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The Multifaceted Health Impacts of COVID-19 Pandemic

Valerie Gilbert T. Ulep

CONTACT US:

RESEARCH INFORMATION DEPARTMENT
Philippine Institute for Development Studies

18th Floor, Three Cyberpod Centris - North Tower
EDSA corner Quezon Avenue, Quezon City, Philippines

publications@mail.pids.gov.ph
(+632) 8877-4000

https://www.pids.gov.ph

The Multifaceted Health Impacts of COVID-19 Pandemic

Valerie Gilbert T. Ulep

PHILIPPINE INSTITUTE FOR DEVELOPMENT STUDIES

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Abstract

Understanding the direct and indirect health consequences of the COVID-19 pandemic is critical in designing a holistic public health response. This study has two objectives. First, we demonstrated the disruption of essential healthcare services using data from selected government facilities. Second, we estimated the productivity losses from direct and indirect health impacts of the pandemic. Validating our earlier study using health insurance claims, our findings showed a sharp decline in admissions and consultations in selected government facilities, particularly among the vulnerable population. Based on our estimates, the long-run costs from productivity losses from direct and indirect health impacts of the pandemic are PHP 2.3 trillion (at net present value). Indirect health impacts account for the majority of these costs.

Keywords: COVID-19, health, broad impact

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The Multifaceted Health Impacts of COVID-19 Pandemic

Valerie Gilbert T. Ulep[1]

I. Introduction

The COVID-19 pandemic has caused a significant health burden globally. As of November 10, 2021, the Philippines recorded 2.8 million confirmed cases and 45, 000 deaths, one of the highest in the Asia-Pacific region (World Health Organization, 2021). However, these numbers barely represent the overall health impact of the pandemic. Understanding both the direct and indirect health consequences of the pandemic is critical in designing a holistic public health response (Ulep, et al., 2021).

In the Philippines, measuring the indirect health impacts of the pandemic is a challenge. While the government has built an entire health information system that regularly monitors COVID-19 cases, hospitalization and deaths, the disruption of essential health services has gone unmeasured (Roberton, et al., 2020; Mikkelsen, Phillips, AbouZahr, & Setel, 2015). Like most countries, the Philippine government has imposed stringent measures to limit the spread of the virus and the resulting morbidity and mortality. However, these policy approaches came with a heavy price (Broadbent, Walker, Chalkidou, Sullivan, & Glassman, 2021). Many countries experienced not only economic recession but prolonged disruption of critical social services including healthcare. In the Philippines, reports on the disruption of health services, especially during the first year of the pandemic, were mostly anecdotal (UNDP and UNICEF, 2020). Because of widespread fear and lockdown measures, many Filipinos have reportedly foregone care out of fear of getting infected or concerns about access at overrun health facilities.

To unfold a looming public health crisis, we estimated the magnitude of the disruption of health services using PhilHealth insurance data in May 2020. Our findings suggest that health insurance claims from high-burden diseases declined by almost 50-60% in 2020 with no signs of recovery throughout the year (Ulep, et al., 2021). The level of decline is alarming. In a setting with a relatively low uptake of essential health services (e.g., child immunization, prenatal care) further disruption will have a huge repercussion on population health and well-being.

This paper is a continuation of our initial work on indirect health impacts of the COVID-19 pandemic in the Philippines. It has two research objectives. First, demonstrate the disruption of essential healthcare services using administrative data from selected government facilities. Second, estimate the economic costs of both direct and indirect health impacts of the pandemic. Our results validate our initial findings using PhilHealth insurance claims. We observe significant decline in admissions and outpatient consultation particularly among vulnerable populations. Lastly, our estimated long-run productivity losses related to health is around Php4.3 trillion mostly from indirect impact (non-COVID-19 deaths and morbidities).

[1] Senior Research Fellow at the Philippine Institute for Development Studies (PIDS).

II. Methodology

a. *Health facility data*

In our initial study (see Ulep et al., 2021), we used insurance claims data from PhilHealth to demonstrate the disruption of healthcare services brought by the pandemic. With possible limitations of insurance claims data, we supplemented our analysis with hospital admissions and outpatient data obtained directly from government primary care facilities (i.e., Rural Health Units) and hospitals. RHUs provide basic public health services in local communities, while hospitals provide higher-level inpatient care. The DOH requested government hospitals and RHUs to submit data as part of the national government's effort to monitor the public health programs of local governments. The data from DOH contains aggregate quarterly admissions and consultations data from January 2019 to December 2020. Only those facilities that submitted and accomplished the monitoring questionnaire are included in our analysis: 60 out of 410 government hospitals (17%) and 114 out of 2,500 (5%) primary care facilities. **Appendix A** provides the distribution of hospitals included in our analysis. In addition to the data from government health facilities, we requested the DOH central office utilization data on public health programs such as tuberculosis and HIV/AIDS.

