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Our health system capacity vs the demand from a large-scale social distancing policy

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Abstract

Current score: 0 - 5

Intro: the instruction (or lack thereof)

As of April 6, 2020, here is the President instruction on COVID-19:

> "…I order for a large-scale social distancing policy [and] physical distancing to be enforced in stricter, more disciplined, and more effective ways…[1]"

[1] See: https://setkab.go.id/rapat-terbatas-melalui-video-conference-mengenai-laporan-tim-gugus-tugas- COVID-19-30-maret-2020-di-istana-kepresidenan-bogor-provinsi-jawa-barat/

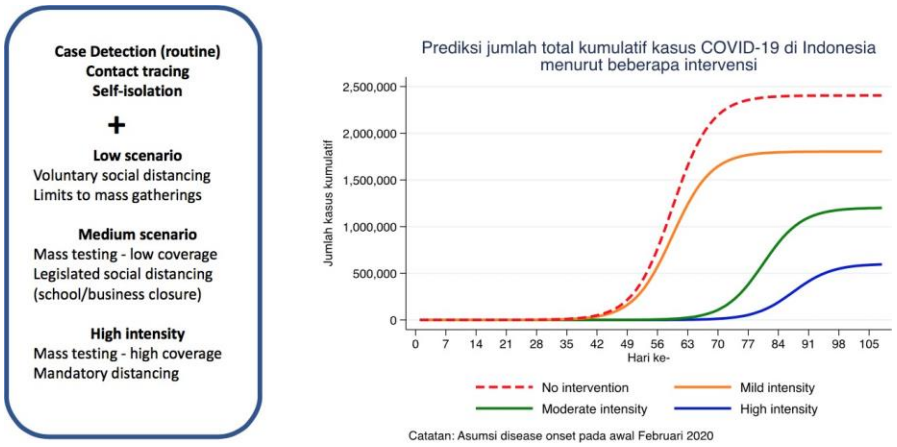
The press release by COVID-19 fast-response chief Doni Monardo, says:

> "…the concluding step taken by the President, that is in the form of a large-scale social distancing…[2]"

A more detailed definition is on the Government Regulation (PP) num. 21/2020: a large- scale social distancing at least in the form of (a) school and business closure, (b) limiting religious activities and/or (c) limiting activities in public spaces. I would also interpret, also from the regulation, that shops and activities for health services, food, and basic necessities would remain open.

At least now the government has come up with some policies to contain coronavirus and to save lives, albeit too late. In this commentary, I want to locate the current policy within various type of interventions to flatten the curve and the related estimated number of up- surging cases. I also want to know, roughly, the health system capacity to anticipate the increasing demand as a result of the government's large-scale distancing policy.

This should be the Ministry of Health's job, but to my knowledge, I do not yet see their publicly available information on what exactly the government plan is to make our health system ready for increasing COVID-19 cases. Thus, take this simple analysis as an opening for further public discussion on the issue.



Source: Ariawan et al. (2020)[3]

Figure 1: Estimated cumulative number of COVID-19 hospitalized cases

This writing is a simple descriptive analysis, mostly done by back-of-the envelope calculation based on some simple parameters' values. In other words, to link the dots based on the best available information that I have. I rely on various government's database as of April 6, 2020, as well as academic report and credible press reports. Needless to say, a more comprehensive analysis with better methodology and data set should follow. Comments and suggestions from experts, especially public health specialists, are more than welcome.

[2] See: https://setkab.go.id/7-arahan-presiden-terbaru-terkait-percepatan-penanganan-COVID-19/
[3] Ariawan, I., P. Riono, M. Farid, and H. Jusril (2020): "COVID-19 Modelling Scenarios - Indonesia," Presentation slides.

Back to the drawing board: it's (just) a moderate intervention policy

Let's try to make sense of the policy taken by the government. The first immediate problem: we do not have government's model on the estimated number of infection and fatalities. On Thursday, April 2, 20202, the government presented a so-called BIN (National Intelligence Agency) model on COVID-19 cases[4] The fact that the government is relying on intelligence agency to predict COVID-19 cases and, presumably, design the policy based on it, is deeply troubling. So far, the epidemiology basis of the model is far from clear.

