Medium and long-term impacts of a moderate lockdown (social restrictions) in response to the COVID-19 pandemic in Malawi: A rapid cost-benefit analysis

National Planning Commission

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Report contributors:

Thomas Munthali, Director General, National Planning Commission of Malawi

Brad Wong, Chief Economist, Copenhagen Consensus Center

Bjorn Lomborg, President, Copenhagen Consensus Center

Nyovani Madise, Malawi Country Director, African Institute for Development Policy (AFIDEP)

Salim Mapila, Malawi Priorities Project, Malawi

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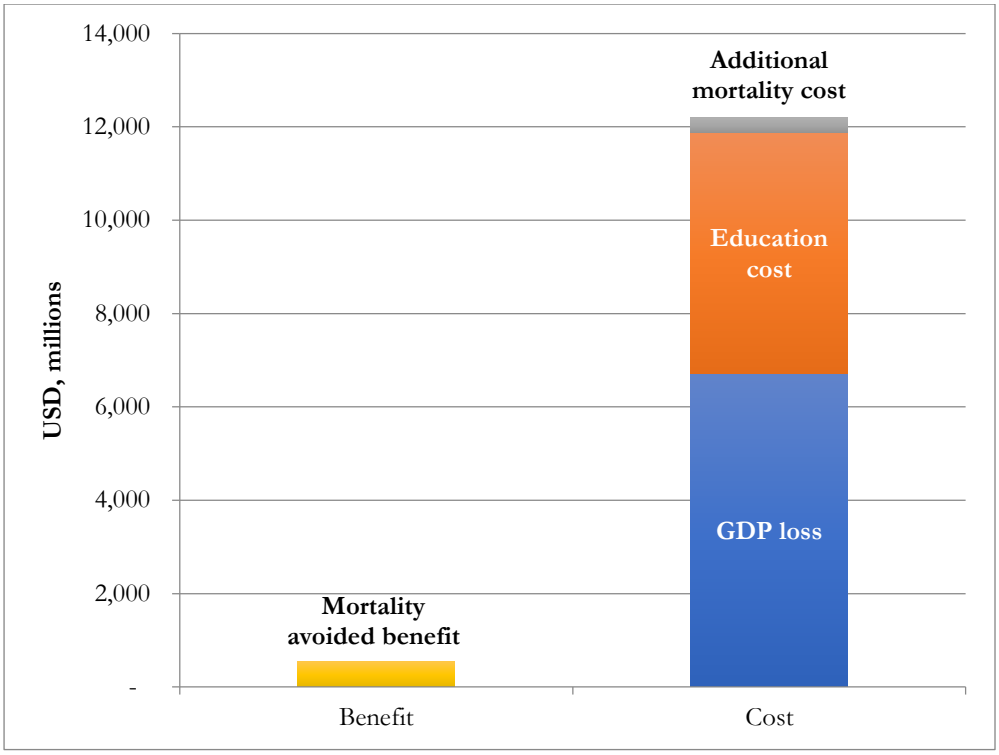
Executive Summary

- The purpose of this brief is to examine the medium and long-term **opportunity costs of different strategies aimed at lessening the impact of the COVID-19 pandemic in Malawi**
- The brief focuses on moderate lockdown measures largely referring to **social restrictions as promoted through school closures as well as movement and livelihood restrictions** principally minimizing social contact.
- **Moderate lockdown measures that promote social restrictions** have a high likelihood of reducing the physical death toll in the short-term:
    - It could reasonably be expected to **reduce the death toll from COVID-19 by about 12,000 if implemented for ~9 months**. In addition, lower social interaction would also mean less traffic and hence fewer traffic deaths, saving about 550 lives. Finally, with lower pressure on the health care system, it is estimated that 3,800 more people with HIV will not die over the coming 5 years. **In total, a moderate lockdown (social restrictions) will likely reduce the death toll by 16,350** over the next five years.
    - However, moderate social restrictions will also lead to less health outreach and more malnutrition, causing more deaths from malaria (3,700), from TB (4,000) and from child mortality (1,700) along with about 100 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 restriction policy would result in at least an extra 9,550 deaths over the next 5 years**.
    - **Total number of deaths avoided by a moderate lockdown (social restrictions) is likely to be around 6,800**.
- 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 **397,000 life years gained, but contribute to 423,000 life years lost**. This means that **moderate social restrictions may increase total number of life years lost**. In other words, moderate social restrictions could lead to lower number of COVID-19

related deaths, but the life years lost could outweigh the life years gained due to more youthful populations losing their lives over the medium-term.

- The **social value of the net number of deaths avoided is $228 million** ($61-394 million).
- Closing schools for 9 months means that each child will receive 9 months less education. This will make each child less productive in their adult years. In total, it is estimated that the **social cost of closing schools for Malawi will be around $5.2 billion – the present value of income loss for 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 restrictions (6,800 deaths), the maximal benefit from this policy would be $228 million. This means that **on current knowledge, a policy of school closures will leave Malawi much worse off with a net social cost of around $5 billion.**
- Moderate movement and livelihood restrictions would generate a higher economic cost, which would lead to a loss of **$6.7 billion** – the estimated present value of GDP loss over the next 30 years. Compared to maximal benefits of $228 million, it means that **on current knowledge, a policy of moderate movement and livelihood restrictions will leave Malawi much worse off with an economic cost of around $6.5 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 lockdown that promotes social restrictions**.

Figure 1 Costs and benefits of moderate social distancing policy in Malawi



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 moderate COVID mitigation strategy are likely to be very large and significantly higher than potential benefits. However, **continuing** with a **series of preventative 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 livelihoods disruption.**

- **Mitigate education loss and open schools when possible**: The analysis indicates that school closures have a large cost in terms of lost future productivity that vastly outweighs even the most optimistic benefits. In the presence of school closures, authorities might consider non-face-to face education modes for all school-going children to avert the opportunity cost of reduced future productivity of students especially for the girl child in a country where early

marriages affect 42% of girls. However, this is likely to be a challenge for Malawi where most families cannot manage to support their children to access such modes of education especially in rural areas. Therefore, opening schools, even in phases that consider exam-writing classes amidst strict COVID-19 containment measures, should be a top priority at the earliest opportunity.

