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Direct and indirect **effects of the COVID-19 pandemic** and response in South Asia

Commissioned by

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for every child

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This report was commissioned by UNICEF and was implemented by SickKids, Center for Global Child Health, to evaluate the direct and indirect effects the COVID-19 pandemic in South Asia.

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Content

Foreword

Over recent decades, South Asia has made remarkable progress in improving the health of mothers and children. Access to life-saving interventions has been expanded, and so millions of needless deaths have been prevented.
The year 2020 brought a great shock to South Asia, as it did to the whole world. The COVID-19 pandemic has had major and multiple impacts – both direct and indirect.

One of the critical indirect impacts has been severe disruptions to the delivery and use of routine services, including essential health and nutrition services. Health systems, which were already stretched in many parts of the region, were not ready to adjust swiftly to the shock. Women and children suddenly faced limitations in accessing facilities. The region saw significant drops in the use of both preventive and curative services. As detailed in this report, Direct and indirect effects of the COVID-19 pandemic in South Asia, the pandemic has undoubtedly resulted in more deaths and more illness – particularly for the most vulnerable women and children. The pandemic is also reversing the development gains made over recent years and risks a negative impact on the overall wellbeing of the population for years to come. It reduces the likelihood of achieving the Sustainable Development Goals.

In South Asia, millions have fallen sick from COVID-19, costing thousands of lives and costing countries billions of dollars. The basic public health tools are key – starting with physical distancing, hand washing, and mask wearing. This report computes the potential to save lives and minimize health care costs by further strengthening the implementation of these across the region.

COVID-19 is likely to remain a significant public health problem for some time. Governments need to achieve a difficult balancing act. They need to continue combatting the pandemic, whilst also minimizing the disruption of the economy and of critical health and other services. This is crucial for the health and well-being of the most vulnerable people. Evidence to help guide this balancing act is urgently required to help guide decisions on how to calibrate COVID-19 mitigation measures.

UNICEF has a mandate to be a voice for every woman and child. In line with this, and to address the critical need for actionable information, we commissioned this study to assess and report on the direct and indirect effects of the COVID-19 pandemic and response. The study focuses on the six most populous countries in South Asia: Afghanistan, Bangladesh, India, Nepal, Pakistan and Sri Lanka. This report will be of value for policy makers, program managers and other stakeholders in prudently fighting the pandemic while increasing the reach to women and children with quality services.

This report is also a call for action. It is a call to governments and to partners. We must urgently come together to address the imperative for focused investment and effort – to strike the difficult balance in the months and years ahead, for the sake of the region's most vulnerable women and children.

Sun Ah Kim
Deputy Regional Director
UNICEF Regional Office for South Asia

Chapter 1: **Background**

The SARS-CoV-2 pandemic and the global response to limit its spread and mortality from COVID-19 has been unprecedented, both in terms of a global health crisis, as well as measures that have been undertaken by countries around the world to combat its spread, including those in South Asia. Response has ranged from physical distancing measures and school closures to travel restrictions and nationwide lockdowns, which has resulted in reduced access to essential healthcare services and wide-ranging disruption of economic activities. As of February 2021, South Asia, which includes Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, India, Pakistan and Sri Lanka, has reported more than 12 million cases of COVID-19, with the vast majority being in India, which has reported more than 10.9 million cases (Figure 1) .

In addition to the direct impact of SARS-CoV-2 in terms of morbidity and mortality, there is growing concern in the global public health community about the extent and scope of the indirect effects COVID-19 pandemic and response on the health, nutrition and social well-being of vulnerable populations in resource-limited settings, especially women and children.

Evidence from past crises, such as the 1997 East Asian financial crisis, the 2008 global financial, and food price increase crises, and the 2013 – 16 Ebola outbreak in West Africa, underscore the vulnerability of these populations and the need for definitive and swift action aimed at alleviating the indirect impacts of the COVID-19 pandemic (2-5).

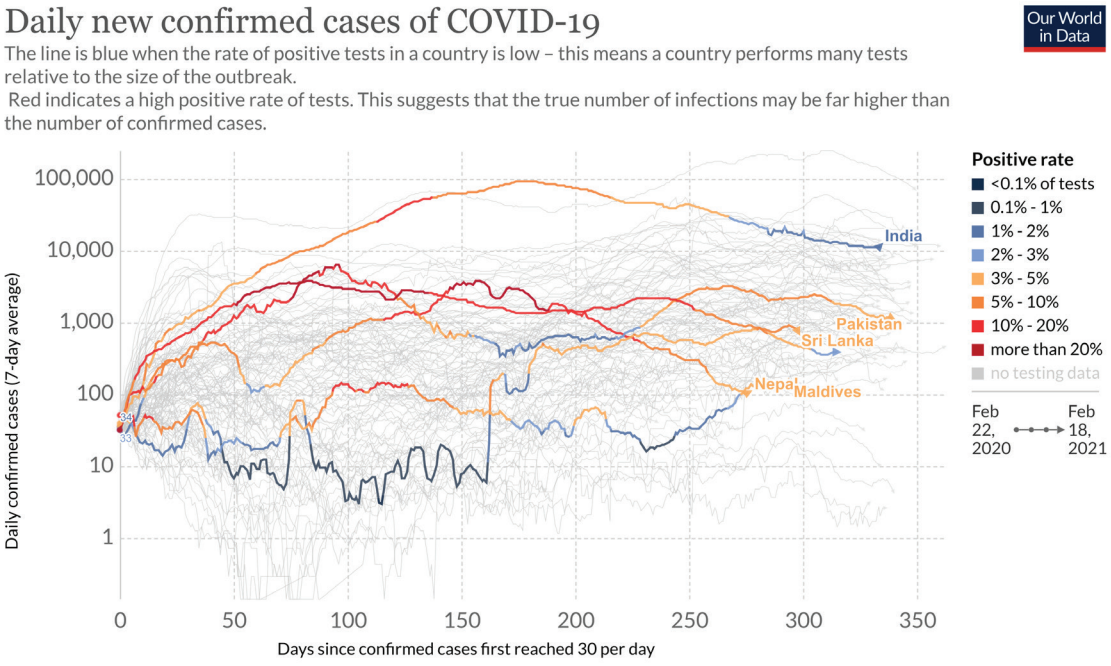

Figure 1: Cumulative confirmed COVID-19 cases and test positivity rate using the log scale, in South Asia

South Asia is home to more than 1.8 billion people, with 1 in 10 living below the international poverty line of US$1.90 and accounting for a third of the global income poor (6). The region also struggles with poor population health and nutrition, educational attainment, and social well-being. South Asia experienced 1.5 million under-5 deaths in 2018, a number that was second only to Sub-Saharan Africa (7). One in three children under five years of age in the region are stunted, and 15% are wasted (7). Furthermore, less than half of pregnant women 15-49 years receive ≥ 4 antenatal care visits (7). However, these aggregate figures obscure the inequities that exists within the region. Country-specific estimates for selected sexual and reproductive, maternal, neonatal, and child health (SRMNCH) indicators are presented in Table 1.

Table 1: Country-specific estimate for selected SRMNCH indicators in South Asia

Selected SRMNCH indicators	AFG	BGD	BTN	IND	MDV	NPL	PAK	SLK
Children received 3 dose of pentavalent vaccine (DPTHepB-Hib)	66	98	97	89	99	91	75	99
Women who received ≥ 4 antenatal care visits	21	47	85	51	82	69	51	93
Women who delivered in health facilities	48	37	74	79	95	57	66	100
Caesarean sections performed in the facilities	7	33	12	17	40	9	22	32
Newborns who received postnatal health check	19	52	30	27	82	58	64	-
Demand for family planning satisfied with modern methods	42	73	85	67	43	56	49	74
CMAM program* (8)	1.5	0	0	0	NA	14.7¥	2.8£	0

All figures are percentages
AFG: Afghanistan; BGD: Bangladesh; BTN: Bhutan; IND: India, MDV: Maldives; NPL: Nepal; PAK: Pakistan; SLK: Sri Lanka
Source: UNICEF Global Databases
*Data for illustrative purposes only. ¥11 of 75 districts have CMAM programs running; £Coverage only available for Khyber Pakhtunkhwa

Similar to other countries in the world, those in South Asia instituted swift and stringent mitigation responses including sweeping lock-down and stay-at-home orders, in March and April 2020. Since then, most countries in South Asia have eased the most severe restrictions, but some, such as school closures, are still in place.

Figure 2 illustrates the composite stringency index for several countries in South Asia from the outset and the current situation. The index, rescaled from 0 – 100, measures the severity of government response across nine indicators, including closure of businesses and schools, and travel restrictions (9).

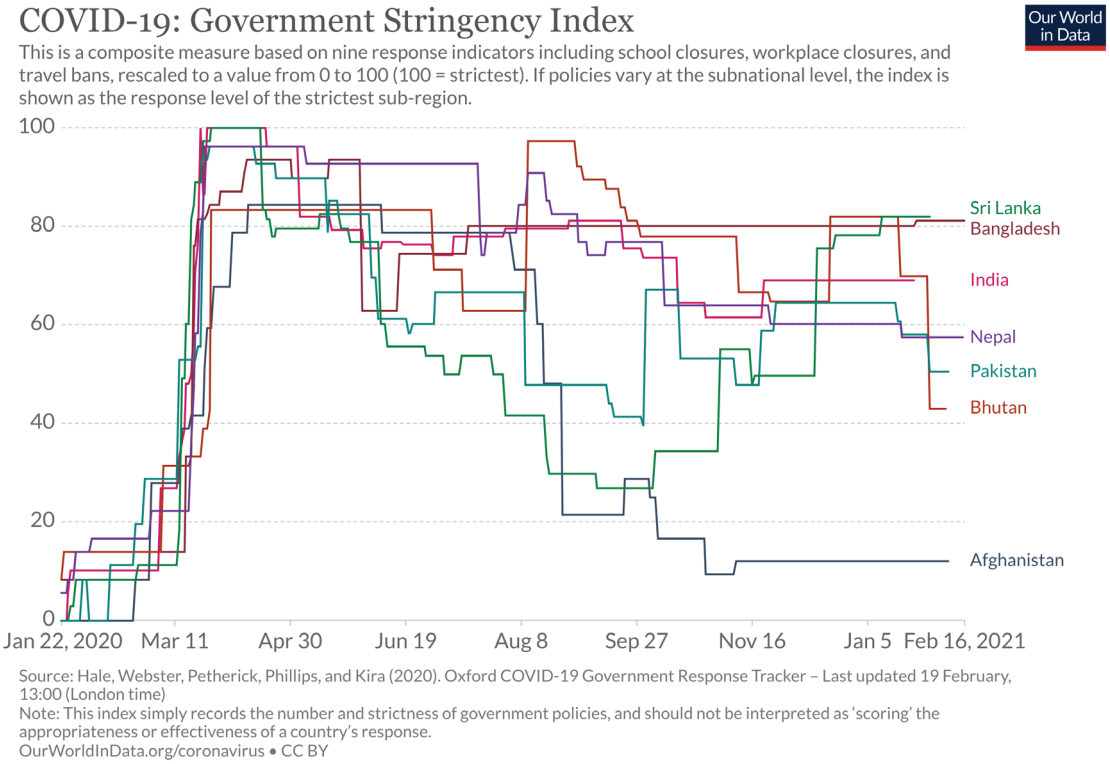

Figure 2: Severity of COVID-19 mitigation response in South Asia

Interruption of essential services is an expected consequence of movement restrictions and closure of services, and were recognized at an early stage of the crisis and COVID-19 mitigation measures. It was anticipated that reduced access to family planning services in low- and middle-income countries (LMICs) could lead to millions of unintended pregnancies in the near future (10). A modelling study used the Lives Saved Tool (LiST) to highlight the potential indirect effects of the pandemic and the response to it on maternal and child mortality (11). According the authors' estimates, the disruption to health services provision and access and the rising food insecurity could lead to additional 253,500 – 1,157,000 child deaths and 12,200 – 56,700 maternal deaths, globally. As a result of these disruptions in South Asia, child mortality could potentially increase by 18 – 40% and maternal mortality by 14 – 52%, over the next year (11).

Given the challenges faced by South Asian countries prior to the current pandemic, the potential impact of COVID-19 pandemic response on the health and well-being of 1.8 billion people was a serious cause for concern. Governments in these countries would need to balance the need for controlling the pandemic within their borders, along with the impact cessation and/or disruption of critical primary health and other services could have on the health and well-being of the most vulnerable of their populations. Notwithstanding the aforementioned health effects, it was recognized that indirect effects of mitigation measures could be much greater than those related to disruption of health services alone. The pathways through which COVID-19 pandemic and response could indirectly impact maternal, child and adolescent health and well-being are presented in Figure 3.

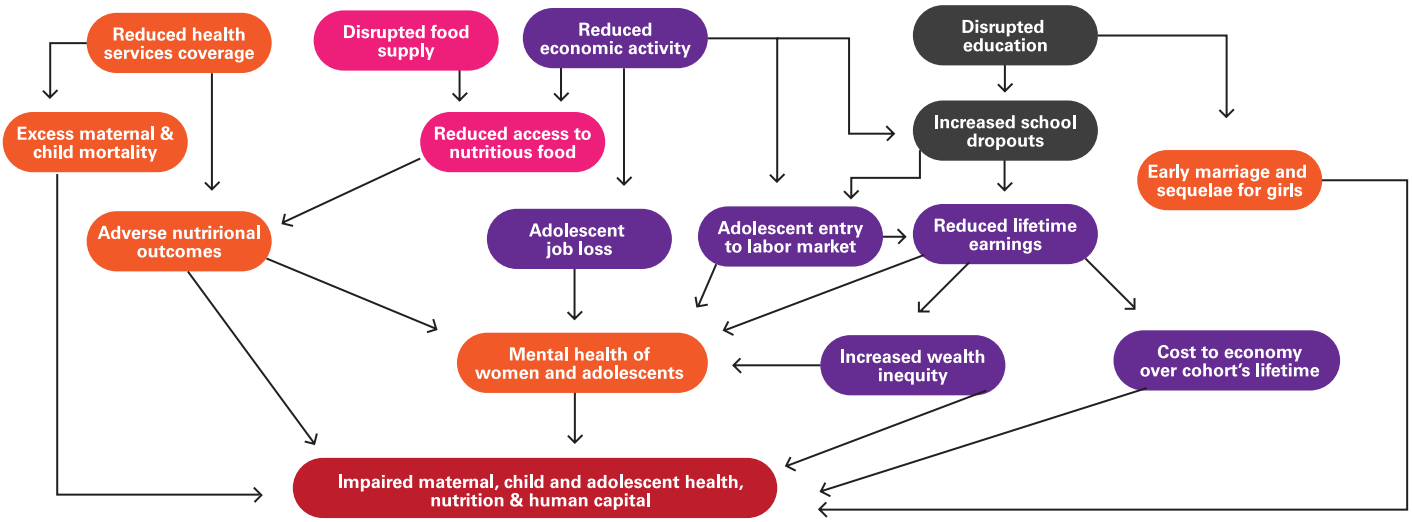

Figure 3: A conceptual framework for the indirect impact of COVID-19 pandemic and response on maternal, child and adolescent health and well-being

At this unprecedented time, governments need information that will help guide their decisions on when to ease/lift COVID-19 mitigation measures. To address this urgent issue, we conducted a series of modelling exercises to assess the expected mortality, hospitalizations and intensive care unit (ICU) admissions due to COVID-19 itself, as well as the impact of nationwide stay-at-home orders implemented to curb the spread of COVID-19 on maternal and child mortality, educational attainment of children, and general economy. We also estimated the potential benefits of mitigation strategies to address these anticipated multi-sectoral challenges focused on the six most populous countries in South Asia: Afghanistan, Bangladesh, Nepal, India, Pakistan and Sri Lanka.

