COVID-19 Forecasts in the Philippines: Insights for Policy Making (Updated as of April 22, 2020)

COVID-19 Forecasts in the Philippines: Insights for Policy Making
Updated to include DOH data up to April 22, 2020, for all provinces in Luzon, Cebu and Davao Del Sur

Guido David, Ph.D.
Professor, Institute of Mathematics
University of the Philippines
Fellow, OCTA Research (www.octaresearch.com)

Ranjit Singh Rye, MPA
Assistant Professor, Department of Political Science
University of the Philippines
Fellow, OCTA Research (www.octaresearch.com)

Ma Patricia Agbulos, MBM
Associate, OCTA Research (www.octaresearch.com)

BACKGROUND

As the country prepares to examine the effects of the Enhanced Community Quarantine (ECQ) and to decide on whether to extend it, modify it or to end it, it is imperative to examine the data thus far and the emerging patterns before major decisions are made.

More than one month since the implementation of the ECQ, it can be stated that the ECQ is a success. The transmission rates of Covid-19 have gone down for most provinces in Metro Manila. The measured transmission rates have gone down in NCR such that the most recent 7-day average of the reproduction number R, which measures the potential of the pandemic to spread, has fallen below 1 as of April 22, 2020. This means that the curve is close to flattening and the pandemic may soon die out. A plot of R and the 7-day moving average are shown in Figure 1. The success of the ECQ is largely due to the efforts of legislators and health care workers. However, care should be taken to avoid complacency, for the following reasons:

1. A mathematical model is just a model and is at best an approximation of reality. Models should always corroborate observed data. This means that we should monitor the pandemic ever more closely to make sure the model predictions are being met.

2. The lack of testing means there might be asymptomatic and mildly symptomatic cases. Based on studies in China and South Korea, the percentage of asymptomatic cases could be as high as 30%. This means that in the Philippines, there may be as many as 2,800 asymptomatic cases. Increased mass testing and tracking will help identify any asymptomatic

cases.

3. The lag in reporting and identification of cases has a significant effect on the model. For example, delays in reporting cases may cause the transmission rate to artificially decrease over the short term, when it would actually have been much higher had there been no delay. The measured transmission rates assume accuracy and honesty of data, and any deviations in the data structure may cause calculations and forecasts in the model to change dramatically.

4. The disruption caused by lifting ECQ prematurely before the pandemic has been controlled with certainty could be catastrophic. For example, in the province of Cebu, the value of R had already fallen below 1 between April 4 and 9. This indicated the curve was already flattening. However, a resurgence of cases from April 15 has put the province back in a high alert level. The most recent 7-day average value of R has risen to 5.90. The pandemic is far from over in the province. Possible explanations for this include a possible asymptomatic carrier, or unreported patient, spread Covid-19. It could take just one spreader to cause resurgence in the pandemic. This is why mass testing to identify asymptomatic cases, and tracking of Covid-19 cases are critical in this battle.
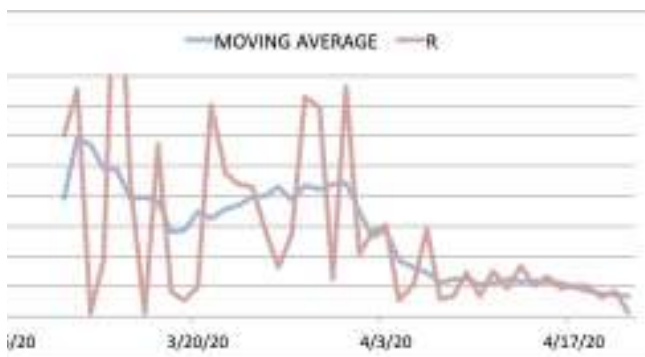

Figure 1. *Estimated (blue) and 7-day moving average (red) of the basic reproduction number for NCR. The reproduction number is proportional to the rate of transmission. The assumed recovery time is 14 days. If R falls below 1, then the pandemic will die out and the curve will flatten. However, data and evidence must first corroborate the theoretical flattening of the curve before ECQ is lifted. This means continued monitoring and implementation of pandemic protocols including testing and tracking.*