So, let us just use a model that I happened to know from Ariawan et al. (2020) from University of Indonesia's School of Public Health instead. This model actually has been presented before COVID-19 fast response team as well as the National Planning Agency (Bappenas—there is no reason for the government to say that we do not have model because of lack of data or the government is not informed by our own epidemiologists.

Consider figure 1 above and think about the definition of the model's scenarios: where is the government's 'large-scale social distancing' policy located in those four possible types of intervention above?

The good news is that it is no longer in the no-intervention scenario—at least the government is trying to do something to contain COVID-19. But it is also unlikely a high intensity scenario of high coverage mass testing and high-intensity lockdown. So, in the remaining options, is it a low intervention (the orange line, in the form of voluntary social distancing and limiting mass-gathering)? Or a medium intervention scenario (the green line, low coverage mass testing and legislated social distancing such as school and business closure)?

I think, based on my reading on the Government Regulation 21/2020, a large-scale social distancing meets the definition of medium scale intervention in this (Ariawan et al., 2020) scenario (the green line). The 'area quarantine', *karantina wilayah*, a stricter option not taken by the government, is closer to the high-intensity intervention. The current large-scale social distancing policy also seems to have many similarities to the Dutch government approach[5]—despite, obviously, they're on the different league of health system capacity, relative to ours.

It does also mean that, eventually, there would be accumulatively around 1.2 million people need to be sent to hospitals.

If it is true that the large-scale social distancing is in line with the moderate-intervention scenario, it may potentially delay the peak of daily hospitalization cases by about 20 days (see figure 2). With staggering hospital admission, we also do not need to provide 1.2 million beds and supporting facilities and medical staffs at once. But at least, we need to be able to anticipate the peak of daily number of COVID-19 hospitalization of 105,000 admissions. Also bear in mind, this model assumes that it takes 14 days for a hospitalized person to recover and 7 days for those who do not manage to survive, which is probably an optimistic estimation for the length of a COVID-19 treatment.

So, we now have a rough idea on the COVID-19's demand on the health system, based on the moderate intervention scenario of large-scale social distancing. The next logical step is to assess our supply capacity to deal with this increasing demand.

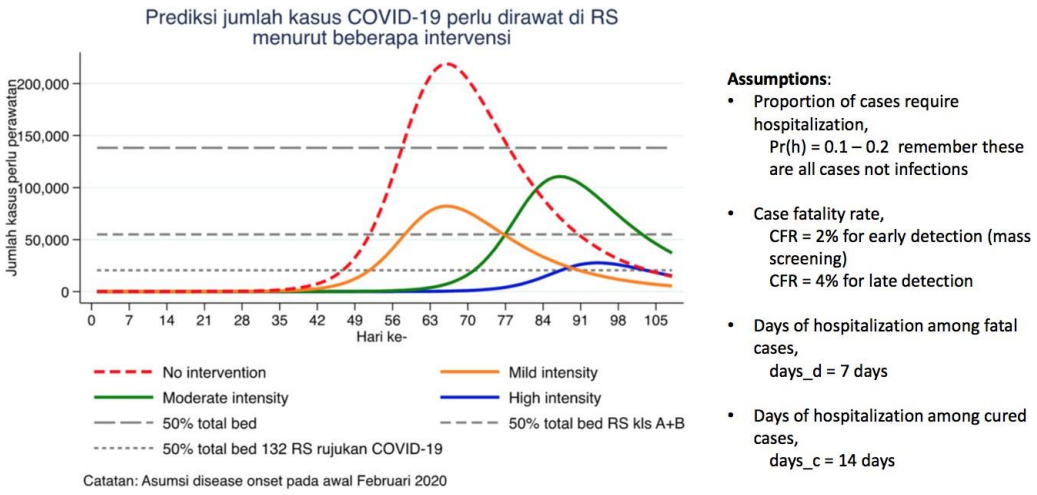
[4] See: https://www.thejakartapost.com/news/2020/04/03/indonesias-coronavirus-cases-may-reach-more-than-106000-by-july-according-to-spy-agency.html

[5] See: https://www.rivm.nl/en/novel-coronavirus-COVID-19/what-are-we-doing-in-the-netherlands-in-response-to-the-coronavirus

Back-of-the-envelope calculation: Do we have enough hospital beds?