Chapter 2: **Methods**

COVID-19 associated morbidity and mortality and forecasting

Model Structure

To evaluate the effects of public health interventions on COVID-19 and forecast its spread in South Asia, we conducted a simulation study using a computational stochastic individual contact model (ICM) based on an extension of the Susceptible-Infectious-Recovered (SIR) compartment model (12), which was used to provide initial projections for the burden of COVID-19 in Pakistan (13). This model comprises of seven compartments as illustrated in Figure 4 (see Supplementary Table 1 for further details). Three components are similar to SIR compartment model: The S compartment denotes susceptible individuals; the I compartment denotes symptomatic individuals who are both infected with COVID-19 and infectious to others; and the R compartment denotes individuals who have recovered from COVID-19 and are no longer infectious.

The SIR model was expanded with the addition of four compartments (E, Q, H, and F) to model both anticipated mitigating effects of public health intervention strategies as well as measurable impact on public health, and extended to September 2021. Unlike the E compartment in traditional SEIR models, the E compartment in our model denotes asymptomatic COVID-19-positive individuals who are infectious, in order to enable simulation of transmission during the COVID-19 incubation period, as reported by several investigators (14); the Q compartment represents symptomatic (or test-positive) infectious individuals who are self-isolating or in supervised isolation; the H compartment represents individuals who require hospitalization (if the number of required hospitalizations is below the hospital capacity, then it is assumed in the model that these individuals would be hospitalized, but if hospital capacity is exceeded then the excess portion of those requiring hospitalization remain not hospitalized, with consequently higher mortality for that fraction of cases); and the F compartment denotes case fatalities due to COVID-19.

Model parameters

Model parameters were populated using a combination of model calibration for a small subset consisting of four key parameters and choice of plausible values for the remaining ones (Supplementary Table 2). The four parameters chosen for calibration include the daily average number of exposure events involving symptomatic individuals, the probability of transmission by symptomatic cases, the daily hospitalization rate of symptomatic cases and the daily case fatality rate. Weekly totals of case fatalities, as recorded on the Covid-19 page of the Our World in Data (OWID) website (15) were the basis for the calibration, using the mean squared error

$$\mathrm{MSE}(\boldsymbol{\theta}) = \sum_{i=1}^{K} \left[F_i^{\mathrm{model}}(\boldsymbol{\theta}) - F_i^{\mathrm{obs}}\right]^2,$$

where $F_i^{\mathrm{model}}(\boldsymbol{\theta})$ is the total number of deaths simulated for the i^{th} week using the quadruple of parameters $\boldsymbol{\theta}$ for simulation, $i=1,\ldots,K$, $K=14$ is the number of weekly totals between June 1st and August 31st, 2020 (the time period used for calibration) and F_i^{obs} is the corresponding observed number of deaths recorded. Calibrated values for the four key parameters are then chosen to minimize the MSE,

$$\hat{\boldsymbol{\theta}} = \mathbf{argmin}_{\boldsymbol{\theta}} \mathrm{MSE}(\boldsymbol{\theta}),$$

namely where minimization was carried out using sequential Bayesian optimization based on the Expected Improvement criterion proposed by Jones et al (16).

National projections under the various interventions were then carried out running the simulation for one year out starting from September 1st, 2020, using the calibrated parameter values as well as the estimated number of symptomatic, asymptomatic and quarantined and recovered cases obtained at the end of the calibration period. The set of interventions included:

1. Smart lockdowns,
2. Use of face masks, and
3. Hand hygiene

All interventions were assumed to have been applied at present at the 25% adherence level, and the simulation study compared a baseline scenario – in which no further intervention was applied – to scenarios where one intervention at a time was raised to the 50% adherence level, as well as a combination off all different intervention applied at once.

The relative reductions in key inputs, as appearing in Supplementary Table 2, are presented in Table 3 below.

Table 3: Effect estimates for selected interventions aimed at reducing the relative risk of exposure and transmission of COVID-19 and other reparatory viruses

Intervention	Relative risk reduction in		Reference
	Exposure	Transmission	
Smart lockdowns vs. none	0.38 (0.01 - 0.56)		Adapted from Aleta et al (17)
Use of face masks		0.34 (0.26 - 0.45)	From Chu et al (18)
Hand hygiene		0.50 (0.38 - 0.66)	From Talaat M et al (19)
Physical distancing (≥ 1m vs. < 1m)		0.30 (0.20 - 0.44)	From Chu et al (18)
All numbers are relative reduction in risk with 95% CI			

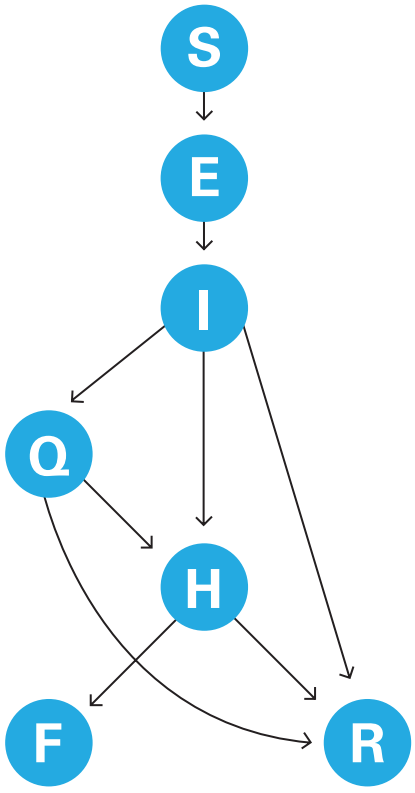

Figure 4: Transition diagram of the extended SIR compartment model. This figure illustrates the transitions between compartments denoted in each box: S - susceptible individuals; E - asymptomatic infectious patients; I - symptomatic infectious patients; Q – self-isolated infectious patients; H – patients requiring hospitalization; R – COVID-19 recovered patients; and F – case fatalities due to COVID-19.

Maternal and child mortality and nutrition

We used the Lives Saved Tool (LiST) and the Family Planning (FamPlan) modules of Spectrum to estimate the increase in maternal and under-5 child mortality, as well as pregnancies, rates of maternal anemia, childhood stunting and wasting, and SGA and LBW, resulting from reduced access and provision of essential SRMNCH services.

We used the most recent Demographic and Health Survey (DHS) and/or MICS from each country to determine baseline (2019) coverage of SRMNCH services. Level of disruption due to COVID-19 pandemic and response was estimated using actual country-specific data available from DHIS/HMIS dashboards. Where health systems data were not available, coverage disruption data were estimated using either a related country-level indicator, or average estimates from the other countries as proxy (Supplementary Table 3). Service disruption was estimated by quarter as follows:

- Compare DHIS/HMIS coverage data between Jan – Mar 2019 and Jan – Mar 2020 (Q1 levels)
- Compare DHIS/HMIS coverage data between Apr – Jun 2019 and Apr – Jun 2020 (Q2 levels)
- 2020 Q3 estimates: 50% recovery from Q2 levels
- 2020 Q4 estimates: 80% recovery from Q2 levels
- 2021 Q1 estimates: 10% increase from 2020 Q4 levels
- 2021 Q2 estimates: 20% increase from 2020 Q4 levels

The interventions included in the LiST and FamPlan modules, along with the estimated disruption to services by each quarter are summarized in Appendix A.

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School-age child and adolescent mortality

Mortality estimates for children aged 5-9, 10-14, and 15-19, stratified by sex, were extracted from the IHME GBD Results Tool (20). The causes of death for which data were extracted, and for which the impact of COVID-19 mitigation strategies are estimated, include:

- Road traffic accidents
- Maternal causes for females aged 15-19
- HIV/AIDS, TB, typhoid, and malaria

We assumed that the number of deaths would be distributed equally throughout the year. Therefore, the total number of deaths in each country, and for each age/sex category by cause of death were divided by 12 to estimate the expected number of deaths expected to occur each month.

A literature search was undertaken to identify either a) estimates of the impact of COVID-19 on these causes of death, or b) studies quantifying the impact on cause-specific mortality of certain interventions, from which we calculated an assumed impact on mortality that could be expected if these interventions were removed/unavailable. From this literature search, we identified six papers quantifying the effect of COVID-19 on vehicular injuries among adolescents (21-26). Of these, one study based in Turkey, gave estimates for the impact on adolescent mortality (26). From this, we assumed a distributional impact of COVID-19 on adolescent mortality whereby the first few months of 2020 saw no decrease as compared to previous years, March saw a 20% decrease as lockdown measures were slowly introduced, April and May saw the largest reduction of 60% as lockdowns were in full effect, with the impact gradually increasing back to expected levels by the end of the year.

To estimate the impact of COVID-19 on maternal mortality amongst 15-19 year-old females, we used the expected increase in maternal deaths from our country-specific LiST and FamPlan models. To quantify the impact of reduced treatment coverage on adolescent mortality due to communicable diseases, we use the effect estimated for same during the 2014 – 2015 Ebola outbreak in West Africa (27). Parpia and colleagues (27) calculated that a 50% reduction in treatment coverage in West Africa during the 2014-15 Ebola crisis would lead to a 48% increase in malaria deaths among adolescents in Guinea, a 53.6% increase in Liberia, and a 50% increase in Sierra Leone. Similarly, TB deaths would increase by 51.1%, 59%, and 61.4% in these three countries, respectively, while HIV/AIDS deaths would increase by 16.2%, 13.0%, and 9.1%, respectively. For deaths due to typhoid, we assumed a 30% mortality rate in the absence of any treatment (28). We scaled these estimated percentage increase in deaths by the reduction in facility-based deliveries calculated as part of our LiST analysis mentioned previously. For example, if a 50% decrease in treatment coverage resulted in a 48% increase in malaria deaths, then a 25% decrease in treatment coverage was assumed to result in a 24% increase in mortality. These estimates were used to calculate the expected number of deaths in adolescents by scaling the observed monthly deaths by each of the effect sizes mentioned above.

Educational attainment

The COVID-19 pandemic has forced school closures across the globe. In South Asia, this mitigation strategy has left 420 million children out of school. We assessed the potential impact of the COVID-19 pandemic on educational attainment of school-aged children in six South Asian countries, and its sequelae on individual earnings and national Gross Domestic Product (GDP). Loss in educational attainment can occur in multiple ways, such as loss of learning time or loss of already acquired learning due to school closures (29). However, we focus on the loss of educational attainment that will occur due to the increase in number of students who permanently drop out of school because of prolonged school closures.

We conceptualized the current cohort of children enrolled in primary and secondary schools using population estimates available from UNESCO (30), and net attendance ratios available from the most recent DHS, for each country (31-36). We used age- and quintile-specific school dropout rates (Table 4), adapted from those observed during the 1997 East Asian financial crisis in Indonesia (37).

Table 4: School dropout rates by child age, gender, and wealth quintile

Child characteristic	Primary school (7 - 12 years)	Secondary school (13 - 19 years)
Wealth quintile		
1st	6.2	11.3
2nd	0	4.5
3rd	2.4	2.3
4th	1	2.2
5th	1	2.2
Gender		
Male	2.4	5.6
Female	2.6	3.9
Adapted from Frankenburg et al (37)		

We assumed that those who drop out in primary school would complete 2.5 years, and those who drop out in secondary school would complete 8.5 years of education. The corresponding years of education lost were calculated based on the highest median years of education attained, irrespective of age and gender, for each country (Table 5). We estimated income loss associated with reduced educational attainment by assuming that one less year of primary and secondary education reduces an individual's income by 4.04% and 2.44%, respectively (38). The 2019 GDP per capita, in current US$, for each country was assumed as baseline. A discount rate of 3% was applied to calculate the present value of loss in lifetime earnings.

Table 5: Median years of education completed by age and gender in six South Asian countries

Country	Age category	Gender	Median years of schooling*	Years of schooling lost	
				Primary	Secondary
Pakistan	20 – 24 years	Male	7.7	5.2	0
Bangladesh	15 – 19 years	Female	8.3	5.8	0
India	20 – 24 years	Male	10	7.5	1.5
Nepal	20 – 24 years	Male	9.1	6.6	0.6
Afghanistan	20 – 24 years	Male	7.3	4.8	0
Sri Lanka	20 – 24 years	Female	11.4	8.9	2.9
Source: Most recent country DHS (31-33, 35, 36, 39) *Assumed for both boys and girls currently enrolled in school					

To address uncertainty around school dropout rates, we also conducted sensitivity analyses using school dropout rates observed during the Ebola crisis in Guinea (40) and Sierra Leone (41). We also conducted sensitivity analysis to address the uncertainty around the economic impact of reduced educational attainment, using an 8% return per year for education, as used by Psacharopoulos et al (42).

Early marriage and adolescent pregnancies

We also estimated the expected number of girls who will drop out of school as a result of the pandemic, using gender-specific school dropout rates observed during the 1997 East Asian financial crisis in Indonesia (37). Dropping out of school is associated with early marriage, especially for girls (43). There is also evidence that number of adolescent pregnancies have increased during the past few months of school closures (44). We used the baseline prevalence of adolescent pregnancies reported in the most recent DHS for each country (31-33, 35, 36, 39), and assumed that adolescent pregnancy rates will increase by 28% as a result of school closures due to COVID-19 pandemic response (44). We assumed that although risk of maternal mortality in adolescent pregnancies will be the same as those observed for women > 19 years (45), risk of neonatal mortality and low birthweight births will increase by 9% and 42%, respectively (46). We also assumed that 20% of children born with low birthweight will be stunted by age 2 years (47), and will lose 10% of their lifetime earnings as a result of their short stature (48).

Economic Impact of COVID-19 control measures

Measures to control the spread of COVID-19 have resulted in wide-ranging disruption of economic activities across the globe. We estimated the economic impact of these strategies on the following outcomes:

1. Change in GDP
2. Job losses
3. Change in poverty rate
4. Change in proportion of population who is food insecure

Given the dynamic nature of the epidemic and the lag in production of many economic inputs, we assumed that the model will be static in nature (i.e. output, employment and poverty will not be an exponential function of ongoing changes per time period, but a function of change from the period prior to the beginning of the epidemic) and as a result may be less sensitive than a fully dynamic model.

The severity of control measures was classified as follows:

- Stage 0 – Baseline: No changes
- Stage 1 – Limited: Warnings/advisories, public gatherings ban, social distancing, schools closures
- Stage 2 – Mild: Closure of shopping areas, imports/exports reduced
- Stage 3 – Moderate: Closure of restaurants, public transport reduced, imports/exports reduced to essential
- Stage 4 – Severe: Closure of parks, public transport closed, all trading restricted

To estimate the impact of the different stages of control measures on output (GDP) we deconstructed output into labor and non-labor related outputs (interest on loans, debt repayment, bonds, etc.).
Our model estimated changes in labor-related output only, as this is the area most likely to be affected by the COVID-19 control measures, leading to reduced capacity of workplaces, factories etc.

The starting point for this part of the model was to estimate the proportion of output (GDP) that is derived from labor-based productivity. Most sets of national accounts highlight this by producing output by sector. Given that we wanted to link output, workforce, capacity, and relative risk of unemployment and proportion of households vulnerable to poverty (relative likelihood of falling into poverty if the primary provider loses income for more than a month), we settled on the following sectors:

1. Agriculture and fisheries,
2. Mining and quarrying,
3. Manufacturing and textiles,
4. Energy generation,
5. Construction,
6. Wholesale and retail trade,
7. Transport and communications,
8. Finance and insurance services,
9. Other private sector and government services

Workforce was estimated by working age population, labor force participation rate, and formal and informal sector worker estimates from the International Labour Organization (ILO). Job losses leading to increase in poverty rates were estimated using the methodology described by Iqbal et al (49). The proportion of labor force laid off at each stage of COVID-19 control measures, is summarized in the table below.

The output model was based on marginal rate of productivity per worker (MPW) as a function of output and workforce data from Jan – Dec 2019.

It was estimated under the following caveats or assumptions:

- No change in stock of capital, or the marginal rate of return on capital (or land)
- No technological advancement/change leading to a rise in relative rate of productivity per worker hour
- Exclude any effects of economies of scale or specialization on changes in MPW, earnings or GDP
- Within the same industry, marginal productivity in worker A will not be affected by the marginal productivity of worker B
- Across industries, marginal productivity of any workers in industry A will not be affected by changes in the marginal productivity of a worker in industry B
- A perfectly competitive market where marginal productivity = marginal cost
- Mitigation strategies will be in place for 12 months, with the impact on outcomes estimated for the same period

Given limited data from other countries and to determine the pandemic's impact on food insecurity, we assessed the relationship between change in household income and food consumption in the previous week as observed in Nepal in April 2020 (51), using a simple linear regression. We then applied the results of this regression to the estimated change in GDP resulting from each stage of mitigation strategies, and assessed the rise in the proportion of population who could become food insecure due to the COVID-19 mitigation response.