- **Keep key community health services funded and operating:** The 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, HIV/AIDS and malaria.

CAUTION: 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 and are based on information as of early May 2020.

1 Purpose and context of this brief

Malawi, like all other nations, is considering what policies to enact to best combat the COVID-19 pandemic. In this context, the National Planning Commission (NPC), with technical support from the Copenhagen Consensus (CCC) and African Institute for Development Policy (AFIDEP), has assessed the medium and long-term **opportunity costs of diverting resources towards addressing the COVID-19 pandemic**. This analysis was made within the context of an ongoing partnership between the National Planning Commission, Copenhagen Consensus and AFIDEP under the *Malawi Priorities* project.

1.1 Basic parameters

The analysis here considers the medium and long-term opportunity costs of a **moderate lockdown that promotes social restrictions** compared to maintaining the status quo. For the purposes of this brief, 'moderate social restriction' means reducing social contacts (or increasing social distancing) by 30-50%, leading to a reduction in the reproduction number, R, of SARS-CoV-2, the virus that causes the COVID-19 disease.

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

The analysis considers these measures to last for **9 months** from the time they are instituted. This is the midpoint of the expected 6-12 months such strategies would need to be implemented to achieve the maximal reduction in COVID-19 deaths under so-called 'mitigation' scenarios.[1] After this time, modeling suggests a sufficient number of people would be infected to reach herd immunity, and restrictions can be lifted.

This paper uses an **8% discount rate**, which is based on the guidance provided in Robinson et al. (2019a). This paper suggests that the real social discount rate should be two times the short term projected real per capita growth rate, which is around 4% in the UN's middle-of-the-road scenario for Malawi (IIASA 2020).

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

[1] 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)

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.**

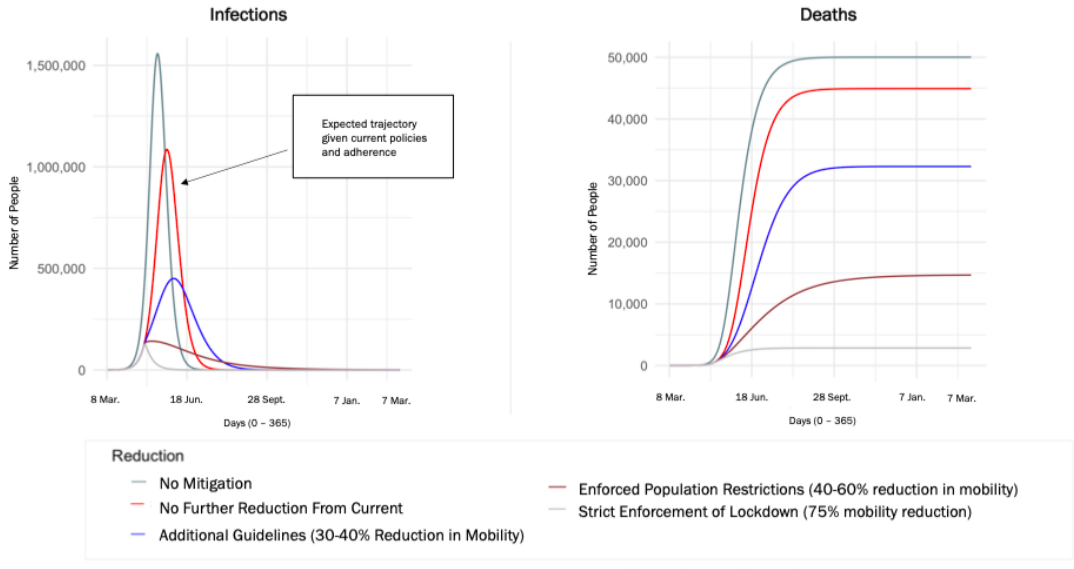
2 What are the net health benefits of moderate lock-down that promotes social restriction?

Here we estimate the total net benefit of moderate social restrictions. 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 Malawi. Therefore, we will assume 100% of expected benefits for each of these policies. This evidently overestimates the benefits of policies, and as will become apparent, makes the results even stronger given that even with an assumed 100% attribution, the maximum achieved positive impacts of these policies are unable to outweigh the negative impacts.

2.1 Avoided COVID-19 deaths

Cooper/Smith, working with the Malawian Ministry of Health, have modeled the outcomes of five social restriction scenarios for the country (Cooper / Smith 2020) – see Figure 2. Their analysis indicates that moving from current circumstances (the red line) to moderate social restrictions (blue line) would avoid approximately 15,000 deaths, assuming the measures could remain for one year. This finding is similar to analyses conducted by researchers from Imperial College London, who 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 Malawi are 37,258, assuming an R_0 of 3. Introducing social restrictions measures (reduction in social contacts by 45%) leads to only 25,575 to 28,251 deaths, for a net benefit of around 9,000-12,000 avoided deaths.

Figure 2: Modeled infections and deaths under various restriction scenarios



Source: Cooper / Smith (2020). The blue line represents moderate restrictions (30-40% reduction in mobility) while the red line represents current situation for Malawi.

Bringing these two studies together, we assume moderate lockdown (social restriction) would generate **benefits of 9,000-15,000 avoided COVID-19 deaths in Malawi**, 9 months to a year after the measures are in place, relative to a status-quo scenario**.** Going forward, we will take the mid-point of 12,000 avoided deaths as the reference outcome.

2.2 Non-COVID-19 deaths

Moderate lockdown (social restriction) 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.[2] 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] However, as noted in 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 Malawi, the difference between do-nothing and other scenarios may not be noticeable.