FORECASTS FOR NCR

All data is obtained from DOH (Department of Health). Figure 2 shows the forecasts for the total number of cases in NCR assuming a continuation of the ECQ and ending the ECQ. In the continuation of ECQ, we used the most recent 7-day average of $R = 0.86$. For ending the ECQ, it is not straightforward to make assumptions on the effects of the policy on the underlying factors in the model. Without ECQ completely, the value of R in NCR was very high, in the range of the value in Cebu currently of 5.90. Even with a modified ECQ, it is not clear how the factors will play out. For this forecast, we assumed a value of $R = 2.21$, which is within the range of R obtained by other studies (usually between 1.5 and 4.0). With ECQ, Figure 2 shows that the total number of Covid-19 cases will not reach 10,000 by May 31, 2020. Without ECQ and with the assumed value of R, the forecast is 80,000 Covid-19 cases by the end of May. As is always the case, mass testing and tracking of Covid-19 cases will reduce the transmission in both scenarios even further.

Figure 3 shows the death forecast under these two scenarios. Under the continued implementation of ECQ, the forecasted number of deaths in NCR is 650, and without ECQ (or a relaxed form of ECQ), the forecast is 3,800 deaths. Again, the forecast without ECQ is highly dependent on numerous factors that cannot be taken into account in a mathematical model. It is very possible to have more than 3,800 deaths in this scenario. What is shown is just one hypothetical scenario that assumes the transmission rates will go up due to relaxing of the ECQ. It is also worth repeating that in Cebu, there was resurgence even with the ECQ, and the transmissions measured there were even higher than assumed in the forecast scenario.
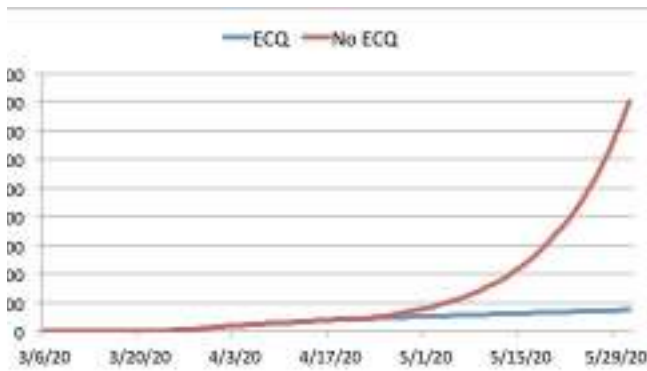

Figure 2. *Forecast of total number of Covid-19 cases in NCR by May 31, 2020 under continued implementation of ECQ (blue line) and no ECQ (i.e. a hypothetical relaxed ECQ).*
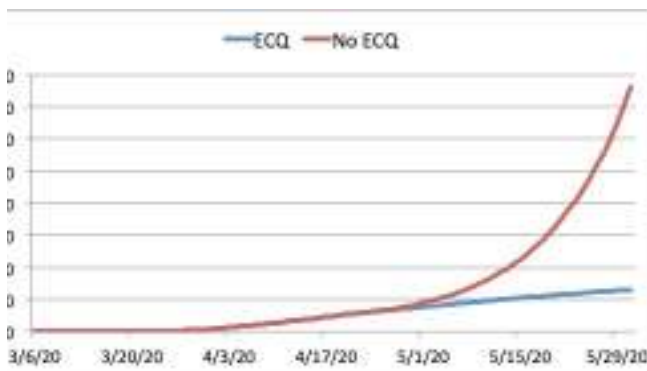

Figure 3. *Forecast of total number of deaths due to Covid-19 in NCR by May 31, 2020 under continued implementation of ECQ (blue line) and no ECQ (i.e. a hypothetical relaxed ECQ).*

Based on these scenarios, lifting the ECQ prematurely may cause a resurgence of 70,000 additional cases of Covid-19 and an additional 3100 deaths.

