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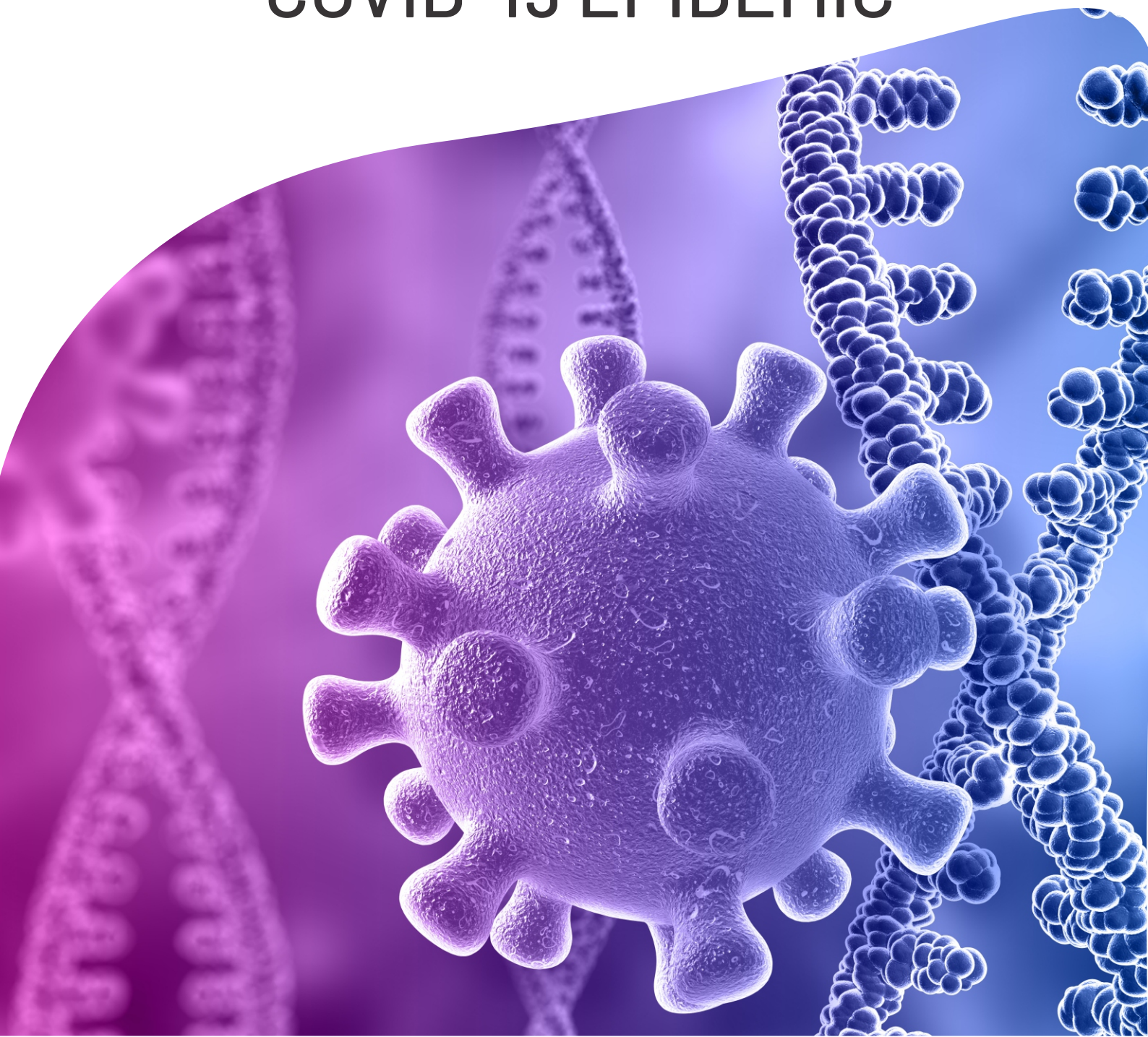
PROTECT
MALAWI

IN-DEPTH ANALYSIS OF MALAWI COVID-19 EPIDEMIC



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PROTECT is a partnership for knowledge and learning in three countries – Malawi, Kenya and Myanmar aimed at countering shrinking civic space, easing pressure on independent media and infomediaries, and enhancing transparency through empowered, independent and informed individuals and communities who demand that governments uphold their obligations in a protective and enabling environment.

In Malawi, PROTECT will focus on the unequal participation in society by women and marginalised groups. PROTECT in Kenya will strengthen and promote the ability of women in media and civil society to protect civic and media space and push for accountable and transparent governance at local and national level. In Myanmar PROTECT will tackle the intolerance which has fuelled so much recent violence in the country.
Above all PROTECT will increase the freedom to enjoy free, open and inclusive societies for many and will promote societies that thrive with diverse voices.

PROTECT
MALAWI

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FOREWORD

Hivos is a Dutch development organization that seeks new solutions to persistent global issues. Hivos has two broad Strategic Themes which are; Green Society and Open Society. It is under the Open Society that Hivos is implementing a 3 year Programme funded by the Foreign, Commonwealth & Development Office (FCDO). The Programme Protecting Rights, Openness, Transparency and Enhancing Civic Transformation (PROTECT) is being implemented under a consortium of ARTICLE 19, Hivos, Internews and the International Center for Not-for-Profit Law (ICNL).

