

## Economic Valuation of Health Impact of Tightening and Easing PSBB Policies in DKI Jakarta

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### Abstract

Coronavirus Disease 2019 or COVID-19 is a pandemic that has affected more than 200 countries around the world. This study aims to see the benefits of differences in the policy of easing the lockdown or PSBB (*Pembatasan Sosial Berskala Besar*), and in the progressive tightening of PSBB execution that had taken place from early March until 31 August 2020. The health impact benefits are calculated using the morbidity which includes Medical Costs and Temporary Productivity Loss (TPL), and the mortality which includes the Value of Statistical Life (VSL). ARIMA model is used for prediction simulation on positive cases of COVID-19 and benefit-transfer method for predicting death cases. If the strict rules are saliently successful in containing the development of positive cases, then DKI Jakarta will only have 54.2% or 18,460 cases and the death will only be 550 cases. Benefits of medical costs that can be incurred could save the health budget amounting to IDR1.26 trillion. TPL affects most of those aged between 25–29, 30–34, and over 60 years and it also yields a benefit of IDR56 billion. From the death of many people aged over 60 years, it will contribute to the benefits of VSL amounting to IDR15.5 trillion.

**Keywords:** COVID-19; lockdown/PSBB; easing and tightening of lockdown; medical cost; Temporary Productivity Loss (TPL); Value of Statistical Life (VSL)

**JEL Classification:** H12; I18

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## 1. Introduction

COVID-19 is an infectious disease that causes high mortalities worldwide has dictated WHO to declare COVID-19 a global pandemic in early March 2020 (WHO, 2020). It was recorded that until August 31, 2020, the number of infected people in the world has reached 25.3 million people, of which 850 thousand have died.

The impact of COVID-19 has harmed the poor and vulnerable the most, and it is threatening to push millions more into poverty. The worst-case analysis scenario that COVID-19 could be pushed as high as 115 million people into extreme poverty this year (Blake & Wadhwa, 2020). The concepts such as “lockdowns”, “social distancing”, and other retrictions are enacted to control the spread of the virus, have had an enormous impact on economic growth. COVID-19 has triggered a global crisis like no other crisis, per capita income would decline during the pandemic. Furthermore, the impact on business and employment, especially micro, small and medium enterprises (MSMEs) in delevoping countries are under strong pressure and has resulted in reduced family income due to job loss.

Indonesia as one of the ASEAN countries and also the fourth most populous country in the world has been predicted to face a major threat from this pandemic. COVID-19 in Indonesia was officially announced by President Joko Widodo on 2 March 2020, when two Depok residents were indicated to have COVID-19 after a contact with a Japanese foreigner. Over time, several provinces in Indonesia implemented a lockdown or restriction policy known as Large-Scale Social Restrictions or PSBB.

The DKI Jakarta Province area as the country’s capital is highly infectious and is referred to as the epicenter of the COVID-19 spread in Indonesia because the number of positive patients has increased. This is because Jakarta is considered as the gateway for ‘global trade’ and also the place for the highest economic interaction in Indonesia. Based on INDEF data, the highest amount of IDR—i.e., as much as 70%—is circulated in Jakarta. With the high level of money turnover, the risk of large losses due to COVID-19 will also increase accordingly (Hadiwardoyo, 2020).

The Provincial Government of DKI Jakarta started a restriction (lockdown) policy, known as PSBB (*Pembatasan Sosial Berskala Besar*) policy on 20 March 2020 through Governor’s Decree No. 337 of 2020 with wider restrictions on Socio-Economic activities. On 10 April 2020, the Central Government through the Decree of the Minister of Health of the Republic of Indonesia No. HK.01.07/Menkes/239/2020 approved the PSBB policy to be implemented in DKI Jakarta. The PSBB policy is equivalent to a restriction policy with an added policy for the acceleration of handling COVID-19. The extension of the restricted PSBB was enforced several times until on 4 June 2020 the Governor of DKI Jakarta announced the Transition (easing) of PSBB policy through Pergub (Governor’s Regulation) No. 51 of 2020.

Due to lack of residents discipline towards health protocols, the increase

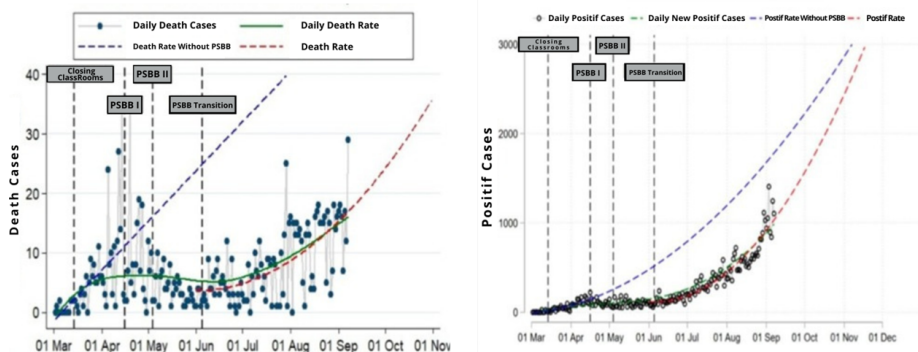


Figure 1: Daily Positive Cases and Mortalities until 7 September 2020

Source: corona.jakarta.go.id (2020)

in positive cases and deaths is much higher than when the tightening PSBB was implemented (Figure 1). In one day on August 31, 2020, more than 1,000 people were confirmed positif, bringing the total positive cases to 40,309 and 1,202 deaths. This sharp increase puts patients at risk of not being served properly due to limited treatment facilities (Ferguson et al., 2020).