ASYMPTOMATIC, MILDLY SYMPTOMATIC CASES

A plot of the distribution of Covid-19 cases, based on DOH data, is shown in Figure 4. This is compared with the demographic distribution by population. Note that there is a higher proportion of cases for those ages above 65, which is just 4% of the population but represents more than 20% of known Covid-19 cases in the Philippines. On the other hand, only 8% of Covid-19 cases are between ages 0 to 24, while that group represents 50% of the population. Such trends are also observed in the data from other countries. Are older people more susceptible to being infected?
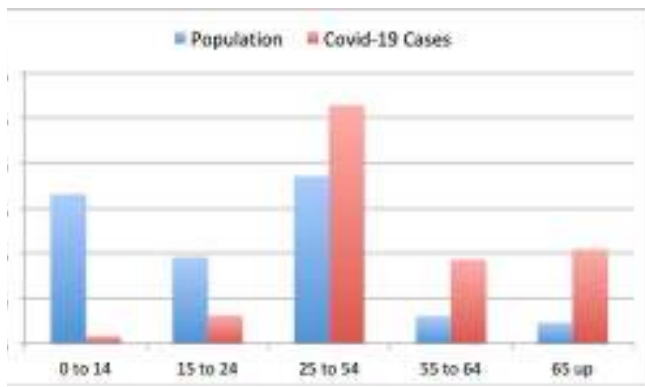
Figure 4. *Demographic distribution by age in the Philippines (as of 2018) vs. distribution of Covid-19 cases in the Philippines. Note that only 4% of people in the Philippines are age 65 and above, but 20% of Covid-19 patients are in that group. On the other hand, more than 50% of the population is from 0 to 24 years of age, but they represent only 8% of Covid-19 cases in the Philippines. This discrepancy suggests there is potentially some number of Covid-19 cases that are asymptomatic, mildly symptomatic, or unreported. Based on data from South Korea, the number of asymptomatic cases may be around 30%. This means there could be as many as 9,000 people carrying the SARS-COV2 virus in the Philippines as of April 19, 2020 (versus the actual number of 6,459). Mass testing and tracking of known cases will help give a better estimate of the total number of Covid-19 cases in the Philippines, and mass testing will help identify these silent spreaders.*

There is no evidence to suggest that infection rates are higher with age. On the other hand, data from other countries suggest a percentage of the cases carry SARS-Cov2 virus but are either asymptomatic (i.e. showing no symptoms of Covid-19, such as fever or dry cough) or mildly symptomatic (i.e. showing no major symptoms such as fever or dry cough, but may be showing lesser symptoms such as lack of taste). This is more prevalent for those in the younger age group who are healthier and do not have health issues. This then suggests that the number of Covid-19 cases in the Philippines is much higher, due not only to under-reporting, but also to asymptomatic and mildly symptomatic cases. A rough estimate of the number of true Covid-19 cases in the Philippines based on percentages of asymptomatic cases is 9,000. Mass testing and tracking of cases will help give a more accurate value for the number of Covid-19 cases, and to identify these silent spreaders. The success of mass testing and tracking was demonstrated in South Korea, which has been able to control the spread of the pandemic.

Figure 5 shows the mortality rate for each age demographic, based on DOH data. The numbers show a pattern of increasing mortality rate with age. Similar patterns have been shown in data of Covid-19 cases in China and USA.
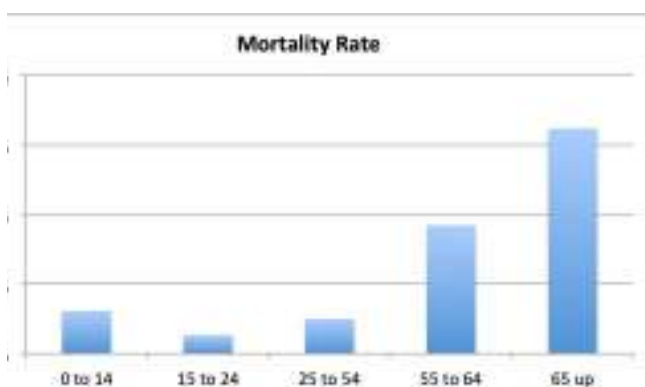
Figure 5. Mortality rates of Covid-19 patients according to age group based on Philippine data (c/o DOH).

ANALYSIS OF TRENDS IN LUZON

For the other provinces, we look at the trends in transmission rates to make a case-by-case study. The indicators considered in assessing the nature of pandemic in the province are: the current number of active cases, the number of new cases, deaths (shown only for illustration), and the value of R, to indicate the level of the pandemic in the province.

Notes: The number of active cases is not very reliable because there is also a delay in reporting recoveries, due to lack of testing equipment. The number of new cases is over the previous 7 days, because most symptoms of Covid-19 appear within that period. If the value of R is less than 1 over the previous week, then we say that the "pandemic has been contained." If the average R value is less than 1 but there were daily values above 1 during the previous week, we say that the "pandemic is close to being contained." If there are no new cases, this is the best indicator of all. Note that we did not include provinces with no known Covid-19 cases.

