Predicitive modeling, empowering women, and COVID-19 in South Sumatra, Indonesia

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FORM REVIEW
ASEAN JOURNAL OF COMMUNITY ENGAGEMENT

Title of Manuscript	Predicitive modeling, empowering women, and Covid-19 in South Sumatra, Indonesia
Paper ID	
Tema	**Checklist**
Tipe	**Checklist**

No.	Commentary of Manuscript
A.	**General Recommendation**
A.1.	Relevance to Community Engagement Article: The manuscript indicates its relevance to community engagement issue, considering the FPAR cycle that is used as research framework.
A.2.	Relevance of services to society: The pandemic needs urgent actions and this research provide solution for tackling the specific case in South Sumatra.
A.3.	Relevance of applying science and technology: The pandemic strongly demands science based quick response to avoid fake news and information. This research is aimed to apply science for mitigating the impact of Covid-19.
A.4.	Relevance of increasing the capacity of society: This research is clearly related to the community engagement, then it is relevant to capacity enhancement, especially using family as a basis for increasing the capacity.
A.5.	Relevance of community empowerment: Based on capacity enhancement perspective, this manuscript is explicitly relevant to community empowerment, particularly focuses on women empowerment issue
B.	**Substance**
B.1.	Introduction: The introduction provides appropriate explanation for the research objective 1, but it has not present sufficient reasoning for objective 2. The manuscript should complete related theories or concept as the state of the art in the area of women empowerment issues. It also indicates unclear on observation data and scientific expectation which show the importance of women experiences for mitigating the impacts of Covid-19.

B.2.	Methodology: The manuscript should provide additional explanation or additional tool/tools to ensure that FPAR will be applied in the context to empowering women, not limited to involve women on the reflection and research activities.
B.3.	Results and Discussions: - The graph legend (figure 5) should clearly define whether indicate both are estimated or estimated and data (reported). - Prediction of business as usual total death (caused by Covid-19 and other common death causes) in South Sumatra needs to accompany and verify the prediction. - The discussion jump to conclusion on "discipline" and it constructs with top down approach, this is in contrary with the FPAR cycle approach
B.4.	Bibliography/References:
B.5.	Conclusion: - the first (quantitative) conclusion needs to present quantitative results - the second (qualitative) conclusion needs to refer the results and discussion chapter
B.6.	Substantive Manuscript of Community Engagement:
B.7.	Others:
C.	**Recommendation** (Please Thick One of the Two Options Below)
C.1	…✓… ACCEPT ……. REJECT

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A.3.	Relevance of applying science and technology:	
A.4.	Relevance of increasing the capacity of society:	
A.5.	Relevance of community empowerment:	
B.	**Substance**	
B.1.	Introduction:	

B.2.	Methodology: In the qualitative method, please elaborate more for the process of the data being collected and processed.
B.3.	Results and Discussions: - More explanation in this section
B.4.	Bibliography/References:
B.5.	Conclusion:
B.6.	Substantive Manuscript of Community Engagement: Novelty and lesson learned need to be clear.

B.7.	Others:
	    1. Figure must be clear
	    2. Please use your figure in English, not in Bahasa

C.	**Recommendation (Please Thick One of the Two Options Below)**
C.1	...✓... ACCEPT .... REJECT

Reviewer comments	Action
	We thank the editor and reviewers so much for their help with this article. The time you have taken to support us, and encouraging

Editor

us, and providing ways to strengthen the article have been most appreciated. Thank you!

Comments from Editors are as follows:
1. Figure must be clear (with high resolution)

We have changed the figure.

2. Please use your figure in English, not in Indonesian.

Corrected thank you.

Reviewer #2

B.1 Introduction: -

-

B.2 Methodology:

In the qualitative method, please elaborate more for the process of the data being collected and processed.

Thank you We have now added this statement:

The qualitative data was collected for three months from April to June 2020. We involved five female volunteers in a suburban area in Palembang to involve to the social movement in Covid-19 awareness health promotion for kids or Pangling. The reflection notes during the field-work were reported every week by the second author to be discussed to other authors for enhancing the robust of the research. In this paper, we focus on the intial finding of the Pangling research project (see our project in Instagram: Englishcamp_13ulu).

B.3 Results and Discussions:

More explanation in this section

We have done this

B.4 Bibliography/References: -

-

B.5 Conclusion: -   -

B.6 Substantive Manuscript of
Community Engagement: -

Novelty and lesson learned need to be clear.

Thank you. We have done this

B.7 Others:
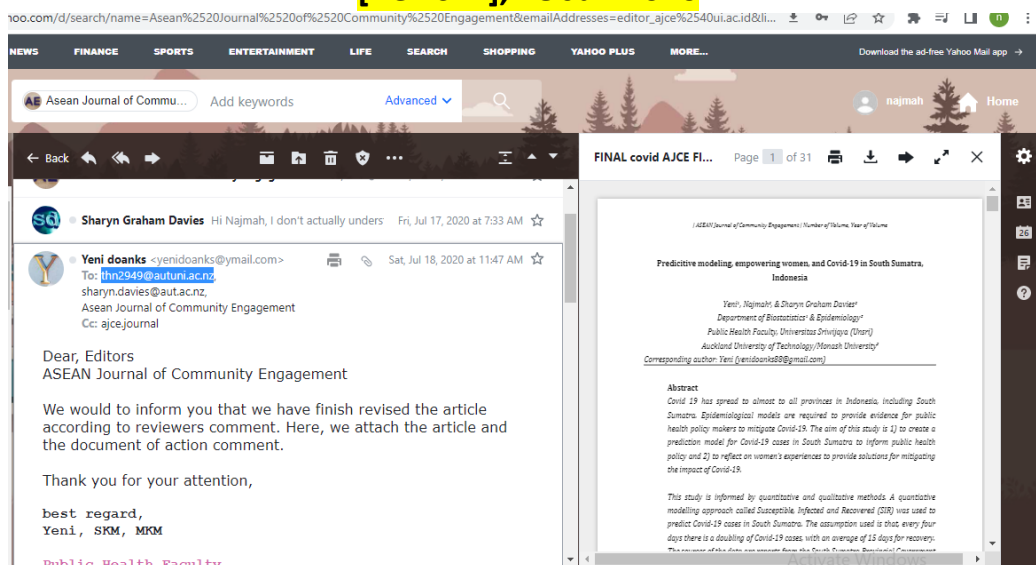
1. Figure must be clear

Thank you, we have changed the figure

2. Please use your figure in English, not in Bahasa

We have done this

Predicitive modeling, empowering women, and Covid-19 in South Sumatra, Indonesia

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Abstract

Covid 19 has spread to almost to all provinces in Indonesia, including South Sumatra. Epidemiological models are required to provide evidence for public health policy makers to mitigate Covid-19. The aim of this study is 1) to create a prediction model for Covid-19 cases in South Sumatra to inform public health policy and 2) to reflect on women's experiences to provide solutions for mitigating the impact of Covid-19.

This study is informed by quantitative and qualitative methods. A quantiative modelling approach called Susceptible, Infected and Recovered (SIR) was used to predict Covid-19 cases in South Sumatra. The assumption used is that, every four days there is a doubling of Covid-19 cases, with an average of 15 days for recovery. The sources of the data are reports from the South Sumatra Provincial Government and the Ministry of Health of the Republic of Indonesia. Qualitative data was obtained through a feminist participarity action research project focused on children's experiences of Covid-19. Reflective analysis was used to develop insights into how to empower women in respect to mitigating Covid-19.

Results show that Covid-19 cases in South Sumatra are still underreported, with only 5-10% of the total estimated Covid-19 cases being reported. Modelling indicates that over 1,000 people had Covid-19 by the end of April, reaching over 150,000 by the end of May, and over a third of South Sumatra's population is likely to be infected by the end of June. Multiple interventions are needed to reduce cases and flatten the curve. Women are key to flattening the curve and must be empowered to undertake actions from a familial base.

Keywords: Covid-19, South Sumatra, multiple intervention, public health, prediction, women's empowerment.

1. Introduction

Covid-19 is a new type of coronavirus, originating in Wuhan, China, in late 2019 and spreading to most countries in the world by June 2020. Covid-19 was recognised as a global pandemic by the World Health Organisation on 11th March 2020 (Bedford, et al.,

2020; WHO, 2020). By the 8th of July 2020, Covid-19 had spread to over 213 countries with over 12 million cases (Worldometer, 2020). Five countries experienced particularly high numbers of Covid-19 cases early on, including the United States, Brazil, India, Russia and Peru (Johns Hopkins University & Medicine, 2020).

In Southeast Asia, Indonesia reported the first-highest number of cases of Covid-19 after Singapore and Indonesia was placed at the first rank for the highest mortality rate at about 5,9 %; this means that, out of 100 people, six would pass away due to Covid-19, per 8 July 2020 (Table 1) (Worldometer, 2020). The number of active cases of Covid-19 in Indonesia are as high as the number of recovered cases with Covid-19. Half of the total reported cases recovered within three months of the first cases being announced by the President of Indonesia, Joko Widodo on 2nd March 2020 (Ministry of Health of RI, 2020g; Worldometer, 2020). Early detection of cases is still a challenge in Indonesia and test faciliaties remain limited (Worldometer, 2020).

Public health experts have modelled Covid-19 in Indonesia and concluded that reported cases by the Ministry of Health are only around 10-20% of actual cases. With low intervention, such as Large Scale Social Distancing, and moderate intervention, such as mass testing and compulsory social distancing through such things as closing schools and businesses, Indonesia should have detected 1.9 million or 1.1 million Covid-19 cases at the beginning of May 2020 respectively (Ariawan, Riono, Farid, Hafizah, & Jusril, 2020). These estimated cases are far from the actual reported cases of approximately 14 000 (Ministry of Health of RI, 2020f). In short, at the start of May, official figures stated that Indonesia had just 14 000 cases of Covid-19 in the country, but modelling suggests this number was as high as 1.9 million.

Tabel 1. Covid-19 cases in South-East Asia

Countries	Total tests	Tests per 1 million population	Number of positive cases	Number of death	Number of recovered	Case Fatality Rate (%)	Proportion of recovery (%)
Indonesia	964,054	3,458	66,226	3,309	30,785	5,0	46
Singapore	757,746	129,506	45,140	26	41,002	0,1	91
Philippine	845,218	7,712	47,873	1,309	12,386	2,7	26
Malaysia	816,118	25,211	8,674	121	8,481	1,4	98

Thailand	286,008	4,099	3,025	56	2,854	1,9	94
Vietnam	275,000	2,825	369	0	341	0,0	92
Myanmar	85,689	1,575	316	6	245	1,9	78
Brunei Darussalam	29,841	68,202	141	3	138	2,1	98
Cambodia	40,521	2,423	141	1	131	0,7	93
Timor-Leste	1,568	1,189	24	0	24	0,0	100
Laos	1,8091	2,486	19	0	19	0,0	100

Note: Number of population in each country: Singapore 6 million; Indonesia 270 million; Philipine 109 million; Malaysia 32 million; Thailand 70 million; Vietnam 97 million; Myanmar 54 million; Brunei 440 thousand; Cambodia 17 million; Timor Leste 1.3 million; Laos 7.3 million.

Source: Report per 8th July 2020 (Worldometer, 2020)

Epidemiological and statistical Covid-19 modeling is needed to solve the problem. Modelling is beneficial to measuring human resources and health facilities, including medical records, information health systems, and readiness of laboratories in each province in Indonesia (Elyazar, et al., 2020). The accurate and timely prediction of infectious diseases, according to Lut et al. (2019) and Lie et al. (2020), can provide information for public health responses to seasonal and a pandemic in the future with appropriate guidance for early mitigation and prevention strategy (Li et al., 2020; Lutz et al., 2019). Previous studies on Severe Acute Respiratory Syndrome (SARS) outbreaks showed that the delay in controlling outbreaks for one week would make the number of cases three-fold higher and increase the duration of the epidemic to four weeks (Wallinga & Teunis, 2004). An evidence-based or scientific policy base will be needed in all countries, especially in limited-resource countries with unequal chances to access health services, including Indonesia (Lutz et al., 2019). At the national level, The Ministry of Health-Indonesia has established Large-Social Scale Guidelines of Restriction or PSBB (*Pembatasan Social Berskala Besar*) as one strategy for Covid-19 mitigation in Indonesia (Ministry of Health of RI, 2020a).

South Sumatra, one of the provinces in Indonesia, is where the first two authors of this report came from. There are three reasons we are focusing on South Sumatra. Firstly, the first case in South Sumatra was announced on the 24th of March, three weeks after the first cases in Indonesia, in early March 2020. The detection of cases was considered too late in the South Sumatra, as Jakarta can be reached by a 50 minute flight. Secondly, the number of samples tested is limited. For instance, Jakarta, with a population over 10 million, has undertaken over 160,824 samples for the Prolymerase Chain Reaction (PCR) test, while South Sumatra with 8.5 million people took only 4,745 samples for PCR test as of the 3rd June, 2020 (BPS, 2010; Provincial Government of South Sumatra, 2020; Communication Informatics and Statistics Department of DKI Jakarta, 2020). Thirdly, South Sumatra, particularly the two cities of Palembang and Prabumulih, saw Large-Social Scale Restriction or PSBB (*Pembatasan Social Berskala Besar*) put in place from 12th May, 2020. PSBB was based on the regulation of the Ministry of Health, number HK.01.07/Menkes/307/2020, (Ministry of Health of RI, 2020d); therefore, there is a need for an epidemiological model with SIR modeling to estimate the number of Covid-19 cases in South Sumatra. This research also provides an epidemic curve, with and without public health intervention, as one measurement to determine the success of Covid-19 mitigation in South Sumatra.

This research argues for the importance of including women's experiences in mitigating the impacts of Covid-19. Feminist research seeks to contribute to women's empowerment (Hesse-Biber, 2012). Women have the potential to contribute to the development of collective consciousness through their active participation, shared knowledge, and collaboration in the research itself (Crotty, 1998; Lykke, 2010). The work of Kramarae and Spender (1992) further supported the notion that women have knowledge of and insight into their social life circumstances that enables them to transform themselves through knowledge construction. Empowering women particularly from low-middle income family, such as a research by Biju in Kerala, Indian, can initiate community to self-manage Covid-19 epidemic, such as mask making and hand sanitizer production, spread and promote at the grassroots level the importance of social distancing and personal hygiene, and provided free counselling service too to the children during the unprecedented lock down period (T, Biju, 2020). In limited-resource countries, with limited access to Covid-19 tests and treatment, including Indonesia, women need to be empowered to protect their family from Covid-19 transmission.

2. Methods

2.1. Quantitative approach

The prediction of Covid-19 cases was undertaken using the mathematical model of SIR or Susceptible, Infected, and Recovered. The SIR model was introduced by Kermack and McKendrick in 1927 as an epidemiological model to provide a simple way to explain the transmission of communicable diseases at an individual level which can pass into three steps: susceptible, infected and recovered (The Institute for Disease Modeling, 2019). To undertake this modeling, we need to know the average of doubling cases or a daily average for a case to infect other people, or transmission rate or β and average days for recovery of one Covid-19 case, or recovery rate (ϒ) (British International School Phuket, 2014; Collins & Abdelal, 2018; Smith & Moore, 2004).

$$\frac{ds}{dt} = -\beta si \quad \text{.................. (1)}$$

$$\frac{di}{dt} = \beta si - \gamma i \quad \text{................... (2)}$$

$$\frac{dr}{dt} = \gamma i \quad \text{................... (3)}$$

Previous research shows that infection of Covid-19 was assumed to occur within 12 hours for symptomatic cases, and on the fourth and sixth day for asymptomatic cases (Ferguson et al., 2020). One infected case needs two weeks to recover with mild symptoms, and three to six weeks for cases with severe symptoms (Aylward, Bruce; Liang, 2020). Therefore, for the Covid-19 case, we applied the assumption that one person infected with Covid-19 will transmit the virus to other people within about four days, and the recovery rate is assumed to take 14 days. This assumption is used to consider laboratory test delays for the first and second samples, especially where there are limited laboratories. South Sumatra's population is estimated to be around 8.6 million (BPS, 2020).