Table 6: Labor force laid off by at each mitigation stage, by industry

Industry	Limited Restrictions	Mild Restrictions	Moderate Restrictions	Severe Restrictions
Agriculture	0%	10%	15%	20%
Manufacturing	10%	35%	53%	70%
Electricity & gas	0%	5%	8%	10%
Construction	0%	45%	68%	90%
Wholesale & retail trade	10%	35%	53%	70%
Transport, storage & communications	10%	45%	68%	90%
Finance & insurance	0%	25%	38%	50%
Other private	11%	36%	54%	73%
Government services	17%	20%	30%	40%

Adapted from: Faraz and Khalid, 2020 (50)


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Chapter 3: **Results**

COVID-19 predicted morbidity and mortality

Based on the results of our extended SIER model, and a potential status quo in infection control and prevention measures, an additional half a million deaths due to COVID-19 are possible in South Asia, between October 2020 and September 2021, (Table 7). This is the number of individuals expected to die of COVID-19, and who likely would not have died in the absence of the pandemic i.e. additional deaths. The highest number of deaths are expected occur in India, with more than 490,000 deaths projected to occur in the country during this period.

Not surprisingly, the expected number of hospitalizations and ICU admission are also expected to be highest in India, with the numbers expected to rise to their highest level in February 2021 (Table 7).

Results for individual mitigations strategies are presented in Appendix B.

Since the observed number of COVID-19 cases and deaths are rising most rapidly in India, compared to other South Asian countries, the impact of modelling the increased coverage and effectiveness of mitigation strategies is also highest in the country (Table 7). Instituting all mitigation strategies could reduce the numbers of deaths due to COVID-19 by 83% (491,117 deaths under the no-additional mitigation scenario vs. 85,821 deaths if all strategies were instituted; Table 7). Similar effects are also noted for hospitalizations and ICU admissions, both of which are expected to decrease by 75% in February 2021, if all mitigation strategies are instituted (Table 7). Results for individual mitigation strategies are presented in Appendix B.

Table 7: Estimated number of COVID-19 deaths, hospitalizations and ICU admissions, by mitigation response and country

Intervention		No additional mitigation			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations*	ICUs*	Cumulative Deaths	Hospitalizations*	ICUs*
India	Sep-20¥	65,228	NA	NA	65,228	NA	NA
	Oct-20	103,994	67,613	11,932	64,676	12,821	2,262
	Nov-20	139,937	76,074	13,425	71,214	9,104	1,607
	Dec-20	178,008	82,772	14,607	75,781	6,354	1,121
	Jan-21	222,202	87,896	15,511	78,916	4,283	756
	Feb-21	267,186	88,209	15,566	81,267	3,079	543
	Mar-21	307,089	84,831	14,970	82,653	2,141	378
	Apr-21	348,060	77,316	13,644	83,721	1,580	279
	May-21	383,795	70,447	12,432	84,526	1,048	185
	Jun-21	418,121	61,320	10,821	85,050	721	127
	Jul-21	445,995	52,311	9,231	85,412	538	95
	Aug-21	470,231	43,937	7,754	85,658	383	68
	Sep-21	491,117	36,442	6,431	85,821	215	38

Intervention		No additional mitigation			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations*	ICUs*	Cumulative Deaths	Hospitalizations*	ICUs*
Pakistan	Sep-20¥	6,298	NA	NA	6,298	NA	NA
	Oct-20	7,374	398	70	7,332	391	69
	Nov-20	7,400	351	62	7,354	295	52
	Dec-20	7,409	404	71	7,361	227	40
	Jan-21	7,423	465	82	7,366	174	31
	Feb-21	7,434	503	89	7,369	147	26
	Mar-21	7,446	552	97	7,372	149	26
	Apr-21	7,464	522	92	7,377	140	25
	May-21	7,473	487	86	7,385	120	21
	Jun-21	7,481	450	79	7,388	114	20
	Jul-21	7,487	380	67	7,388	129	23
	Aug-21	7,499	332	59	7,388	118	21
	Sep-21	7,507	294	52	7,390	140	25
Bangladesh	Sep-20¥	4,281	NA	NA	4,281	NA	NA
	Oct-20	5,086	444	78	4,973	466	82
	Nov-20	5,905	427	75	5,839	432	76
	Dec-20	6,656	316	56	6,623	370	65
	Jan-21	7,266	341	60	7,335	323	57
	Feb-21	7,892	298	53	7,940	271	48
	Mar-21	8,378	268	47	8,345	250	44
	Apr-21	8,840	191	34	8,838	229	40
	May-21	9,209	193	34	9,253	187	33
	Jun-21	9,564	176	31	9,614	165	29
	Jul-21	9,863	171	30	9,916	162	29
	Aug-21	10,159	139	25	10,217	124	22
	Sep-21	10,412	110	19	10,462	96	17
Nepal	Sep-20¥	228	NA	NA	228	NA	NA
	Oct-20	424	65	12	422	57	10
	Nov-20	499	50	9	487	46	8
	Dec-20	555	38	7	536	33	6
	Jan-21	596	30	5	573	28	5
	Feb-21	629	23	4	602	21	4
	Mar-21	654	19	3	625	16	3
	Apr-21	675	15	3	644	13	2
	May-21	690	12	2	659	9	2
	Jun-21	703	8	1	670	8	1
	Jul-21	711	7	1	678	6	1

Intervention		No additional mitigation			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations*	ICUs*	Cumulative Deaths	Hospitalizations*	ICUs*
Nepal	Aug-21	717	5	1	686	5	1
	Sep-21	723	5	1	691	4	1
Afghanistan	Sep-20¥	1,406	NA	NA	1,406	NA	NA
	Oct-20	2,306	442	78	2,157	326	58
	Nov-20	2,850	426	75	2,607	305	54
	Dec-20	3,354	406	72	3,015	288	51
	Jan-21	3,885	378	67	3,455	273	48
	Feb-21	4,375	359	63	3,849	251	44
	Mar-21	4,807	349	62	4,204	248	44
	Apr-21	5,230	323	57	4,565	241	42
	May-21	5,638	311	55	4,910	236	42
	Jun-21	6,075	291	51	5,259	218	38
	Jul-21	6,453	266	47	5,552	201	35
	Aug-21	6,802	241	42	5,825	185	33
	Sep-21	7,106	237	42	6,094	177	31

¥Number of deaths observed as of September 1, 2020. Source: Our World in Data (15)
*Numbers are "snapshots" taken on the 1st of every month, indicating healthcare utilization over time

The direct costs associated with COVID-19 hospitalizations and ICU admissions are commensurate with their observed and expected numbers for each country. We estimated the direct costs as follows:

- Costs of diagnostic tests, assumed to be US$ 20 (52)
- Healthcare utilization costs associated with COVID-19 mortality, assuming a 16 days' stay in the hospital, including ICU admission, and cost of care assumed to be US$ 4,708 (53-55)

To date, the disease is estimated to have cost the region more than US$ 2.4 billion, including cost of testing (US$ 1.9 billion) and healthcare utilization for COVID-19 deaths (US$ 581 million). If the current status quo in terms of testing, and infection control and prevention, is maintained, the region is expected to spend an additional US$ 8.1 billion on COVID-19 diagnostic tests, and between US$ 520 million and US$ 2.4 billion on healthcare utilization by September 2021, depending on the level of mitigation response instituted. India is expected to bear the largest share of these costs with the country having to spend more than US$ 7.8 billion on testing, and US$ 1.7 billion on healthcare utilizations due to COVID-19 infections leading to death by September 2021. Table 8 summarizes the estimated costs associated with COVID-19 diagnostic tests and healthcare utilization until September 2021.

Although there will be costs associated with implementing COVID-19 mitigation strategies, such as households having to spend money out-of-pocket purchasing masks and hand sanitizers, these cannot be measured with any specificity. However, any costs associated with increased use of masks and hand sanitizers will likely be much lower than what countries will spend on COVID-19 healthcare utilization.

Table 8: Estimated costs (US$) of COVID-19 testing, and healthcare utilization, by mitigation response and country

Country	Testing*	No additional mitigation	Hand Hygiene	Smart Lockdowns	Masks	All strategies
India	7,895,416,016	2,312,178,836	659,011,716	1,188,388,652	845,015,380	404,045,268
Pakistan	87,407,669	35,342,956	34,396,648	33,464,464	34,095,336	34,792,120
Bangladesh	78,182,660	49,019,696	49,010,280	48,544,188	48,878,456	49,255,096
Nepal	26,757,389	3,403,884	3,323,848	3,342,680	3,370,928	3,253,228
Afghanistan	NA	33,455,048	29,975,836	32,249,800	31,468,272	28,690,552
Total	**8,087,763,734**	**2,433,400,420**	**775,718,328**	**1,305,989,784**	**962,828,372**	**520,036,264**

All figures are in US$
No testing data available for Afghanistan
*Testing is assumed to continue at the current level

Maternal and child mortality and nutrition

Even before the World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020, coverage of essential SRMNCH services were being affected in several countries of South Asia. The SRMNCH services for which actual DHIS/HMIS data were available for all countries are summarized in Panel 1.
Based on actual data available from country-specific health data systems, coverage of family planning services decreased by 3 – 31% in five of the six South Asian countries included in our analysis (Figure 5) in the first quarter of 2020, compared to that observed during the same period in 2019. Afghanistan is the only country which reported an increase in coverage family planning services over this period, which could be questioned as erroneous (^12%, Figure 5).

In the second quarter of 2020, which corresponds with the most stringent COVID-19 control strategies being instituted in the region, coverage of all essential SRMNCH services declined substantially, with coverage of most services reducing by >50% across South Asia (Figure 5), compared to levels observed during the same period in 2019.

Panel 1: SRMNCH services included and modelled in the LiST analysis

Family planning
Antenatal care (4+ visits)
Tetanus Toxoid (2 or more doses)
Facility births
Postnatal visit within 2 days after birth
Vaccine: DPT3/Penta3
Full immunization
Zinc for treatment of diarrhea – Zinc Supplementation
Antibiotics for pneumonia
SAM- treatment for severe acute malnutrition

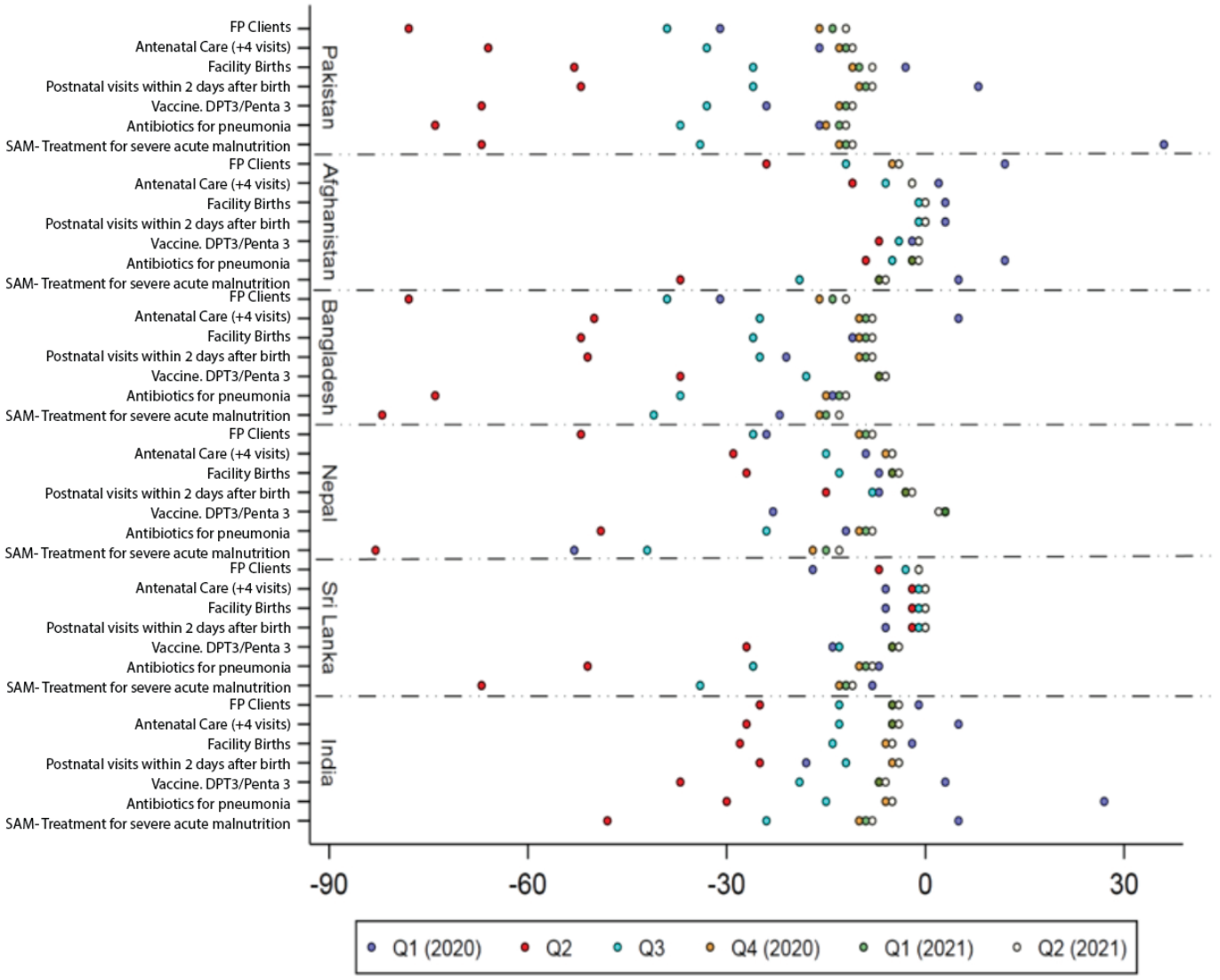

Figure 5: Observed (Quarter 1 and 2) and estimated (Quarter 3 and 4 of 2020, and Quarter 1 and 2 of 2021) coverage disruption of selected SRMNCH services in 2020 and 2021, due to the COVID-19 pandemic response in South Asia

The observed and estimated disruption in SRMNCH services is expected to have had a substantial impact on maternal and child mortality. The number of deaths among children < 5 years are estimated to increase by a total of 228,641 across the six South Asian countries in 2020 compared to the previous year, with 134,789 of these deaths expected to occur in the neonatal period. The greatest increases are anticipated in India (154,020, 15% increase) and Pakistan (59,251, 14% increase) respectively.

The number of stillbirths are also predicted to increase in the region. Across South Asia as a whole, an estimated 89,434 additional stillbirths are anticipated as a result of reduced coverage of essential SRMNCH services. At the country-level, the largest increase in the number of stillbirths is expected in India (60,179, 10% increase), followed by Pakistan (39,752, 11% increase) and Bangladesh (5,502, 3% increase). Similarly, the number of maternal deaths is also expected to increase in 2020 as a result of the COVID-19 pandemic response, compared to those observed in 2019, with the highest number of deaths anticipated in India (7,750, 18% increase) and Pakistan (2,069, 21% increase). Due to the observed and expected reduction in coverage of modern contraceptive methods, more than 3.5 million additional unintended pregnancies are expected in South Asia, with the highest number likely in India (~3 million).

The number of unsafe abortions are also expected to increase in the region, by more than 50%. Overall in South Asia, child and maternal mortality is expected to increase by 14% and 16%, respectively. Table 9 summarizes the estimated increase in maternal and under-5 child mortality, and pregnancies, for each country by each quarter of 2020.

