A RAPID COST-BENEFIT ANALYSIS OF MODERATE SOCIAL DISTANCING IN RESPONSE TO THE COVID-19 PANDEMIC IN GHANA

GHANA PRIORITIES PROJECT

20 MAY 2020

GHANA PRIORITIES

COPENHAGEN CONSENSUS CENTER

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We thank the following individuals for helpful comments on an earlier version of this draft: Justice Nonvignon, Festus Ebo Turkson and Priscilla Twumasi-Baffour, University of Ghana. This brief is based on a similar report conducted for the Malawi National Planning Commission (NPC), and we acknowledge the input of Thom Munthali (NPC), Nyovani Madise (AFIDEP) and Salim Mapila (AFIDEP) for contributing to the Malawi report. We also acknowledge comments on the Malawi report from Kalipso Chalkidou, Center for Global Development, Julian Jamison, University of Exeter, Bahman Kashi, Limestone Analytics, Lisa Robinson, Harvard University, Cyandra Carvalho, Copenhagen Consensus Center.

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 22,600 if implemented for 9 months**. In addition, lower social interaction would also mean less traffic and hence fewer traffic deaths, saving about 1,300 lives. Finally, with lower pressure on the health care system, it is estimated that almost 1,300 more people with HIV will not die over the coming 5 years. **In total, moderate social distancing will likely reduce the death toll by 25,200** over the next five years.
    - However, moderate social distancing will also lead to less health outreach and more malnutrition, causing more deaths from malaria (1,400), from TB (5,200) and from child mortality (2,450) along with about 150 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 9,200 deaths over the next five years**.
    - **The total number of deaths avoided from moderate social distancing is likely to be around 16,000**.
- 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 **446,000 life years gained, and contribute to 348,000 life years lost**, a relatively smaller differential than a measure examining deaths.
- The **social value of the net benefits of deaths avoided is GHS 8.3 billion.**
- Closing schools for 9 months means that 7.2 million children will receive 9 months less education and 2.8 million children will not receive school feeding. This will make each child less productive in their adult years. In total, it is estimated the **social cost of closing schools for Ghana will be around GHS 14.9 billion - the**

present value of income loss for 7.2 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 (16,000 deaths), the maximal benefit from this policy would be GHS 8.3 billion. This means that **on current knowledge, a policy of school closures will leave Ghana at least GHS 6.6 billion worse off.**

- Moderate movement and livelihood restrictions would generate a higher economic cost, which would lead to a loss of GHS 262 billion - the estimated present value of GDP loss over the next 30 years. Compared to maximal benefits of GHS 8.3 billion, it means that **on current knowledge, a policy of moderate movement and livelihood restrictions will leave Ghana much worse off** with a net economic cost of **GHS 253 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 1a: Costs of moderate social distancing vastly outweigh benefits (GHS)

