to the hospital. Tested asymptomatic contacts.	Issued testing protocols for laboratory investigation of symptomatic cases admitted to the hospital. Tested asymptomatic contacts.	Issued testing protocols for laboratory investigation of symptomatic cases admitted to the hospital. No documented evidence of testing asymptomatic contacts.
		Sporadic cases	Updated the testing protocols as case definitions were revised.	Updated the testing protocols as case definitions were revised.	Updated the testing protocols as case definitions were revised.	Updated the testing protocols as case definitions were revised.
B) Case management strategy		No cases	Implemented triage protocols at the points of access to the health system. Prepared case management strategies and guidelines to treat patients affected by COVID-19. Set up a referral system.	Implemented triage protocols at the points of access to the health system. Prepared case management strategies and guidelines to treat patients affected by COVID-19. Set up a referral system.	Implemented triage protocols at the points of access to the health system. Prepared case management strategies and guidelines to treat patients affected by COVID-19. Set up a referral system.	Implemented triage protocols at the points of access to the health system. Prepared case management strategies and guidelines to treat patients affected by COVID-19. Set up a referral system.
		Sporadic cases	Implemented triage protocols at the points of access to the health system. Increased the capacity of the health sector in response to predicted demand associated with COVID-19. No documented evidence of assigning patients with COVID-	Implemented triage protocols at the points of access to the health system. Increased the capacity of the health sector in response to predicted demand associated with COVID-19. No documented evidence of assigning patients with COVID-	Implemented triage protocols at the points of access to the health system. Increased the capacity of the health sector in response to predicted demand associated with COVID-19. Sri Lanka designated 24 centers across the country to	Implemented triage protocols at the points of access to the health system. Increased the capacity of the health sector in response to predicted demand associated with COVID-19. No documented evidence of assigning patients with COVID-19

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Action Areas		Australia	Singapore	Sri Lanka	United Kingdom
		19 to specific hospitals; cases were managed within the existing infrastructure.	19 to specific hospitals; cases were managed within the existing infrastructure.	accommodate COVID-19 patients.	to specific hospitals; cases were managed within the existing infrastructure.
C) Case management recommendations by case severity and risk factors	No cases	Took steps to test suspected COVID-19 cases according to laboratory testing strategies.	Took steps to test suspected COVID-19 cases according to laboratory testing strategies.	Took steps to test suspected COVID-19 cases according to laboratory testing strategies.	Took steps to test suspected COVID-19 cases according to laboratory testing strategies.
		No documented evidence of implementing asymptomatic contact isolation by cohorting patients in community facilities.	No documented evidence of implementing asymptomatic contact isolation by cohorting patients in community facilities.	Implemented asymptomatic contact isolation by cohorting patients in community facilities.	No documented evidence of implementing asymptomatic contact isolation by cohorting patients in community facilities.
	Sporadic cases	Continued to test suspected COVID-19 cases according to laboratory testing strategies.	Continued to test suspected COVID-19 cases according to laboratory testing strategies.	Continued to test suspected COVID-19 cases according to laboratory testing strategies.	Continued to test suspected COVID-19 cases according to laboratory testing strategies.
		Used telephone triaging for home isolation of mild to moderately ill patients.	Organized institutionalized care for mild to moderately ill patients and developed intermediate care facilities for moderate cases.	Organized institutionalized care for mild to moderately ill patients.	Used telephone triaging for home isolation of mild to moderately ill patients.
		Took additional measures to isolate/cohort asymptomatic contacts at specific community facilities.	No documented evidence of asymptomatic contact isolation.	Took additional measures to isolate/cohort asymptomatic contacts at specific community facilities.	No documented evidence of asymptomatic contact isolation.
D) Societal response	No cases	Did not develop society and business continuity plans specific to COVID-19.	Did not develop society and business continuity plans specific to COVID-19.	Did not develop society and business continuity plans specific to COVID-19.	Did not develop society and business continuity plans specific to COVID-19.
	Sporadic cases	Developed society and business continuity plans.	Developed society and business continuity plans.	Developed society and business continuity plans.	Developed society and business continuity plans.

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	Provided financial assistance to affected businesses and industries. Implemented online awareness programs for COVID-19.	Provided financial assistance to affected businesses and industries. Implemented online awareness programs for COVID-19.	Provided financial assistance to affected businesses and industries. No documented evidence of online awareness programs.	Provided financial assistance to affected businesses and industries. Implemented online awareness programs for COVID-19.

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ORIGINAL RESEARCH

DATA TRANSPARENCY AND INFORMATION SHARING: CORONAVIRUS PREVENTION PROBLEMS IN INDONESIA

Transparansi Data dan Penyebaran Informasi: Masalah Pencegahan Virus Corona di Indonesia

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ABSTRACT

Background: Information and data of coronavirus outbreak from central government shared publicly was lacking. Such the lack of information and data has several negative impacts, such as confusion about the information experienced by local governments in accessing positive case data at the beginning of the pandemic and the red zone of the spread of the corona virus, "panic buying" by the community, and confusion on finding accurate data source to respond to the corona pandemic.
Aim: This study analyzed the Indonesian Government's attitude in providing information and data transparency of the latest coronavirus outbreak to the public in Indonesia.
Method: This study was qualitative research with a content analysis approach. Some information in this analysis was retrieved from COVID-19 official websites of the Indonesian Government and other Indonesian governmental institutions. To deepen the analysis, this study also featured South Korea and Singapore official websites. Other information was also obtained from mass media, social media, and policy briefs.
Results: Coronavirus data transparency in Indonesia was still insufficient as seen from the information and data on the official COVID-19 website. Since the first coronavirus case was announced on March 2nd to March 17nd, 2020, the Government also did not provide comprehensive data on the outbreak through official speeches. The process of case tracking was also not carried out openly. Some case tracking innovations were also released late and massive coronavirus tests for tracking cases also did not run optimally. Information and data delivered to the public through policy speeches were inconsistent and closed in nature.
Conclusion: Insufficient data transparency and information sharing can be seen from the availability of partial data on website, not optimal case tracking process, and inconsistent and instransparant information conveyed through policy messages.

Keywords: Coronavirus, data transparency, information, prevention.

ABSTRAK

Latar Belakang: *Informasi dan data yang disampaikan oleh pemerintah pusat kepada publik terkait perkembangan virus corona sangat minim. Minimnya data dan informasi memberikan dampak negatif seperti kebingungan yang dialami oleh pemerintah daerah dalam mengakses data kasus positif di awal pandemi dan zona merah penyebaran virus corona, "panic buying" pada masyarakat, dan kebingunan dalam mendapatkan sumber data akurat untuk merespon pandemic corona.*
Tujuan: *Penelitian ini menganalisis sikap pemerintah Indonesia dalam memberikan informasi dan transparansi data kepada masyarakat terkait penyebaran virus corona di Indonesia.*
Metode: *Penelitian ini merupakan penelitian kualitatif dengan pendekatan analisis konten. Beberapa informasi yang digunakan dalam analisis ini bersumber dari website resmi COVID-19 pemerintah Indonesia dan lembaga-lembaga pemerintah Indonesia lainnya. Untuk memperdalam analisis, penelitian ini juga mengkaji website resmi Korea Selatan dan Singapura. Informasi lain juga didapat dari media massa, media sosial, dan policy brief.*
Hasil: *Transparansi data coronavirus di Indonesia masih minim seperti yang terlihat dari konten yang ditampilkan dalam website resmi COVID-19. Sebelumnya pemerintah pusat juga tidak memberikan data komprehensif tentang penyebaran virus tersebut melalui pidato resmi. Kurangnya transparasi juga terlihat dalam proses pelacakan kasus yang tidak dilakukan secara terbuka. Beberapa inovasi pelacakan kasus juga terlambat dirilis, selain itu tes massal untuk melacak kasus juga tidak berjalan dengan optimal. Informasi dan data yang disampaikan kepada publik melalui pesan kebijakan bersifat inkonsisten dan tertutup.*
Kesimpulan: *Transparansi data dan pembagian informasi yang minim terlihat dari ketersediaan sebagian data di website, pelacakan kasus yang tidak maksimal, dan informasi yang disampaikan melalui pesan kebijakan masih tertutup dan tidak konsisten.*

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***Kata kunci**: Virus Corona, transparansi data, informasi, pencegahan.*

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INTRODUCTION

The spread of the coronavirus in Indonesia has continued to dramatically increase since the announcement of the first case on March 2nd, 2020. In April, coronavirus has spread and infected more than 5,000 people (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). Due to the outbreak, the mortality rate in Indonesia was quite high with a total of 582 deaths with Case Fatality Rate (CFR) of 8.9% on April 19th, 2020 (Indonesian Ministry of Health, 2020). The percentage of deaths due to coronavirus in Indonesia exceeds the global CFR of 5.85% on April 19th, 2020 (Worldometers, 2020). Moreover, when looking at the trend of the increasing spread per day from March 25th, 2020 to April 19th, 2020, an average of more than 100 people every day were positively infected by the coronavirus (Indonesian Ministry of Health, 2020). If the negative effects of the pandemic continue, the government has a greater responsibility to solve this problem. The burden on the government is that the government needs to take action or respond harder to solve coronavirus problems.

In urgent conditions, the Government should take responsive steps to produce policies based on accurate data. Indeed, from the second week of March to the first week of April, the Government issued early appeals to avoid the spread of viruses, such as social distancing policies and large-scale social restriction policies (PSBB). However, the government faces many problems in responding to this pandemic (Secretary of the Cabinet of the Republic of Indonesia, 2020).

The main problems faced by the Indonesian government when responding to the pandemic include the government's inability to manage information and the lack of publicly accessible data related to the spread of corona (Djalante *et al.*, 2020). The lack of information causes confusion among the community and the Government itself at the central and regional levels (Purwanto, Kumorotomo and Widaningrum, 2020). Furthermore, the lack of open information also raises various new problems, such as panic buying, negative stigma in patients with positive corona, and rejection towards ODP status (Institute for Research, Education and Information on Economy and Social Affairs, 2020).

Poor manifestations of management and data transparency of coronavirus by the central government can also be seen from the absence of a single transparent public information channel (Agahari, 2020). In fact, an open government can increase public trust in the government as a reliable source of information providers (Song and Lee, 2016; Wanna, 2018; Porumbescu *et al.,* 2019; Cucciniello and Nasi, 2014).