b. *Direct and indirect health cost*

We estimated the Disability-Adjusted Life Years (DALYs), which is the sum of years of life lost due to premature mortality and disability due to COVID-19 and other indirect health effects (WHO, 2002). We converted the year life lost to monetary terms by multiplying the estimated DALYs with GDP per capita (Weisbrod, 1963). We disaggregated our analysis by direct and indirect health impacts. Direct impacts include premature deaths and morbidities (including severity) because of COVID-19. While indirect impact includes foregone hospitalization and outpatient visits, increase in the prevalence of malnutrition, mental health, diabetes, obesity, and physical inactivity, and decline in prenatal care, immunization, anti-retroviral therapy (ART) and TBDOTS for HIV/AIDS and tuberculosis. See **Appendix B** for a detailed description of the methodology.

III. The COVID-19 pandemic in the Philippines: a brief background

The Philippines is one of the countries severely affected by the COVID-19 pandemic. As of November 10, 2021, the country recorded 2.8 million confirmed cases and 45,000 deaths because of COVID-19 (World Health Organization, 2021). The country ranked 21st in terms of total deaths, but significantly lower than the global average if adjusted to population size (339 deaths per million population).[2] However, as many infections have gone undetected, epidemiologic modeling suggests that the total infections in the country are about 4-5 times higher than the official tally (Gu, 2020). In 2020, COVID-19 was included as one of the leading causes of death (Philippine Statistical Authority, 2021). While the mortality data from the civil registry might not be entirely comparable to the DOH tally, the large discrepancy suggests that the official death toll might be underestimated.

[2] Compared to the global average 655 deaths per million.

Table 1. Top causes of deaths in the Philippines

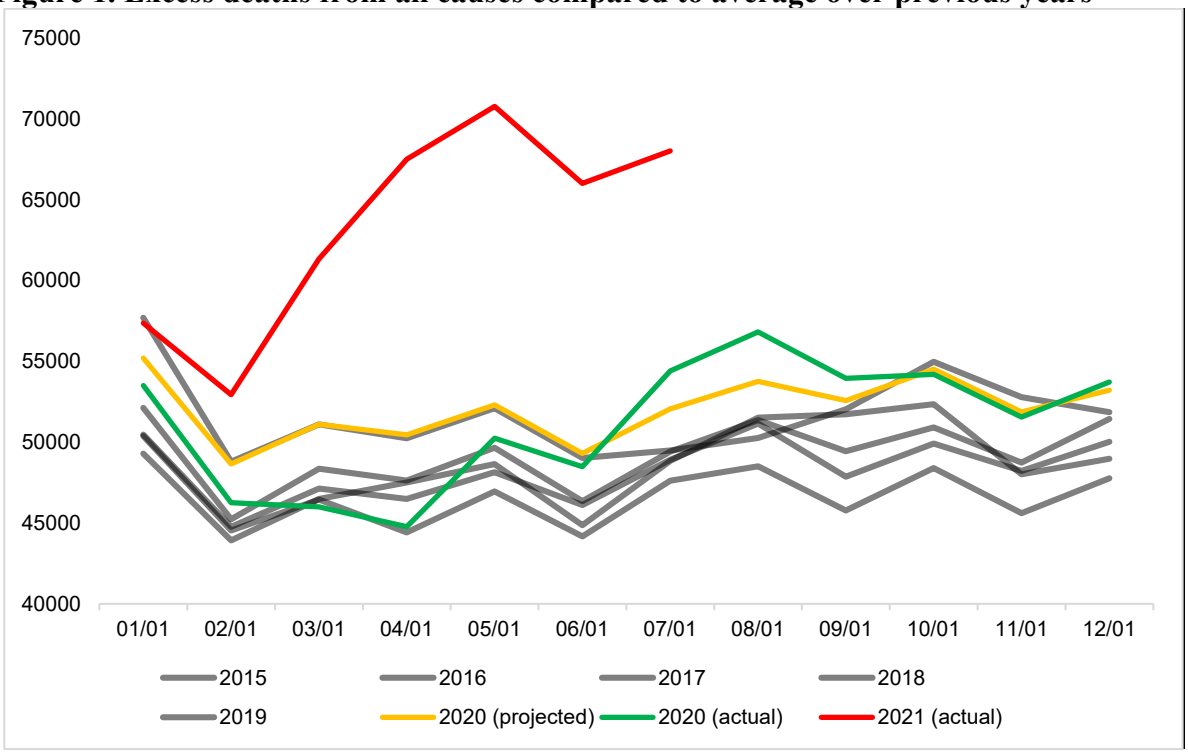
	2015	2016	2017	2018	2019	2020	Share in 2020
Total	560,605	582,183	579,237	590,709	620,414	613,035	100%
Diseases of the circulatory system	198,077	198,507	196,900	201,483	213,625	225,196	37%
Neoplasms	63,003	64,594	64,125	67,138	68,657	66,179	11%
Diseases of the respiratory system	78,859	88,139	87,760	87,720	95,879	60,155	10%
Endocrine, nutritional and metabolic diseases	42,728	42,571	41,642	42,654	45,449	51,562	8%
Injuries	39,256	44,426	44,646	43,808	42,960	36,343	6%
Certain infectious and parasitic diseases	42,475	44,340	41,099	40,929	42,726	32,954	5%
COVID (virus and non-virus detected)	*	*	*	*	*	30,140	5%
Diseases of the digestive system	22,456	22,803	24,168	24,341	25,165	24,533	4%
Diseases of the genitourinary system	22,031	23,526	18,759	19,227	20,603	21,584	4%
Certain conditions originating in the perinatal period	9,831	9,785	11,054	11,768	11,260	9,535	2%
Diseases of the nervous system	7,565	7,741	8,915	9,185	10,181	8,282	1%
Congenital malformations, deformations	5,138	5,100	5,336	5,415	5,912	4,718	1%
Diseases of the musculoskeletal system	2,210	2,580	3,521	3,959	4,358	4,398	1%
Diseases of the blood and blood forming organs	3,709	3,889	4,789	4,657	4,339	4,184	1%
Diseases of the skin and subcutaneous tissue	2,327	2,191	2,803	3,339	3,718	3,625	1%
Pregnancy, childbirth and the puerperium	1,721	1,483	1,484	1,616	1,458	1,965	0%
Mental and behavioral disorders	503	654	1,433	1,416	1,086	1,312	0%
Diseases of the ear and mastoid process	38	10	78	93	75	86	0%
Diseases of the eye and adnexa	19	5	45	43	45	54	0%
NEC	18,659	19,839	20,680	21,918	22,918	26,230	4%