The PROTECT consortium seeks to translate complex data into actionable information for marginalized groups, journalists and civil society. It seeks to produce practical evidence on challenges facing open societies to inform other activities; support locally driven multi-stakeholder coalitions to bridge the supply-demand gap of data and support infomediaries and media to contextualise and 'translate' complex data into actionable information for broader segments of society and marginalized groups to act upon.

Malawi just like any other country in the world has been hit by the Covid 19 pandemic. Humanitarian actors and policy makers are scaling up and reprogramming their activities in response to COVID-19 in the country. Unfortunately, they are finding themselves in an unfamiliar territory, lacking the required tools and information for planning an effective and realistic response to the pandemic. When there is a crisis like this, credible data becomes very critical to inform decisions that are made to address the pandemic.

Hivos therefore commissioned a study which sought to conduct an in-depth analysis of COVID 19 data in Malawi which should provide disaggregated data as evidence base for response planning to COVID- 19 by the Policy makers and other development partners. The study aimed to disaggregate COVID - 19 data according to gender, age, and various vulnerable groups including disability and elderly in order to establish an evidence base for response planning to Policy makers and other development partners. Specifically, there was interest in describing the epidemic by gender, age, and various vulnerable groups including disability and elderly. This in-depth analysis report provides the first detailed description of the Malawi epidemic and response in a language easily understood by a wide section of the general public and further presents recommendations to be considered in order to improve the data compilation, presentation and use.

1. EXECUTIVE SUMMARY

1.1. Background

The PROTECT (Protecting Rights, Openness and Transparency Enhancing Civic Transformation) consortium seeks to translate complex data into actionable information for marginalized groups, journalists and civil society. The goal of this research was to conduct an in-depth analysis of COVID 19 data in Malawi and establish an evidence base for response planning to Policy makers and other development partners. Specifically, there was interest in describing the epidemic by gender, age, and various vulnerable groups including disability and elderly. This in-depth analysis report provides the first detailed description of the Malawi epidemic and response in a language easily understood by a wide section of the general public.

1.2. Methods

We collected data from daily COVID-19 situation reports produced by the Public Health Institute of Malawi (PHIM) and Ministry of Health social media pages. Synthesis was enriched by a review of scientific literature, publicly available epidemic management documents, other government documents, and media reports. Additional insights came from interaction with staff at various levels of the Malawi COVID-19 response. The analysis involved examining the evolution of the epidemic, sections of the population most affected, the amount of risk associated with dying from COVID-19 once diagnosed and the population-level impact of the disease, and population level impact. The report closes with recommendations for the public and for the national response.

1.3. Results

Malawi registered her first COVID-19 case in Lilongwe on 02 April 2020, and a first death on 08 April 2020 in Blantyre. The number of new cases and new deaths remained relatively low in the months of April and May, but rose sharply in June, peaked in July and started descending after mid-August. The epidemics highest numbers of cases and death have been in the cities of Blantyre, Lilongwe and Mzuzu. Most of the registered cases are economically active males, followed by economically active females likely because their characteristics (especially travel or being linked to someone who recently travelled) are associated with higher risk of transmission and met national criteria for COVID-19 monitoring. To the society, the most important public health outcome is death. Once diagnosed, the risk of dying from COVID-19 was significantly higher in cities (Blantyre, Lilongwe, and Mzuzu [1.47 times higher risk of death than rural]), for males (1.54 times higher risk of death than males) and for individuals aged at least 60 (12 times higher risk of death than those aged 0 to 59). Similar to most African countries, Malawi has registered fewer deaths (~9 per 100,000 population) than what was projected based on data from China and Europe (150 per 100,000 population), and the top ten public health priorities included in the essential health package. There are gaps in COVID-19 data management processes which are hampering efforts to fully describe risk factors for severe disease and mortality beyond age, gender, and location. It is pleasing to note that upon discussing the data challenges with authorities, several initiatives have already been launched to address both past and future data management problems.

1.4 Conclusions

The Malawi epidemic is currently on a downward trend. Being a confirmed case aged at least 60 increases carries a 12 times higher risk of dying from COVID-19 compared to those aged 59 years and lower. Other key risk factors identified are being male and living in urban areas. The population level burden of COVID-19 in Malawi has remained low relative to projected burden and against top ten health priorities. The conclusions drawn in this work would have been sharper if the national response had more complete individual-level data than it has now.

1.5. **Recommendations**

The COVID-19 national response must urgently adapt to the current trend and impact of the epidemic. One effective and resource-efficient approach the response can take is to identify and protect individuals with factors that are independently associated with death (apart from age and gender). The carefully conducted risk factor identification will provide a rich basis for a COVID-19-safer work environment, schools, and communities on the path that will involve allowing economic and social activity to coexist with the disease and disease management efforts. The current transmission levels (as of 31 Aug 2020) are still high enough to lead to more deaths, we therefore recommend that the general public maintain their efforts on limiting movements to essential needs, wearing masks whenever out of homes, and practicing frequent hand wash. Management of the path to co-existence will only be smooth if the public connect with COVID-19 prevention guidance issued by the national response.

