A rapid cost-benefit analysis of moderate social distancing in response to the COVID-19 pandemic in Nigeria

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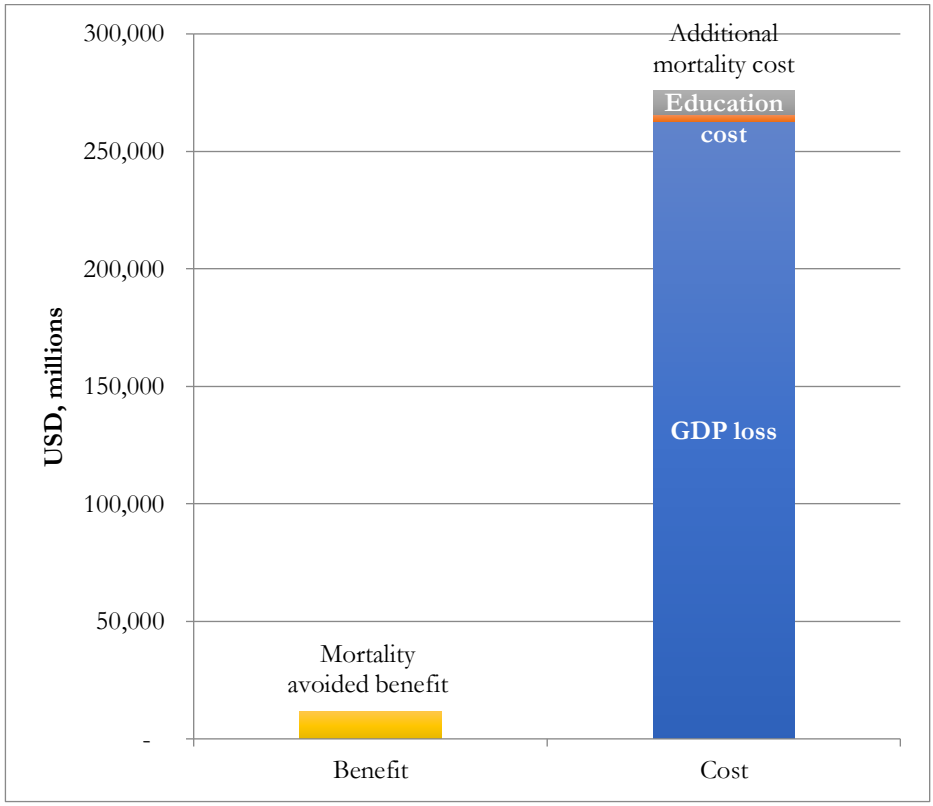
Executive Summary

- The purpose of this brief is to examine the **opportunity costs of different strategies to lessen the impact of the COVID-19 pandemic**.
- **Moderate social distancing** will lead to lower mortality in the short run, compared to current minimal restrictions:
    - It could reasonably be expected to **reduce the death toll from COVID-19 by about 102,191 if implemented for 9 months**. In addition, lower social interaction would also mean less traffic and hence fewer traffic deaths, saving about 4,793 lives. Finally, with lower pressure on the health care system, it is estimated that almost 12,661 more people with HIV will not die over the coming 5 years. **In total, moderate social distancing will likely reduce the death toll by 119,645** over the next five years.
    - However, moderate social distancing will also lead to less health outreach and more malnutrition, causing more deaths from malaria (24,478), from TB (28,107) and from child mortality (51,548) along with about 3,361 extra maternal deaths. There is evidence to suggest that total but unmodeled impacts from air pollution, non-communicable diseases, mental health, and from unemployment would be more likely to increase rather than decrease these extra deaths. In total, it is likely that **the complications following a moderate social distancing policy would result in at least an extra 107,494 deaths over the next five years**.
    - **The total number of deaths avoided from moderate social distancing is likely to be around 12,151**.
- In this scenario, most of the deaths avoided would be from relatively older individuals, while the additional lives lost would be from relatively younger individuals. Our estimates suggest moderate social restrictions would lead to **2,059,131 life years gained, and contribute to 5,316,482 life years lost**.
- The **social value of the net benefits of deaths avoided is USD 1.179 billion.**
- Closing schools for 9 months means that 25.6 million children will receive 9 months less education. This will make each child less productive in their adult years. In total, it is estimated the **social cost of closing schools for Nigeria will be around USD 5.72 billion - the present value of income loss for 25.6 million children over the next 50 years**. Given that the benefits from school closure cannot result in a higher number of deaths avoided than what would come from moderate social distancing

(12,151 deaths), the maximal benefit from this policy would be USD 1.179 billion. This means that **on current knowledge, a policy of school closures will leave Nigeria at least USD 4.54 billion worse off.**

- Moderate movement and livelihood restrictions would generate a higher economic cost, which would lead to a loss of USD 373.5 billion - the estimated present value of GDP loss over the next 30 years. Compared to maximal benefits of USD 1.179 billion, it means that **on current knowledge, a policy of moderate movement and livelihood restrictions will leave Nigeria much worse off** with a net economic cost of **USD 372.3 billion**.
- Valuing all the costs and all the benefits in economic terms, using Value of Statistical Life to convert deaths and avoided deaths, it means that **on current knowledge the costs vastly outweigh the benefits from moderate social distancing**.

Figure 1: Costs of moderate social distancing vastly outweigh benefits (USD)



The COVID-19 pandemic presents policy-makers with difficult trade-offs. Based on this analysis, this report suggests **three headline policies** that balance out the need to contain COVID-19 with other concerns:

- **Do not increase social restrictions more than what is already in place -** to avoid escalating both health and economic costs that have lasting effects on the economy and livelihoods. The analysis has shown that impacts on the economy from a moderate COVID mitigation strategy are likely to be very large and significantly higher than potential benefits. However, **continuing** with a **series of low-cost social restrictions** – including ensuring physical distancing and non-contact greetings, cocooning of the elderly and vulnerable, restricting large gatherings and promoting hand washing – appear effective. Bottom line, to the greatest extent possible, **avoid mass economic and livelihoods disruption.**

- **Reopen schools**: The preceding analysis indicates that school closures have a large cost in terms of lost future productivity that outweighs even the most optimistic benefits. Encouragingly, it appears that children are at least risk from COVID-19. Modelling for the US and UK indicates that school closures might only contribute 2-4% of deaths from COVID-19 (Ferguson et al. 2020).

- **Keep key community health services funded and operating:** The preceding analysis suggests that there is a risk of significant loss of life associated with the disruption to health services. To ensure that long-term health and economic welfare is not heavily compromised, at a minimum crucial areas should not see their funding cut when considering diverting resources towards fighting the COVID-19. These include child nutrition and survival programmes, maternal health, family planning and support towards major infectious diseases like TB, and malaria.

This is an evolving situation with new information coming to light regularly. The recommendations in this brief should be considered in the context of a rapidly changing epidemiological, economic and information environment.