Under the existing capacity, adopting a large-scale social distancing would delay the surge of COVID-19 hospitalized cases but still see about 25 days when the number of hospitalized patients exceeds 50 percent of total beds in major type A and B hospitals (see figure 2). In other words, the pressure on the existing hospital system is still too big. To illustrate the problem, at the peak, we need 105,000 beds, but, the *total number of beds* in type A and B hospitals is just 110.000!

Figure 2: Number of daily COVID-19 hospitalized cases



Source: Ariawan et al. (2020)

Just how many beds do we need to prepare for upsurging COVID-19 cases? Here is a back-of- the-envelope calculation. Let's suppose that on only major hospitals (type A and B) have capacity to deal with COVID-19 cases. These hospitals' have 110,000 beds. But we know that some of those beds are already occupied by patients of non-COVID-19 diseases. If the occupancy rate is 50 percent, that is only half of the total beds in type A and B hospitals are available as illustrated by the dashed-line in middle of figure 2, it means that we need to set up at least 45,000 beds quickly.

But what is our actual hospital bed occupancy rate? Let's use the national bed occupancy rate of 77 percent, based on the state-owned (PT Sarana Multi Infrastruktur) report[6]. By that, the number of available beds that could be allocated for COVID-19 cases is 25,000 – that is 23 percent of 110,000 beds. Ergo, to absorb additional 105,000 COVID-19 cases at the peak, we need to provide at least additional hospital 80,000 beds! A tall order, indeed.

A more detailed data on hospital bed availability by province is on figure 3. Java generally has more beds, but also higher bed occupancy ratio, and, this is crucial, also higher number of COVID-19 cases at the moment. This descriptive statistics on the distribution of hospital beds would be particularly relevant once we have data on estimated COVID-19 cases by province to identify the level of shortage as well as to design a proper local policy.