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Table 9: Estimated increase in deaths, pregnancies and abortions by country and quarter of 2020

	2020*	Afghanistan	Bangladesh	India	Nepal	Pakistan	Sri Lanka	Overall
Child mortality	Q1	-0.6%	5.0%	0.0%	6.2%	3.2%	16.9%	16.9%
	Q2	2.8%	29.3%	39.3%	12.8%	33.2%	5.1%	5.1%
	Q3	2.0%	13.0%	16.8%	7.1%	16.6%	1.9%	1.9%
	Q4	1.5%	4.7%	5.7%	1.0%	5.0%	0.5%	0.5%
	Overall	**1.4%**	**13.0%**	**15.4%**	**6.8%**	**14.5%**	**6.1%**	**6.1%**
Neonatal mortality	Q1	0.2%	4.4%	2.2%	2.6%	1.2%	24.3%	24.3%
	Q2	2.3%	22.3%	36.5%	16.6%	39.1%	2.5%	2.5%
	Q3	1.7%	9.6%	14.8%	9.8%	20.2%	0.8%	0.8%
	Q4	1.4%	3.4%	4.5%	1.5%	5.4%	-0.1%	-0.1%
	Overall	**1.3%**	**9.9%**	**14.5%**	**7.6%**	**16.5%**	**6.9%**	**6.9%**
Stillbirths	Q1	0.5%	1.2%	1.1%	1.1%	0.8%	51.7%	51.7%
	Q2	1.8%	8.8%	26.7%	14.1%	23.6%	3.0%	3.0%
	Q3	1.5%	2.7%	10.6%	11.1%	16.4%	1.1%	1.1%
	Q4	1.3%	0.7%	2.9%	0.4%	2.3%	0.0%	0.0%
	Overall	**1.3%**	**3.4%**	**10.3%**	**6.7%**	**10.8%**	**14.0%**	14.0%
Maternal deaths	Q1	0.0%	1.6%	-1.6%	6.1%	2.3%	77.2%	77.2%
	Q2	3.3%	24.7%	47.1%	34.4%	47.5%	5.4%	5.4%
	Q3	2.2%	8.3%	18.7%	23.4%	30.1%	2.2%	2.2%
	Q4	1.5%	2.9%	6.0%	3.0%	5.2%	1.1%	1.1%
	Overall	**1.7%**	**9.4%**	**17.6%**	**16.7%**	**21.3%**	**21.5%**	**21.5%**

	2020*	Afghanistan	Bangladesh	India	Nepal	Pakistan	Sri Lanka	Overall
Additional unintended pregnancies	Q1	-2,747	28,873	18,780	2451	14722	2,708	2,708
	Q2	2,567	96,536	2,237,563	11,434	176,453	2,806	2,806
	Q3	518	40,409	622,372	2,901	41,299	1,405	1,405
	Q4	-555	13,956	201,488	-254	2,504	630	630
	Overall	**-217**	**179,774**	**3,080,202**	**16,531**	**234,978**	**7,548**	**7,548**
Additional unsafe abortion	Q1	-7.8%	20.6%	15.3%	26.0%	3.0%	14.1%	14.1%
	Q2	14.5%	58.0%	200.1%	61.8%	52.8%	8.2%	8.2%
	Q3	6.8%	26.6%	74.7%	28.5%	19.6%	4.1%	4.1%
	Q4	2.3%	10.2%	27.4%	10.6%	6.3%	1.8%	1.8%
	Overall	**3.9%**	**28.9%**	**79.4%**	**31.7%**	**20.4%**	**7.1%**	**7.1%**

*Compared to 2019

Compared to 2019 levels, we did not observe a significant impact on child nutrition as measured by changes in rates of childhood wasting and stunting, and SGA and LBW, in 2020 (Supplementary Table 4). This is likely due to low rates of current coverage of many key interventions related to community management of moderate and severe malnutrition and food supplementation. However, based on LiST estimates, rates of maternal anemia increased in Q2 of 2020, corresponding to the largest disruption in coverage of essential health services.

Table 10: Increase in rates of maternal anemia in Q2 2020, compared to 2019, by country

	Afghanistan	Bangladesh	India	Nepal	Pakistan	Sri Lanka
Pregnant women with IDA	2.1%	11.2%	2.3%	20.7%	4.8%	2.0%
Pregnant women with anemia	4.4%	22.8%	5.0%	40.8%	11.0%	3.2%

IDA: Iron deficiency anemia

We also assessed the impact of essential SRMNCH services coverage recovery in Q1 and Q2 of 2021. Given the current state of the pandemic in India (the major population driver) and continued gradual upsurges in other countries of the region, we have used conservative estimates for recovery in anticipation of the persisting COVID-19 challenge in 2021, potentially until an effective vaccine is deployed and widely available. We assumed 10-20% pragmatic increase in service coverage across the continuum of SRMNCH interventions in the first half of 2021, the end-date of the current modelling exercise.

If service coverage improved by 10% in Q1 2021, and 20% in Q2 2021, compared to their Q4 2020 levels, an additional 537 child deaths (0.1% increase), but 97 fewer maternal deaths (0.3% decrease) are expected in the region. Nepal and Sri Lanka are expected to see a decrease in child deaths in both Q1 and Q2 of 2021, whereas Bangladesh, India and Sri Lanka are expected to have fewer maternal deaths in Q1 and Q2 of 2021, compared to those observed in 2019. However, number of unintended pregnancies are still expected to be higher in 2021, compared to those observed during the same period in 2019. This is plausible given the lag period between restitution of family planning services and reduction in unwanted pregnancies.

Table 11 summarizes the estimated impact on maternal and child mortality, and pregnancies, for each country for first two quarters of 2021.

Table 11: Estimated increase in deaths, pregnancies and abortions by country and quarter of 2021

	2021*	Afghanistan	Bangladesh	India	Nepal	Pakistan	Sri Lanka	Overall
Child mortality	Q1	2.7%	0.1%	0.1%	-0.3%	0.5%	-1.2%	0.3%
	Q2	2.7%	-0.4%	-0.4%	-0.3%	-0.1%	-1.3%	-0.2%
	Overall	**2.7%**	**-0.2%**	**-0.2%**	**-0.3%**	**0.2%**	**-1.2%**	**0.1%**
Neonatal mortality	Q1	3.6%	-0.4%	-0.4%	0.1%	0.4%	-1.0%	0.0%
	Q2	3.6%	-0.8%	-0.8%	0.1%	-0.2%	-1.0%	-0.4%
	Overall	**3.6%**	**-0.6%**	**-0.6%**	**0.1%**	**0.1%**	**-1.0%**	**-0.2%**
Stillbirths	Q1	3.6%	-0.2%	-0.2%	0.3%	0.7%	-1.0%	0.2%
	Q2	3.6%	-0.3%	-0.5%	0.3%	0.5%	-1.1%	-0.1%
	Overall	**3.6%**	**-0.2%**	**-0.3%**	**0.3%**	**0.6%**	**-1.0%**	**0.0%**
Maternal deaths	Q1	3.6%	-0.2%	-0.5%	-1.3%	0.6%	-1.1%	0.0%
	Q2	3.6%	-1.4%	-1.0%	0.1%	0.1%	-1.1%	-0.5%
	Overall	**3.6%**	**-0.8%**	**-0.7%**	**-0.6%**	**0.3%**	**-1.1%**	**-0.3%**
Additional unintended pregnancies	Q1	6,536	6592	41151	2533	17399	61	74271
	Q2	6,472	4373	21079	2533	15007	-20	49442
	Overall	**13,008**	**10,964**	**62,230**	**5,065**	**32,406**	**41**	**123,713**
Additional unsafe abortion	Q1	3.6%	-0.2%	-0.5%	-1.3%	0.6%	-1.1%	0.0%
	Q2	3.6%	-1.4%	-1.0%	0.1%	0.1%	-1.1%	-0.5%
	Overall	**3.6%**	**-0.8%**	**-0.7%**	**-0.6%**	**0.3%**	**-1.1%**	**-0.3%**

*Compared to 2019

School-age child and adolescent mortality

The number of deaths due to maternal causes among 15-19 year-old females is estimated to increase by a total of 1,191 across South Asia in 2020, compared to the previous year, with the greatest increases anticipated in India (643) and Pakistan (476), respectively.

A rise in communicable disease-related adolescent mortality is also likely. Across South Asia as a whole, an estimated 5,943 additional deaths from malaria, TB, HIV/AIDS, and typhoid are anticipated as a result of reduced treatment coverage, with the largest increases expected in typhoid (2,243) and malaria (1,965). At the country-level, India is expected to be hit hardest with an additional 3,412 adolescent deaths followed by Pakistan (1,629) and Bangladesh (836).

However, the increases in both adolescent maternal and communicable disease mortality are more than offset by the expected reduction in adolescent deaths as a result of fewer road accident related deaths. An estimated 8,079 fewer adolescents are expected to die in 2020 as a result of traffic accidents across South Asia as compared to the previous year, with the greatest reduction in India (4,145) followed by Pakistan (2,697). Bangladesh is the only country where an increase in the number of adolescent deaths is expected, mainly due to an increase in deaths due to malaria and typhoid (Table 12).

Overall, adolescent deaths caused by road traffic accidents, maternal causes, or communicable diseases are expected to decrease by 945 in South Asia, with the largest reduction expected in Pakistan (533) and Afghanistan (495) (Table 12).

Table 12: Expected change in number of deaths due to road traffic accidents, maternal causes, and communicable diseases among adolescents in 2020 and compared to 2019

Country	2020	RTAs*	Maternal causes	Communicable diseases				Overall
				HIV/AIDS	TB	Typhoid	Malaria	
Pakistan	Q1	-176	13	0	0	0	0	-163
	Q2	-1,407	263	3	459	187	288	-208
	Q3	-879	171	1	225	100	144	-238
	Q4	-176	29	1	112	50	60	76
	Overall	**-2,637**	**476**	**5**	**796**	**336**	**491**	**-533**
India	Q1	-276	-14	0	0	0	0	-291
	Q2	-2211	431	25	491	736	710	183
	Q3	-1382	171	11	227	393	355	-225
	Q4	-276	55	6	113	196	148	242
	Overall	**-4,145**	**643**	**41**	**831**	**1,325**	**1,214**	**-91**
Nepal	Q1	-13	2	0	2	3	3	-3
	Q2	-102	8	1	6	13	12	61
	Q3	-64	6	1	3	7	6	-41
	Q4	-13	1	0	1	4	3	-4
	Overall	**-192**	**16**	**2**	**12**	**27**	**24**	**-110**
Bangladesh	Q1	-38	2	0	5	60	27	57
	Q2	-302	32	0	23	274	123	150
	Q3	-189	11	0	11	146	61	41
	Q4	-38	4	0	6	73	26	70
	Overall	**-566**	**48**	**1**	**46**	**553**	**236**	**318**
Sri Lanka	Q1	-2	1	0	0	1	0	0
	Q2	-19	0	0	0	0	0	-19
	Q3	-12	0	0	0	0	0	-12
	Q4	-2	0	0	0	0	0	-2
	Overall	**-36**	**1**	**0**	**0**	**1**	**0**	**-34**
Afghanistan	Q1	-33	0	0	0	0	0	-34
	Q2	-268	3	0	0	0	0	-264
	Q3	-167	2	0	0	0	0	-165
	Q4	-33	2	0	0	0	0	-32
	Overall	**-502**	**7**	**0**	**0**	**0**	**0**	**-495**
South Asia	Q1	-539	3	0	7	64	30	-434
	Q2	-4309	737	29	980	1210	1133	-219
	Q3	-2693	361	13	466	646	566	-641
	Q4	-539	90	7	233	323	236	349
	Overall	**-8,079**	**1,191**	**50**	**1,685**	**2,243**	**1,965**	**-945**

*Road traffic accidents resulting in death of either pedestrian or passenger
Maternal causes include all pregnancy-related deaths in girls 15 – 19 years

Educational attainment

South Asia is home to approximately 420 million school-aged children who have been out of school since March 2020. At best, only 2 out of every 3 are being reached by remote learning, with children living in rural areas and poorer households less likely to be able to access remote learning (56). The impact on the youngest children, who are within the most sensitive windows for learning, are also likely to be substantial. As a result of prolonged school closures in response to the COVID-19 pandemic almost 9 million (8,788,476) primary and secondary school-aged children (2,724,686, and 6,063,789, respectively) are expected to permanently dropout of schools, with the highest number expected in India (7,017,721) (Table 13).

The disruption in education is also expected to have considerable economic costs over the long term. Across South Asia, lower educational attainment by this cohort will result in a 15 – 23% decrease in their future lifetime earnings, costing the region US$ 63.5 billion over 45 years. The highest cost will be borne by India (US$ 52.8 billion) and Bangladesh (US$ 7.4 billion), followed by Sri Lanka (US$ 1.9 billion). Table 13 summarizes the estimated number of children expected to permanently dropout of school, and the impact this will have on each country's GDP over the course of these children's lifetime.

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Table 13: Number of estimated additional dropouts and present value of per student average income loss in annual, lifetime and national gross GDP terms in six South Asian countries

	Dropouts	Present value of income loss			
	N	%	Per year	Lifetime (45 yrs.)	Gross GDP
		Per student			National
Pakistan					
Primary dropouts	261,305	15.6%	$201	$3,816	
Secondary dropouts	403,695	0%	-	-	
Total	664,999		$ 201	$ 3,816	$997,072,322
Bangladesh					
Primary dropouts	268,631	6.9%	$313	$27,484	
Secondary dropouts	359,972	0%	-	-	
Total	628,602		$313	$27,484	$7,383,005,896
India					
Primary dropouts	2,031,509	20.3%	$427	$18,029	
Secondary dropouts	4,986,212	3.6%	$77	$3,236	
Total	7,017,721		$ 504	$21,265	$52,762,813,476
Nepal					
Primary dropouts	48,703	18.5%	$198	$4,985	
Secondary dropouts	128,893	1.5%	$16	$397	
Total	177,595		$504	$21,265	$293,982,934

	Dropouts	Present value of income loss			
	N	%	Per year	Lifetime (45 yrs.)	Gross GDP
		Per student			National
Afghanistan					
Primary dropouts	79,221	14.8%	$74	$1,820	
Secondary dropouts	83,630	0.0%	-	-	
Total	162,851		$74	$1,820	$144,193,226
Sri Lanka					
Primary dropouts	35,319	23.0%	$886	$29,149	
Secondary dropouts	101,388	6.9%	$267	$8,771	
Total	136,706		$1,153	$ 37,921	$1,918,810,96
Compared to 2019					

To address uncertainty around school dropout rates and the economic impact of reduced educational attainment, we also conducted a series of sensitivity analyses. The results are summarized in Table 14. The models are defined as follows:

- Model A: Rates of school dropouts assumed as those observed during the 1997 Asian financial crisis in Indonesia and an 8% per year return on education
- Model B: Rates of school dropouts assumed as those observed during the Ebola crisis in Guinea and Sierra Leone and 4.04% per year return on primary education and 2.44% per year return on secondary education
- Model C: Rates of school dropouts assumed as those observed during the Ebola crisis in Guinea and Sierra Leone and an 8% per year return on education

The results of sensitivity analyses demonstrate that the impact of COVID-19 pandemic response on educational attainment and subsequent losses in income could be even worse that what our original model predicts.

The estimated number of school dropouts and the consequent economic impact increase substantially, from 8.8 million children dropping out of school in our original model to more than 45.5 million dropping out under Model C. Similarly, the estimated economic impact on the region increases from US$ 63.5 billion in our original model to almost US$ 1 trillion in Model C.

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Table 14: Results of sensitivity analyses to address uncertainty around school dropout rates and economic impact of reduced educational attainment in six South Asian countries.