Efforts to keep tightening the PSBB will certainly enable to reduce the level of virus outbreak attacks compared to easing the PSBB. Therefore, the economic health impact is measured by evaluating the reduction in attack rates in cases of COVID-19 morbidity and mortality in DKI Jakarta. Morbidity calculates the valuation of Medical Costs and Loss of Productivity due to not working based on data sources using positive cases; while mortality evaluates the Value of Statistical Life of death cases (Scherbina, 2020).

Medical costs include counting the number of people exposed to COVID-19, both symptomatic and asymptomatic. People who have symptoms allow for further treatment costs as well as the cost of using medical equipment when needed. Considering that COVID-19 is an Emerging Infectious Disease, it is based on the current regulation of the Minister of Health that medical costs are borne by the Government. The valuation of calculating medical costs uses the amount of costs listed in the Decree of the Minister of Health Number HK.01.07/MENKES/446/2020, with the technical classification of treatment and administration of drugs and other supporting services using standard procedures for handling COVID-19 patients, namely the COVID-19 Management Guidelines (PDFI et al., 2020).

A person will lose their productivity if they are exposed to COVID-19, both asymptomatic and symptomatic with mild symptoms, severe symptoms, and critical. At least people who are exposed to COVID-19 will isolate or take care for at least 14 days so they do not become carriers or transmit the virus to healthy people. This isolation or treatment period is evaluated as a loss of productivity

(productivity loss).

For patients who died due to COVID-19, the calculation is the statistical value of a person's life at the age when he died or also called the Value of Statistical Life (VSL). Research by Viscusi & Masterman (2017) calculates VSL in general without looking at the age group factor, but by comparing the income elasticity of a country. The result, although not referring to COVID-19, is that Indonesians who died had a Value of Statistical Life (VSL) of IDR7.4 billion per person. So if the potential for the spread of this pandemic is increasingly widespread and thereby creating a high positive number and death rate, the greater the cost of the outbreak will be borne accordingly.

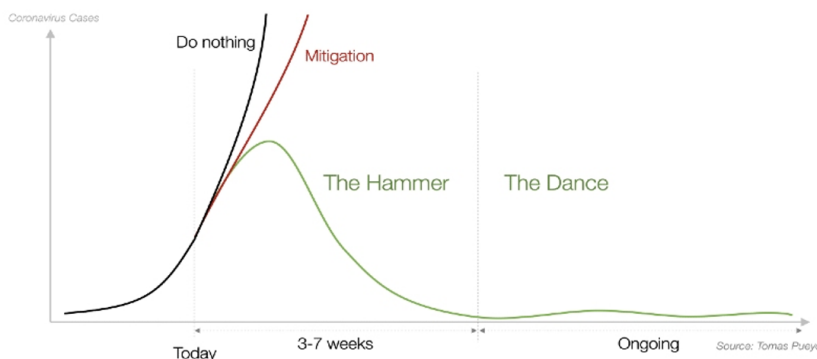
The valuation of morbidity and mortality is calculated using the daily trend data object of the number of positive cases and cases of death taken from 25 March 2020 to 31 August 2020. The research subjects use aggregate data from the DKI Jakarta Provincial Government and 44 Districts throughout DKI Jakarta. For positive cases forecasting or prediction, we use the ARIMA model, while for death cases we use the benefit-transfer method.

The purpose of this study is to find out the magnitude of the benefits of health economic costs that can potentially be obtained from the simulation of implementing the policy of continuously tightening the PSBB, compared to the current condition of easing the PSBB.

The NPIs or Non-Pharmaceutical Interventions (Intervensi Non-farmasi) are an appropriate health disaster management strategy to be applied during the COVID-19 outbreak. According to research by Anderson et al. (2020), there are 2 basic strategies for NPIs, which are: (1) Restriction or Lockdown in which the goal is to reduce the number of reproductions below 1 ( $R_t < 1$ ) or eliminate human-to-human transmission; and, (2) Mitigation or relaxation in which it does not completely reduce the disease transmission with the number of reproduction above 1 ( $R_t > 1$ ).

Referring to Figure 2, based on research by Ferguson et al. (2020) which takes the example of implementing NPI policies in several countries, China took drastic steps by stopping all economic activities in many parts of the country (the dance), followed by Spain and the Philippines (the hammer). The United States, Britain, and Switzerland took policies to slow down the spread by implementing lessening rather tightening the restriction in order not to significantly affect economic activities (mitigation). Meanwhile, if a country or region is lessening its restriction policies or its people do not comply with health protocols, positive cases will most likely soar (do nothing), as happened in Brazil and some states in the United States (Pueyo, 2020).

All kinds of policy interventions will obviously affect the economy. The study conducted by Yusuf (2020) simulated the economic costs in Indonesia due to the pandemic by taking the variables GNE (Gross National Expenditure) and VSL (Value of Statistical Life). Meanwhile, Nurchis et al. (2020) calculated COVID-19 as the burden of disease in Italy using DALY (Disability-Adjusted Life Year) and lost productivity (lost productivity). Research Scherbina (2020) calculates the costs



**Figure 2: The Curve of Number of COVID-19 cases with a Comparison of Policy Implementation**  
Source: Pueyo (2020)

and benefits of simulating the tightening policy with viral reproduction rates ( $R_t$ ) of 0.5 and 0.7 in the United States. The calculated epidemic cost variables include among others: (1) Loss of productivity (productivity loss); (2) Medical Costs (Medical Costs); and (3) Statistical Life Value (VSL).

