Arndt-Corden Department of Economics

Crawford School of Public Policy

ANU College of Asia and the Pacific

Problems with recording the spread of COVID-19 in developing countries Evidence from a phone survey in Indonesia

Budy P. Resosudarmo[1], Rus'an Nasrudin[2], Pyan A. Muchtar[3],

Usep Nugraha[2,4], Anna Falentina[4]

[1] Arndt-Corden Department of Economics, Australian National University

[2] Faculty of Economics and Business, Universitas Indonesia

[3] Economic Research Institute for ASEAN and East Asia

[4] Statistics Indonesia

June 2022

Working Papers in Trade and Development

No. 2022/08

This Working Paper series provides a vehicle for preliminary circulation of research results in the fields of economic development and international trade. The series is intended to stimulate discussion and critical comment. Staff and visitors in any part of the Australian National University are encouraged to contribute. To facilitate prompt distribution, papers are screened, but not formally refereed.

Copies are available at https://acde.crawford.anu.edu.au/acde-research/working-papers-trade-and-development

Problems with recording the spread of COVID-19 in developing countries: Evidence from a phone survey in Indonesia

Budy P. Resosudarmo*, Rus'an Nasrudin,, Pyan A. Muchtar, Usep Nugraha, Anna Falentina

* Corresponding author

Abstract

During the COVID-19 pandemic governments in developing countries tended to underestimate the actual spread of the pandemic due to limited number of tests. To provide alternative to the government announced COVID-19 figures, many non-governmental agencies/individuals used various methods to gather data on the spread of the pandemic. One of the methods applied is phone survey approach of directly asking respondents whether they are infected and how the sickness impacts on their livelihood. This paper focuses on evaluating the reliability and usefulness of this approach by carefully conducting a phone survey on our own. The findings suggest that by developing a careful algorithm, a phone survey might be able to provide a better estimate than those announced by the government in developing countries where capabilities of conducting COVID-19 test are limited. Nevertheless, our findings also reveal that the reliability of a phone survey could be low when the response rate is too low.

Keywords: Indonesia, COVID-19 pandemic, phone survey, developing countries,

JEL code: I18, I15, C83, H12

1. INTRODUCTION

Not much attention was given when the Wuhan Municipal Health Commission in China identified a novel coronavirus in late December 2019 or even when the Chinese government closed down a wet market in Wuhan on 1 January 2020 due to potential disease outbreak. At that time, approximately 260 people were identified as infected in China. The infection was originally named 2019-nCoV and later became widely known as coronavirus disease 2019 or COVID-19. COVID-19 started to attract global attention when, at the end of January 2020, the World Health Organisation (WHO) announced that there were approximately 7,700 confirmed COVID-19 cases globally. Among them, approximately 170 people passed away, and the disease spread to 18 other countries. Since then, cases of COVID-19 spread rapidly around the world, severely impacting human health and the global economy. By end of April 2020, it was reported that approximately 3.1 million people were affected and approximately 217 thousand people had died because of the virus. By June 2020, almost no country had been left untouched, due to the severity of the virus and its ability to rapidly spread between humans. Since then, the world quickly realised that they were facing a major crisis (Baldwin & di Mauro, 2020).

Developed countries, which have better health facilities than developing countries, quickly developed testing, trace, and treat (3T) systems. The 3T system is an effort to detect the presence of the COVID-19 virus by conducting as many as possible COVID-19 tests within any communities, provide as soon as possible comprehensive treatment to patients diagnosed with positive COVID-19, and trace contacts, mostly using mobile applications, who have interacted with those patients. In such case, developed countries—i.e., several European countries and the United States of America (USA)—could at least accurately predict the magnitude of the pandemic and monitor the spread of the pandemic. Governments in those countries could, therefore, promptly and appropriately respond to the pandemic, e.g., by implementing a policy of restricting people mobility and social activities in areas with high confirmed COVID-19 cases.

On the other hand, most developing countries did not have the capabilities in implementing a solid 3T system. Most of them could not conduct the COVID-19 test as many as those in developed countries (Olivia, Gibson & Nasrudin, 2020). As a result, governments' announcements on the figures of COVID-19 cases have been underestimated and the actual size of the pandemic has become difficult to determine. This has led to inappropriate policy responses, such as no strict restriction on travelling or on gathering in crowded places (Resosudarmo et al., 2021).

At least in the first year of the pandemic, in many developing countries, solid prediction of the spread and magnitude of the pandemic was not available. The lack of clarity about the size of the COVID-19 pandemic can cause some further problems. First, this condition can cause public panic and conflicts (Mietzner, 2020). Second, fluctuations of the outbreaks could frequently happen, i.e., the cases of India's drastic increases of infection cases

on September 2020 and in May 2021, or of Thailand's increase of infection cases on August 2021.[1] Third, the pandemic may become endemic in several areas within developing countries due to the inability of those countries to locally eliminate the virus (Herrero and Madzokere, 2021).

To overcome the uncertainty of the actual spread and size of the COVID-19 in developing countries, many non-governmental agencies/individuals conducted various methods to gather data on the spread of the pandemic as alternative of government announced figures. Most of these methods expect that the actual numbers are much larger than those announced by their governments (Barro et al., 2021; Chandra, 2013; Resosudarmo & Irhamni, 2021). This paper aims to assess these data gathering and estimation methods conducted by non-governmental agencies/individuals to be able to quickly assess the spread and the magnitude of pandemic, with Indonesia as the case study. This paper deals with the question whether these alternative methods produce reliable quality of estimates and so could be an alternative estimate for government formal figures on the spread of COVID-19.

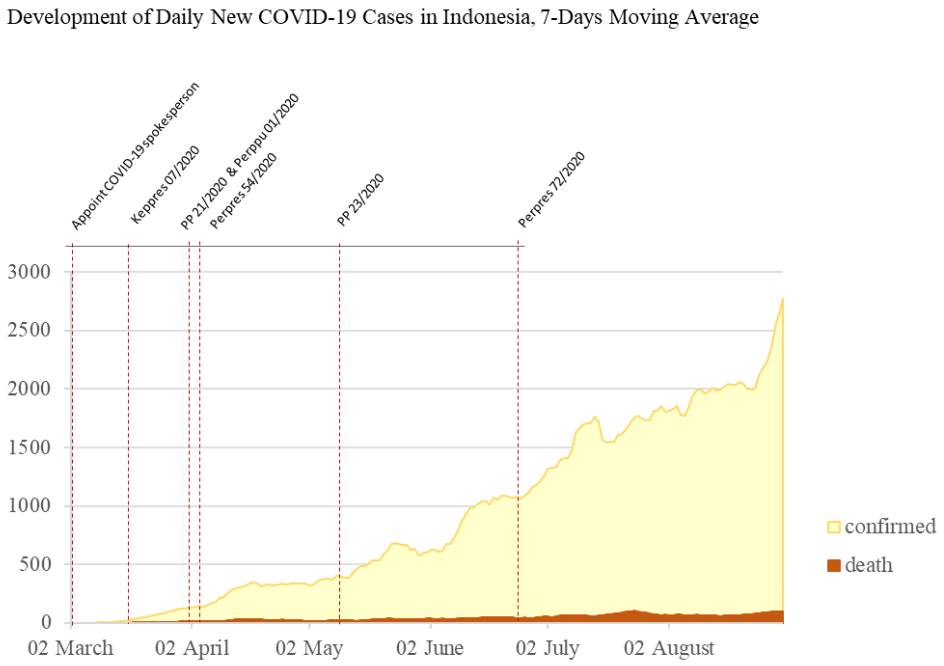
This paper evaluates the reliability and useful of a phone survey approach by carefully conducting rapid phone surveys in Jakarta and Yogyakarta on our own in the mid 2020. We evaluate the results of our phone survey to understand the quality of rapid data gathering and estimation method with phone survey approach in predicting the spread of COVID-19. We also compare our results with those based on other methods whenever possible. However, our conclusion will remain subjective. We admit that a phone survey is not a substitute for comprehensive COVID-19 testing for precisely estimating the spread of the pandemic in a given country/region.

Indonesia is used as the case study for the following reason. Indonesia is not that far from China and has a relatively strong economic connection with China. Large number of exchange business trips has happened daily between the two countries. Consequently, Indonesia is not an exception; rather, it seems highly susceptible to the spread of COVID. Although initial there was an optimism among Indonesians that COVID-19 would not spread out much in the country due to its tropical weather of the country, the Indonesian government reported the first COVID-19 case found in the country on 2 March 2020 (Kompas, 3 March 2020). Since then, more tests have been conducted; these tests initial have been mostly in Java and later throughout the country. Cases of COVID-19 infected detected has since then rapidly grown. Figure 1 shows the average 7 days new cases detected since the first case was announced by the Indonesian government till end of August 2020. As mentioned before, we argued that these numbers might be underestimate the actual spread of the pandemic. However, these numbers can illustrate how the pandemic has spread out throughout the country.

