Jakarta, are we ready for the second wave of COVID-19?

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Abstract. In January, WHO declared the Coronavirus Disease (COVID-19) outbreak as a global pandemic. The easy spread of this virus through contact with infected sufferers is a concern. The COVID-19 pandemic should not be taken lightly, like the Iceberg phenomenon, we do not know for sure the factors that affect the level of exposure. Meanwhile, this pandemic has an impact not only on health but also on the economy, society, culture, and psychology. This paper aims to make modelling using a systems thinking approach with the system dynamics method in DKI Jakarta. This model focuses on the conditions during the "homecoming" before Eid, during Eid, and after Eid (when a back flow that occurs). Simulation results show that the flow of homecoming before and during Eid causes positive case behavior is slightly less than without flow, but the flow of homecoming with a back flow that goes out and into DKI Jakarta will cause a second wave of COVID-19 cases.

1. Introduction

In late 2019, the virus was shocked the world, that attacks the tract respiratory and inflammation of the lungs in Wuhan, Hubei, China. This virus is spread by very quickly through contact directly with the infected people; just in three months had occurred 68,500 cases happened. Then in early January 2020, WHO identify this virus such as novel coronavirus (2019-nCoV). Then in February they was announced the officially name of virus is COVID-19 [1]. The virus transmission spread rapidly, not only in China, this virus has affected almost every country in the whole world. There are almost 3.8 million cases infected in more than 220 countries, including Indonesia (www.covid-19.gov.org accessible 7 April 2020; 10:26).

This virus has a magnitude impact, it is not only causes health problems and several forms of community psychological stress, including anxiety, fear, depression, stigmatization, irritability, insomnia, and traumatic stress disorder (PTSD) [2], but also impacted the economic, social, and political. So, in late January, WHO announced it as a global pandemic [3]. Pandemic originating in the etymology of the word Greek is "Pandemos", which means the epidemic globally. It is different from the epidemic, which can refer to restrictions for the area that is smaller and concepts that relate to all people and communities in the world [4]. By definition, a pandemic is defined as the global level of emergency health and affects several regions in the world. In general, declaring a pandemic is considered an event of history as a problem of health and has a dimension of economic, political, and social at the level globally.

In Indonesia, the first case of COVID-19 was announced on 2 March 2020. The number of cases continues to increase as significantly. According to the data until April 2020, the positive cases of the COVID-19 is 2,491 people, were recovered 192 cases (7.8%) and died 209 cases (8.4%). Until May 9,
2020, an increase of positive cases of is 13,112 people, where recovered 2,494 cases (19%) and died 943 cases (7.2%).

The COVID-19 pandemic is not taken lightly, like the iceberg phenomenon, we do not know the many factors that affect the level of exposure. With the increasing number of COVID-19 cases, efforts are needed to accelerate the handling and prevention of this virus. Some of the steps that have been set by the government apart from appealing for self-discipline to maintain cleanliness by diligently washing hands, carrying out social distancing, and implementing Large-Scale Social Restrictions. Meanwhile, to deal with the homecoming tradition, the government has prohibited and controlled transportation flows to prevent the spread of this virus. However, in the field, this effort is still full of challenges because “homecoming” as a social-cultural tradition, inherent with community, and it is difficult to prevent.

This paper aims to show behavior of the pandemic phenomenon in DKI Jakarta with system dynamics method. This model focuses on the conditions during the homecoming before Eid, during Eid and when there is a back flow that occurs.

2. Method

Modelling the COVID-19 pandemic in DKI Jakarta uses the Systems Thinking approach and the System Dynamics method. In the system dynamics method that is modelled is a structure that describes a causal relationship between system components that can explain real phenomena that occur in nature. Because the model has the meaning of imitating the real world, the results of model simulations with the system dynamics method aim not to obtain accurate numbers or results, but only show behavior trends. If the simulation results' behavior trend is following the reference pattern (according to real data/reference data), then the model is declared valid.