In our modeling, the prediction of cumulative cases of Covid-19 was based on three assumptions: 1) non-pharmaceutical intervention; 2) single intervention, and 3) multiple interventions. The non-pharmaceutical intervention is known as the public health approach without using any medication approach, such as health promotion. Single intervention is an intervention related to social distancing in working places, schools, and other mass gatherings. The multiple interventions are both non-pharmaceutical

intervention and single intervention as well as other public health approaches, such as travel restriction (Ahmed, Zviedrite, & Uzicanin, 2018). This intervention can reduce over 80% of imported cases from other countries or provinces in Indonesia to another country or provinces (Chinazzi et al., 2020). The multiple interventions with vaccination are the combination of multiple interventions with anti-retroviral therapy or prophylaxis therapy, or availability of vaccination (Halloran et al., 2008; World Health Organization, 2019). Yet, for a pandemic with a new strain of the virus, the third intervention is quite challenging as the new vaccines or medicines would take over 6 months of trials before they are used for randomised controlled trials at community levels (World Health Organization, 2019).

2.2. Qualitative approach

2.2.1. Feminist Participatory-Action Research (FPAR)

Empowerment practices have a strong root in feminist research (Carr, 2003; Turner & Maschi, 2015). Carr (2003) and Turner and Maschi (2015) argued that women are often positioned as powerless or marginalized in their social, cultural, and political spheres. FPAR, first introduced by Patricia Maguire (1987), and used by Brinton Lykes, Collen Reid, and Wendy Frisby (2008), was chosen as a suitable research methodology to facilitate the emergence of women's voices and collective empowerment leading to social action. Applying FPAR, we argue for the centrality of a woman's position as a subaltern, as a woman. This is followed by co-constructing knowledge and engaging in the co-learning process through women's shared experiences, thoughts, and aspirations. Furthermore, even the often-silenced voices are enabled to develop a collective voice to raise their critical consciousness, and to reflect and find solutions to their problems, leading to individual and collective actions (Brydon-Miller, Maguire, & McIntyre, 2004). Previous research in health and social fields has been applied in the context of empowering women, such as among Hmong women in Canada (Yoshihama & Carr, 2002), and vulnerable women, such as those fleeing from violence at home (Jategaonkar & Ponic, 2011). The previous research and current research, as it was participatory in nature, was open to the use of any data collection method that would enhance women's participation and social transformation.

Figure 12 below summarises the research cycle of FPAR in this study by adopting some principles and dimensions of Feminist Participatory Action Research based on previous literature and research by Lykes (2007, 2012), Maguire (1987), and Reid and Frisby (2008). Women in the general population, with different education backgrounds, social roles, and life context, were central to this study to allow for the construction of knowledge, critical understanding of the vulnerability of Covid-19 in a family and the individual and collective consciousness needed to

enhance Covid-19 awareness for children (Points 1, 2, 3 in Figure 12). Moving to Points 3 and 4 of the cycle, the collective awareness of the importance of the protecting family, particularly children from Covid-19 was addressed. Mobile Covid-19 awareness movement for children (*Penyuluhan keliling anak* or PangLing) was critically examined by all-female volunteers as the beginning action to enable social transformation in practice, including being a volunteer, giving out masks and soap, and educating Covid-19 prevention for children aged 5-12.
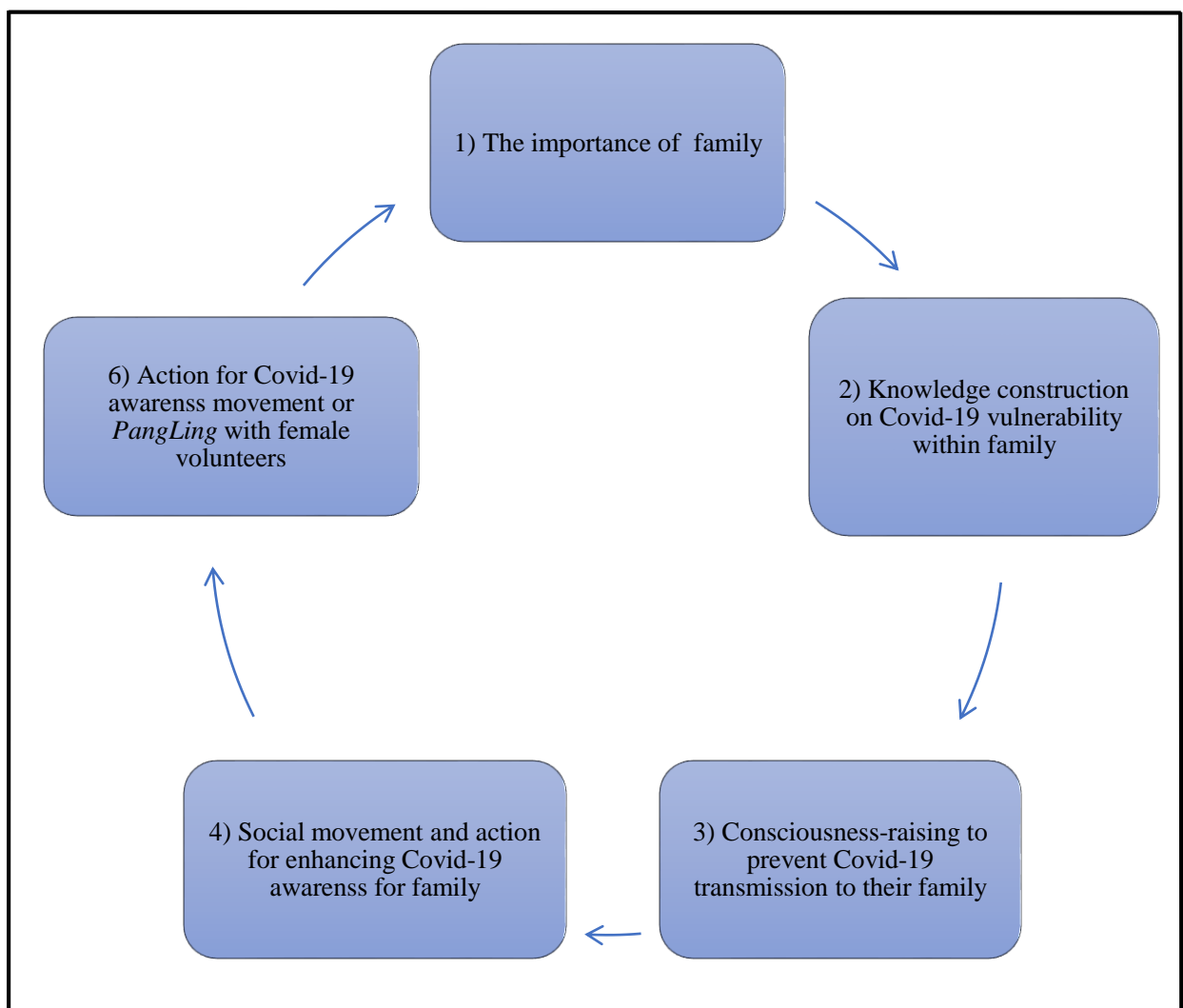
Figure 1: FPAR cycle of enabling women to be involved in movement of Covid-19 awareness for children in Palembang, South Sumatra.

Sources: Lykes (2007, 2012); Reid & Frisby (2008).

The qualitative data was collected over three months from April to June 2020. This research involved ten women who participated in a social movement or *Pangling* voluntarily, in a suburban area or *kampung* in Palembang (South Sumatra). The reflective notes, during the field-work, were reported every week by the second author, and discussed with other authors to enhance the robustness of the research. Visual outcomes also were published on social media (Instagram: englishcamp_13ulu). In this paper, we focus on the initial findings of the Pangling research project.

Author's reflections were noted in field notes and included a description of research activities, details of participants involved, and overall assessment of the research process and participants' evaluations of activities. Reflection is an important aspect of data generation and analysis in FPAR (Lykes & HershBerg, 2012). Based on the work of Regmi and Naidoo (2013), reflective analysis started with a descriptive process, followed by assessment and analysis, and evaluation and action.

3. Results and Discussion

Indonesian context and Covid 19

Covid-19 causes mild to severe respiratory symptoms in a short time caused by a coronavirus, SARS-Cov 2 (Gorbalenya et al., 2020). This new virus is quite different from other viruses such as SARs-Cov in 2003 and Mers-Cov in 2012 which also caused outbreaks of acute respiratory disorders. SARS-Cov 2, discovered in 2019, consists of a combination of many viruses isolated from human hosts and various types of bats (Gorbalenya et al., 2020). The main symptoms that appear are fever, dry cough, fatigue, and sputum production (Figure 2). Out of the 10 cases that show clinical symptoms, two will have difficulty breathing (Aylward, et al., 2020). It should be noted that 80% of patients infected with Covid-19 will not have symptoms that are mild to moderate, but they are still able to transmit the virus (Li et al., 2020; The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020).
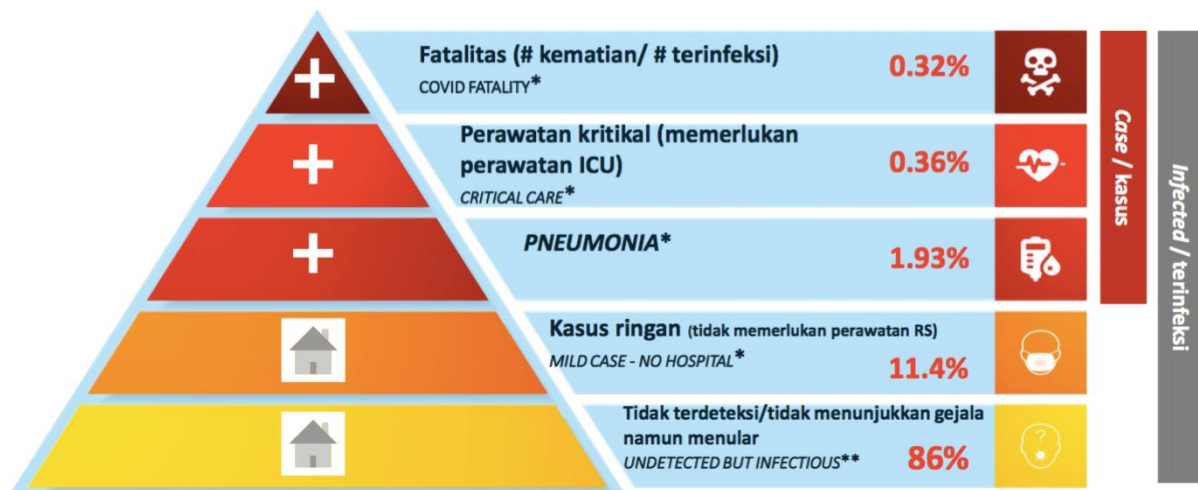
Figure 2: Covid 19 based on symptoms (Ariawan et al., 2020)

Note: Image source (Ariawan et al., 2020), citation information from (R. Li et al., 2020; The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020)

Indonesia announced the first positive Covid-19 case on March 2, 2020. On April 9, 2020 (the 39th day) confirmation of the cumulative number of positive Covid-19 cases in Indonesia had reached 3,923 (Ministry of Health of RI, 2020f). On May 15, there were 16,496 positive Covid-19 cases reported officially by the Indonesian Ministry of Health, with a death rate reaching 1,076 and a recovered rate of 20% or 3,803 cases, but with new cases increasing. On July 7, confirmation of the new cases of positive Covid-19 in Indonesia had reached 1,268 by the Indonesian Ministry of Health, with the cumulative number of cases reaching 66,226 cases (Figure 3).
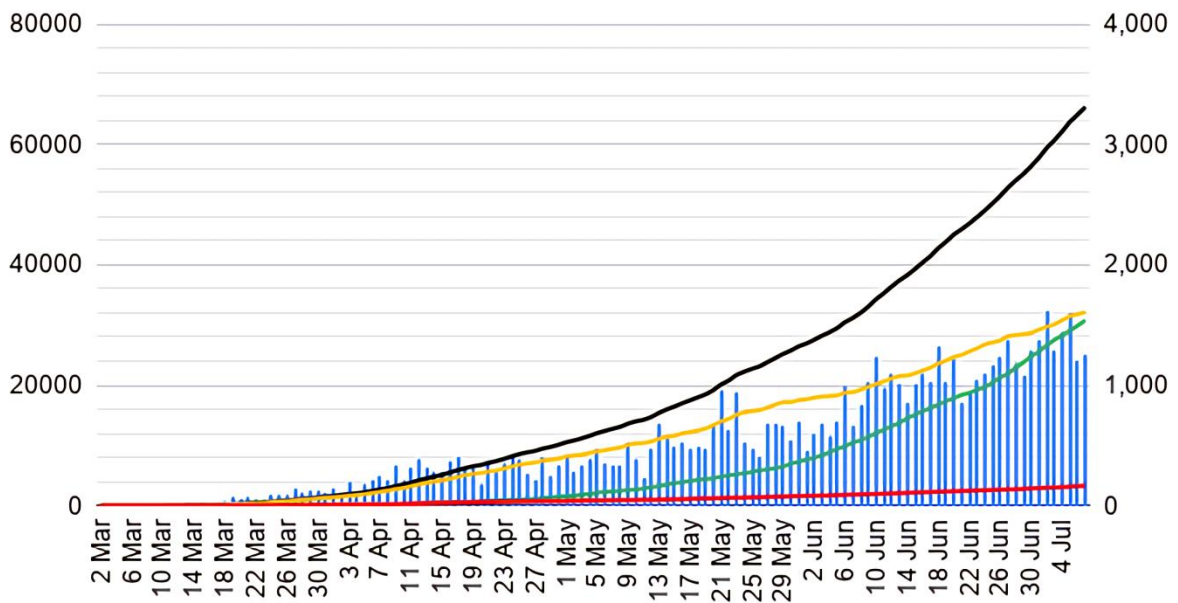
Note: ▬ New cases, ▬ Total cases, ▬ Active cases, ▬ Recovery, ▬ Death

Figure 3: Incidence rate (new cases) every day in Indonesia (Kawal Covid 19, 2020; Ministry of Health of RI, 2020b)

South Sumatra Context and Covid-19

South Sumatra announced that 2 patients under supervision (PDP, Indonesian literally *Pasien Dalam Pengawasan*) in South Sumatra Province died on March 23, 2020. One PDP person who died in the city of Palembang was confirmed as positive for Covid-19 on March 24. The press led by the Governor of South Sumatra and one PDP person, who died from the City of Prabumulih was confirmed positive on 19 March 28, 2020, and was the head of the Prabumulih Hospital (Provincial Government of South Sumatra, 2020). The first two cases that died had a history of travel from Jakarta, Bogor, and/or Batam and were categorized as imported cases and are over 50 years old and have a history of comorbidities namely Diabetes (Putra, 2020; Septianto, 2020). Based on these data, South Sumatra Province had 2 positive cases of Covid-19 as of March 23, 2020.

The coverage testing and tracing of suspected Covid-19 is still low in this province; therefore the positive-results from all cases seem higher compare to the results at the national level. The data as of May 11, 2020, shows that from all specimen results that were completed were obtained positive Covid-19 test results in South Sumatra in 278 cases (51.7%) and negative Covid-19 counts of 260 samples (48.3%) (Provincial Government of South Sumatra, 2020). The percentage of positive cases of Covid-19 identified in South Sumatra is very large when compared to the percentage of positive cases at the national

level, where data from the Republic of Indonesia Ministry of Health shows 14,265 (12.3%) of specimens are positive Covid-19 from a total of 116,358 specimens examined from 34 provinces in Indonesia (Ministry of Health of RI, 2020e).