[1] WHO Coronavirus (COVID-19) Dashboard: https://covid19.who.int.

It is concerning that number of new cases detected has not been flattened at least till end of August 2020 and, although it cannot be seen in Figure 1, the spread of the cases has gone throughout the country. By 31 August 2020, there were at least approximately 174 thousand confirmed cases in the country. Observing what has happened in Indonesia will be an important lesson for other developing countries, particularly those in Southeast Asia.

Figure 1. Government's Report on the Spread of COVID-19 in 2020



Source: Our World in Data-University of Oxford.

Furthermore, Indonesia is the fourth most populous country in the world, after China, India and the USA. Hence, what has happened in Indonesia matters for a not insubstantial portion of the world's population. Important to note as well is that other populous countries are continental countries, while Indonesia is a large archipelago. Indonesian case in managing COVID-19 hence will be an interesting case to observe because it illustrates the global ability in managing the pandemic.

The next section reviews the uncertainty situation in Indonesia during the first semester and the Indonesian government's initial respond in managing the pandemic. This section is followed by a section reviewing several private attempts to estimate the actual spread of the virus in the country. We then describe our own phone survey to monitor the spread of the virus and the results of our estimates. This paper is then ended with a final remark.

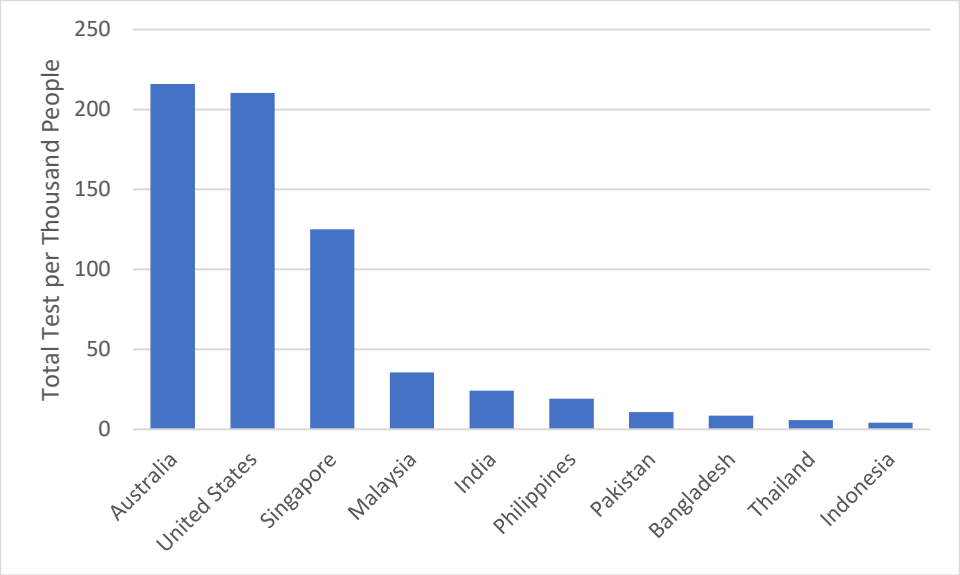
Our general conclusion would be that, although the reliability of a phone survey could be variable, a phone survey might be able to provide a better estimate than those announced by the government in developing countries where capabilities of conducting 3T system are limited.

2. INDONESIA DURING THE FIRST SEMESTER OF THE PANDEMIC

In the early period of the pandemic outbreak, there are two main questions related Indonesia's public health sector: (1) how effective Indonesia could implement public health policies to curb the spread of the pandemic, and (2) how prepared Indonesia's health sector in treating massive number of patients affected by COVID-19. On the public health sector, it was quickly realised that the country's ability to detect and to control the spread of the pandemic has been limited. The country was unable to quickly increase the number of testing and making the results quickly available, particularly off Java-Bali islands.

For example, the number of tests per 1,000 head of population in Indonesia by mid-August 2020 was only 2–3 per cent of those numbers in developed countries such as Australia and the United States. The number of tests per capita in Indonesia so far has also been smaller than those in India, the Philippines, Vietnam, or Thailand (Figure 2). This limitation to timely detect the COVID-19 cases created uncertainty on the actual spread of the virus. It seemed, however, the spread of the pandemic has been much larger than the situation formally announced by the government.

Figure 2. Number of COVID-19 Test in Several Countries by Mid-August 2020.



Source: Our World in Data-University of Oxford.

Strict restriction of human movements to avoid the spread of the pandemic seemed to be almost impossible, given a large proportion of the population's livelihood depends on their daily activities. Furthermore, in the early period of the outbreak, the Eid al-Fitr holiday was approaching, which most Indonesians have a tradition to return to their hometowns. This created more speculative predictions that there would be an explosion of COVID-19 cases in several areas of the country, particularly in Jakarta and some other areas in Java Island.

Ability of the country's health facilities to treat COVID-19 patients was also in question. Table 1 shows Indonesia's health sector facilities when the pandemic entered the country in 2019 in comparison with the situation in other countries. Despite the improvement of Indonesia's health infrastructure, the national number of health facilities per population had been low compared to advanced countries, such as Australia, United States, Japan, and EU countries. Indonesia's health facilities might be comparable with India and the Philippines, but below Thailand and Vietnam. Even in comparison with India and the Philippines, Indonesia is in a disadvantaged situation. Indonesia might have more hospital beds (health physical capital), but not medical workers (health human capitals) which could be more crucial in treating patients.

Important to note as well is that Indonesia is still struggling in managing several endemics such as tuberculosis, dengue fever and malaria infections. Furthermore, which might be true for some other developing countries, these health facilities are not equally distributed throughout Indonesia. The facilities, such as number of medical doctors, have been, in general, limited outside Java and Bali Islands. The overall condition of health facilities in Indonesia, hence, indicates that the country has limited ability to prevent the outbreak of COVID-19 pandemic.

Table 1. Health Facilities in Indonesia and in Other Countries.

Country	Nurses and midwives (Per 1,000 people)	Hospital beds (Per 1,000 people)	Physician (Per 1,000 people)
Australia	12.6	3.8	3.7
Indonesia	2.4	1.2	0.4
India	1.7	0.7	0.9
Latin America & Caribbean	5.1	2.2	2.3
Euro area	9.8	6.2	3.9
United States	14.5	2.9	2.6
Vietnam	1.4	2.6	0.8
Thailand	2.8	2.1	0.8
Philippines	4.9	1	0.6
Japan	12.2	13.4	2.4

Source: World Development Indicators (WDI), World Bank (2020).

Government responses to the pandemic have been, nevertheless, relative quick. Few days after the first confirmed cases were found, a new task force to manage the spread of the pan-demic was formed. The government also quickly enacted a regulation for large social distancing (31 March 2020). However, Indonesia has never strictly imposed the social distancing policy as well has never fully restricted movement of people within and across regions.

On 31 March 2020, the President signed the Government Regulation in Lieu of Law (*Peraturan Pemerintah Pangganti Undang-Undang* or Perppu) No. 1/2020 on State Financial Policy and Stability of Financial Systems in Mitigating the COVID-19 Pandemic and/or Other Threats to the National Economy and/or the Financial System Stability. The Law allows the government to have budget deficit for more than 3 percent from 2020 to 2022, to seek other revenues to fund this deficit, and to revise the 2020 national government budget to be able to provide better responses to the pan-demic.

On 3 April 2020, the President issued the Presidential Regulation (*Peraturan Presiden* or Perpres) No. 54/2020 to set up budget for COVID-19 public health and national economic recovery (PEN) programs. By signing Perpres No. 72/2020 on 24 June 2020, the government increased this budget allocation to be as high as IDR 695.20 trillion.

The general objectives of the COVID-19 public health and PEN program would be: (1) to control the spread of COVID-19 pandemic as well as providing better treatment for COVID-19 affected patients by, among others, providing supports to medical workers and COVID-19 patients; (2) to soften the impact of the pandemic on poor and vulnerable groups by providing social assistances and preserving jobs; and (3) to be able to implement countercyclical policies to reverse the economic downturn as well as increasing the resilience of the economy and providing foundations to jump start the economy when the pandemic is manageable by, among others, supporting enterprises, particularly micro, small and medium enterprises (MSMEs).