Based on the previous studies mentioned above, an issue that is quite relevant to the condition of DKI Jakarta as an economic health impact is the valuation of morbidity and mortality due to COVID-19. One of the costs associated with morbidity can be assessed using the Cost of Illness (COI) approach. This COI method calculates the costs of people who experience illness in the form of medical costs, medical care, and hospitalization and costs of lost productivity (productivity loss) (Hoffmann et al., 2012).

Medical costs or COVID-19 treatment financing are calculated using the INA-CBG (Indonesia Case Based Group) standards referring to the Regulation of the Minister of Health No 69 of 2013, namely Regional 1 Hospital Class A tariffs, Class 3 rates, with INA-CBG code A-4-13-III. The details of unit costs per service need based on the classification of symptoms and comorbid factors are regulated through the Decree of the Minister of Health of the Republic of Indonesia No. HK.01.07/Menkes/446/2020 and the COVID-19 Management Guidelines (PDPI et al., 2020).

Loss of productivity is one of the economic evaluations that can be done by comparing costs and benefits. One way to measure and evaluate lost productivity is using the Human Capital Approach (HCA) or an approach to human resources as capital (CREST, 2016). The calculation of HCA according to Pearce et al. (2015) and Nurchis et al. (2020) is a temporary loss of productivity. The concept is the regional wage data multiplied by the number of days of absence and the number of cases. In the case of COVID-19, it is assumed that a period of self-isolation or treatment of 14 days is the number of absences from work.

Research by Robinson et al. (2019) calculates the economic valuation of death (mortality) or VSL (Value of Statistical Life) using cost-benefit analysis. Furthermore, the simulation using this research for the COVID-19 pandemic in America was analyzed by Conover (2020) where to determine the total VSL, it is necessary to calculate the Life Expectancy of Indonesians in each age group range. This figure is then multiplied by VSLY (Value of Statistical Life Year) or the Annual Value of Statistical Life obtained from the calculation of the unit value benefit-transfer method with income and elasticity adjustments (Viscusi & Masterman, 2017).

## 2. Methodology

The study is focused on the DKI Jakarta area which includes 5 Administrative Cities and 1 Regency covering 44 Districts. The data used—i.e., data on the daily accumulation of COVID-19 positive cases and deaths—are taken from the website of the DKI Jakarta Provincial Government Health Office ([corona.jakarta.go.id](http://corona.jakarta.go.id), 2020) The benefits of the intervention are seen through the large difference in the cost of the outbreak on 31 August 2020 between the easing and the tightening PSBB policies. The easing PSBB is a term for the real scenario of the DKI Jakarta Provincial Government starting from 25 March 2020 until the limitation of this research, namely 31 August 2020. While the tightening PSBB is a simulation of a continuous tightening policy without any easing policy for the same time period. We call the easing PSBB in this study as Real Data and the tightening PSBB as Data Forecast.

The total cost of illness (COI) and VSL are health economic costs, both for easing PSBB and tightening PSBB. Furthermore, these costs are divided and the result is the benefit of tightening PSBB interventions. The initial hypothesis from the comparison of these two policies is that the easing PSBB has a higher health economic cost than the tightening PSBB.

To make forecasting data, we took 72 days of positive case, due to availability of data (25 March to 4 June 2020), the amount of which is considered sufficient because to create an optimal ARIMA model requires at least 30 observation data (Hyndman & Athanasopoulos, 2020), while the amount of data to predict is 88 days of data (5 June to 31 August 2020). Referring to Medical Letter on the CDC & FDA (2020) which also predicts using ARIMA for the next two months in the 15 countries in the world most infected with Covid-19, the predicted data we use is therefore more than basic data.

Especially for mortality or death cases in forecasting data, ARIMA simulation is not carried out as in the positive case, but using the benefit-transfer method of unit value with adjustments that are in line with the increase in the daily accumulation of positive cases resulting from forecasting in each area that is the subject of this research.

## 2.1. COI Economic Valuation Method: Medical Expenses

Calculation of Cost of Illness refers to the Decree of the Minister of Health No HK.01.07/MENKES/446/2020, which is formulated as follows:

$$\text{Claim Rate} = (a + ((n.b) - a) - c) - d \quad (1)$$

where  $a$  is the INA-CBG tariff is Rp6.750,986,-;  $n$  is total length of stay; (hospitalization);  $b$  is tariff per day (cost per day);  $c$  is PPE (Personal Protective Equipment) and medicines from assistance; and  $d$  is support services that are not performed

In general, there are five classifications of symptom levels, including asymptomatic, mild symptoms, moderate symptoms, severe symptoms, and critical (ICU). Just like other diseases, that the total cost of treatment per patient is adjusted to the condition of different patients.

The value of  $n$  or the number of LOS (length of stay) in the Hospital refers to the COVID-19 Management Guidelines (PDPI et al., 2020), which is determined by the patient condition, i.e., asymptomatic 7 days, mild symptoms 10 days, moderate symptoms 13 days, severe symptoms 17 days, and ICU 33 days.

Tariff per day (cost per day) or component  $b$  applies to only 3 symptom classifications—i.e., mild symptoms, severe symptoms, and Critical/ICU—which are calculated using the above formula. For component  $c$ , which include Personal Protective Equipment/PPE (*Alat Pelindung Diri/APD*) and medical aids are government assistance through the APBN. Component  $d$  is supporting services (laboratory and radiological examinations) that are not performed.