Information to the public about coronavirus is spread in the National Disaster Management Agency of Indonesia and the Indonesian Ministry of Health to the provincial and district / city levels in Indonesia (Wahyuni and Ambardi, 2020; East Java COVID-19 Report, 2020). One of the problematic coronavirus information flows between districts, provinces and central government can be seen in Yogyakarta Regional Government (Idhom, 2020). There are differences in the number of coronavirus positive cases between Yogyakarta province and the central government.

On corona.jogjaprov.go.id website, there were 19 positive cases on March 27th, 2020. Positive case data in

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Yogyakarta province were obtained by tracking through Yogyakarta Environmental Health and Disease Control Bureau (BBTKLPP) and COVID-19 referral hospitals in Yogyakarta (Pertana, 2020). While the central government reported that Yogyakarta Province on March 27th, 2020 had a total of 22 positive cases as posted on the central government's COVID-19 website (Idhom, 2020). The flow of coronavirus data tracking by the central government was not mentioned in detail to the public (Idhom, 2020). Data about people under surveillance (ODP), patients under surveillance (PDP), recovered cases and deaths were released by each institution via the website. The Indonesian National Disaster Management Agency published this data through the covid19.bnpb.go.id website. While districts or provinces had their respective websites, for example East Java through the infocovid19.jatimprov.go.id website or West Java through the pikobar.jabarprov.go.id website. Therefore, people feel confused in finding information about the pandemic.

This study analyzed data transparency and information sharing of coronavirus to the public in Indonesia. Some important points such as merely incomplete data on the official government websites, transparency, limitations and inconsistencies of the government's policy were rendered.

METHOD

This study used a qualitative method with content analysis. It collected actual information of coronavirus on COVID-19 official websites of the Indonesian Government and other Indonesian governmental institutions from the first week of March to the third week of April 2020. The official websites analyzed included www.covid19.go.id, www.kemkes.go.id, www.kominfo.go.id, www.ombudsman.go.id, www.setkab.go.id, and www.radarcovid19.jatimprov.go.id. In addition, the data were collected from mass media, social media and policy briefs.

This study also compared some information on COVID-19 official website of Indonesia (www.covid19.go.id), South Korea (www.ncov.mohw.go.kr), and Singapore (www.moh.gov.sg/COVID-19). This study made the comparison because South Korea and Singapore have succeeded in suppressing the distribution of coronavirus and transparently shared information of coronavirus with the public on their official websites (Son, Lee and Hwang, 2020; Ahn, 2020; Fisher, 2020; Winanti, Darmawan and Putri, 2020). This study searched some information through menus displayed on those websites (see Table 1).

RESULTS AND DISCUSSION

Open government is a concept that discusses openness and interactive information that is built by the government to the business sector to citizens (Meijer *et al.*, 2012; Geiger and von Lucke, 2012). Open Government is implemented in governance activities for 3 reasons, namely transparency, social releasing and commercial value and participatory governance (Attard *et al.*, 2015). In addition, open government is also needed to narrow the gap that has occurred between the government and citizens (Wijnhoven *et al.,* 2015). Open Government is needed not only in normal governance situations (Cahlikova and Mabillard, 2019). Open government is also needed in crisis situations such as disasters to global pandemics (Lan, 2005; Brajawidagda *et al.,* 2015; Open Government Parthnership, 2020).

In the context of the coronavirus pandemic, open government becomes a

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means for governments to be more open in sharing data to the public and to build models for estimating the spread of viruses. (Open Government Partnership, 2020). Furthermore, this mechanism is needed to dispel misinformation that is spread online and becomes a means of building trust between government and citizens (Open Government Parthnership, 2020).

Table 1. Comparison of COVID-19 Information on Indonesia, South Korea and Singapore Official Websites on April 9th-20th, 2020.

Country	Menu	Information Description
Indonesia	Coronavirus news	Latest news updates about coronavirus.
	Coronavirus distribution data	- Information displayed in the data distribution includes cases by province state. - Cases by province include confirmed cases, recovered cases, and deaths. - Cases by state include national trends, daily change (recovered cases, deaths, and new cases), confirmed cases, treated cases, recovered cases, and deaths.
	Coronavirus protocol	Some COVID-19 guidelines and appeals made by the Indonesia Government to the public.
	Coronavirus education	- Some coronavirus educational materials provided by the government to the communityinclude information of coronavirus and its prevention. These materials were given to several communities, such as general public, parents, health workers, religious and community leaders, teachers and students, mothers and children, as well as entrepreneurs.
	Question and answer sections	Information of coronavirus is explained in forms of questions and answers.
	Government's agenda about coronavirus	Activities done by the Indonesian Government to prevent the spread of coronavirus.
	Hoax buster	List of hoax coronavirus news in media.
	Other information	Regulations, independent reports, a list of referral hospitals, and a group of experts.
South Korea	COVID-19 response	- The Korean Government's response system since February 25th, 2020 in preventing the inflow and spread of the infectious disease. This menu describes preventive efforts by South Korea including managing passengers in public transportation, conducting early detection of infected patients and investigations and quarantine of contacts. - Managing passengers provides special entry procedures, stronger measures for infection prevention and control of overseas entrants, and overseas travel histories to medical institutions. - Information of early detection includes a list of COVID-19 screening stations for people with symptoms. - Information of epidemiological investigations and quarantine of contacts includes how to do epidemiological investigation and monitor contact.
	Patient treatment	Guidelines of treatment and support for suspected

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Country	Menu	Information Description
	and management	symptomatic people, confirmed patients, and patients discharged from quarantine.
	Cases in South Korea	- Confirmed cases to date (confirmed cases, discharged from quarantine, quarantined, and death). - Imported cases (classification by country of origin, confirmation stage, and nationality). - Testing in Korea Confirmed cases (quarantined, discharged from quarantine, and deaths), negative results, in-progress, a breakdown of confirmed cases per region, a breakdown of cluster outbreaks. - Daily and cumulative number of confirmed cases. - Daily and cumulative number of people discharged from quarantine. - Cases in Korea by city/province. - National distribution (confirmed cases, daily change, deaths, and discharged from quarantine). - Daily change (imported cases and local outbreak). - Confirmed cases (isolated, discharged from quarantine, and deaths). - Global locations of COVID-19 spread (Global statistics). - Confirmed cases and deaths by country.
	Media resources	- Press release about the updates of coronavirus.
	Public advice	- Some guidelines and appeals of coronavirus for public.
	Publication and briefing	- Materials as briefings for implementing policies of the outbreak prevention.
Singapore	Current situation	The latest data of the coronavirus outbreak, such as total cases, total active cases, total patients in ICU and general wards, total isolation, total discharged patients from hospital, total free from isolation, and total demised cases.
	Summary table for daily report	Case number, date of confirmation, hospital admission, age, gender, nationality, travel history, exposure, relationship with other cases, and cluster.
	Number of cases	- Imported new cases, community new cases, total average movement in 7 days, average imported movement in 7 days, and average community movement in 7 days. - Epidemic curve of community based on press release date and symptom onset date. - Average number of days from onset of symptoms to isolation.
	Case status	- Current admission at hospitals by day (ICU and general wards). - Number of care facilities by day. - Recovered cases by day (complete isolation and discharge). - Demised cases by day. - Total cases by day.
	Stay at home notices and	- Stay at Home Notice (SHN) by press release date. - Number of individuals under Stay at Home Notice (SHN)

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Country	Menu	Information Description
	quarantine orders	by press release date. - Daily Quarantine Orders (QOs) issued. - Active number of People Under Quarantine (PUQ).
	Symptoms checker	Some questions are available online to detect coronavirus based on risk factors and symptoms.
	Public Health Preparedness Clinic (PHPC)	The detector is used to find the nearest public health preparedness clinic to detect emergency situation.

Source: Indonesian Task Force for the Acceleration of Handling COVID-19, 2020; Ministry of Health and Welfare of South Korea, 2020; Ministry of Health of Singapore, 2020.

One of the most important elements of open government in dealing with a coronavirus pandemic is transparency of data and information sourced from the government (Spalluto *et al.,* 2020). Data transparency amid the turmoil of a pandemic needed to manage fear and anticipation of uncertainties to the reference in the decision (Spalluto *et al.*, 2020). Data transparency in times of disease crisis is the basis for the government in identifying positive cases of corona based on big data analysis that can track travel history and clinical symptoms (Duff-Brown, 2020). Various countries and regional organizations have implemented data transparency based policies to dispel the spread of the corona virus (Open Government Parthnership, 2020).

Different responses were showed by Indonesia in facing corona virus outbreaks. At the beginning of the coronavirus outbreak in March, the Indonesian government was considered not transparent in providing data to the public (Djalante *et al.*, 2020). One form of closed government related to data can be seen from the delay in the formation of a single channel of corona virus information that was only released on March 18th, 2020 (Monggilo, 2020). The Indonesian government is also not transparent in providing data related to the potential spread of disease and the path of tracking corona virus cases (Rezkisari, 2020). This ambiguous condition is exacerbated by the attitude of the Government of Indonesia which also seems contradictory in providing information to the public through various policy messages (Widaningrum and Mas'udi, 2020). In detail, this study will present three sub-chapters of data transparency and information sharing problems to the public in dealing with the spread of the corona virus in Indonesia.

Limited and Inconsistent Public Information

The first statement on the urgency of integrating data and information finally came out of the Indonesian President's speech in a limited teleconference about the COVID-19 task force on April 13th, 2020 (Presidential Secretariat, 2020). It seemed very late because the speech just came out after the corona outbreak has occurred for 40 days and infected nearly 4557 people in Indonesia (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). It needs to be noted that ideally since the beginning, the Government should have encouraged public information transparency.