1 Purpose and context of this brief

Nigeria, like all other nations, is considering what policies to enact to best combat the COVID-19 pandemic. In this context, researchers based at the Department of Economic Development and Social Studies of the National Institute for Legislative and Democratic Studies with technical support from the Copenhagen Consensus (CCC), has assessed the medium and long-term **opportunity costs of diverting resources towards addressing the COVID-19 pandemic**. Note that this report does **not** assess the costs and benefits of the 5-week lockdown that was imposed during April, but a future hypothetical lockdown of 9 months, including school closures.

1.1 Basic parameters

The analysis here considers the opportunity costs of **moderate social distancing** compared to a 'do-nothing'[1] scenario. For the purposes of this brief, moderate social distancing means reducing social contacts by 30-50%, leading to a reduction in the reproduction number, R, of SARS-CoV-2, the virus that causes the COVID-19 disease.[2]

It is unlikely that, given the current climate, Nigeria would attempt to introduce very stringent nationwide restrictions associated with a suppression strategy as has been tried in, for example, South Africa and India i.e. enforced stay-at-home orders reducing social contact by 50-75% and reducing R to below 1. This type of strategy is therefore considered out of scope for this brief.

In this brief we consider the opportunity costs of i) **school closures**[3], of ii) **movement and livelihood restrictions**, and of iii) **both of these policies**.

The analysis considers these measures to last for **9 months**. This is the midpoint of the expected 6-12 months such strategies would need to be implemented to achieve the full reduction in COVID-19 deaths. After this time, modeling suggests a sufficient number of people would be infected to reach herd immunity, and restrictions can be lifted.

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[1] In the absence of any covid-19 preventive measures; a situation in which no action is taken

[2] The leading epidemiological papers typically define mitigation as a reduction in R to some value lower than the natural reproduction number, R_0, but not less than 1. Strategies that bring R below 1 are called 'suppression' strategies and are out of scope for this brief. (Ferguson et al. 2020; Walker, Whittaker, Watson et al. 2020; Hogan, Jewell and Sherrard-Smith et al. 2020)

[3] Primary School

This paper uses an **8.6% discount rate**, which is based on the guidance provided in Robinson et al. (2019a). This paper suggests that the social discount rate should be two times the short term projected per capita growth rate, which is around 4.3%.

This brief pulls together **existing** information, reports and literature as of early May 2020 to provide some indicative policy recommendations. It does not attempt any new epidemiological modeling and provides economic analysis building on existing knowledge. This is an evolving issue with new information coming to light regularly. **The results of this brief should be considered in the context of a rapidly changing epidemiological, economic and information environment.**

2 What are the net health benefits of moderate social distancing?

Here we will estimate the total net benefit of moderate social distancing. At the time of writing, epidemiological modeling was not available to separate out the net benefits of just school closures or the net benefits of just movement and livelihood restrictions for Ghana. Therefore, we will assess the benefits for each of these policies as if they achieved the total benefits. This evidently overestimates the benefits of policies, and as will become apparent, makes the results even stronger.

2.1 Avoided COVID deaths

The Imperial College London, modeled disease outcomes for do-nothing, mitigation and suppression strategies across all countries (Walker, Whittaker, Watson et al 2020). In the Imperial study, researchers note that under an 'unmitigated' scenario the expected deaths in Nigeria are 412,635, assuming an R_0 of 3[4]. Introducing social distancing measures (reduction in social contacts by 45%) leads to 310,444 predicted deaths, for a net benefit of 102,191 predicted avoided deaths in Nigeria, relative to a do-nothing scenario (unmitigated). **Going forward, we will take 102,191 predicted avoided death as the reference outcome.**

2.2 Non-COVID deaths

Moderate social distancing is likely to impact utilization of health services, by reducing demand and access to healthcare, as well as the availability of equipment and health worker personnel required to provide services (Roberton et al. 2020). At the same time, a do-

[4] R_0 of 3 assumes the infection and mortality patterns observed in Europe and is considered the central estimate in Walker, Whittaker, Watson et al. (2020).

nothing strategy may also impact the health system, particularly secondary and tertiary care, if a large number of individuals contract COVID-19 and require hospitalization in a short period of time.[5] A full accounting of health impacts should include any flow-on effects from restrictions relative to do-nothing. Here we outline some of the existing evidence and the assumptions used in the analysis.

2.2.1 Major infectious diseases (HIV / AIDS, TB, Malaria)

Hogan, Jewell, Sherrard-Smith et al. (2020) model the additional deaths for HIV / AIDS, TB and malaria brought about by various mitigation and suppression strategies across low-and-middle income countries, with results split by high or moderate burden scenarios.

Applying the most appropriate scenarios to Nigeria indicates mixed impacts across the diseases from moderate socio-economic restrictions compared to do-nothing. According to the modeling by Hogan, Jewell and Sherrard-Smith et al., HIV / AIDS deaths are lower under moderate restrictions, while TB and malaria mortality are substantially higher. The reasons for this finding are complex, but in essence health services under do-nothing are interrupted completely for a relatively short period of time (6 weeks) when overall health care demand is high, while under moderate restrictions preventative health services and care seeking are reduced modestly for a longer period of time (6 months). The net effect of these is lower HIV / AIDS, but higher TB and malaria mortality.[6] The interruption in care services for HIV/AIDS during a period of high demand has greater medium-term consequences since it means some have unsuppressed viral loads and for example, progress from HIV to AIDS. For malaria and TB the longer interruption to bed net distribution and diagnostics, respectively, overwhelms any short-term disruption in care.

The impacts of the moderate restrictions are presented in Table 1. Note that these are five-year impacts, caused by moderate social distancing over a six month period. Being infectious diseases, it is appropriate to adopt a longer time horizon to account for changes in transmission resulting from restrictions. Additionally, we reduce some of the reported impacts from Hogan, Jewell and Sherrard-Smith (2020) to account for lower burden of each disease relative to the reference case. **Overall, moderate socio-economic restrictions would increase deaths by around 39,924, over five years** though with

[5] However, as noted in Barnett-Howell and Mobarak (2020), and explicitly modeled in Hogan, Jewell, Sherrad-Smith et al. (2020), if hospitals already have low capacity, as is the case in Nigeria, the difference between do-nothing and other scenarios may not be noticeable.

[6] The large malaria impact is confirmed in a separate analysis by WHO (2020), while the large TB impact corroborates a related analysis by StopTB Partnership (2020).

mixed impacts across the diseases. **HIV/AIDS deaths are lower by 12,661, while there are 28,107 and 24,478 more TB and malaria deaths respectively under moderate restrictions relative to do-nothing.**

Table 1: Estimated change in deaths caused by six months of social distancing, for three major infectious diseases over the next five years

Disease	Do-nothing (mortality per 1 million people)	Moderate restrictions (mortality per 1 million people)	Difference (mortality per 1 million people)	Absolute excess deaths for Nigeria
HIV / AIDS	293	83	-63*	(12,661)
TB	29	362	140*	28,107
Malaria	464	667	122*	24,478
TOTAL	**786**	**1112**	**199**	**39,924**

Source: Adapted from Hogan, Jewell, Sherrard-Smith et al. (2020). TB and malaria are reported impacts under 'high' burden scenarios. *HIV/AIDS reported impacts reduced by 80%, TB reported impacts Nigeria relative to disease-specific reference cases in Hogan, Jewell, Sherrard-Smith et al. (2020).