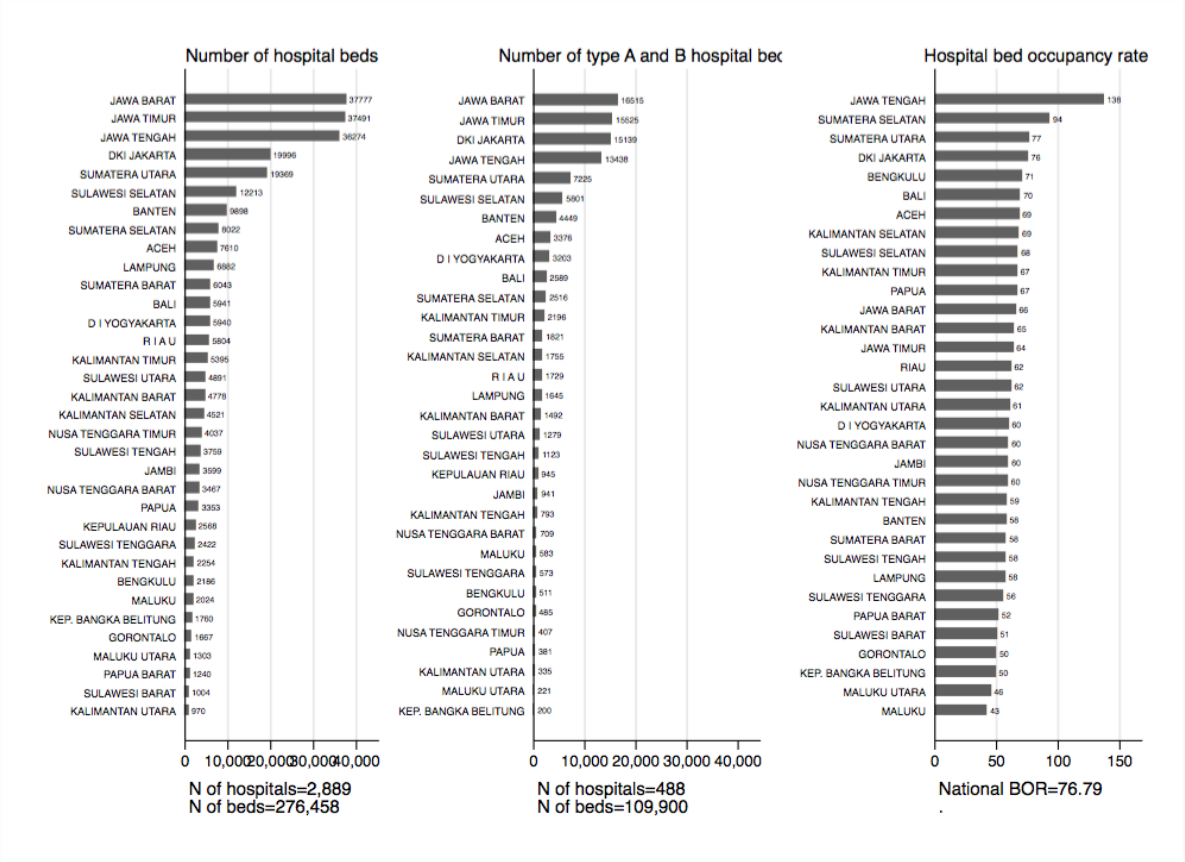
[6] PT Sarana Multi Infrastruktur (2016): "PT SMI Insight 2016 - Q4: Overview of healthcare industry in Indonesia," https://www.ptsmi.co.id/wp-content/uploads/ 2018/09/SMI_Insight_Q4_2016_ENG.pdf.

…and enough ICU beds?

But here is another catch: COVID-19 cases need not only just regular hospital beds, but also intensive care units to treat severe cases. If we assume that 14 percent of hospitalized cases needs intensive care (as suggested in (Ariawan et al., 2020) model), we need at least 14,700 intensive care units (ICU) beds at the peak—that is 14 percent of 105,000 hospitalized cases. Let us call this a low-case scenario.

If we take more conservative rate and follows the Imperial College's model[7], "…30 percent of those that are hospitalized will require critical care (invasive mechanical ventilation or ECMO)…". With this rate, the demand for ICU is as high as 31,500 units—and let's call it a high-case scenario.

Figure 3: Hospital beds availability in Indonesia



Source: Ministry of Health http://sirs.yankes.kemkes.go.id/fo/home; BPJS https://faskes.bpjs-kesehatan.go.id/aplicares/#/app/dashboard.

PT SMI https://www.ptsmi.co.id/wp-content/uploads/2018/09/SMI_Insight_Q4_2016_ENG.pdf

How many ICU beds do we have? I take the data from PT BPJS's Aplicares on the list of hospitals that provide information on their bed availability[8], and the data shows that, nationally, there are around 3300 ICU beds. In other words, in low-scenario, we're short of ICU units by 11,400 units – 14,700

[7] Ferguson, N., D. Laydon, G. Nedjati Gilani, N. Imai, K. Ainslie, M. Baguelin, S. Bhatia, A. Boonyasiri, Z. Cucunuba Perez, G. Cuomo-Dannenburg, ET AL. (2020): "Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand,".