The COVID-19 and PEN programs consist of (1) public health program (IDR 87.55 trillion), (2) social assistance program (IDR 203.9 trillion), (3) sectoral and regional pro-gram (IDR 106.11 trillion), MSME incentive program (IDR 123.46 trillion), enterprise incentive program (IDR 120.61 trillion) and corporate financing program (IDR 53.57 trillion).

By mid-July, a total of IDR133.93 trillion (or approximately 19.3 per-cent of the total COVID-19 related program budget) has been disbursed. Given implementation period of many programs are for until September (or 6 months since April) this year, this rate of disbursement is slow.

Disbursement of funding for social assistance has reached approximately 38 percent. The social assistance programs also disbursed the most funding so far (IDR77.42 trillion). Most of the mechanisms to distribute this

fund are existing mechanisms such as PKH and Kartu Sembako. This is the main reason for being able to smoothly distribute the funding, in general.

By July 2020, approximately 19 million households participated in the Kartu Sembako. Approximately 10 million households among those Kartu Sembako holders also likely to also receive PKH packages, i.e., those having pregnant women, children aged 0-6 years old and school- aged children. For Bansos-Sembako in Greater Jakarta area, by mid-July, there have been approximately 1.8 million households receiving this pro-gram. For Bansos-Tunai in outside Greater Jakarta areas, approximately 8.7 million households have received this program from April until June this year. Implementation of electricity subsidy has also seemed to work well. More than 45 percent of the budget for the electricity subsidy has been spent as of mid-July 2020, which is on track as the remaining budget is for the allocation from July to September 2020.

The concern is the disbursement for the public health budget. Only approximately 7 percent of the budget (Olivia, Gibson, and Nasrudin, 2020) for this program (approximately IDR 6.32 trillion) has been disbursed by mid-July. More than 70 percent of the budget (IDR 65.8 trillion) is allocated to expenses for COVID-19 disease mitigation and prevention. Unfortunately, the budget process to allocate the funding to appropriate ministries has been slow. Only in July 2020 that Rp. 31.8 trillion have been included in the budget execution list (DIPA) of Ministry of Health (IDR 23.8 trillion) and Ministry of Defence (Rp. 8.1 trillion), which means that the budget is ready to be spent. Unlike the other sub-programs under health sector which have more specific disbursement mechanism and clear target of potential beneficiaries, the details on the activities for budget allocation for expenses for handling COVID-19 sub-program is yet to be updated and made publicly available. Without any comprehensive strategies on how to spend such health budget allocation, it is even more challenging to timely meet the needs of public health demand to address the existing COVID-19 cases and contain its spread. It may not necessarily mean that there is a decline in the abilities of the country's public health sector in managing a pandemic, since the regular public health budget should still be disbursed as usual. However, it does mean that the abilities of the public health sector in managing the pandemic may not be as high as expected.

The largest budget for the COVID-19 public health program is for COVID-19 disease mitigation and prevention, which mostly providing medical equipment (IDR 65.8 trillion). Budget disbursement for this activity has yet to happen. Using the budget allocated to them, the COVID-19 response acceleration task force, however, has been able to provide some COVID-19 medical equipment and distributed them throughout the country. The most recent figures reported that the task force has distributed the following medical equipment related to handling of COVID-19 patients; approximately 4.7 million Personal Protective Equipment (PPE) coveralls, 22 million surgical masks and 1.1 million rapid testing kits, throughout the country.

Budget disbursements for MSMEs incentive and enterprise incentive programs by mid-July has also been slow, i.e., approximately 24.4 percent (IDR 30.15 trillion) and 11.3 percent (IDR 13.64 trillion), respectively, from their total budget. As consequences, resilience of the country's MSMEs in facing the current pandemic im-pact might not improve as much as expected. Hence, it is particularly important to monitor the implementation progress of these programs.

Incentives to support enterprises by relaxing their tax obligations, in general, have been progressively implemented. For example, although the level of budget implementation for the income tax relief (PPh 21 DTP) programs by 15 July have only been ap-proximately 3 percent of its target, approximately 108 thousand enterprises have received benefits from this program. Majority of beneficiaries are small enterprises. Implementation of the programs to support enterprises by relaxing their credit obligation, meanwhile, has yet to be effective.

The fund disbursement through regional governments has been slow. Coordination with regional government typically takes time. Channelling funding through sectoral ministries should be much faster. Unfortunately, this is not the case so far. By mid-July, IDR 6.40 trillion of the sectoral and regional programs have been disbursed (6.03 percent of its total budget).

No budget for the corporate financing has been disbursed by mid-July. Slow implementation of corporate finance program is not that alarming. It needs careful preparation to ensure its effectiveness.

Given the inability of the Indonesian government in increasing the number of COVID-19 test, in quickly disburse budget to control the spread of the virus and the weak public health facilities, finding reliable estimate of the spread of the virus became urgent. This was the reason that several private agencies took their own initiative to do conduct various methods of data gathering and estimation to predict the spread of COVID-19 in the country.

3. PRIVATE INITIATIVES OF ESTIMATING THE SPREAD OF COVID-19

3.1. Digital COVID-19 Information Collection Platforms

The first method of quick data gathering implemented in Indonesia has been digital information collection platform. Since the beginning of the pandemic around March 2020, there have been voluntary initiatives by private agencies/citizens to collect reports from individuals or organisations on COVID-19 cases in their areas via digital platforms. The most prominent of these platforms are Kawal COVID-19 and Lapor COVID-19. These platforms gathered public attention as they successfully present decent and user-friendly visualization of COVID-19 related data and information. Their presence as a source of information was important during the early pandemic given the chaotic information flow among citizens, particularly in the online environment on the spread of COVID-19.

Lapor COVID-19 built a citizen reporting platform that works as a place to share information about incidents related to COVID-19 which are not covered by the government. The website uses a crowdsourcing approach that involves the participation of citizens in recording COVID-19 numbers, including death outside hospital and death during self-isolation. It also gathers and publishes citizens' report on COVID-19 issues, such as health protocol violation, stigma related to COVID-19, public services on COVID-19 case, and government social assistance program. Citizens can easily report these issues through WhatsApp and Telegram-based chatbots which are active 24/7. Lapor COVID-19 does not provide an estimate on the number of COVID-19 cases; it does, however, provide some indications on where COVID-19 has been spread-out. Figure 3 shows an example of a citizen's 'mapstory' report. It shows a case of a person tested positive but could not get any response from the COVID-19 hotline in Sukabumi, West Java. This type of report makes people aware that this formally uncounted case could happen in several places.

Figure 3. An Example of a Citizen's 'Mapstory' Report at the Lapor COVID-19

Translation:
28 April 2021
Hello, good afternoon. I hope this message reaches you. I am ****, a citizen of Sukabumi district. On 19th of April, I tested positive of COVID-19. I am in self-isolation and my company covers my medical needs. I tried to call the district COVID-19 hotline which I got from the government website (Pilkobar) but did not get any response. I have also registered myself on the website for a free swab test, but the schedule has not been provided. I am still waiting for any notification. …

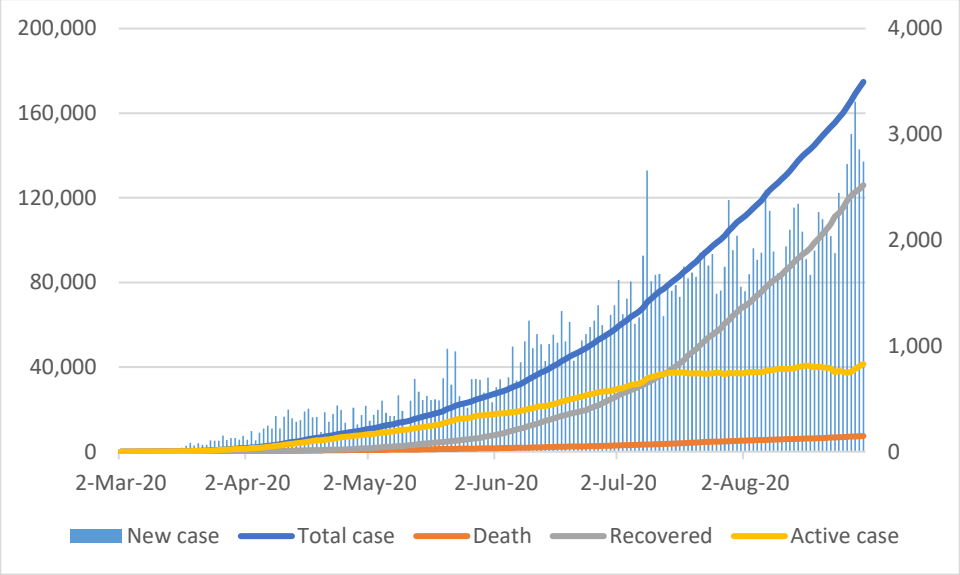
Source: Lapor COVID-19, retrieved from https://laporcovid19.org/data/mapstory

Kawal COVID-19 started as a web-based platform that serves as a source of information from Indonesian citizen volunteers, consisting of health practitioners, academics, and professionals. The site provides some real-time statistics, such as the number of active cases, death rate, and cure rate. It also educates people about health-

related information and guides them to fight against hoaxes. The data and information presented in the platform is an aggregation of various data taken from government sources, health NGOs, and the media that have been published, both in Indonesia and outside Indonesia.