Covid-19 Case Prediction without Intervention in South Sumatra

Based on the prediction results, it can be seen that since the first positive case of Covid-19 in South Sumatra by the 11th day it was predicted that the cumulative number of cases would reach 10 cases and on the 12th day the number of cumulative cases was predicted to reach 12 cases (Figure 4). In the first two weeks after the Corona case was announced in South Sumatra, the results of this prediction had a difference that is not far apart (Provincial Government of South Sumatra, 2020). But during the following week, there were significant differences in the number of cumulative cases compared to the number of positive cases reported by the Provincial Government of South Sumatra (Figure 6).
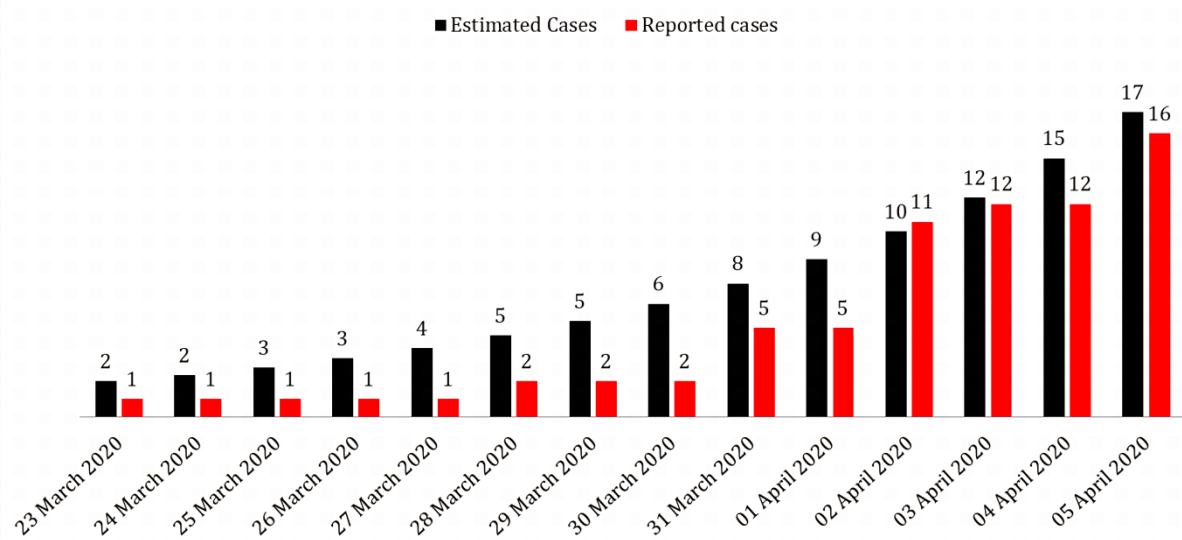
Figure 4: Estimated number of cumulative cases of positive cumulative cases of Covid 19 reported during the first 14 days in South Sumatra Province
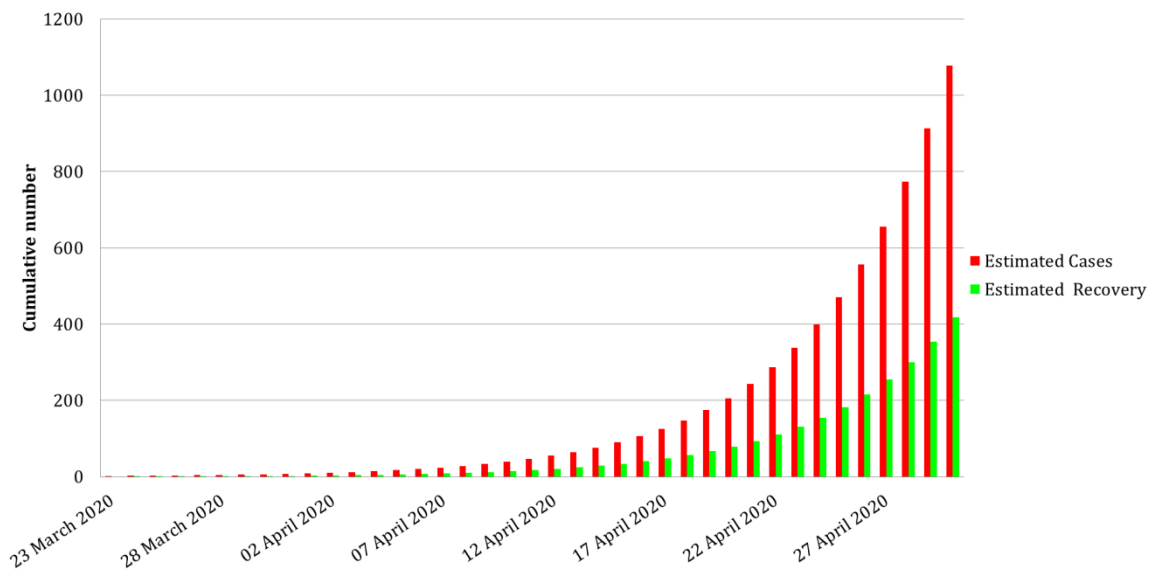
Figure 5: Estimated number of cumulative cases and estimated number of cumulative cases recovered in South Sumatra Province on the last day of April 2020
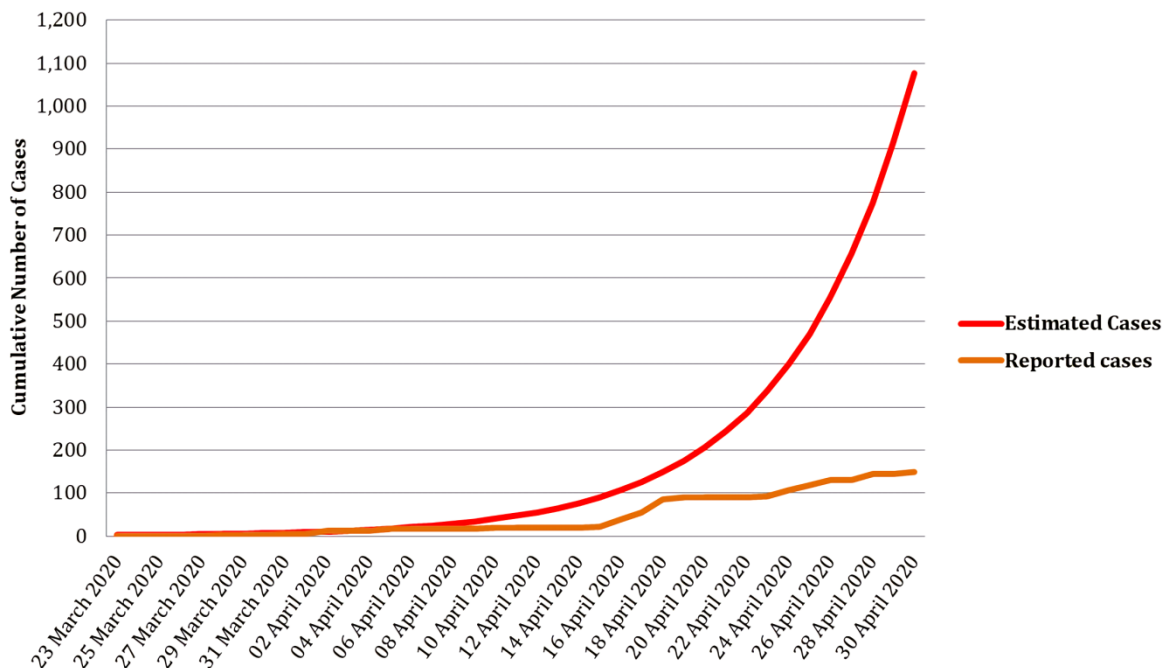

Figure 6:. Estimated cumulative number of positive cases of Covid-19 and cumulative number of positive cases reported in South Sumatra Province

Without comprehensive intervention, the results of this prediction show that by the end of April 2020, the estimated number of Covid-19 cases in South Sumatra had reached

more than 1000 cases, with an estimated 400 patients recovered (figures 5, 6). However, on April 30, 2020, 150 new positive cases were detected, and the new recovered number were 23 people (Provincial Government of South Sumatra, 2020). This shows that early detection was still weak through testing and tracking in this province. If there are no sustainable interventions and public health approaches, the prediction results show that one-third of the total population in South Sumatra will be infected with Covid-19 by the end of June 2020 (figure 7). For the record, until early May 2020, there was no PSBB intervention in South Sumatra as had been done by other provinces such as DKI Jakarta, and West Java (Ministry of Health of RI, 2020c).
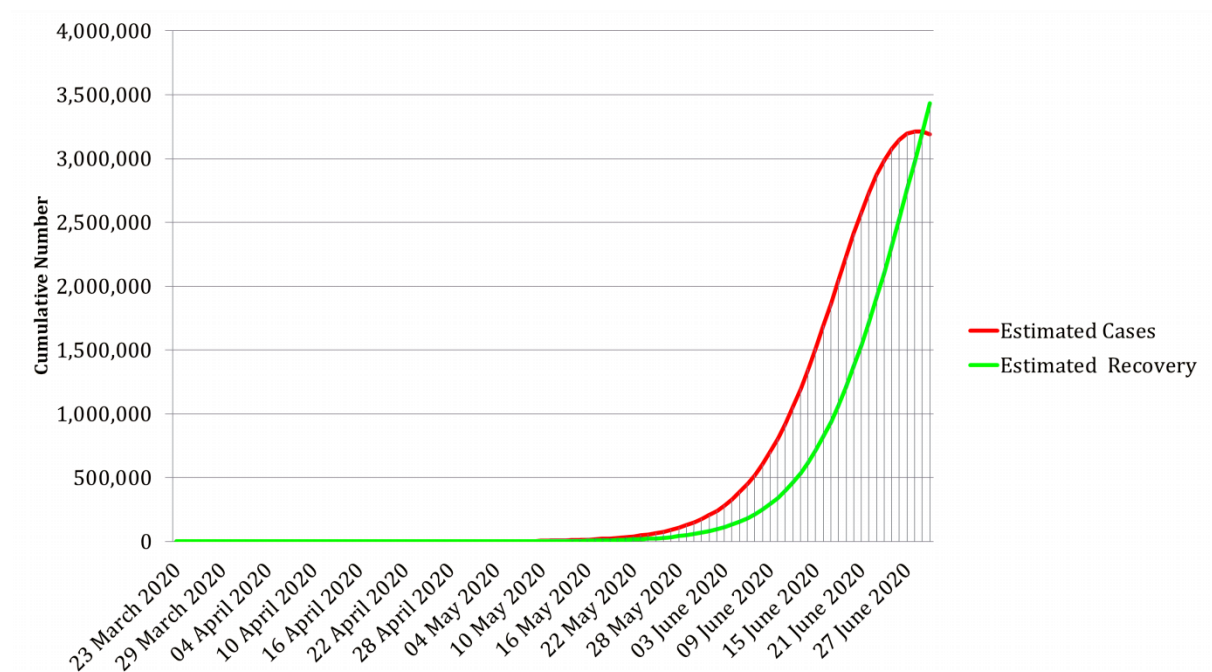

Figure 7: Predicted peak results of the Covid 19 pandemic in South Sumatra Province if there is no intervention from the Provincial Government

Predicted Number of Covid 19 Cases without and with intervention in South Sumatra

Based on prediction results, the implementation of a single intervention or a single intervention in the form of social distancing can only reduce the number of cumulative cases from 3.2 million cases to 2.5 million cases (figure 8). A significant reduction in the number of cumulative cases occurred during the implementation of multiple

interventions where the number of cases decreased from 3.2 million cases to 500,000 cases at the height of the pandemic (figure 8).
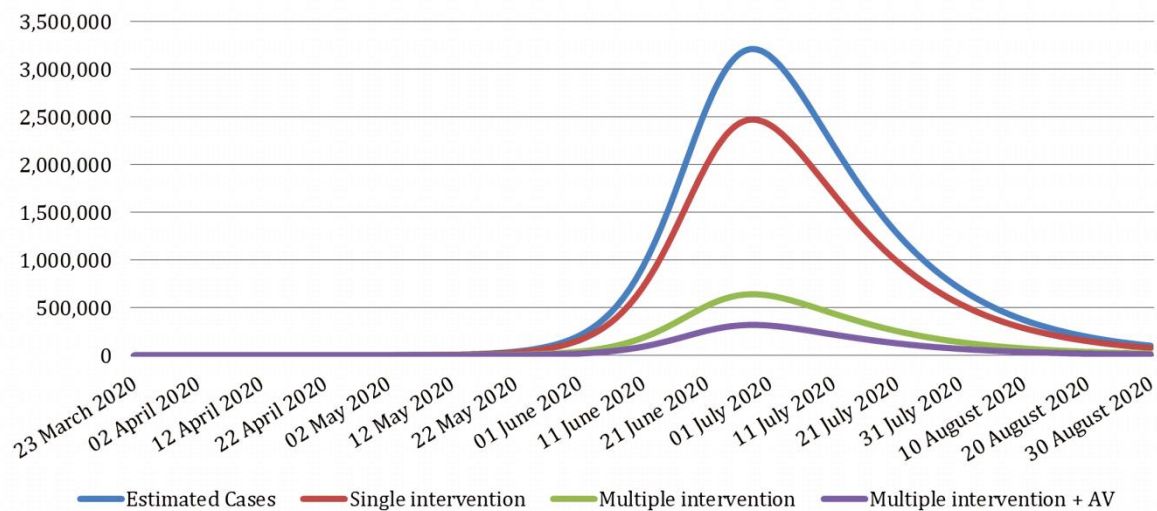

Figure 8: Predictions of Covid 19 positive cases in South Sumatra Province according to several types of interventions

Note: 1) No intervention: no intervention; 2) Single intervention: a single intervention; 3) Multiple interventions: Multiple interventions; 4) Multiple intervention with anti-virus treatment: Multiple interventions and anti-virus and vaccination treatments

The need for treatment rooms and ICU at the height of the pandemic without multiple Interventions

Prediction results based on epidemic curve modeling show that as many as 600,000 cases will require hospitalization at the time of the peak of the pandemic. Based on the assumption of CFR Covid-19 in Indonesia, it is estimated that the number of deaths will reach half of the number of patients receiving care in hospital if patient care support devices, such as ventilators, isolation rooms and ICU (Intensive Care Unit) are still limited (Figure 9).

At the height of the pandemic it is predicted that around 250,000 people have died from covid-19 (figure 9). On July 16, 2020, it was known that out of a total of 2,829 positive covid-19 cases reported by the government of South Sumatra Province, 135 people positive covid-19 cases were reported died. So, covid-19 can be one of another causes of death today, around 4.7% of the total cases, despite other five most cauess of death common diseases, such as stroke (17.31%), Ischemic Heart diseases (15.91%),

Based on the analysis, it is known that from the total prediction of the number of patients who need treatment in the hospital, one in ten need ICU treatment. The data shows that the number of patients who need care and ICU exceeds the availability of beds and ventilators. Figure 10 shows that by the end of June, the South Sumatra Government will need almost 1 million hospital beds, and 10% of these cases needed to be treated in the ICU room; however, RI Ministry of Health data shows that in 2018 in the Province of South Sumatra had 9045 beds (Pusdatin Ministry of Health of RI, 2019) and 281 ventilator units spread across the South Sumatra Province. This is based on data from the Task Force for the Co-19 Handling Acceleration (Databoks, 2020), and does not include extra beds in the guesthouse South Sumatra Athletes.
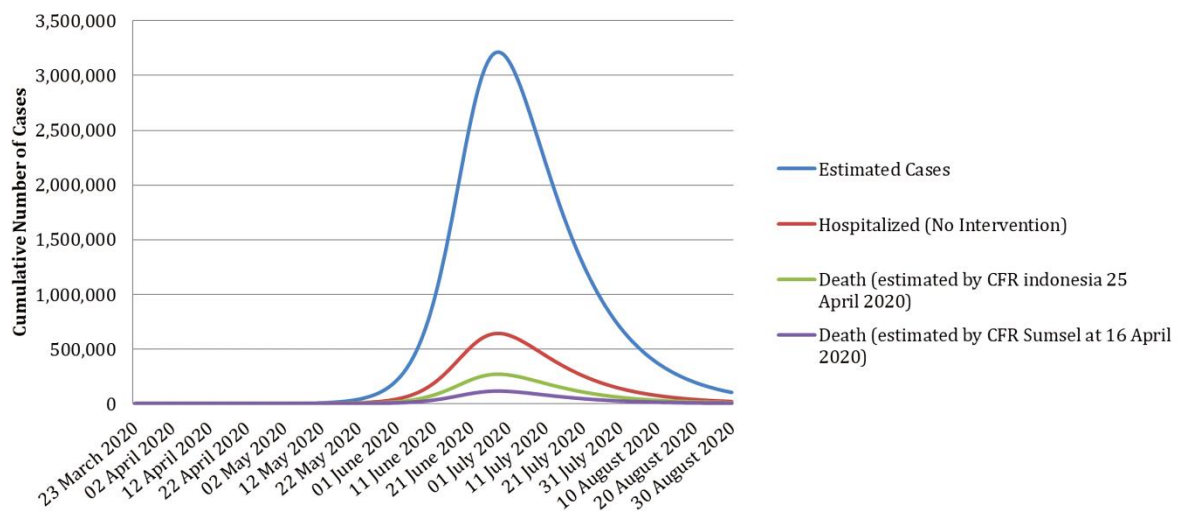