Looking back at the beginning of coronavirus occurence in Indonesia, the Government gave a policy speech that seemed inconsistent (Purwanto, Kumorotomo and Widaningrum, 2020). Previously, the Government stipulated a policy of boosting the tourism sector by giving significant aircraft discounts. In addition, the Indonesian Ministry of Health also stated that Indonesia was not

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vulnerable to corona (Triwibowo, 2020). The conditions turned drastically when the Government confirmed two initial positive cases (Triwibowo, 2020). Information which was contradictory to the Government's policies resulted in panic buying and widespread public unrest (Institute for Research, Education and Information on Economy and Social Affairs, 2020). The inconsistent public information delivery cannot be separated from the lack of scientific-based research conducted by the Government (Djalante *et al*., 2020). It has some side effects, such as "scientific Pseudo" and racial, religious, and mystical arguments in dealing with coronavirus (Djalante *et al.,* 2020). On February 18th, 2020, the Indonesian Minister of Health, Terawan said that prayer could avoid coronavirus in Indonesia (Persada, 2020). On April 2th, 2020, the Coordinating Minister of Maritime and Investment Affairs, Luhut Binsar Pandjaitan claimed that coronavirus would disappear due to hot weather in Indonesia (Nur Hakim, 2020).

When coronavirus is increasingly widespread, the Indonesian Government has taken some policies that tend to be closed, especially in providing public information (Agahari, 2020). The websites of Indonesian Ministry of Health and Indonesian National Disaster Management Agency present lack of data (Agahari, 2020). Until the second week of April 2020 the National Disaster Management Authority and the Ministry of Health's website only displayed general data such as the number of positive cases, ODP, PDP, death and cured patients (Indonesian Ministry of Health, 2020; Agahari, 2020). Furthermore, the website of the National Disaster Management Authority and the Ministry of Health displays data formats that are difficult to be reprocessed by non-state parties (academics, think thank or companies) to use them (Agahari, 2020). Meanwhile, the public needs open, accurate and comprehensive data to respond to the COVID-19 outbreak. Open data of the pandemic distribution can increase public trust on the government and result in community stability (DroneEmprit, 2020). On the contrary, data hidden from the public will actually create the government's mistrust in taking action against the pandemic (Hamzah *et al.,* 2020).

The next problem is the unsynchronous data between the central government and the local governments. For example, mismatch of confirmed cases occurred between the Central Government and the Regional Government of Banten Province (Indonesian Ombudsman, 2020a). Moreover, the number of confirmed cases were not synchronous between the provincial government and the district/ city government (Indonesian Ombudsman, 2020b). For instance, the Banten Provincial Government had different data from the South Tangerang Government. On April 6th, 2020, the number of deaths reported by the Banten Provincial Government and South Tangerang Governmentwas not the same. The Banten Provincial Government on April 6th, 2020 reported 22 deaths, while South Tangerang Government reported additional 24 deaths (Rabbani, 2020).

Transparency of Case Tracking

At first, the COVID-19 prevention and control method was formulated by the Directorate General of Disease Control and Prevention and released on the COVID-19 website (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). One of information displayed is close contact tracking among positive cases. The case tracking was carried out in three methods, such as identifying contacts, collecting close contact data, and following up to record the close contact traces. Besides, the

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identification of close contact was conducted to people who interacted with patients and associated with places where patients ever visited in the last two days (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). However, the identification method was not defined in detail. There was no detailed information regarding the methods of tracking the distribution of cases and the steps of methods used to do this. The method formulated only provides records of received data (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020).

Furthermore, after 43-day spread in Indonesia, the Indonesian Ministry of Communication and Information created a digital application on April 14th, 2020 to track people at risks of virus transmission. It is called *Peduli Lindungi* or Care Protect. *Peduli Lindungi* App is used to track people who interact with people under surveillance and patients under surveillance. This application works by looking at the radius of detected cases as detected on the mobile Bluetooth (Peduli Lidungi, 2020). Another new innovation, *East Java COVID-19 Radar,* was also made and relased on the official websites of East Java Province on April 15th, 2020 (East Java COVID-19 Radar, 2020). The *COVID-19 Radar* provides information on a radius of 1 km from the confirmed positive patients' residence and only informs the presence history of the previous patients (East Java COVID-19 Radar, 2020).

Resilient health systems are needed in disaster situations, one of which is a health information system and surveillance network that is able to accurately show the current situation and health threats in real time. This is important for making predictive modeling (Kruk *et al.*, 2015). One of the information that must be provided transparently is a complete case tracking flow. South Korea is an example that provides transparency in tracking data. They announced information about methods and flows of case tracking in detail on the official COVID-19 website that they have created. In tracing cases, they used subjective and objective data. Subjective data were taken from interviews with people who have the possibility of interacting with patients. Whereas, objective data were collected from medical records, mobile GPS, and credit card records (Ministry of Health and Welfare of South Korea, 2020). In tracking cases, the objective data can have an important role in providing more accurate information compared to subjective data. Tracking via GPS, card transactions, and CCTV will provide location data, time of exposure and detailed situations (COVID-19 National Emergency Response Center, Epidemiology & Case Management Team and Korea Centers for Disease Control & Prevention, 2020).

Mass testing was an option for tracking cases, but the Indonesian Government was late to stipulate mass testing policy. The Indonesian President, Joko Widodo just released a mass testing policy to detect cases early on March 19th, 2020 (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). The tools used for mass tests were also still being questioned by the public. Some experts claimed that the rapid detection kits (RDT) were in use to conduct early detection, but these had low accuracy. Polymerase Chain Reaction (PCR) was believed to have higher accuracy compared to RDT. The World Health Organization have already confirmed on this issue (Djalante *et al.*, 2020; World Health Organization, 2020). Low accuracy may result in wrong data and affect the data analysis process. Moreover, only people who have a positive RDT result can do a PCR test for confirmation. While for those with negative

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results, PCR tests will be done when patients have done the test several times after an interval of 5-7 days (Djalante *et al.*, 2020). Therefore, WHO recommended countries should coordinate and collaborate to conduct more PCR tests. They must build infrastructure for the laboratory procurement in all provinces (Worl Health Organization, 2020).

After the implementation of mass tests, it was found that the tests were only distributed to around 240 people every day in early April (Lidwina, 2020). It is far different from South Korea, where mass tests were conducted to 15.000 people every day (Lidwina, 2020). Until April 14th, 2020, the number of specimens received was 27953 (Indonesia Ministry of Health, 2020). While South Korea obtained 527,438 specimens (Ministry of Health and Welfare of South Korea, 2020). Tests using the PCR method were also low until the second week of April. The average PCR examination is less than 2,000 per day (LaporCovid19, 2020).

Also, information regarding the flow of mass testing services was not clearly informed by the Indonesian Government. There is no transparent information about health facility which serve the test and no clear information about the criteria of testing recipients (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). Since the initial release of the policy regarding mass tests, the Government should have informed which healthcare facilities serve as testing centers. In contrast to South Korea, the South Korean Government set up a screening centers for mass tests. Mass testing has been done not only in health clinics, but also drive-thru and walk-thru inspections (Ministry of Health and Welfare of South Korea, 2020). Mass testing is the beginning of tracking the coronavirus outbreaks, and thus it must be done optimally. Case tracking data can also allow easier implementation of isolation policies in avoiding places with high risks (Pang *et al*., 2020). The World Health Organization (WHO) has also given guidance to countries in the world to conduct early detection, and thus patients who are diagnosed early will have smaller disease severity. In addition. Early test for all countries worldwide also describe the case trend with detailed supervision (World Health Organization, 2020).

Partial Official Website Data Update

The Indonesian government seemed not transparent in the display data to the public through the official website (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). The official government website should display comprehensive data related to the spread of coronavirus. However, the data content displayed on the official website COVID-19 was only partial (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). In addition, the process of collecting data displayed through the official website of the central government was also not comprehensively explained to the public. The central government was making the COVID-19 official website late. Previously, information about coronavirus was spread from several websites such as Provincial, District and Ministry of Health official websites. Resulting in overlapping data between the central and regional governments (Djalante *et al.,* 2020).

South Korea and Singapore showed different conditions. South Korea and Singapore become countries that provide reliable data and information through their official website (Winanti, Darmawan and Putri, 2020). They released more comprehensive distribution data in their official website (Ministry of Health and Welfare of South Korea, 2020; Ministry of Health of Singapore, 2020). The Indonesian Government did not release some important content such as the

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progress of mass tests among the community on this website. This information is not centralized on one official website. The progress of mass testing was just released on the Indonesian Ministry of Health. However, it only released specimens received and negative examination results (Indonesian Ministry of Health, 2020). South Korea showed a comprehensive and transparent mass testing data. This country released not only the cumulative number of people tested, but they also more detailed data such as confirmed cases on specimens that have been received. Quarantined cases and deaths of confirmed cases were also published on their website (Ministry of Health and Welfare of South Korea, 2020). Other than that, they also provided information on in-progress test, a breakdown of confirmed cases per regional, and a breakdown of cluster outbreaks.

The Indonesian Government also did not release the cluster spread of coronavirus cases on this COVID-19 website (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). The website of Indonesian Ministry of Health and the COVID-19 official website created by provinces and districts also did not display this content. In fact, grouping cases into several clusters is important for the investigation process. Cluster determination becomes an important point for supervising people with positive symptoms and risks of transmission to the closest people (Pung *et al*., 2020). The grouping of cases into clusters has been carried out in Singapore and released on its official website. Singapore has provided clusters with information of places and source of infections such as local and imported cases to the public (Ministry of Health of Singapore, 2020). Even, this website also provides information of coronavirus cases in detail. This website displays cases by age, gender, nationality, country of origin, travel history, exposure, relationship with other cases, cluster (Ministry of Health of Singapore, 2020).

On the Indonesian COVID-19 website, the development of patient treatment at hospitals was not carried out transparently.The Indonesian Government only provided information on the cumulative number of patients treated at several hospitals (Indonesian Task Force for the Acceleration of Handling COVID-19, 2020). The Singapore official website can be a reference for the Indonesian Government in providing more detailed information. The website also displays patients who were currently admitted to ICU and general wards by day, the number of care facilities by day, and recovered cases by day (complete isolation and discharge) (Ministry of Health of Singapore, 2020).

All important information was shown in the menu display on the official websites of Singapore and South Korea (Ministry of Health and Welfare of South Korea, 2020; Ministry of Health of Singapore, 2020). South Korea provided information on several guidelines in detail. They provided information on management to passengers from abroad to prevent coronavirus outbreaks, epidemiological investigations, quarantine and mass test procedures, also provided in detail on this website (Ministry of Health and Welfare of South Korea, 2020). Singapore's official website also provided information about the nearest public health preparedness clinic to the public (Ministry of Health of Singapore, 2020). This clinic provided a general service to conduct tests for those who have mild symptoms and determine whether patients require serious medical services or not without going to hospitals (Campbell and McGregor, 2020).