On the cases of COVID-19, this platform mostly, however, recorded those who has been formally confirmed as COVID-19 patient. Hence, Kawal COVID-19 does not provide an alternative estimate of COVID-19 cases, which is supposed to include those who have not formally confirmed to be infected by COVID-19, but sick. Kawal COVID-19 reveals the latest formal counts faster than the government typically does. An example of information can be seen in Figure 4. It shows the total cases of COVID-19 infection, death and recovered by August 2020.

Figure 4. Cases of COVID-19 reported by the Kawal COVID-19



Note: The right axis is only for new case, others use the left axis

Source: KawalCOVID-19 database, retrieved from https://datastudio.google.com/u/0/reporting/fda876a7-3eb2-4080-92e8-679c93d6d1bd/page/3cjTB

There have been other digital COVID-19 information gathering platforms established in Indonesia collecting publicly available data and presenting them for a specific purpose. Among others are Kawalcorona.com specializing in collecting information at provincial levels, zicare.id specializing information in inpatient status, and Drone Emprit specializing in analysing COVID-19 sentiments in Twitter.

Despite providing convenient information, these platforms have not inclusively accessible for all citizens. Smartphones are widely available in Indonesia, but more than 50 percent of the population still have no access to this technology, particularly in the rural area (Falentina et al., 2021). Even for someone who has access, some

may still find it difficult to interact with a bot in Whatsapp/Telegram. There is no local land-based office where a citizen can report in person. Hence, the main issue with this technology in collecting information would be a selection bias issue; there are certain characteristics of individual who would participate in the system. The results from this method would be bias or reliable for covering some cases only (Solanki, Gopal, and Rath, 2020; Wu et al., 2020). They mostly cover data and information about cases in metropolitan areas, such as Jakarta, Surabaya, and Yogyakarta.

3.2. Online Survey Approach

One of the earliest household surveys conducted related to the COVID-19 in Indonesia is an on-line survey, i.e., making a list of questions available at a webpage and directing candidates for respondents to the website. Instead of phone survey, some organisations employ online survey approach. An example of this approach is an on-line survey conducted the J-PAL Southeast Asia using the Google Survey Platform to monitor the economic impact of the pandemic.[2] In this survey they utilise a convenient sampling—a type of non-probability sampling method where the sample is taken from a group of people easy to contact or to reach—among Gmail users in Indonesia.

The Statistics Indonesia took similar approach to understand people's behaviour during the pandemic and the implementation of health protocol (BPS, 2020). Based on information of their respondents in their previous surveys, Statistics Indonesia invited these respondents to visit the website containing their on-line survey. For the period of 7-14 September 2020, they can get approximately 90 thousand people filling out their on-line survey.

Online survey is the cheapest and the most convenient approach to collect data. The time span needed to complete the survey is much less than other traditional approach. It also allows for quick analysis and quick policy response. However, as the data collection lies on voluntary responses, the sample may not sufficiently represent the targeted population. Most online surveys do not use rigorously designed sampling weight. More importantly, it may suffer from low accountability and low accuracy (Solanki, Gopal, and Rath, 2020; Wu et al., 2020).

[2] See: https://www.povertyactionlab.org/blog/11-10-20/monitoring-social-impact-covid-19-pandemic-indonesia

3.3. Rapid Phone Survey Approach

Another approach available in Indonesia in providing alternative information on the spread of COVID-19 for government announcements is by conducting a rapid phone survey asking people whether they are sick or not. The choice of phone survey was due to the need to follow the protocol on conducting safe and fast data collection during the COVID-19 pandemic. A number of research organisations and academic institutions have shifted all of their field data collection to remote approaches, primarily rapid phone surveys. Phone surveys bear no risk of diseases infection spread which was the main reason it was used for data collection during Ebola crisis in West Africa (Etang and Himelein, 2020), and hence it suits the condition of COVID-19 pandemic.

Compared to field survey, rapid phone survey is cheaper as it does not require transportation and accommodation expenses[3]. Surveyors can conveniently move from one interview to another without traveling and thus save time. Phone surveys are often used in epidemiology research because it has some advantages, including large-scale accessibility, rapid data collection (especially with the integration of computer-assisted systems), quality control, anonymity, and flexibility (Safdar et.al., 2016). Furthermore, the centralised aspect of phone-based data collecting enables for quick identification and correction of errors, real-time interaction with primary researchers, and faster data entry (Dillon, 2012).

Nevertheless, phone surveys have some disadvantages, such as lack of visual materials, time constraints, wariness, and inattentiveness (Safdar et al., 2016). Sometimes telephone calls are perceived as telemarketing, spam, or even scam, causing potential respondents to respond negatively. It can also be challenging to design an effective interview because the questions need to be short and precise for easy comprehension. Ideally, a phone interview should be less than 30 minutes. Another major issue is that phone surveys are prone to considerable nonresponse, especially for mobile phone samples in panel survey (Fuchs, 2012). The list of potential respondents is frequently unreliable as many people change their phone number or they do not want to participate in another interviews. Other criticism on phone survey concern on its methodological implications of survey error design, such as coverage (Busse and Fuchs, 2012), sampling issues (Wolter, Smith and Blumberg, 2011) and measurement error (Vehovar, Berzelak, and Manfreda, 2010).

Several phone surveys are conducted in Indonesia on COVID-19-related topics, including older people's wellbeing (Komazawa et.al., 2020) on 3,430 respondents. The study found that along with the decline in economic conditions, the physical and mental health of some older people during the COVID-19 pandemic has deteriorated. The World Bank conducted 5 rounds phone-based survey over 4,000 households to track impact of COVID-19 on their welfare (Purnamasari and Sjahrir, 2020). One of the findings from the latest round (March

[3] The interview cost to obtain one respondent for in-person interview is approximately 10 to 30 USD in Indonesia, while phone interview cost is approximately 5 to 10 USD.

2021) is that while recovery in employment continued, the prevalence of food insecurity remains unchanged since July 2020. The World Bank also run another call survey to study gender-based violence during the pandemic (Halim et.al., 2021).

Lembaga Survey Indonesia (LSI) (2021) managed to collect over 1,200 respondents through phone interview which gathered information as follows. The majority, 66.5%, feel very/sufficiently aware about the COVID-19 and they feel that the virus is a threat to the economy. Around 40.5% of the respondents think that they are very/quite likely infected with the virus. The majority, 90.3%, know that the government has started vaccination program. Furthermore, the majority, 84.9%, strongly/agree with the COVID-19 vaccine program for the community. Although much information was collected, these surveys do not estimate the number of COVID-19 case and its spread.

Regarding the phone survey, the quality of information they gathered is questionable, as rejection rates have been exceedingly high (approximately 80-90%) and respondents tend to be not as serious, because they felt like being directly interviewed in responding to the questions. This paper is evaluating the effectiveness of the phone survey approach and compares the results with those from the econometric approach.

3.4. Econometric Cross-Country Approach

Several agencies are collecting global data on the number of tests, confirmed COVID-19 cases, deaths due to COVID-19, and other COVID-related measures in various countries in the world. Among the popular ones are those that have bee conducted by John Hopkin University Corona Virus Research Centre, Google Cloud's COVID-19 Public Dataset Program, and Our World in Data-University of Oxford. These global datasets are publicly available, allowing academics, NGOs, and government staff to use them for research purpose or policymaking.