2.2.2 Reproductive, Maternal, Newborn and Child Health

Roberton et al (2020), estimate the impacts of reduced workforce, supplies, demand and access to reproductive, maternal, newborn and child health services (RMNCH), and increased child malnutrition associated with movement restrictions and economic disruption, across 118 countries. They model three scenarios each with different assumptions on the reduction of coverage in health services and increase in child wasting. Their results indicate that if coverage and wasting were to increase, child deaths would rise by 9.8-44.7% and maternal deaths by 8.3%-38.6% (see Table 2).

Table 2: Modeled impacts of various changes to RMNCH coverage and child wasting across 118 countries

Scenario	Increase in child deaths relative to baseline (%)	Increase in maternal deaths relative to baseline (%)
Low: 10%-18% reduction in coverage; 10% increase in wasting	9.8%	8.3%
Medium: 19%-27% reduction in coverage; 20% increase in wasting	17.3%	14.7%
High: 39%-52% reduction in coverage; 50% increase in wasting	44.7%	38.6%

Source: Adapted from Roberton et al. (2020)

Roberton et al (2020) provide scenarios against a baseline of 'no-change'. Comparing potential costs to this baseline will overstate the opportunity costs of restrictions, since it is likely, even in the absence of government intervention, that people will spontaneously social distance leading to a reduction in health utilization.[7] We therefore interpret the difference between the low and medium scenarios in Roberton et al. (2020) as the effect of increasing restrictions i.e. a 7.5 percentage point increase in child deaths and a 6.4 percentage point increase in maternal deaths.

Applying these impacts to current child and maternal mortality rates in Nigeria indicates **51,548 extra child deaths and 3,361 additional maternal deaths** due to moderate social restrictions over 9 months.

2.2.3 Traffic accidents

Fewer vehicles on the road should, all things being equal, mechanistically result in fewer deaths from traffic accidents. However, this will be somewhat countered by the fact that remaining vehicles will drive with higher average speeds, which is a known risk factor for

[7] It is important to stress that Roberton et al (2020) does **not** explicitly model the impacts of social distancing policies on maternal/child deaths. This study describes the impact of scenarios where health services contract and child wasting worsens.

traffic accidents. Therefore, we speculate a **30% reduction in traffic accidents** due to the overall 30-50% reduction in movement associated with moderate socio-economic restrictions. According to the Global Burden of Disease there were 6,391 deaths in Nigeria in 2017 from transport injuries. Therefore the expected benefit from reduced **traffic accidents is 4,793 deaths** over a 9-month period.

2.2.4 Air pollution

There are reports of socio-economic restrictions resulting in lower outdoor air pollution in several major cities (IQAir, 2020). In Nigeria, outdoor air pollution causes 49,110 deaths each year according to Global Burden of Disease. However, it seems likely that staying more at home will also increase indoor air pollution which is a risk factor for around 25% more deaths in Nigeria (64,226 deaths). We do not include these effects in our analysis due to lack of data, but had it been included, it would likely have made the conclusions even stronger.

2.2.5 Non-communicable disease

Socio-economic restrictions may increase deaths from non-communicable diseases (NCDs) such as hypertension, cancer and diabetes. For example, emerging evidence from India, where the government implemented a strict lockdown, indicates outpatient services for most major NCDs ailments fell by 40-50% and there was a 30% reduction in stroke and heart attack emergencies reaching hospitals (Rukmini, 2020). We do not include any impacts from NCDs due to lack of data, but had it been included, it would likely have made the conclusions even stronger.

2.2.6 Mental Health

It is likely that the COVID-19 pandemic, including the socio-economic restrictions that accompany it, would impact individuals' mental health (Holmes et al. 2020). A meta-analytic review of studies shows that isolation and loneliness increased the odds of mortality by around 30% (Holt Lundstad et al. 2015). It is unclear to what extent this would apply in the Nigerian context given the existence of large, multi-generational households. We do not include any impacts from mental health in this analysis, but had it been included, it would likely have strengthened the conclusions.

2.2.7 Indirect health impacts from unemployment

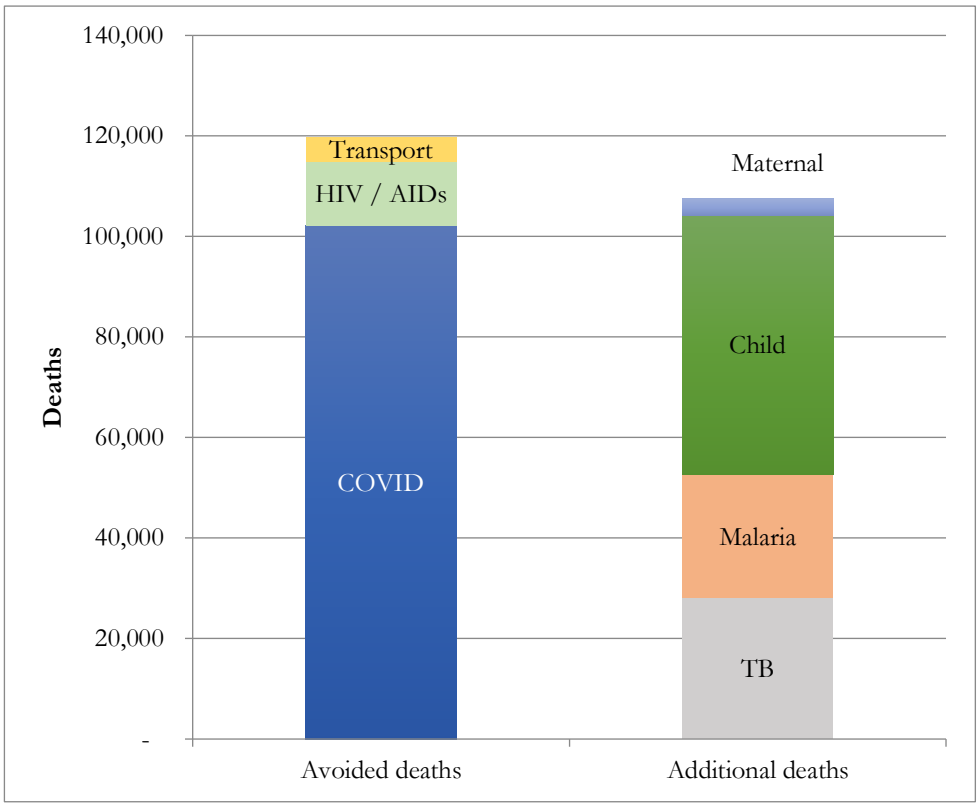
Studies from developed and developing countries report associations between unemployment / loss of livelihoods and mortality (Roelfs et al. 2011; Hone et al. 2019). In Brazil, a 1-percentage increase in unemployment due to a recession during 2014-2016 was

associated with an increase in mortality of 0.5 per 100,000 of population, predominantly from cardiovascular disease and cancer, though this effect was ameliorated in areas with large expenditures on health and social protection (Hone et al. 2019). We do not include any health impacts associated with potential loss of employment, but had these impacts been included, they would likely have strengthened the conclusion.