2. List of Acronyms

COVID-19	Coronavirus Disease 2019
CSO	Civil Society Organisations
SARS-cov	Severe Acute Respiratory Syndrome Coronavirus
MERS-cov	Middle East Respiratory Syndrome Coronavirus
PCR	Polymerase Chain Reaction
PHEIC	Public Health Emergency of International Concern
PHIM	Public Health Institute of Malawi
PROTECT	Protecting Rights, Openness and Transparency Enhancing Civic Transformation
RD	Risk Difference
RR	Risk Ratio
SARI	Severe Acute Respiratory Infection
SARS-COV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WHO	World Health Organisation

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5.0 INTRODUCTION AND BACKGROUND

5.1. About The PROTECT Programme

The PROTECT (Protecting Rights, Openness and Transparency Enhancing Civic Transformation) Consortium brings together four leading organisations: ARTICLE 19, Hivos, Internews and the International Center for Not-for-Profit Law (ICNL), working on shifting the paradigm from unequal and closed societies towards free and open societies with civil society including media organisations, able to help people to hold governments to account. The Consortium, alongside local and expert partners, will strengthen the foundations for an open society in three target countries: Kenya, Malawi and Myanmar by combining their worldwide expertise in the areas of Civic Space, Media Freedom, and Data Transparency.

There are several challenges that PROTECT will tackle in Malawi. One of them focuses on the growing public demand for and government commitment to increasing transparency and accountability. However, accessing Open Data or Government Information remains a challenge for citizens, CSOs and the media. Data literacy is limited in Malawi. Government, civil society, media outlets and infomediaries are generally under-equipped to understand how to work with the data they have access to.

PROTECT therefore seeks to translate complex data into actionable information for marginalized groups, journalists and civil society. PROTECT will also address gaps in the available data on gender inequality, building the capacity of journalists and actors from vulnerable groups to access and use information to improve government accountability.

To do this, PROTECT will use five approaches to tackle country context challenges. One the of them is the Enabling The Power Of Data. At national level many citizens in civil society, particularly women, face obstacles in utilizing the power and potential of data analysis to effect change. To understand gaps in mobilizing data, and the gender-based information asymmetries, PROTECT will use a framework to reflect the value chain of public data - flowing from generation, to use, to action and response. The program will produce practical evidence on challenges facing open societies to inform other activities; support locally driven multi-stakeholder coalitions to bridge the supply-demand gap of data and support infomediaries and media to contextualise and 'translate' complex data into actionable information for broader segments of society and marginalized groups to act upon.

The study therefore sought to conduct an in-depth analysis of COVID 19 data in Malawi which should provide disaggregated data as evidence base for response planning to COVID- 19 by the Policy makers and other development partners. The data will have to disaggregate COVID - 19 data according to gender, age, and various vulnerable groups including disability and elderly.

5.2. Objectives and Scope Of Study

The global community has been battling Coronavirus Disease of 2019 (COVID-19), which is caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), from the end of 2019. The World Health Organisation (WHO) declared COVID-19 a Public Health Emergency of International Concern (PHEIC) on 30 January 2020, and a Pandemic on 11 March 2020. In Malawi, the President declared COVID-19 a State of Disaster on 20 March 2020 putting in place measures that limited social and economic activity and increased public spending on the disease. Despite having this huge impact on individual and national productivity, many have not been able to fully appreciate what has been going on and why.

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IMPORTANT BASIC CONCEPTS REGARDING COVID-19
WHAT IS IT THAT PEOPLE SHOULD WORRY ABOUT

The in-depth analysis of COVID 19 data in Malawi study therefore set out to put together COVID-19 information already gathered by the government and other stakeholders to make interpretations that will enable a deeper understanding of the local epidemic. The report starts with describing basic concepts of the disease and isolating what public health concerns people should be worried about, then describes the growth of the Malawi epidemic over time, the distribution of disease burden by age and gender, what impact the epidemic has had on women and children, and how evidence can be used for decision-making.

5.3. IMPORTANT BASIC CONCEPT: REGARDING COVID-19 WHAT IS IT THAT PEOPLE SHOULD WORRY ABOUT?

5.3.1. Where did COVID-19 Come From?

Coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The best available understanding is that SARS-COV-2 lived in bats for many years before jumping onto pangolins, who then passed to humans. Evidence based on the genetic material of the virus suggests that the move into humans happened late 2019 which coincides with the emergence of the first COVID-19 outbreak in Wuhan, Hubei Province, China in late November of 2019. SARS-COV-2 is a new virus from the corona virus (corona because of the crown-like ring around its cell, see inset in Figure 1) family of viruses that have been known for a long time, and we have had them in Malawi as etiologies of severe pneumonia (**Figure 1**).