Source: Philippine Statistics Authority (2021)

Estimates of excess deaths could provide information about the true disease burden of the pandemic. In epidemiology, 'excess deaths' is one of the commonly used indicators of the 'overall' impact of the pandemic on mortality (US Centers for Disease Control and Prevention, 2021). It includes not only the confirmed COVID-19 cases, but also the unconfirmed COVID-19 deaths and other deaths from indirect causes. **Figure 1** shows the number of deaths compared to projected deaths from all causes based on projections[3] on previous years. In the Philippines, the excess deaths became only conspicuous in 2021 (Hannah, Edouard , Rodés-Guira, Cameron , & Giattino, 2020).

[3] 2020 projections are based on 2015-2019 deaths

Figure 1. Excess deaths from all causes compared to average over previous years



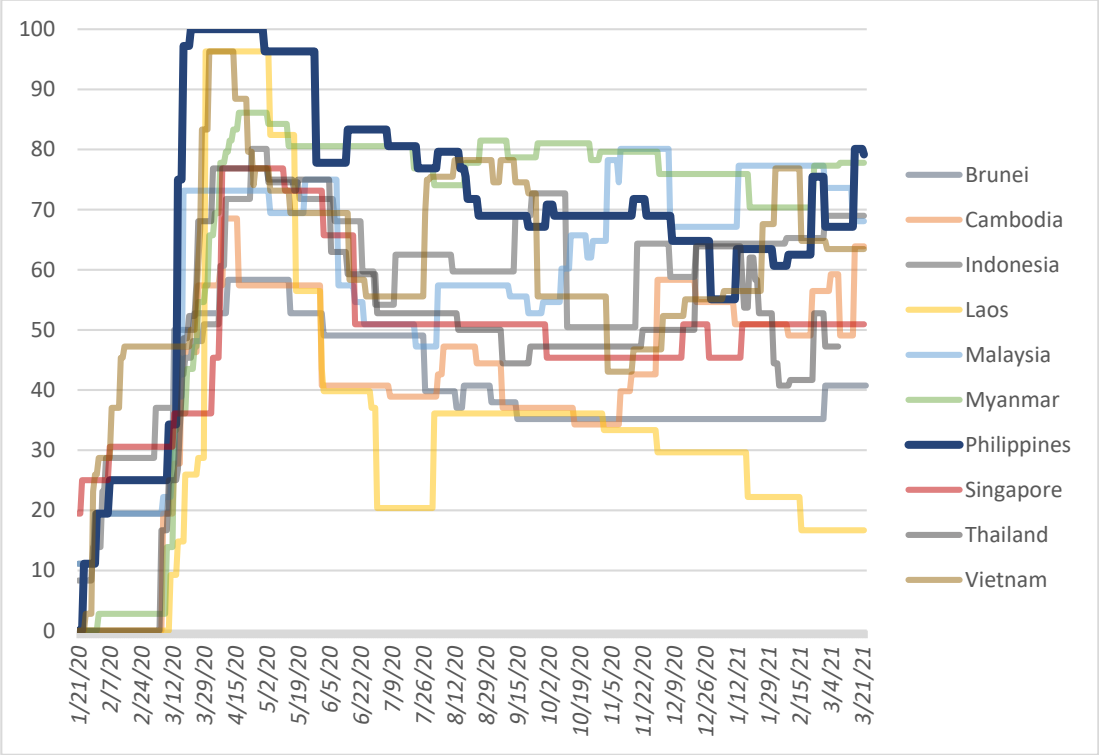
Source: Ritchie et al (2020)