2.3 Summary of avoided deaths from moderate social distancing

The analysis above suggests that moderate socio-economic restrictions for 9 months might result in **119,645 reductions in deaths**, comprising approximately 102,191 avoided deaths from COVID-19, 12,661 avoided deaths from HIV / AIDS and 4,793 avoided deaths from traffic accidents. However, this would likely be partially offset by **an increase in 107,494 deaths** associated with health services contraction and child malnutrition. These comprise 28,107 additional TB deaths, 24,478 additional malaria deaths, 51,548 additional child deaths and 3,361 additional maternal deaths. **The net impact is 12,151 avoided deaths from moderate social distancing**. Again we stress the substantial uncertainty in these estimates.

Figure 2 Number of deaths avoided and incurred by moderate social distancing in Nigeria



2.4 Summary of avoided life years lost from moderate social distancing

The deaths avoided from COVID-19 are likely to be of older people, since age is a known risk factor for the disease. In contrast, the deaths from the remaining causes are likely to be of younger people, particularly children under 5. Trading off mortality risk across groups with different life expectancy generates challenging ethical dilemmas with no easy answers. However, evidence from both high income and low-income settings suggests mortality risk reductions in children are at least twice as much as similar reductions for adults (Robinson et al. 2019a; Robinson et al. 2019b; Redfern et al. 2019).

One standard and parsimonious approach is to count the impacts in terms of 'years of life' lost rather than a death count. Utilizing the age structure of Nigeria , country specific life tables from the UN-World Population Prospects 2019 and the age-specific infection mortality rates from Ferguson et al. (2020) generates an expected years of life lost from a COVID-19 death in Nigeria of 16.[8] In contrast, the comparable years of life lost for a child

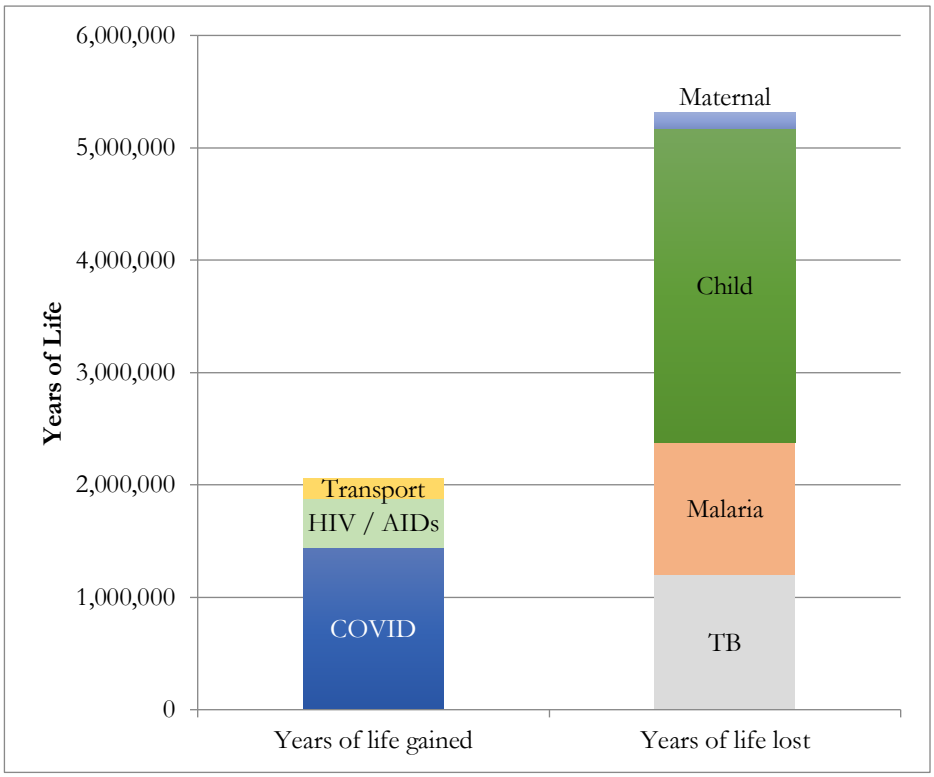
[8] This calculation assumes age-specific infections would mirror the age population structure of Nigeria. For example if 35-39 year olds make up 5% of the population, we expect 5% of infections to be in this age bracket.

(0 – 4 years) death is 55. Utilizing disease specific years-of-life lost per death from Global Burden of Disease we calculate the equivalent impacts using years of life, instead of death count. This suggests:

- **2,059,131 years of life gained** from moderate socio-economic restrictions comprising 1,442,223 years of life gained from avoided COVID-19 mortality, 435,998 years of life gained from avoided HIV/AIDS mortality and 180,910 avoided years of life gained from avoided traffic accidents
- **5,316,482 years of life lost** from moderate socio-economic restrictions comprising 1,201,591 years of life lost from increased TB mortality, 1,174,890 years of life lost from increased malaria mortality, 2.792,873 years of life lost from additional child mortality and 147,128 years of life lost from additional maternal mortality.

The analysis indicates that life years lost are higher than life years gained under moderate social distancing. However, the relative difference is far larger than when health impacts are measured by death count.

Figure 3 Loss of life years avoided and incurred by moderate social distancing in Nigeria



2.5 Summary of cost of death and loss of life years

Societies often make decisions to fund some life-saving policies but not others. One clear preference is that saving few lives at very high cost is relatively less attractive than saving many lives at lower cost. In a realistic setting of limited resources, not all life-saving policies can be funded, and hence the most life-saving policies are implemented first. Decisions on life-saving policies are often highly formalized, especially within traffic regulation, where decisions to put in life-saving measures like crash barriers on roads weigh the costs against the number of lives saved. This sort of analysis uses what is called the value of statistical life (VSL) as a cut-off point for where more spending is justified and where it is not.

The VSL reflects the willingness of individuals to pay for a reduction in mortality risk. It is important to stress this is not the value to avoid mortality with certainty but rather the value of many small mortality risk reductions across a large population that would lead to the saving of one life in a statistical sense. There is considerable uncertainty about the appropriate VSL for lower-and-middle-income countries (Robinson et al. 2019a)

Robinson et al (2019a) suggest using a U.S. value of statistical life (VSL) of $9.4m USD (2015 dollars) – representing approximately 160 times income as measured by income per capita PPP – transferred to Nigeria using an income elasticity of 1.5. This generates a value

of statistical life for Nigeria of USD 97,000 which we adopt as the benefit of a death avoided.

In many economic analyses, a constant value of statistical life is applied to each avoided death of the beneficiary population. However, this ignores differences in life expectancy between different individuals within the population. To account for this requires an estimation of the benefit associated with an avoided year of life lost – often referred to as a value of statistical life year (VSLY). Following the recommendations from Robinson et al. (2019a) we estimate a VSLY by dividing the VSL by the life expectancy at average adult age in Nigeria (36).[9] This yields a VSLY of USD 97,000 / 36 = USD 2,667.

Applying the VSL to the figures above yields estimates of the impacts from moderate social distancing: the benefit of avoided deaths is USD 11.6 billion, while the cost of additional deaths is USD 10.4 billion (see Figure 4). Applying the VSLY instead results in a benefit of USD 5.5 billion from years of life gained, and a cost of USD 14.2 billion from years of life lost (see Figure 5).