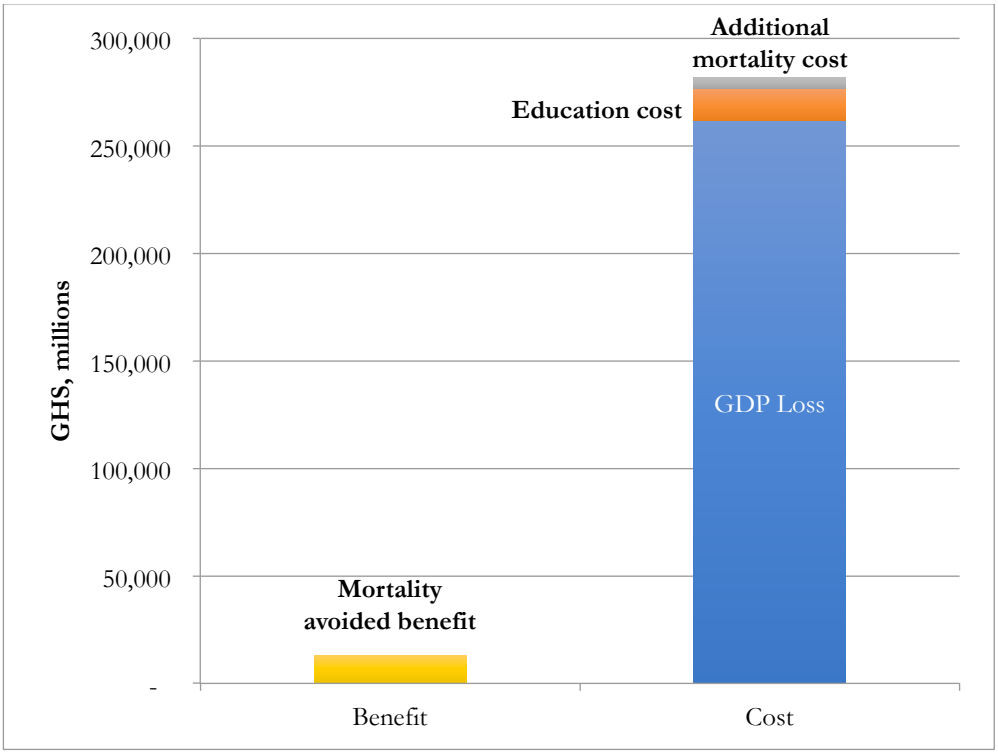
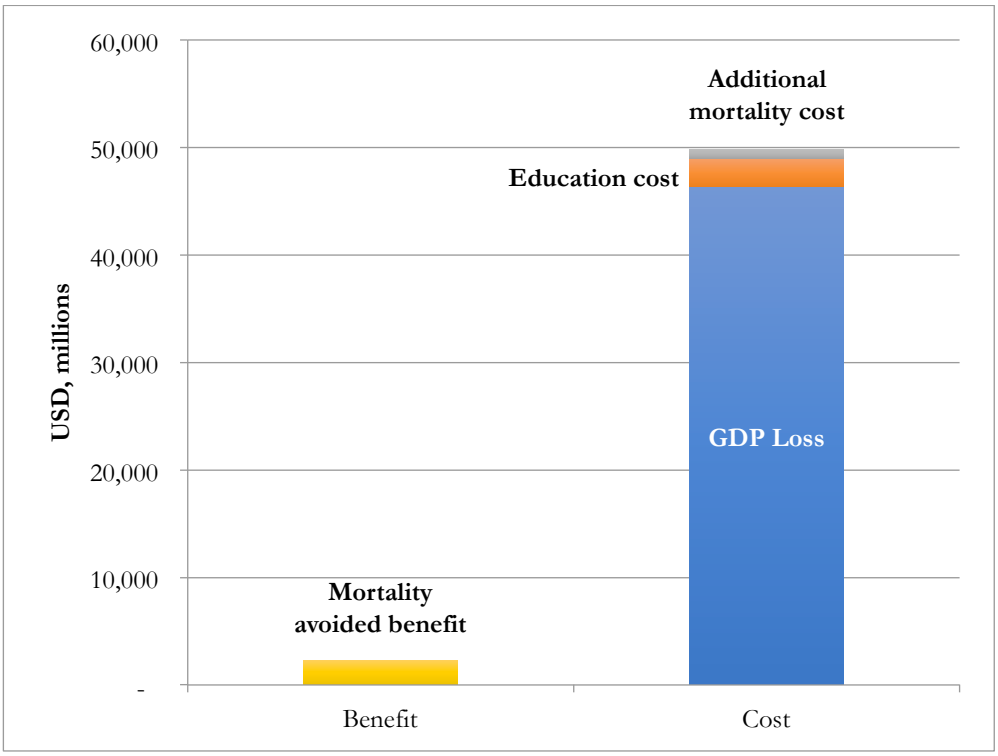


Figure 1b: Costs of moderate social distancing vastly outweigh benefits (USD)



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

Ghana, like all other nations, is considering what policies to enact to best combat the COVID-19 pandemic. In this context, this report assesses the **opportunity costs of diverting resources towards addressing the COVID-19 pandemic**. This analysis being made within the context of an ongoing partnership between the National Development Planning Commission and Copenhagen Consensus under the *Ghana Priorities* project. Note that this report does **not** assess the costs and benefits of the 3-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, Ghana 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, Junior High School and Senior High School

This paper uses an **8% 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%.

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 Ghana are 74,214, assuming an R_0 of 3[4]. Introducing social distancing measures (reduction in social contacts by 45%) leads to 49,124 to 54,142 predicted deaths, for a net benefit of 20,072 – 25,090 predicted avoided deaths in Ghana, relative to a do-nothing scenario (unmitigated). **Going forward, we will take the midpoint of 22,581 predicted avoided death as the reference outcome.**

[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). However, an unpublished analysis using local data by a team from the University of Ghana suggests an R_0 of 2 might be more appropriate for Ghana (private communication, Justice Nonvignon). Given that this report is unpublished we cannot access those results. However, we do note that under an R_0 of 2 the benefits of moderate social distancing would be lower and the findings of this report would be strengthened.

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-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 Ghana 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.

[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 Ghana, 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).

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 5,284, over five years** though with mixed impacts across the diseases. **HIV/AIDS deaths are lower by 1,305, while there are 5,174 and 1,416 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 Ghana
HIV / AIDS	293	83	-42*	(1,305)
TB	29	362	167*	5,174
Malaria	287	355	46*	1,416
TOTAL	**609**	**800**	**170**	**5,284**

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 reduced by 50% and malaria impacts reduced by 1/3rd to account for lower incidence of diseases in Ghana 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 of 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.

[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.

Applying these impacts to current child and maternal mortality rates in Ghana indicates **2,461 extra child deaths and 135 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 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 5,740 deaths in Ghana in 2017 from transport injuries. Therefore the expected benefit from reduced **traffic accidents is 1,291 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 Ghana, outdoor air pollution causes 5,208 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 50% more deaths in Ghana (9,780 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 Ghanaian 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.