Referring to the guidelines for handling COVID-19 patients, for asymptomatic patients and those with mild symptoms, they are only admitted to Wisma Athletes or carry out self-isolation at home. They do not require health support services, and do not use the INA-CBG Tariff, and as a replacement is the cost of compensation for treatment, doctor's consultation, and others.

Based on the DKI Jakarta COVID-19 epidemiological study report for the data period until 7 August 2020 (Dinkes, 2020), it is known that the percentages of sufferers of People Without Symptoms (*Orang Tanpa Gejala/OTG*), Mild Symptoms, Moderate Symptoms, Severe Symptoms, and Critical (ICU) are 45%, 15%, 20%, 14.5%, and 5.5% respectively. Especially for OTG and Mild Symptoms, the ratio of outpatient (self-isolation) with hospitalization is 50:50; while for mild symptoms the ratio of outpatient and inpatient is 35:65.

In sum, the costs are broken down according to the patient category, i.e., for Asymptomatic Patient (OTG) is IDR4,725,000; patient with mild symptoms IDR6,910,930; moderate symptoms IDR86,933,514; severe symptoms IDR121,647,860; and critical/ICU IDR385,569,760. Besides, the Government has also stipulated costs for patients who died due to COVID-19 amounting to IDR18,360,000 which is broken down into the cost for relocating the corpse of IDR3,360,000 (Kepmenkes No. HK.01.07/MENKES/446/2020), and the cost for Death Compensation of IDR15,000,000.

## 2.2. COI Economic Valuation Method: Temporary Productivity Loss (TPL)

The economic valuation method in calculating the Temporary Productivity Loss (TPL) in this study only counts in the labor force group, namely those aged over 15 years and over (Pearce et al., 2015).

This study uses the 2020 data of BPS which provides data on Average Monthly Wage/Net Salary (DKI Jakarta Province) for Formal Workers by Type of Work and by Age Group and Main Occupation. Hence, the estimated income of DKI Jakarta residents from the two wage data is based on ten age groups.

The estimated data is still the wages for the DKI Jakarta Province. For wages at the sub-district level, it is calculated through the conversion of expenditure per capita at the City and District levels in DKI Jakarta. The results of this conversion represent the district level wages in it. The results of the wages calculation are presented in Appendix 1.

The formula for calculating TPL uses the HCA approach (Pearce et al., 2015), which is written as follows:

$$HCA(TPL) = \text{Average wage } j \times \text{number of absenteeism} \times \text{number of cases} \quad (2)$$

where *Average wage j* is regional wage in each age group; *number of absences from work* is the average assumption of isolation during Covid-19 illness is 14 day; and *number of cases* is positive confirmed cases.

## 2.3. Mortality Economic Valuation: Value of Statistical Life (VSL)

The first step needed to determine the value of VSL is to calculate the remaining life expectancy in the 13 age groups. Based on the study by Ospina & Roser (2020), the median for each age group was calculated based on the United States Standard Life Table<sup>1</sup> of 2017. The results were multiplied by the United States remaining life expectancy ratio in 2020. The life expectancy of Indonesians is not as high as those of the United States, so the previous result is multiplied by the deflate ratio. Assuming better health and technology services or "the longer a person lives in the world", it is necessary to know the inflate ratio between cohort life expectancy<sup>2</sup> and period life expectancy<sup>3</sup>. The ratio obtained is 1.07652 multiplied by the life expectancy of Indonesians in 2020. Next, it is necessary to

<sup>1</sup>Source: [https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68\\_07-508.pdf](https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_07-508.pdf), National Vital Statistics Reports, vol. 68 No. 7. United States Life Tables, 2017.

<sup>2</sup>Reference: Social Security Cohort Life Expectancy (Tabel V.A4), on the website: <https://www.ssa.gov/oact/TR/2012/lr5a4.html>.

<sup>3</sup>Reference: Social Security Period Life Expectancy (Tabel V.A3), on the website: <https://www.ssa.gov/oact/TR/2012/lr5a3.html>.

calculate the value of VSL Years (VSLY) using the following formula:

$$VSLY = VSL_{target} / \text{life expectancy} \quad (3)$$

Life expectancy or the remaining average life expectancy of the population is a calculation of the average age of the population of DKI Jakarta converted into a table of life expectancy for the period to be multiplied by the inflate ratio. The result of this ratio is different from the average age of the population of DKI Jakarta (Robinson et al., 2019). The VSL target is calculated using the following formula<sup>4</sup>:

$$VSL_{target} = VSL_{base} \times (Income_{target} / Income_{base})^{elasticity} \quad (4)$$

VSL base and Income base are values from the United States, while the income elasticity assumption is 1.0 (Viscusi & Masterman, 2017). The VSLY value obtained is multiplied by the age group of Indonesian life expectancy, and the result is VSL per age category for DKI Jakarta, as shown in the graph of Appendix 2.

### 3. Result and Analysis

As shown in Figure 3, the green line is real data that has increased due to the easing of the PSBB policy (March 25–August 31, 2020). The blue line is the ARIMA fitted model (period 25 March–4 June 2020). And the red line is the result of forecasting for the PSBB policy simulation of continuous tightening for the period 5 June–31 August 2020.