[9] An adult, for the purposes of this calculation, is defined as anyone above the age of 15. Based on population structure of Nigeria the age of an average adult is 32, and the life expectancy at this age is 36.

Figure 4: Mortality costs and benefits of moderate social distancing (VSL approach)

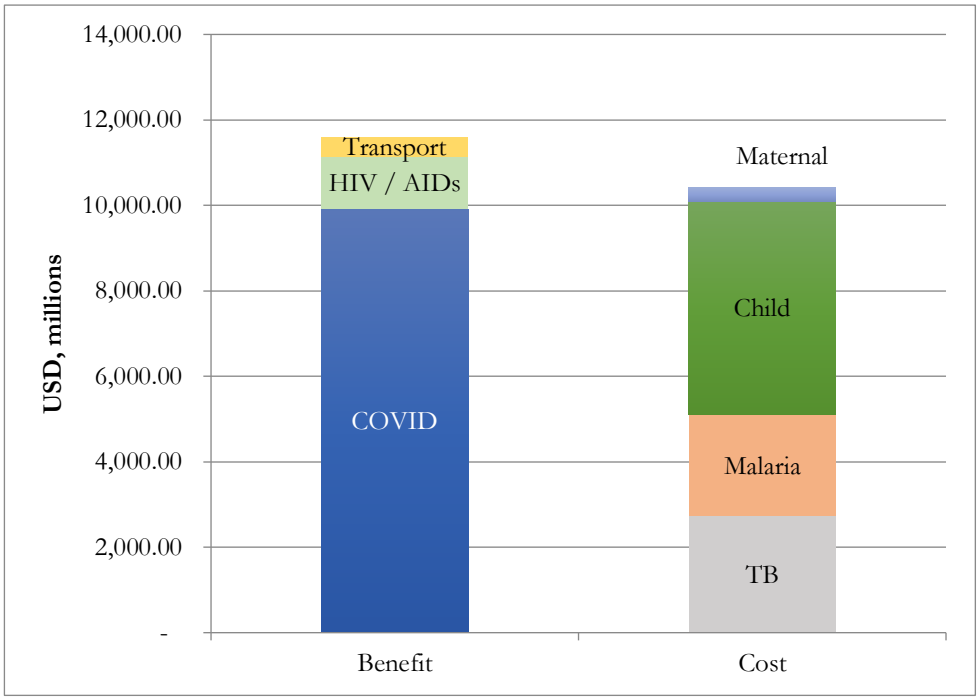
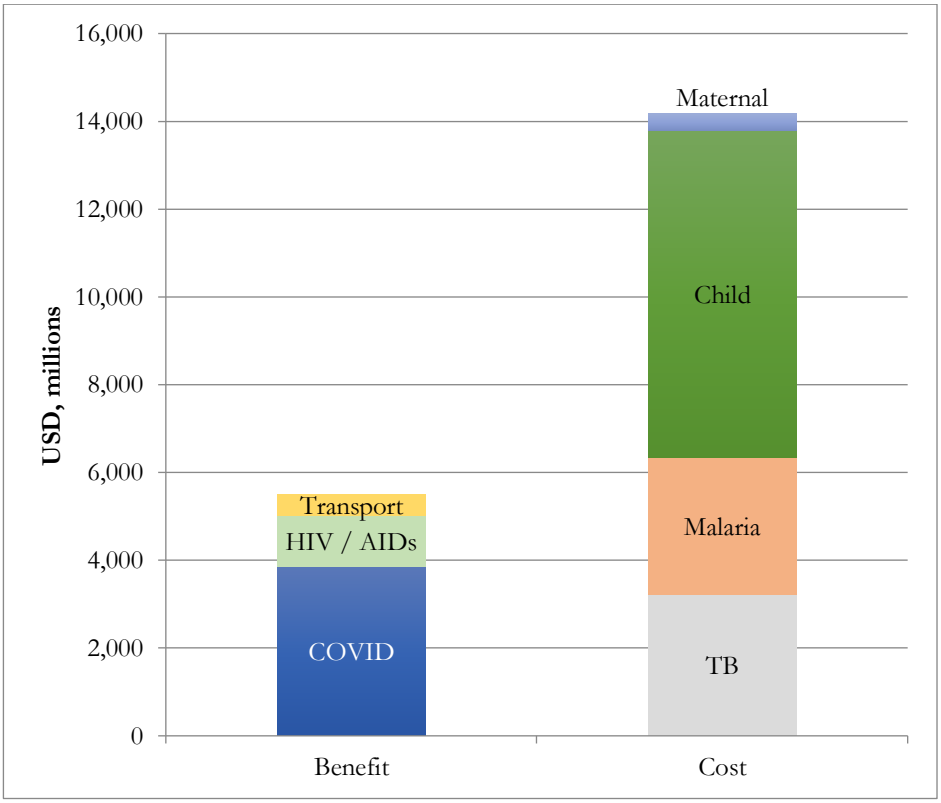


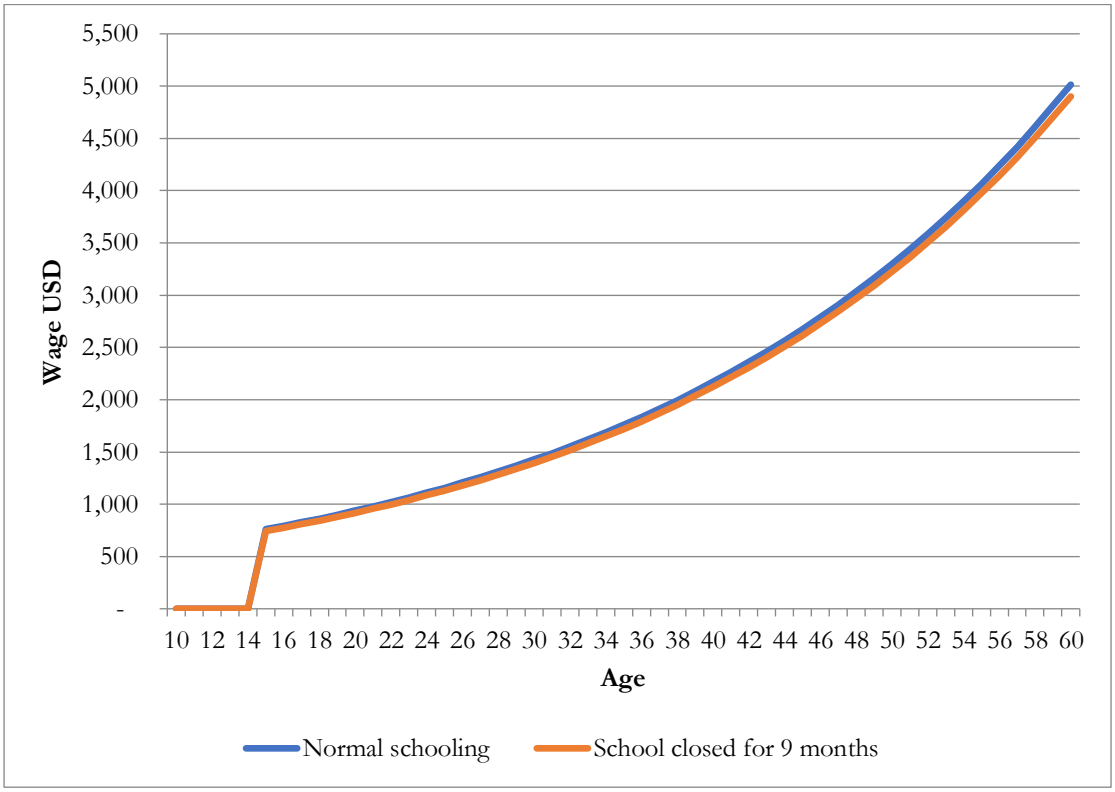
Figure 5: Mortality costs and benefits of moderate social distancing (VSLY approach)