Based on these behavioral trends, interventions will be made on certain system components to produce desired behavior in the future. This model is focused on the conditions leading up to Eid al-Fitr, namely during "homecoming", during "Eid" and when there is a "backflow" that occurs in DKI Jakarta. Some of the limitations in the preparation of this model are: (1) there is no definite infection rate per contact, (2) no definite normal contact fraction has been obtained, (3) there is no accurate data about how long it takes a positive person to undergo treatment until healed or passed away. As a consequence, to overcome this problem in these model assumptions are used. All of this is understandable because this virus's character as a new species (Novel Corona) is also unknown. Therefore, in this model the numbers used are the assumed numbers with reference based on the experience of other epidemic cases whose causes are viruses in the same group as the COVID-19.

The model structure built is based on DKI Jakarta events and based on data released by the www.corona.jakarta.go.id site. What is being modelled is the structure of the relationship between the components that causes the emergence of COVID-19 as a real event (real phenomenon). The reference data used to build the initial model structure were taken from the sources mentioned above from March 1, 2020 to April 7, 2020. Jakarta's total population is considered to be the exposure population, which with the emergence of infected people will cause more and more susceptible populations. Like other disease agents, this virus also has transmission to other people whenever a person is susceptible to contact with an infected person (infections per contact). People who are infected and asymptomatic or do not show clinical symptoms (carrier), with all their daily activities, have contact with other humans with a certain number of contacts that are considered normal (normal contact fraction). Contact between a susceptible person and a carrier will increase the rate of transmission.

Based on this information, the relationship between susceptible people, infected people, normal contact fraction, and infection rate per contact forms a circular cause-and-effect relationship (forming a feedback loop). Furthermore, people who are infected will continue during a certain incubation period to become suspected people, the more people who are infected will cause more people suspected. At a later stage, people suspected will be detected (with certain tests) containing the virus and declared as positive case.

Theoretically, the more people who suspect that will cause the number of positive people to increase. People who have tested positive in further treatment (within a certain time) will experience 2
possibilities, namely being cured with a certain level of recovery and not being helped (passing away) with a certain mortality rate. The relationship between suspected people, positive people, people recovering, and people who died forms a circular cause-and-effect relationship (feedback loop).

Figure 1. Causal Loop Diagram.

3. Results and discussion

3.1. Simulation results and data validation

In the system dynamics method, the real phenomenon being modeled must be supported by reference data. If the reference data from these sources is made in graphical form, it appears that the behavior increases exponentially (exponential growth). This behavior is called a reference pattern and it is this pattern that will be imitated in the model to be built. Validation of the model simulation results is done visually which means seeing the trend of the simulation pattern behavior (model simulation results) compared to the reference pattern. If the simulation pattern's behavior trend can mimic the reference pattern, the model is said to be valid. Statistical validation was not carried out because some of the data used to build the model structure were still assumptions; the actual data had not been obtained. Some of the assumptions used to build the model structure include are: (1) The population of DKI Jakarta is constant in its administrative area (does not take into account migration/commuting), except for the calculation of "homecoming" and "return flow", (2) There was no virus mutation during the on-going pandemic, and (3) There is no transmission other than droplet infection. The aspects that have not been modeled in making this model include: (1) Effect of temperature on the incidence of coronavirus infection, (2) Coronavirus re-infection, (3) The social impact of the pandemic due to policies implemented by the government, (4) The influence of culture (culture) society in terms of responding to emergencies including responding to the policies established by the government, (5) The effect of health facilities (health facilities) on the treatment and prognosis of people who are positive cases, and (6) Other social impacts due to the pandemic.