	Number of dropouts			Economic impact
Country	**Primary-school aged**	**Secondary-school aged**	**Total**	**US$ (Billions)**
Model A				
Pakistan	261,305	403,695	664,999	$2.2
Bangladesh	268,631	359,972	628,602	$16.8
India	2,031,509	4,986,212	7,017,721	$136.0
Nepal	48,703	128,893	177,595	$0.7
Afghanistan	79,221	83,630	162,851	$0.3
Sri Lanka	35,319	101,388	136,706	$5.1
Total	**2,724,686**	**6,063,789**	**8,788,476**	**$161.2**
Model B				
Pakistan	2,248,519	1,895,581	4,144,100	$8.6
Bangladesh	1,921,179	1,386,222	3,307,401	$52.8
India	14,485,269	18,327,017	32,812,287	$320.5
Nepal	336,413	435,455	771,867	$1.9
Afghanistan	578,933	317,645	896,577	$1.1
Sri Lanka	250,759	340,469	591,228	$10.3
Total	**19,821,072**	**22,702,388**	**42,523,460**	**$395.0**
Model C				
Pakistan	2,248,519	1,895,581	4,144,100	$19.3
Bangladesh	1,921,179	1,386,222	3,307,401	$120.0
India	14,485,269	18,327,017	32,812,287	$789.9
Nepal	336,413	435,455	771,867	$4.4
Afghanistan	578,933	317,645	896,577	$2.4
Sri Lanka	250,759	340,469	591,228	$25.9
Total	**19,821,072**	**22,702,388**	**42,523,460**	**$961.9**


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Early marriage and adolescent pregnancies

Rates of adolescent pregnancies are quite high in South Asia, with the proportion of girls 15 – 19 years who have given birth ranging from 5.2% in India (32) to 24.6% in Bangladesh (31). Of the 8.8 million children expected to permanently drop out of school, 4.5 million of them are expected to be girls (Table 15). Given the cultural and social context of South Asia, as well as the economic hardship many families in the region are facing as a result of the COVID-19 pandemic and response, many of these girls are likely to be married off early, resulting in an increase in the number of adolescent pregnancies.

Recent data from Kenya shows that the rate of adolescent pregnancies between April and June 2020 has indeed increased by 28%, compared to the same period in 2019 (44).

As a result of the increase in the number of girls dropping out of school early due to the COVID-19 pandemic, the number of adolescent pregnancies are expected to increase by 405,640 in the region, and could lead to an additional 655 maternal and 9,986 neonatal deaths, 154,985 low birthweight births, and 29,000 children who are likely to be stunted by the age of 2 years.

Table 15 summaries the estimated number of girls expected to permanently dropout of school and the sequelae resulting from their early marriages and consequent adolescent pregnancies.

Table 15: Estimated number of additional adolescent pregnancies, maternal and neonatal deaths, low birthweight births and stunted children resulting from girls dropping out of school due to the COVID-19 pandemic in six South Asian countries

Country	School dropouts	Adolescent pregnancies	Maternal deaths	Neonatal deaths	LBW births	Stunted
Pakistan	397,453	28,998	41	1,328	11,118	1,958
Bangladesh	352,250	110,916	192	2,055	44,100	8,409
India	3,531,683	235,069	341	5,893	90,125	16,846
Nepal	84,587	18,406	34	401	5,750	1,070
Afghanistan	69,288	7,095	45	286	2,720	487
Sri Lanka	66,024	5,155	2	22	1,171	230
Total	**4,501,285**	**405,640**	**655**	**9,986**	**154,985**	**29,000**

Compared to 2019

Economic impact of COVID-19 control measures

In the absence of an effective vaccine or clinical treatment, the main strategy used to control the spread of disease has been non-pharmaceutical interventions, such as physical distancing measures, school closures, travel restrictions and nationwide lockdowns. All of these have resulted in wide-ranging disruption of economic activities.

To assess the economic impact of the COVID-19 pandemic response by different stages of severity of mitigation measures, we estimated the impact on GDP, poverty and food insecurity, resulting from wage loss due to the proportion of industry-specific labor force laid off at each stage (Table 16).

It is not surprising that the economic impact of COVID-19 mitigation strategies worsens with the severity of these strategies, with the most severe stage (Stage 4) resulting in a 20 – 28% year-on-year decrease in GDP, with consequent implications for rates of national poverty and food insecurity. Even at the least severe stage (Stage 1), the increase in the share of the population who is food insecure could range from 17.4% in Afghanistan to 18.9% in Sri Lanka. The estimated impact of the COVID-19 pandemic and response, across the range of economic indicators, is summarized in Table 16.

Table 16: Estimated economic impact of the COVID-19 pandemic and response in South Asia, by stages of mitigation strategies

	Stage 1	Stage 2	Stage 3	Stage 4
Pakistan				
Job losses (millions)	1.7	7.1	10.7	14.3
Change in GDP*	– 4%	– 12%	– 18%	– 24%
Rise in poverty rate	1.3%	5.7%	8.5%	11.4%
Rise in food insecurity	18.3%	24.0%	28.1%	32.2%
Bangladesh				
Job losses (millions)	1.8	8.1	12.2	16.2
Change in GDP*	-3%	-13%	-20%	-27%
Rise in poverty rate	1.0%	4.6%	6.8%	9.1%
Rise in food insecurity	18.1%	24.8%	29.3%	33.8%
India				
Job losses (millions)	9.0	53.0	79.5	106.0
Change in GDP*	-4%	-14%	-21%	-28%
Rise in poverty rate	0.6%	3.5%	5.2%	6.9%
Rise in food insecurity	18.5%	25.3%	30.0%	34.7%
Nepal				
Job losses (millions)	0.4	1.7	2.5	3.4
Change in GDP*	-3%	-10%	-15%	-20%
Rise in poverty rate	1.9%	7.9%	11.8%	15.8%
Rise in food insecurity	17.6%	22.4%	25.7%	29.0%
Afghanistan				
Job losses (millions)	0.2	1.0	1.5	2.1
Change in GDP*	-2%	-12%	-17%	-23%
Rise in poverty rate	0.8%	3.6%	5.5%	7.3%
Rise in food insecurity	17.4%	23.6%	27.5%	31.4%
Sri Lanka				
Job losses (millions)	0.4	1.4	2.1	2.8
Change in GDP*	-5%	-15%	-23%	-30%
Rise in poverty rate	3.7%	15.3%	22.9%	30.5%
Rise in food insecurity	18.9%	26.1%	31.2%	36.3%

*Assuming restrictions are in place for 12 months

Chapter 4: **Implications and Way Forward for South Asia**

We systematically quantified the direct and indirect effects of COVID-19 pandemic and response, and the associated economic costs for South Asia. To our knowledge, this is the first study to do so at a regional level and across a large population (> 1.5 Billion). Our analysis provides a comprehensive view of the adverse impact of COVID-19 pandemic and response across a multitude of population health indicators, and the economic consequences of the disease, as well as the mitigation strategies instituted to control it. The results can be used to inform economic and public health policies in South Asia aimed at mitigating the direct and indirect effects of COVID-19 pandemic and response, over the medium and long term.

The current repertoire of interventions for COVID-19 pandemic response has been defined by lead global health agencies focused on "flattening the curve" and curbing the pandemic, without much regard for the resulting economic and public health fall-out. Almost a year into the pandemic, we now know that a one-size-fits-all mitigation response may not have been the right course of action, and in some cases such as India, perhaps applied too early, given the continuing spike in cases, and for too long in light of the impact on the economy (57). Apart from the enormous impact on lives and livelihoods of millions of people living in poverty or forced below the poverty line, the stringent measures also uprooted millions from urban slums to move to rural areas, often on foot and at huge human costs (58). It remains to be seen if this was also a factor in the widespread transmission of COVID-19 beyond major population centers in South Asia, especially India. There are also additional consequences for interrupting the education of children and girls dropping out of school that are life long and difficult to quantify in their entirety. There are also intriguing elements of country-specific responses which suggest that the pandemic could have been brought under control reasonably well and with a more limited impact on economies (59, 60). Recent serological survey data from South Asia underline the need for a regional and/or country-specific response. Given the high prevalence of COVID-19 antibodies observed in Afghanistan, India and Pakistan (ZAB's personal communication and unpublished data), a blanket "stay-at-home" order is not the best way forward for South Asia. Our models help identify evidence-informed mitigation and remedial strategies that will be suitable for low-income countries in general, and for South Asia in particular.

Re-establishing essential maternal and child health services

In addition to dealing with the direct effects of COVID-19, there is a critical need to address the much larger and longer-term fallout from the indirect effects of the pandemic. According to our estimates, additional ~230,000 child, and ~11,000 maternal deaths will occur in South Asia in 2020 alone, as a result of coverage disruption of essential SRMNCH services due to the COVID-19 pandemic and response. This number (> 240,000 maternal and child deaths) is far higher than the COVID-19 deaths observed and expected (< 200,000 by Dec 1, 2020) if no additional mitigation strategies are instituted in the region this year. Furthermore, even if coverage of essential services improves to pre-COVID-19 levels or better, some deficits such as fewer facility births or treatment for diarrhea and pneumonia are opportunities lost for good.

WHO has recommended strategies to minimize the disruption to essential SRMNCH services, including use of telemedicine to minimize patient-provider contact in the midst of the pandemic, strengthening infection prevention and control capacities, and ensuring essential supplies (61). Encouragingly, many countries have indicated the need for technical assistance and support in implementing these strategies to ensure that the impact of COVID-19 on essential SRMNCH services is minimized (61).

In addition, rates of undernutrition, including anemia, stunting and wasting are also likely to increase as disruptions in food supply systems and economic activity lead to increase in poverty and food insecurity. Prospective data from Bangladesh underscores this concern, where households experiencing food insecurity increased by more than 50% during stay-at-home orders implemented in March – May 2020 (62). Similarly, our economic impact model shows, that even the least severe stage of mitigation strategies, which include warnings/advisories, public gatherings ban, social distancing, and schools closures, could increase the share of the population who is food insecure by almost 20%.

As countries, including those in South Asia, continue to ease COVID-19 restrictions, coverage of maternal and child health and nutrition services need to be prioritized. These services include, but are not limited to: 1) prioritization of services to maximize health impact and protect services for the most vulnerable such as pregnant women and young infants or patients with pre-existing conditions 2) ensuring supply chain of essential medicines and commodities with change in protocols as needed to ensure adequate therapy such as provision of longer term supply 3) protection of supply-chain and delivery mechanisms for continued and increasing coverage of childhood immunizations, antenatal care and family planning services, with the aim to avoid stock-outs amid a potential surge in demand for emergency contraception and abortion services; 4) Safe re-opening of ambulatory care systems for antenatal, delivery and child health and nutrition with adequate provision of PPE and a secure, safe environment for patients; 5) improving coverage of community-based nutrition services and immunizations for all antigens included under each country's Expanded Programme on Immunizations, using outreach services such supplementary immunization activities; 6) expanding the capacity of existing fixed and outreach health services such as community health workers , with an increased focus on MNCH, nutrition, and detection and triage of serious illnesses for rapid referral to facilities; and 7) instituting and improving nutrition support services for the most vulnerable, such as community-based management of moderate and acute malnutrition (CMAM) programs, the need for which is likely to increase across the region in the wake of the COVID-19 pandemic.

Strategies for control, prevention and management of COVID-19

Given the current global trajectory of the pandemic, we might be living with COVID-19 for the foreseeable future (for the best part of 2021 and potentially into 2022). In the absence of an effective vaccine or clinical treatments, COVID-19 prevention and management methods will continue to rely on non-pharmaceutical interventions, such as targeted "smart" lockdowns and use of masks, as well as health systems strengthening to successfully resolve severe cases. Even after a vaccine or an effective treatment has been found, it will take time for it be produced and made available globally and at scale (63). Until then, non-pharmaceutical interventions are the world's best defense against COVID-19.


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Measures for personal protection

Many countries, including those in South Asia have invested heavily in procuring and securing supply-chains for personal protective equipment (PPE) for health workers and ventilators for treatment of severe cases of COVID-19. In Pakistan, for example, total number of beds allocated for COVID-19 patients has increased from less than 8,000 in March 2020 to 30,000 in July 2020, including more than 50,000 healthcare staff virtually trained in providing critical care (ZAB personal communication).

Many countries, including India and Pakistan have also issued directives mandating face masks in public spaces (64, 65). However, with limited enforcement, it is unclear what proportion of the population is consistently complying with these mandates. These are however, highly effective and we would strongly endorse the continued focus on the established principles for self and community protection against the spread of COVID-19 including

- Universal usage of appropriate face masks in public places and group settings
- Physical distancing and restrictions on indoor gatherings as well as large scale gatherings outdoors
- Hand sanitization and frequent washing
- Special precautions in public transport, train and air travel

Safe schools

As countries come out of the initial lockdowns imposed to curb the spread of COVID-19, safe reopening of schools is a top priority. School closures in Bangladesh and Nepal have been extended, while those in Sri Lanka were forced to close again after reopening in July and experiencing a spike in cases (66). In India, schools are open on a voluntary basis for older students, but five states and the capital Delhi are continuing with school closures (66). Pakistan has issued a set of Standard Operating Procedures (SOPs) for safe reopening of schools, including a limit of 25 students per class, alternating school days, ban on assemblies and other group events, temperature checks for all entrants into a school, and encouraging use of face masks (67). Reopening of school needs to be done while minimizing risk of COVID-19 exposure and transmission, and policies need to be coordinated between the federal and subsequent administrative levels within a country.

School re-openings also need to be targeted, based on localized rates of disease transmission and public health capabilities around testing and contract tracing. There must also be appropriate support for safe transportation of children to schools with adequate space in buses and vans and utilization of private resources for transportation by families (where and as possible).

Smart lockdowns

As countries emerge from the initial sweeping lockdowns and stay-at-home orders instituted early in the pandemic, smart lockdowns that target potential hot-spots of COVID-19 infection have gained increasing global popularity, and are an extension of the "test, trace and quarantine" policy. Across the globe, these smart lockdowns are being more and more frequently used by governments to stem the spread of the virus, while ensuring continuation and resumption of economic activities (60). The strategy has also been hailed as pivotal for stemming the spread of COVID-19 in Pakistan (59). The impact on India's economy resulting from the sweeping stay-at-home orders instituted on March 24, 2020 (57), also highlights the need for targeted, "smart" lockdowns. In the absence of the understandable lack of political appetite for another wave of blanket, nationwide stay-at-home orders, these smart lockdowns seem to be an effective tool in the world's public health arsenal against COVID-19.

Securing and re-establishing food supply chain

The COVID-19 pandemic has highlighted the vulnerability of existing food systems, with the effects of disruptions being disproportionately felt by the most vulnerable (68). Vulnerable food systems can lead to increase in food insecurity and consumption of poor quality diets, which in turn affects the health and nutrition of populations, especially women and children (69). This pandemic highlights the immediate need to create and facilitate sustainable food systems which ensure an affordable and nutritionally adequate diet to all peoples of the world.

Failure to build and foster resilient food systems which yield improved diet quality, will have immeasurable consequences for the health of most of the world's population. While the state bears a clear responsibility for restituting food security through food supply chain and food systems as well as price-regulation, there is also the need for ensuring adequate financial support and purchasing power for families through cash transfers. There are notable examples of this initiative in South Asia with cash transfer programs such as the Ehsaas program under the auspices of the Benazir Income Support program in Pakistan (70) .

Education

Education has been another indirect casualty of the COVID-19 pandemic, with over 90% of the world's students forced to stay home during temporary school-closures earlier this year. Even prior to the pandemic, disparities in educational attainment existed, both within and across countries. However, the pandemic is expected exacerbate existing inequities, especially along socioeconomic and gendered lines, with serious consequences for school-aged children and adolescent health, nutrition, educational attainment and economic productivity and earnings during adulthood.

Many countries have implemented remote learning polices in the wake of temporary school closures, but 31% of the world's students cannot be reached by remote learning programs, with more than 70% of children from rural and/or poor households unable to access these programs (71). There is also limited focus on early childhood education, with almost 70% of children who were attending preschool prior to the pandemic unable to access remote learning programs (71).

The COVID-19 pandemic is an opportunity to design and enact innovative education programs and policies that will reduce and overcome pre-existing inequities in education access, such as introduction of school shift systems and open air classrooms, and incentivizing continued and increased attendance for girls using conditional cash transfers to families. We need to ensure that all children of the world are able to access quality education, irrespective of their gender or socioeconomic status. Schools in Pakistan are reopening in a phased manner as we speak and early experience indicates that despite much apprehension, it has been possible to get the bulk of secondary school children back to school.