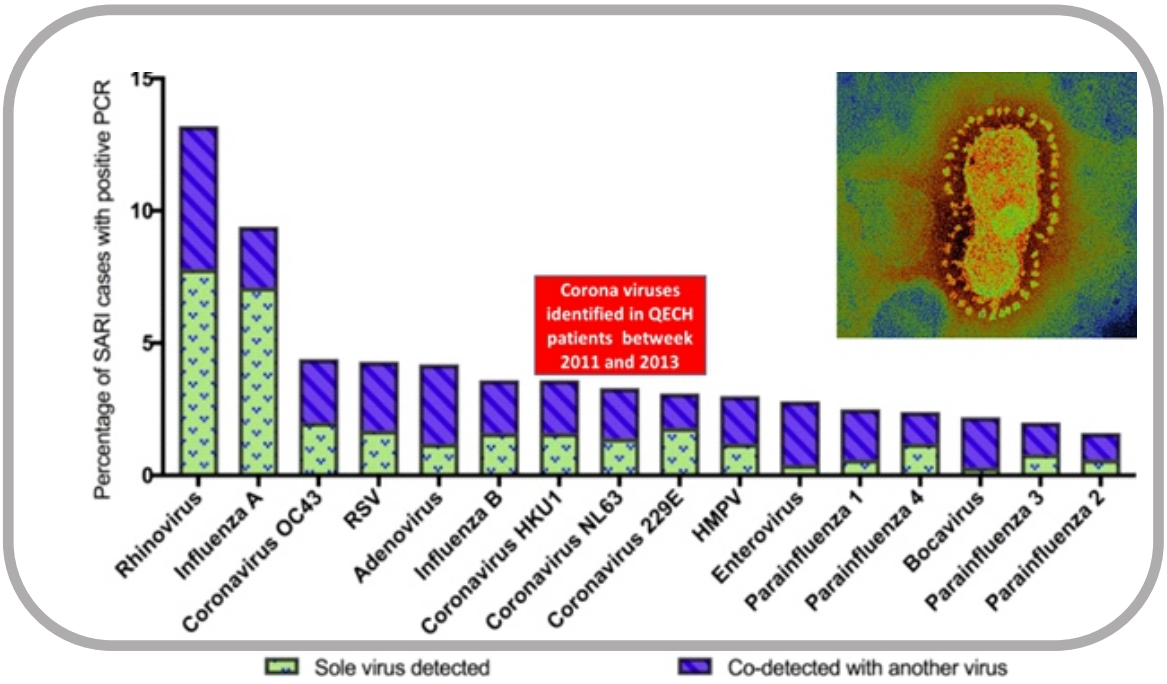

Figure 1: **Viruses isolated from patients presenting to QECH with severe acute respiratory infection (SARI) 2011 to 2013**

Other epidemics from similar viruses were severe acute respiratory syndrome coronavirus (SARS-cov) in 2002 and Middle East respiratory syndrome coronavirus (MERS-cov) in 2012. This new coronavirus (SARS-COV-2) is worrisome first because it is new and no one has immunity against it, and there is no known effective vaccine or treatment; second is it's the fact that it easily spreads; and lastly and perhaps most importantly because it can cause severe disease and death in a significant proportion of the population.

5.3.2. **Why is it Called a Pandemic?**

The normal baseline rate of a common disease is termed endemic, but when a sudden rise in numbers is identified, the terminology shifts to outbreak (Figure 2). COVID-19 was discovered because authorities in Wuhan observed a more than usual cases of severe pneumonia. This immediately made them realise it was an outbreak and investigations on what may be causing it commenced. When an outbreak covers a large geographic area, it becomes an epidemic. If it spreads to even larger areas such as multiple continents, like COVID-19 did, it takes up the term pandemic.

