

CHAPTER 1

INTRODUCTION

1.1. Background

Human history is coloured by many outbreaks of infectious diseases and left with the horrendous impact on its society. These tragedies have shaped the health, economic, and social aspect of humanity. The emergence of infectious diseases is thought to be caused by socioeconomic, environmental, and ecological factors. Although epidemic or pandemic outbreaks have also greatly improved many aspects of modern medicine, urging the scientific communities to develop containment strategies, vaccines, treatment, and prevention. Despite these improvements, however, there are still significant challenges to face in the preparedness of a global pandemic (Huremović, 2019; Madhav et al., 2017).

At the end of 2019, a highly infectious and pathogenic disease has emerged in Wuhan, China, called the novel coronavirus disease 19 (COVID-19), which was caused by SARS-CoV-2 (Arifin, Chan, Amaran, & Musa, 2020). After a genomic analysis, it is revealed that the virus' genome is similar to severe acute respiratory syndrome-like (SARS-like) bat viruses; thus it is strongly believed that the bats were the primary reservoir of the disease (Shereen et al., 2020). Like the common cold, this disease primarily affected the upper respiratory tract with symptoms mild to severe that includes fever, dry cough, and dyspnea. Unfortunately, elder and immunocompromised population are susceptible to severe cases of this disease, and the growing number of mortality amongst the older population seems to increase worldwide (Martins-Chaves, Gomes, & Gomes, 2020; Yuki, Fujiogi, & Koutsogiannaki, 2020).

Less than three months after the disease emerged, it has spread out to more than 110 countries, with over 118,000 cases and 4,292 fatalities, until the World Health Organization (WHO) announced it had developed into a pandemic on March 11, 2020. By this time, the global death rate of COVID-19 was up to 3.6% (WHO, 2020). By the end of April, the number of cases had increased to over 2 million cases; while the death toll had accumulated up to over 200,000 worldwide as of April 30, according to the WHO. The cases of COVID-19 infection are still exponentially rising to the time of writing, mostly in countries with large populations and have not yet shown signs of declining.

As global travel and interaction have become accessible, many countries were directly affected by the pandemic, one of which is Indonesia. The first two cases found in Indonesia was when two residents contracted COVID-19 after visiting a cafe, in which an infected Japanese nationality had also been visiting. Later, it was informed that the person was positive with COVID-19; soon, the infection had spread out rapidly. As WHO had announced a global pandemic, Indonesia has reported 27 cases

with one death; thus bringing up the fatality rate of 3.7%. By the end of the month (March 31), the case had risen to 1,528 with a death toll of 138, bringing up the fatality rate of 8.9%. Indonesia's high fatality rate was observed to be the highest rate amongst the South-Eastern Asia region (WHO, 2020). These cases were primarily clustered around the most populated region of Indonesia, the Island of Java. The high fatality rate is assumed due to the lag of the healthcare systems and the government's response towards the disease (Ritchie et al., 2020). Towards the end of March, it was reported that only 450 individuals were tested against COVID-19 out of the 270 million population that lives within the country, way below the global average (WHO, 2020).

The local government of Jakarta issued the close-down of all regional schools and institutions in the area on March 14 due to the overwhelmingly large number of cases in Jakarta. However, many of the other provinces have followed with the measures taken by the local government of Jakarta soon after. On March 16, the president of Indonesia instructed many workplaces to work from home, not including essential workers, starting from ministry offices and government-owned business. It resulted in many people working from home and being homeschooled as a measure to self-quarantine everyone for over one month. On March 31, the government issued large-scale social restrictions (Pembatasan Sosial Berskala Besar or PSBB) policies based on the health quarantine law that will take place from April 10 to April 24. They have also suggested that local governments take actions to enforce the policies with the help of law enforcement. This PSBB policy includes the closure of schools and workplaces, ban on a gathering of more than five people, restrictions of public transport, restrictions of religious activities and limiting cross-province travel. These PSBB policies apply to all workplaces, excluding hospitals, clinics, grocery markets, as they are one of a few essential workplaces that need to be open during this pandemic. This has greatly impacted the nation, explicitly burdening its economy to its public health system. Even for many of the individuals affected, the self-isolation has greatly impacted its psychology, with many reported experiencing post-traumatic stress symptoms, confusion, and anger (Brooks et al., 2020).

Unlike Indonesia, the neighbouring countries such as Australia and Malaysia have shown an overall decline of daily cases amid April. Although there are still sporadic surges of cases and a threat of a second wave of COVID-19 outbreak, they have successfully mitigated the spread of disease. Malaysia has reported 8,764 with 122 deaths while Australia has reported 11,441 positive cases with 118 deaths at the time of writing. Thus brings up the fatality rate of respective countries to 1.4% and 1%. In contrast to Indonesia's fatality rate of 3.7%, the two countries show a difference of over 2% (WHO, 2020).

While scientific data of new diseases is vital to understand the new information of pathogens, statistical data is critical to assess the outbreak situation. These data help to make critical decision making from authorities involved. One of the most widely used epidemiology models is the

epidemiology curve. It is a graphical representation of the incidence of a particular disease over a time period (Bartlett & Judge, 1997). The use of the epidemiology curve in this pandemic is crucial in the early stages of the outbreak; it is able to assess the growth and decline. The growth and decline of a disease occurrence are shown as the bell-shaped curve, the desired shape to mark the end of an outbreak. The particular shape gives an insight into the possible outcome of the outbreak, the number of cases, as well as the duration of the outbreak (Kamvar et al., 2019). A Susceptible-Infected-Recovered (SIR) model is used to predict the bell-shaped curve of an outbreak. SIR model segregates the compartments to create the predicted number of daily cases plotted over a period of time. With this epidemiologist may predict the outcome of a particular outbreak in its early stages to help control the spread of disease.

In this study, the epidemic curve of daily positive cases of COVID-19 from Indonesia, Australia, and Malaysia will be constructed using actual data gathered. The epidemic curves of the three countries will be compared on the pattern of the epidemic curve. With intensive research, factors that may affect the epidemiological curve such as measures and healthcare capability will be identified and evaluated on their effectiveness. Lastly, using the SIR model, the epidemiology curve will be constructed and predict the outcome of the outbreak in Indonesia.

1.2. Objective

The objectives of this research are as follows:

1. To construct the epidemiology curve of daily positive cases of COVID-19 from Indonesia using the actual data.
2. To compare Indonesia's epidemiology curve with that of Australia and Malaysia.
3. To identify measures which may factor in the epidemiology curve in Indonesia, Australia and Malaysia.
4. To utilize the SIR model to predict and construct the epidemiology curve of Indonesia.