Strict imposition of standard operating procedures and compliance with protocols are needed with sentinel surveillance to ensure that there are no major outbreaks. Given the many primary schools are still closed at the time of writing this report, it is imperative that safe protocols be adopted to get these children back into an education and learning environment soonest before they lose a vital and sensitive year of learning.

Poverty alleviation and safety nets

Designing and implementing these policies will take time, which most of the vulnerable populations, including women, children, people with disabilities and daily wage earners, simply do not have in the wake of the pandemic. This is where poverty alleviation and social support programs can help bridge the gap. Since the start of the pandemic, many countries, including LMICs, have instituted social safety net programs, such as income or food support, to alleviate the hardships brought on by the sweeping lockdowns put in place for several weeks earlier this year.

A recent report from United Nations Development Programme (UNDP) highlights the efficacy of unconditional emergency cash transfers, or temporary basic income (TBI) in ameliorating the worst effects of COVID-19, especially on poor or near-poor households (72). The authors stipulate that at a cost of 0.27 – 0.63% of each country's GDP, TBI is within reach for all 132 countries included in their analysis (72).

One example of a TBI program implemented to mitigate the worst of the immediate effects of the COVID-19 pandemic is Ehsaas Emergency Cash program in Pakistan, which provided a lump sum of PKR 12000 (~US$75) to poor households, and is reported to have reached more than 14.6 million beneficiaries since its inception earlier this year (73, 74). The program is also focusing on gender equality in Pakistan by ensuring that at least 50% of all beneficiaries are women (75).

The World Bank reports that since March 2020, a total of $589 billion has been spent (reported from 114 countries) on social protection programs with per capita spending ranging from $121 in high-income countries to $1 in low-income settings (76). The impact of these on utilization and access to health and nutrition services is still unknown and needs to be estimated.

Data systems and rapid information

The COVID-19 pandemic has highlighted the importance of national health data systems. Not only are these systems necessary for monitoring progress towards public health targets, such as Sustainable Development Goals, they are also critical in detecting infectious disease outbreaks, such as the current COVID-19 pandemic, containing them and minimizing the economic fall-out (77). National health data systems are specially lacking in LMICs, including those in South Asia. Even with support from UNICEF country offices, we had difficulty in obtaining data on COVID-19 cases and deaths, and had to obtain these data from University of Oxford's Our World in Data (OWID) website (15), for our direct effects model.

Investing in health data systems that are updated in real time and publicly available for research collaborations, needs to be a priority at the regional and global level.

Limitations

Our models have several limitations, most if not all, resulting from constraints around data availability, especially at sub-national level. Although we were able to use country-level DHIS/HMIS data for many indicators included in our LiST analysis, for some we either had to use a related country-level indicator or average estimates from the other countries, as proxies (Supplementary Table 3). We also faced limitations with data availability for our models assessing the impact on educational attainment, economy and food insecurity. Even though there is considerable historical evidence on how crises can impact children's schooling and incomes of households, it is limited with reference to the unique effects of the COVID-19 pandemic in both scale and rapidity of spread.

We were constrained to apply the assumptions on rates of school dropouts from Indonesia during the 1997 Asian financial crisis, and households experiencing food insecurity in Nepal in April 2020, across all six countries.

These could well be under-estimates and as one very recent report from Bangladesh indicates that the proportion of households earning less than US$ 1.90 per day increased from <1% to almost 50%, and those experiencing food insecurity increased by more than 50% (62). For our economic impact model, we used labor force attrition by industry estimated for Pakistan across the other five South Asian countries, as country-specific data were not available. Our economic impact model also does not include gender related impacts, since data on capacity and MPW by industry were not disaggregated by gender. This is a limitation since the type of industry, hierarchical position, level of payment, and share within informal sector are all affected by gender.

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Conclusions

Both modelled and prospective data reveal serious consequences of the COVID-19 pandemic with implications for maternal and child health and nutrition (11, 62). Therefore, it is imperative that we now turn our focus towards mitigating the indirect effects of the COVID-19 pandemic and response.

These should include strengthening food systems to ensure a resilient supply of nutritious and affordable foods, creating economic opportunities and income generating activities using a gendered lens, ameliorating inequities in educational attainment, and a renewed focus on improving coverage of basic health and nutrition interventions during pregnancy, infancy and childhood, and adolescence, especially for girls.

Our modelling study also has implications for specific public policy measures that should be undertaken by the region's governments. These include, but are not limited to:

- Increase the coverage of COVID-19 mitigation measures, such as use of masks and hand hygiene, which can lead to ~400,000 fewer deaths over the next year
- Ensure uninterrupted and improved coverage of essential maternal and child health and nutrition services, such as family planning services, antenatal care, skilled birth attendance and postnatal care, and community-based health and nutrition support services
- Ensure safe reopening of schools, with increased focus on continued and increased enrollment of vulnerable children, especially girls.
- Continue social safety net programs to support vulnerable population, with increased focus on women-led households, people with disabilities, and daily wage earners

All countries, including those in South Asia need to continue, and even increase investment in health systems, poverty alleviation, education and creation of human capital, and gender equity, if the world wants to maintain and improve on the gains in maternal, child and adolescent health and nutrition achieved over the past few decades.

We need to do more than just catch up the loss in health and human capital experienced over the past several months. We need to build back better, overcoming gaps in equity and disadvantages faced by populations, simply because of the geographic region they live in. This pandemic may have been unprecedented, but those in the future will not be, and the world needs to be prepared.

Glossary

DHIS	District Health Information System
DHS	Demographic and Health Survey
DPT	Diphtheria, pertussis and tetanus
GDP	Gross Domestic Product
GBD	Global Burden of Disease
HMIS	Health Management Information System
ICU	Intensive care unit
IHME	Institute for Health Metrics and Evaluation
ILO	International Labour Organization
LBW	Low birthweight
LiST	Lives Saved Tool
LMIC	Low and middle income countries
MICS	Multiple Indicator Cluster Survey
MPW	Marginal rate of productivity per worker
Penta	Pentavalent
SAM	Severe acute malnutrition
SGA	Small for gestational age
SRMNCH	Sexual, reproductive, maternal, newborn, and child health
TBI	Temporary basic income
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

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Supplementary tables

Table 1:
Compartments and functional definitions of the model

Compartment	Functional definition
S	Susceptible individuals
E	Exposed and infected, not yet symptomatic but potentially infectious
I	Infected, symptomatic, and infectious
Q	Infectious, but (self-)isolated
H	Requiring hospitalization (would normally be hospitalised if capacity available)
R	Recovered, immune from further infection
F	Case fatality (death due to COVID-19, not other causes)

Table 2:
Model parameters for base case scenarios

Variable name	Description	No intervention	Hand hygiene	Face masks	Smart lockdowns	Comments
s.num	Initial number of susceptible (not yet infected) individuals in the simulated population.	Population size divided by the cumulative number of known active cases at the beginning of the calibration period				These values were chosen to scale the simulation size to q.num = 1.
e.num	Initial number of exposed (infected, asymptomatic, and potentially infectious) individuals in the simulated population.	1 at start of calibration. Simulation starts with the value obtained at the end of the calibration period.				Assumptions made for the model; discussed in the manuscript
i.num	Initial number of infected (symptomatic and infectious) individuals in the simulated population.	1 at start of calibration. Simulation starts with the value obtained at the end of the calibration period.				Assumptions made for the model; discussed in the manuscript
q.num	Initial number of infectious but quarantined.	1 at start of calibration. Simulation starts with the value obtained at the end of the calibration period.				The simulation size was scaled according to this choice.
h.num	Initial number of individuals requiring hospitalization.	0 at start of calibration. Simulation starts with the value obtained at the end of the calibration period.				Assumed zero at the beginning of calibration.
r.num	Initial number of recovered (and immune) individuals.	0 at start of calibration. Simulation starts with the value obtained at the end of the calibration period.				Assumed zero at the beginning of calibration.

Table 2:
Model parameters for base case scenarios

Variable name	Description	No intervention	Hand hygiene	Face masks	Smart lockdowns	Comments
f.num	Initial number of fatalities.	0 at start of calibration. Simulation starts with the value obtained at the end of the calibration period.				Assumed zero at the beginning of calibration. Recorded fatalities before start of simulation run are added to the eventual total after rescaling.
act.rate.i	The daily number of exposure events (encounters) between susceptible and infectious (symptomatic).	Calibrated to match fatalities data – discussed in manuscript.	No change from the calibrated value.	No change from the calibrated value.	4% reduction off the calibrated value.	
inf.prob.i	Probability of passing on infection at each exposure event between infectious (symptomatic) people and susceptible.	Calibrated to match fatalities data – discussed in manuscript.	10% reduction off the calibrated value.	7% reduction off the calibrated value.	No change from the calibrated value.	
act.rate.e	The number of exposure events (encounters) between susceptible and exposed (asymptomatic) per day.	Same as act.rate.i.				
inf.prob.e	Probability of passing on infection at each exposure event between exposed (asymptomatic) people and susceptible.	2/3 of inf.prob.i.				
act.rate.q	The daily number of exposure events (encounters) between susceptible and quarantined (symptomatic)	25% of act.rate.e.				
inf.prob.q	Probability of passing on infection at each exposure event between quarantined (symptomatic) people and susceptible.	Same as inf.prob.i.				
quar.rate	Rate per day at which symptomatic (or tested positive), infected people enter self-isolation	0.033333				Value chosen to reflect a 50% probability of self-isolation within 21 days since onset of symptoms.
hosp.rate	Rate per day at which symptomatic (or tested positive), infected people require hospital care	Calibrated to match fatalities data – discussed in manuscript.				
disch.rate	Rate per day at which people requiring hospital care recover	0.066667				Daily recovery rate of 2%
prog.rate	Rate per day at which infected and asymptomatic people become symptomatic.	0.048305				50% of exposed individuals develop symptoms within 2 weeks
rec.rate	Rate per day at which infected and symptomatic people recover.	0.05				Expected recovery duration of 20 days from onset of symptoms (Default value used by Tim Churches)
fat.rate.base	Baseline daily mortality rate for people needing hospitalisation.	Calibrated to match fatalities data – discussed in manuscript.				

Variable name	Description	No intervention	Hand hygiene	Face masks	Smart lockdowns	Comments
hosp.cap	Number of available hospital beds for the modelled population	Extracted from the table downloaded from *https://github.com/owid/covid-19-data/tree/master/public/data. Scaled by the same factor as s.num.*				
fat.rate.overcap	Daily mortality rate for people needing hospitalisation but cannot get into hospital due to the hospitals being full	fat.rate.base times 2.				
fat.tcoeff	Time coefficient for increasing mortality rate for people requiring hospitalization who cannot get a hospital bad	0.5	0.5	0.5	0.5	This assumes that the fatality rate doubles once the number of hospitalizations required exceeds the hospitalization capacity

Table 3:
Summary of indicators used as proxy in LiST analysis, by country

Country	LiST indicator	Proxy indicator from DHIS/HMIS
Afghanistan	Family planning services	Couple year of protection from Afghanistan HMIS data
Afghanistan	Tetanus Toxoid (2 or more doses)	Antenatal care seeking from Afghanistan HMIS data
Afghanistan	Postnatal visit within 2 days after birth	Facility births from Afghanistan HMIS data
Bangladesh	Family planning services	Family planning services from Pakistan DHIS data
Bangladesh	Tetanus Toxoid (2 or more doses)	Antenatal care seeking from Bangladesh HMIS data
Bangladesh	Measles vaccine	DPT3/PENTA3 from Bangladesh HMIS data
Nepal	FP clients, injectable, condom, male and female sterilization	Average of available family planning services from Nepal HMIS data
Nepal	Tetanus Toxoid (2 or more doses)	Antenatal care seeking from Nepal HMIS data
Nepal	Measles vaccine	DPT3/PENTA3 from Nepal HMIS data
Sri Lanka	Tetanus Toxoid (2 or more doses)	Antenatal care seeking from Sri Lanka data
Sri Lanka	Vaccination (DPT3/PENTA3/measles)	Averages of rest of the countries
	Care seeking for diarrhea/pneumonia	
	Malnutrition	
India	FP clients	Average of short term family planning services from India HMIS data

Table 4:

Estimated impact on maternal anemia, childhood stunting and wasting, and small for gestational age (SGA) and low birthweight (LBW), using LiST, by country and quarter of 2020 and 2021

Country	Indicators	2019	2020				2021	
			Q1	Q2	Q3	Q4	Q1	Q2
Afghanistan	Pregnant women with anemia	38.2	38.1	39.0	38.6	38.4	38.4	38.4
	Pregnant women with iron-deficiency anemia	18.6	18.4	19.4	19.0	18.7	18.7	18.7
	Women of reproductive age with anemia	41.9	41.9	42.0	41.9	41.9	41.9	41.9
	Women of reproductive age with iron-deficiency anemia	19.1	19.0	19.2	19.1	19.1	19.1	19.1
	Moderate wasting	7.8	8.0	7.9	7.9	7.9	8.0	8.0
	Severe wasting	3.1	2.9	2.9	2.9	2.9	2.9	2.9
	Moderate stunting	22.0	22.0	22.0	22.0	22.0	21.9	21.9
	Severe stunting	16.0	16.0	16.0	16.0	16.0	16.0	16.0
	Pre-term: Small for gestational age (SGA)	2.6	2.6	2.6	2.6	2.6	2.6	2.6
	Pre-term: Appropriate for gestational age (AGA)	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	Term: Small for gestational age (SGA)	37.4	37.4	37.4	37.4	37.4	37.4	37.4
	Term: Appropriate for gestational age (AGA)	51.1	51.1	51.1	51.1	51.1	51.1	51.1
	Percent low birth weight (LBW)	23.7	23.6	23.6	23.6	23.6	23.6	23.6
Bangladesh	Pregnant women with anemia	45.7	45.2	50.8	48.3	46.7	46.7	44.9
	Pregnant women with iron-deficiency anemia	22.4	21.9	27.5	24.9	23.4	23.4	21.6
	Women of reproductive age with anemia	40.0	40.0	40.3	40.1	40.0	40.0	39.9
	Women of reproductive age with iron-deficiency anemia	20.5	20.5	20.8	20.7	20.6	20.6	20.5
	Moderate wasting	11.3	11.3	11.3	11.3	11.3	11.3	11.3
	Severe wasting	3.1	3.1	3.1	3.1	3.1	3.1	3.1
	Moderate stunting	24.3	24.3	24.2	24.3	24.3	24.3	24.3

Country	Indicators	2019	2020				2021	
			Q1	Q2	Q3	Q4	Q1	Q2
Bangladesh	Severe stunting	11.5	11.5	11.5	11.5	11.5	11.5	11.5
	Pre-term: Small for gestational age (SGA)	3.1	3.1	3.1	3.1	3.1	3.1	3.1
	Pre-term: Appropriate for gestational age (AGA)	10.9	10.9	10.9	10.9	10.9	10.9	10.9
	Term: Small for gestational age (SGA)	36.5	36.5	36.5	36.5	36.5	36.5	36.5
	Term: Appropriate for gestational age (AGA)	49.5	49.5	49.5	49.5	49.5	49.5	49.5
	Percent low birth weight (LBW)	24.4	24.4	24.4	24.4	24.4	24.4	24.4
India	Pregnant women with anemia	50.1	50.1	51.2	51.2	50.3	50.3	50.3
	Pregnant women with iron-deficiency anemia	22.7	22.8	23.9	23.9	23.0	22.9	22.9
	Women of reproductive age with anemia	51.4	51.4	51.5	51.5	51.4	51.4	51.4
	Women of reproductive age with iron-deficiency anemia	21.9	21.9	21.9	21.9	21.9	21.9	21.9
	Moderate wasting	13.7	13.7	13.8	13.7	13.7	13.7	13.7
	Severe wasting	7.7	7.7	7.8	7.7	7.7	7.7	7.7
	Moderate stunting	21.8	21.8	21.6	21.8	21.8	21.8	21.8
	Severe stunting	16.1	16.1	16.0	16.1	16.1	16.1	16.1
	Pre-term: Small for gestational age (SGA)	2.9	2.9	2.9	2.9	2.9	2.9	2.9
	Pre-term: Appropriate for gestational age (AGA)	10.1	10.1	10.1	10.1	10.1	10.1	10.1
	Term: Small for gestational age (SGA)	44.0	44.0	44.0	44.0	44.0	44.0	44.0
	Term: Appropriate for gestational age (AGA)	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Percent low birth weight (LBW)	27.5	27.5	27.5	27.5	27.5	27.5	27.5
Nepal	Pregnant women with anemia	40.0	44.3	48.3	44.1	41.7	38.6	41.7
	Pregnant women with iron-deficiency anemia	20.3	24.6	28.6	24.4	22.0	18.9	22.0
	Women of reproductive age with anemia	35.2	35.5	35.8	35.5	35.3	35.1	35.3
	Women of reproductive age with iron-deficiency anemia	18.0	18.3	18.6	18.3	18.2	18.0	18.2