[8] https://faskes.bpjs-kesehatan.go.id/aplicares/

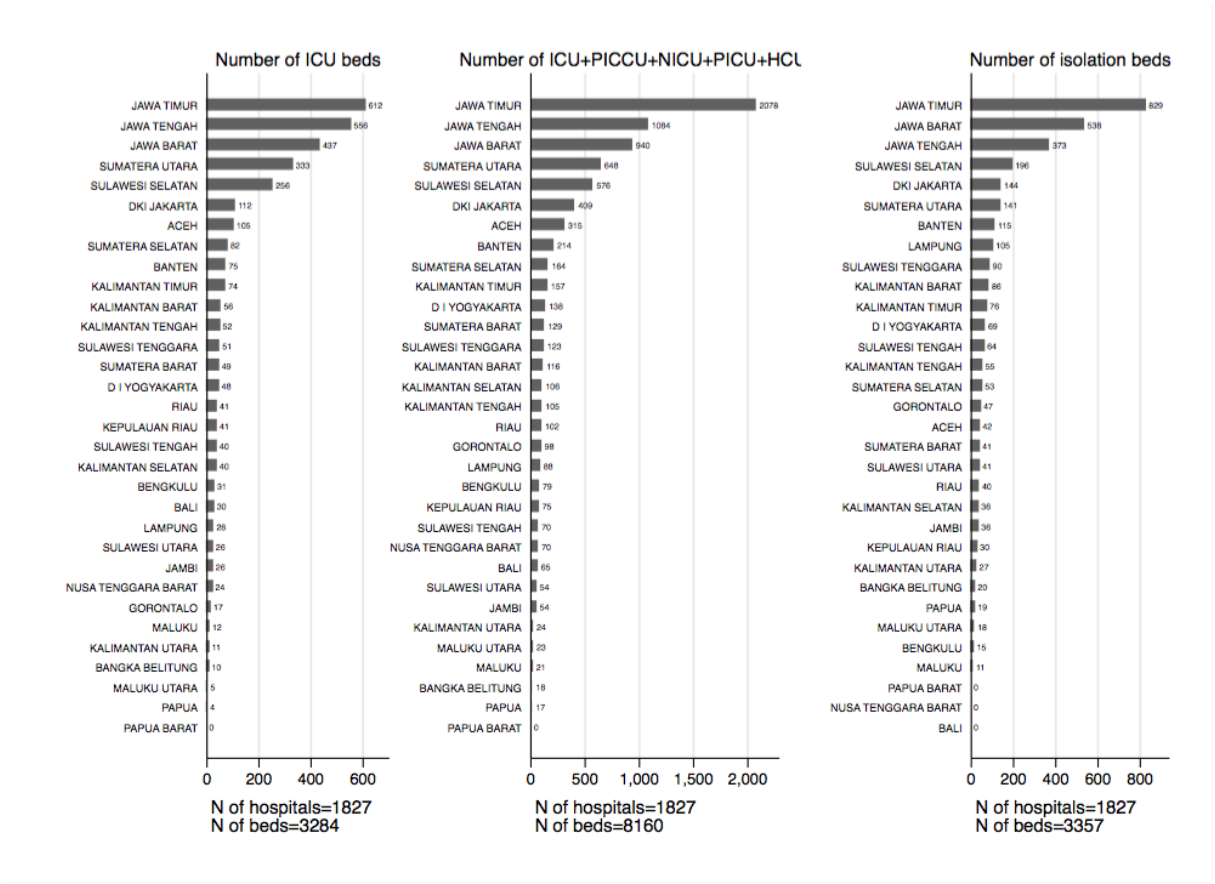
needed minus 3,300 available. But in high scenario, as we need 31,500 ICU units, we are short by 28,200 units.

What if we mobilize all intensive care units (ICU, ICCU, NICU, PICU, and HCU)? In total, we have around 8000 units—still short by 6,700 units in low-scenario and 23,500 in high scenario.

As in hospital beds, this numbers assumes that all ICU beds are available for COVID-19 cases. If taking into account the bed occupancy rates of 77 percent, which is very likely too low for ICU, the number of available ICU bed is just 1,850. In low scenario, we are short by 12,850 ICU units in low scenario, and 29,650 units in high scenario. Very concerning, indeed.