If the estimation is properly conducted, this approach could also provide an alternative estimate on the cases of COVID-19 in a country. An example for this work is by Resosudarmo and Irhamni (2021) who use data provided by the Our World in Data-University of Oxford on numbers of tests and of detected cases for countries around the world. Controlling for country- and day-fixed effects, there appears to be a strong relationship between the number of tests and the number of cases detected. The details are as follows:

Using a daily observation data on total cases and tests in approximately 100 countries from 1 January to 24 August 2020, the following relation is estimated to reveal the true size of the pandemic:

$$ln(h_{i,d}) = \sigma . ln(t_{i,d}) + \theta_i + \theta_d + \varepsilon_{i,d}$$

where $h_{i,d}$ is total daily case in country i on day d, $t_{i,d}$ is the total daily test in country i on day d. These variables are specified in logarithm unit. θ_i is the country-fixed effect representing time-invariant characteristics of each country. θ_d is the day-fixed effect representing daily global condition during the observation. Parameter of interest is σ, which is the elastiCity of a person being infected per testing.

Table 2 shows the regression result. Models (1) and (2) are results for an ordinary least square (OLS) estimation method and models (3) and (4) are from a fixed effects method. Models 2 and 4 uses the number of total test-lagging 14 days. The models are preferred as there has been some lag between the COVID-19 test and the result in many countries at that time. Among models (2) and (4), model (4) is preferable since it strictly control time-invariant characteristics of each country and daily global condition during the observation. The model indicates that a one percent increase in the total number of tests on any given day increases the total number of confirmed COVID-19 cases by approximately 0.34 percent.

Utilising the model (4), Resosudarmo and Irhamni then estimated the cases of COVID-19 in Indonesia as follows. It was recorded that on 20 August 2020 in Indonesia, the total number of tests per thousand people was 4.1 tests and the total number of confirmed COVID-19 cases was about 145,000. If by that date the number of tests per thousand people in Indonesia was approximately 210 per thousand people instead, or about the same as those in the United States (210 tests) or United Kingdom (183 tests), it is estimated that the number of confirmed COVID-19 cases would be 560,000, approximately 4 times the actual confirmed cases.

The estimated number means that 0.2 of the population is infected. It is not an overestimation if compared to the United States and the United Kingdom, which were approximately 1.7 percent and 0.5 percent of their populations, respectively. The number of COVID-19 cases provided by Resosudarmo and Irhamni (2021), hence, could indicate the true spread of COVID-19 in Indonesia.

Table 2. Estimation Results

	OLS		Fixed effects	
	(1)	**(2)**	**(3)**	**(4)**
Total tests	0.908***		1.296***	
	(0.006)		(0.011)	
Total test-lagging 14 days		0.700***		0.343***
		(0.008)		(0.010)
With control variables	Yes	Yes	No	No
Date dummies	No	No	Yes	Yes
Country fixed effect	No	No	Yes	Yes
Observations	7,291	6,768	10,243	9,603
R-squared	0.882	0.824	0.890	0.688
# of country	55	59	83	104

Note: *** p < 0.01, ** p < 0.05, * p < 0.1. Numbers in the brackets are standard errors. Total tests are in million tests. Total cases are in thousand cases. Both total tests and cases are calculated based on their 7-day moving average numbers. Control variables are 2019 population, 2019 population density, 2019 portion of urban population, 2019 (PPP) current GDP per capita, 2017 diabetes prevalence, 2016 portion of smokers and 2017 physicians per thousand population.

Source: Resosudarmo and Irhamni (2021).

No systematic data, however, is available yet at subnational level. A collection of subnational case studies in Resosudarmo et al. (2021) indicate that the spreads of COVID across subnational levels in Indonesia vary a great deal. There are regions in Indonesia, such as some remote districts in the Papua Province where no COVID-19 case detected till end of August 2020. While the number of COVID-19 detected in Jakarta Province reached approximately 37 thousand by the end of August 2020.

4. OUR RAPID PHONE SURVEY

4.1. Survey Areas

We conducted a phone survey to analyse the potential size of COVID-19's spread in two Indonesia's major urban areas: Jakarta City and Yogyakarta Province. Jakarta is the capital City of the country and Yogyakarta is another large City in the centre of the Java Island. Table 3 provides general characteristics of Jakarta City and Yogyakarta Province. Although Yogyakarta Province covers a large area, but its population is much smaller than Jakarta City. Jakarta City has a much highly density population. Jakarta City is a much business-oriented place where living cost is among the highest in the country. Yogyakarta Province is a more student-oriented area where many schools have been established over there since the country became independent and living cost is among the lowest in the country. Social capital is expected to be stronger in Yogyakarta Province then that in Jakarta City.

By 9 November 2020, there have been approximately 113 thousand formally reported cases and formally reported casualties reached approximately 2.4 thousand in Jakarta City. Death rate due to COVID-19 has been approximately 2.1 percent in this City; lower than the national situation of 3.3 percent. The PCR (polymerase chain reaction) test rate in Jakarta has been much higher than that in other places, covering approximately 127.6 thousand tests per million persons, while the the rate is approximately 11.5 thousand for the national average.

In Yogyakarta, by 9 November 2020, there have been approximately 4.3 thousand formally reported cases and formally reported casualties reached approximately 105. Death rate due to COVID-19 has been approximately 2.5 percent in this Province, which is lower than the national situation. The PCR test rate in Yogyakarta Province has been much lower than Jakarta, but slightly higher than the national average.

Table 3. Characteristics of Jakarta City and Yogyakarta Province

2019	Indonesia	Jakarta City	Yogyakarta Province	Unit
Population	266.9	10.5	3.9	million persons
Population density	0.1	15.9	1.2	thousand persons/km^2
Land area	1,919.4	0.7	3.2	thousand km^2

Source: Statistics Indonesia.

4.2. Survey Implementation

A small team was established at the Faculty of Economics and Business, Universitas Indonesia, in April 2020 to implement our survey. The survey was performed from 1 May to 30 June 2020 in Jakarta City and from 14 June to 17 August 2020 in Yogyakarta Province. Our sampling frames originated from the sampling frame of the 2018 flood survey and the one of micro and small enterprises in the 2016 BPS Economics Census for the Jakarta region. As for Yogyakarta, the sampling frame used is only from the latter. These sampling frame also contains information on sample weights for each respondent constructed by the statistical agency of Indonesia (BPS), also known as Statistics Indonesia. We then randomly took as much as 4,600 and 3,600 respondents for Jakarta City and Yogyakarta Province, respectively as our sampling frames.

The 15 survey enumerators for the Jakarta region were mainly undergraduate students from Universitas Indonesia (UI) and Universitas Negeri Jakarta (UNJ). While the 15 survey enumerators for Yogyakarta region were mainly undergraduate students from Universitas Gadjah Mada (UGM). Prior to conducting the survey, enumerators attended training sessions to master the survey questionnaire, interview mechanisms as well as survey mobile application. The training was performed online through Zoom facilities.

We divided the questionnaire into nine sections. The first section aims to capture the characteristics of respondents with five items, including age, gender, size of household, and born in the City. The second section is the core section for measuring the potential size of the COVID-19 pandemic. It consists of seven question items, i.e., information about patients under surveillance, people under surveillance, and possible contracted household members. The third section seeks information about the impact of mental health during the pandemic, seen with the level of anxiety described in three simple questions. Sections four to seven contain social distancing behaviour, expenditure, food insecurity, and social assistance questions. Section eight, consisting of six questions, is the section that collects information on family members who died due to the pandemic. The last section aims to collect information on working status and characteristics before and after the pandemic occurred. In total, there were 40 questions that the respondents had to answer with an estimated 15-minute interview.

Computer-Assisted Personal Interviewing (CAPI) technology, the Survey Solutions developed by the World Bank, was used for the enumeration process. Together with the use of the telephone as a medium for conducting interviews, enumeration can be carried out cheaper and easier than in-person field surveys. Especially during the pandemic, this approach reduces the risk of infection because the enumerators do not need to meet directly with respondents. Phone surveys also have advantages in terms of the cost because they require lower costs than field surveys. On average, approximately USD15 per fully interviewed respondent. It covers the cost of the enumerator and the cost of respondent time and phone use. Another advantage of using telephone surveys is that there are almost no costs for respondents who fail to be interviewed.

Despite the convenience of phone surveys, this approach has a drawback of a low response rate. This is reflected in the small number of respondents who want to be interviewed compared to its target sample (Table 4). Out of 4,600 targeted samples in Jakarta City, only 342 received the call and agreed to be interviewed. 3,559 respondents could not be contacted, and 699 refused to be interviewed[4]. High rejection rates also occurred in Yogyakarta Province. The rates are about 67 percent and 51 percent in Jakarta and Yogyakarta, respectively[5]. The ultimate step in preparing our dataset is to create a frequency weight for our observations.