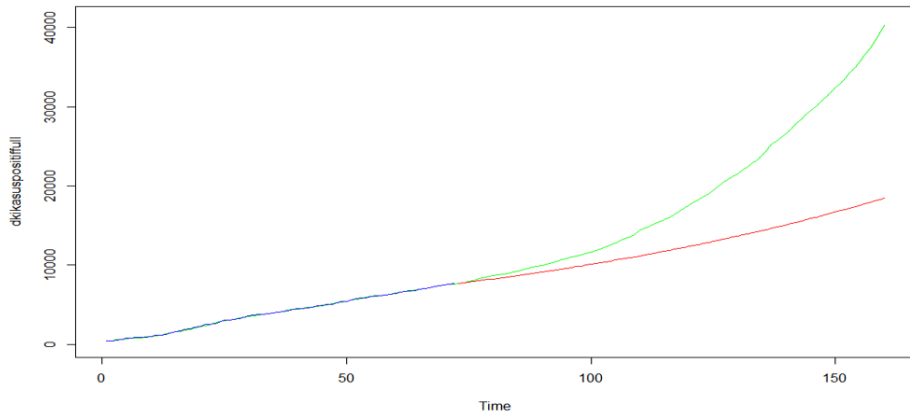
As of 31 August 2020, real data shows the number of infected people in DKI Jakarta amounting to 40,309 people and 1,202 deaths. Meanwhile, forecast data shows that the number of positive cases is only 18,460 people and deaths have also decreased to 550 cases.

#### 3.1. Medical Economic Cost

Based on the calculation of medical costs, in total the Government, both at the central and regional (DKI Jakarta) level, has spent more than IDR2 trillion (or IDR2,359,076,768,884) as of 31 August 2020. If the Government continues to implement the tightening policy then the expenditure is only around IDR1 trillion (IDR1,080,360,228,048), or 54.2% savings (IDR1,278,726,540,836).

As indicated in Table 1, the lowest expenditure for medical costs is in the Thousand Islands Regency, while the highest is in East Jakarta City. The potential for Medical Expenses benefits is obtained from the City of East Jakarta with savings of IDR168 billion (IDR168,091,566.136), while the lowest benefit is from

<sup>4</sup>Per capita GDRP figures are sourced from DKI Jakarta statistics, DKI Jakarta income per capita, on the website: <http://statistik.jakarta.go.id/media/2020/01/4-Income-per-Capita.pdf>.



**Figure 3: Real Data Curve (Easing PSBB) vs Forecast Data (Tightening PSBB) Using ARIMA Model of DKI Jakarta Positive Case**

the City of West Jakarta of IDR108 billion (IDR108,544,815,956).

The best compliance is obtained when the benefits achieved are very low, because it is considered that there is not much difference in terms of costs, between real conditions and continuous tightening simulations (Piguillem & Shi, 2020). In this case, the City of West Jakarta in implementing the PSBB is quite good, the benefits obtained are only 38.34%.

At the sub-district level, the five regions with the lowest benefit or the best compliance were obtained from the Districts of the South Kepulauan Seribu, North Kepulauan Seribu, Penjaringan, Tanah Abang, and Setia Budi. Meanwhile, five areas have the potentials to generate large benefits if the PSBB implementation is continuously tightened, namely Cilincing, Koja, Tanjung Priok, Kemayoran, and Pulo Gadung Districts.

### 3.2. Cost of Productivity Loss (Temporary Productivity Loss/TPL)

As shown in Table 2, the productivity loss of positive patients of COVID-19 in DKI Jakarta in real conditions until 31 August 2020 amounted to IDR105 billion (IDR104,993,945.647). Meanwhile, if in the condition of forecasting simulation the tightening PSBB is continuously implemented, the TPL will decline to IDR48 billion (IDR48,082,254,364). The savings or benefits that can be achieved will be IDR56.9 billion or 54.2%. The highest TPL value is dominated by the age range of 30–34 years, while the lowest in the age group 15–19 years (Figure 4).

Similar to the calculation of Medical Economic Costs, the highest potential for TPL benefits can be achieved by the City of East Jakarta, which is IDR6.8 billion or 52.58%. The best compliance is also in the City of West Jakarta, where the benefit is 38.48% or IDR4.2 billion. At the sub-district level, successively the

**Table 1: Medical Economic Costs for DKI Jakarta Province, City, and Regency**

No	Name of Region	Type of Case	Number of Cases			Medical Costs (IDR Million)		Benefit of Medical Cost	
			Real	Forecast	Difference	Real	Forecast	IDR (Million)	%
a	b	c	d	e	f = d - e	g	h	i = g - h	j = i / g
1	DKI Jakarta Province	Positive	40309	18460	21849	2,359,077	1,080,360	1,278,717	54.20%
		Death	1202	550	652				
2	Kep. Seribu	Positive	48	27	21	2,924	1,644	1,28	43.77%
		Death	0	0	0				
3	South Jakarta	Positive	3988	1964	2024	245,697	121,084	124,613	50.72%
		Death	152	79	73				
4	East Jakarta	Positive	5202	2468	2734	320,014	151,923	168,092	52.53%
		Death	172	87	85				
5	Central Jakarta	Positive	4703	2436	2267	290,206	150,199	140,008	48.24%
		Death	204	99	105				
6	West Jakarta	Positive	4597	2834	1763	283,124	174,58	108,545	38.34%
		Death	170	107	63				
7	North Jakarta	Positive	4733	2495	2238	291,13	153,571	137,559	47.25%
		Death	170	107	63				