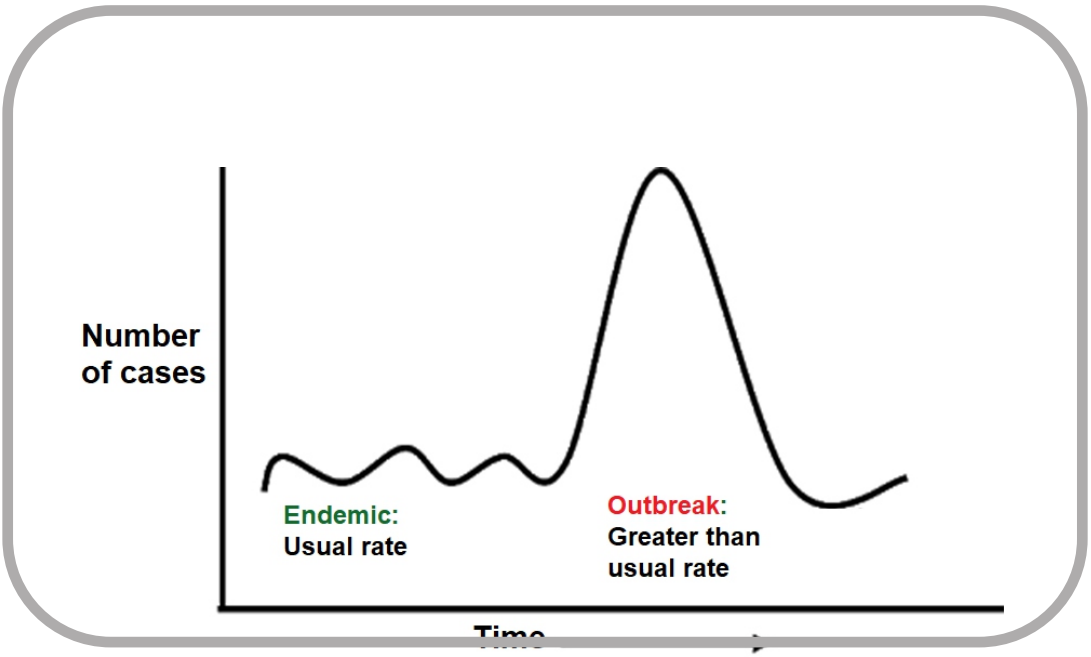

Figure 2: *Definition of an outbreak*

5.4. **What are the characteristics of the clinical syndrome?**

For those who develop disease, it takes approximately 5 days after infection for symptoms to develop. Unfortunately, during this period, they can still be infectious, and is the basis for applying transmission-prevention measures such as face masks to all people regardless of symptoms. The common initial symptoms are fever, cough, fatigue, body pains, diarrhoea, loss of taste or smell, all which are simple, and most people recover at this stage without requiring hospital care. Some people progress to develop severe disease which is characterised by breathlessness. Most patients with severe disease recover after receiving oxygen therapy but some progress to critical stage where ventilation is required. As directed by clinical need, some drugs doctors may use in hospital include dexamethasone, heparin and various forms of pneumonia therapy. Considering that there is no known drug that acts directly to slow or kill SARS-COV-2, the goal of hospital care is to support the body as it fights the virus. Many people have used forms of home therapy. The primary goal for this should be to relieve symptoms, and should not be misplaced as a cure. To minimise the risk of harm from herbal products, a very common occurrence in COVID-19 patients, use of herbs or other medical products should not go beyond what is normally considered as vitamins or food.

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WHAT ARE THE PUBLIC HEALTH IMPORTANT EVENTS AND WHERE SHOULD RESOURCES BE INVESTED

5.5. **What are the Public Health Important Events, and Where Should Resources be Invested?**

There are several areas of concern in the continuum of COVID-19 syndrome (Figure 3) but the key are development of severe disease and death, and preventing these stages of the disease should therefore be the focus of national response. The known risk factors for COVID-19 severe disease and death are age, diabetes, hypertension, obesity, chronic lung or heart disease, cancer, and being male. Theoretically, once you prevent infection, you can avoid everything downstream, making infection prevention the gold target for population level control. However, national response programs ought to anticipate and prepare to manage the entire continuum based on how much resources are at their disposal, value for money, and the distribution of the above risk factors. As shown in the triangle (Figure 3), most cases (over 80%) will require no clinical intervention as they will be mild or moderate. The key concern in this group is to ensure observance of transmission prevention measures. For those who progress to severe disease, most recover only with oxygen therapy and basic supportive treatment, making access to adequately staffed and equipped treatment centres the next most important investment after community transmission-prevention measures. A proportion of the severe diseased progresses to critical and will rely on investment in intensive care. The higher one goes in the triangle, the more costly interventions become.

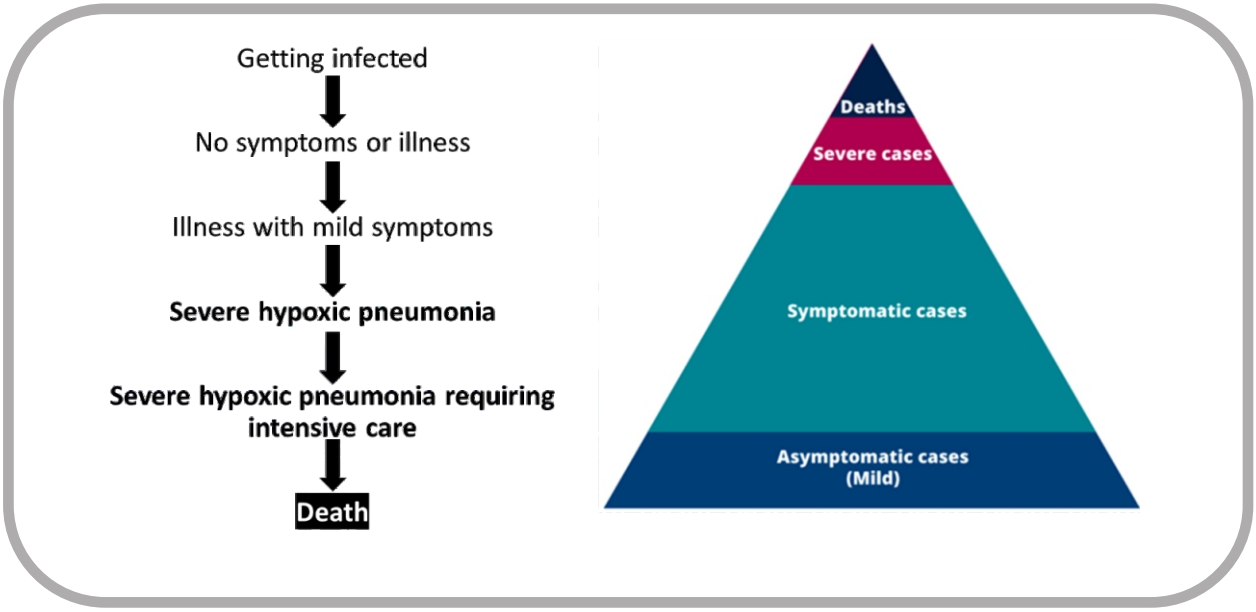

Figure 3: the continuum of the COVID-19 syndrome

5.5.1. **Measuring Burden of Covid-19**

Traditionally, disease burden is measured by number of new infections over time (incidence), number of all infections at a specific time (prevalence), number of deaths out of the infected (case fatality rate/ratio) or per population. For COVID-19, at the very beginning and tail end, the parameter to look for is number of infections. When transmission increases, it becomes impossible to detect all cases and a proxy measure relate to the number that test positive out of the tested. If testing capacity is high or systematic enough, an even better decision-making metric to use is the effective reproduction number which means the number of infections each case is transmitting to. If the reproduction number falls below 1 it means transmission is getting under control.