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 COVID-19 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 Malawi (moderate burden HIV / AIDS; high burden TB; moderate burden malaria) 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 is 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.[3] 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, but caused by moderate social restrictions over a six months period.[4] Being infectious diseases, it is appropriate to adopt a longer time horizon to account for changes in transmission resulting from restrictions. **Overall, moderate socio-economic restrictions would increase deaths by around 3,900, over five years** though with mixed impacts across the diseases. **HIV/AIDS deaths are lower by 3,800, while there are 4,000 and 3,700 more TB and malaria deaths respectively under moderate restrictions relative to do-nothing.**

[3] 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).

[4] The paper does not identify the impacts from a 9-month restriction period. If it had, it would likely lead to more deaths from infectious diseases in aggregate.

Table 1: Estimated change in deaths caused by six months of social restrictions, 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 Malawi
HIV / AIDS	293	83	-210	(3,810)
TB	29	362	222*	4,028*
Malaria	464	667	203	3,683
TOTAL	**786**	**1112**	**326**	**3,901**

Source: Adapted from Hogan, Jewell, Sherrard-Smith et al. (2020). HIV / AIDs and malaria are reported impacts under 'moderate' burden scenarios. *TB reported impacts under 'high' burden scenario reduced by 1/3rd to account for lower incidence of TB in Malawi relative to the representative high burden country (South Africa) 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 coverage 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 were to reduce 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	17.3%	14.7%

wasting		
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.[5] 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 Malawi[6] indicates **1,735 extra child deaths and 104 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 social restrictions. According to the Global Burden of Disease there were 2,384 deaths in Malawi in 2017 from transport injuries. Therefore the expected benefit from reduced **traffic accidents is 536 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 Malawi, outdoor air pollution causes 1,046 deaths each year according to Global Burden of Disease. However, it seems likely that staying more at home will also increase indoor air pollution deaths because of

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

6 The assumed child mortality rate is 49 per 1000 live births, while the assumed maternal mortality rate is 349 deaths/100,000 live births (World Bank, 2018.).

overcrowding and biomass fuel pollution which are risk factors with seven times as many deaths in Malawi (7,628 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 Malawian 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. Similarly, there are reports of domestic violence in Malawi due to COVID 19 and loss of livelihoods which may contribute to psychosocial distress but we do not include the impacts due to lack of data.

2.2.7 Indirect health impacts from unemployment

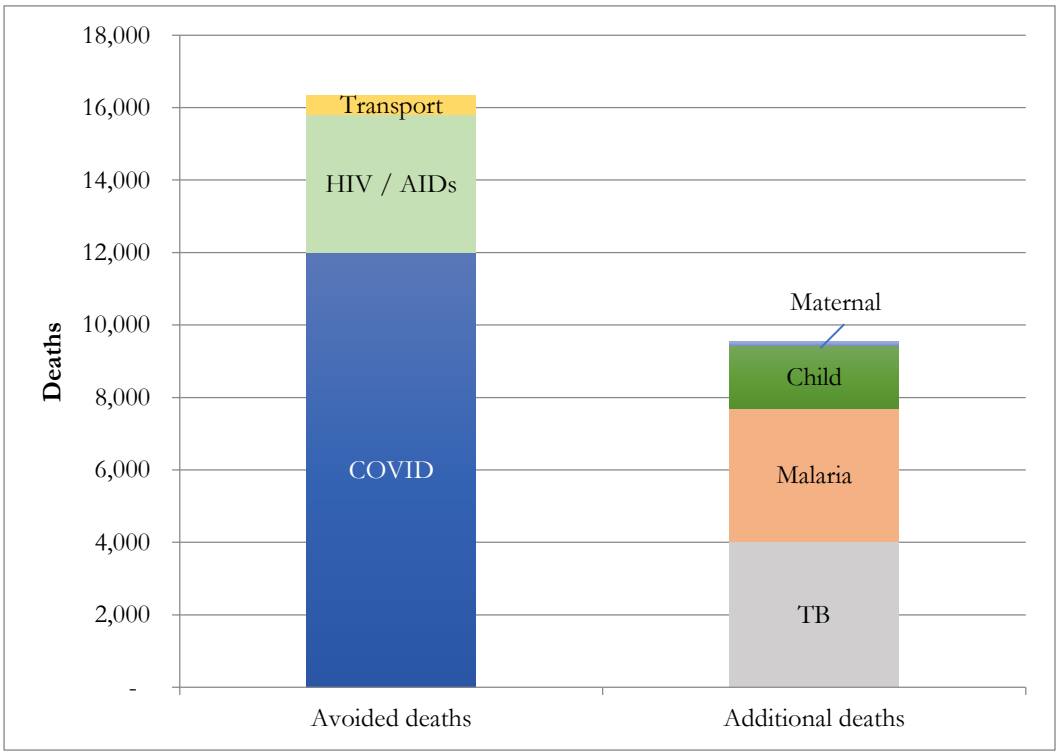
Studies from developed and developing countries report associations between unemployment / loss of livelihoods and mortality (Roelfs et al. 2011; Hone et al. 2019). In Brazil, a 1-percentage increase in unemployment due to a recession during 2014-2016 was associated with an increase in mortality of 0.5 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 particularly since Malawi lacks the fiscal space with which to support populations in vulnerable employment on a large scale.

2.3 Summary of avoided deaths from moderate lockdown (social restrictions)

The analysis above suggests that moderate socio-economic restrictions for 9 months might result in **16,350 reduction in deaths**, comprising approximately 12,000 avoided deaths from COVID-19, 3,800 avoided deaths from HIV / AIDS and 550 avoided deaths from traffic accidents. However, this would likely be partially offset by **an increase in 9,550 deaths** associated with health services contraction and child malnutrition. These comprise 4,000 additional TB deaths, 3,700 additional malaria deaths, 1,750 additional child deaths and 100 additional maternal deaths. **The net impact is 6,800 avoided deaths from moderate lockdown (social restrictions)**. Again we stress the substantial uncertainty in these estimates.