The spatial distribution of ICU units is shown in figure 4. Notice that the intensive care capacity is concentrated in Java, North Sumatra, and South Sulawesi, the current epicentre of COVID-19, DKI Jakarta and West Java, are on top of the list. If the outbreak spills out of Java, we are in a deep trouble.

Figure 4: Intensive-care beds availability in Indonesia



Source: BPJS https://faskes.bpjs-kesehatan.go.id/aplicares/#/app/dashboard

…and the ventilators?

Still, ICU is not the only important factor. The other medical equipment crucial for COVID-19 cases is ventilator. So crucial that many countries are now mobilize all of their resources to secure this vital

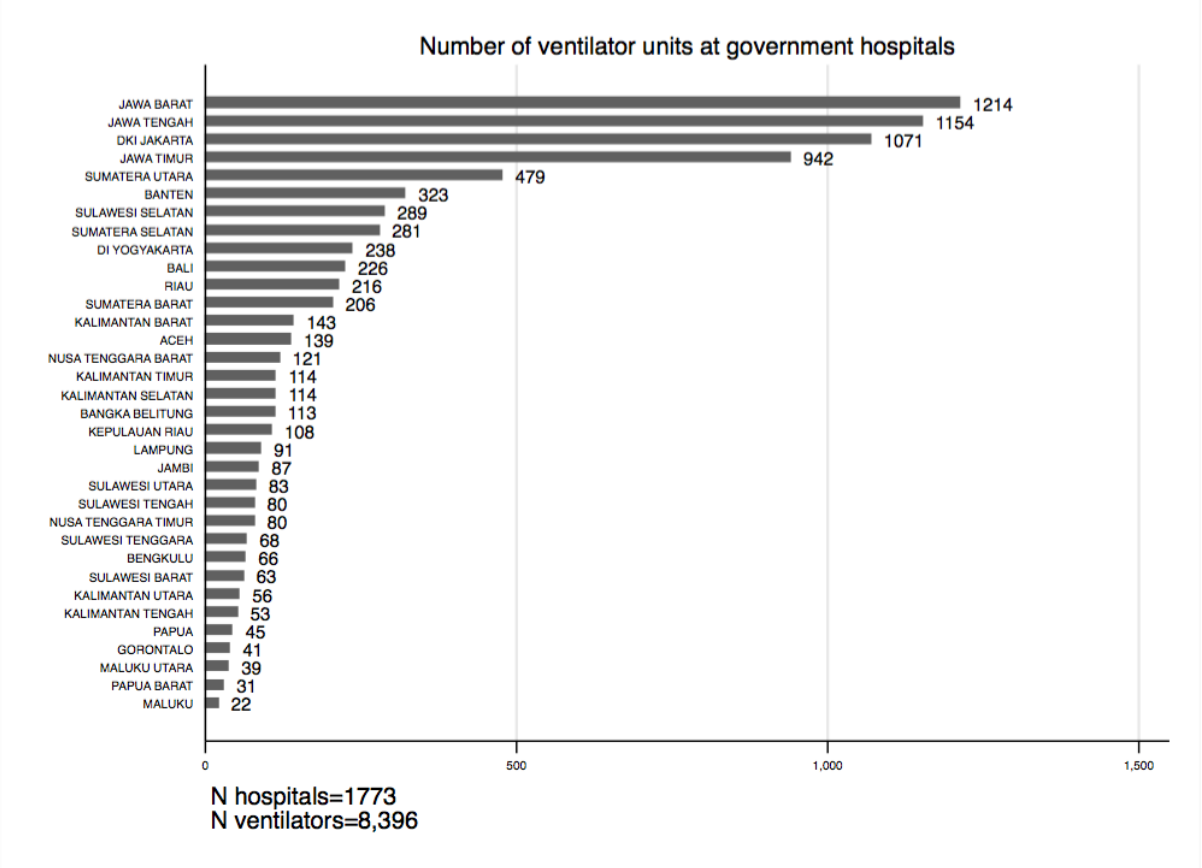
equipment and some governments directly order their industries to realign their production facilities for ventilators.