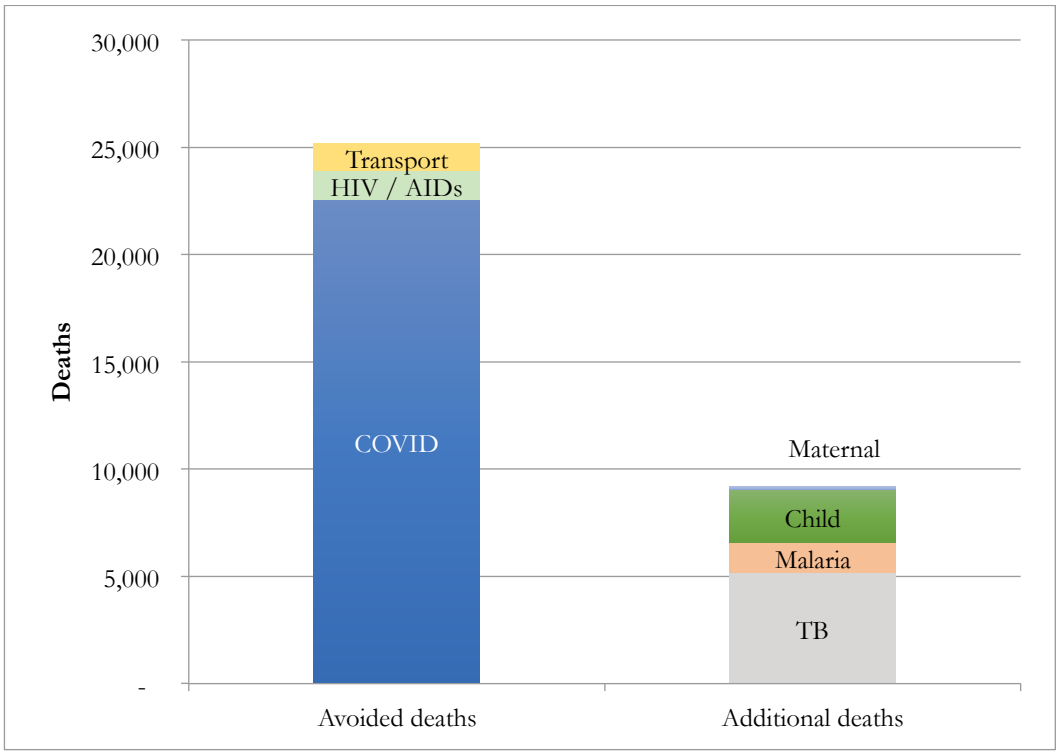
2.2.7 Indirect health impacts from unemployment

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 **25,178 reductions in deaths**, comprising approximately 22,581 avoided deaths from COVID-19, 1,305 avoided deaths from HIV / AIDS and 1,291 avoided deaths from traffic accidents. However, this would likely be partially offset by **an increase in 9,186 deaths** associated with health services contraction and child malnutrition. These comprise 5,174 additional TB deaths, 1,416 additional malaria deaths, 2,461 additional child deaths and 135 additional maternal deaths. **The net impact is 15,992 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 Ghana



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).

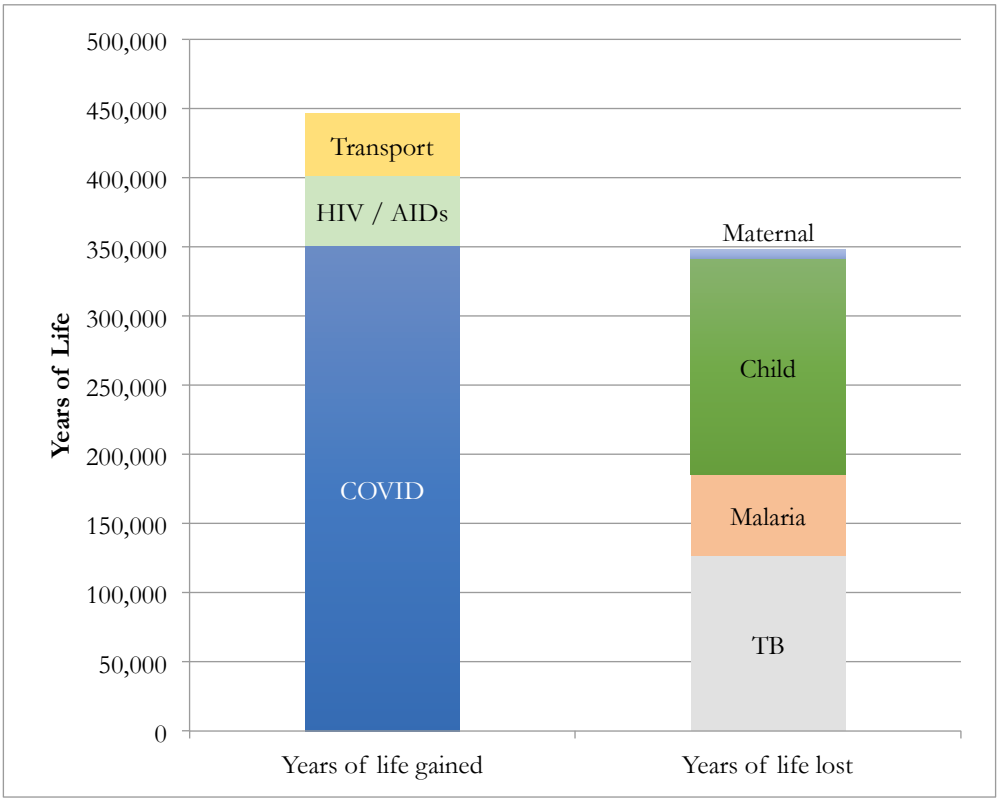
One standard and parsimonious approach is to count the impacts in terms of 'years of life' lost rather than a death count. Utilizing the age structure of Ghana , country specific life tables from the WHO and the age-specific infection mortality rates from Ferguson et al. (2020) generates an expected years of life lost from a COVID-19 death in Ghana of 16.[8] In contrast, the comparable years of life lost for a child (0 – 4 years) death is 64. 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:

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

- **446,000 years of life gained** from moderate socio-economic restrictions comprising 351,000 years of life gained from avoided COVID-19 mortality, 51,000 years of life gained from avoided HIV/AIDS mortality and 45,000 avoided years of life gained from avoided traffic accidents
- **348,000 years of life lost** from moderate socio-economic restrictions comprising 127,000 years of life lost from increased TB mortality, 58,000 years of life lost from increased malaria mortality, 156,000 years of life lost from additional child mortality and 7,000 years of life lost from additional maternal mortality.

The analysis indicates that life years gained are higher than life years lost under moderate social distancing. However, the relative difference is not as large as when health impacts are measured by death count.

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



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 Ghana using an income elasticity of 1.5. This generates a value of statistical life for Ghana of GHS 520,000 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 Ghana (36).[9] This yields a VSLY of 520,027 / 36 = 14,445.

Applying the VSL to the figures above yields estimates of the impacts from moderate social distancing: the benefit of avoided deaths is GHS 13.1 billion, while the cost of additional deaths is GHS 4.8 billion (see Figure 5). Applying the VSLY instead results in a benefit of GHS 6.4 billion from years of life gained, and a cost of GHS 5.0 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 Ghana the age of an average adult is 37, and the life expectancy at this age is 36.

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

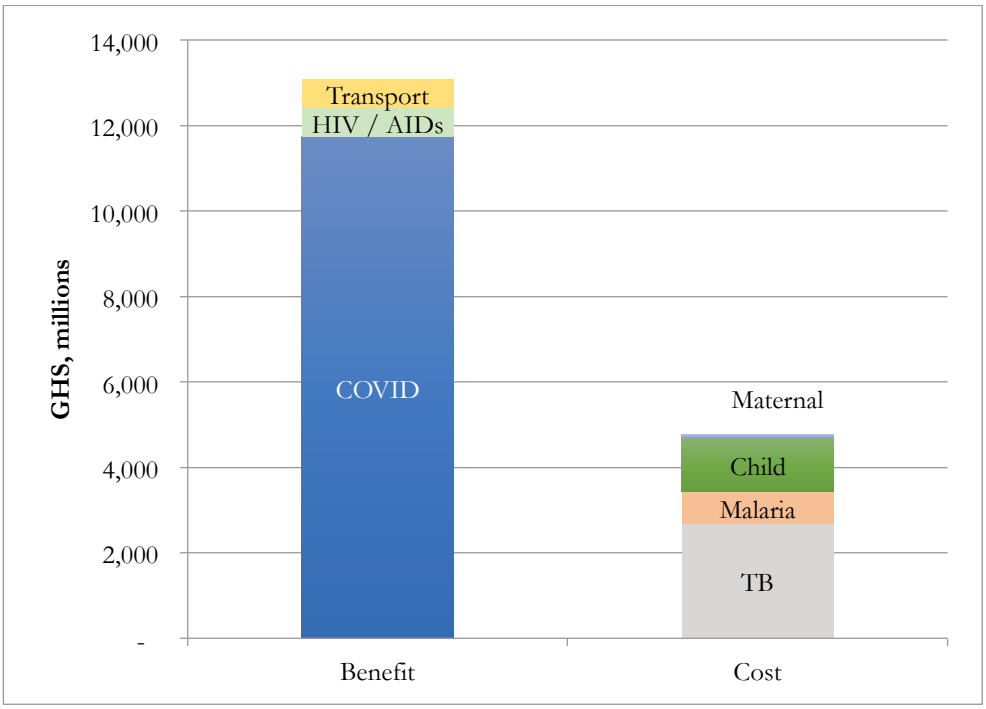
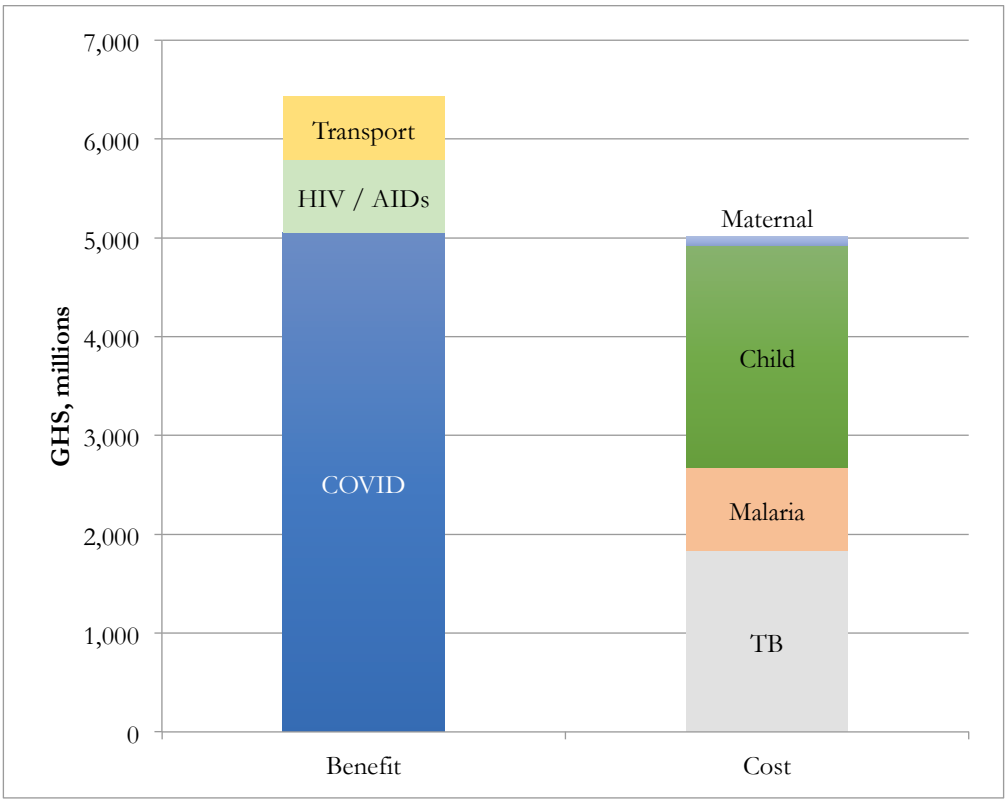