Country	Indicators	2019	2020				2021	
			Q1	Q2	Q3	Q4	Q1	Q2
Nepal	Moderate wasting	7.9	7.9	7.9	7.9	7.9	7.9	7.9
	Severe wasting	1.9	1.9	1.9	1.9	1.9	1.9	1.9
	Moderate stunting	23.6	23.8	23.6	23.6	23.7	23.6	23.6
	Severe stunting	11.5	11.6	11.5	11.5	11.6	11.6	11.6
	Pre-term: Small for gestational age (SGA)	3.1	3.1	3.1	3.1	3.1	3.1	3.1
	Pre-term: Appropriate for gestational age (AGA)	10.9	10.9	10.9	10.9	10.9	10.9	10.9
	Term: Small for gestational age (SGA)	36.2	36.2	36.2	36.2	36.2	36.2	36.2
	Term: Appropriate for gestational age (AGA)	49.8	49.8	49.8	49.8	49.8	49.8	49.8
	Percent low birth weight (LBW)	24.3	24.3	24.3	24.3	24.3	24.3	24.3
Pakistan	Pregnant women with anemia	51.3	51.9	53.8	52.5	51.8	51.8	51.8
	Pregnant women with iron-deficiency anemia	22.4	23.0	24.9	23.6	22.9	22.9	22.9
	Women of reproductive age with anemia	52.1	52.2	52.4	52.2	52.2	52.2	52.2
	Women of reproductive age with iron-deficiency anemia	20.2	20.3	20.5	20.3	20.3	20.3	20.3
	Moderate wasting	7.8	7.9	7.9	7.9	7.9	7.9	7.9
	Severe wasting	3.4	3.3	3.4	3.3	3.3	3.3	3.3
	Moderate stunting	20.9	20.9	20.9	20.9	20.9	20.9	20.9
	Severe stunting	23.4	23.4	23.3	23.4	23.4	23.4	23.4
	Pre-term: Small for gestational age (SGA)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
	Pre-term: Appropriate for gestational age (AGA)	12.3	12.3	12.3	12.3	12.3	12.3	12.3
	Term: Small for gestational age (SGA)	43.5	43.5	43.5	43.5	43.5	43.5	43.5
	Term: Appropriate for gestational age (AGA)	40.7	40.8	40.7	40.8	40.8	40.8	40.8
	Percent low birth weight (LBW)	28.6	28.6	28.6	28.6	28.6	28.6	28.6
Sri Lanka	Pregnant women with anemia	35.4	37.5	36.1	35.8	35.6	35.6	35.6

Country	Indicators	2019	2020				2021	
			Q1	Q2	Q3	Q4	Q1	Q2
Sri Lanka	Pregnant women with iron-deficiency anemia	22.3	24.3	23.0	22.7	22.4	22.4	22.4
	Women of reproductive age with anemia	32.7	32.8	32.7	32.7	32.7	32.7	32.7
	Women of reproductive age with iron-deficiency anemia	17.7	17.8	17.7	17.7	17.7	17.7	17.7
	Moderate wasting	7.7	7.8	7.8	7.8	7.8	7.8	7.8
	Severe wasting	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Moderate stunting	22.2	22.2	22.2	22.2	22.2	22.2	22.2
	Severe stunting	16.2	16.2	16.2	16.2	16.2	16.2	16.2
	Pre-term: Small for gestational age (SGA)	2.4	2.4	2.4	2.4	2.4	2.4	2.4
	Pre-term: Appropriate for gestational age (AGA)	8.3	8.3	8.3	8.3	8.3	8.3	8.3
	Term: Small for gestational age (SGA)	21.9	21.9	21.9	21.9	21.9	21.9	21.9
	Term: Appropriate for gestational age (AGA)	67.4	67.4	67.4	67.4	67.4	67.4	67.4
	Percent low birth weight (LBW)	16.0	16.0	16.0	16.0	16.0	16.0	16.0

Afghanistan						
Interventions	Change in 2020				Change in 2021	
	Q1	Q2	Q3	Q4	Q1	Q2
FP clients	12%	-24%	-12%	-5%	-4%	-4%
Injectables	12%	-24%	-12%	-5%	-4%	-4%
Condom	12%	-24%	-12%	-5%	-4%	-4%
IUD	12%	-24%	-12%	-5%	-4%	-4%
Female sterilisation	12%	-24%	-12%	-5%	-4%	-4%
Male sterilisation	12%	-24%	-12%	-5%	-4%	-4%
Implant	12%	-24%	-12%	-5%	-4%	-4%
Safe abortion servicess	--	--	--	--	--	--
Post abortion case management	--	--	--	--	--	--
Ectopic pregnancy case management	--	--	--	--	--	--
Antenatal care (4+ visits)	2%	-11%	-6%	-2%	-2%	-2%
Tetanus Toxoid (2 or more doses)	2%	-11%	-6%	-2%	-2%	-2%
Syphilis detection and treatment	--	--	--	--	--	--
Calcium supplementation	--	--	--	--	--	--
Iron supplementation in pregnancy	--	--	--	--	--	--
Hypertensive disorder case management	--	--	--	--	--	--
Diabetes case management	--	--	--	--	--	--
Malaria case management	--	--	--	--	--	--
MgSO4 management of pre-eclampsia	--	--	--	--	--	--
Fetal growth restriction detection and management	--	--	--	--	--	--
Total home deliveries by clinic staff	-45%	-32%	-16%	-6%	-6%	-5%
Facility births	3%	-1%	-1%	0%	0%	0%
Postnatal visit within 2 days after birth	3%	-1%	-1%	0%	0%	0%
Vitamin A supplementation	--	--	--	--	--	--
Zinc Supplementation	--	--	--	--	--	--
Vaccine:BCG	--	--	--	--	--	--
Vaccine:OPV3	--	--	--	--	--	--
Vaccine:DPT3/Penta3	-2%	-7%	-4%	-1%	-1%	-1%
Vaccine:HepB3	--	--	--	--	--	--
Vaccine: PCV3	--	--	--	--	--	--
Vaccine:RV2	--	--	--	--	--	--
Vaccine: Measles	-6%	-7%	-4%	-1%	-1%	-1%
Fully immunization	--	--	--	--	--	--
Maternal sepsis case management	--	--	--	--	--	--
ORS - oral rehydration solution	--	--	--	--	--	--
Antibiotics for treatment of dysentery	--	--	--	--	--	--
Zinc for treatment of diarrhea – Zinc Supplementation	0%	-21%	-11%	-4%	-4%	-3%
Antibiotics for pneumonia	12%	-9%	-5%	-2%	-2%	-1%
Vitamin A for treatment of measles	--	--	--	--	--	--
ACTs - Artemisinin compounds for treatment of malaria	--	--	--	--	--	--
SAM - treatment for severe acute malnutrition	5%	-37%	-19%	-7%	-7%	-6%

*Based on actual health systems data *Approximated using related indicators for same country

Bangladesh						
Interventions	Change in 2020				Change in 2021	
	Q1	Q2	Q3	Q4	Q1	Q2
FP clients	-31%	-78%	-39%	-16%	-14%	-12%
Injectables	-24%	-68%	-34%	-14%	-12%	-11%
Condom	-15%	-87%	-44%	-17%	-16%	-14%
IUD	-13%	-81%	-41%	-16%	-15%	-13%
Female sterilisation	-27%	-88%	-44%	-18%	-16%	-14%
Male sterilisation	-29%	-96%	-48%	-19%	-17%	-15%
Implant	-65%	-79%	-40%	-16%	-14%	-13%
Safe abortion servicess	--	--	--	--	--	--
Post abortion case management	--	--	--	--	--	--
Ectopic pregnancy case management	--	--	--	--	--	--
Antenatal care (4+ visits)	5%	-50%	-25%	-10%	-9%	-8%
Tetanus Toxoid (2 or more doses)	5%	-50%	-25%	-10%	-9%	-8%
Syphilis detection and treatment	--	--	--	--	--	--
Calcium supplementation	--	--	--	--	--	--
Iron supplementation in pregnancy	--	--	--	--	--	--
Hypertensive disorder case management	--	--	--	--	--	--
Diabetes case management	--	--	--	--	--	--
Malaria case management	--	--	--	--	--	--
MgSO4 management of pre-eclampsia	--	--	--	--	--	--
Fetal growth restriction detection and management	--	--	--	--	--	--
Total home deliveries by clinic staff	--	--	--	--	--	--
Facility births	-11%	-52%	-26%	-10%	-9%	-8%
Postnatal visit within 2 days after birth	-21%	-51%	-25%	-10%	-9%	-8%
Vitamin A supplementation	--	--	--	--	--	--
Zinc Supplementation	--	--	--	--	--	--
Vaccine:BCG	--	--	--	--	--	--
Vaccine:OPV3	--	--	--	--	--	--
Vaccine:DPT3/Penta3	-6%	-37%	-18%	-7%	-7%	-6%
Vaccine:HepB3	--	--	--	--	--	--
Vaccine: PCV3	--	--	--	--	--	--
Vaccine:RV2	--	--	--	--	--	--
Vaccine: Measles	-6%	-37%	-18%	-7%	-7%	-6%
Fully immunization	--	--	--	--	--	--
Maternal sepsis case management	--	--	--	--	--	--
ORS - oral rehydration solution	--	--	--	--	--	--
Antibiotics for treatment of dysentery	--	--	--	--	--	--
Zinc for treatment of diarrhea – Zinc Supplementation	-5%	-66%	-33%	-13%	-12%	-11%
Antibiotics for pneumonia	-14%	-74%	-37%	-15%	-13%	-12%
Vitamin A for treatment of measles	--	--	--	--	--	--
ACTs - Artemisinin compounds for treatment of malaria	--	--	--	--	--	--
SAM - treatment for severe acute malnutrition	-22%	-82%	-41%	-16%	-15%	-13%

*Based on actual health systems data *Approximated using related indicators for same country

India						
Interventions	Change in 2020				Change in 2021	
	Q1	Q2	Q3	Q4	Q1	Q2
FP clients	-1%	-25%	-13%	-5%	-5%	-4%
Injectables	-10%	-64%	-32%	-13%	-12%	-10%
Condom	-2%	-25%	-13%	-5%	-5%	-4%
IUD	1%	-49%	-25%	-10%	-9%	-8%
Female sterilisation	-1%	-86%	-43%	-17%	-16%	-14%
Male sterilisation	-5%	-86%	-43%	-17%	-16%	-14%
Implant	--	--	--	--	--	--
Safe abortion servicess	-6%	-43%	-22%	-9%	-8%	-7%
Post abortion case management	120%	-6%	-3%	-1%	-1%	-1%
Ectopic pregnancy case management	8%	-28%	-14%	-6%	-5%	-4%
Antenatal care (4+ visits)	5%	-27%	-13%	-5%	-5%	-4%
Tetanus Toxoid (2 or more doses)	-2%	-25%	-13%	-5%	-5%	-4%
Syphilis detection and treatment	3%	17%	8%	3%	3%	3%
Calcium supplementation	18%	-9%	-5%	-2%	-2%	-2%
Iron supplementation in pregnancy	0%	-20%	-10%	-4%	-4%	-3%
Hypertensive disorder case management	22%	-29%	-15%	-6%	-5%	-5%
Diabetes case management	10%	-29%	-15%	-6%	-5%	-5%
Malaria case management	5%	-27%	-13%	-5%	-5%	-4%
MgSO4 management of pre-eclampsia	8%	-28%	-14%	-6%	-5%	-4%
Fetal growth restriction detection and management	6%	-27%	-13%	-5%	-5%	-4%
Total home deliveries by clinic staff	-19%	-28%	-14%	-6%	-5%	-5%
Facility births	-2%	-28%	-14%	-6%	-5%	-5%
Postnatal visit within 2 days after birth	-18%	-25%	-12%	-5%	-4%	-4%
Vitamin A supplementation	-1%	-78%	-39%	-16%	-14%	-13%
Zinc Supplementation	-19%	-87%	-44%	-17%	-16%	-14%
Vaccine:BCG	-4%	-28%	-14%	-6%	-5%	-4%
Vaccine:OPV3	2%	-37%	-18%	-7%	-7%	-6%
Vaccine:DPT3/Penta3	3%	-37%	-19%	-7%	-7%	-6%
Vaccine:HepB3	-11%	39%	19%	8%	7%	6%
Vaccine: PCV3	-4%	-28%	-14%	-6%	-5%	-4%
Vaccine:RV2	95%	29%	14%	6%	5%	5%
Vaccine: Measles	-68%	-55%	-27%	-11%	-10%	-9%
Fully immunization	--	--	--	--	--	--
Maternal sepsis case management	8%	-28%	-14%	-6%	-5%	-4%
ORS- oral rehydration solution	-22%	-79%	-39%	-16%	-14%	-13%
Antibiotics for treatment of dysentery	-9%	-75%	-37%	-15%	-13%	-12%
Zinc for treatment of diarrhea – Zinc Supplementation	-19%	-87%	-44%	-17%	-16%	-14%
Antibiotics for pneumonia	27%	-30%	-15%	-6%	-5%	-5%
Vitamin A for treatment of measles	64%	-40%	-20%	-8%	-7%	-6%
ACTs- Artemisinin compounds for treatment of malaria	1%	-88%	-44%	-18%	-16%	-14%
SAM- treatment for severe acute malnutrition	5%	-48%	-24%	-10%	-9%	-8%

*Based on actual health systems data *Approximated using related indicators for same country

Nepal						
Interventions	Change in 2020				Change in 2021	
	Q1	Q2	Q3	Q4	Q1	Q2
FP clients	-24%	-52%	-26%	-10%	-9%	-8%
Injectables	-24%	-52%	-26%	-10%	-9%	-8%
Condom	-24%	-52%	-26%	-10%	-9%	-8%
IUD	-35%	-61%	-30%	-12%	-11%	-10%
Female sterilisation	-24%	-52%	-26%	-10%	-9%	-8%
Male sterilisation	-24%	-52%	-26%	-10%	-9%	-8%
Implant	-13%	-43%	-22%	-9%	-8%	-7%
Safe abortion servicess	--	--	--	--	--	--
Post abortion case management	--	--	--	--	--	--
Ectopic pregnancy case management	--	--	--	--	--	--
Antenatal care (4+ visits)	-9%	-29%	-15%	-6%	-5%	-5%
Tetanus Toxoid (2 or more doses)	-9%	-29%	-15%	-6%	-5%	-5%
Syphilis detection and treatment	--	--	--	--	--	--
Calcium supplementation	--	--	--	--	--	--
Iron supplementation in pregnancy	-14%	-26%	-13%	-5%	-5%	-4%
Hypertensive disorder case management	--	--	--	--	--	--
Diabetes case management	--	--	--	--	--	--
Malaria case management	--	--	--	--	--	--
MgSO4 management of pre-eclampsia	--	--	--	--	--	--
Fetal growth restriction detection and management	--	--	--	--	--	--
Total home deliveries by clinic staff	--	--	--	--	--	--
Facility births	-7%	-27%	-13%	-5%	-5%	-4%
Postnatal visit within 2 days after birth	-7%	-15%	-8%	-3%	-3%	-2%
Vitamin A supplementation	-91%	-3%	-1%	-1%	0%	0%
Zinc Supplementation	--	--	--	--	--	--
Vaccine:BCG	--	--	--	--	--	--
Vaccine:OPV3	--	--	--	--	--	--
Vaccine:DPT3/Penta3	-23%	3%	3%	3%	3%	2%
Vaccine:HepB3	--	--	--	--	--	--
Vaccine: PCV3	--	--	--	--	--	--
Vaccine:RV2	--	--	--	--	--	--
Vaccine: Measles	-23%	3%	3%	3%	3%	2%
Fully immunization	--	--	--	--	--	--
Maternal sepsis case management	--	--	--	--	--	--
ORS - oral rehydration solution	--	--	--	--	--	--
Antibiotics for treatment of dysentery	--	--	--	--	--	--
Zinc for treatment of diarrhea – Zinc Supplementation	-12%	-35%	-18%	-7%	-6%	-6%
Antibiotics for pneumonia	-12%	-49%	-24%	-10%	-9%	-8%
Vitamin A for treatment of measles	--	--	--	--	--	--
ACTs - Artemisinin compounds for treatment of malaria	--	--	--	--	--	--
SAM - treatment for severe acute malnutrition	-53%	-83%	-42%	-17%	-15%	-13%