Figure 9: Prediction of positive cases of Covid 19, cases needing treatment and death in South Sumatra province

Note: 1) Infected: cases that are infected / contracting Covid-19; 2. Hospitalized: Covid-19 patients who need hospital treatment; 3 Death (estimated by CFR Indonesia)
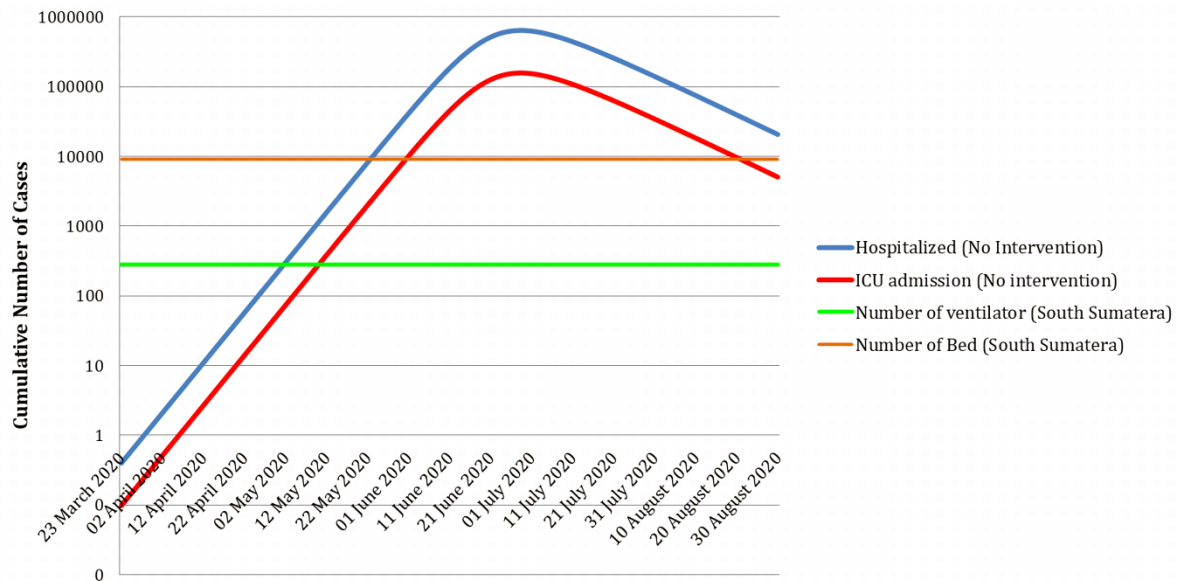
Figure 10: Prediction of the number of cases that need treatment in hospital on the availability of ventilators and beds in the province of South Sumatra

The need for treatment rooms and ICU at the height of the pandemic with Multiple Interventions

The results of modeling use the assumption of multiple interventions where as much as 80% of the number of cases will be reduced if multiple interventions are carried out (Chinazzi et al., 2020). Modeling results show that with multiple interventions, the number of Covid-19 cases requiring treatment in the hospital was reduced from the initial estimate of 128,568 cases, and the estimated number of cases requiring ICU treatment was 31,499 cases (figure 11).
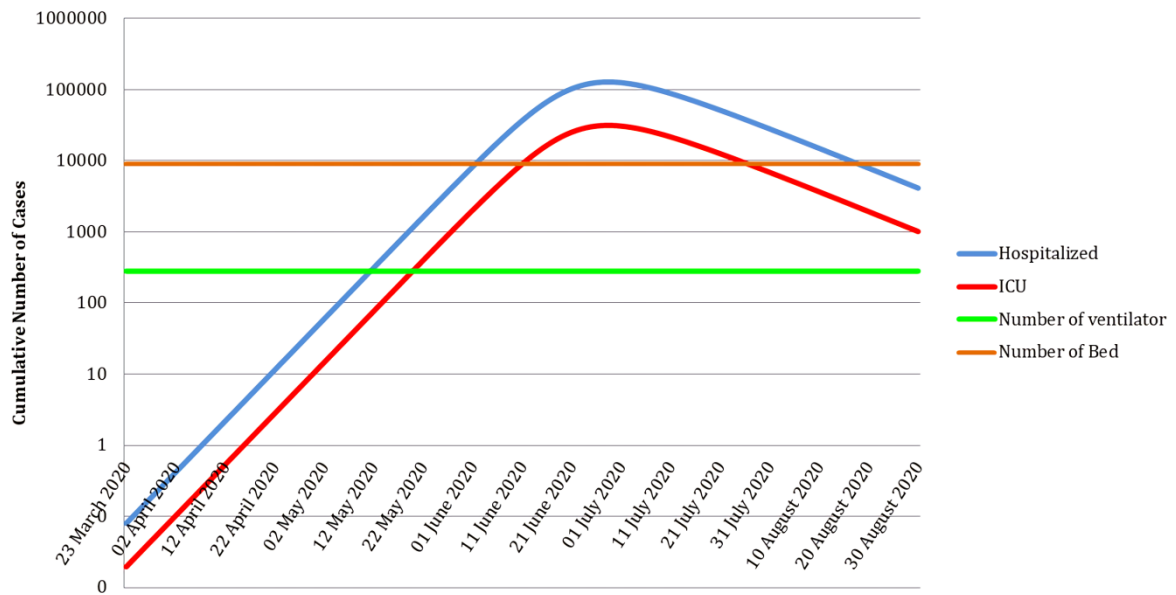
Figure 11. Prediction of the number of cases that need hospitalization for the availability of ventilators and beds with multiple interventions

Lessons to learn for Indonesia

The spread of Covid-19 cases in Indonesia is at the 'local transmission' level. It means that every citizen can be infected with Covid-19, without having to travel to areas with red zones or countries with already widespread cases. The Indonesian health system is still overlapping between the central and regional governments requiring the development of a Covid-19 mitigation strategy based on epidemic curves in each Province (Djalante, et al., 2020).

The current study shows that in South Sumatra, a study setting, without the comprehensive intervention, one-third of the people in the province are at risk of being infected by Covid-19. Prediction results and cases differ quite significantly, with only 5-10% of cases being detected compared with the estimated Covid-19 cases in South Sumatra. This shows the still weak, early detection through Covid-19 tests in the community and tracking in the South Sumatra Province and also a picture in Indonesia (Soeriaatmadja, 2020). The current prediction indicates that the real number of the positive cases of Covid-19 is far more likely than the reported cases by the South Sumatra Provincial Government. A 'denial' of cases of Covid-19 in Indonesia in early February 2020 may lead to the delay in preventing Covid-19 in Indonesia, including in other 34 provinces (Lindsley & Mann, 2020). Without overall intervention by the government

accompanied by community participation, Indonesia could bet he third virus hotspot in Asia (Riono, cited in Massola, 2020).

South Sumatra must act faster to prevent the surge in the Covid-19 cases. Our study considers cases might peak in late June 2020 (Yeni, Najmah, Davies, 2020a). Yet with the current improvement in Covid-19 tests and coverage in Indonesia, the peak epidemic curve could move to following months, September or October, with late response of Covid-19 (Riono, cited in Massola, 2020). Sadly, the risk of mortality due to Covid-19 and the complication of non-communicable diseases seriously threaten the age group over 50 years in Indonesia and other countries (Ferguson, 2020; MoH, 2020b).

Reflecting the urgent needs of hospital beds

Based on the results of our predictions, in South Sumatra, the assumption is that 20% of patients will require treatment in hospitals (Tamara Pilishvili, Razzaghi, Reed, Ritchey, & Sauber-Schatz, 2020). So, the percentage of the number of positive cases of Covid-19 in South Sumatra requiring hospitalization will reach 600,000 people by the end of June 2020 without the intervention of a public health approach. This will exceed the capacity of hospitals in South Sumatra, the availability of beds in South Sumatra is as many as 9045 units where as many as 979 units are the availability of beds in other inpatient rooms [Intensive Care Unit (ICU), High Care Unit (HCU), Intensive Coronary Care Unit (ICCU), Respiratory Intensive Care Unit (RICU), Neonatal Intensive Care Unit (NICU), Pediatric Intensive Care Unit (PICU), and Isolation], outside from an extra bed prepared by the South Sumatra government (Pusdatin Ministry of Health of RI, 2019). If multiple interventions are carried out, modeling results show that the number of cases that need treatment will be reduced to one-tenth of the estimated initial case that require ICU care to around 31 000 people.

Reflecting Indonesia's effort in mitigating Covid-19 with other countries

Reflection from several countries, the virus spreads quickly. For instance it spread to all parts of China within 30 days of the first case being discovered (The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020). Restricting mobilization to and from an area, crowd restrictions such as working at home and limiting school movements can slow the spread of the Covid virus by one to three weeks (Ahmed et al., 2018; Chinazzi et al., 2020). However, without changes in individual behavior, such as washing hands with

soap, keeping physical distance, and offset by early detection of cases and rapid tracking of Covid 19 cases, as well as isolation or quarantine at home, the effectiveness of limiting human movement (including PSBB in the Indonesian context) will not be effective to reduce the number of cases over time (Chinazzi et al., 2020; The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020; World Health Organization, 2019). Social distancing, such as PSBB in Indonesia, is predicted to be less effective at reducing the number of new Covid 19 cases if R0 continues to increase and is not carried out at the beginning of the pandemic, before the cases soars (Ahmed et al., 2018; Milne, Kelso, Kelly, Huband, & McVernon, 2008).

Many countries have successfully implemented multiple interventions to protect public health admist Covid-19. Vietnam and Thailand are examples of countries that have successfully carried out epidemic prevention using the approach of several public health interventions together with social-physical intervention programs. This can be seen from the number of positive case data and low mortality rate that occurred in Vietnam and Thailand (Table 1) (Worldometer, 2020). Vietnam did not apply lockdown to all cities where infected cases occured but closed all places and canceled all potentially crowded events such as schools, festivals and conferences (Nguyen & Vu, 2020). On 30 January 2020, Vietnam refused entry to all foreigners from China or other countries who had transit in China within 14 days of their arrival in Vietnam. All tourists who come to Vietnam must be quarantined in a centralized facility for 14 days that provides with food and room cleaning facilities their isolation routinely (Nguyen & Vu, 2020). Timely communication about the development of outbreaks from the government and the media, combined with the latest research on new viruses by the Vietnamese science community is a rapid strategy for Vietnam to respond to its public health crisis (La et al., 2020).

Another country in Southeast Asia, Thailand, is an example that implemented lockdown to prevent the spread of covid-19 by closing their international flights since early March 2020 (Medina, 2020). The intervention continued with significant restrictions on educational institutions, markets, and international travel on March 18, 2020 (Kanok-Nukulchai, 2020). In terms of disease mitigation, Thailand established a center in charge of managing trips in and out of the kingdom with more stringent screening, quarantine and monitoring measures as well as opening free mask outlets for their residents and imposing imprisonment or fines for their communities in violation of the rules this early vigilance (Bangkok post, 2020).

The combination of early case tracking and multiple public health interventions such as isolation or independent quarantine at home, and changes in behavior such as washing hands and wearing masks, can reduce transmission and effects of influenza pandemics. However, case tracking requires adequate resources to survive after the initial pandemic phase due to the number of cases and contacts growing exponentially in a short time. Case tracking can be applied in a number of conditions or objectives such as case identification in high-risk groups to allow early treatment, delay widespread dissemination in small isolated communities, or in aircraft settings to prevent import cases (Fong et al., 2020).

What needs to be considered for the Indonesian context? The tight closure of inter-provincial and international human mobilization pathways requires the commitment of local governments to reduce the case of imports from other provinces or other countries and establish epidemic curves in collaboration with cross-sectors, especially those that will be affected economically by the closure of this transport route (World Health Organization, 2019). This needs to be done considering Covid-19 case screening with rapid tests with an accuracy rate of around 30%, and body temperature measurements are less effective for early detection of Covid 19 cases.

What Indonesian's community need to do?

Most countries have entered or are preparing for the New Normal Life phase, with the following records: 1) there are no more deaths due to Covid-19; 2) there are no positive new cases of Covid-19; 3) recovery rate exceeds 95% (Yeni, et al., 2020b). Indonesia is unique as Indonesia plans to implement this when the epidemic curve graph still shows an increasing trend; there are still cases of death and positive new cases of Covid-19 and the cure rate is still around 50%.

While in South Sumatra, especially in the city of Palembang, the three points above actually must be resolved immediately. The facts show, that since the PSBB was implemented, the number of new cases and deaths continues to increase, the recovered number of patients is still far from 95% (Yeni et al., 2020a; Yeni, et al. 2020b). We need to evaluate the prevention efforts that have been made so far in South Sumatra.

Indonesia's readiness, including in South Sumatra, is still far below that of several neighboring countries. WHO predicts Covid-19 will move from a pandemic to endemic. It means the Covid-19 virus will stay for a long time in a country. Therefore, without knowing which population has been infected with Covid-19, due to limited access to the

Covid-19 test, family empowerment is urgently needed so that mothers and daughters can break the chain of virus transmission. For instance, at a community level, our study shows the needs of women's empowerment to engage in Covid-19 awareness for kids or *PangLing* in their closest neighbourhood in their own sub-urban or kampung. The initial finding of the current research indicated that with the critical awareness of 10 women in the Pangling movement, the social movement can provide health education, masks, and soap toover 500 kids. Over 10 donors became involved our activities to provide masks and soap after we published our activities on social media.The evaluation of this research is still an on-going process.
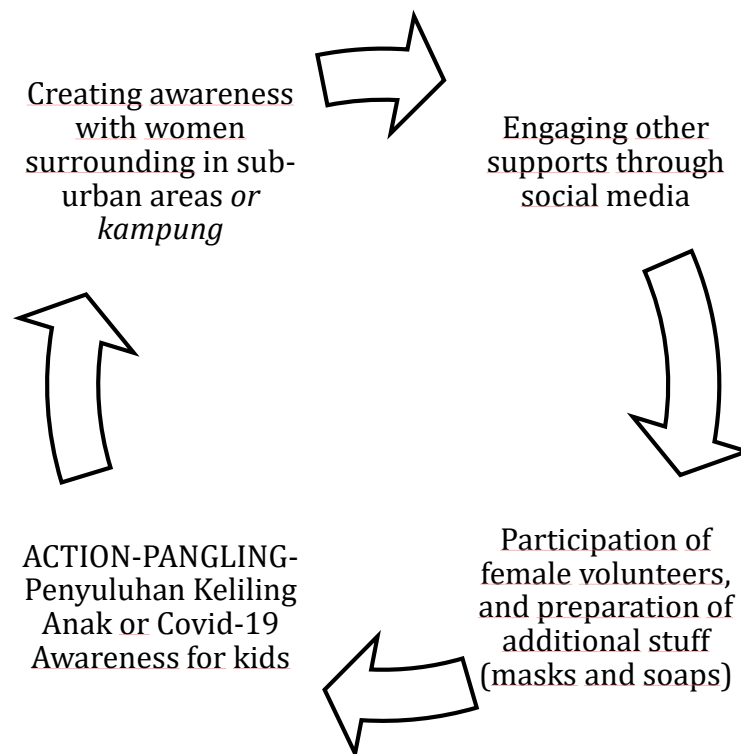
Creating awareness with women surrounding in sub-urban areas *or kampung*

Engaging other supports through social media

Participation of female volunteers, and preparation of additional stuff (masks and soaps)

ACTION-PANGLING-Penyuluhan Keliling Anak or Covid-19 Awareness for kids

Figure 11: Cycle of Feminist-PAR in Covid-19 Awareness for kids in suburban area in Palembang (Kampun*g 13 Ulu and 14 Ulu)*

Note: The activities of Pangling can be access in
https://www.instagram.com/englishcamp_13ulu/?hl=en

4. Conclusion

There are two main conclusions in this study. Firstly, through a quantitative approach, modeling shows that a large number of Covid-19 cases are not detected in South Sumatra. Only 5 to 10 percent of the total cases can be detected by the government of Southern Sumatra at the end of April 2020, and one-third of the total population in South Sumatra will be infected with Covid-19

by the end of June 2020. The implementation of multiple interventions is needed to reduce transmission rates, including implementing social distancing, in combination with other public health interventions such as travel restrictions, hand washing and wearing a mask. In addition, expanding the scope of testing, contact tracing, and case isolation will help map the spread of Covid-19 cases, and this mapping can help reduce local transmission.