From the descriptions above, the Indonesian Government did not provide transparent and comprehensive data on their official websites. Compared to South Korea and Singapore, Indonesia's official websites had weaknesses in displaying the progress of mass tests, the spread of

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coronavirus clusters and the development of patients at hospitals. In addition, South Korea and Singapore provided some important data, for example management of overseas passengers, epidemiological investigations, quarantine and mass test procedures and the nearest public health preparedness clinic.

Studies related to data and information transparency in handling corona virus spread are still rarely conducted. In Indonesia, the study became one of the earliest conducted. The results contributed to present the analysis of the government's transparency in presenting data and information to the public. While in China, there were closure and delay in information delivery by the central and local governments (Gao and Yu, 2020). However, this study did not have in-depth analysis but only provided a brief mechanism of closed information (Gao and Yu, 2020).

A study conducted by Alamo et al. (2020) provided an overview of global contact and testing tracking of coronavirus. However, they did not provide a detailed analysis of the website content. This was different from this present study which explained detailed analysis of the coronavirus management in Indonesia, South Korea and Singapore.

However, the data from social media and mass media used in this study had a potential bias related to ideology and tendency of the sources. In addition, this study did not present a coherent time and detailed analysis of each case.

CONCLUSION

The transparency of coronavirus information to the public was still lacking in Indonesia. The official speech of the presidential spokesperson was incomplete, and the official COVID-19 website was not comprehensive. The Indonesian Government was not open to inform methods and case tracking flow, such as mass tests. Some regions still had limitations to confirm RDT tests via PCR. The speech of COVID-19 policies also contained untransparent information, and the updates of caseswere inconsistent and lacking.

This study had some implications. First, this study rendered the dynamics of implementing COVID-19 policies at various government's levels. Second, this study gave the central and regional governments insights about open government to prevent coronavirus in Indonesia.

CONFLICT OF INTEREST

The authors declared that there was no conlifct of interest in this article.

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ORIGINAL RESEARCH

MISINFORMATION RELATED TO COVID-19 IN INDONESIA

Kesalahan Informasi COVID-19 di Indonesia

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ABSTRACT

Background: An increase in COVID-19 cases has been accompanied by an increase in public misinformation around basic coronavirus facts, its transmission, and its prevention.
Aims: This study describes public knowledge of COVID-19 misinformation in Indonesia.
Methods: This study was a cross-sectional study using online questionnaires for data collection from 4 April to 11 April 2020. The questionnaires consisted of two parts regarding demographic characteristics and knowledge of misinformation. The sample in this study was 530 respondents. Descriptive analysis was used for data analysis.
Results: The majority of respondents were below 25 years old (n = 342, 64.5%) and had graduated from junior/senior high school education (n = 277, 52.3%). Of the respondents, 13.2% believed the COVID-19 would stop in Indonesia's climate, while 27.7% stated that COVID-19 is a biological weapon deliberately created by another country. Meanwhile, 19.6% believed that gargling with salt water or vinegar can kill the COVID-19 virus.
Conclusion: A group of people still did not understand misinformation regarding COVID-19. Various efforts are needed to align community understanding of COVID-19 prevention and to provide accurate information.

Keywords: COVID-19, misinformation, prevention measures, SARC-CoV-2.

ABSTRAK

Latar Belakang: *Meningkatnya kasus COVID-19 diiringi dengan meningkatnya misinformasi publik seputar fakta dasar virus corona, penularan dan pencegahannya.*
Tujuan: *Penelitian ini bertujuan untuk menggambarkan pengetahuan publik terkait misinformasi COVID-19 di Indonesia.*
Metode: *Penelitian ini merupakan studi potong lintang menggunakan formulir daring untuk pengumpulan data. Pengumpulan data dilakukan pada 4 hingga 11 April 2020. Kuesioner penelitian terdiri dari dua bagian terkait karakteristik demografi dan pengetahuan terkait misinformasi. Sampel dalam penelitian ini berjumlah 530 responden. Analisis deskriptif digunakan untuk analisis data.*
Hasil: *Mayoritas responden berusia kurang dari 25 tahun (n= 342, 64,5%) dan lulus dari tingkat pendidikan sekolah menengah pertama/atas (n= 277, 52,3%). Terdapat 13,2% responden yang masih beranggapan bahwa virus SARS-CoV-2 tidak bisa hidup di iklim Indonesia, sedangkan 27,7% menyatakan bahwa virus tersebut merupakan senjata biologis yang sengaja dibuat oleh suatu negara. Sementara itu, 19,6% responden masih percaya bahwa berkumur dengan air garam atau cuka dapat membunuh virus.*
Kesimpulan: *Sekelompok orang masih tidak mengetahui kesalahan informasi terkait pencegahan COVID-19. Berbagai upaya perlu diambil untuk meluruskan pemahaman masyarakat terkait pencegahan COVID-19, sehingga masyarakat memiliki pemahaman yang benar .*

Kata kunci*: COVID-19, misinformasi, langkah pencegahan, SARS-CoV-2.*

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INTRODUCTION

The World Health Organization (WHO) announced the coronavirus (COVID-19) pandemic on March 11th, 2020 (World Health Organization, 2020f). This infection is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). A study stated that people infected by SARS-CoV-2 exhibit such symptoms as dry cough, fatigue, fever, and dyspnea (Wu *et al.*, 2020). The virus is transmitted from person to person through

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respiratory droplets and contact routes (World Health Organization, 2020e).

As of April 24th 2020, a total of 2,626,321 people globally had been confirmed as testing positive for the virus (World Health Organization, 2020d). The number of COVID-19 cases in Indonesia also continued to increase. On May 7th, 2020, the number of confirmed cases reached 12,776. The COVID-19 pandemic has affected not only people's health, but also other aspects of life. The United Nations University World Institute for Development Economics Research estimated that COVID-19 has become one of the challenges to ending poverty as one of the United Nations Sustainable Development Goals. Although poverty has decreased since 1990, it has dramatically surged since the COVID-19 pandemic (Sumner, Hoy, and Ortiz-juarez, 2020). Moreover, the United Nations Development Program has predicted that COVID-19 supresses economies and exacerbates inequality (United Nations Development Programme, 2020).

Combating the COVID-19 pandemic has become the responsibility of health workers and communities since they are on the frontline in detecting and managing epidemics (World Health Organization, 2018). WHO recommends basic protective measures against COVID-19 including frequent handwashing with soap; social (physical) distancing; not touching the eyes, nose, and mouth; and respiratory hygiene etiquette (World Health Organization, 2020b). Certainly, appropriate knowledge should be provided to each person so they may perform preventive measures correctly. The social ecological model, as defined by McLeroy, identifies knowledge as one of the intrapersonal factors that determine health behaviors (Sutton, 2014).

Unfortunately, the increase in the number of COVID-19 cases is consistent with the spread of an infodemic. An infodemic involves an excessive amount of information, some of which is accurate while some is not, and thus people find it difficult to identify trustworthy, reliable sources as needed (World Health Organization, 2020c). The WHO has identified several themes of misinformation related to COVID-19 such as its cause and origins, its symptoms and transmission patterns, available treatments, and the effectiveness and impact of interventions by health authorities or other institutions (World Health Organization, 2020c).

Misinformation is a false health-related claim of fact that lacks scientific evidence (Chou, Oh, and Klein, 2018). It is also defined as information that is incorrect possibly by accident (Scheufele and Krause, 2019). Misinformation is different from disinformation. Disinformation does not always spread false information; it can also be accurate information that has an intended harmful effect on a target (Volkin, 2020).

Anxiety and uncertainty about the pandemic can create a suitable environment for misinformation (Thulin, 2020). Misinformation regarding COVID-19 could put people at risk as it may give them a false sense of security (Simon Fraser University, 2020). The spread of COVID-19 misinformation has been rising globally (Mian and Khan, 2020). The public health crisis due to the disease has stimulated misinformation. Moreover, evidence suggests that untruths spread more easily than truths (Vosoughi, Roy, and Aral, 2018).

COVID-19 misinformation has also occurred in Indonesia, spreading massively on social media. This is not surprising because most Indonesians are social media users. With 120 million Facebook users, Indonesia is ranked third among Facebook users, behind only India and United States in January 2020 (Statista, 2020).

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Hence, the Indonesian government has identified and taken action against misinformation through a hoax-buster section on their official website. There are several issues regarding misinformation, such as government policies of COVID-19 countermeasures, various conditions of several regions after the COVID-19 impact, and other several issues (COVID-19 Response Acceleration Task Force, 2020c). Although the government has responded to tackle false information, it still spreads throughout the community.

Nonetheless, research about COVID-19 misinformation among Indonesians is rare. Research on this topic is required to give insights to the government or other parties concerned with health education. With such data, they can design suitable material for prevention issues, and thus the public can gain accurate information. Therefore, this study aimed to describe public knowledge of COVID-19 misinformation among Indonesian citizens.

METHODS

This study was cross-sectional, using online questionnaires for data collection from 4 April to 11 April 2020. The variable assessed was respondents' knowledge of COVID-19 misinformation. Misinformation in this study was defined as a false claim of fact due to lack of scientific evidence (Chou, Oh, and Klein, 2018). A respondent was considered informed when they had correct knowledge of the issues. The respondents were categorized as misinformed when they believed in incorrect or counterfactual claims. Moreover, they were considered uninformed when they were simply unaware of the facts or did not have a factual belief (Gidengil *et al.*, 2004; Scheufele and Krause, 2019).

The online questionnaire consisted of two sections: demographic characteristics of the respondents (sex, age, level of education, and occupation) and public knowledge of 11 misinformation topics related to COVID-19 basic facts, its modes of transmission, and prevention measures. Misinformation topics were developed by selecting several current issues of COVID-19 misinformation from the "Myth Busters" section on World Health Organization's website and the "Hoax Buster" section on the COVID-19 Response Acceleration Task Force's website (COVID-19 Response Acceleration Task Force, 2020c; World Health Organization, 2020a).