3 Opportunity costs of school closures

Nigeria announced school closures on 23 March 2020 which is still in force at the time of writing this paper. This section examines the opportunity costs of ongoing school closures, in terms of reduced future productivity of students. Aromolaran (2006) note that one year of primary education boosts wages by 3% on average in Nigeria. We assume that the relevant wage for a person who has completed primary school is the minimum wage of $700 per year. We estimate the future wages of two 10 year-olds today - one who would finish with 6 full years of primary school, and another with 5.25 years of primary schooling. Both wage profiles start at age 15 and end at age 60, and are projected into the future using real GDP per capita growth forecasts from the UN's middle-of-the-road scenario for Nigeria, (here from IIASA 2020, see also Riahi et al. 2017). The difference between the two represents the cost of missed schooling associated with a moderate COVID-19 lockdown (see Figure 6).

Figure 6: Estimated life-time wage profiles of two children with normal schooling, and one with 9 months of missed education



Source: Estimates by authors' utilizing an expected wage boost of 3% per year from each year of schooling from Aromolaran (2006)

Using the 9% discount rate, the present value of the loss of future income is $224 per student. Given that there are approximately 25.6 million[10] Nigerian children typically in primary school, this suggests a **cost on the order of USD 5.7 billion if school closures continue for 9 months.**

This cost may be a significant underestimate because those in secondary school who would command higher wages than the stylized 10 year old used in this example have not been accounted for. Additionally, this analysis does not account for lost productivity and free time of parents and caregivers who may now have to homeschool or take care of children. The impact of home schooling or other work done during schooling will slightly reduce the cost of school closure. However, it is also likely that many students having been out of school will fail to return to school (especially girls, leading to long term gender inequality) or do much worse afterwards, which would increase the costs, potentially enormously. In total, this cost is more likely to be an underestimate.

3.1 Comparing net health benefits to the opportunity costs of school closure

To assess the value of the school closures to help tackle COVID-19 we have to compare the likely benefit from school closures with its opportunity cost. The costs were estimated above at about USD 5.7 billion.

However, we have no good evidence of the epidemiological benefit of just school closures. It is clear that school closures can *at the very most* reduce future deaths as much as a full moderate social distancing policy. We will use the estimate of 12,150 fewer deaths in section 2.2 from a full moderate social distancing policy as the *most optimistic* estimate for the impact of school closures. Recall that our estimation of net health impacts is perhaps on the optimistic side, since epidemiological modeling is not available that disentangles the effects of school closures from a package of restrictions and does not include impacts on NCDs, mental health, air pollution nor impacts from isolation and unemployment. Realistically, this number may be orders of magnitude too large (Viner et al. 2020).

Figure 7 shows the comparison with the value of the highest possible number of lives saved and compares this with the opportunity cost for school closures for 9 months. **The opportunity cost in terms of loss of future income from school closures outweighs even the most optimistic estimate of the net impacts from health**.

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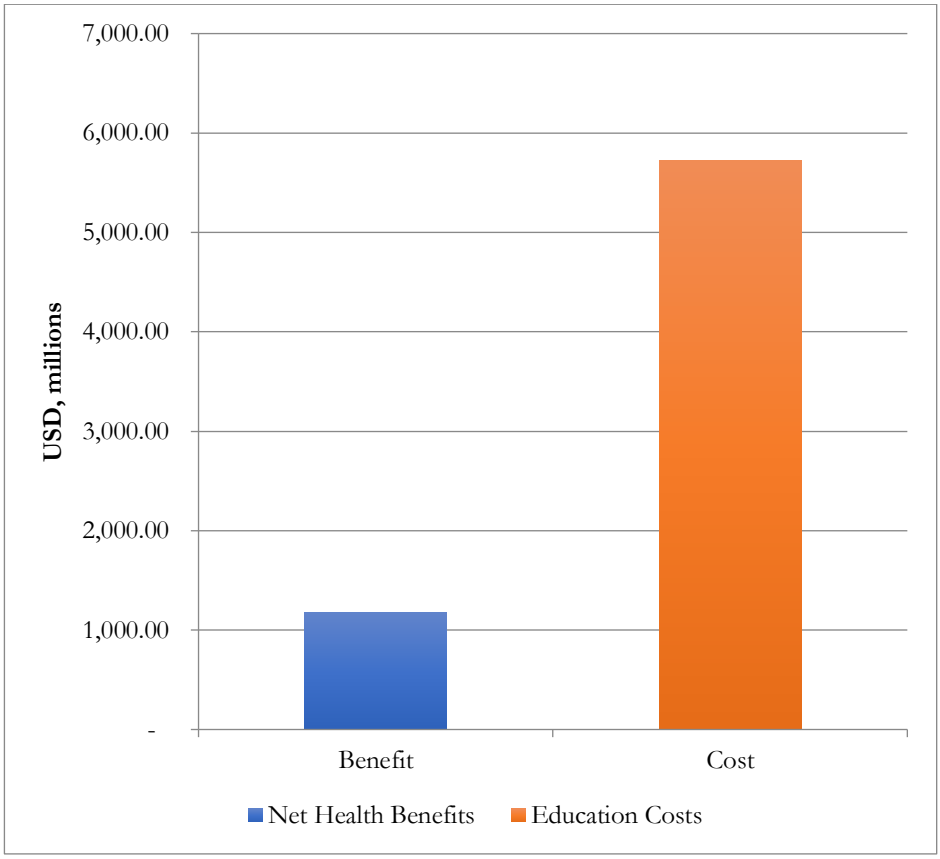
10 https://africacheck.org/factsheets/factsheet-grading-nigerias-progress-in-education/#:~:text=data%20in%20Nigeria.-,School%20enrolment,according%20to%20the%20education%20ministry.

The result holds when using VSL to value deaths. It is even stronger when estimated with values of years of life saved (which established above leads to fewer net benefits).

The interpretation of this result is that **given current understanding, school closures probably have much greater opportunity costs than the potential COVID-19 benefits it could yield**.