Figure 3 Number of deaths avoided and incurred by moderate social restrictions in Malawi



2.4 Summary of avoided life years lost from moderate lockdown (social restrictions)

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).

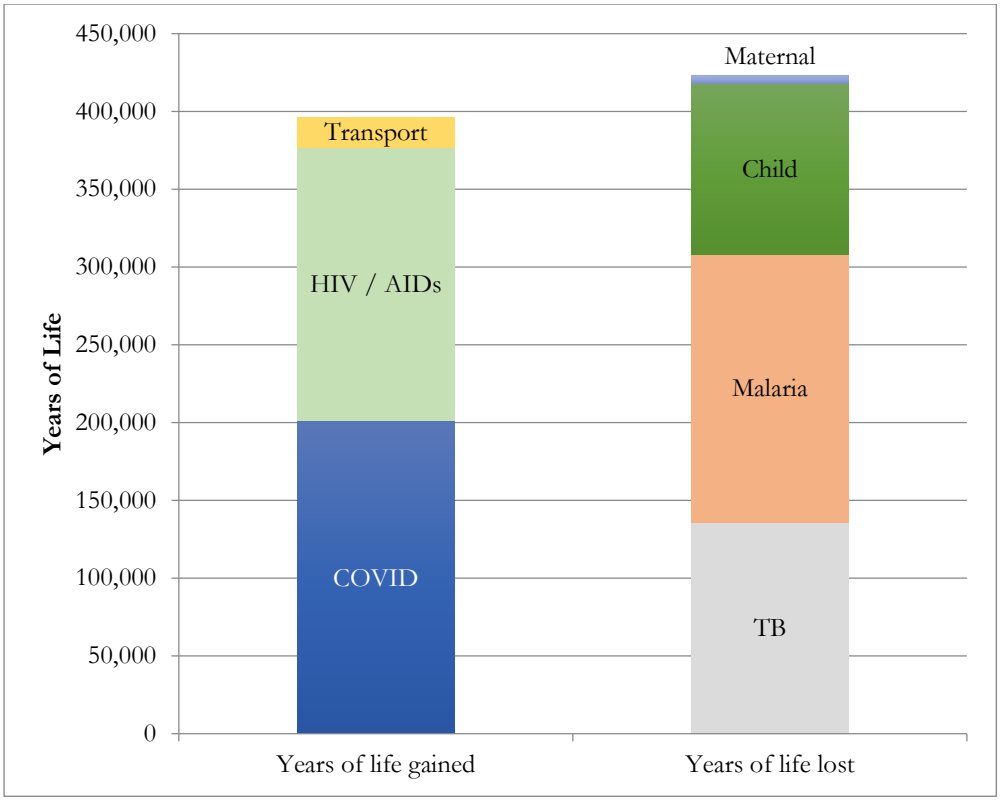
One standard and parsimonious approach is to count the impacts in terms of 'years of life' lost rather than a death count. Utilizing the age structure of Malawi, country specific life tables from the WHO and the age-specific infection mortality rates from Ferguson et al. (2020) generates an expected years of life lost from a COVID-19 death in Malawi of 17.[7] In contrast, the comparable years of life lost for a child death is 63. 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:

- **397,000 years of life gained** from moderate socio-economic restrictions comprising 201,000 years of life gained from avoided COVID-19 mortality, 176,000 years of life gained from avoided HIV/AIDS mortality and 20,000 avoided years of life gained from avoided traffic accidents
- **423,000 years of life lost** from moderate socio-economic restrictions comprising 136,000 years of life lost from increased TB mortality, 172,000 years of life lost from increased malaria mortality, 110,000 years of life lost from additional child mortality and 5,000 years of life lost from additional maternal mortality.

The figures are similar from a life year perspective and functionally equivalent within the bounds of uncertainty.

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

Figure 4 Loss of life years avoided and incurred by moderate lockdown (social restrictions) in Malawi



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 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 in developed economies 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 to avoid one death, 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)

Because of this uncertainty we adopt a range for the VSL following the recommendations from two papers. Robinson et al (2019a) suggest using a U.S. value of statistical life (VSL) of $9.4m (2015 dollars) – representing approximately 160 times income as measured by income per capita PPP – transferred to Malawi using an income elasticity of 1.5. This generates a value of statistical life for Malawi of $9,000 which we adopt as the low end of the range. Additionally, Viscusi and Masterman (2017) estimate a VSL for Malawi of $58,000 (using a similar methodology, but with an income elasticity of 1.0) which we adopt as the high end of the range. The midpoint of these values, $33,500 is used in further calculations.

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 associate 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 Malawi (40).[8] This yields a VSLY of 33,550 / 40 = $834.

Applying the VSL, the benefit of avoided deaths is $548m, while the cost of additional deaths is $320m (see Figure 5). Applying the VSLY instead results in a benefit of $331m from years of life gained, and a cost of $353m from years of life lost (see Figure 6).

[8] An adult, for the purposes of this calculation, is defined as anyone above the age of 15. Based on population structure of Malawi the age of an average adult is 33, and the life expectancy at this age is 40.

Figure 5: Mortality costs and benefits of moderate social restrictions (VSL approach)