Eleven topics were chosen from several misinformation issues applicable only to the Indonesian context. For example, the public was misinformed about COVID-19 transmission through houseflies (this study assumed that such a topic did not exist among Indonesians). Several topics were irrelevant to the health aspect, such as political issues. Respondents were asked to answer "yes," "no," and "do not know" for each piece of misinformation presented in the online questionnaire.

The questionnaire was then measured for reliability by calculating Cronbach's α. The Cronbach's α for the questionnaire was 0.704. The α-value of 0.70 was considered sufficient for reliability or internal consistency of an instrument (Taber, 2018).

Before the respondents filled out the questionnaire, they were informed about the aim of the study, how to answer questions, and other information related to this research. Respondents who agreed to join the study would click the "next" button to continue to fill out the questionnaire.

The minimum sample was calculated for cross-sectional studies/surveys (Charan and Biswas, 2013). The sample was obtained with the precision of 5%, and the expected proportion in population based on the previous study was 23% with a minimum of 237 samples (Berman, 2020). Inclusion criteria of the respondents included age and location. The

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respondents were a minimum of 17 years old, and a total of 530 respondents lived in Jakarta and outside. The sample was chosen by using a consecutive sampling method in which the respondents could be recruited per the inclusion criteria (Setia, 2016). The survey invitation was sent via social media such as WhatsApp and Instagram. A descriptive statistical method was employed to present the results of the study.

RESULTS AND DISCUSSION

Table 1 illustrates the respondents' demographic characteristics. Most of the respondents were female (n= 404, 76.3%) and in the age group of ≤ 25 years old (n= 342, 64.5%). Around 52.3% (n=277) graduated from secondary high school, and 70% of them resided in Jakarta (n= 371).

In Table 2, COVID-19 misinformation is explained. As many as 13.2% expressed that the SARS-CoV-2 virus cannot live in the Indonesian climate, while 17.2% of them were not sure about that issue. Furthermore, 27.7% of them stated that the SARS-CoV-2 virus was a biological weapon of a particular country. Moreover, 36.2% of them believed that exposing money or goods to the sun for about 30 minutes can kill the virus. There were 19.6% of respondents who thought that gargling with salt water or vinegar can kill the virus, while 3.47% were not aware of that issue. The last issue is that 12.1% of the respondents did not know whether or not spraying disinfectant on the body is safe or not.

There was a growing assumption that high temperature and humidity will reduce the virus and its ability to reproduce and spread. Some people still believe that COVID-19 could not survive in a tropical country like Indonesia (COVID-19 Response Acceleration Task Force, 2020a). In fact, WHO stated that COVID-19 virus can spread in hot and humid climates. Besides, the SARS-CoV-2 virus has infected more than 21,000 people in Indonesia by May 2020 (COVID-19 Response Acceleration Task Force, 2020b). In spite of temperature and humidity's effect on viral growth, a preliminary study found a significant correlation between temperature average and the incidence rate of COVID-19 in Jakarta (Tosepu *et al.*, 2020). Another study revealed sunlight exposure was correlated significantly with COVID-19 recovery among patients in Jakarta (Asyary and Veruswati, 2020). Therefore, 13.2% of respondents were still misinformed, and 17.2% were still uninformed about that issue.

The idea that the virus is a bioweapon was oppsed by Tom Inglesby, an expert in health security, who said there was no evidence of anything of it being anything other than a naturally occurring virus (Powder, 2020). Moreover, Saputra, a researcher from the Indonesian Institute of Sciences (LIPI), stated that the virus was not a biological weapon because it had no gene similar to other corona viruses such as flu, MERS and SARS 2002 (COVID-19 Response Acceleration Task Force, 2020c). However, the community easily believed information about tips to prevent the infection of the SARS-CoV-2 virus since they were too afraid of viral infection. The results revealed that 27.7% of respondents were misinformed about this issue.

The results also explained that 17.2% of the respondents believed the virus could spread through the air. However, from the analysis of 75,465 COVID-19 cases in China, airborne transmission was not reported (Ong *et al.*, 2020). With a such evidence, some respondents were still misinformed about this issue.

Using hand sanitizer is believed to eliminate the virus. As a result, the public bought an excessive amount of hand sanitizers, causing stockout, which, in turn, stimulated fake hand sanitizer producers. A

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previous study pointed out that, when simple handwashing with unmedicated soap and water was undertaken appropriately, it was highly effective in removing influenza virus from hands (Grayson *et al.*, 2009).

Despite physical or social distancing, the best practice to prevent the transmission of the SARS-CoV-2 virus is by maintaining personal hygiene, especially by washing hands with soap frequently after touching surfaces or after coming in from outside. Hand sanitizers are alternatives when it is hard to find water and soap. Improper use of hand sanitizers could cause irritation. Therefore, the 16.4% of the respondents who believed one must use hand sanitizers for handwashing have been misinformed.

Table 1. Respondents' Demographic Characteristics.

	n= 530	%
Sex		
Female	404	76.3
Male	126	23.8
Age group		
≤ 25	342	64.5
26 – 45	148	27.9
> 45	40	7.5
Education		
Primary school	1	0.2
Secondary high school	277	52.3
Diploma	51	9.6
Bachelor degree	174	32.8
Graduate/Postgraduate	27	5.1
Occupancy		
Civil Servant/State-owned corporation staf/Police/Military	52	9.8
Private sector	127	24.0
Informal sector	15	2.8
Student with health major	246	46.4
Student with non-health major	45	8.5
Housewife	45	8.5
Domicile		
Jakarta	371	70.0
Outside Jakarta	159	30.0

Another instance of misinformation found was that gargling with saltwater or vinegar can kill the virus. Gargling with salt water, vinegar, or warm water was asummed to prevent the virus from entering the lungs. Unfortunately, no evidence has, to date, demonstrated this (Mascarenhas, 2020). Even though gargling or drinking hot/warm water mixed with vinegar or salt has long been used by Indonesians as an alternative to relieve influenza or sore throat symptoms, but there is no medical evidence for this method to prevent COVID-19 (Ika, 2020). Among the respondents, 19.6% were still uninformed as they agreed with the idea of gargling with salt or vinegar.

Spraying disinfectant all over the body was assumed to kill the virus. The community's perception was that someone who has been sprayed can freely move without physical distancing anymore. However, WHO stated that spraying

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alcohol or chlorine all over the body can be harmful to clothes or mucous membranes (i.e., eyes, mouth) (World Health Organization, 2020b).

The use of disinfectant became massive since people believed it would make them free from the virus. However, they should be informed that people infected by the SARS-CoV-2 virus still had the possibility to transmit the virus although their body may have been sprayed with disinfectant. Inappropriately using disinfectant may be poisonous. Some cases were reported in the United States for using disinfectant during the COVID-19 pandemic (Chang *et al.*, 2020). Moreover, physical or social distancing and good personal hygiene are more important to reducing the potential risk of infection rather than using disinfectant products, some of which did not effectively kill the virus (Hamzelou, 2020). Based on this evidence, 12.1% of respondents were still misinformed about the use of disinfectant.

Table 2. COVID-19 Misinformation in the Indonesian Community.

Statements	Yes n (%)	No n (%)	Do not know n (%)
COVID-19 Basic Facts			
The virus cannot live in the Indonesian climate	70 (13.2)	369 (69.6)	91 (17.2)
The virus is a biological weapon made by a certain country	147 (27.7)	155 (29.2)	228 (43.0)
COVID-19 Transmission			
The virus is transmitted through the air	91 (17.2)	439 (82.8)	-
Turmeric makes the body more susceptible to the virus	26 (4.9)	325 (61.3)	179 (33.8)
If we are not strong enough to hold our breath for 10 seconds, then we are suspected of having contracted the virus	53 (10.0)	316 (59.6)	161 (30.4)
Prevention of COVID-19			
Handwashing with water (no need to use soap) is enough to prevent the virus	132 (24.9)	390 (73.6)	8 (1.5)
Handwashing must involve hand sanitizer (cannot use soap) to prevent the virus	87 (16.4)	430 (81.1)	13 (2.5)
Taking chloroquine can prevent the virus	39 (7.4)	295 (55.7)	196 (37.0)
Gargling with salt water or vinegar can eliminate the virus	104 (19.6)	242 (45.7)	184 (34.7)
Exposing money or goods to the sun for about 30 minutes can eliminate the virus	192 (36.2)	152 (28.7)	186 (35.6)
Spraying disinfectant on the body is a safe way to disinfect surfaces	64 (12.1)	423 (79.8)	43 (8.1)

There were 225 pieces of COVID-19 misinformation published in English between January and March 2020 (Brennen *et al.*, 2020). That “the virus is not heat-resistant and will halt in a temperature of just 26/27 degrees” is one of the misinformation issues in Indonesia. The rapid spread of misinformation confuses the public, hindering public trust, consensus, and subsequent action to prevent and mitigate COVID-19 measures (Limaye *et al.*, 2020).

This present study revealed that there are groups of people who remained misinformed and uninformed about the COVID-19 and its prevention. Only valid and agile information that could be accessed by all groups can become a defense against rising public panic, financial market hysteria, and unintended

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misunderstandings of the science and epidemiology of SARS-CoV-2 (Garrett, 2020).

Actions should be carried out to increase public awareness of the risks of misinformation, subliminal advertising, and polarization by building an international coalition to increase the state's capacity to prevent, detect, and respond to threats of the infectious disease (Felten and Nelson, 2019). Another strategy to counter misinformation is by swamping fake news with the truth using the counterintuitive approach (Alemanno, 2018). Trustworthy data produced by healthcare researchers could fight against misinformation (Rochwerg *et al.*, 2020).

This study has presented new insights into COVID-19 misinformation in Indonesia, but it also has some limitations. First, this study's is too small to represent the general Indonesian population. Second, the differences in the public's understanding based on the different demographic characteristics could not be analyzed since this study used a descriptive design. Further research with an analytical design needs to be conducted to examine the public's understanding of misinformation among different groups. Third, this study merely described 11 issues of COVID-19 misinformation. Hence, further studies which analyze more COVID-19 misinformation issues need to be performed in the future.