Table 1 shows the indicators for Calabarzon and NCR. The pandemic is still spreading in Cavite, Laguna and Quezon. In NCR, Batangas and Rizal, indicators are positive. However, this trend has to continue for at least 2 weeks to make sure there is no resurgence. It is advised that ECQ be continued in all these areas.

Table 2 shows the indicators for Central Luzon. The pandemic is still spreading in Bulacan, Pampanga and Zambales. In Bataan and Tarlac, indicators are positive. The pandemic appears to be contained in Nueva Ecija. However, this trend has to continue for at least 2 weeks to make sure there is no resurgence. It is advised that ECQ be continued in all these areas.

Table 1. Pandemic indicators for NCR and Calabarzon. The indicators are positive in NCR, Batangas and Rizal. Further monitoring is needed and a continuation of ECQ is advised, especially in Cavite, Laguna and Quezon.

Province	Active Cases	New Cases	Died	R	Comments
	55	10	12	0.84	Pandemic is close to being contained
	182	44	23	1.18	Pandemic is still spreading
	264	77	6	1.41	Pandemic is still spreading
	3505	672	277	0.96	Pandemic is close to being contained
	58	16	4	2.01	Pandemic is still spreading
	265	34	24	0.89	Pandemic is close to being contained

Table 2. Pandemic indicators for Central Luzon. The indicators are very good in Nueva Ecija, and positive in Bataan and Tarlac. Further monitoring is needed and a continuation of ECQ is advised, especially in Bulacan, Pampanga and Zambales.

Province	Active Cases	New Cases	Died	R	Comments
	69	41	2	1.24	Pandemic is close to being contained
	81	13	5	1.18	Pandemic is still spreading
	46	2	0	0.63	Pandemic is contained
	48	7	7	1.20	Pandemic is still spreading
	27	4	1	1.34	Pandemic is close to being contained
	22	6	2	1.62	Pandemic is still spreading

Table 3 shows the indicators for Ilocos, Cagayan and Cordillera Administrative Regions. There are no new cases in Abra, Cagayan, Ilocos Norte, Ilocos Sur, Isabela and Nueva Vizcaya. The ECQ may be lifted in those areas provided they comply with the other benchmarks in our recommendation. In Benguet, La Union and Pangasinan, the indicators are positive. However, this trend has to continue for at least 2 weeks to make sure there is no resurgence. It is advised that ECQ be continued in all these areas.

Table 3. Indicators for Ilocos, Cagayan Valley and Cordillera Administrative Regions. The pandemic may so be absent in Abra, Cagayan, Ilocos Norte, Ilocos Sur, Isabela and Nueva Vizcaya. Indicators are live in Benguet, La Union and Pangasinan, but further monitoring is needed and a continuation of ECQ is advised.

Place	Active Cases	New Cases*	Died	R	Comments
a	0	0	0		No new cases
guel	6	2	1	0.54	Pandemic is contained
ya m	4	0	0		No new cases
as Norte	1	0	0		No new cases
os Sur	1	0	0		No new cases
ula	4	0	0		No new cases
Union	12	2	3	0.46	Pandemic is contained
eva Vizcaya	1	0	1		No new cases
asinan	26	1	2	0.58	Pandemic is contained

Table 4 shows the indicators for Mimaropa and Bicol Regions. There are no new cases in Camarines Sur, Occidental Mindoro, Oriental Mindoro, Marinduque, Palawan and Romblon. The ECQ may be lifted in those areas provided they comply with the other benchmarks in our recommendation. In Catanduanes, there is only one new case: further monitoring is required. It is advised that ECQ be continued in Albay.

Table 4. MIMAROPA and Bicol regions. The pandemic seems to be absent in Camarines Sur, Occidental Mindoro, Oriental Mindoro, Marinduque, Palawan and Romblon. Catanduanes is also close to containing the pandemic with only one new case. Further monitoring is needed and a continuation of ECQ is advised in Albay.

Place	Active Cases	New Cases*	Died	R	Comments
ay	12	5	1	1.23	Pandemic is still spreading
arines Sur	5	0	1		No new cases
anduanes	2	1	0		Very low number of cases
ndoro Occ.	1	0	1		No new cases
ndoro Or.	4	0	2		No new cases
induque	0	0	0		No new cases
awan	1	0	1		No new cases
mblon	1	0	1		No new cases

Table 5 shows the indicators in two major provinces outside Luzon: Cebu and Davao Del Sur. In Davao Del Sur, the pandemic is still spreading but the transmission rates have gone down. In Cebu, the recent resurgence has caused the pandemic to rebound. ECQ is necessary in Cebu.