Public health important measures for COVID-19 include number of patients with severe disease, number of hospital beds available, and number of deaths. These measures are critical as they are easy to connect with, and provide a direct reflection of how much damage the epidemic is having, how much clinical response preparedness is needed, the amount of seriousness the nation should attach to reducing disease transmission, and also becomes a benchmark for judging how efficient the whole response is. The importance of each parameter changes as the epidemic evolves, and at times one has to use several before making public health decisions.

Knowing stage of transmission (Table 1) is invaluable as it determines how the population can help reduce transmission and how the national response can best invest available resources. The extent of transmission is classified in four stages that are defined as follows:

Table 1: stages of COVID-19 transmission

Stage	Name	Description
I	No cases	No confirmed cases
II	Sporadic cases	One or more cases, imported or locally detected
III	Clusters of cases	Experiencing cases, clustered in time, geographic location and/or by common exposures
IV	**Community transmission**	**Experiencing larger outbreaks of local transmission defined through an assessment of factors including, but not limited to:** • **Large numbers of cases not linkable to transmission chains** • **Large numbers of cases from sentinel lab surveillance** • **Multiple unrelated clusters in several areas of the country**

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WHAT HAS THE TREND BEEN AND WHAT IS THE BURDEN OF COVID 19 IN MALAWI

6.0 METHODS AND DATA SOURCES

We collected data from daily COVID-19 situation reports produced by the Public Health Institute of Malawi (PHIM) and Ministry of Health social media pages. Synthesis was enriched by a review of scientific literature, publicly available epidemic management documents, other government documents, and media reports. Additional insights came from interaction with staff at various levels of the Malawi COVID-19 response. The analysis involved examining the evolution of the epidemic, sections of the population most affected, the amount of risk associated with dying from COVID-19 once diagnosed and the population-level impact of the disease, and population level impact. The report closes with recommendations for the public and for the national response.

7. FINDINGS AND DISCUSSION

7.1. What has the Trend Been, and What is the Burden of Covid-19 in Malawi?

7.1.1. New Infections

Malawi started off with three confirmed cases on 02 April 2020 followed by sporadic clusters in the cities of Blantyre and Lilongwe, then reached community transmission stage at the end of May 2020. The Malawi epidemic seemed to be growing very slowly at the beginning, escalated sharply towards the end of May (**Figure 4** and **Figure 6**), and has remained relatively high since then.

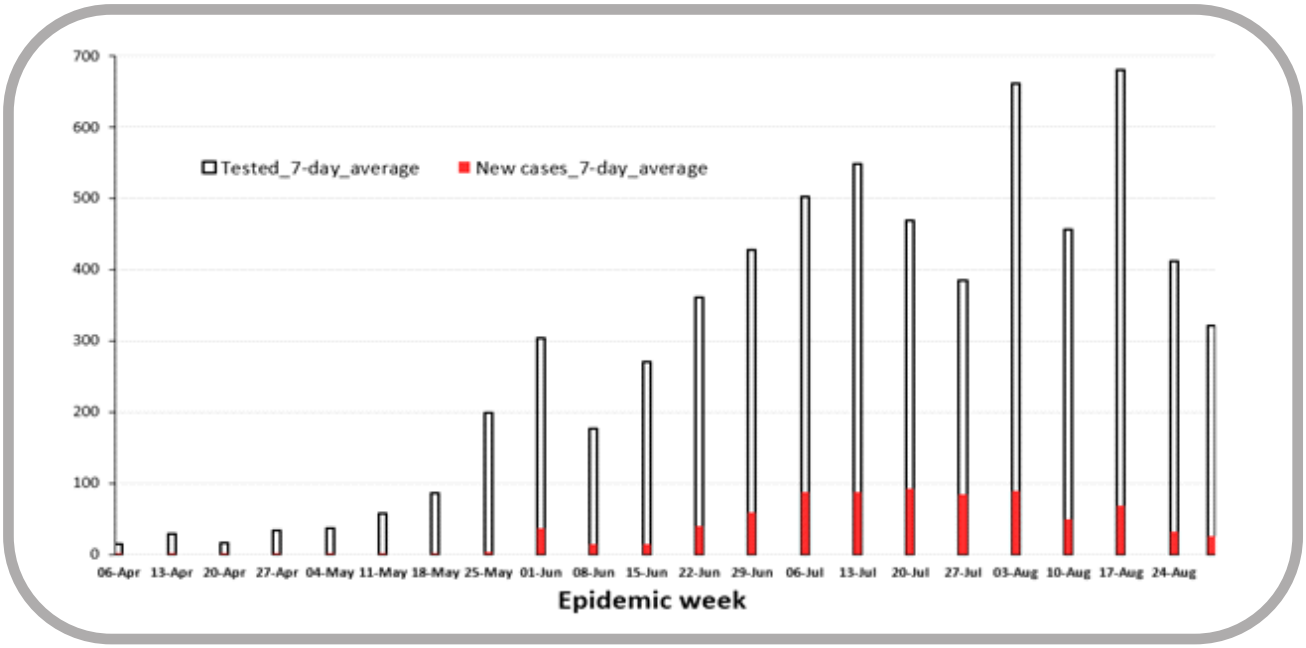

Figure 4: Average number of new cases by epidemic week

7.1.2. **Rates of Severe Disease**

There is no reliable tracker for rates of severe disease. Rates of severe acute respiratory infection (SARI) presentations, an important proxy of severe disease rates, are also not publicly available. Examination of Public Health Institute data showed that daily COVID-19 hospitalisations, another fair proxy for rates of severe disease, started being documented but more need to be done to establish a complete picture. Plans are underway to document rates of hospitalisations and make it publicly available.