Figure 5: Mortality costs and benefits of moderate social distancing (VSLY approach)



3 Opportunity costs of school closures

Ghana announced school closures on 15 March 2020 and at the time of writing they are still in force. This section examines the opportunity costs of ongoing school closures, in terms of reduced future productivity of students.

We assess the costs separately for students in primary school, Junior High School (JHS) and Senior High School (SHS). To make the analysis tractable we consider costs for a representative individuals in each school category – 8 year olds for primary school, 14 year olds for JHS and 17 year olds for SHS – and follow the various pathways for these students until graduation. At each termination point, we assess the expected wages of the individuals until age 60. This analysis is conducted once for the baseline scenario using typical transition rates observed pre-COVID-19, and once for a scenario where students have 9 months less schooling. The net present value of future wage difference between these two scenarios, is the cost of school closures.

Some key parameters are required for this analysis. The first is the expected wage from each level of schooling. Here we draw from Wong, Turkson and Twumasi-Baffour (2020) who estimated wages by education levels using information contained in the Ghana Living Standards Survey, 2017. Wage levels, projected to 2020, are no education or primary – GHS 5841 per year;[10] JHS – GHS 6601 per year; SHS – GHS 6863 per year. These figures imply a return to each year of primary school, JHS and SHS of 0%, 4.2% and 2% respectively.

Another important set of parameters is the expected graduation rates by cohort. These are assumed to be: 82% of children will reach the end of primary school (UNESCO, 2020); 76% of children will reach the end of JHS (UNESCO, 2020); 57% of children will reach the end of SHS (Ghana Education Service, 2020).[11]

Lastly wages are projected into the future using the UN's middle-of-the-road scenario for Ghana, (here from IIASA 2020, see also Riahi et al. 2017).

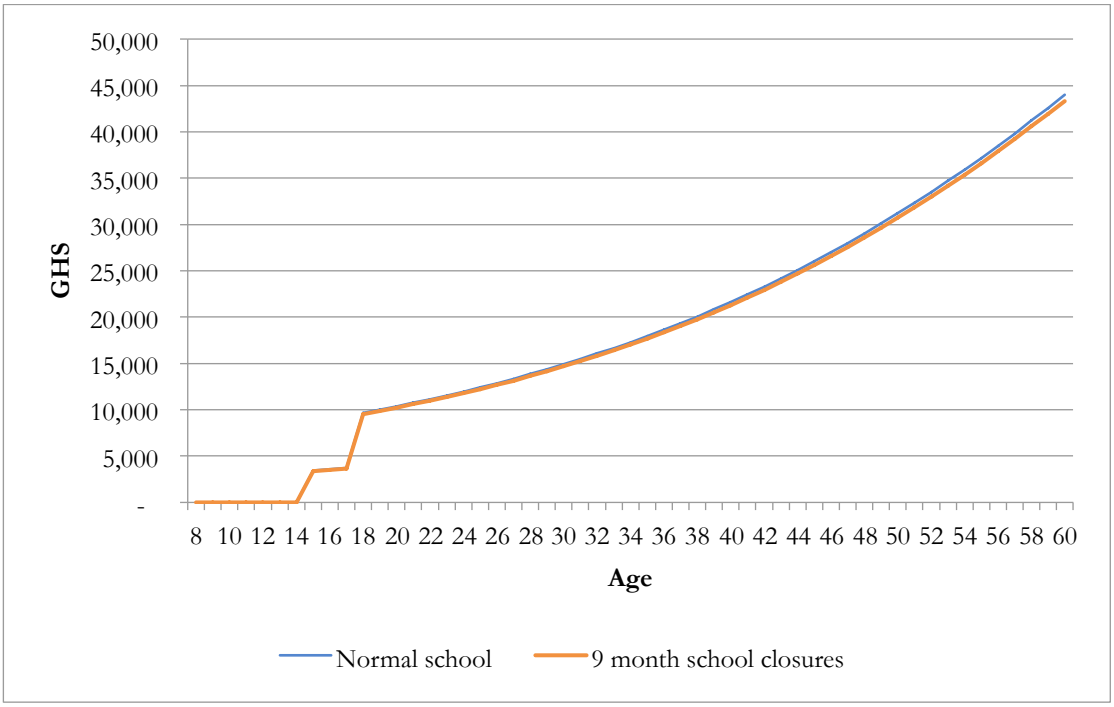
The wage profile of the 'typical' 8 year old under normal and school closure scenarios is presented below (Figure 6). Note this is the weighted average of actually multiple routes