**Table 2: Total Costs of TPL for the Province, City, and District of DKI Jakarta**

Name of Region	Positive Case		Total TPL Costs		Benefits of TPL Cost	
	Real Data	Forecast Data	Real Data	Forecast Data	IDR	%
a	b	c	d	e	f = d - e	g = f / d
DKI Jakarta Province	37458	17154	Rp104,993,945,647	Rp48,082,254,364	Rp56,911,691,283	54.20%
Kep. Seribu Regency	45	24	Rp94,791,302	Rp50,247,424	Rp44,543,878	46.99%
South Jakarta City	3714	1830	Rp11,793,649,302	Rp5,819,118,338	Rp5,974,530,964	50.66%
East Jakarta City	4785	2271	Rp13,087,747,891	Rp6,206,515,268	Rp6,881,232,623	52.58%
Central Jakarta City	4403	2282	Rp11,653,543,410	Rp6,033,514,437	Rp5,620,028,973	48.23%
West Jakarta City	4296	2644	Rp10,994,814,879	Rp6,764,260,451	Rp4,230,554,427	38.48%
North Jakarta City	4386	2321	Rp12,814,936,905	Rp6,783,717,135	Rp6,031,219,770	47.06%

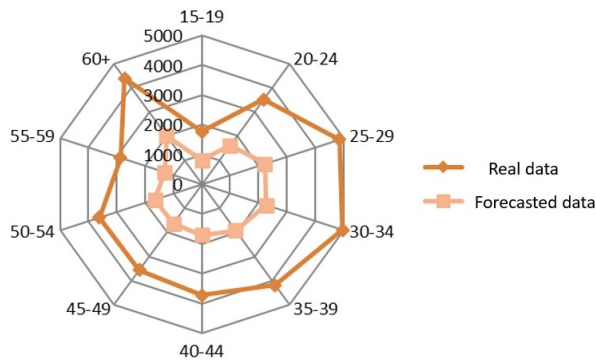
four areas with the lowest benefit or the best compliance are equal to the results of medical economic costs, but the fifth place is obtained by Cengkareng District. For five sub-districts, if the PSBB is continuously tightened, it has the potential to generate large benefits equal to medical costs.

Figure 4 shows that in DKI Jakarta, there are three age groups most exposed to Covid-19 in sequence, namely those aged 30–34 years, 25–29 years, and 60 years and over.

### 3.3. Cost of Economic Value of Statistical Life (VSL)

The VSL Economic Cost is calculated as the monetary value of a small change in life to change the risk of mortality.

As shown in Table 3, when the PSBB is eased (real data) the VSL amounted to IDR28.5 trillion, whereas in forecast simulation (forecast data), the VSL value reached only IDR13 trillion, or the difference in benefits that can be achieved is



**Figure 4: Age Distribution of Positive Cases in the DKI Jakarta Workforce**

around 45.58% of the easing policy. The number of mortalities fell from 1,202 people to 550 people. Judging from the simulation effect of forecasting, the policy of continuously tightening PSBB is able to defend one's life from the ferocity of COVID-19.

The highest VSL is in the age category of over 60 years, because the number of deaths reached 547. If the forecasted death at that age is only 251 people, the VSL value in the 60+ age group is the lowest among other age groups. Yet, because there are so many aged people, the total calculation is therefore the highest. The lowest death cases were in the age group 05–09, 10–14, and 15–19 years old, as real data show that there are only 3 death cases respectively, while the forecast data show only 1 case.

Unlike the calculation of TPL and Medical Costs, in VSL calculation the area with the potential benefit of not many people losing their lives due to COVID-19 is Central Jakarta (51.81%). And again, the citizens of West Jakarta City are considered the most obedient with the lowest potential benefits (37.59%). However, the best area with the lowest real death cases is South Jakarta with only 152 cases, and the forecast results are also low at 79 cases.

The mortalities at the sub-district level with the highest potential benefit (code a in Table 3) are Pancoran, followed by Mampang Prapatan, Makasar, Kemayoran, and Pulogadung, while the benefits are low (code b in Table 3) for the areas of Tanah Abang, Penjaringan, Kebayoran Lama, Pademangan, and Cengkareng sub-districts.

### 3.4. Analysis

#### 3.4.1. Economic Benefits of Tightening PSBB

This emergency condition requires the central government to spend its budget for the treatment of patients suffering from COVID-19. Based on information

**Table 3: Economic Costs of VSL DKI Jakarta Province, City, District, and Regency**

No	Name of Region	Number of Mortality Case		Value of Statistical Life (IDR Million)		Benefit	
		Real	Forecast	Real	Forecast	IDR (Million)	%
1	DKI Jakarta Province	1202	550	28,532,347	13,005,475	15,526,873	54.42%
2	Kep. Seribu Regency	0	0	0	0	0	0.00%
3	South Jakarta City	152	79	4,001,114	2,056,252	1,944,862	48.61%
	Kebayoran Lama	26	20	694,225	575,985	118,24	17.03%
	Mampang Prapatan	14	4	364,239	91,727	272,512	74.82%
	Pancoran	5	1	165,66	23,577	142,083	85.77%
4	East Jakarta City	172	87	3,964,752	2,060,502	1,904,251	48.03%
	Makasar	11	3	222,542	57,782	164,76	74.04%
	Pulogadung	19	5	424,353	112,392	311,96	73.51%
5	Central Jakarta City	204	99	4,543,188	2,189,312	2,353,876	51.81%
	Kemayoran	40	10	891,453	235,623	655,83	73.57%
	Tanah Abang	33	28	751,005	642,635	108,37	14.43%
6	West Jakarta City	170	107	3,623,941	2,261,862	1,362,079	37.59%
	Cengkareng	26	20	638,621	484,86	153,761	24.08%
7	North Jakarta City	155	87	3,979,740	2,234,263	1,745,477	43.86%
	Pademangan	22	17	579,714	456,365	123,349	21.28%
	Penjaringan	23	20	585,145	499,648	85,496	14.61%

from the Ministry of Finance that the budget for handling COVID-19 is IDR87.55 Trillion. This study shows for the area of DKI Jakarta, it is estimated that the medical cost budget that has been issued is IDR2.36 trillion or 2.69% of the COVID-19 handling budget. However, if the PSBB implementation is tightened, this budget can be saved by 53.95% or to IDR1.08 trillion or 1.23% of the budget for handling COVID-19.