7.1.3. **Deaths**

The first COVID-19 death was reported on 08 Apr 2020. Number of documented deaths per day has remained relatively low with 9 as the highest reported number per day. Most of the deaths occurred between end June and mid-August (Figure 5).

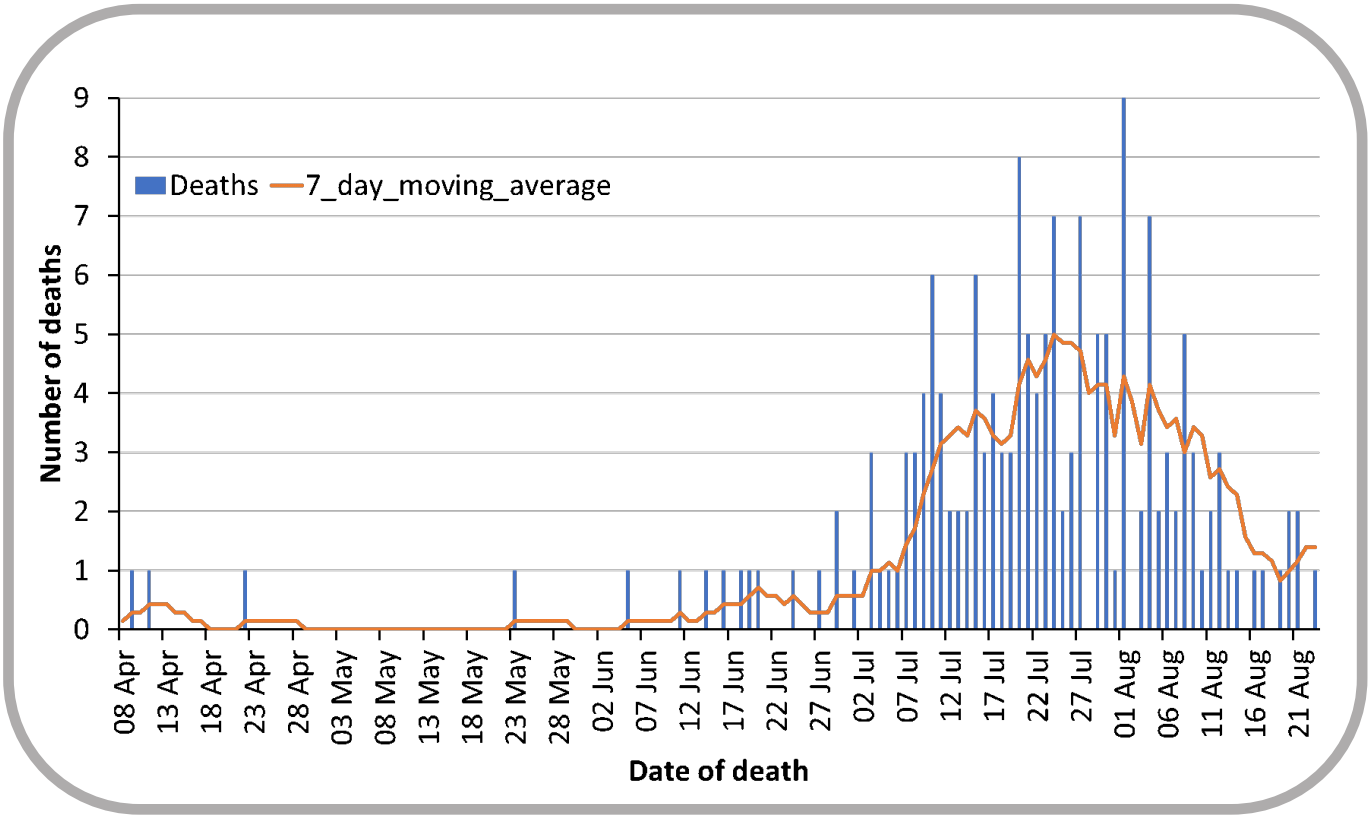

Figure 5: Number of deaths by date reported

7.2. How Did the Malawi Epidemic Evolve?

7.2.1. The Epidemic Rise and Potential Explanations

The slow start is usually attributed to the limited connectedness of the country to the international community, early stop of international flights, and closed borders in the entire region, all which reduced seeding. The speedy rise at the end of May (Figure 4 and Figure 6), could be from natural progression from the few detected and undetected cases before then, and from several transmission-encouraging factors. First set of transmission-encouraging factors relate to poor border control starting with the Malawi/Tanzania border, which remained freely open even when transmission was very high and uncontrolled in Tanzania. The next border relates to the returning of Malawians from devastating lockdown settings (South Africa, and Zimbabwe) whose reception did not include observation of safe-reintegration and transmission-preventing measures. The second set of transmission factors relate to political instability, which led to massive misinformation, distrust, and non-adherence to physical distancing measures (street demonstrations, political campaign, presidential elections, and post-election celebrations). The political actions climaxed in May and ended amicably upon ushering a more accepted and uniting political leadership at the end of June 2020. In the week of 15th June 2020, the 7-day-average positivity rate was at 6%, but this rose sharply to 21% at the end of July (**Figure 6**).