[10] Wong, Turkson and Twumasi-Baffour(2020) show no statistically significant gains from primary education in Ghana relative to no education

[11] The figure of SHS is based on data which indicate that 560,000 children per year in JHS on average, while there are 400,000 students in SHS under the free SHS program. Some comments on the report suggest these figures might be an underestimate, particularly given the recent free SHS program. If this were the case, it would make the costs of school closures larger, and strengthen the findings of the report.

– some terminating at primary, others terminating at JHS and most terminating at SHS. For the purposes of this analysis we do not consider tertiary or vocational education.

Figure 6: Wage profiles of an 'average' 8 year old today –normal schooling pathway vs 9 month of school closures



For an 8 year old, having 9 months of school closures would lead to a slightly lower wage profile over the lifetime. This equals GHS 1,366 in net present value terms. Similar analyses conducted for JHS and SHS reveal opportunity costs of GHS 2,282 and GHS 1,930 respectively per student.

The above costs represent losses associated with less schooling. However, they do not account for losses associated with not being exposed to interventions that improve learning, holding years of education constant. One such intervention, school feeding, is widespread in Ghana with currently 2.8 million children receiving meals. Wong, Turkson, Twumasi-Baffour (2020) estimate the costs and benefits of school feeding in Ghana, and note an annualized benefit of GHS 1,374 per beneficiary, mostly in the form of improved learning. For a 9 month lock-down this foregone benefit is GHS 1,031.

Table 3: **Total Education Loss**

	No. of Students[12]	Cost per student	GHS (millions)
SHS schooling loss	1,025,551	1,930	1,979
JHS schooling loss	1,678,132	2,282	3,830
Primary schooling loss	4,511,268	1,366	6,161
School feeding loss	2,800,000	1,031	2,885
TOTAL	**7,214,951***		**14,856**

* total does not include students who experience school feeding loss since these individuals are contained within primary or JHS totals

Table 3 shows the total education loss from school closures. The analysis indicates future income losses around **GHS 14,856 million for 7.2 million children in Ghana**. 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 or do much worse afterwards, which would increase the costs, potentially enormously. In total, this cost is more likely to be an underestimate than an overestimate

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 GHS 14.9 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 16,000 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