Table 5. Indicators in Cebu and Davao Del Sur. The resurgence in Cebu means that ECQ must be implement strictly. In Davao Del Sur, further monitoring is needed and a continuation of ECQ is advised.

Province	Active Cases	New Cases*	Died	R	Comments
Cebu	116	102	6	5.09	Pandemic is spreading. Attention Needed
Davao Del Sur	54	15	16	1.35	Pandemic is still spreading

SUMMARY RECOMMENDATIONS

Based on data available, **the Enhanced Community Quarantine (ECQ) is effective in reducing the rate of transmission of Covid-19**. In NCR, the reproduction number based on the recent 7-day moving average is below 1 as of April 22, 2020. This indicates that the curve is flattening.

The ECQ is indeed working but the gains are not irreversible. **Ending the ECQ prematurely may disrupt the flattening of the curve.** There are possible rebound effects and increase in transmissions. Since the curve is close to flattening, it is advisable to wait until the curve has flattened before the ECQ is lifted. **A forecast of the pandemic without the current ECQ in place shows a surge in total number of cases from 10,000 (projected with ECQ) to 80,000, and a surge in deaths from 650 (projected with ECQ) to 3,800 by May 31, 2020.** A mathematical forecast will depend heavily on numerous factors, and this is just one possible scenario shown by the effects of prematurely lifting the ECQ.

The higher number of cases for older patients, and low number of cases for those below 25 years of age, indicate an unknown number of asymptomatic and mildly symptomatic cases. A rough estimate of the total number of cases including asymptomatic cases is 9,000 (versus the

current 6,459 reported and known cases). Asymptomatic cases, if not diagnosed, may still interact with the general population and potentially spread Covid-19. There is the danger that asymptomatic cases may act as super spreaders of Covid-19. **Mass randomized testing and contact tracing will help determine the actual number of cases, including asymptomatic and mildly symptomatic cases, and will help control the spread of Covid-19 by identifying and tracking the silent spreaders of the disease.**

Given these scenarios, we recommend the following:

1. That the national government (NG) **consider extending the enhance community quarantine beyond April 30, 2020**. As shown above there had been gains due to the ECQ. The goal is to sustain these gains until such time that the NG has scaled up and rolled out its programs and its initiatives for mass testing, contact tracing and isolation of infective individuals. We wish to emphasize that we are faced with a choice not between the economy or public health (lives vs livelihood) but between a less or more costly disruption among ordinary Filipinos. Based on our data, if we lift the ECQ prematurely,we may be faced with another wave or a surge in transmission that is certain to squander our gains forcing us to make further costly interventions and increasing the total economic cost and the number of lives lost. **One possible scenario caused by lifting the ECQ prematurely shows a surge in deaths from 650 to 3,800 and in the number of Covid-19 cases from 10,000 to 80,000 by May 31, 2020**.

The proposal of extending the ECQ will ensure that the fundamentals are firmly in place providing the government a secure basis upon which to modify the ECQ in the near term.

2. The NG may also consider relaxing the quarantine rules in provinces or regions outside the NCR based on clear parameters. We suggest the following parameters as guide to decision making. A province (including the highly urbanized city located herein) should decide to relax quarantine measures if it has achieved the following:

a. Access to mass testing facilities with enough capacity and reasonable turnaround time to test all probable and suspected cases, the number of which is determined by provincial data.

b. An effective and efficient contact tracing system to identify people exposed to those who were confirmed as positive based on the mass testing done, especially those who are asymptomatic. These people should be quarantined to reduce the risk of spreading the virus if they are infected.

c. As estimated by models at the provincial level, adequate number of hospital beds, ventilators, health workers, personal protective equipment, and quarantine facilities to accommodate Covid-19 patients should there be a surge of cases given the relaxation of quarantine.

d. A declining trend of new cases for a period of two weeks even with mass testing. It takes a maximum two weeks for the symptoms to manifest.

Given these parameters, provinces are encouraged not to lift the EQC until such time that these are met. Admittedly, there are areas in the country that the virus was not able to reach due to the timely intervention of imposing community quarantine in Luzon. These provinces may resume economic activity provided that they will continue to restrict the flow of people in and out of its jurisdiction and provisions for letters a, b, and c are met. It only takes one infective

person to start an outbreak.