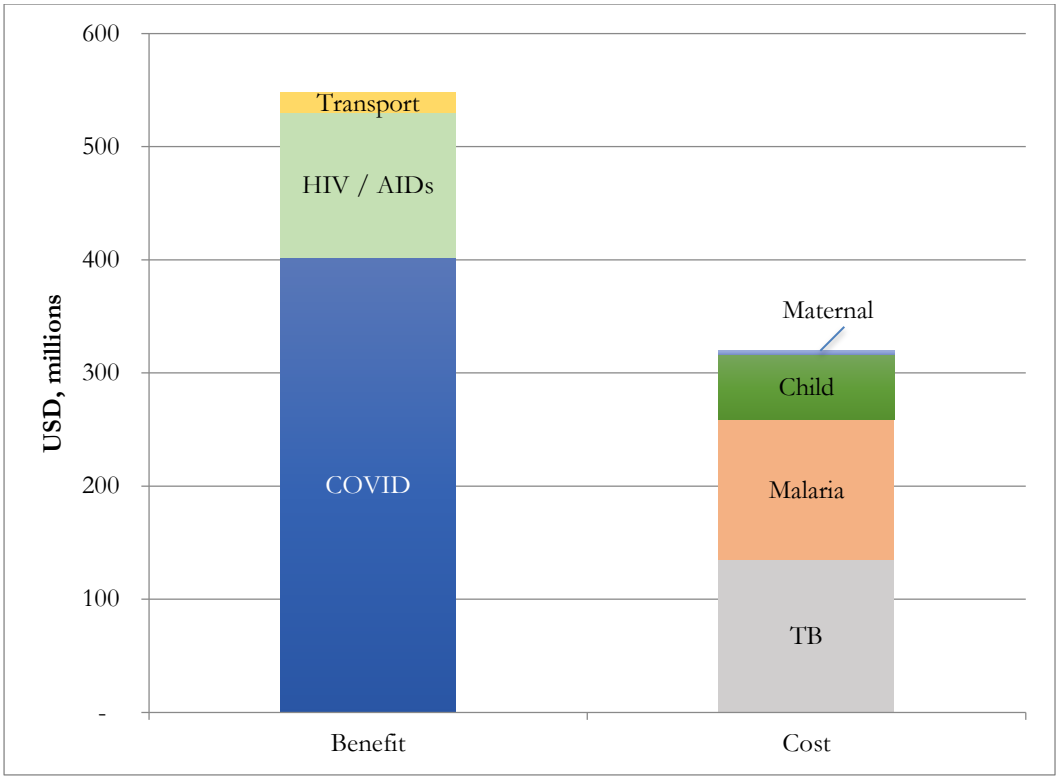
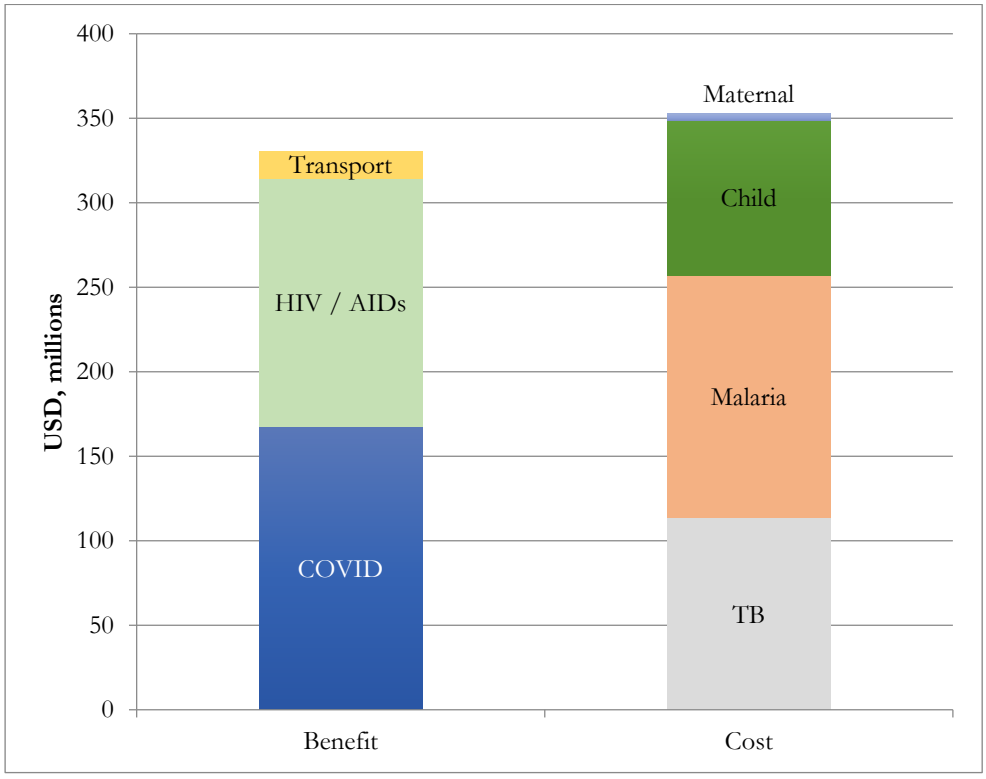


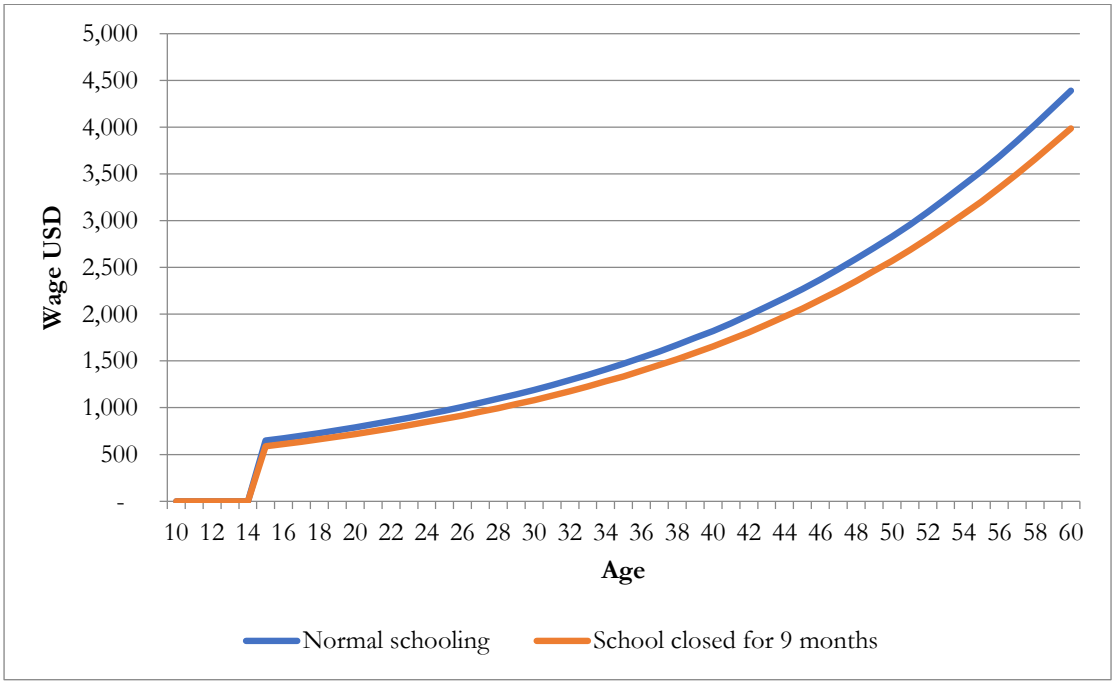
Figure 6: Mortality costs and benefits of moderate lockdown (social restrictions) (VSLY approach)