T**he Philippine has adopted stringent measures to reduce the spread of infection.** To reduce widespread community transmission, the government has enforced community lockdowns with varying levels of stringency: (1) Extreme Community Quarantine (ECQ) – the entire population except essential industries need to stay home, public transportation and mass gatherings are prohibited; (2) Modified ECQ (MECQ) - limited number of businesses are open, restaurants for-delivery, and individual outdoor excise are permitted; (3) General Community Quarantine (GCQ) - government offices may operate at full capacity, 25%-50% venue capacity for public gatherings, recreational facilities, and restaurants; and (4) M/GCQ - public gatherings at 50%-75% venue capacity, and restaurants fully operational. From March 2020 (start of the pandemic) until April, the government imposed ECQ. Most provinces shifted to GCQ in May 2020, and by June 2020, provinces in the country remained under MGCQ or GCG (Uy, Van, Ulep, Bayani, & Walker, 2021).

The Philippines has imposed one of the strictest lockdowns in the world. **Figure 2** shows the stringency index[4] of the Philippines compared to the ASEAN neighbors. The country has consistently recorded high stringency index since the start of the pandemic' it recorded the highest stringency index of 100 in March 2020 and had the lowest in December 2020 (Our World in Data, 2021; Hale, et al., 2021). The social, economic, and health repercussions of prolonged mobility restrictions, school closures, and border controls are costly. Therefore, the both the indirect and direct consequences of the pandemic and the associated policy approaches to control should be measured in order to have a more informed and calibrated public health response.

4 Stringency index is a "composite measure based on nine response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 =strictest). If policies vary at the subnational level, the index is shown as the response level of the strictest sub-region" (Our World in Data 2021).

Figure 2. COVID-19 Stringency Index, 2020 – March 2021



Source: Our World in Data (2021); Hale et al. (2021)