[12] Source: 2018/2019 Education Profiles, Ministry of Education, Ghana

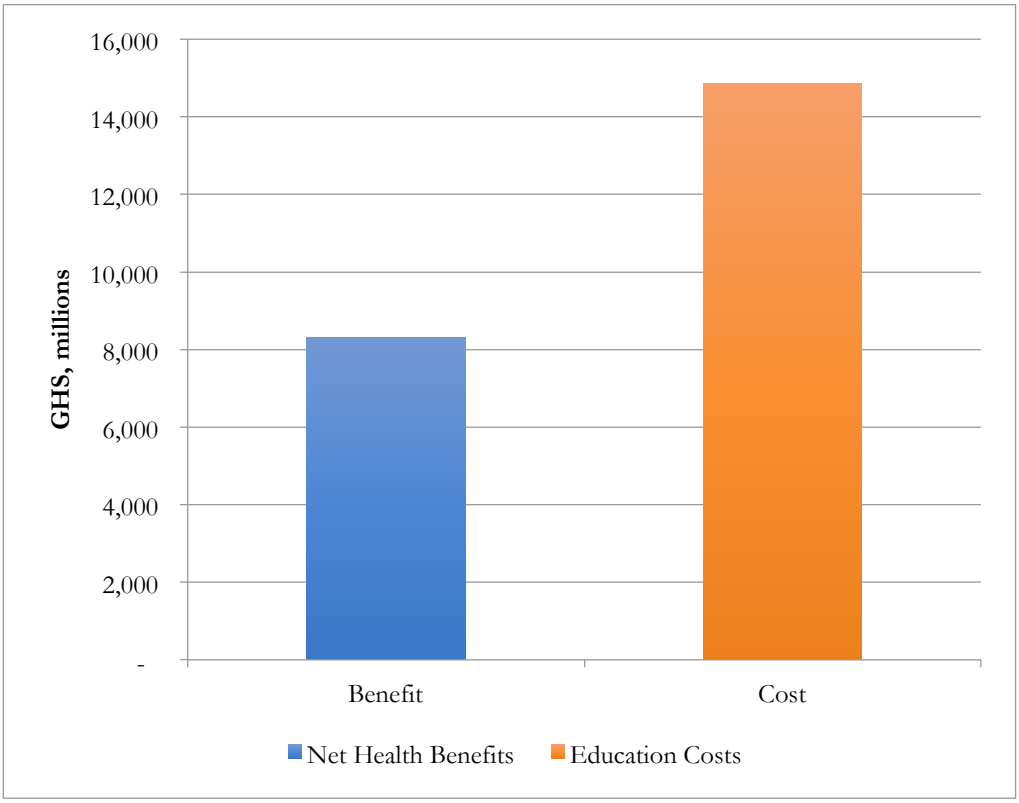
that disentangles the effects of school closures from a package of restrictions and does not include impacts on NCDs, mental health, air pollution nor impacts from isolation and unemployment. Realistically, this number may be orders of magnitude too large (Viner et al. 2020).

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**.

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

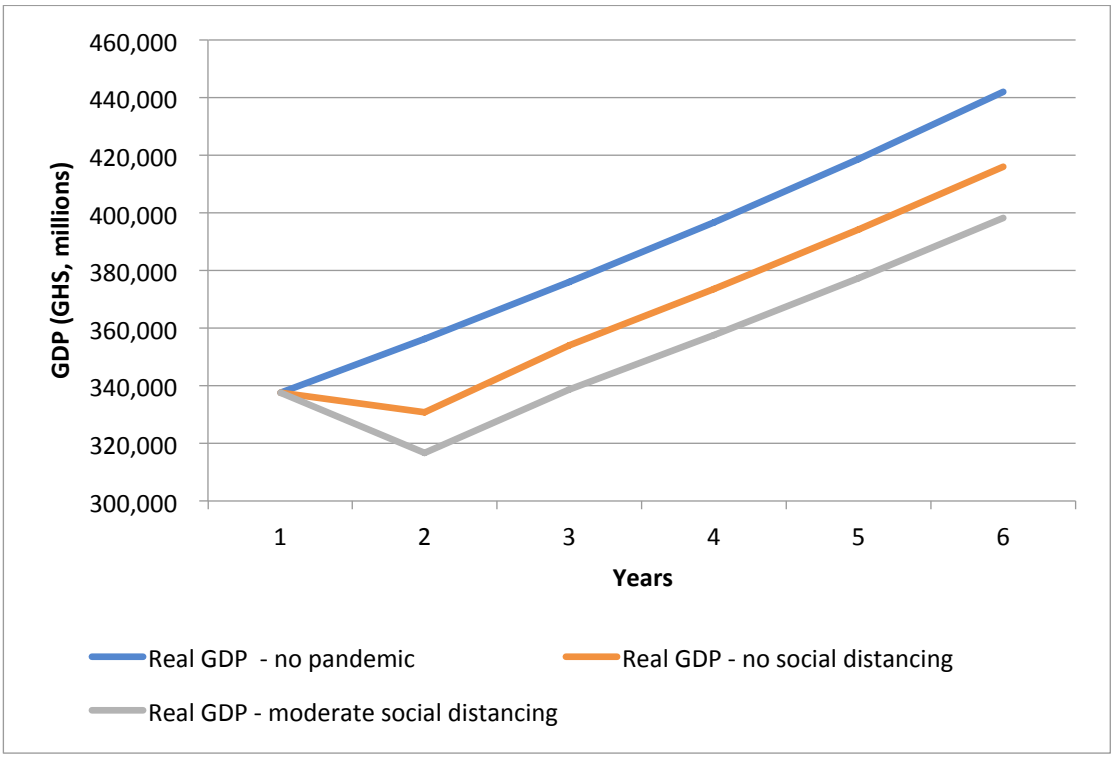
In this section we estimate the costs associated with movement and livelihood restrictions, here defined as GDP loss. These could likely be similar to the social distancing restrictions proposed, including closures of central markets, closures of non-essential businesses, limiting public gatherings, 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%. 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 Ghanaian context.

Here we adopt the same GDP percentage losses, but use Ghana GDP figures and expected growth rates for Ghana (Ghana Priorities). Those projections assume quite a rapid rate of real GDP growth, starting at 6% in 2020 and lowering to 4.9% by 2050. For the second year, we assume a catch-up growth of 7%.[13] From year 3, we assume growth continues as per projections under a no pandemic scenario (Figure 8).

[13] Thunström et al. (2020) expects 5.5% recovery growth for the US compared to 1.75% no-pandemic growth. Given Ghana's reliance on oil exports, expected catch up growth is proportionally lower in Ghana.