Getting information on how many ventilators our hospitals have is not easy. Here I use a data from presumably the Ministry of Health, but still needs to be verified—so, read with caveat. The data shows that as of March 22, 2020, there are 8,400 ventilators in state hospitals. This number is not too far from what the Minister of Health claim before the parliament on Tuesday, April 2, 2020[9]. The breakdown by province is presented in figure 5.

Assuming that all who needs intensive care also needs ventilators, we need at least 6,300 more ventilators—that is 14,700 intensive care cases minus 8,400 available ventilators—in low scenario. In a high case scenario, we are short by 23,100 ventilators.

But, again, as in the availability of beds, some of the ventilators have already been used by non-COVID-19 patients. If we assume a similar occupancy rate with the bed occupancy rates, 77 percent, it means that the number of available ventilators is just 1,900—not 8,400. We are short of ventilators by 12,800 units in low scenario and 29,600 in high scenario!

Figure 5: Ventilators availability in Indonesia



Source: Ministry of Health. Preliminary data, subject to further verification

[9] https://nasional.kompas.com/read/2020/04/02/19433911/menkes-sebut-hampir-8500-ventilator-sudah-didistribusikan-ke-seluruh-rs

Recap

Let us recap the numbers: we now probably need approximately additional 80,000 hospital beds. Out of them, it should be in the form of 12,850 ICU units in low scenario and 29,650 units in high scenario. For the ventilators, we need additional 6,300 or 23,100 units in low or high scenario respectively. I do not know how many protective gears needed to treat 1.3 million COVID-19 cases—but I would imagine it'd be very substantial.

How much will it cost? I do not have any idea on how much building hospital and ICU beds as soon as possible will cost. But the cost of a unit of ventilator can go between USD 18,000[10] and USD 30,000[11]. Just multiply the numbers with the number of ventilators needed above.

Beside upgrading the health system capacity, there is also direct cost of treating COVID-19 patients. I do not know the unit cost of specifically treating a COVID-19 cases. But to illustrate, the unit cost for the hospitalization of a simple pneumonia and severe whooping cough case in a 3rd classroom of type A government hospital is IDR 12,276,800[12] (Kementerian Kesehatan Republik Indonesia, 2016). For a severe case that needs long-term mechanical ventilation without tracheostomy, the cost is IDR 92,025,200. Think about this number while knowing that the predicted accumulative number of cases under large-scale social distancing policy is as high as 1.2 million COVID-19 hospitalized cases.

Do we have the money? The Ministry of Finance has allocated IDR 75 trillion for upgrading the health system capacity and this significantly reduces the financial constraints in dealing with upsurging COVID-19 cases. The problem is: I do not see a good plan from the Ministry of Health to disburse the money effectively.

Last, I have just shown you my (back-of-the-envelopes) numbers. I do hope that the government or anyone who has better knowledge on the matter also show their numbers—so that, hopefully, we can have a more thorough evidence-based policies to save lives.

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[10] Based on failed US government's USD 1.5 billion proposal to buy ventilators from the General Motors https://www.nytimes.com/2020/03/26/us/politics/coronavirus-ventilators-trump.html

[11] http://news.mit.edu/2020/ventilator-covid-deployment-open-source-low-cost-0326. You can also check multiple company websites such as https://hcpresources.medtronic.com/blog/ high-acuity-ventilator-cost-guide

[12] Kementerian Kesehatan Republik Indonesia (2016): "Peraturan Menteri Kesehatan Republik Indonesia Nomor 64 Tahun 2016 tentang Perubahan Atas Peraturan Menteri Kesehatan Nomor 52 tahun 2016 tentang Standar Tarif Pelayanan Kesehatan dalam Penyelenggaraan Program Jaminan Kesehatan," http://hukor.kemkes.go.id/uploads/produk_hukum/PMK_No._64_ttg_Standar_Tarif_Pelayanan_Kesehatan_Dalam_Penyelenggaraan_Program_Jaminan_Kesehatan_.pdf.