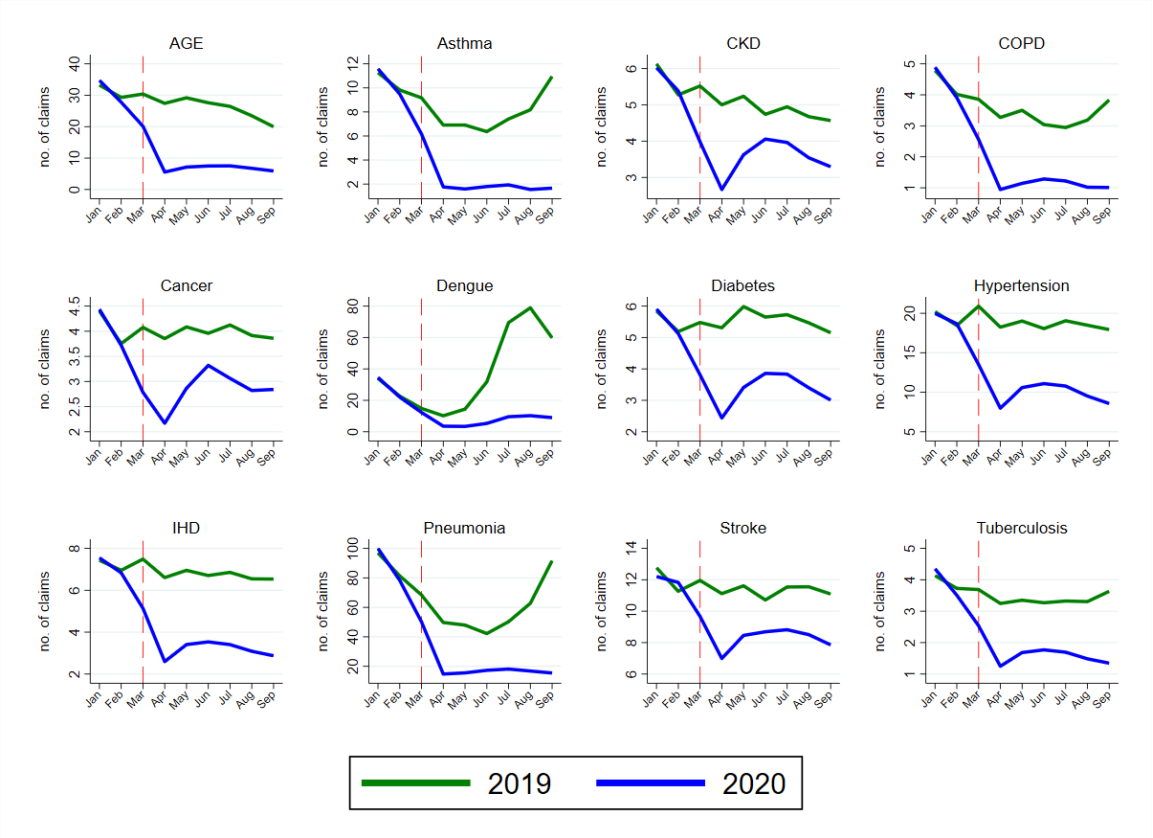
IV. The disruption of healthcare services

The pandemic has further weakened countries' frail health systems. Many countries reported disruption in health services because of the pandemic. According to the World Health Organization (WHO), about 94% of countries reported any disruption of essential health services. However, low and middle-income countries (LMICs) are more likely to suffer from the wrath because of their relatively weaker health systems. For example, Shapira et al (2020) demonstrated significant disruption of essential maternal and child health services in Sub-Saharan Africa. Nguyen et al (2021) showed that COVID-19 disrupted the provision of health and nutrition services in one of the poorest states of India despite attempts to restore services. Studies have theorized possible reasons for declining health services during the pandemic: (1) patients are foregoing hospitalization and procedures because of limited resources as they re-allocated to the pandemic response; (2) non-COVID-19 patients are skipping clinic visits because of mobility restrictions or fear of contagion (Birkmeyer, Barnato, Birkmeyer, Bessler, & Skinner, 2020). The disruption of health has caused fear, lack of trust, and structural dysfunction in the health system, causing patients with non-COVID-19 illnesses to delay seeking medical care (Barach et al., 2020; Schirmer et al., 2020).

In the Philippines, inpatient care for high-burden diseases sharply declined during the first year of the pandemic. The poorest population suffered the largest decline. Ulep et al (2021) demonstrated the large decline in medical claims for twelve (12) high-burden diseases, which accounted for the majority of the country's disease burden (Institute for Health Metrics and Evaluation, 2020). The average decline in 2020 was 57% compared to the same period in the previous year (2019). The number of claims remained relatively low with no signs of recovery even in the third quarter of 2020. Acute gastroenteritis, asthma, chronic pulmonary disease, and pneumonia suffered a 60-70% decline. Other non-communicable diseases

(NCDs), such as chronic kidney disease, cancer, and stroke declined at a lower range, about 20-30%. Uy, Van, Ulep, Bayani, & Walker (2021) expanded the study of Ulep et al (2021) and further examined the decline in inpatient claims for high-burden disease by insurance membership. Among types of PhilHealth members, direct-formal contributors and the poorest indirect-indigent or sponsored suffered the largest declines in medical claims.[5]