*Based on actual health systems data *Approximated using related indicators for same country

Pakistan						
Interventions	Change in 2020				Change in 2021	
	Q1	Q2	Q3	Q4	Q1	Q2
FP clients	-31%	-78%	-39%	-16%	-14%	-12%
Injectables	-24%	-68%	-34%	-14%	-12%	-11%
Condom	-15%	-87%	-44%	-17%	-16%	-14%
IUD	-13%	-81%	-41%	-16%	-15%	-13%
Female sterilisation	-27%	-88%	-44%	-18%	-16%	-14%
Male sterilisation	-29%	-96%	-48%	-19%	-17%	-15%
Implant	-65%	-79%	-40%	-16%	-14%	-13%
Safe abortion servicess	--	--	--	--	--	--
Post abortion case management	-3%	-55%	-27%	-11%	-10%	-9%
Ectopic pregnancy case management	--	--	--	--	--	--
Antenatal care (4+ visits)	-16%	-66%	-33%	-13%	-12%	-11%
Tetanus Toxoid (2 or more doses)	-12%	-52%	-26%	-10%	-9%	-8%
Syphilis detection and treatment	--	--	--	--	--	--
Calcium supplementation	--	--	--	--	--	--
Iron supplementation in pregnancy	--	--	--	--	--	--
Hypertensive disorder case management	--	--	--	--	--	--
Diabetes case management	--	--	--	--	--	--
Malaria case management	--	--	--	--	--	--
MgSO4 management of pre-eclampsia	--	--	--	--	--	--
Fetal growth restriction detection and management	--	--	--	--	--	--
Total home deliveries by clinic staff	--	--	--	--	--	--
Facility births	-3%	-53%	-26%	-11%	-10%	-8%
Postnatal visit within 2 days after birth	8%	-52%	-26%	-10%	-9%	-8%
Vitamin A supplementation	--	--	--	--	--	--
Zinc Supplementation	--	--	--	--	--	--
Vaccine:BCG	--	--	--	--	--	--
Vaccine:OPV3	--	--	--	--	--	--
Vaccine:DPT3/Penta3	-24%	-67%	-33%	-13%	-12%	-11%
Vaccine:HepB3	--	--	--	--	--	--
Vaccine: PCV3	--	--	--	--	--	--
Vaccine:RV2	--	--	--	--	--	--
Vaccine: Measles	-15%	-53%	-26%	-11%	-9%	-8%
Fully immunization	0%	-51%	-26%	-10%	-9%	-8%
Maternal sepsis case management	--	--	--	--	--	--
ORS - oral rehydration solution	--	--	--	--	--	--
Antibiotics for treatment of dysentery	--	--	--	--	--	--
Zinc for treatment of diarrhea – Zinc Supplementation	-12%	-69%	-34%	-14%	-12%	-11%
Antibiotics for pneumonia	-16%	-74%	-37%	-15%	-13%	-12%
Vitamin A for treatment of measles	--	--	--	--	--	--
ACTs - Artemisinin compounds for treatment of malaria	--	--	--	--	--	--
SAM - treatment for severe acute malnutrition	36%	-67%	-34%	-13%	-12%	-11%

*Based on actual health systems data *Approximated using related indicators for same country

Sri Lanka						
Interventions	Change in 2020				Change in 2021	
	Q1	Q2	Q3	Q4	Q1	Q2
FP clients	-17%	-7%	-3%	-1%	-1%	-1%
Injectables	-22%	-12%	-6%	-2%	-2%	-2%
Condom	-11%	3%	2%	1%	1%	1%
IUD	-30%	-34%	-17%	-7%	-6%	-5%
Female sterilisation	-1%	-8%	-4%	-2%	-1%	-1%
Male sterilisation	-21%	-55%	-27%	-11%	-10%	-9%
Implant	-19%	-9%	-4%	-2%	-2%	-1%
Safe abortion servicess	--	--	--	--	--	--
Post abortion case management	--	--	--	--	--	--
Ectopic pregnancy case management	--	--	--	--	--	--
Antenatal care (4+ visits)	-6%	-2%	-1%	0%	0%	0%
Tetanus Toxoid (2 or more doses)	-6%	-2%	-1%	0%	0%	0%
Syphilis detection and treatment	--	--	--	--	--	--
Calcium supplementation	--	--	--	--	--	--
Iron supplementation in pregnancy	--	--	--	--	--	--
Hypertensive disorder case management	--	--	--	--	--	--
Diabetes case management	--	--	--	--	--	--
Malaria case management	--	--	--	--	--	--
MgSO4 management of pre-eclampsia	--	--	--	--	--	--
Fetal growth restriction detection and management	--	--	--	--	--	--
Total home deliveries by clinic staff	--	--	--	--	--	--
Facility births	-6%	-2%	-1%	0%	0%	0%
Postnatal visit within 2 days after birth	-6%	-2%	-1%	0%	0%	0%
Vitamin A supplementation	-19%	3%	1%	1%	1%	0%
Zinc Supplementation	--	--	--	--	--	--
Vaccine:BCG	--	--	--	--	--	--
Vaccine:OPV3	--	--	--	--	--	--
Vaccine:DPT3/Penta3	-14%	-27%	-13%	-5%	-5%	-4%
Vaccine:HepB3	--	--	--	--	--	--
Vaccine: PCV3	--	--	--	--	--	--
Vaccine:RV2	--	--	--	--	--	--
Vaccine: Measles	-12%	-23%	-12%	-5%	-4%	-4%
Fully immunization	--	--	--	--	--	--
Maternal sepsis case management	--	--	--	--	--	--
ORS - oral rehydration solution	--	--	--	--	--	--
Antibiotics for treatment of dysentery	--	--	--	--	--	--
Zinc for treatment of diarrhea – Zinc Supplementation	-7%	-48%	-24%	-10%	-9%	-8%
Antibiotics for pneumonia	-7%	-51%	-26%	-10%	-9%	-8%
Vitamin A for treatment of measles	--	--	--	--	--	--
ACTs - Artemisinin compounds for treatment of malaria	--	--	--	--	--	--
SAM - treatment for severe acute malnutrition	-8%	-67%	-34%	-13%	-12%	-11%

*Based on actual health systems data *Approximated using related indicators for same country

Deaths and hospitalizations

Intervention		No additional mitigation			Hand Hygiene			Smart Lockdowns			Masks			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs
India	1/Sep/20	65,228	NA	NA	65,228	NA	NA	65,228	NA	NA	65,228	NA	NA	65,228	NA	NA
	1/Oct/20	103,994	67,613	11,932	77,784	25,700	4,535	91,294	44,743	7,896	83,783	33,395	5,893	64,676	12,821	2,262
	1/Nov/20	139,937	76,074	13,425	90,662	21,920	3,868	114,432	43,770	7,724	100,998	30,865	5,447	71,214	9,104	1,607
	1/Dec/20	178,008	82,772	14,607	100,901	18,487	3,262	135,828	42,001	7,412	115,771	26,972	4,760	75,781	6,354	1,121
	1/Jan/21	222,202	87,896	15,511	109,545	14,824	2,616	156,109	39,629	6,993	128,184	23,101	4,077	78,916	4,283	756
	1/Feb/21	267,186	88,209	15,566	116,676	12,170	2,148	174,339	36,225	6,393	139,125	20,131	3,552	81,267	3,079	543
	1/Mar/21	307,089	84,831	14,970	122,100	10,026	1,769	189,569	32,850	5,797	147,704	16,959	2,993	82,653	2,141	378
	1/Apr/21	348,060	77,316	13,644	126,942	7,797	1,376	204,667	28,577	5,043	155,553	14,509	2,560	83,721	1,580	279
	1/May/21	383,795	70,447	12,432	130,592	6,555	1,157	217,388	24,415	4,309	162,042	12,363	2,182	84,526	1,048	185
	1/Jun/21	418,121	61,320	10,821	133,519	5,214	920	228,789	20,701	3,653	168,005	10,357	1,828	85,050	721	127
	1/Jul/21	445,995	52,311	9,231	135,935	4,275	754	238,071	17,314	3,055	172,840	8,383	1,479	85,412	538	95
	1/Aug/21	470,231	43,937	7,754	138,185	3,649	644	245,890	13,955	2,463	176,663	6,727	1,187	85,658	383	68
	1/Sep/21	491,117	36,442	6,431	139,977	3,014	532	252,419	11,724	2,069	179,485	5,200	918	85,821	215	38

Intervention		No additional mitigation			Hand Hygiene			Smart Lockdowns			Masks			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs
Pakistan	1/Sep/20	6,298	NA	NA	6,298	NA	NA	6,298	NA	NA	6,298	NA	NA	6,298	NA	NA
	1/Oct/20	7,374	398	70	7,220	388	68	7,004	340	60	7,154	387	68	7,332	391	69
	1/Nov/20	7,400	351	62	7,245	304	54	7,015	315	56	7,175	350	62	7,354	295	52
	1/Dec/20	7,409	404	71	7,256	292	51	7,030	340	60	7,183	306	54	7,361	227	40
	1/Jan/21	7,423	465	82	7,267	261	46	7,042	374	66	7,193	306	54	7,366	174	31
	1/Feb/21	7,434	503	89	7,273	242	43	7,049	373	66	7,205	307	54	7,369	147	26
	1/Mar/21	7,446	552	97	7,280	220	39	7,055	388	68	7,215	278	49	7,372	149	26
	1/Apr/21	7,464	522	92	7,285	219	39	7,074	369	65	7,222	260	46	7,377	140	25
	1/May/21	7,473	487	86	7,288	205	36	7,090	346	61	7,228	253	45	7,385	120	21
	1/Jun/21	7,481	450	79	7,292	202	36	7,094	333	59	7,230	255	45	7,388	114	20
	1/Jul/21	7,487	380	67	7,296	184	33	7,099	289	51	7,236	219	39	7,388	129	23
	1/Aug/21	7,499	332	59	7,301	170	30	7,103	258	46	7,240	201	36	7,388	118	21
	1/Sep/21	7,507	294	52	7,306	157	28	7,108	238	42	7,242	185	33	7,390	140	25

Intervention		No additional mitigation			Hand Hygiene			Smart Lockdowns			Masks			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs
Bangladesh	1/Sep/20	4,281	NA	NA	4,281	NA	NA	4,281	NA	NA	4,281	NA	NA	4,281	NA	NA
	1/Oct/20	5,086	444	78	5,032	468	83	4,972	448	79	5,164	462	81	4,973	466	82
	1/Nov/20	5,905	427	75	5,921	431	76	5,812	395	70	5,999	412	73	5,839	432	76
	1/Dec/20	6,656	316	56	6,631	362	64	6,525	366	65	6,675	364	64	6,623	370	65
	1/Jan/21	7,266	341	60	7,253	304	54	7,230	352	62	7,345	305	54	7,335	323	57
	1/Feb/21	7,892	298	53	7,853	263	46	7,830	280	49	7,895	267	47	7,940	271	48
	1/Mar/21	8,378	268	47	8,312	242	43	8,295	243	43	8,320	239	42	8,345	250	44
	1/Apr/21	8,840	191	34	8,797	234	41	8,753	233	41	8,767	221	39	8,838	229	40
	1/May/21	9,209	193	34	9,186	191	34	9,166	201	36	9,154	204	36	9,253	187	33
	1/Jun/21	9,564	176	31	9,506	153	27	9,486	168	30	9,559	177	31	9,614	165	29
	1/Jul/21	9,863	171	30	9,811	166	29	9,770	136	24	9,868	127	22	9,916	162	29
	1/Aug/21	10,159	139	25	10,136	143	25	10,043	141	25	10,135	146	26	10,217	124	22
	1/Sep/21	10,412	110	19	10,410	123	22	10,311	122	22	10,382	105	18	10,462	96	17

Intervention		No additional mitigation			Hand Hygiene			Smart Lockdowns			Masks			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs
Nepal	1/Sep/20	228	NA	NA	228	NA	NA	228	NA	NA	228	NA	NA	228	NA	NA
	1/Oct/20	424	65	12	417	60	11	427	61	11	427	61	11	422	57	10
	1/Nov/20	499	50	9	486	47	8	496	47	8	494	48	8	487	46	8
	1/Dec/20	555	38	7	538	39	7	548	36	6	546	36	6	536	33	6
	1/Jan/21	596	30	5	580	28	5	587	28	5	587	29	5	573	28	5
	1/Feb/21	629	23	4	611	22	4	618	22	4	622	23	4	602	21	4
	1/Mar/21	654	19	3	635	19	3	641	18	3	643	18	3	625	16	3
	1/Apr/21	675	15	3	658	16	3	662	14	2	664	15	3	644	13	2
	1/May/21	690	12	2	675	10	2	676	11	2	681	11	2	659	9	2
	1/Jun/21	703	8	1	685	8	1	688	9	2	692	11	2	670	8	1
	1/Jul/21	711	7	1	694	7	1	696	6	1	703	7	1	678	6	1
	1/Aug/21	717	5	1	700	6	1	704	5	1	711	5	1	686	5	1
	1/Sep/21	723	5	1	706	5	1	710	4	1	716	4	1	691	4	1

Intervention		No additional mitigation			Hand Hygiene			Smart Lockdowns			Masks			All strategies		
Country	Month	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs	Cumulative Deaths	Hospitalizations	ICUs
Afghanistan	1/Sep/20	1,406	NA	NA	1,406	NA	NA	1,406	NA	NA	1,406	NA	NA	1,406	NA	NA
	1/Oct/20	2,306	442	78	2,185	350	62	2,310	405	71	2,268	382	67	2,157	326	58
	1/Nov/20	2,850	426	75	2,669	339	60	2,866	388	69	2,775	348	61	2,607	305	54
	1/Dec/20	3,354	406	72	3,130	324	57	3,383	343	61	3,230	330	58	3,015	288	51
	1/Jan/21	3,885	378	67	3,600	308	54	3,833	320	56	3,736	333	59	3,455	273	48
	1/Feb/21	4,375	359	63	4,011	290	51	4,274	330	58	4,195	301	53	3,849	251	44
	1/Mar/21	4,807	349	62	4,375	290	51	4,669	308	54	4,571	293	52	4,204	248	44
	1/Apr/21	5,230	323	57	4,783	269	48	5,094	287	51	4,985	271	48	4,565	241	42
	1/May/21	5,638	311	55	5,109	240	42	5,458	262	46	5,362	264	47	4,910	236	42
	1/Jun/21	6,075	291	51	5,452	242	43	5,811	262	46	5,747	241	43	5,259	218	38
	1/Jul/21	6,453	266	47	5,760	223	39	6,168	263	46	6,062	233	41	5,552	201	35
	1/Aug/21	6,802	241	42	6,074	217	38	6,528	233	41	6,376	238	42	5,825	185	33
	1/Sep/21	7,106	237	42	6,367	199	35	6,850	220	39	6,684	223	39	6,094	177	31

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Direct and indirect effects of the COVID-19 pandemic in South Asia

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