Secondly, through a qualitative approach, women's empowerment within an neighbourhood could be one core intervention to mass education of Covid-19 awareness in small groups of community in sub-urban areas or kampung. In a small system, prevention of covid-19 transmission in South Sumatra will be more effective with discipline that starts from each individual to adhere to the health protocol (diligently washing hands, using masks, and keeping a distance). With discipline at the family level too, we will feel the impact at the community level. The Government's commitment to discipline in enforcing regulations and health protocols that have been made, will make effort built at the level of Individual - Family - Community can run as expected. Furthermore, by empowering a social security level at lower level at local government in Indonesia is urgently needed. For instance, such as the *kelurahan* level (local sub-district office) with the *Lurah* (the leader of *kelurahan*) and *Rukun Tetangga* and mobilizing *posyandu* (maternal and child health community centres) cadres and educated communities, particulary women with a diverse background, to join together with the government to monitor the continuity of Covid-19 handling on a smaller scale.

Limitations of this study include the fact that modeling has not considered vulnerable groups such as the elderly, children, sufferers of chronic diseases and people with disabilities, or people travelling domestically, especially at the end of the fasting month.

Acknowledgements

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Asean Journal of Community Engagement <editor_ajce@ui.ac.id>
To: thn2949@autuni.ac.nz, sharyn.davies@aut.ac.nz, Yeni doanks

Najmah ~ 🔍

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I think just answer it the best you can??

- First comments: Prediction of business as usual total death (caused by Covid-19 and other common death causes) in South Sumatra needs to accompany and verify the prediction.
- our answers:
- At the height of the pandemic it is predicted that around 250,000 people have died from co-19 (figure 9). this is very worrying when compared to other causes of death in southern Sumatra. Based on data from the Institute for Health Metrics and Evaluation it is known that the 5 most causes of death per 100,000 population in 2017 in South Sumatra are stroke (17.31%), Ischemic Heart diseases (15.91%), diabetes (5.98%), Tuberculosis (4.76%), and cirrhosis (4.07%) (IHME (Institute for Health Metrics and Evaluation), 2017)
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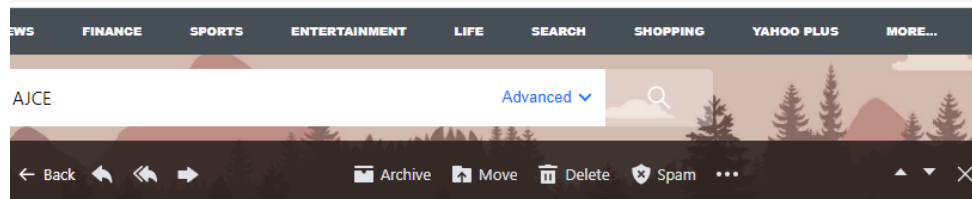
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To: Najmah Najmah
Cc: The Authors, The Editors

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Predictive modeling, empowering women, and COVID-19 in South Sumatra, Indonesia

Yeni[a]*, Najmah[b], Sharyn Davies[c]

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[c]Auckland University of Technology, New Zealand

Abstract

The Coronavirus disease (COVID-19) has spread to almost all provinces in Indonesia, including South Sumatra. Epidemiological models are required to provide evidence for public health policymakers to mitigate the virus. The aim of this study is: 1) to create a prediction model for COVID-19 cases in South Sumatra to help inform about public health policy and 2) to reflect on women's experiences to provide solutions for mitigating the impact of COVID-19. This study uses quantitative and qualitative methods. A quantitative modeling approach called Susceptible–Infected–Recovered (SIR) model is used to predict COVID-19 cases in South Sumatra. The assumption used is that every four days, a doubling of COVID-19 cases is observed, with an average of 15 days for recovery. The sources of data are reports from the South Sumatra Provincial Government and the Ministry of Health of the Republic of Indonesia (MOH RI). Qualitative data are obtained through a feminist participatory action research project, which is focused on children's experiences of COVID-19. Reflective analysis is conducted to develop insights into how to empower women with respect to mitigating COVID-19. Results show that COVID-19 cases in South Sumatra are still underreported, with only 5%–10% of the total estimated COVID-19 cases being reported. Modeling indicates that over 1,000 people had COVID-19 by the end of April, reaching over 150,000 by the end of May, and over a third of South Sumatra's population is likely to be infected by the end of June. Multiple interventions are needed to reduce cases and flatten the curve. Women are key to flattening this curve and must be empowered to undertake actions from a familial base.

Keywords: COVID-19; South Sumatra; multiple intervention; public health; prediction; women's empowerment

5. Introduction

The Coronavirus disease (COVID-19) is a new type of coronavirus, originating in Wuhan, China, in late 2019 and spreading to most countries in the world by June 2020. COVID-19 was recognized as a global pandemic by the World Health Organization (WHO) on March 11, 2020 (Bedford et al., 2020; WHO, 2020). By July 8, 2020, COVID-19 had spread to over 213 countries with over 12 million cases (Worldometer, 2020). Five countries experienced particularly high numbers of COVID-19 cases early on, including

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u (Johns Hopkins University & Medicine, 2020).

In Southeast Asia, Indonesia reported the first-highest number of COVID-19 cases after Singapore. Indonesia also had the highest mortality rate at approximately 5.9%, indicating that out of 100 people, six would pass away due to COVID-19, as of July 8, 2020 (Table 1) (Worldometer, 2020). The number of active cases of COVID-19 in Indonesia is as high as that of the recovered cases. Half of the total reported cases recovered within three months of the first cases being announced by the President of Indonesia, Joko Widodo on March 2, 2020 (Ministry of Health RI, 2020g; Worldometer, 2020). The early detection of cases is still a challenge in Indonesia, and test facilities remain limited (Worldometer, 2020).

Public health experts have modeled COVID-19 in Indonesia and concluded that the reported cases by MOH RI are only approximately 10%–20% of actual cases. With low interventions, such as large-scale social distancing, and moderate intervention, such as mass testing and compulsory social distancing by closing schools and businesses, Indonesia should have detected 1.9 million or 1.1 million COVID-19 cases at the beginning of May 2020, respectively (Ariawan, Riono, Farid, Hafizah, & Jusril, 2020). These estimated cases are far from the actual reported cases of approximately 14,000 (Ministry of Health RI, 2020f). In short, at the beginning of May 2020, official figures stated that Indonesia only had 14,000 COVID-19 cases in the country. However, the modeling suggests that this number is as high as 1.9 million.

Table 1. COVID-19 cases in Southeast Asia

Country	Total test	Test per one million population	Number of positive cases	Number of deaths	Number of recovered cases	Case fatality rate (%)	Proportion of recovery (%)
Indonesia	964,054	3,458	66,226	3,309	30,785	5,0	46
Singapore	757,746	129,506	45,140	26	41,002	0,1	91
Philippines	845,218	7,712	47,873	1,309	12,386	2,7	26
Malaysia	816,118	25,211	8,674	121	8,481	1,4	98
Thailand	286,008	4,099	3,025	56	2,854	1,9	94
Vietnam	275,000	2,825	369	0	341	0,0	92
Myanmar	85,689	1,575	316	6	245	1,9	78
Brunei Darussalam	29,841	68,202	141	3	138	2,1	98
Cambodia	40,521	2,423	141	1	131	0,7	93
Timor-Leste	1,568	1,189	24	0	24	0,0	100
Laos	1,8091	2,486	19	0	19	0,0	100

Note: Numbers of population in each country: Singapore = six million; Indonesia = 270 million; Philippines = 109 million; Malaysia = 32 million; Thailand = 70 million; Vietnam = 97 million; Myanmar = 54 million; Brunei = 440,000; Cambodia = 17 million; Timor-Leste = 1.3 million; Laos = 7.3 million.

Source: Report as of July 8, 2020 (Worldometer, 2020)

Epidemiological and statistical COVID-19 modeling is needed to solve the problem. Modeling is beneficial to measuring human resources and health facilities, including medical records, information health systems, and the readiness of laboratories in each province in Indonesia (Elyazar et al., 2020). According to Lutz et al. (2019) and Li et al. (2020), the accurate and timely prediction of infectious diseases can provide information for public health responses to seasonal pandemics in the future with appropriate guidance for early mitigation and prevention strategy. Previous studies on Severe Acute Respiratory Syndrome (SARS) outbreaks showed that the delay in controlling outbreaks for one week would make the number of cases three-fold higher than before and increase

the duration of the epidemic to four weeks (Wallinga & Teunis, 2004). An evidence-based or scientific policy base is necessary in all countries, especially in limited-resource countries with unequal chances to access health services, including Indonesia (Lutz et al., 2019). At the national level, MOH RI has established the Large-scale Social Guidelines of Restriction or *Pembatasan Social Berskala Besar* (PSBB) as one strategy for COVID-19 mitigation in Indonesia (Ministry of Health RI, 2020a).

South Sumatra, one of the provinces in Indonesia, is where the first two authors of this report came from. The study focuses on South Sumatra for three reasons. First, the first case in South Sumatra was announced on March 24, 2020, three weeks after the first case in Indonesia was reported. The detection of cases in South Sumatra is considered too late, as Jakarta can be reached by a 50-minute flight. Second, the number of samples tested is limited. For instance, Jakarta, with a population of over 10 million, has undertaken over 160,824 samples for the Polymerase Chain Reaction (PCR) test, whereas South Sumatra, with 8.5 million people, took only 4,745 samples for PCR test as June 3, 2020 (BPS, 2010; South Sumatra Provincial Government, 2020; Communication Informatics and Statistics Department of DKI Jakarta, 2020). Third, PSBB was implemented in South Sumatra, particularly in the cities of Palembang and Prabumulih, on May 12, 2020. PSBB is based on the regulation of MOH RI, number HK.01.07/Menkes/307/2020, (Ministry of Health RI, 2020d); therefore, an epidemiological model with SIR modeling is needed to estimate the number of COVID-19 cases in South Sumatra. This research also provides an epidemic curve, with and without public health intervention, as one measurement to determine the success of COVID-19 mitigation in South Sumatra.

This research argues the importance of including women's experiences in mitigating the impacts of COVID-19. Feminist research seeks to contribute to women's empowerment (Hesse-Biber, 2012). Women can contribute to the development of collective consciousness through their active participation, shared knowledge, and collaboration in the research itself (Crotty, 1998; Lykke, 2010). Kramarae and Spender (1992) further supported the notion that women have knowledge of and insight into their social life circumstances that enable them to transform themselves through knowledge construction. Empowering women, particularly from low-middle income families, as investigated by Biju (2020) in Kerala, India, can initiate communities to self-manage the COVID-19 pandemic through mask and hand sanitizer production, the spread and promotion of the importance of social distancing and personal hygiene at the grassroots

level, and the provision of free counseling service to children during the unprecedented lockdown period ([Biju, 2020](#)). In limited-resource countries with limited access to COVID-19 tests and treatments, including Indonesia, women must be empowered to protect their family from COVID-19 transmission.

6. Methods

6.1. Quantitative approach

The prediction of COVID-19 cases was undertaken using the mathematical model of SIR. The SIR model was introduced by Kermack and McKendrick in 1927 as an epidemiological model to provide a simple way to explain the transmission of communicable diseases at the individual level, which can pass into three steps: susceptible, infected, and recovered ([Institute for Disease Modeling, 2019](#)). To undertake this modeling, we must know the average of doubling cases or the daily average for a case to infect other people, or transmission rate or β and average days for recovery of one COVID-19 case, or recovery rate (ϒ) ([British International School Phuket, 2014](#); [Collins & Abdelal, 2018](#); [Smith & Moore, 2004](#)).

$$\frac{ds}{dt} = -\beta si \dots\dots\dots\dots (1)$$

$$\frac{di}{dt} = \beta si - \gamma i \dots\dots\dots\dots (2)$$

$$\frac{dr}{dt} = \gamma i \dots\dots\dots\dots (3)$$

Previous research showed that COVID-19 infection is assumed to occur within 12 hours for symptomatic cases and on the fourth and sixth day for asymptomatic cases ([Ferguson et al., 2020](#)). Infected cases with mild symptoms need two weeks to recover, whereas cases with severe symptoms require three to six weeks to recover ([Aylward, Bruce; Liang, 2020](#)). Therefore, for COVID-19 cases, we applied the assumption that one person infected with COVID-19 will transmit the virus to other people within approximately four days, and the recovery rate is assumed to take 14 days. This assumption is used to consider laboratory test delays for first and second samples, especially where laboratories are limited. South Sumatra's population is estimated to be approximately 8.6 million ([BPS, 2020](#)).

In our modeling, the prediction of cumulative cases of COVID-19 was based on three assumptions: 1) non-pharmaceutical intervention, 2) single intervention, and 3) multiple

interventions. Non-pharmaceutical intervention is known as the public health approach without using any medication approach, such as health promotion. Single intervention is an intervention related to social distancing in working places, schools, and other mass gatherings. Multiple interventions involve non-pharmaceutical and single interventions, including other public health approaches, such as travel restriction (Ahmed, Zviedrite, & Uzicanin, 2018). This intervention can reduce over 80% of imported cases from other countries or provinces in Indonesia to another country or province (Chinazzi et al., 2020). Multiple interventions with vaccination are the combination of multiple interventions with anti-retroviral therapy or prophylaxis therapy or availability of vaccination (Halloran et al., 2008; WHO, 2019). Yet, for a pandemic with a new strain of the virus, the third intervention is quite challenging as new vaccines or medicines take over six months of trials before they are used for randomized controlled trials at community levels (WHO, 2019).

6.2.Qualitative approach

6.2.1.Feminist participatory action research (FPAR)

Empowerment practices have a strong root in feminist research (Turner & Maschi, 2015). Turner and Maschi (2015) argued that women are often positioned as powerless or marginalized in their social, cultural, and political spheres. FPAR, which was first introduced by Maguire (1987) and used by Lykes, Reid, and Frisby (2008), was selected as a suitable research methodology to facilitate the emergence of women's voices and collective empowerment leading to social action. Applying FPAR, we argued for the centrality of a woman's position as a subaltern, as a woman. We then co-constructed knowledge and engaged in the co-learning process through women's shared experiences, thoughts, and aspirations. Furthermore, even the often-silenced voices are enabled to develop a collective voice to raise their critical consciousness and to reflect and find solutions to their problems, leading to individual and collective actions (Brydon-Miller, Maguire, & McIntyre, 2004). Previous research in health and social fields had been conducted in the context of empowering women, such as among Hmong women in Canada (Yoshihama & Carr, 2002) and vulnerable women, such as those fleeing from violence at home (Jategaonkar & Ponic, 2011). Previous and current studies, as both are participatory in nature, are open to use any data collection method that can enhance women's participation and social transformation.