CONCLUSION

A group of people still remained misinformed and uninformed about COVID-19 (its origin, transmission and preventive measures). Public health authorities and other parties concerned about public health education should be more aware of clarifying those misinformation issues, particularly virus transmission and preventive measures. They could use various forms of social media to spread truths to tackle misinformation. Again, even though the public might have been informed several times, education on how to choose accurate information should be intensified. Otherwise, more people will be exposed to a lot of misinformation which can place them at risk of performing wrong protocol and preventive measures.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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COMMENTARY ARTICLE

CONTRIBUTIONS OF SPACE TECHNOLOGY TO GLOBAL HEALTH IN THE CONTEXT OF COVID-19

Kontribusi Teknologi Antariksa untuk Kesehatan Global pada Konteks COVID-19

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ABSTRACT

Background: Space technologies have been used in each aspect of mankind's life, including health. The United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) has instigated several programs to address how space technologies can contribute to global health.
Aims: This article deepened the understanding of how space technology contributes to global health and identified how it may be used in the context of COVID-19.
Results: This research identified four different domains of space technology that can or may contribute to global health, which are remote sensing, global navigation satellite system, satellite communication, and human space flight. Generally, these four domains can track disease outbreaks and help mitigate its spread such as by minimizing patient contact with medical personnel. They also keep daily activities such as communication and work afloat. Future developments in space technologies may prove to have an even bigger role to minimize spread.
Conclusion: Space technologies are invaluable in helping healthcare personnel and governments track the disease's sources and spread. Also, they can identify locations with the most damage, and thus immediate actions can be taken.

Keywords: geographic information system, infectious disease, outbreak, remote sensing, space technology.

ABSTRAK

Latar Belakang: *Teknologi antariksa telah digunakan dalam tiap aspek kehidupan manusia, termasuk kesehatan. United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS) telah mencetuskan beberapa program untuk menyikapi bagaimana teknologi antariksa dapat berkontribusi bagi kesehatan global.*
Tujuan: *Artikel ini memperdalam ilmu mengenai bagaimana teknologi antariksa berkontribusi untuk kesehatan di dunia dan mengidentifikasi bagaimana teknologi antariksa dapat digunakan dalam konteks COVID-19.*
Hasil: *Penelitian ini mengidentifikasi empat bidang teknologi antariksa yang dapat atau mungkin dapat berkontribusi bagi kesehatan global, yakni penginderaan jauh, sistem navigasi satelit global, komunikasi satelit, dan penerbangan antariksa berawak. Secara umum, keempat bidang ini mampu melacak wabah dan membantu memitigasi penyebarannya seperti melalui meminimalkan kontak pasien dengan tenaga kerja medis. Teknologi antariksa juga membantu kegiatan sehari-hari seperti komunikasi dan pekerjaan tetap berjalan. Perkembangan teknologi antariksa di masa depan dapat memiliki peran lebih besar untuk meminimalkan penyebaran.*
Kesimpulan: *Teknologi antariksa berperan penting dengan membantu tenaga kerja medis dan pemerintah melacak sumber dan penyebaran penyakit. Teknologi antariksa juga mengidentifikasi lokasi yang terkena dampak terparah, sehingga tindakan dapat segera dilakukan.*

Kata kunci*: sistem informasi geografis, penyakit menular, wabah, penginderaan jauh, teknologi antariksa.*

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INTRODUCTION

The COVID-19 pandemic has forced billions of people to stay at home or be quarantined in a health facility (Langton, 2020). It has changed the way modern society lives, works, and connects to others (Singh, 2020). Compared to past pandemics such as the Spanish flu pandemic in 1918, society has the technology to stay in touch with family members and coworkers residing in different homes. During the 2020 COVID-19 pandemic, health facilities, logistics,

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transportation, education, and other vital businesses must continue operating, and governments have to work together to make sure the society's needs have been met. Also, they have to ensure the COVID-19 spread could be minimized.

Space technology itself is an overarching term defined as technology related to the exploration of and activity in space, referring to satellites infrastructure and aerospace industry (Lexico, 2020). It is a once-foreign concept that has gradually integrated itself into mankind's daily life. The existence of space technology allows effective communication, navigation, and much more. However, current and potential contributions of space technology to better healthcare are still often overlooked.

In the past, space technology helped to track cholera in Bangladesh. In hindsight, space technology may have predicted the occurrence of cholera in South America in 1991. It also tracked and predicted malaria outbreaks in the sub-region of Saharan Africa (Ford *et al.*, 2009).

This study aims to deepen the understanding of how space technology contributes to global health, specifically in combating infectious diseases. It also identifies how space technology has or may be used in the context of COVID-19 mitigation.

An overview is given at the beginning to give some context and familiarize the readers with ongoing space and global health programs conducted or planned under the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS). It then identifies the utilization of space technologies for the betterment of healthcare with possible uses which may help to fight against COVID-19. Lastly, it specifically discusses how Indonesia up to April 2020 has utilized space technology for mitigating COVID-19 before reaching to conclusions.

This study is expected to contribute to a greater understanding of how space technology has affected global healthcare. This study also hopes to spark similar interests of further studies in this topic.

DISCUSSION

This commentary article is supported with references from articles, space law books, UN Resolutions, and other multilateral meeting documents that discuss the use of space technology for global health, particularly in the COVID-19 context. The selection of articles or references may be prone to bias since the topic of space and global health has only recently been put into focus.

Overview of Space and Health Programs

UNCOPUOS is the United Nation's focal point for issues pertaining to international outer space. It has two permanent subcommittees; the Legal Subcommittee (LSC) and the Scientific and Technical Subcommittee (STSC). Each subcommittee holds annual meetings known as sessions and gives reports of these sessions during the annual UNCOPUOS main session (also referred to as the "parent"). Then, UNCOPUOS will report the results to the United Nations General Assembly (UNGA).

In 2015, the United Nations through Resolution A/RES/70/1 developed an action plan for the people, planet and prosperity, known as the 2030 Agenda for Sustainable Development (2030 SDGs) which contains 17 challenges. From a short glance, the use of space technology plays an important role to fulfill the SGDs' ambitions.

The journey to this ambition was captured by the "Space2030" agenda, which UN Member States negotiated over the next two years following the resolution through the UN Committee on the Peaceful Uses of Outer Space (UNCOPUOS). The Space2030 agenda promises a change on how space is considered in the UN system

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(United Nations Office for Outer Space Affairs, 2015), in which Member States laid out a vision to enhance the use of space science and technology for the attainment of the 2030 Sustainable Development Agenda (United Nations Office for Outer Space Affairs, 2018).

The UNCOPUOS also has working groups dedicated to certain issues, including the Space 2030 formed with the purpose to implement the Space 2030 agenda. These working groups collaborate on the basis of a strategically comprehensive, inclusive, and oriented visions for strengthening international cooperation in the exploration and peaceful uses of outer space (United Nations General Assembly, 2020). This agenda was mentioned in the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50) to reflect on more than 50 years of space exploration achievement to strengthen global cooperation in outer space and its use for sustainable development.

The UNCOPUOS Meeting in 2018 also agreed with the role of Expert Group on Space and Global Health. This Expert Group identified four different domains of space technology that are or may be applied to contribute to global health, such as (A) remote sensing, (B) global navigation satellite system (GNSS), (C) satellite communication, and (D) human space flight (Dietrich *et al.*, 2018).

It is important to note that although the four domains manifest into different technologies, there are intersections between them. These domains are created based on the functions of space technology. Noticeably, a single satellite may be equipped with several kinds of satellite technologies, and thus it can serve more than one function. An apparent example is space technologies in the remote sensing and GNSS domains, which use satellite to record information on the Earth's surface by producing images. GNSS, therefore, can fulfil the function of a space object to conduct remote sensing.

There are several differences between the two (Dietrich *et al.*, 2018). GNSS must consist of multiple satellites to maintain constant signal broadcast, while it is common to use a single satellite in remote sensing. While a GNSS is able to track moving objects, remote sensing focuses on collecting data to reproduce what is happening on a certain location at a specific time.

The following parts of this study discuss each key domain in space activities that have directly been used in health sectors. It looks at the definition of each domain with familiar examples for readers and how space technologies in that particular domain function. It also put descriptive case studies on how the space technology in question has been conducted and applied during the COVID-19 outbreak.

Domain A: Remote Sensing

Space technology is used to mitigate COVID-19 spread is through remote sensing. Remote sensing is defined as gathering information from a distance without making contact with the object observed, similar to how human eyes or camera lens work (Dietrich *et al.*, 2018). Space technologies used for remote sensing are equipped with sensors which can be used by scientists to observe the properties of electromagnetic waves emitted, reflected, or diffracted by the sensed objects. These waves are then studied further to identify and/or classify the aforementioned objects (Dunk and Tronchetti, 2015).

Having an eagle's eye of the Earth's surface has always been beneficial for healthcare. Before the mass use of space technology, the visualization of the relation between location and health was done through cartography. In fact, a 2014 study of the health GIS literature found that

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infectious disease mapping became the focus of 248 out of 865 (28.7%) papers reviewed (Lyseen *et al.*, 2014).

The earliest recorded map visualization was in 1694 on plague containment in Italy. Within the next 225 years, the value of maps as a communication tool blossomed in the service of understanding and tracking infectious diseases. Several diseases such as yellow fever, cholera, and the 1918 influenza pandemic were tracked, and to some extent their spread was also predicted (Boulos and Geraghty, 2020).

Since the 1960s, when computerized geographic information systems were born, analyzing, visualizing, and detecting disease patterns dramatically had increased. Space technology in the form of remote sensing will only serve to exponentially increase mapping capabilities for healthcare.

Essentially, satellites which perform remote sensing can create high quality maps (depending on how advanced the technology is) of a designated area. Having a satellite that can periodically or continuously take images allows to track the sensed object or area.

Pertaining to healthcare, remote sensing is commonly utilized to monitor environmental changes, which could be proven useful in predicting diseases. Bangladesh used remote sensing to address a cholera break. By collecting information from the sea temperature, surface height, and chlorophyll A levels, scientists were able to predict the actual cholera incidence rate in Bangladesh by constructing an environmental model (Christaki, 2015).