3 Opportunity costs of school closures

Malawi announced school closures on 23 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. Peet, Fink and Fawzi (2015) note that one year of schooling boosts wages by 12% on average in Malawi. We assume that the relevant wage for a person who has completed primary school is the minimum wage of 35,000 kwacha or approximately $50 per month. We estimate the future wages of two 10 year-olds today - one who would finish with 8 full years of primary school, and another with 7.25 years of primary schooling.[9] 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 Malawi, (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 7).

Figure 7: 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 12% per year from each year of schooling from Peet, Fink and Fawzi (2015)

[9] The first 8 years of school in Malawi are referred to as primary school and are compulsory.

Using the 8% discount rate, the present value of the loss of future income is $861 per student. Given that there are approximately 6 million Malawian children typically in primary or secondary/high school (UNESCO, 2020), this suggests a **cost on the order of USD 5.2 billion if school closures continue for 9 months.**

This cost may be a significant underestimate because 2.7 million of the 6 million students are actually in secondary school and would command higher wages than the stylized 10 year old used in this example. 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 $5.2 billion.

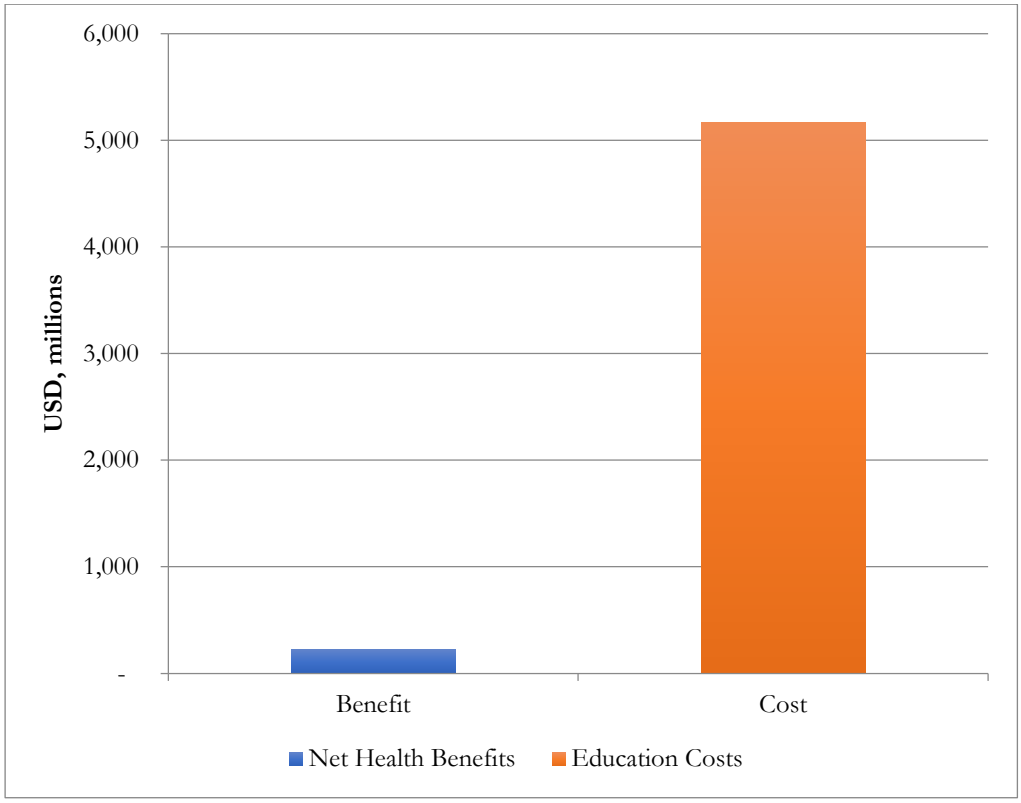
However, we have no good evidence of the epidemiological benefit of just school closures. It is clear that school closures can *at the very most* reduce future deaths as much as a full moderate social restrictions policy. We will use the estimate of 6,800 fewer deaths in section 2.2 from a full moderate social restrictions 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 8 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 clearly outweighs even the most optimistic estimate of the net mortality benefits**.

The result holds whether using VSL to value deaths (either the high or low value). It is even stronger when estimated with values of years of life saved (VSLY) which established above leads to around zero net benefits.