Figure 12 summarizes the research cycle of FPAR in this study by adopting some principles and dimensions of FPAR on the basis of previous research by Lykes (2007, 2012), Maguire

(1987), and Reid and Frisby (2008). Women in the general population, with different education backgrounds, social roles, and life contexts, are central to this study to allow for the construction of knowledge, critical understanding of the vulnerability of COVID-19 in a family, and the individual and collective consciousness needed to enhance COVID-19 awareness among children (Points 1, 2, and 3 in Figure 12). Moving to Points 3 and 4 of the cycle, the collective awareness of the importance of protecting family, particularly children, from COVID-19 was addressed. The mobile COVID-19 awareness movement for children (*Penyuluhan keliling anak* or *PangLing*) was critically examined by all-female volunteers as the beginning action to enable social transformation in practice, including being a volunteer, giving out masks and soaps, and educating children aged 5–12 about COVID-19 prevention.
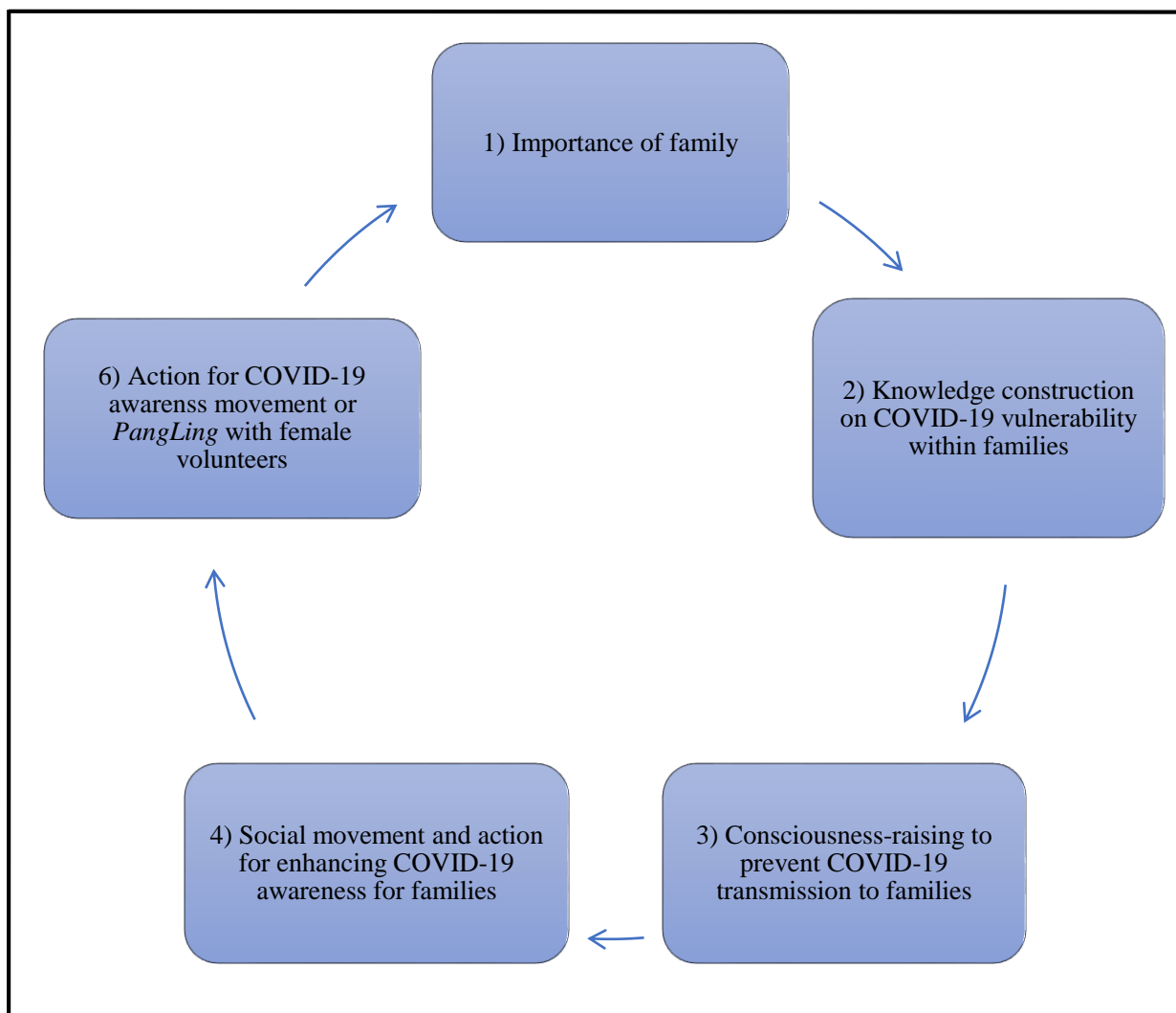
Figure 12: Feminist Participatory Action Research (FPAR) cycle of enabling women to be involved in the movement of COVID-19 awareness for children in Palembang, South Sumatra

Sources: Lykes (2007; 2012), Reid and Frisby (2008)

Qualitative data were collected for over three months from April 2020 to June 2020. This research involved 10 women who participated in a social movement or *PangLing* voluntarily in a suburban area or *kampung* in Palembang (South Sumatra). The reflective notes during the fieldwork were reported every week by the second author and discussed with other authors to enhance the robustness of the research. Visual outcomes were also published on social media (Instagram: englishcamp_13ulu). In this study, we focused on the initial findings of the *PangLing* research project.

Authors' reflections were noted in field notes and included descriptions of research activities, details of participants involved, and overall assessments of the research process and participants' evaluations of activities. Reflection is an important aspect of data generation and analysis in FPAR

([Lykes & HershBerg, 2012](#)). Based on the work of [Regmi and Naidoo (2013)](#), reflective analysis starts with a descriptive process, followed by assessment and analysis, and then evaluation and action.

7. Results and Discussion

7.1.Indonesian Context and COVID-19

COVID-19 causes mild to severe respiratory symptoms in a short time caused by a coronavirus, namely, SARS-CoV 2 ([Gorbalenya et al., 2020](#)). This new virus is quite different from other viruses, such as SARS-CoV in 2003 and Middle East respiratory syndrome coronavirus in 2012, which also caused outbreaks of acute respiratory disorders. SARS-CoV 2, discovered in 2019, consists of a combination of many viruses isolated from human hosts and various types of bats ([Gorbalenya et al., 2020](#)). The main symptoms that appear are fever, dry cough, fatigue, and sputum production (Figure 2). Out of the 10 cases that show clinical symptoms, two will have difficulty breathing ([Aylward, et al., 2020](#)). Note that 80% of patients infected with COVID-19 will not have symptoms that are mild to moderate, but they can still transmit the virus ([Li et al., 2020](#); [The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020](#)).
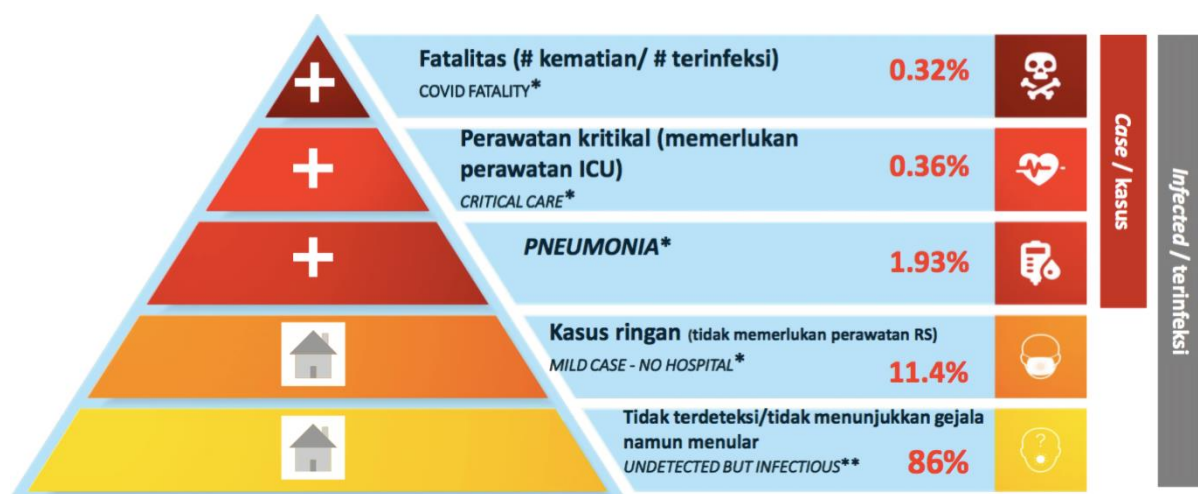

Fg. 2 COVID-19 based on symptoms

Source: [Ariawan et al. (2020)](#), citation information from [R. Li et al. (2020)](#) and [The Novel Coronavirus Pneumonia Response Epidemiology Team (2020)](#)

Indonesia announced its first positive COVID-19 case on March 2, 2020. On April 9, 2020 (the 39th day), the confirmed cumulative number of positive COVID-19 cases in Indonesia had reached 3,923 ([Ministry of Health RI, 2020f](#)). On May 15, 2020, 16,496

positive COVID-19 cases were reported officially by MOH RI, with a death rate reaching 1,076 and a recovery rate of 20% or 3,803 cases, but with new cases increasing. On July 7, 2020, MOH RI reported that the number of confirmed new cases of positive COVID-19 in Indonesia had reached 1,268, with the cumulative number of cases reaching 66,226 cases (Figure 3).
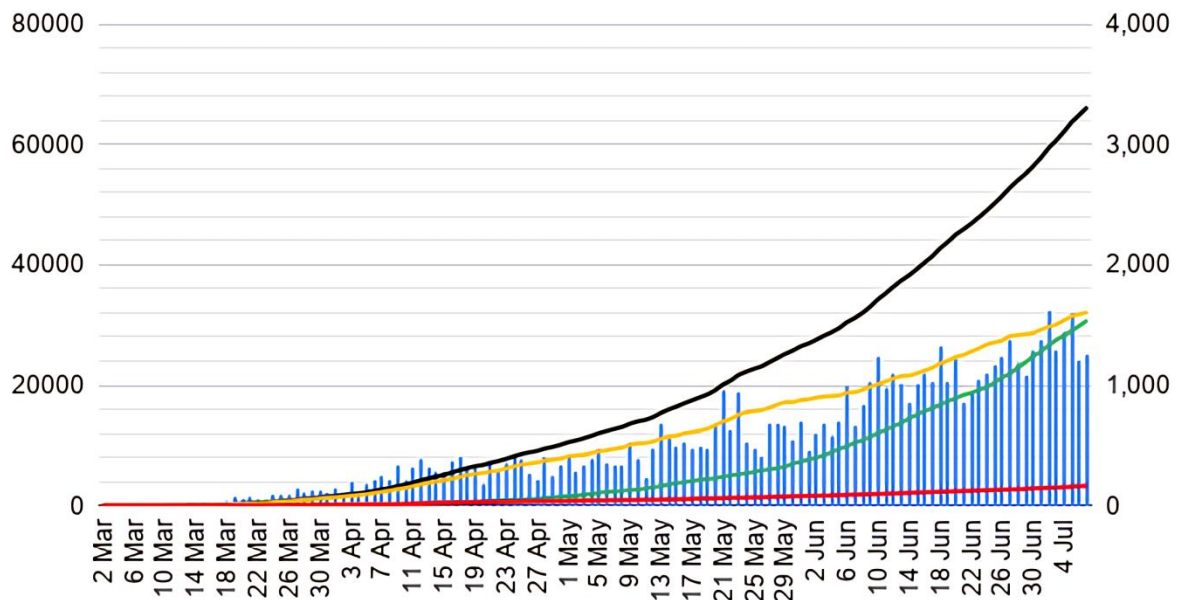
Note: __ New cases, __ Total cases, __ Active cases, __ Recovery, __ Death

Fg. 3 Daily incidence rate (new cases) in Indonesia

Source: Kawal COVID-19, 2020; Ministry of Health RI, 2020b

7.2.South Sumatra Context and COVID-19

Two patients under supervision or *Pasien Dalam Pengawasan* (PDP) in South Sumatra Province died on March 23, 2020. One PDP person, who died in the city of Palembang, was confirmed positive for COVID-19 on March 24, 2020. The press led by the Governor of South Sumatra revealed that another PDP person, who died in the city of Prabumulih, was confirmed positive for COVID-19 on March 28, 2020; this person was the head of the Prabumulih Hospital (Provincial Government of South Sumatra, 2020). The first two cases had a history of travel from Jakarta, Bogor, and/or Batam and thus were categorized as imported cases; both were over 50 years old and had a history of comorbidities, namely, diabetes (Putra, 2020; Septianto, 2020). Based on these data, South Sumatra Province had two positive cases of COVID-19 as of March 23, 2020.

The coverage testing and tracing of suspected COVID-19 cases are still low in this province; therefore, the positive results from all cases seem higher than those at the national level. Data (as of May 11, 2020) show that from all the completed specimen results in South Sumatra, 278 cases (51.7%) were positive, and 260 samples (48.3%) were negative (South Sumatra Provincial Government, 2020). The percentage of the positive cases of COVID-19 identified in South Sumatra is larger than that at the national level, where data from MOH RI reveal that out of the 116,358 specimens examined from 34 provinces in Indonesia, 14,265 (12.3%) are positive for COVID-19 (Ministry of Health RI, 2020e).

7.3.COVID-19 Case Prediction without Intervention in South Sumatra

Based on the prediction results, given that the first positive case of COVID-19 in South Sumatra is reported on the 11th day, the cumulative number of cases is predicted to reach 10 cases; on the 12th day, the number of cumulative cases is predicted to reach 12 cases (Figure 4). In the first two weeks after the positive case of COVID-19 was announced in South Sumatra, the prediction results had a difference that is not far apart (South Sumatra Provincial Government, 2020). However, in the following week, significant differences in the number of cumulative cases were found compared with the number of positive cases reported by the South Sumatra Provincial Government (Figure 4.
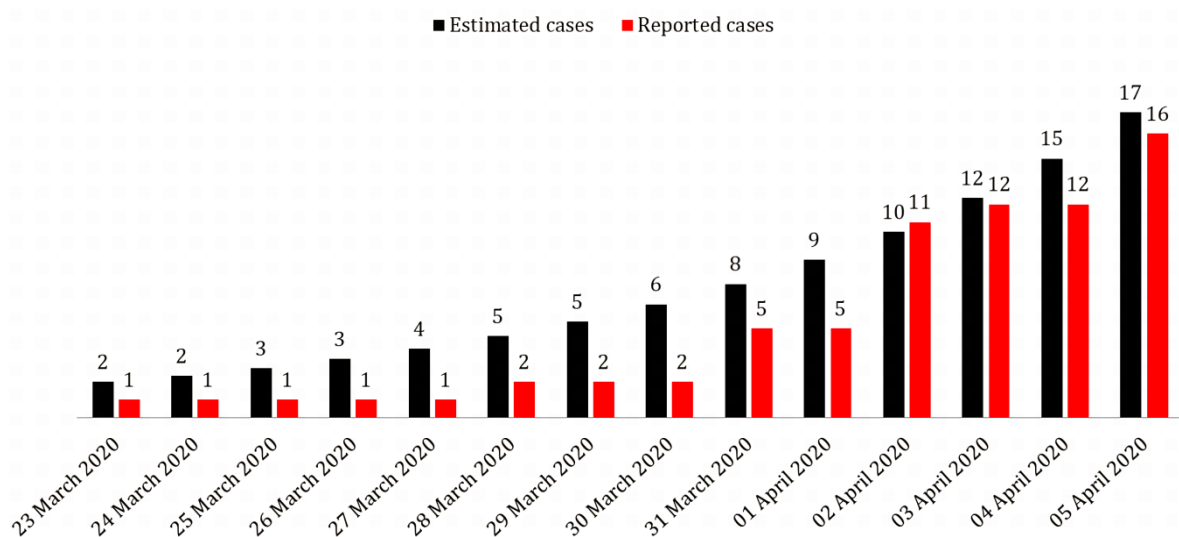