Figure 3. Seasonally-adjusted insurance claims, by disease

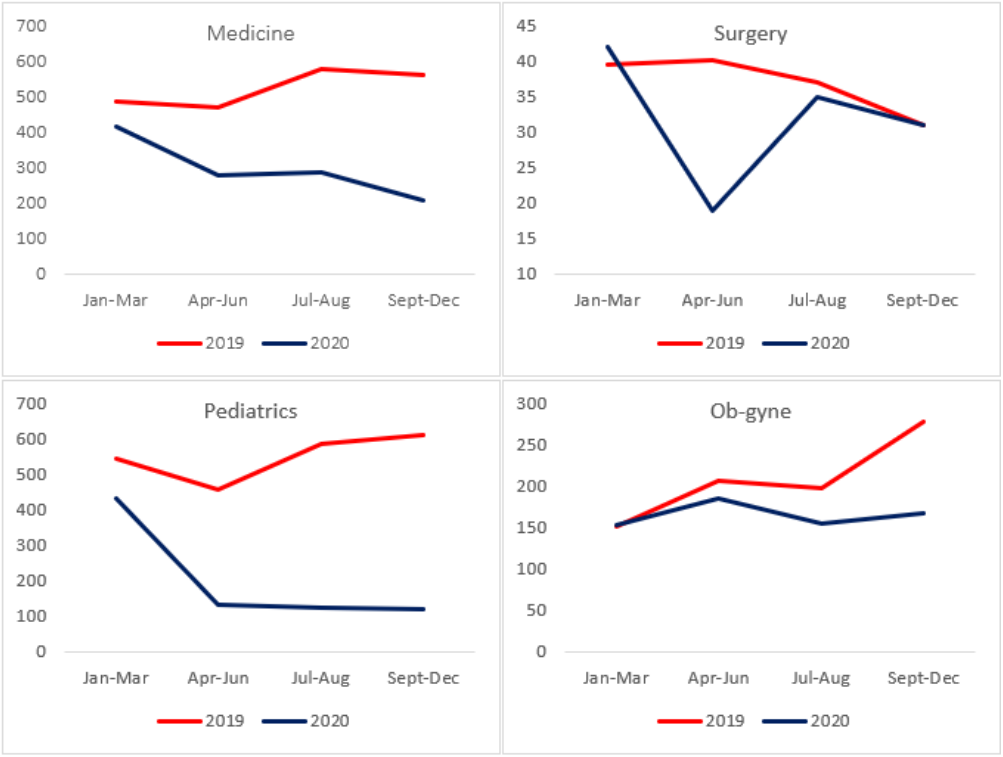


Source: Ulep et al. (2021)

Children are bearing the brunt of the pandemic. Using admissions data from selected government hospitals, we estimated the median number of admissions by quarter and patient type, namely: (1) adult medicine; (2) surgery; (3) pediatrics; and (4) Ob-Gyne. For adult internal medicine and pediatrics, the median admissions declined by 40% and 70%, in the second quarter of 2020, relative to the preceding year. with no sign of recovery throughout the year. The decline in inpatient care among children reinforces that the pandemic has affected the most vulnerable populations. In contrast, the median surgical admissions declined in the second quarters of 2020, which was the peak of the strictest lockdown. We observed a recovery in the third and fourth quarters of 2020.

[5] See the study of Uy, Van, Ulep, Bayani and Walker (2021) for the methodology and the more detailed analysis of claims data from PhilHealth.

Figure 4. Median admissions, by patient type



Source: This study, using admissions data from the Department of Health (DOH)

The number of consultations in RHUs significantly declined as well, particularly among vulnerable populations. RHUs are the gateway of individuals and communities to the public healthcare system. They provide basic healthcare services such as nutrition interventions, maternal and child and reproductive health services, and primary and secondary prevention against non-communicable diseases (NCDs) and infectious diseases. Using data from primary care facilities (i.e., RHUs), we demonstrate decline in consultations among the vulnerable population, particularly among under-five (5) children and the elderly population (+65 years old up). The large decline in consultations among these age-groups suggests the possible growing unmet need of essential healthcare services. Several factors could have contributed to the large decline in outpatient visits, in particular, the strict stay-in-home imposed to children and elderly since the start of the pandemic.

The coverage of critical public health programs also suffered – a major blow to the country's efforts in achieving health system targets. Using data from primary care facilities, the median number of consultations for Directly Observed Therapy for the Treatment of Tuberculosis (TBDOTS) declined in the second quarter of 2020, with no improvements up to the fourth quarter. The program data from the central DOH corroborates this finding. The number of people who were tested, diagnosed, and treated against tuberculosis (TB) dramatically declined (see **Table 2**). HIV testing, diagnosis and treatment, also considered a mainstay public health intervention in reducing HIV burden, demonstrated suffered a precipitous decline as well. The poor uptake of these critical public health interventions affects the country's prospect in reducing the incidence of TB and HIV as part of its global commitment to the Sustainable Development Goals (SDGs). The Philippines is one of the countries with the highest TB burden, and the country with the fastest growing HIV cases in the world. For example, the reduction in uptake in TBDOTS services (i.e., testing, screening and treatment) could be attributed to the dwindling of TB supplies because

of re-allocation of human resources and diagnostic equipment to COVID response (e.g., Xpert machines used for TB diagnosis were re-purposed for COVID testing).