Table 4. Enumeration Results

	Jakarta City	**Yogyakarta Province**
Original list	4,600	3,600
Reasons		
Cannot be connected	3,559	2,794
Refused to be interviewed	699	409
Interviewed	342	397
Characteristics		
Percentage of female (%)	42.7 [32.4]	43.1 [43.5]
Average age (year)	45.8 [44.7]	46.1 [49.3]
Average size of Household (person)	4.6 [3.88]	4.3 [3.80]
Percentage of migrant household (%)	55.6 [54.8]	29.5 [23.7]

Source: Authors' own survey.

Note: The numbers in the brackets are the population weighted statistics from the National Socioeconomic Survey (SUSENAS) March 2020 of household members who work in self-employment activities.

The demography of our samples in both cities is quite comparable to the statistics obtained from the National Socioeconomic Survey (SUSENAS) 2020. See the numbers in the bracket in Table 4. The only minor differences are that our samples have a larger household size, a higher representation of females in Jakarta City and migrants in Yogyakarta Province. Moreover, respondent's characteristics interviewed in both Jakarta City and Yogyakarta

[4] The case is similar to Fuchs (2012)'s attrition issue in which he loses phone survey samples from 1,451 in 2009 to 208 in 2010.

[5] For comparison with other survey in Indonesia, the response rate in LSI (2021) study is 16.05% (1,200 respondents out of 7,477 target) and the response rate in Komazawa et.al. (2020) is 73.54% (2,574 respondents out of 3,500 target).

Province are similar. Judging from the percentage of female respondents, the average age of the respondents, and the average household size, the results are not much different between the two regions (Table 4). Regarding the characteristics, a vast difference between respondents in both regions is the percentage of migrant households, where the percentage of respondents from migrant households in Jakarta is 55.6 percent, whereas in Yogyakarta is only 29.5 percent. As with these characteristics, however, we do not know whether the respondents were successfully interviewed or not.

The last step of preparing our dataset is to adjust our sampling weight considering they could not be contacted and rejected to be interviewed.

5. TRACING COVID-19 CASES AND IMPACTS

5.1. Principle of the Heuristic Algorithm To estimate the potential number of COVID-19 cases, we use four questions related to 'being exposed to the COVID-19' or 'having symptoms of COVID-19 infected'. The first question (Q1) looks at the presence of confirmed COVID-19 patients in the respondent's family:

> *"Is there anyone, including yourself, in this house who is/was stated by a medical doctor as patient under surveillance (PDP) or a person stated by a medical doctor as 'very possible to be infected by the Coronavirus? If yes, how many of them?"*

The second question (Q2) sees people suspected of having COVID-19 in the respondent's family:

> *"Is there anyone, including yourself, in this house who is/was stated by a medical doctor as people under surveillance or a person stated by a medical doctor as 'possibly infected by the Coronavirus'? If yes, how many of them"*

Question three (Q3) identifies the emergence of COVID-19 symptoms in the respondent's family:

> *"Since March this year, is there anybody, including yourself, in this house who ever got illness with following symptoms: fever-high temperature or cough or breathing difficulties, but not being a patient under surveillance?" If yes, how many of you?*

Meanwhile, the last question (Q4) asked whether the respondent has possible contact with a COVID-19 patient:

> *"Have you, or anybody living in your house, ever in contact with a person stated by a medical doctor as infected by Coronavirus?"*

We differentiate respondent's status regarding COVID-19 infection into three, i.e., confirmed COVID-19, very possibly contracted COVID-19, and maybe contracted COVID-19 cases. The number of confirmed COVID-19 cases represents the accuracy of our phone survey in replicating government formal number of COVID-19 cases. Very

possible contracted COVID-19 and maybe contracted COVID-19 cases are our prediction on the true number of COVID-19 cases in Jakarta City and Yogyakarta Province.

A heuristic algorithm based on respondent's answers on question one until question four is developed to determine the number of confirmed COVID-19, very possible contracted COVID-19, and maybe contracted COVID-19 cases, as follows:

- Respondents are categorised into confirmed COVID-19 cases if their answer is "yes" to question one (Q1 = yes). We then calculate how family members are in this category.
- Respondents are categorised into possible COVID-19 cases (excluding those who are confirmed infected) if they meet the following three conditions. First, people under surveillance who met patient COVID-19 but not the patient, when respondents answered "yes" on questions two and four but answered "no" on question one (Q2 = yes and Q4 = yes but Q1 = no). Second, people under surveillance with COVID-19 symptoms but not a patient, when respondents answered "yes" on questions two and three but answered "no" on question one (Q2 = yes and Q3 = yes but Q1 = no). Third, people with COVID-19 symptoms who met patient COVID-19 but not the patient, when respondents answered "yes" on questions three and four but answered "no" on question one (Q3 = yes and Q4 = yes but Q1 = no). We then calculate how many family members are in each of the above categories.
- Furthermore, if the respondent answered "yes" on question two or question three but answered "no" on question one, he was categorised as maybe contracted COVID-19 cases (Q2 = yes or Q3 = yes but Q1 = no). We then calculate how many family members are in this situation.

The rules applied in the algorithm was developed based on several interviewed conducted with medical doctors at the Universitas Indonesia and at several health centres in Depok and Jakarta cities. We run this heuristic algorithm on our datasets from our phone surveys in Jakarta City and Yogyakarta Province. We use our sample weight when calculating each prediction of COVID-19 cases.

5.2. Estimated Cases of COVID-19 and Discussion

As announced by the Indonesian government by end of August 2020, the formal number of contracted COVID-19 cases in Jakarta City and Yogyakarta Province were that approximately 0.34 percent of Jakarta City's population and approximately 0.03 percent of Yogyakarta Province's population. Meanwhile, in large cities in developed countries the number of COVID-19 test announced was much larger than their population affected by COVID-19 by end of August 2020—i.e., 2.83 percent in New York City and 1.93 percent in Los Angeles (Our World in Data-University of Oxford). Information from these modern cities indicates that the number of COVID-19 infected cases announced by the Indonesian government might be lower than the actual number of COVID-19 cases in Jakarta City and Yogyakarta Province. The main reason for this is the small number of COVID-19 tests per population in the country.

Table 5 depicts the estimated results of COVID-19 cases in Jakarta City and Yogyakarta Province using our phone survey. In Jakarta, the results predict that 0.009 percent of the population were confirmed positive COVID-19, 0.5 percent were very possible contracted COVID-19 cases, and 18.5 percent maybe contracted COVID-19 cases by July 2020. In Yogyakarta Province, our results show that 0.2 percent of the population were predicted as confirmed COVID-19 cases, 0.5 percent of very possible contracted COVID-19 cases and 19.7 percent maybe contracted COVID-19 cases.

Table 5. Estimated Cases of COVID-19 (in %)

Type of COVID-19 Cases	Jakarta City	Yogyakarta Province
Confirmed to be contracted	0.009	0.233
Very possible contracted	0.498	0.536
Maybe contracted	18.508	19.679

Source: Authors' owned calculation.

Important to note that the consistency between the numbers of very possible contracted COVID-19 and maybe contracted COVID-19 cases in Jakarta City and Yogyakarta Province. By also considering the numbers in modern cities such as New York and Los Angeles, we can expect that the true size of COVID-19 cases in Jakarta City and Yogyakarta Province would be 0.5 percent of their population by July-August 2020 (about 6 months after the first case found). For Jakarta City, this prediction would be almost twice the number announced by the government; whereas for Yogyakarta Province, this prediction would be more than ten times the government's number.

On the other hand, our predictions on confirmed COVID-19 cases were not able to trace government's announced number of confirmed COVID-19 cases in both Jakarta City and Yogyakarta Province. Our number is too low in Jakarta City, but too high in Yogyakarta Province. These results indicate the low, but rather varied, quality of a phone survey. The first reason for this low but varied reliability of a phone survey is due to the large rejection and uncontactable cases. The second reason is that people is less likely to reveal their true condition if they were positive COVID-19. There has been negative social stigma on those infected (WHO, 2020).