Fg. 4 Estimated number of positive cumulative cases of COVID-19 reported during the first 14 days in South Sumatra Province
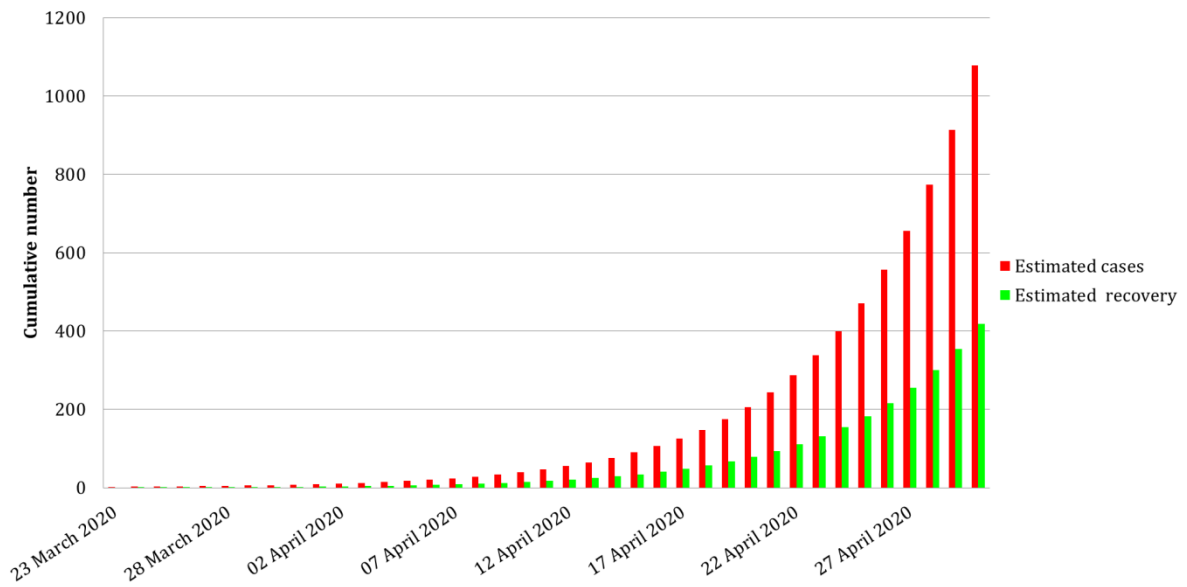
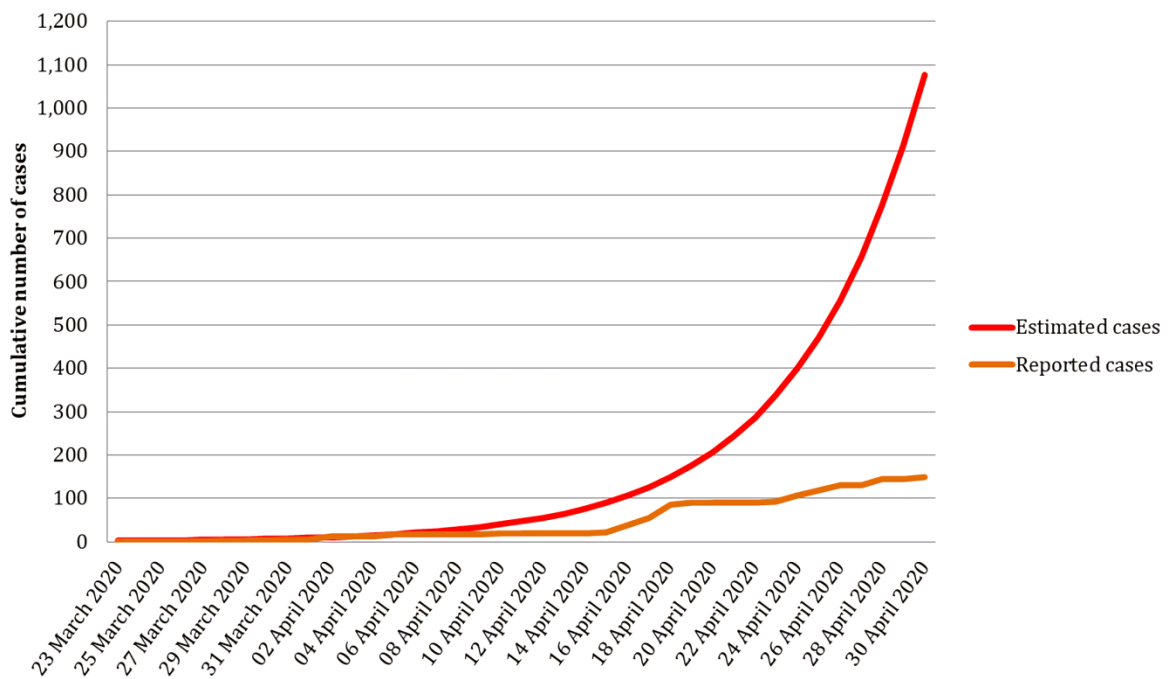Fg. 5 Estimated number of cumulative cases recovered in South Sumatra Province on the last day of April 2020

Fg. 6 Estimated cumulative number of positive cases of COVID-19 and cumulative number of positive cases reported in South Sumatra Province

Without comprehensive intervention, the prediction results show that by the end of April 2020, the estimated number of COVID-19 cases in South Sumatra had reached more than 1,000 cases, with an estimated 400 patients recovered (Figures 5 and 6). However, on April 30, 2020, 150 new positive cases were detected, and the new number of recoveries was 23 people (South Sumatra Provincial Government, 2020). This finding indicates that early detection was still weak through testing and tracking in this province. As no sustainable interventions and public health approaches exist, the prediction results show that one-third of the total population in South Sumatra will be infected with COVID-19 by the end of June 2020 (Figure 7). For the record, until early May 2020, no PSBB intervention was observed in South Sumatra, similar to other provinces, such as DKI Jakarta and West Java (Ministry of Health RI, 2020c).
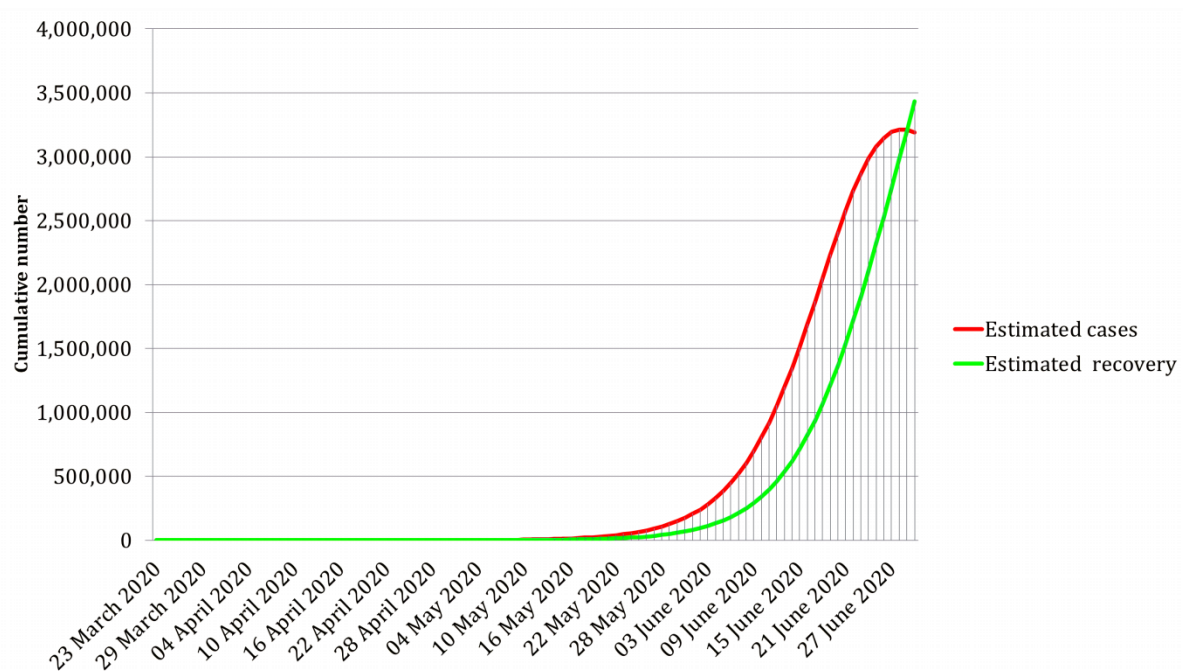

Fig. 7 Predicted peak results of the COVID-19 pandemic in South Sumatra Province without intervention from the provincial government

7.4. Predicted Number of COVID-19 Cases without and with Intervention in South Sumatra

Based on prediction results, the implementation of a single intervention or a single intervention in the form of social distancing can only reduce the number of cumulative cases from 3.2 million cases to 2.5 million cases (Figure 8). A significant reduction in the number of cumulative cases occurred during the implementation of multiple

interventions where the number of cases decreased from 3.2 million cases to 500,000 cases at the height of the pandemic (Figure 8).
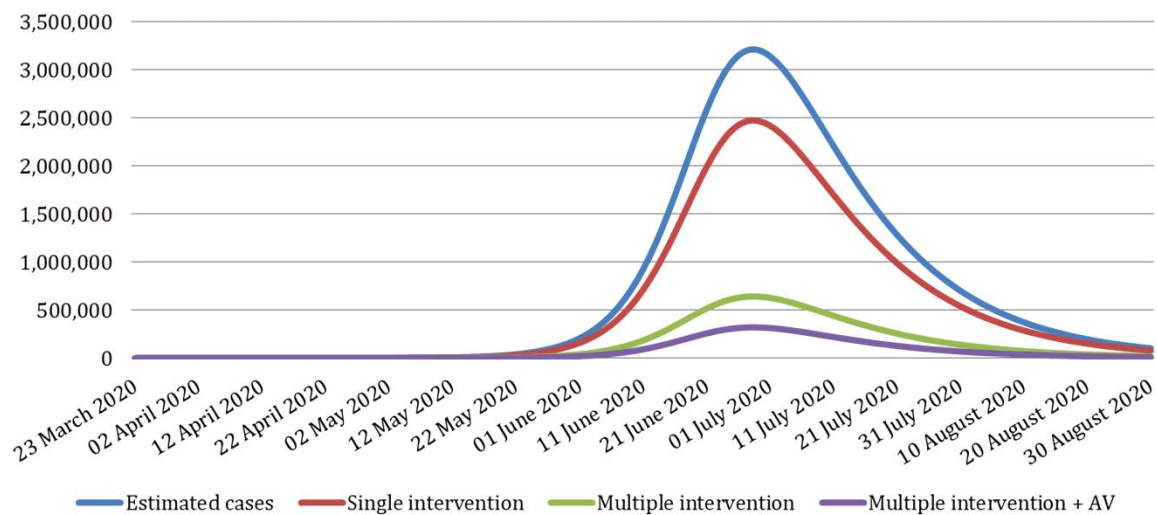

Fg. 8 Predictions of positive COVID-19 cases in South Sumatra Province according to several types of interventions

Note: 1) No intervention: no intervention; 2) Single intervention: a single intervention; 3) Multiple interventions: multiple interventions; 4) Multiple intervention with anti-virus treatment: multiple interventions and anti-virus and vaccination treatments

7.5. Need for Treatment Rooms and Intensive Care Units (ICUs) at the Height of the Pandemic without Multiple Interventions

Prediction results based on the epidemic curve modeling show that as many as 600,000 cases will require hospitalization during the peak of the pandemic. Based on the assumption of the CFR COVID-19 in Indonesia, the number of deaths will reach half of the number of patients receiving care in hospital if patient care support devices, such as ventilators, isolation rooms, and ICUs, are still limited (Figure 9).

At the height of the pandemic, approximately 250,000 people are predicted to have died from COVID-19 (Figure 9). On July 16, 2020, the South Sumatra Provincial Government reported that out of the 2,829 people who tested positive for COVID-19, 135 died. Therefore, COVID-19 can be another cause of death today, approximately 4.7% of the total cases, apart from other five most common causes of death, such as stroke (17.31%), ischemic heart disease (15.91%), diabetes (5.98%), tuberculosis (4.76%), and

cirrhosis (4.07%) per 100,000 population (Institute for Health Metrics and Evaluation, 2017; South Sumatra Provincial Government, 2020).

Based on the analysis, one in 10 patients needs ICU treatment, as exhibited from the total prediction of the number of patients who need hospital treatment. The data show that the number of patients who need care and ICU treatment exceeds the availability of beds and ventilators. Figure 10 illustrates that by the end of June, the South Sumatra Provincial Government would need almost one million hospital beds, and 10% of these cases must be treated in ICUs; however, the MOH RI data show that in 2018, 9,045 beds were available in South Sumatra Province (Pusdatin Ministry of Health RI, 2019), and 281 ventilator units were spread across the province. This information is based on the data from the Task Force for the COVID-19 Handling Acceleration (Databoks, 2020) and excludes extra beds in guesthouses for South Sumatra athletes.
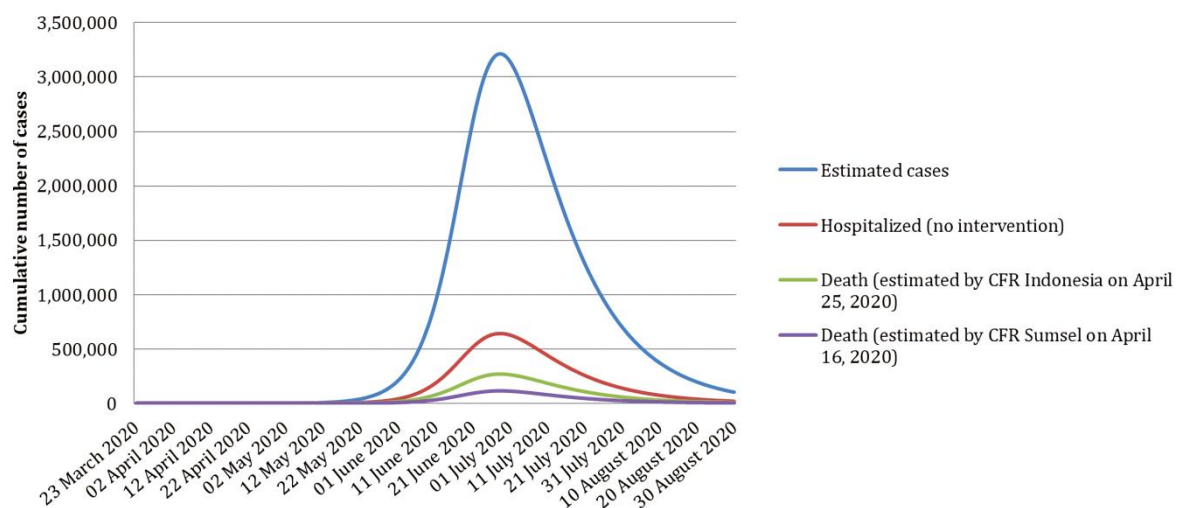

Fg. 9 Prediction of the positive cases of COVID-19, cases needing treatment, and cases of death in South Sumatra Province

Note: 1) Infected: cases that are infected/contracting COVID-19; 2) Hospitalized: COVID-19 patients who need hospital treatment; 3) Death (estimated by CFR Indonesia)
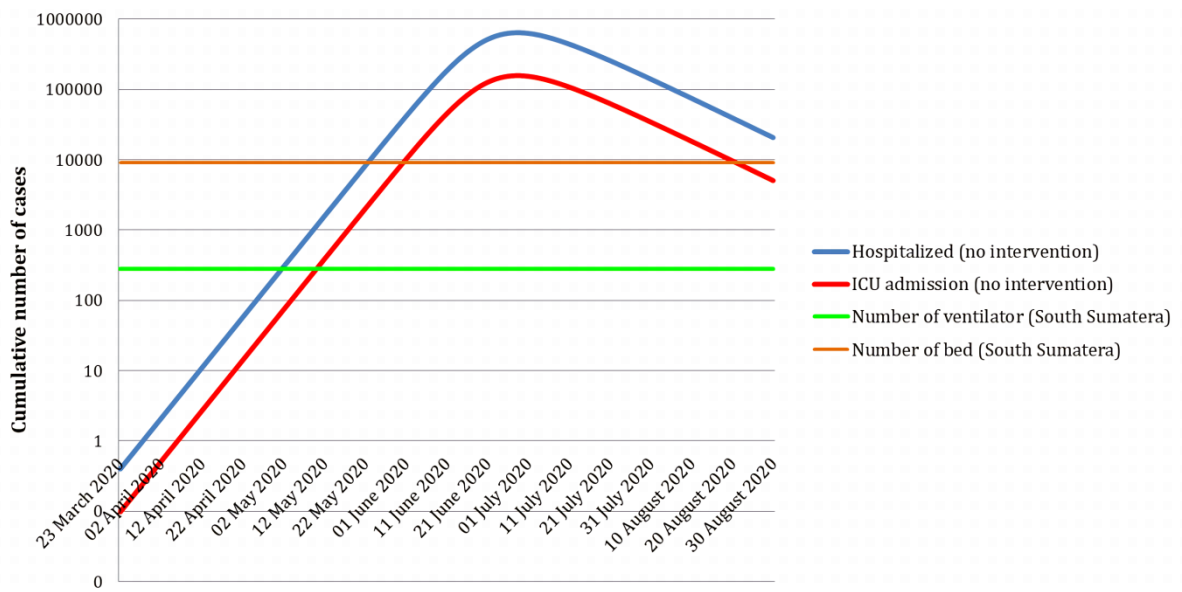
Fg. 10 Prediction of the number of cases that need hospital treatment for the availability of ventilators and beds in South Sumatra Province