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



Source: Authors estimates using GDP growth estimates from Ghana Priorities (2020) and GDP impacts adapted from Thunström et al. (2020)

The additional cost is the discounted difference between the orange and the grey development in GDP over time. Using an 8% discount rate, the total GDP loss over 30 years is equivalent to around **GHS 262 billion.** Eleven 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

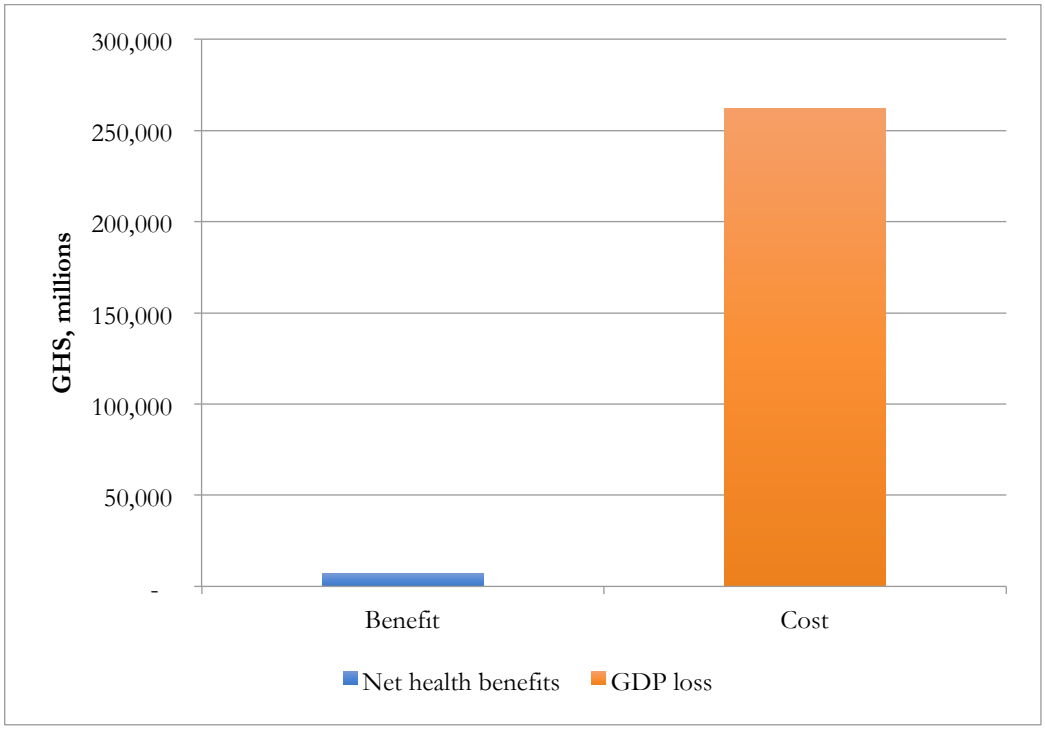
It is likely that the net health benefits of a moderate social distancing policy would be in the order found in section 2, with about 16,000 avoided deaths. This should be compared to the opportunity cost of lower economic growth at about GHS 262 billion.

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 Ghana, 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 0.13 percentage points more than do-nothing (i.e. -2.13% 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 **25,200 avoided deaths**, relative to 'do-nothing' comprising approximately 22,600 avoided deaths from COVID-19, 1,300 avoided deaths from HIV / AIDS and 1,300 avoided deaths from traffic accidents

- However, this likely would be partially offset by **an increase of 9,200 deaths** associated with health services contraction and child malnutrition. These comprise 5,200 additional TB deaths, 1,400 additional malaria deaths, 2,450 additional child deaths and 150 additional maternal deaths.
- **The net health impact is 16,000 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 relatively less with 446,000 years of life gained against 348,000 years of life lost.
- In terms of social value, the best outcome from a moderate social distancing policy would generate **net benefits worth GHS 8.3 billion**.
- Keeping schools closed for 9 months could generate a GHS 14.9 billion loss of future incomes for about 7.2 million children. The opportunity cost of a more productive future workforce in Ghana is higher than even the most optimistic benefit estimate of GHS 8.3 billion. **Based on current information a policy of school closures will leave Ghana much worse off by GHS 6.6 billion**
- Moderate movement and livelihood restrictions could generate GHS 262 billion in GDP loss over the next 30 years. The opportunity cost from damage to the economy vastly outweighs the potential health benefits of GHS 8.3 billion. **Based on current information a policy of moderate social distancing will leave Ghana 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 0.05.

Table 4: Summary of costs and benefits

	Benefits (GHS, millions)	Costs (GHS, millions)	BCR
Health impacts from moderate social distancing	13,093	4,777	n/a
Future income loss from 9 month school closure	0	14,856	n/a
GDP loss from movement and livelihood restrictions	0	262,039	n/a
TOTAL	13,093	281,672	0.05

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 find 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 (Ghanaian) 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 Ghana

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

- Certain co-morbidities or risk factors present in the Ghanaian 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 Ghana 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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