Figure 5. Median consultations in RHUs, by age group and type of service

Source: This study, using consultation data from the Department of Health (DOH)

Table 2. TBDOTS indicators, before and during pandemic

	2018	2019	2020
Number Tested (Target - 2,450,000)	1,164,290	1,083,877	**556,773 (-49%)**
Number Diagnosed and Treated, New and Relapse (Target - 442,600)	371,668	409,167	**256,541(-37%)**
Number Diagnosed and Treated Drug Resistant TB (DR-TB) (Target - 8,500)	7,267	7,492	**6,279 (-16%)**
Treatment Success Rate, New and Relapse (Target - 90%)	91%	83%	**74% (-11%)**

Source: This study, using admissions data from the Department of Health (DOH)

Table 3. HIV/AIDS indicators, before and during pandemic

	2019	2020
Number of HIV Tests	1,220,765	480,285 (-61%)
Number of newly diagnosed cases	12,778	8,058 (-37%)
Newly enrolled clients in Anti-Retroviral Therapy	11,654	8,429 (-28%)

Source: This study, using admissions data from the Department of Health

Productivity losses

The long-run productivity losses because of direct and indirect health impact of COVID-19 is Php2.3 trillion (in net present value). The deterioration of health and well-being brought by COVID-19 come with a price. To assess the productivity losses, we estimated the monetary value of Disability Adjusted Life Years (DALYs) directly accounted to COVID-19. In addition to the direct mortality and morbidity cause by COVID-19, policy approaches to control the spread of the infection have led to unintended consequences, *that is*, of foregone hospitalization and outpatient visits, increase in the prevalence of malnutrition, mental health, diabetes, obesity, and physical inactivity, and decline in the uptake of essential prenatal care visits, immunization, ART and TBDOTS services. **Table 4** shows the long-run productivity losses because of the COVID-19 pandemic. Of the total long-run cost, indirect health impact accounts for the majority. This reinforces the need to address the indirect health impacts of non-COVID patients as a critical component of the pandemic response.

Table 4. Forgone future wages and productivity, and additional healthcare costs due to COVID-19 and non-COVID-19 illnesses

	Lifetime years life lost (in billions)	Equivalent years of life lost
Forgone wages (pre-mature deaths)		
COVID premature deaths	94	284,863
Non-COVID deaths due to lack of healthcare	398	1,086,599
Forgone wages (morbidity)		
COVID morbidity (including long-COVID)	66	164,390
Non-COVID morbidities due to lack of healthcare (including new illnesses and risk due to COVID policy)	1,688	2,114,038
Total	2,247	3,649,890

V. Conclusion and recommendations

In this study, we provided evidence on the multifaceted and broad health impact of the COVID-19 pandemic. We demonstrated the sharp decline in the uptake of essential health services during the first year of the pandemic, While we have observed this trend in our previous studies using PhilHealth insurance claims (Ulep et al, 2021; Uy et al., 2021), validating the results with admissions and consultations data from health facilities provides a more compelling argument for the government and society to adapt a more holistic and calibrated public response in reducing the total harm caused by the pandemic.

Also, this study unfolds an alarming equity implication. The impact of the pandemic and the associated policy responses appear to have severely affected the most vulnerable population, such as the poor, senior citizens, and children. Uy et al (2021), shows that decline in insurance claims is significantly larger among indigent and sponsored program compared to non-sponsored members of PhilHealth. Using data directly from facilities, our study demonstrates that children and the elderly population suffered the most decline. In normal times, both population groups demand more healthcare services than the general population.

In our earlier study, we have discussed supply and demand-side reasons to explain the sharp decline in the uptake of essential health services in the Philippines. Demand-side factors include the widespread fear of getting infected, which forced people particularly those who are considered vulnerable to forego or delay seeking care. Mobility restriction could explain the decline; during the first year of the pandemic, the government halt public transportation, which made it hard for people to move around. The sharp decline in income could also explain the lower healthcare demand. In settings with high level of out-of-pocket private spending, healthcare demand tends to be elastic or more sensitive to income changes. In 2020, the Philippine economy declined by almost 10%, one of the biggest contractions in recent decades (PSA, 2021). Lastly, supply-side factors could largely the precipitous decline. With more COVID-19 patients getting infected, health facilities are no choice but to re-allocated resources for the pandemic response, or worse decline patients to get treated.