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

Figure 8: 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

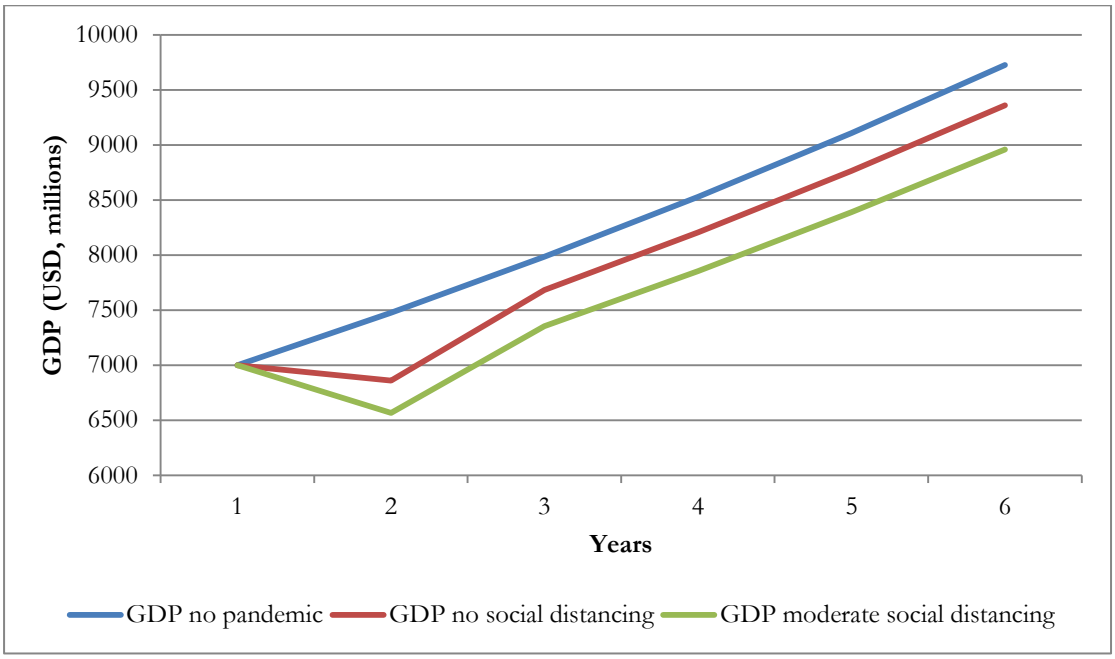
In this section we estimate the costs associated with movement and livelihood restrictions, here defined as GDP loss. These could be similar to the social restrictions proposed on 18 April 2020, including closures of central markets, closures of non-essential businesses, partial limits on agricultural activity, limiting public gatherings, and limiting public transport. We note these are still tied up in legal proceedings, but here we

simply analyze a general policy of movement and livelihood restrictions to achieve moderate social restrictions.

We draw from the only peer-reviewed published cost-benefit analysis done of social restrictions – a study by Thunström et al. (2020) examining a moderate lockdown policy in US but applying the Malawi low-income economic realities. 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 Malawian context.

Here we adopt the same GDP percentage losses, but use Malawi GDP figures and expected growth rates for Malawi for the UN's middle-of-the-road scenario under the Shared Socio-economic Pathways (IIASA 2020, Riahi et al. 2017). Those projections assume quite a rapid rate of real GDP growth, starting at 6.8% in 2020 and lowering to 6.4% by 2050. For the second year, we assume a catch-up growth of 12%. From year 3, we 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 restrictions



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

The additional cost is the discounted difference between the red and the green development in GDP over time. Using an 8% discount rate, the total GDP loss over 30 years is equivalent to around **USD 6.7 billion.** Nine 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.

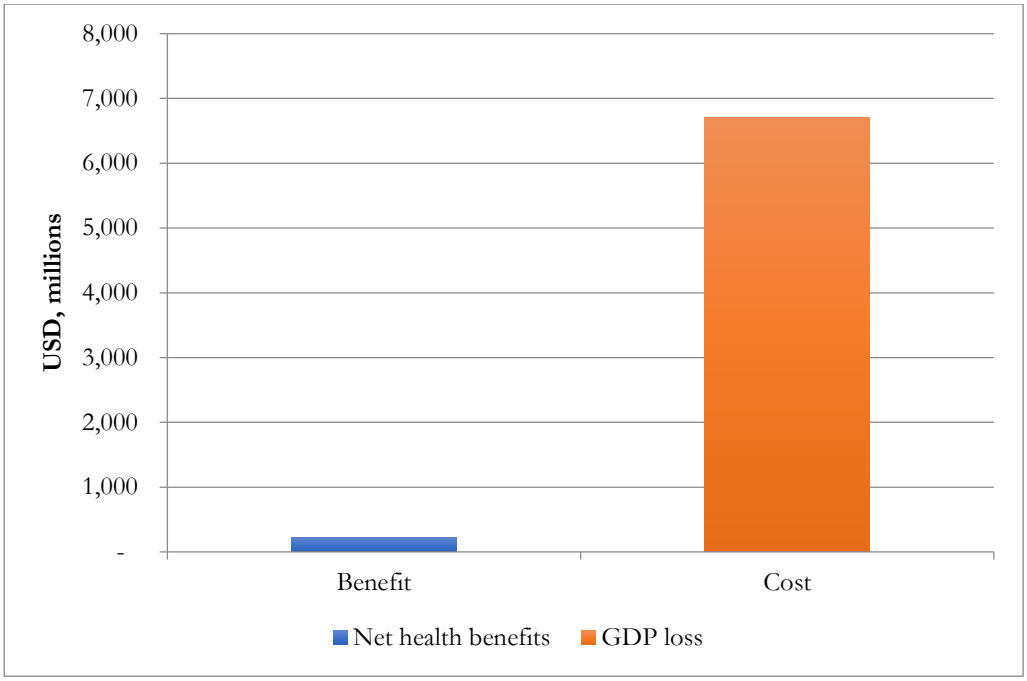
4.1 Comparing the net health benefits with the opportunity cost of lower economic growth

It is likely that the net health benefits of a moderate social restrictions policy would be in the order found in section 2, with about 6,800 avoided deaths. This should be compared to the opportunity cost of lower economic growth at about $6.7 billion.

Figure 9 shows this comparison. As above, the GDP loss outweighs the net health benefits by a considerable margin. Different specifications of net health benefits (not shown) do not change the result. 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 0.15 percentage points more than status quo (i.e. -2.15% 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 containment benefits it could yield**.