Figure 7: An optimistic estimate of the benefits of school closures are dwarfed by the opportunity costs from school closures



4 Opportunity Costs of Movement and Livelihood Restrictions

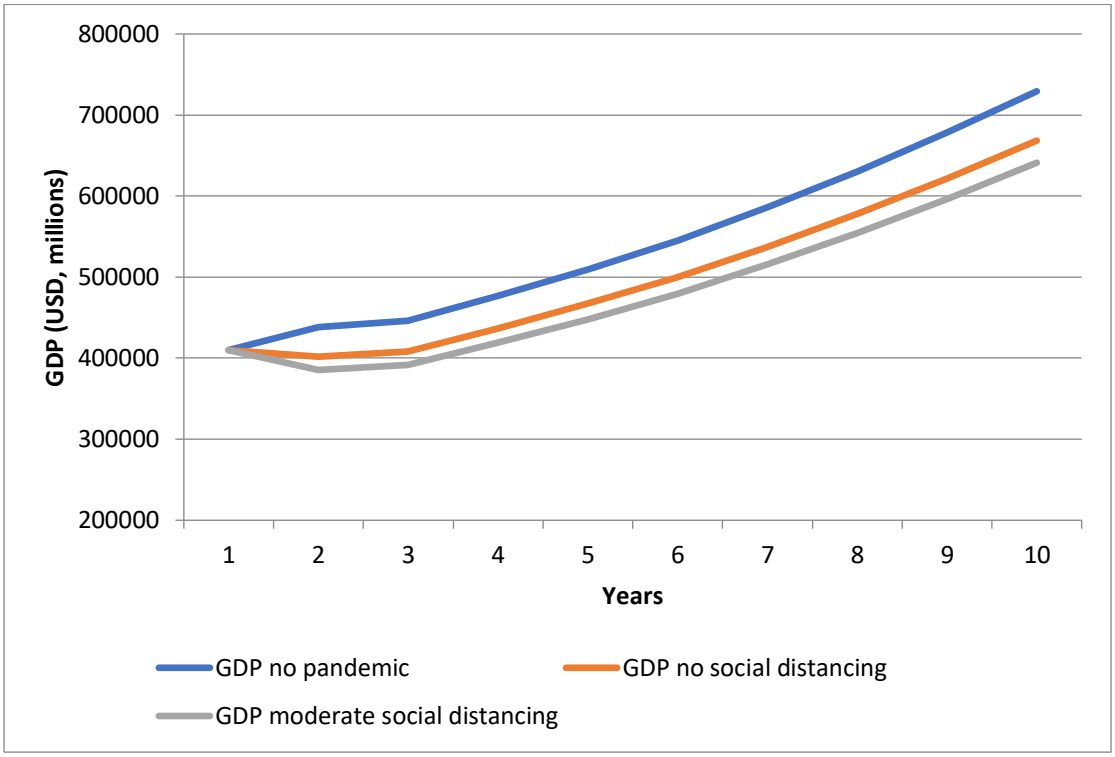
In this section we estimate the costs associated with movement and livelihood restrictions, here defined as GDP loss. These could likely be similar to the social distancing restrictions proposed, including closures of central markets, closures of non-essential businesses, limiting public gatherings, and limiting public transport. We analyze a general policy of movement and livelihood restrictions to achieve moderate social distancing.

We draw from the only peer-reviewed published cost-benefit analysis done of social distancing – a study by Thunström et al. (2020) examining a moderate lockdown policy in US. They show that under an unmitigated scenario the GDP loss is expected to be 2% in

the first year, while for a moderate mitigation scenario the GDP loss is 6% for 2020. This means the reduction in economic growth for a moderate mitigation scenario is the difference between the unmitigated and the mitigated scenario. There is considerable uncertainty in the transfer of this effect from the US to the Nigerian context.

Here we adopt the same GDP percentage losses, but use Nigeria GDP figures and the expected growth rates for Nigeria. Those projections assume quite a rapid rate of real GDP growth, starting at 6.9% in 2022 and lowering to 6% by 2050. For the second year (2021), we use the World Bank projected growth rate of 1.7% and assume growth continues as per projections under a no pandemic scenario. From year 3 (2022), we use GDP growth forecasts from the UN's middle-of-the-road scenario for Nigeria, (here from IIASA 2020, see also Riahi et al. 2017) and assume growth continues as per projections under a no pandemic scenario (Figure 8).

Figure 8: Pathways of GDP under no pandemic, moderate or no social distancing



Source: Authors estimates using GDP impacts adapted from Thunström et al. (2020), the World Bank (2020) and GDP growth estimates from IIASA (2020)

The additional cost is the discounted difference between the orange and the grey development in GDP over time. Using a 9% discount rate, the total GDP loss over 30 years is equivalent to around **USD 373.5 billion.** About five percent occurs in the first

two years due to differences in growth rates leading to lower GDP. Over the next 28 years, growth rates are the same, but because of the larger recession, the economy is at a lower starting point and never catches up. It should be noted that this is based on figures from Thunström et al (2020), which assumed a 5-month moderate lockdown. It is likely that a 9-month lockdown would have a higher cost.

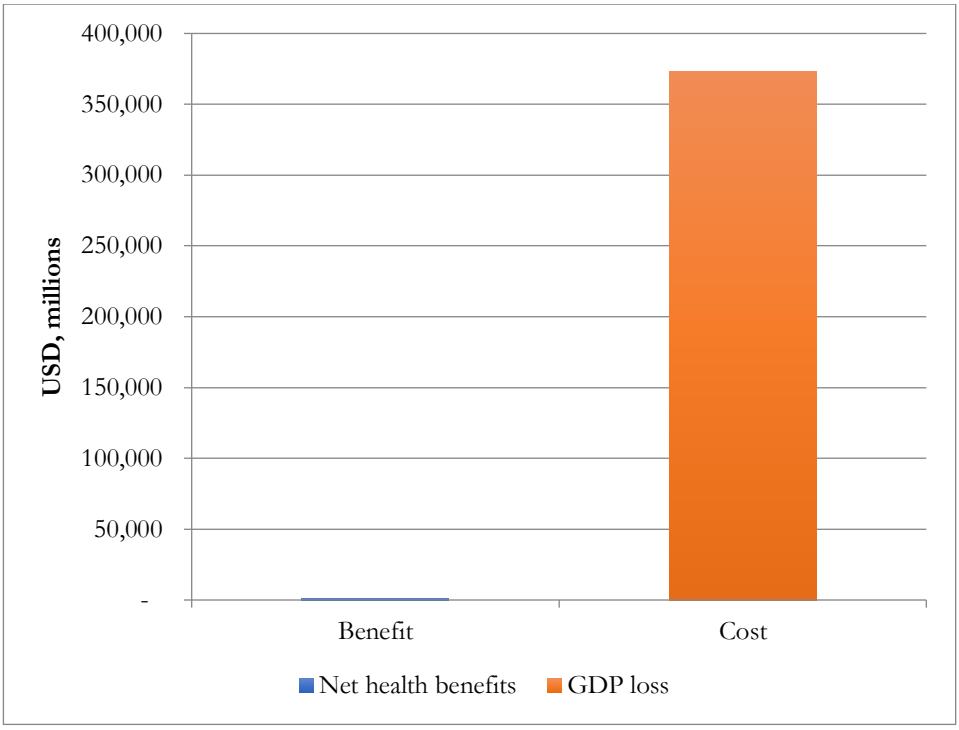
4.1 Comparing the net health benefits with the opportunity cost of lower economic growth

It is likely that the net health benefits of a moderate social distancing policy would be in the order found in section 2, with about 12,150 avoided deaths. This should be compared to the opportunity cost of lower economic growth at about USD 373.5 billion.