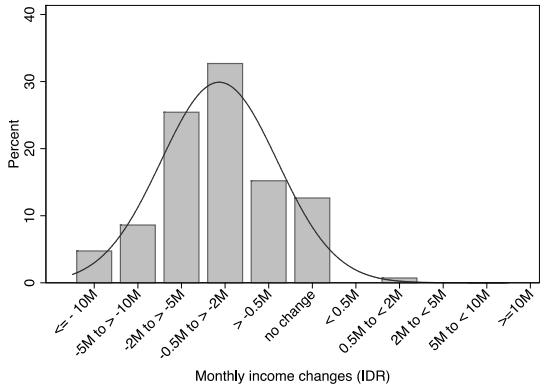
5.3. Impacts of the Pandemic

Aside from its reliability and its short length, phone surveys could gather some particularly useful information detecting consequences of COVID-19 pandemic on societies. In our phone survey we collected some of this information. First, our phone survey also tries to estimate the impact of income changes felt by households during the pandemic. We asked for changes in average income before and after the COVID-19 pandemic emerged. Households in Jakarta and Yogyakarta reported a decrease in income or no change in income. In both regions,

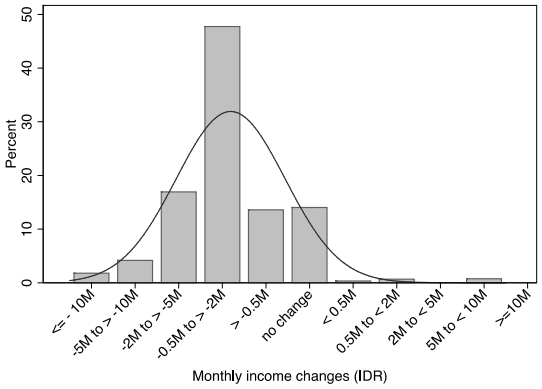
the median change in income experienced by households is an income decrease of 0.5 to 2 million rupiahs (Figure 5). Slightly a bit more than 10 percent of the population in both cities reported that their incomes do not change due to the pandemic and few of them claimed an increase of income.

Figure 5. Impacts of COVID-19 Pandemic on household income

Jakarta City



Yogyakarta Province



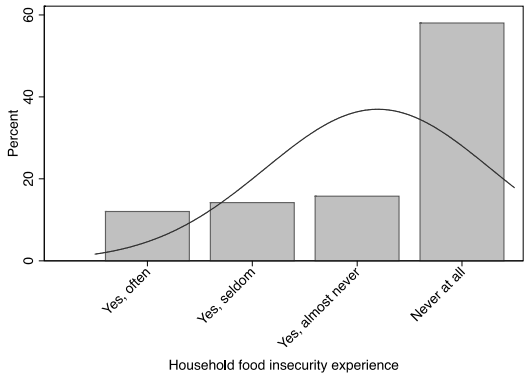
Source: Authors' own calculation.

Considering the average household incomes in Jakarta City and Yogyakarta Province, these changes in household income before and after the COVID-19 pandemic occurred seems to be reasonable. During the pandemic, Indonesian people tend to be more open when providing income reduction information but could be reluctant in providing precise information regarding COVID-19 infection.

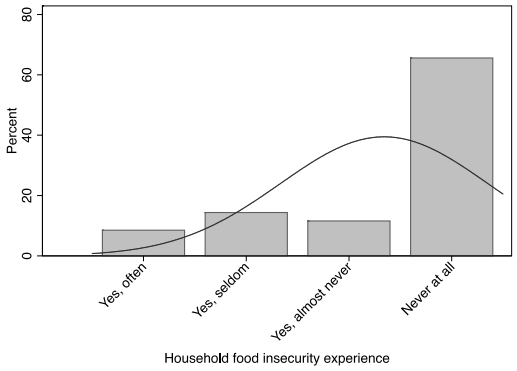
Second, it is interesting that our phone survey managed to collect information related to the food insecurity impact of the pandemic. We asked whether due to the pandemic respondents had to eat less than previous week before being interviewed. Our survey predicts that more than 40 percent of Jakarta City's population, in various degrees, had to eat less in the previous week before being interviewed due to the pandemic. The number is slightly lower in Yogyakarta (Figure 6).

Figure 6. Household Food Insecurity Experience

Jakarta City



Yogyakarta Province



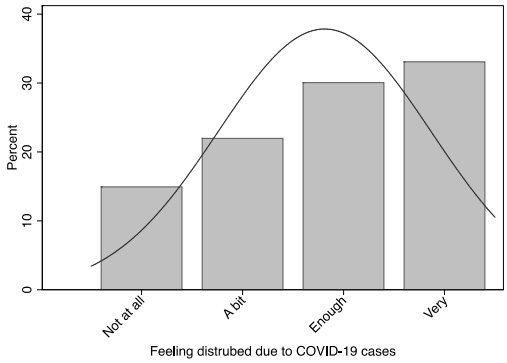
Source: Authors' owned calculation.

The results related to food insecurity experiences are consistent with the predictions of household income reduction. Hence, the information would be reliable and could indicate the severeness of the pandemic impacts on the society.

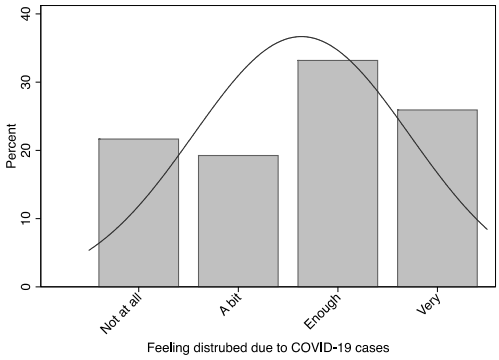
The third information collected by our phone survey is whether respondents feel disturbed due to the COVID-19 pandemic. Our results indicate that the majority of population in Jakarta City and Yogyakarta Province feel somewhat or very disturbed due to the pandemic. The concern is that the proportions of population that feel very disturbed by the pandemic were more than 30 percent in Jakarta City and more than 20 percent in Yogyakarta Province. If these numbers are reliable, this indicates the seriousness of mental health issues caused by the pandemic in those cities.

Figure 7. Feeling Disturbed due the COVID-19 Pandemic

Jakarta City



Yogyakarta Province



Source: Authors' owned calculation.

This information—which is related to the impacts of the pandemic on household incomes, food insecurity experience and feeling disturbed by the pandemic—is certainly useful for supporting countries' governments in developing policies softening the impact of pandemic on their population.

6. SENSITIVITY ANALSYSI ON THE ESTIMATED CASES OF COVID-19

To understand whether the results of our phone survey is robust, we conduct a sensitivity analysis toward the estimated cases of COVID-19 from this survey. The procedure in conducting the sensitivity analysis is as follows. First, we randomly take as many as 20 percent of the total observations in our data. Second, we add these randomly selected observations into our original data. Then, we compute the heuristic procedure in estimating cases of COVID-19 as mentioned in section 5.2. We iterate this process for five hundred times. The results are as can be seen in Table 6.

As shown in Table 6, the 95 percent confident intervals for all estimations—i.e., Confirmed COVID-19 cases, Very possible contracted COVID-19 cases, and Maybe contracted COVID-19 cases—are relatively narrow. This indicates that the estimates are robust.

Table 6. Estimated Cases of COVID-19 from Our Phone Survey (in %)

Type of COVID-19 Cases	Mean	[95% confident interval]	
Jakarta City			
Confirmed COVID-19 cases	0.009	0.008	0.009
Very possible contracted COVID-19 cases	0.492	0.478	0.506
Maybe contracted COVID-19 cases	18.498	18.463	18.534
Yogyakarta Province			
Confirmed COVID-19 cases	0.234	0.230	0.239
Very possible contracted COVID-19 cases	0.539	0.526	0.552
Maybe contracted COVID-19 cases	19.679	19.645	19.713

Source: Authors' own calculation.

7. CONCLUSION

Due to limited health facilities and fiscal capabilities, developing countries typically have serious issues managing an outbreak of a pandemic. In this case, the fundamental issue is their inability to conduct enough testings, let alone implementing proper tracing and treatment, as part of the proper 3T (testing, trace, and treat) system to control the pandemic. Government formal announcements about the spread of a pandemic would therefore be not accurate. While the econometric approach as conducted by Resosudarmo and Irhamni (2021) might provide a reliable estimate of the magnitude of the pandemic, systematic data at subnational level are not available.

Digital information collection through mobile phone applications and rapid phone survey seems two alternative methods in obtaining quick data on estimating the spread and magnitude of a pandemic in a developing country, where a robust public health testing, trace, and treatment system is not available. These two methods are inexpensive, mainly because there is no need for transportation and accommodation costs to obtain the information. However, the main issue with the digital information collection platforms is that participants providing information could be self-selected, resulting in bias or incomplete information. Samples or participants of a phone survey, on the other hand, theoretically could be purely random representing a defined population. Statistically a phone survey could be more reliable than a digital information collection platform. However, how reliable the results from a phone survey remains debatable.