Furthermore, in the evaluation of productivity losses as a complement to the calculation of the morbidity value due to COVID-19 in DKI Jakarta—namely, using the Human Capital Approach methodology, especially in the workforce, it was calculated that the lost productivity (Temporary Production Loss/TPL) under the easing PSBB conditions was IDR105 billion, the figure of which is equivalent to 0.0041% of GRDP in DKI Jakarta (assuming the GRDP of DKI Jakarta is the same as in 2019 which was IDR2,599.17 Trillion). In the PSBB is simulated to be tightened, the figure drops to IDR48 billion or 0.0018% of DKI Jakarta's GRDP. The percentage of potential benefits that can be incurred is 52.2%.

As with the age distribution of people exposed to COVID-19, in DKI Jakarta the three largest groups are sequentially of aged 30–34 years, 25–29 years, and over 60 years. Meanwhile, in Indonesia, as of 22 August 2020, the three largest positive cases sequentially belong to the age groups of 25–29 years, 30–34 years, and 35–39 years (Kemenkes, 2020). It is suspected that for DKI Jakarta there is already a family cluster, because it is assumed that there is an interaction between the age group with high mobility (30–34 years and 25–29 years) and parents (age 60+) who live in the same house. From this information, it is necessary to prepare a budget with the priority of this age group, from the health care system, services, to the provision of vaccines, as has been studied regarding the economic burden

lost due to the cold disease (Putri et al., 2018).

In the VSL calculation, this study explains that the value of potential mortalities from the real conditions—if the PSBB implementation is eased—will amount to IDR28.53 trillion or 1.097% of DKI Jakarta's GRDP. Meanwhile, if the PSBB implementation is tightened, it will decrease to IDR13 trillion or 0.5% of GRDP. The percentage of benefits that can be obtained could reach 54.42%.

The highest mortality is caused by the age factor. Starting at the age range over 60 years as many as 547 cases, then 55–59 years (205 cases), 50–54 years (178 cases) and so on until the age group 5–9 years (3 cases), which is later followed by a slight increase in the age group of 0–4 years (9 cases). The highest mortality in the elderly has been studied by (Wolff et al., 2002), where the elderly in the United States need more medical equipment, especially if they are comorbid.

There is a strong relationship between the severity of COVID-19 symptoms and comorbidities. Based on the world case data using meta-analysis methods (Ssentongo et al., 2020), it is found out that out of 10 types of comorbidities, six were very significant—i.e., cardiovascular with risk ratio/RR (2.25), hypertension (1.82), diabetes (1.48), congestive heart failure (2.03), chronic kidney disease (3.25), and cancer (1.47). These results are almost the same as DKI Jakarta, where comorbidities that cause death include chronic kidney failure, diabetes, hypertension, heart failure, chronic liver failure and immunological disorders (Dinkes, 2020). In this case, there is a need for infection prevention and treatment strategies tailored to these high-risk populations in order to improve their survival.

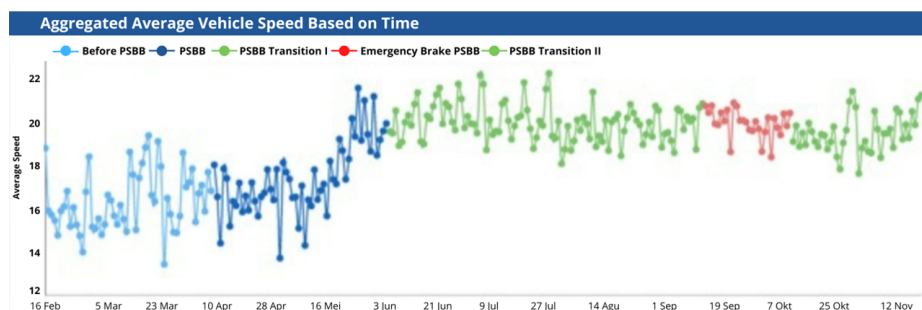
### **3.4.2. Compliance Level of PSBB in DKI Jakarta**

Many countries in the world in mid-March 2020 implemented policies of restricting people mobility to anticipate the spread of COVID-19. At that time, Indonesia was considered as a low-middle income country with a lower number of positive cases and deaths than high-income countries. Overtime, the perception of the Indonesian people regarding the low spread of the virus and the risk of disease (measured by the number of new cases and new deaths per million population) resulted in uncontrolled mobility, especially driven by urgent economic needs due to increasing number of income cuts and layoffs (Hale et al., 2020).

If the analogy of low mobility is the high level of community compliance with government regulations to stay at home. As indicated in Figure 5, the people of DKI Jakarta do not obey the Government's appeal in which when the PSBB tightening was implemented in mid-May 2020 there was even an increase in their mobility. It indicated that there was movement out of town considering that it was the Lebaran holiday. In line with increased mobility, positive cases and deaths slowly increased in July-August during the transitional/easing PSBB.