Figure 9 shows this comparison. As above the GDP loss outweigh the net health benefits by a considerable margin. Different specifications of net health benefits (not shown) do not change the result. Given the uncertainty in the application of the US case to Nigeria, it is worth estimating what level of GDP loss, relative to the assumed do-nothing cost of -2% growth, would yield a GDP loss that just exceeds the net health benefits. In this case, the GDP loss of movement and livelihood restrictions would only need to be 0.32 percentage points more than do-nothing (i.e. -2.32% for GDP) for the loss to exceed the net health benefits.

Thus, it is likely that **given current understanding, restrictions on movement and livelihood are likely to have much greater opportunity costs than the potential COVID-19 benefits it could yield**.

Figure 9: Costs of movement and livelihood restrictions assessed against net health benefits from moderate social distancing



5 Summary of Results and Policy Implications

This brief provided some indicative indications of the benefits from moderate socio-economic restrictions as a whole as well as impacts from school closures and movement and livelihood restrictions. To summarize:

- Moderate social distancing for 9 months could result in **119,645 avoided deaths**, relative to 'do-nothing' comprising approximately 102,191 avoided deaths from COVID-19, 12,661 avoided deaths from HIV / AIDS and 4,793 avoided deaths from traffic accidents
- However, this likely would be partially offset by **an increase of 107,494 deaths** associated with health services contraction and child malnutrition. These comprise 28,107 additional TB deaths, 24,478 additional malaria deaths, 51,548 additional child deaths and 3,361 additional maternal deaths.
- **The net health impact is 12,151 avoided deaths from moderate social distancing.**
- Since most of the lives saved from COVID-19 are considerably older than the lives saved from other effects, the differential in terms of years of life lost is very high with 2,059.131 years of life gained against 5,316,482 years of life lost.

- In terms of social value, the best outcome from a moderate social distancing policy would generate **net benefits worth USD 1.179 billion**.
- Keeping schools closed for 9 months could generate a USD 5.72 billion loss of future incomes for about 25.6 million children. The opportunity cost of a more productive future workforce in Nigeria is higher than even the most optimistic benefit estimate of USD 1.179 billion. **Based on current information a policy of school closures will leave Nigeria much worse off by USD 4.54 billion**
- Moderate movement and livelihood restrictions could generate USD 373.5 billion in GDP loss over the next 30 years. The opportunity cost from damage to the economy vastly outweighs the potential net health benefits of USD 1.179 billion. **Based on current information a policy of moderate social distancing will leave Nigeria much worse off.**

Either school closures or movement and livelihood restrictions would generate costs larger than the net health impacts. As noted above the net health impact is based on a package of restrictions, while the costs are for only one class of restrictions respectively. Combining the two costs against the benefits would reinforce the main argument, and as noted in Table 4 below the benefit-cost ratio is only 0.03.

Table 4: Summary of costs and benefits

	Benefits (USD, millions)	Costs (USD, millions)	BCR
Health impacts from moderate social distancing	11,606	10,427	n/a
Future income loss from 9 month school closure	0	5,724	n/a
GDP loss from movement and livelihood restrictions	0	373,483	n/a
TOTAL	11,606	389,634	0.03

This analysis indicates that school closures as well as movement and livelihood restrictions are unlikely to generate benefits greater than costs. Given the above results, the government should consider **three headline policies** to balance out the need to contain COVID-19 with competing concerns:

- **Do not increase social restrictions more than what is already in place -** to avoid escalating both health and economic costs that have lasting effects on the economy and livelihoods. The analysis has shown that impacts on the economy from moderate COVID mitigation strategy are likely to be very large and significantly higher than potential benefits. However, **continuing** with a **series of low-cost social restrictions** – including ensuring physical distancing and non-contact greetings, cocooning of the elderly and vulnerable, restricting large gatherings and promoting hand washing – appear effective. Bottom line, to the greatest extent possible, **avoid mass economic and livelihoods disruption.**

- **Reopen schools**: The preceding analysis indicates that school closures have a large cost in terms of lost future productivity that outweighs even the most optimistic benefits. Encouragingly, it appears that children are at least risk from COVID-19. Modelling for the US and UK indicates that school closures might only contribute 2-4% of deaths from COVID-19 (Ferguson et al. 2020).

- **Keep key community health services funded and operating:** The preceding analysis suggests that there is a risk of significant loss of life associated with the disruption to health services. To ensure that long-term health and economic welfare is not heavily compromised, at a minimum crucial areas should not see their funding cut when considering diverting resources towards fighting the COVID-19. These include child nutrition and survival programmes, maternal health, family planning and support towards major infectious diseases like TB, and malaria.

5.1 Note on Uncertainty

There are several sources of uncertainty in this analysis. The first type of uncertainty concerns the impacts of the various strategies, including 'do-nothing', on mortality, education, and economic outcomes. With the exception of education outcomes, we have drawn these impacts from studies that only model disease or economic effects. Like all models, the results rest on a series of assumptions (and their interactions) and naturally

there is substantial uncertainty in the results. As we move forward, we may find that the effects of each scenario are better or worse than predicted. Perhaps the parameters where the evidence base is the weakest are the assumed impacts on non-COVID deaths, where research is still evolving. We have been conservative insofar as omitting many types of potential impacts, such as mental health and unemployment, which would strengthen the headline findings.

The second type of uncertainty concerns the epidemiological and disease characteristics of the SARS-CoV-2 itself. Despite the large amount of research already produced, there is still much the global community does not know about the coronavirus. Some features that would **reduce** the benefits of moderate social restrictions:

- the disease is not as deadly as initially believed e.g. due to the discovery of many asymptomatic carriers reducing the infection fatality rate
- much of the (Nigerian) population has already been exposed and acquired immunity
- a treatment, cure, vaccine or other intervention has been discovered that reduces the impact, transmission or deadliness of SARS-CoV-2 / COVID-19 and it is available in sufficient quantities in Nigeria

Some features that would **increase** the benefits of moderate social restrictions:

- Certain co-morbidities or risk factors present in the Nigerian population, increase the effective infection fatality rate
- Exposure to the SARS-CoV-2 leads to a long-term, non-trivial disability that increases the costs of catching the coronavirus
- Catching the virus does not confer immunity from future infection
- A treatment, cure, vaccine or other intervention is imminent but not yet available. In this case, depending on the level of infection in the population, short-term moderate social distancing might be valuable (the 'buy time' argument).
- Sufficient people have been infected that Nigeria is close to, but has yet to reach, herd immunity. In this case moderate social distancing for a short period of time might avoid 'overshooting' the herd immunity level leading to lower infections overall (see Mulligan, Murphy and Topel, 2020 for more discussion on this dynamic)

Despite these uncertainties, the difference between the potential benefits vs. education costs and GDP loss is sufficiently large that the headline policy recommendations seem rather strong. As the global community learns more about both COVID-19 and the

impacts of strategies to address it, analyses should be updated to determine to what extent the benefits of strategies exceed their costs.

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