ECONOMIC ANALYSIS

A. The Economic Rationale for Investing in the Project

1. The main objective of the proposed Health System Enhancement to Address and Limit COVID-19 (HEAL) is to augment the government's response towards the coronavirus disease (COVID-19) pandemic. HEAL has three outputs: (i) upgrade surveillance and diagnostic capacity; (ii) expand prevention and control measures; and (iii) scale up treatment capacity of COVID-19. These three outputs are aligned with the current strategy of the Philippine government to expand testing capacity, immediately isolate confirmed cases from the general population, and treat those who are severely and critically ill.[1]

2. Addressing the COVID-19 pandemic requires large and aggressive public spending to ensure that the response is immediate and comprehensive. While the primary goal of HEAL is to ramp up government spending to mitigate the acute effects of the pandemic, it should be viewed as a long-term health facility investment, as their benefits may go beyond the epidemic days. These investments address some of the long-standing challenges, such as scarcity of priority technology (e.g., computed tomography scan, diagnostic capacity) and limited hospital beds, especially outside Metro Manila.

3. Two economic analyses were conducted. The first analysis was to determine the most cost-effective post-enhanced community quarantine (ECQ) intervention in the Philippines and the second analysis pertains to specific project intervention.

B. Cost-Effectiveness Analysis of Post-ECQ Interventions in the Philippines

4. A cost-effectiveness analysis was conducted on various non-pharmaceutical strategies post ECQ. The incremental impact of various scenarios compared to the baseline scenario. The cost effectiveness indicator is presented below:

Cost Effectiveness Indicator

$$CEI = \frac{C_{si} - C_b}{HI_{si} - HI_b}$$

Note:
1. C is the cost of the intervention scenario i from 17 March 2020 to 31 December 2021.
2. HI is the health impact, expressed in terms of years of disability adjusted life years.
3. s_i refers to intervention scenarios.
4. b refers to baseline scenario 1.

Source: ADB. 2000. *Handbook for the Economic Analysis of Health Sector Projects*. Manila.

C. Health Impact

5. Health impact was quantified by converting deaths and cases due to COVID-19[2] into Disability-Adjusted Life Year (DALY) which is a composite indicator that combines both morbidity and mortality impacts into a single measure.[3] For deriving morbidity, average duration of the

[1] Department of Health. COVID-19 Advisories (last accessed 18 April 2020).
[2] Deaths and cases are derived from the modelled estimate of the Asian Development Bank (ADB) Economic Analysis and Operational Support Division, University of the Philippines Los Baños, and National University of Singapore (unpublished mimeo).
[3] Another composite measure is called Quality Adjusted Life Year. While frequently used in developed countries, it has limited application in developing countries.

disease was assumed to be 21 days.[4] The disability weight was proxied by the value for lower respiratory disease of 0.13.[5] A time discount rate of 3% was applied to the DALY, which is consistent with the discounting rate for Commission on Macroeconomic on Health and WDR 1993.[6] This implies that a year of life gained today will be valued more than a year of life gained next year.

D. Costs of Interventions

6. The cost of implementing each intervention was derived from the societal (i.e., the Inter-Agency Task Force) perspective. The cost therefore considered cost to the economy, patients, and population. The costing did not include the budgets of the Department of Health and local government units (LGUs) which are already reflected in the General Appropriations Act and LGU budgets; interventions are evaluated and compared as though operating under steady-state conditions. The costs were or will be incurred from various interventions from 17 March 2020 to 31 December 2021 (700 days). The costs were not discounted due to the short timeline.[7] There are six streams of cost that were calculated: (i) cost of personal protection; (ii) cost of testing; (iii) direct cost of hospitalization; (iv) productivity loss of those who got sick; (v) economic losses due to ECQ, general community quarantine, and sustainable social distancing restrictions; and (vi) human capital losses due to school closures.

7. The cost of personal protection is the sum of costs of cloth masks (assuming cloth masks cost ₱15 per piece and each person uses 4 masks in total per day) [8] and costs of handwashing (assuming a person washes six times using ₱0.02 amount of water and ₱0.11 for soap, costing ₱0.78 per person per day).[9] The cost of population testing is ₱3,000 per polymerase chain reaction test[10] and ₱894 per tracer per day.[11] The different percentage of symptomatic and asymptomatic populations was tested depending on the scenario (see Table 1). The cost of hospitalization was obtained from the Philippine Health Insurance Company case rates where: ₱22,449 is for isolation; ₱143,267 for moderate cases; and ₱786,384 for critical cases.[12] The

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[4] F. Zhou, et al. 2020. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, Chila: a retrospective cohort study. *The Lancet*. 395 (10229). pp. 1054–1062. Given that not much is known about the longer term impacts of COVID-19, for simplicity it is assumed that there will be no lingering impacts of COVID-19 to those who will recover from the disease. It should be noted that this assumption may most likely underestimate Years Lived with Disability (YLD).