Based on our study, the following provinces would be candidates for a modification of the ECQ, subject to compliance with the above benchmarks: Ilocos Norte, Ilocos Sur, Abra, Cagayan, Isabela, Nueva Vizcaya, Camarines Sur, Occidental Mindoro, Oriental Mindoro, Marinduque, Palawan, Romblon, along with the provinces that have not recorded a single case of Covid-19.

3. During the remaining days of the ECQ as extended, we recommend that the national government continue with the acquisition of mass testing capability and the operationalization of an efficient and effective contact tracing network in order to identify and isolate infective individuals in quarantine areas, and when necessary, in hospitals within seven days from infection. As shown in the distribution of cases, there are more older people reporting because of the severity of the symptoms they are likely to experience. This does not mean that young people, while not sick, will stop carrying the virus that puts other lives at risk. The mass testing capability will give us a better picture of the gravity of the situation.

4. And considering that the vaccine is still more than a year away and we have not attained "herd immunity", the NG should use the extension of the ECQ to implement its program to further strengthen the national health system. The special powers of the President provided in Republic Act No. 11469 could muster additional resources to provide more testing kits and testing facilities, to procure needed equipment (e.g. ventilators) and critical medical supplies for our health workers and hospitals including proper personal protective equipment, to build more quarantine facilities; to hire more front liners provided with the proper incentives and financial assistance; and to widely disseminate PhilHealth's coverage for testing and hospitalization to encourage low-income households to seek medical attention. Philhealth's coverage is especially important because young individuals with mild symptoms might not seek medical attention without knowledge of the full coverage that Philhealth affords.

5. During the period of extension, the national government should continue the provision of assistance under the social amelioration program (SAP) provided in Republic Act No. 11469 or the Bayanihan to Heal as One Act. Local governments should continue providing relief goods especially to the poorest of the poor. We also recommend the continued assistance to those who were displaced or temporarily out of work, e.g. no work, no pay, during these times. These assistance programs include the unemployment benefits program of SSS, the Small Business Wage Subsidy under the DOF, the Covid-19 Adjustment Measures Program (CAMP) and the *Tulong Panghanapbuhay sa ating* Disadvantaged/Displaced Workers (TUPAD) of DOLE.

Appropriate monitoring mechanisms should also be put in place to ensure that assistance is delivered to intended beneficiaries. The initiative of the DILG to require the publication of beneficiaries of the SAP at the barangay level is laudable. It can also be done for beneficiaries of TUPAD at the provincial level. Similar transparency initiatives have been made by DOLE regional offices with its CAMP. It could also be made for companies availing of the Small Business Wage Subsidy. Equally important to the provision of subsidy is to ensure that these funds will reach their intended beneficiaries.

6. Coupled with the provision of liquidity is a mechanism to ensure the availability of reasonably priced goods in the market by ensuring that the supply chains of key commodities are not disrupted during the extension period. Price monitoring and strict enforcement of regulations against hoarding and profiteering should continue to be in place.

7. Given the significant economic cost of ensuring the safeguarding public health during the pandemic and in order to provide confidence among our enterprises, the NG should also consider preparing an economic stimulus package that would provide opportunities for reskilling displaced workers, bridge loans for businesses including wage subsidies for micro, small and medium scale enterprises(MSME), and extend the social amelioration program. This is a crucial intervention to ensure that people's jobs and enterprises' viability are not perceived as being unfairly sacrificed. The NG will need the support of the Philippine Congress to realize this crucial economic stimulus package.

8. Prospectively, the national government should invest more resources to enhance data collection and reporting at the local level given enabling laws (RA 11055 or the Philippine ID System Act and RA 11315 or the CBMS Act) to ensure that provision of assistance would be easier. It will also facilitate data collection and analysis at the local level.

9. In the same manner that a national task force is in place to manage emerging infectious diseases, a similar government mechanism must be put in place to enable government agencies to share information and widely institutionalize strategies and programs that enhance national resilience.

Further, institutions such universities and research institute, which can do evidence-based research to improve policy and program formulation and evaluation should be supported to conduct researches that could underpin national plans to bolster resilience of national institutions, e.g. distance education and blended learning in schools, telecommuting, telehealth, and other similar initiatives.

This crisis and all our collective experiences hould not go to waste.

For questions or clarifications related to the technical or other aspects of this policy note, please send an email to gdavid@math.upd.edu.ph and rsrye@up.edu.ph.