### **3.4.3. Relationship between Population Density and Number of Cases**

We further attempted to analyse in simple terms, the relationship between population density and the number of cases. According to Bliss & Capps (2020), there



**Figure 5: Average Vehicle Speed Aggregate Based on Time**

Source: corona.jakarta.go.id (2020)

is a strong relationship between population density and the rate of virus spread, whereas research Li et al. (2018) concludes that there is a weak relationship between population density and outbreak spread due to ease of moving or high mobility.

The results of the study show that for DKI Jakarta the number of positive cases were not closely related to the level of population density, but more related to the death rate. For example, Central Jakarta is the most populous area (23,877 people/km<sup>2</sup>) with the highest death rate among other areas, which is 204 people. Furthermore, West Jakarta (19,640 people/km<sup>2</sup>) with 170 deaths, and East Jakarta (16,896 people/km<sup>2</sup>) with 172 deaths.

Furthermore, if we look at the population, East Jakarta is the highest among other areas, which has a population of 3,182,264 people, followed by West Jakarta (2,537,889 people), South Jakarta (2,345,029 people), North Jakarta (1,819,958 people), Central Jakarta (1,149,176 people) and finally the Thousand Islands Regency (29,008 people). For East Jakarta, there is quite a correlation between the number of residents with the highest number of positive cases, but subsequently for the City and District there is no correlation with the rate of positive cases.

## 4. Conclusion and Implication

### 4.1. Conclusion

The main objective of this study is to determine the magnitude of the benefits that can be obtained from the PSBB tightening simulation (forecast data), compared to the actual conditions of the easing of PSBB implementation (real data) in the DKI Jakarta area. The measurement of health impact benefits is evaluated through the cost of illness (COI), including Loss of Productivity due to not working (Temporary Productivity Loss/TPL) and Medical Costs. In addition, this study estimate mortality through the Value of Statistical Life. The ARIMA model and the unit value transfer method are also used to predict the number of positive

cases and mortality from the tightening PSBB policy simulation.

The results of the analysis concluded that continuing to tighten the implementation of PSBB policy will result in a lower number of positive cases and death cases than the easing PSBB policy. The benefits of medical costs that can be obtained are the potential for budget savings of IDR1.28 trillion or 53.95%; whereas Temporary Loss of Productivity (TPL) has the benefits that can be obtained amounting to IDR56 billion or 54.2% of the total budget. In addition, the Life Statistical Value (VSL) of death can be minimized by IDR15.5 trillion (54.42%). Or if assessed using DKI Jakarta's GRDP, the VSL for the easing of PSBB has an effect of 1.097% of the GRDP, while the effect of the tightened PSBB is only 0.5% of DKI Jakarta's GRDP. In total, the valuation of easing PSBB reached IDR30.99 trillion, while the tightened PSBB was only IDR14.13 trillion. This IDR16.86 trillion difference can be taken into consideration by the Government in its policy of saving health impacts due to COVID-19 in DKI Jakarta.

## 4.2. Recommendation

The tightening PSBB policy has been proven to be able to reduce positive cases and deaths in DKI Jakarta and all cities, regencies, and sub-districts therein. It is highly recommended to re-enact the tightening PSBB with the same implementation at the beginning of the pandemic where mobility is very low, there are no mass gathering events, work from home, stay at home, and so on.

The prediction of the number of cases and the calculation assumptions in this study (as forecast data for the tightened PSBB) resulted in a valuation that could be considered overestimate or underestimate, because the calculations in this study takes into account the additional benefits only, while the additional costs (costs) have not been calculated. This study still uses assumptions, such as estimated treatment costs by classifying people without symptoms and with symptoms as mild, moderate, severe, and critical. The calculation of lost productivity also uses the assumption of the DKI Jakarta Provincial Government's minimum wage and the same length of treatment for COVID-19 which is 14 days. The lack of data availability causes the valuation of value in the study to be quite sensitive to the actual number, which could be higher or lower. Therefore, before citing the results of this study, further research is needed.

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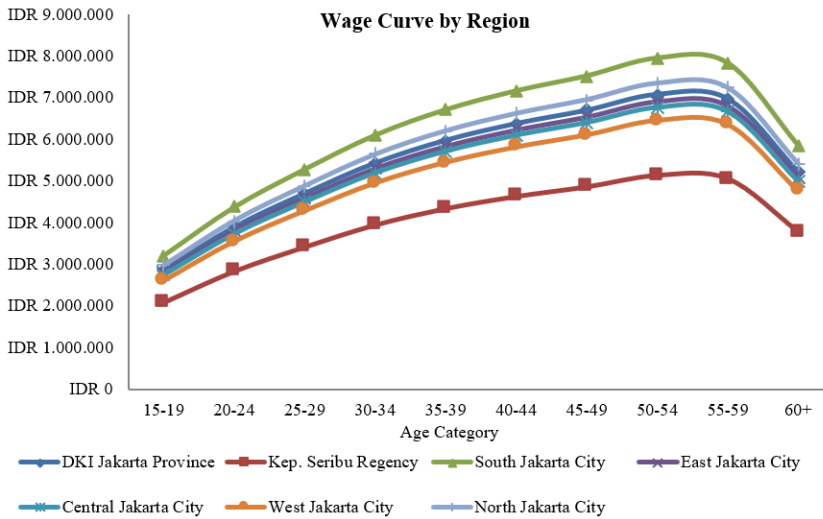
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## Appendices

### Appendix 1. Wage Curves per Province, City, and Regency of DKI Jakarta by Age Category



### Appendix 2. VSL Curve per Province, City, and Regency of DKI Jakarta