[5] Global Burden of Disease Collaborative Network. 2018. *Global Burden of Disease Study 2017 (GBD 2017) Disability Weights*. Seattle, United States: Institute for Health Metrics and Evaluation (IHME).

[6] World Health Organization (WHO) Commission on Macroeconomics and Health & WHO. 2001. *Macroeconomics and health: investing in health for economic development: executive summary/report of the Commission on Macroeconomics and Health*. Geneva.

[7] D. Husereau et al. 2013. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. *Value Health*. 16(2).

[8] Cheapest cost of masks. Shopee.

[9] Assuming that 135 grams bar of soap will last 60 days per person. Price from the Department of Trade and Investment. 2019. *Suggested Retail Prices of Basic Necessities and Prime Commodities as of 30 September 2019*. Manila; the frequency is based on Q. Wang et al. 2020. *Effectiveness and cost-effectiveness of public health measures to control COVID-19: a modelling study*. China: medRxiv.

[10] Broken down as $25 for test kit, consumables and reagents, and personal protective equipment, which is the negotiated rate due to volume; $15 allocated per test of the costs installing and maintaining the laboratory, including polymerase chain reaction machines and other equipment; and $20 for staff and other operations (electricity, water, others) and other capital expenditure cost.

[11] Average income based on the International Labour Organization plus ₱300 (median value of travel costs); assumed there will be 10 paid tracer per 81 provinces, 16 National Capital Region cities and municipalities; 13 Metro Cebu cities and municipalities; and 7 Metro Davao cities and municipalities.

[12] Based on Philippine Health Insurance Company. 2020. *Circular 2020-0009*. Manila. Benefit packages for inpatient care of probable and confirmed COVID-19 developing severe illness/outcomes.

average length of stay was assumed to be 14 days for isolation, 19 days for mild and moderate cases, and 23 days for severe and critical cases.[13] The loss of productivity due to sickness was calculated as average daily income of ₱653 (based on average monthly income from International Labour Organization database of $256.11 divided by 20) multiplied by hospitalization days and 7 extra days for rest. Lost economic activity was measured as gross value added lost from each sector that was restricted or allowed during ECQ/general community quarantine following the Inter-Agency Task Force memoranda. Multipliers were derived and applied to national accounts to derive value added lost. The economic cost of school closure was captured as the loss of education during and after ECQ/general community quarantine, and estimated as lost returns to education using standard Mincer earnings regression.

8. Results indicate that the most cost-effective measure moving forward is a massive investment in tracing, testing, and isolation capacity, which is the focus of HEAL. The cost per DALY averted is above the 2019 gross national income per capita of ₱199,000 but below three times the gross national income, making the intervention cost-effective. The intervention with testing and tracing also results to least number of people falling into poverty (5.6% compared to 7% in a long extended ECQ).

Table 1: Cost-Effectiveness Analysis of Non-Pharmaceutical Interventions in the Philippines

	Baseline	Long extended ECQ	ECQ plus testing	ECQ plus testing and tracing
ECQ Duration	17 March–15 May 2020	17 March–15 June 2020	17 March–15 May 2020	17 March–15 May 2020
GCQ Duration	NA	SSD from 15 June	SSD from 15 May 2020	SSD from 15 May, no school closures
Testing and contact tracing post ECQ	NA	NA	40% symptomatic cases	50% symptomatic cases
Estimated total deaths	201,280.0	5,690.0	5,186.0	2,672.0
Estimated total cases	9,195,096.0	263,696.0	273,709.0	152,294.0
DALYs averted	0.0	3,294,134.0	3,302,065.0	3,343,341.0
Incremental economic cost	0.0	2,013,378,999,910.0	1,182,087,647,360.0	1,184,878,484,873.0
Incremental cost per DALY averted	0.0	611,201.0	357,984.0	354,400.0
Population falling below the poverty line	24.0	31.0	30.0	30.0
Incremental poverty impact	0.0	7.0	5.6	5.6

DALY = disability-adjusted life year, ECQ = enhanced community quarantine, GCQ = general community quarantine, NA = not applicable, SSD = sustainable social distancing.
Source: Asian Development Bank.