By conducting our own phone survey in Jakarta City and Yogyakarta Province, this paper is observing a reliability and usefulness of a phone survey approach directly asking respondents whether they are infected or sick and the impacts of the pandemic on their livelihoods. The main results of our observation would be as follows.

First, on the issue of providing a better estimate on the magnitude of a pandemic, with developing a careful algorithm, a phone survey might be able to provide a better estimate than those announced by the government in developing countries where capabilities of conducting 3T system are limited. Furthermore, the estimate on the magnitude of a pandemic could also be relatively robust. For example, our phone survey reveals that the magnitude of the pandemic in Jakarta City and Yogyakarta Province could be as big as infecting 0.5 percent of their population by July-August 2020 (about six months after the first case found).

Second, the reliability of a phone survey in predicting the magnitude of a pandemic, however, could be low but varied. To resolve this issue, proper strategies to significantly reduce cases of rejection and uncontactable respondents and to ensure that respondents honestly reveal their situation related to be infected by COVID-19 should be implemented.

Third, phone surveys could be used to collect important relatively reliable information related to the impact of the pandemic on societies' livelihood. This information could be very useful to develop policies for softening the impact of the pandemic. Our phone survey indicates that median population in Jakarta City and Yogyakarta Province experienced a decline in their incomes by around 0.5 to 2 million rupiahs. More than 40 percent of Jakarta City's population, in various degrees, have ever to eat less last week, before being interviewed, due to the pandemic. The number is slightly lower in Yogyakarta. Finally, our phone survey discloses a possibility of mental health issue due to the pandemic among population in Jakarta City and Yogyakarta Province.

The overall conclusion of this paper is that private agencies/individuals should be encouraged to conduct proper phone surveys to provide alternative better information on the status of a pandemic and its livelihood impact. Furthermore, it is important to encourage these private agencies/individuals to make data they collected publicly available.

ACKNOWLEDGEMENT

The authors would like to acknowledge the supports from the Arndt-Corden Department of Economics at the Australian National University for providing some funding to conduct the phone survey and from the Statistics Indonesia for the list of phone numbers in Jakarta and Yogyakarta. We also would like to thank the two reviewers for their suggestions and comments. All mistakes are, nevertheless, the authors' responsibility.

REFERENCES

Badan Pusat Statistik (BPS) (2020). *Prilaku Masyarakat di Masa Pandemi COVID-19: Hasil Survey 7-14 September 2020*. Jakarta: BPS.

Baldwin, R., & di Mauro, B. W. (2020). Mitigating the COVID economic crisis: Act fast and do whatever it takes. *Centre for Economic Policy Research* (Issue July). https://voxeu.org/content/mitigating-covid-economic-crisis-act-fast-and-do-whatever-it-takes

Barro, R. J., Ursua, J. F., and Weng, J. (2021). The Coronavirus and the great influenza epidemic - Lessons from the "Spanish Flu" for the Coronavirus's potential effects on mortality and economic activity. CESifo Working Paper No. 8166. https://doi.org/10.2139/ssrn.3556305

Busse, B., and Fuchs, M. (2012). The components of landline telephone survey coverage bias. The relative importance of no-phone and mobile-only populations. *Quality & Quantity, 46*(4), 1209-1225.

Chandra, S. (2013). Mortality from the influenza pandemic of 1918-19 in Indonesia. *Population Studies*, *67*(2), 185–193. https://doi.org/10.1080/00324728.2012.754486

Dillon, B. (2012). Using mobile phones to collect panel data in developing countries. *Journal of International Development*, *24*(4), 518-527.

Falentina, A. T., Resosudarmo, B. P., Darmawan, D., and Sulistyaningrum, E. (2021). Digitalisation and the performance of micro and small enterprises in Yogyakarta, Indonesia. *Bulletin of Indonesian Economic Studies*, *57*(3), 343–369. https://doi.org/10.1080/00074918.2020.1803210

Fuchs, M. (2012). Nonresponse and panel attrition in a mobile phone panel survey. Paper presented at the Federal Committee on Statistical Methodology Research Conference in Washington, USA, 10-12 January. https://nces.ed.gov/FCSM/pdf/Fuchs_2012FCSM_III-B.pdf

Halim, D., Can, E. R., and Perova, E. (2020). What factors exacerbate and mitigate the risk of gender-based violence during COVID-19?: Insights from a phone survey in Indonesia. Washington, D.C.: World Bank. https://openknowledge.worldbank.org/bitstream/handle/10986/35007/What-Factors-Exacerbate-and-

Mitigate-the-Risk-of-Gender-Based-Violence-During-COVID-19-Insights-From-a-Phone-Survey-in-Indonesia.pdf?sequence=1&isAllowed=y

Herrero, L. and Madzokere, E. (2021). COVID will likely shift from pandemic to endemic – but what does that mean?, *The Convesation.Com*, 20 September.

Komazawa, O., Suriastini, N. W., Wijayanti, I. Y., & Maliki, K. D. (2021). *Older People and COVID-19 in Indonesia*. Jakarta: BAPPENAS. https://www.eria.org/research/older-people-and-covid-19-in-indonesia/

Kompas. (2020). Standing together against COVID-19. Kompas, 03 March 2020. https://www.kompas.id/baca/english/2020/03/03/standing-together-against-covid-19

Lembaga Survei Indonesia (LSI) (2021). Rilis hasil survei nasional: Sikap publik terhadap vaksin dan program vaksin pemerintah. Jakarta: LSI. https://www.lsi.or.id/post/rilis-survei-lsi-terkait-vaksin-18-juli-2021

Mietzner, M. (2020). Populist anti-scientism, religious polarisation, and institutionalised corruption: How Indonesia's democratic decline shaped its COVID-19 response. *Journal of Current Southeast Asian Affairs*, *39*(2), 227–249. https://doi.org/10.1177/1868103420935561

Olivia, S., Gibson, J., & Nasrudin, R. (2020). Indonesia in the Time of Covid-19. *Bulletin of Indonesian Economic Studies*, *56*(2), 143–174. https://doi.org/10.1080/00074918.2020.1798581

Purnamasari, R., & Sjahrir, B. S. (2020). High-frequency monitoring of socio-economic impact of COVID-19 on households in Indonesia. *ANU Indonesia Project Global Seminar Series*, Vol. 30. https://www.bps.go.id/publication/2021/08/02/29234b08faa4910dee5279af/perilaku-masyarakat-pada-masa-ppkm-darurat--hasil-survei-perilaku-masyarakat--pada-masa-pandemi-covid-19--periode-13

Resosudarmo, B. P., & Irhamni, M. (2021). Consequences of the COVID-19 pandemic on human capital development. B. Lewis and F. Witoelar (eds.), *Economic Dimensions of Covid-19 in Indonesia*, 170–189. https://doi.org/10.1355/9789814951463-013

Resosudarmo, B.P., Mulyaningsih, T., Priyarsono, D.S., Pratomo, D. and Yusuf, A. (Eds.) (2021). *Regional Perspectives of COVID-19 in Indonesia*. Bandung: IRSA Press.

Safdar, N., Abbo, L. M., Knobloch, M. J., & Seo, S. K. (2016). Research methods in healthcare epidemiology: survey and qualitative research. *Infection Control & Hospital Epidemiology*, *37*(11), 1272-1277.

Solanki, H.K., Gopal, P.G., & Rath, R.S. (2020). Common pitfalls in using online platforms for data collection in COVID times and its implications. *Nepal Journal of Epidemiology*, 10(4); 930-932. https://doi.org/10.3126/nje.v10i4.31614

Vehovar, V., Berzelak, N., & Manfreda, K. L. (2010). Mobile phones in an environment of competing survey

modes: Applying metric for evaluation of costs and errors. *Social Science Computer Review, 28*(3), 303-318.

WHO. (2020). Social stigma associated with COVID-19: A guide to preventing and addressing (Issue February). https://www.who.int/docs/default-source/coronaviruse/covid19-stigma-guide.pdf

Wolter, K. M., Smith, P., & Blumberg, S. J. (2010). Statistical foundations of cell-phone surveys. *Survey Methodology, 36*(2), 203-215.

Wu, J., Wang, J., Nicholas, S., Maitland, E., and Fan, Q. (2020). Application of big data technology for COVID-19 prevention and control in China: Lessons and recommendations. *Journal of Medical Internet Research*, 22(10), e21980. https://doi.org/10.2196/21980