Based on the structural drawing of figure 1, the model built consists of seven feedback consisting of one positive feedback and six negative feedback. The initial incidence of virus transmission can be explained by R1 and B2 feedback, where susceptible people who come into contact with infected people or people without symptoms will increase the rate of transmission by a certain normal contact fraction and infection rate per contact. The greater the transmission rate, the more vulnerable people will be, and the more vulnerable people will cause the greater the rate of transmission. Normal contact fraction is a number that describes normal contact between one person and another in one day based on work or activity. The infection rate per contact is a number that describes how likely it is that a susceptible person who has been in contact with an infected person becomes infected over. These two factors determine the size or size of the transmission rate.
Based on the structural image of figure 2, the model structure shown in the causal loop diagram is transformed using symbols in software and system dynamics. The results of the general simulation of business as usual (BAU) for 240 days of behavior can be explained as follows: The behavior of "Vulnerable People" will decrease with a gentle slope then will decrease rapidly (rapid decline) to a certain extent becomes stable in number. In the real world this is understandable because vulnerable people in the next phase (in line with changing times) will change their status.

The results of the business as usual simulation for 275 days with the beginning of March 1, 2020 for the "Positive People Covid19" component, show a simulation pattern of growth that is quite fast (growth) but not linear but growth that tends to be exponential (exponential growth). This behavior visually corresponds to a reference pattern (based on time series data for the same time frame). With this visual validation method, it can be concluded that the model built is valid. Statistically using the absolute mean error (AME) method, the error is 16%.

The simulation results with homecoming show the behavior of the number of positive cases of Covid19 has decreased slightly compared to conditions without homecoming. This can be explained because the number of travellers from DKI Jakarta to outside is quite large (a total of 750 thousand...
people to 1 million people). This large number will certainly reduce the number of susceptible people and the unchanging contact rate will cause the number of infected people to decrease.

There are no new positive cases after behavior becomes zero. However, with the movement of population through the homecoming flow, the potential for new cases in new locations will increase. Homecoming will spread the virus to new locations with high population mobility. The number of cases in DKI Jakarta will decrease along with the homecoming of the community but will add new positive cases in other locations that are the destination of homecoming. The simulation results taking into account the flow of "homecoming" which took place slowly from mid-April 2020 to the end of June 2020 and the "reverse flow" which also took place gradually from the end of June 2020 to the end of September 2020, showed a second wave from positive cases. The second wave started to increase rapidly in early August 2020 and reached its peak at the end of September 2020.

3.2. Discussion

Based on the research results [5], when it measures the best that can be done to minimize or even negate the rate of transmission, it is to perform quarantine, isolation themselves. In line with that [6] also stated to negate and decrease the rate of transmission of coronavirus can be done by reducing the contact and reducing or restricting the community's activities. Reducing community activity can be realized by:

a) Social distancing, physical distancing, quarantine, large-scale social distancing.

b) Eliminating viruses that stick to the surface of objects can be minimized or eliminated by washing hands with soap, using a hand sanitizer, spraying objects with a disinfectant. And prevent droplet infection by using a mask.

c) Based on the aforementioned matters, what is easiest for the community to do is to familiarize themselves with maintaining and improving personal hygiene. One way is to encourage frequent handwashing with soap, especially after handling objects.

Population mobility will increase the transmission and spread of COVID-19 [7,8,9,10]. Because if people are obedient to no back and forth, it does not happen displacement or migration of the population that will decrease positive cases more quickly. Not doing "homecoming" also has the potential for no
new cases to occur in the homecoming destination, thereby reducing the risk of forming a new virus transmission epicenter.

4. Conclusion
Based on the results of model simulations that have been conclusions, The flow of "homecoming" causes the behavior of positive cases of COVID-19 in DKI Jakarta to be slightly reduced compared to without the flow, but the "homecoming" flow with a "reverse" flow that goes out and into DKI Jakarta will cause a second wave of positive cases. The number of positive cases in the second wave really depends on the number of contacts that occur in the community due to the entry of many people from various regions to DKI Jakarta. The greater the number of contacts, the faster the number of positive cases of Covid19 will increase and the faster it will reach its peak.

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