E. Cost-Effectiveness Analysis of Project interventions

9. **Economic benefits.** The gains were quantified in terms of DALYs due to COVID-19 for the epidemic period 2020–2022. DALYs is the number of years lost due to ill-health, disability, or premature death. It is the sum of Years of Life Lost (YLL) and YLD. To obtain the averted YLL, the death/mortality projections from the Philippine Institute for Development Studies modelling

[13] Z. Wang et al. 2020. *Survival analysis of hospital length of stay of novel coronavirus (COVID-19) pneumonia patients in Sichuan, China*. China: medRxiv.

study were used, where without project scenario is post-(ECQ with less aggressive intervention, and with project scenario is the post-ECQ with very aggressive intervention (i.e., effective isolation/quarantine of cases, and quick turn-around-time viral testing).[14] In the absence of data on YLD, it was assumed that YLD is approximately 30% of YLL.[15] For DALYs averted beyond 2022, it was assumed that the hospital investments made during the epidemic period can also benefit other patients suffering from other health conditions other than COVID-19. For example, the mechanical ventilators and computed tomography scans can be used in the treatment and diagnosis of acute and chronic medical conditions. The historical data on DALYs of other diseases from the IHME was obtained.[16] The economic cost of HEAL was discounted at 3% following the WHO guidelines[17] and 6% following the ADB guidelines on social sector projects.[18]

10. **Economic costs.** The total capital investment costs (excluding price contingencies and taxes) are spread over the 3 years of implementation based on the disbursement schedule. Economic investment costs were estimated using the domestic price numeraire method by applying a shadow exchange rate factor of 1.2[19] on traded costs; a standard conversion factor of 1 for non-traded and scarce labor; and a shadow wage rate factor of 0.6 (footnote 19) for surplus labor. Recurrent and maintenance costs were assessed at 5% of major equipment costs (i.e., laboratory reagents, fuel for ambulance), and replacement of major equipment was assumed to be carried out every 10 years. The economic cost of the HEAL was discounted at 3% and 6%, following ADB guidelines.

Table 2: Economic Benefits and Costs of the Project

Benefits	Costs
Morbidity and mortality averted Disability adjusted-life years (DALYs) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or premature death. DALYs is the sum of years life lost and years living with disability.	Economic investment cost of the HEAL. Recurrent government costs

Source: Asian Development Bank.

F. Results of the Economic Analysis

11. Cost-effectiveness analysis following ADB guidelines on economic analysis[20] shows that cost per DALY is less than the gross domestic product (GDP) per capita using the 3% discount rate, making the intervention very cost effective.[21] Using the discount rate of 6%, the typical hurdle rate of social sector projects shows that HEAL is between GDP per capita and three times GDP per capita, making HEAL cost effective (footnote 17). Sensitivity analysis shows that HEAL is cost-effective, regardless of discount rate, decrease in benefits, and increase in benefits (Table 4).

[14] M. Abrigo et al. 2020. Projected Disease Transmission, Health System Requirements, and Macroeconomic Impacts of COVID-19 in the Philippines. *Philippine Institute for Development Studies*. No. 2020-15. Quezon City.
[15] YLD accounts for about 30% of the total DALYs in lower respiratory tract infection (e.g., pneumonia). The share was based on the IHME estimates for lower respiratory tract infection. IHME. GBD 2017 Resources (Last accessed 18 April 2020).
[16] IHME. COVID-19 Projections.
[17] WHO. 2003. *Guide for Cost Effectiveness Analysis*. Geneva.
[18] ADB. 2017. *Guidelines for the Economic Analysis of Projects*. Manila.
[19] National Economic and Development Authority. 2004. *ICC Project Evaluation Procedures and Guidelines*. Manila.
[20] ADB. 2017. *Guidelines on Analysis of Health Projects*. Manila.
[21] The project intervention will be deemed very effective if the cost per DALY is less than three times GDP per capita, cost effective if cost per DALY is less than GDP per capita, and not cost effective if cost per DALY exceed these levels. WHO. 2016. *Cost Effectiveness Thresholds: Pros and Cons*. Geneva.

Table 3: Results of Cost Effectiveness Analysis

		DALYs Averted
2020	101,246,309	15,211
2021	23,068,779	5,645
2022	2,563,198	3,136
2023	1,281,599	2,822
2024	2,570,700	2,819
2025	2,570,700	2,817
2026	2,570,700	2,814
2027	2,570,700	2,811
2028	2,570,700	2,809
2029	2,570,700	2,806
2030	51,414,000	2,803
2031	2,570,700	2,801
2032	2,570,700	2,798
2033	2,570,700	2,795
2034	2,570,700	2,793
2035	2,570,700	2,790
2036	2,570,700	2,787
2037	2,570,700	2,785
2038	2,570,700	2,782
2039	2,570,700	2,779
2040	2,570,700	2,777
PV at 3%	188,883,594	58,220
PV at 6%	166,277,979	47,494
CER at 3%		3,244
CER at 6%		3,501
GDP per capita		3,339
Three times GDP per capita		10,017

CER = Cost effectiveness Ratio, DALY = Disability-Adjusted Life Years, GDP = gross domestic product, PV = present value.
Source: Asian Development Bank.

Table 4: Sensitivity Analysis

	CER at 3%	CER at 6%
10% increase in cost	3,569	3,851
10% decrease in benefits	3,605	3,890
10% increase in Cost and 10% decrease in benefits	3,965	4,279

CER = cost effectiveness ratio.
Source: Asian Development Bank.