Identifying the time frame in which an outbreak is likely to occur can inform public health workers to take action. Simple steps can be taken to stress the importance of basic hygiene and sanitation and implementing simple mitigation efforts. In Bangladesh, simple steps such as filtration of water with sari cloth was credited in several areas by reducing deaths due to cholera by over fifty percent (Ford *et al.*, 2009; Christaki, 2015).

Another case is how satellite imagery can monitor the spread of vector-borne diseases. It has been used to track malaria in sub-Saharan Africa by predicting the distribution of five of the six *Anopheles gambiae* complex species for a large amount of malaria transmissions throughout the African regions (Ford *et al.*, 2009).

The result accuracy was dependent on the amount of data available for disease modeling (Christaki, 2015). The constant improvement in disease modelling and the increase of satellite data accuracy through real-time collection of information on location help to ensure that satellite imaging will be capable of providing tremendous prediction powers for infectious diseases.

In the present context of COVID-19, satellite imagery has been used to analyze the way humans interact with other humans and animals. Satellite imagery can monitor boundaries where humans live near wildlife, which is important because animals can be the source of disease outbreaks. Satellite images also can be used to study anomalies in the environment such as differences in weather, temperature, and other factors that may affect animal migrations which could bring and spread diseases (Rodríguez, Quarantelli and Dynes, 2007).

Since the imagery can be monitored for long periods of time, remote sensing is also used to indicate successful lockdown or quarantine procedures enacted in many areas across the globe such as in China, Europe, and the United States. Satellite images can also predict the spreading virus' centrum based on human behavior (such as crowded beaches or religious gatherings) or the behaviors and movements of wild animals if necessary.

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Public places are monitored to ensure no activities operate, thereby helping to contain further spreading (Planet.com, 2020).

Space technology, including remote sensing, is often combined with other technologies such as Bluetooth or Artificial Intelligence to garner best results. To denote this potential, the Indonesian Ministry of Communication and Information Technology has recently launched an application called *PeduliLindungi* as a measure to contain the COVID-19 outbreak (Public Relations Bureau of the Ministry of Communication and Information Technology, 2020). This application uses Bluetooth technology to track COVID-19 spread and alerts its users if they are entering an area with a high number of people infected by COVID-19. It also has a QR (Quick Response) Code scanner for providing rapid tests to patients and people who still need to travel during the pandemic (PeduliLindungi, 2020). *PeduliLindungi* is equipped with telehealth as well, which is a form of space technology that will be further explained in the satellite communication domain.

Remote sensing can help to map the distribution of health institutions or testing facilities according to the movement of people (Rodríguez, Quarantelli and Dynes, 2007). When planes and unmanned aerial vehicles are too difficult to use in the period of COVID-19, space assets can fill this role. This means society can be directed to the nearest health facility that still holds capacity to treat more patients.

A related and complementary voluntary system was implemented in Guangzhou Underground, China's underground train system in Guangdong Province. Since 17 February 2020, each of the train's carriages has been equipped with a unique QR code that can be scanned by passengers once they board that particular carriage. The passengers then fill their personal data such as identification number (optional), gender, and their route by selecting their starting station and destination station (Boulos and Geraghty, 2020). If passengers wish to move to another carriage, they must scan the new QR code and repeat the same process. If an individual is unfortunately diagnosed with COVID-19, their transport routines will be easily tracked. The government can notify passengers who boarded the same metro carriages at the relevant time.

Satellite images also can be used to track and analyze the possibility of the lack of food supply by monitoring the agriculture area. They also can be used to study and analyze the impact of the pandemic to certain businesses, such as tourism, retail shops, and public transportation.

Domain B: Global Navigation Satellite System (GNSS)

The Global Navigation Satellite System (GNSS) is a space-based system designed to transmit signals. It has three key functions, i.e. Position, Navigation, and Timing (PNT). The GNSS consists of the space segment, the ground segment, and the user segment (Jakhu and Dempsey, 2017). The space segment comprises of a group of satellites, referred to as a constellation. The GNSS is also commonly known under another name, Geospatial Information System (GIS). In the most basic sense, this technology allows geographic data (including hazard-related data) to be mapped and then transformed into interactive visual information. The user can manipulate the data to control the desired interaction.

Each GNSS or satellite constellation has autonomous geo-spatial positioning capabilities. These constellations detect and locate an object with an accuracy from several meters to centimeters, depending on how advanced the system is. Because of its constellation form, the GNSS is constant and thus able to send a continuous signal to its recipient on Earth.

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The recipient has access to receive signal broadcasts from at least four satellites simultaneously. Broadcasts are then calculated to determine location, altitude speed, and direction by calculating the time the signal spends to travel from the satellites to the recipient (Jakhu and Dempsey, 2017).

This means the GNSS is the perfect system to conduct tracking and surveillance. It enables an increased use of spatial analysis to identify the ecological, environmental, and various other factors which contribute to the spread of vector-borne diseases and disease pattern monitoring. Thus, users can define areas that require disease-control planning.

The past decade has seen a tremendous growth for several countries to create and operate their own satellite constellations. Some of these are the Global Positioning System (GPS) owned by the United States of America (US), Global Navigation Satellite System (GLONASS) owned by the Russian Federation, and Galileo owned by the European Union (EU). Executing this system means the operating country—and any other parties that are given access—will be able to have a bird's eye view of Earth at a certain level similar or more advanced to that of Google Maps.

As previously mentioned, the GNSS technology is fundamentally used to explore spatial relationships. For example, a disaster manager could figure out which public facilities such as roads or hospitals that may be affected by earthquakes or floods (Rodríguez, Quarantelli and Dynes, 2007). A single advanced GNSS also can show live and continuous feed of satellite images akin to remote sensing. This means the operators can get data on which health facilities are affected by quarantine measures and identify areas that need fast medical supply rerouting.

In the US and China, during the COVID-19 pandemic, governments used geospatial information to feed fresh data to the artificial intelligence system built to solve logistic problems. This includes the distribution of healthcare items and food. The US-based Atlanta Community Food Bank (ACFB) launched its COVID-19 Help Map for families in need. It has helped weekly deliveries of over 100 tons of food to 21 locations for those affected by school and business closures (Thomas, 2020).

Fresh data is crucial to make sure patients and the local resident receive facilities and basic necessities that they need without traveling. This technology allows several data to be combined, including manual data input by the residents, patients, workers, and the acquired geospatial data.

Due to social distancing, lockdowns, quarantines, and other measures taken across the globe, online shopping is the only viable option for many people to get their daily necessities. GNSS technology can track facilities such as food banks, open restaurants, or even grocery shops that have online delivery. It maps the data and enables supply chains to adapt to the ever-changing conditions during the pandemic. As a result, people can manage to survive or at least feel more normal by getting goods and services needed with the help of this technology.

An initiative stemming from the US is HealthMap, a healthcare application. HealthMap was found back in 2006 by a team of epidemiologists, researchers, and software developers at Boston Children's Hospital. It performs by utilizing online informal sources to search for data which can be used to monitor disease outbreaks and perform surveillance to identify emerging threats to public health in real time (Boulos and Geraghty, 2020). It collects outbreak data from a range of sources including but not limited to news networks, social media, validated official alerts such as the World Health

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Organization (WHO), and experts' curated accounts.

In the context of COVID-19, HealthMap managed to curate an interactive map which shows geolocation updates from the aforementioned sources, and thus users can grasp a better understanding of how the pandemic spread. It has an "outbreaks near me" feature which informs users of nearby disease transmission risks based on their current location, obtained from the user's device (Boulos and Geraghty, 2020).

Similar to HealthMap, Canada has BlueDot, a firm specializing in automated infectious disease surveillance. The firm uses natural language processing techniques and machine learning to filter news reports, forums, blog posts, disease networks, and various data in 65 languages. The data is periodically sifted to find indications of possible disease outbreaks through any unusual events. Trained epidemiologists employed by BlueDot further analyze the automated data for any outbreak prior to releasing them to clients (Boulos and Geraghty, 2020). As a result, the firm was considered as the the earliest platform to give news of the COVID-19 outbreak which firstly began in China.

Like remote sensing, the GNSS technology also can be used to analyze the impact of COVID-19 on various business industries, including but not limited to air travel, tourism, and trading (European Global Navigation Satellite Systems Agency, 2020). The data in flight radars showed that the number of flights has plummeted, and the movement of tourism ships that has still operated also follows this trend (Scatteia and Ravichandran, 2020).

Domain C: Satellite Communication

When discussing satellite communication, it must be distinguished from communication methods which only make use of radio signals for sending and receiving a message. Rather, it must use specifically designed satellites as part of an infrastructure to transmit messages {Formatting Citation}.

Satellite communication's main contribution to global healthcare is through telemedicine technology. Telemedicine is the delivery of healthcare and its exchange across distances in instances where medical expertise or resources are not readily available on site for various reasons. Usage of telemedicine may be incurred by geographical distance, the existence of physical barriers such as mountainous or extreme terrains, and insufficient resources when transferring a patient.

Patients under the treatment by a health care provider in rural areas can be connected with specialists in urban areas. For instance, Thailand's telemedicine network is connected through THAIOM, the country's first satellite dedicated for communication launched in 1993. Under the Ministry of Public of Health, all hospitals within the telemedicine network have access to a direct communication link with the government base (Dietrich *et al.*, 2018). This communication link means guaranteed access to experts' opinions among general practitioners, nurses, paramedics, or specialists, often accompanied by images from radiography or dermatoscopy. The images used were predominantly 2D and non-animated images until recent advancements that enabled the transfer of 3D images and live ultrasound feed.

The use of telemedicine surprisingly is effective for a nation's defense system (Dietrich *et al.*, 2018). Each of Germany's defense units is equipped with medical officer personnel on board with access to telemedicine workstations. Each of these stations may have devices such as X-ray film digitizers, dermatoscopes, otoscopes, ultrasounds, and video cameras. Another example comes from the US Navy. Over

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300 US Navy ships are equipped with telemedicine features, and there have been estimations that 17% of medical evacuations can be avoided. This finding potentially saved the US as much as $4400 per medical evacuation (Dietrich *et al.*, 2018).