Given the health and economic burden arising from both COVID and non-COVID patients, the government must find innovative ways on how non-COVID patients can still access healthcare services during the pandemic. The pandemic should serve as catalyst for genuine reforms in the health sector, including the realization of the Philippine Health Facility Development Plan (PHFDP), which include addressing the chronic underinvestment in public health infrastructure. When we say infrastructure, it does not simply mean the service itself, rather, it also pertains to the collective capacity of the system to provide these services - from capital outlay, skilled human resources, and information systems.

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VII. Appendix

Appendix A. data description

The respondents came from 77 different public hospitals located in the various regions in the Philippines. Of the 77 hospitals submitted, five (5) are from the National Capital Region (6.49%) and the rest are from other regions (93.5%); 55 are Level 1 (71.43%), seven (7) are Level 2 (9.09%), and 14 are Level 3 (19.48%); for the breadth of capacity, 55 are general (71.43%), 21 are infirmary (27.27%), and 1 is psychiatric (1.3%). Table 1 below shows the breakdown of the service capacity and location of each healthcare facility.

Table 1. Hospital Level Service Capacity, Breadth of Capacity, Location, and Frequency

Demographic	**Service Capacity**	**Number**	**Share (%)**
Hospital level	Level 1	55	71.43
	Level 2	7	9.09
	Level 3	15	19.48
Location	NCR	5	6.49
	non-NCR	72	93.50
Breadth of Capacity	General	55	71.43
	Infirmary	21	27.27
	Psychiatric	1	1.3
	Total	77	100%

Appendix B. Methodology

The DALY measures health gaps as opposed to health expectancies. It measures the difference between a current situation and an ideal situation where everyone lives up to the age of the standard life expectancy, and in perfect health. The DALY combines in one measure the time lived with disability and the time lost due to premature mortality

DALY = YLL + YLD

Where:
YLL=Years Life Lost
YLD=Years Lived with Disability

a. YLL due to COVID-19 (direct effects)

I used the following formula to calculate the YLL directly attributed to COVID-19

$$YLL_i = \frac{N_i\,(1 - e^{-rL})}{r}$$

Where:
YLL_i=Years Life Lost due to COVID-19 at age group i
N_i = number of COVID-19 deaths at age group i
r= discount rate (3%)
L =expected life years

I used the number of COVID-19 deaths by age group from DOH data drop.

b. YLD due to COVID-19

I used the following formula to calculate the YLD directly attributed to COVID-19

$$YLD_{ij} = \frac{N_{ij}\,W_{ij}(1 - e^{-rL})}{r}$$

Where:
YLD_{ij}=Years of Life with Disability due to COVID-19 at age group i and disease disposition group j (mild/asymptomatic, moderate, critical, severe, and long COVID)
$N_{i\,j}$ = number of COVID-19 cases at age group i and disease disposition group j
W_j = Disability weight at disease disposition group j
r= discount rate (3%)
L =expected life years

I used the number of COVID-19 cases by age group and disease disposition from DOH and disability weights from Wyper et al, 2021 (https://biblio.ugent.be/publication/8699826/file/8699836)

c. YLL due to indirect health effects (decline in hospitalization and outpatient visits)

I used the following formula to estimate the impact of non-COVID inpatient and outpatient services on premature deaths (YLL):

$$PIF_i = \frac{(P_i - P_i^*)(RR - 1)}{RR}$$

Where:
PIF_i=Population impact fraction at age group i
P_i=Prevalence of inpatient/outpatient conditional to need at age group i before pandemic
P_i^*= Prevalence of inpatient/outpatient conditional to need at age group i after pandemic
RR_i= Relative Risk

P_i was estimated using the National Demographic and Health Survey 2017 (NDHS). The decline in prevalence was based on a survey by Ulep et al (2021).

The RR of delay or missed care on all-cause mortality is based on epidemiologic study by McQueenie et al (2019): https://bmcmedicine.biomedcentral.com/articles/10.1186/s12916-018-1234-0

The mortality attributed to decline in hospitalization or outpatient visit could be estimated by multiplying the PIF with all-cause mortality.

$$ID_i = PIF_i \ x \ Mor_i$$

Where:
ID_i=indirect deaths due to decline in healthcare at age group i
Mor_i=all-cause mortality at age group i
The YLL due to indirect health effects then can be calculated using the formula:

$$YLL_i = \frac{IDD_i\,(1 - e^{-rL})}{r}$$

The same process can be used to obtain the YLD due to indirect health effects. I just substituted all-cause mortality with total YLD from Institute for Health Metrics and Evaluation (IHME).

The cost of DALYs can obtained by multiplying the DALYs with NHGDP per capita (GDP per capita-health expenditure per capita).