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



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 restrictions for 9 months could result in **16,350 reductions in deaths**, relative to 'do-nothing' comprising approximately 12,000 avoided deaths from COVID-19, 3,800 avoided deaths from HIV / AIDS and 550 avoided deaths from traffic accidents
- However, this likely would be partially offset by **an increase of 9,550 deaths** associated with health services contraction and child malnutrition. These comprise 4,000 additional TB deaths, 3,700 additional malaria deaths, 1,700 additional child deaths and 100 additional maternal deaths.
- **The net health impact is 6,800 avoided physical deaths from moderate social restrictions.**
- Since most of the lives saved from COVID-19 are considerably older than the lives saved from other effects, when comparing the number of life years lost it

turns out that **when measuring net health impacts in life years, moderate lockdown (social restrictions) will lead to slightly more life years lost - 423,000 life years lost relative to 397,000 life years gained.**

- In terms of social value, the best outcome from a moderate lockdown (social restrictions) policy would generate **net benefits worth USD 228 million**.
- Keeping schools closed for 9 months could generate a loss in future incomes for 6 million children, equivalent to **USD 5.2 billion** in net present value terms. The opportunity cost of a more productive future workforce in Malawi is much higher than even the most optimistic benefit estimate of USD 228 million. **Based on current information a policy of school closures will leave Malawi much worse off socio-economically.**
- Moderate movement and livelihood restrictions could generate **USD 6.7 billion in GDP loss** over the next 30 years, in net present value terms. The opportunity cost from damage to the economy and livelihoods vastly outweighs the potential health benefits of USD 228 million.

A combination of school closures as well as movement and livelihood restrictions would generate costs larger than the net health benefits. As noted in the brief, the net health impact is based on a package of restrictions, while the costs are for only one class of restrictions. Combining the two - costs against the benefits leads to a benefit-cost ratio of only 0.04 (as shown in Table 3 below) thereby reinforcing the main argument of avoiding further restrictions than is presently the case.

Table 3: Summary of costs and benefits

	Benefits (USD, millions)	Costs (USD, millions)	BCR
Health impacts from moderate socio-economic restrictions	548	320	n/a
Future income costs from 9 month	0	5,165	n/a

school closure			
GDP loss from movement and livelihood restrictions	0	6,706	n/a
TOTAL	548	12,191	0.04

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 livelihoods disruption.**

- **Mitigate education loss and open schools when possible**: The preceding analysis indicates that school closures have a large cost in terms of lost future productivity that vastly outweighs even the most optimistic benefits. In the presence of school closures, authorities might consider non-face-to face education modes for all school-going children to avert the opportunity cost of reduced future productivity of students especially for the girl child in a country where early marriages affect 42% of girls. However, this is likely to be a challenge for Malawi where most families cannot manage to support their children to access such modes of education especially in rural areas. Therefore, opening schools, even in phases that consider exam-writing classes amidst strict COVID-19 containment measures, should be a top priority at the earliest opportunity.

- **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, HIV/AIDS and malaria.

Other recommendations that have not been analyzed in the current document but have direct connection to the emerging findings which government may wish to consider given Malawi's peculiarities include:

- Direct more resources towards containing the pandemic by conducting **large scale random testing** and contact tracing to understand how wide spread the coronavirus is, as this can help further inform policy at a more granular level.
- Put identified cases under **institutional quarantine**, rather than self-quarantine given the crowded homes that characterize both urban and rural areas. Self-quarantine may not be sufficient to halt the spread of the virus but may even lead to other non-COVID-19 related illnesses/deaths.
- The Presidential Taskforce on COVID-19 should have a cluster that **conducts independent COVID-19 impact assessments** and proposes well-researched evidence-based measures for the Taskforce's consideration with regard to effective containment of the pandemic; economy and livelihoods recovery; and the country's future pandemic readiness (Munthali, 2020). The immediate task of the cluster would include determining the potential and real impacts of the pandemic on health, economic sectors, businesses – large and small, and various segments of the population in order to ascertain the specific areas and populations that will deliver the most benefits, amidst scarce resources.

- **Conduct capacity needs assessment** on the various socio-economic sectors and populations that are likely to be affected by the pandemic. This will help to develop a long-term recovery plan.

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 (Malawian) 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 Malawi

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

- Certain co-morbidities or risk factors present in the Malawian 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 Malawi 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.

6 Malawi Priorities: Future estimates of effective spending

Over the coming year, the National Planning Commission, along with the Copenhagen Consensus Center and AFIDEP, will be presenting economic evidence across a wide range of challenges like health, education, gender, environment and infrastructure for Malawi, to show where resources can be best spent under the *Malawi Priorities* Project. This can help the government, politicians and voters, along with donors, to evaluate where more resources should be spent first.

One way to use these economic considerations is to look at what it costs to save a human life in Malawi. Over the project, we will identify many such estimates, but let us here just take one from the literature. Bergmann et al. (2017) shows that better nutrition for HIV-infected people can very effectively save human lives, with an estimated cost of $11-29 per life year saved. For example, take the total number of lives saved from moderate lockdown (social restrictions) of about 12,000, and with life on average saving 17 years, or 204,000 life years saved in total. Let us also pessimistically assume the highest cost for each life year saved at $29. This means we could have saved the same number of lives for the same number of years by investing $5.9 million (12,000 x 17 x $29) in nutrition for HIV-infected people in Malawi.

This helps us understand why spending on moderate lockdown (social /restrictions) is less effective. We will end up spending about two thousand times more ($12 billion) to achieve only half the benefits (because we only save about 6,800 lives, since many will also die more from moderate social restrictions). Nutrition in this case turns out to be an investment that can help save about 4,000 persons for the same amount of resources that spent on moderate social restrictions will save one person. This is perhaps the most important opportunity cost that has not been quantified in our analysis – the loss of life

(as well as other social, economic, and environmental benefits) associated with not spending economic resources effectively. We intend to develop the information that can generate this estimated opportunity cost over the next year.

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