The Project Emergency Telehealth and Navigation (ETHAN), initiated by the Houston Fire Department in 2014, is another program which combines telehealth, social services, and alternative transportation to navigate primary care-related patients. The project aimed to make the emergency care system more efficient (Langabeer *et al.*, 2016). Since emergency medical service agencies dominantly mobilize patients with non-emergent and low acuity conditions to Houston's local emergency departments, ETHAN may improve the emergency system's capacity.

During the first year, 5,570 patients participated in ETHAN. The participant group was compared with a control group of the same size. Results of this study found a 56% absolute reduction of the time ambulance trips to and from emergency departments. The median time for the productivity of emergency medical services was also reduced by a 44-minute average, dropping from 83 minutes to only 39 minutes (Langabeer *et al.*, 2016). The productivity time is the median time measured from the time the emergency medical services receive a notification to when the ambulance returns to the hospital.

For patients with more severe illnesses, electronic intensive care unit (e-ICU) monitoring programs are suitable, as they allow nurses and physicians to remotely monitor around sixty to one hundred patients in ICUs from multiple hospitals. In the US, these programs are provided in several healthcare facilities, such as Sutter Health, Mercy Virtual Care Center, and Sentara Healthcare (Hollander and Carr, 2020).

A combination of telemedicine with robot technology was also found in the US. The Boston Dynamics' robot dog "Spot" was assigned to Brigham and Women's Hospital in Boston. Spot has a tablet where the head would have been, and thus the robot operator can communicate with patients and other healthcare personnel. These robots are deployed with a special payload in triage tents and parking lots to help hospital staff receive information of COVID-19 suspects and perform initial assessments (Mack, 2020; Simon, 2020).

The existence of robots which can navigate hospitals to monitor certain patients and exercise menial tasks such as delivering supplies and food would free up human doctors, nurses, and other medical personnel. Spot is a new model with deft footwork, which could navigate halls better compared to wheeled robots. This minimizes chances of getting stuck in hospital halls and doorways.

Boston Dynamics is also open-sourcing Spot's sensor codes to help other machines remotely interview patients (Simon, 2020). Theoretically, if this experiment is successful, more specialists can monitor patients from a safe distance and administer medical actions such as temperature taking or medicine deliveries. Reducing medical personnel exposure is important. It is noted that in the US alone, up to 100 workers from a single institution must undergo quarantine due to COVID-19 exposure, raising concerns for their workforce capacity. The company hopes Spot will eventually be able to collect vital signs from patients such as body temperature, respiratory rate, pulse, and oxygen levels to solve this issue (Mack, 2020).

There are still setbacks of using robots. Disinfection must be done periodically. Robots' fans may also spread viruses similar to human sneezes. However, Spot's case study has proved

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that robot utilization can help to optimize the use of telemedicine.

Engineers at Boston Dynamics hope to enable Spot to use a thermal camera that can remotely measure patients' temperatures in the future. Strapping a UV light used for disinfecting hospital rooms is another idea that still needs further analysis as it will need a powerful but compact and safe power source (Simon, 2020).

In the developing countries, telemedicine is a key in providing health services. Governments and private entities have worked together to provide high-resolution telemedicine services using 4G and 5G signals that cover the entire globe. Affordability of connection is also important to ensure clinics and hospitals in remote areas can access telemedicine.

Specifically, for highly contagious diseases such as COVID-19, telemedicine also can be used to prevent the virus spread. Local health technicians can operate stethoscopes, thermometers, or even x-ray machines connected via Bluetooth, and then send the data to a pulmonologist to make a diagnosis. Therefore, patients can stay in quarantine and still receive health services.

Domain D: Human Space Flight

The human space flight domain has proven to have contributions to general health concerns and certain diseases. Resources and tools used in space flight bear more relevance to the COVID-19 pandemic than what was initially thought. This specific domain takes on the wide spectrum of technologies used in human space flight which may relate to other health concerns (Dietrich *et al.*, 2018).

Telemedicine is an element which intersects the use of technology in both healthcare and human space flight, despite falling under the satellite communication domain as previously explained. Both missions face similar issues, such as having low bandwidth connection leading to weak signal, acquiring and maintaining a stable power source, assuring adequate data storage, requiring an intelligent software development and user training to ensure the availability of reliable human resources (Dietrich *et al.*, 2018).

A potential breakthrough comes from NASA. Their engineers at the Jet Propulsion Laboratory (JPL) in Southern California have developed Ventilator Intervention Technology Accessible Locally (VITAL), a new high-pressure ventilator tailored to treat COVID-19 patients (Good, 2020). In April 2020, NASA seeked for expedited approval from the Food and Drug Administration (FDA) for VITAL via an emergency authorization, and the request was approved in May 2020. This system uses a fast-track approval process developed for crisis situations and takes just several days rather than months or years.

The whole space industry and space agencies have started to modify and apply technology for human space flight to help patients with COVID-19 and health workers (Naray, 2020). Engineers can modify technologies used for creating space suits and breathing devices for astronauts. Such alternatives can be applied to help patients who need ventilators and health workers who need extra protection due to their high exposure to the virus. The industry also has the capacity to produce both ventilators and special gears required (National Aeronautics and Space Administration, 2020; Porter, 2020).

Application of Space Technologies in Indonesia in Response to COVID-19

The use of space technology in Indonesia, whether for remote sensing, telecommunication satellites, or navigation satellites, has been oriented to support the achievement of the Sustainable Development Goals, the Sendai Framework, as well as the Paris Agreement. Over the last four years, the

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Ministry of Health has been using space technology for telehealth and telemedicine to provide health services to 50 remote areas in Indonesia. They will push such ways to reach more remote areas.

For that goal, the Indonesian Government has invested in an infrastructure known as Palapa Ring and a sky highway (*tol langit*), with the ambition of connecting health centers, schools, disaster mitigation agencies, and other government institutions, including the ones located in remote areas throughout the Indonesia archipelago (PT. Palapa Ring Barat, 2016). The infrastructure includes optical cables, microwave signals, and 4G connection. The Government has also procured its own communication satellites and will sell the services to different government institutions.

In terms of disaster management, the Indonesian National Agency for Disaster Management has made use of space technology to support disaster management in Indonesia and in other ASEAN countries. Meanwhile, to anticipate climate change, space technology, particularly remote sensing, has been used to periodically monitor the condition of forests in Indonesia. For example, currently almost all provincial governments have space-based earth observation systems, as a result of collaboration between Lembaga Antariksa dan Penerbangan Nasional (National Institute of Aeronautics and Space of Indonesia, abbreviated as LAPAN) and provincial governments.

Article 29 of Indonesia's Government Regulation Number 11 of 2018 on Remote Sensing states the necessity of validating and calibrating remote sensing data to have accurate and dependable end results. Collaborations as mentioned in the above paragraph are important, and LAPAN as Indonesia’s appointed focal point for space activities needs access to remote sensing data from its own satellites, other government institutions, private entities, and foreign agencies to ensure better disaster management in the future.

Indonesia has also implemented telemedicine. The elucidation of Article 24 of Law Number 21 of 2013 on Space Activities includes telemedicine as a part of spin-off technology, refering to the benefits of space technologies for other industries. Considering how much Indonesia depends on this technology, the Indonesian Government has mandated LAPAN to master it.

Back in 2018, the Ministry of Health's Directorate General of Health Service launched Sehatpedia, an application aiming to disseminate accurate, credible, and trustworthy healthcare information to Indonesian society. Sehatpedia is supported by specialists from 33 hospitals who have the capacity to provide specific consultations for users (Indonesian Ministry of Health, 2018). It is featured with an interactive live chat for consultations, access to articles related to health care, the Directorate General of Health Service's health tracker, a website link for patient registration, and E-Policy.

The Indonesian Ministry of Health also built an application called Integrated Technology Telemedical for Medical Service (Temenin) to connect doctors, hospitals, and clinics to combat the challenges of equal access to medical services in rural areas. Technicians and general practitioners in small clinics will operate the machineries to perform certain medical actions such as radiology, electrocardiography (EKG), and ultrasonography (USG). Results would then be sent to specialists in bigger hospitals (Indonesian Ministry of Health, 2020a).

In 2018, the tele-radiology, tele-EKG, tele-USG, and tele-consultation were successfully used in smaller government clinics. Based on Article 2 of the World Health Organization International Regulation 2005 (WHO IHR 2005),

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Indonesia also has the obligation to prevent, protect against, control, and provide a commensurate public health response to the international spread of disease in ways could restrict public health risks in the pandemic.

During the COVID-19 pandemic, these technologies can be modified to medical equipment that are possibly required to connect the clinics to pulmonologists working at larger hospitals in urban areas. Tele-consultation and applications mentioned previously also can be used to determine whether a patient should be referred to other specialists or not and to identify the right doctors in certain locations. There were over 700 general practitioners and specialists working with Temenin as reported in April 2020 (Indonesian Ministry of Health, 2020b), with 55 hospitals supporting 148 healthcare facilities (Indonesian Ministry of Health, 2020c).

Indonesia has also used the satellite communication technology domain to combat the COVID-19 spread. Using satellite communication, LAPAN through the LAPAN-A2/LAPAN-ORARI satellite has given public information on physical distancing and raised awareness of the importance of wearing masks when going outside (National Institute of Aeronautics and Space of Indonesia, 2020). Some of the campaigns are “Tetap Sehat, Tinggal di Rumah/Stay Healthy, Stay at Home” #LAWANCORONA/#FIGHTCORjONA, “Stay Healthy at Home and Productive” #FIGHTCOVID-19, and “Wajib Pakai Masker/A Mask is a Must” #JagaJarak/Social Distancing #Stay@Home #FightCovid19.

CONCLUSION

Space technologies hold a role in advancing global health goals. They allow efficiency, tracking, surveillance, and disease-control planning. In the context of COVID-19, space technologies have been proven to be invaluable in helping health care personnel and governments track the disease’s sources and spread, and identifying where the most damage occurs. It also maintains daily activities such as communication and work afloat. Future developments in space technologies would possibly have an even bigger role, such as minimizing patient contact with medical personnel to minimize the virus spread.

Indonesia has used space technology through remote sensing, GNSS, and satellite communication although it is not as advanced as in some other developed countries. There is plenty of room for innovation and cooperation in order to encounter and mitigate the COVID-19 pandemic.

CONFLICT OF INTEREST

The authors stated that there was no conflict of interest with anyone for this article.

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