7.6. Need for Treatment Rooms and ICUs at the Height of the Pandemic with Multiple Interventions

The results of modeling use the assumption of multiple interventions where as much as 80% of the number of cases will be reduced if multiple interventions are conducted (Chinazzi et al., 2020). The modeling results show that with multiple interventions, the number of COVID-19 cases requiring hospital treatment is reduced from the initial estimate of 128,568 cases. Moreover, the estimated number of cases requiring ICU treatment is 31,499 cases (Figure 11).
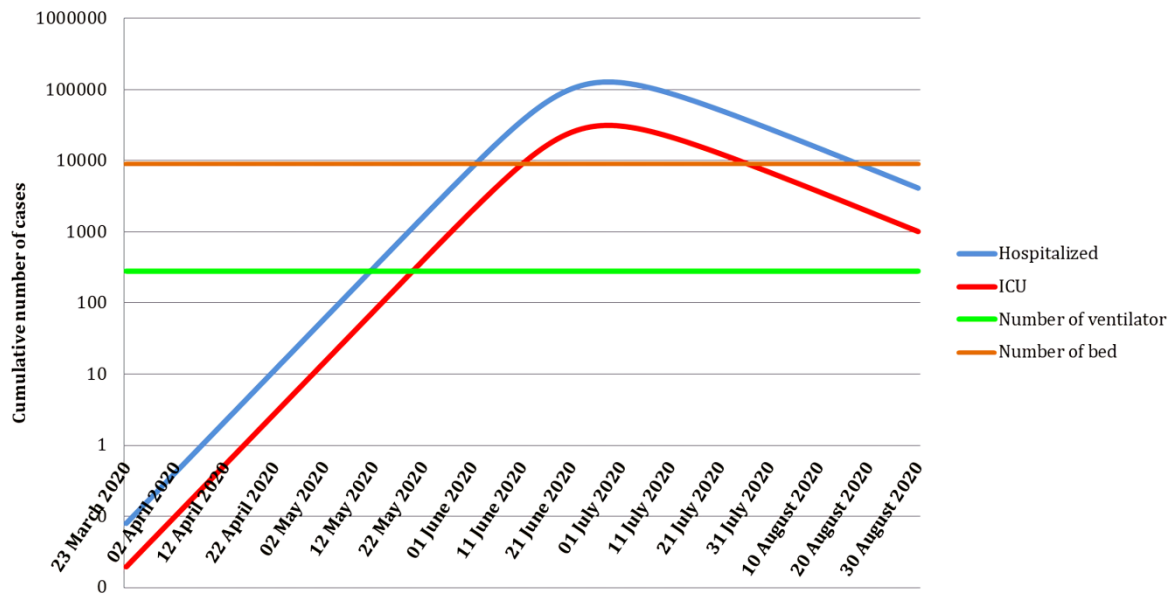
Fg. 11 Prediction of the number of cases that need hospitalization for the availability of ventilators and beds with multiple interventions

7.7.Lessons to Learn for Indonesia

The spread of COVID-19 cases in Indonesia is at the "local transmission" level. That is, every citizen can be infected with COVID-19, without having to travel to areas with red zones or countries with already widespread cases. The Indonesian Health System is still overlapping between the central and regional governments and thus requires the development of a COVID-19 mitigation strategy based on the epidemic curves in each province (Djalante et al., 2020).

The current study shows that in South Sumatra, the research setting, one-third of the people are at risk of being infected by COVID-19 without comprehensive intervention. Prediction results and cases differ quite significantly, with only 5%–10% of cases being detected compared with the estimated COVID-19 cases in South Sumatra. Therefore, early detection through COVID-19 tests and tracking in South Sumatra Province remains weak and thus reflects the condition in Indonesia (Soeriaatmadja, 2020). The current prediction indicates that the real number of the positive cases of COVID-19 is far more likely than the reported cases by the South Sumatra Provincial Government. The "denial" of cases of COVID-19 in Indonesia in early February 2020 might have led to the delay in preventing COVID-19 in the country, including that in other 34 provinces (Lindsley & Mann, 2020). Without overall intervention by the government accompanied by

community participation, Indonesia can be the third virus hotspot in Asia (Riono, cited in Massola, 2020).

South Sumatra must act fast to prevent the surge in the number of COVID-19 cases. Our study considers that cases may peak in late June 2020 (Yeni, Najmah, & Davies, 2020a). However, with the current improvement in COVID-19 tests and coverage in Indonesia, the peak epidemic curve can move to following months, September or October, with a late response of COVID-19 (Riono, cited in Massola, 2020). Sadly, the risk of mortality due to COVID-19 and the complication of non-communicable diseases seriously threaten the age group of over 50 years in Indonesia and other countries (Ferguson, 2020; Ministry of Health RI, 2020b).

7.8. Reflecting the Urgent Needs of Hospital Beds

Based on the results of our predictions, the assumption is that 20% of patients in South Sumatra will require hospital treatment (Tamara Pilishvili, Razzaghi, Reed, Ritchey, & Sauber-Schatz, 2020). Therefore, the percentage of the number of positive cases of COVID-19 in South Sumatra requiring hospitalization will reach 600,000 people by the end of June 2020 without the intervention of a public health approach. This number will exceed the capacity of hospitals in South Sumatra, as the number of available beds in the province is 9,045 units, whereas that in other inpatient rooms [ICU, High Care Unit, Intensive Coronary Care Unit, Respiratory Intensive Care Unit, Neonatal Intensive Care Unit, Pediatric Intensive Care Unit, and Isolation] is 979; these quantities exclude the extra beds prepared by the South Sumatra Provincial Government (Pusdatin Minstry of Health RI, 2019). If multiple interventions are conducted, then the number of cases that need treatment may be reduced to one-tenth of the estimated initial cases that require ICU care that is approximately 31,000 people.

7.9. Reflecting Indonesia's Effort in Mitigating COVID-19 with Other Countries

As observed in several countries, the virus spreads quickly. For instance, it spread to all parts of China within 30 days of the first case being discovered (The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020). Restricting mobilization to and from an area and crowd restrictions, such as working at home and limiting school movements, can slow the spread of COVID-19 from one to three weeks (Ahmed et al., 2018; Chinazzi et al., 2020). However, without changes in individual behavior, such as washing hands with

soap, keeping physical distance, offsetting by early detection of cases, and rapid tracking of COVID-19 cases, including isolating oneself or being quarantined at home, the effectiveness of limiting human movement (including PSBB in the Indonesian context) will not be effective in reducing the number of cases over time (Chinazzi et al., 2020; The Novel Coronavirus Pneumonia Response Epidemiology Team, 2020; WHO, 2019). Social distancing, such as PSBB in Indonesia, is predicted to be less effective in reducing the number of new COVID-19 cases if R0 continues to increase and is not conducted at the beginning of the pandemic, before the cases soar (Ahmed et al., 2018; Milne, Kelso, Kelly, Huband, & McVernon, 2008).

Many countries have successfully implemented multiple interventions to protect public health amid the COVID-19 pandemic. Vietnam and Thailand are examples of countries that have successfully carried out epidemic prevention using the approach of several public health interventions together with social–physical intervention programs. The successful prevention can be seen from the number of positive cases and low mortality rate that occurred in Vietnam and Thailand (Table 1) (Worldometer, 2020). Vietnam did not apply lockdown to all cities where infected cases occurred but closed all places and canceled all potentially crowded events, such as schools, festivals, and conferences (Nguyen & Vu, 2020). On January 30, 2020, Vietnam refused entry of all foreigners from China or other countries who had transit in China within 14 days of their arrival in Vietnam. All tourists who come to Vietnam must be quarantined in a centralized facility for 14 days where food and room cleaning facilities are provided during their isolation routinely (Nguyen & Vu, 2020). Timely communication about the development of outbreaks from the government and the media, combined with the latest research on new viruses by the Vietnamese science community, is a rapid strategy for Vietnam to respond to its public health crisis (La et al., 2020).

Another country in Southeast Asia, Thailand, is an example where lockdown was implemented to prevent the spread of COVID-19 by closing their international flights since early March 2020 (Medina, 2020). The intervention continued with significant restrictions on educational institutions, markets, and international travel on March 18, 2020 (Kanok-Nukulchai, 2020). In terms of disease mitigation, Thailand established a center in charge of managing trips in and out of the kingdom with more stringent screening, quarantine, and monitoring measures, including the opening of free mask

outlets for residents and the imposing of imprisonment or fines for communities where rules for early vigilance are violated (Bangkok Post, 2020).

The combination of early case tracking and multiple public health interventions, such as isolation or independent quarantine at home, and changes in behavior, such as washing hands and wearing masks, can reduce transmission and the effects of influenza pandemics. However, case tracking requires adequate resources to survive after the initial pandemic phase because the numbers of cases and contacts grow exponentially in a short time. Case tracking can be applied in several conditions or objectives, such as case identification in high-risk groups, to allow early treatment, delay widespread dissemination in small isolated communities or in aircraft settings to prevent import cases (Fong et al., 2020).

What should be considered for the Indonesian context? The tight closure of inter-provincial and international human mobilization pathways requires the commitment of local governments to reduce the case of imports from other provinces or countries and establish epidemic curves in collaboration with cross-sectors, especially those that will be affected economically by the closure of this transport route (WHO, 2019). This action must be performed while considering COVID-19 case screening with rapid tests with an accuracy rate of approximately 30%. Note that body temperature measurements are less effective for the early detection of COVID-19 cases.

7.10. What does the Indonesian community need to do?

Most countries have entered or are preparing for the New Normal Life phase, with the following records: 1) no more deaths due to COVID-19; 2) no new positive cases of COVID-19; 3) recovery rate exceeds 95% (Yeni et al., 2020b). Indonesia is unique, as it plans to implement this phase while the epidemic curve graph is still showing an increasing trend; cases of death and new positive cases of COVID-19 are still recorded; the cure rate remains approximately 50%.

In South Sumatra, especially in the city of Palembang, the three points above must be resolved immediately. Data indicate that since the implementation of PSBB, the numbers of new cases and deaths have been continuously increasing; the number of patients who recovered is also still far from 95% (Yeni et al., 2020a; Yeni et al., 2020b). We must evaluate the prevention efforts that have been made so far in South Sumatra.

The readiness of Indonesia, especially in South Sumatra, is still far below that of several neighboring countries. WHO predicts that COVID-19 will move from a pandemic to an endemic. That is, the COVID-19 virus will remain for a long time in a country. Therefore, without knowing which population has been infected with COVID-19, due to the limited access to COVID-19 tests, family empowerment is urgently needed, so that mothers and daughters can break the chain of virus transmission. For instance, at the community level, our study shows the need for women's empowerment to engage in COVID-19 awareness for kids or *PangLing* in their closest neighborhood in their own suburban or kampung. The initial finding of the current research indicates that with the critical awareness of 10 women in the *PangLing* Movement, the social movement can provide health education, masks, and soaps to over 500 kids. Over 10 donors became involved in our activities to provide masks and soaps after we posted our activities on social media. The evaluation of this research is still an on-going process.

Creation of awareness with women in suburban areas *or kampung*

Engagement of other kinds of support through social media

Participation of female volunteers and preparation of additional stuff (masks and soaps)

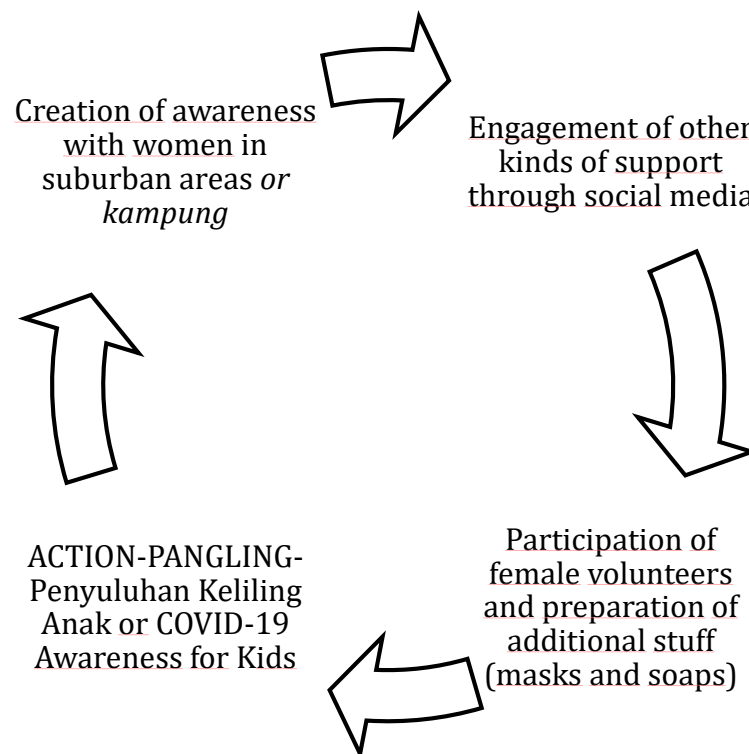ACTION-PANGLING-Penyuluhan Keliling Anak or COVID-19 Awareness for Kids

Fg. 12 Cycle of feminist-PAR in COVID-19 awareness for kids in a suburban area in Palembang (Kampun*g 13 Ulu and 14 Ulu)*

Note: Activities of PangLing can be access here: https://www.instagram.com/englishcamp_13ulu/?hl=en

8. Conclusion

This study has two main conclusions. First, modeling through a quantitative approach shows that a high number of COVID-19 cases are not detected in South Sumatra. Only 5%–10% of the total cases could be detected by the South Sumatra Provincial Government at the end of April 2020, and one-third of the total population in South Sumatra would be infected with COVID-19 by the end of June 2020. The implementation of multiple interventions is needed to reduce transmission rates, including that of social distancing, in combination with other public health interventions, such as travel restrictions, hand washing, and mask wearing. In addition, expanding the scope of testing, contact tracing, and case isolation can help map the spread of COVID-19 cases, and this mapping can help reduce local transmission.

Second, through a qualitative approach, women's empowerment within a neighborhood can be one core intervention to the mass education of COVID-19 awareness in small groups of community in suburban areas or kampung. In a small system, the prevention of COVID-19 transmission in South Sumatra will be more effective with discipline that starts from each individual to adhere to the health protocols (diligently washing hands, wearing masks, and keeping a distance). With discipline at the family level, we can feel the impact at the community level. The government's commitment to discipline in enforcing regulations and health protocols that have been made will try built at the level of Individual - Family - Community can run as expected. Furthermore, empowering the grass-root at local governments in Indonesia is urgently needed. For instance, the *kelurahan* level (local subdistrict office) with the *Lurah* (the leader of *kelurahan*) and *Rukun Tetangga* and mobilizing *posyandu* (maternal and child health community centers) cadres and educated communities, particularly women with diverse backgrounds, should cooperate with the government to monitor the continuity of COVID-19 handling on a small scale.

The limitations of this study include the fact that modeling has not been considered in investigating vulnerable groups, such as the elderly, children, sufferers of chronic diseases, and people with disabilities or people traveling domestically, especially at the end of the fasting month.

Author Contribution

All authors conceived of the presented idea. NA and SD developed the theory and YN performed the computations. NA and YN verified the analytical methods. SD supervised the findings of this work. All authors discussed the results and contributed to the final manuscript.

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Predicitive modeling, empowering women, and COVID-19 in South Sumatra, Indonesia

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