7.2.2. Has Malawi Passed Her Peak?

The daily number of new infections (Figure 6) do not show a clear peak, it seemed to have plateaued in July 2020 before starting to drop in early August. The lack of a stable trend is not unexpected given that Malawi's COVID-19 testing has been quite limited and inconsistent. In such a context, a trend of 7-day average test positivity rate provides for a more stable marker of progress.

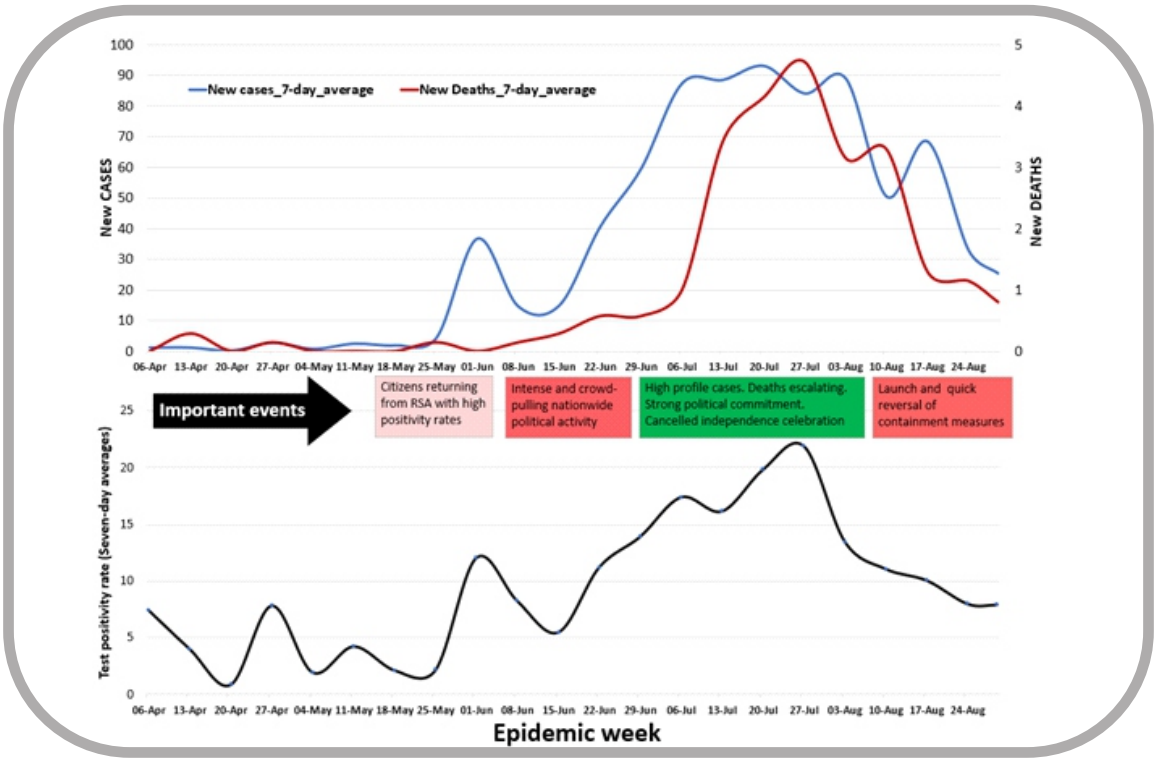

Figure 6: COVID-19 New cases, new deaths, and PCR test positivity rates by wee

The clear peak for test positivity rate is seen at the end of July 2020 before experiencing a sharp decline. This trend has to be read together with changes in case definition for accessing testing. At the very beginning of the epidemic, only travellers and contacts of identified cases were being tested, then testing was more accessible (at times going beyond secondary contacts) at the beginning of community transmission, and it was later limited to only symptomatic individuals. The changes in the testing access towards only symptomatic individuals should ideally lead to higher test positivity rates than average, adding confidence that the downward trend observed after mid-August is a real decline. In the week of 27th July 2020, the 7-day-average positivity rate was at 21%, but this had sharply dropped to 7% by 31 August 2020 (**Figure 6**).

Another factor that confirms that the curves we see are a true reflection of COVID-19 trend is the kind of overlap the new cases and new deaths trends overlap. On average, most people die 2 weeks from the time they were infected, the deaths curve runs at least 2 weeks away from the infections (cases) curve and this is clearly visible from Figure 6.

To sum it all, it appears that Malawi's infection and death rates peaked in the final week of July and are now on a sustained downward trend. The curves are very wobbly but that is likely to be due to inconsistencies in reporting cases and deaths, changes in characteristics of who should get tested, shocks introduced by large numbers of returning residents with high positivity against a generally small testing volume against a population of 18 million.

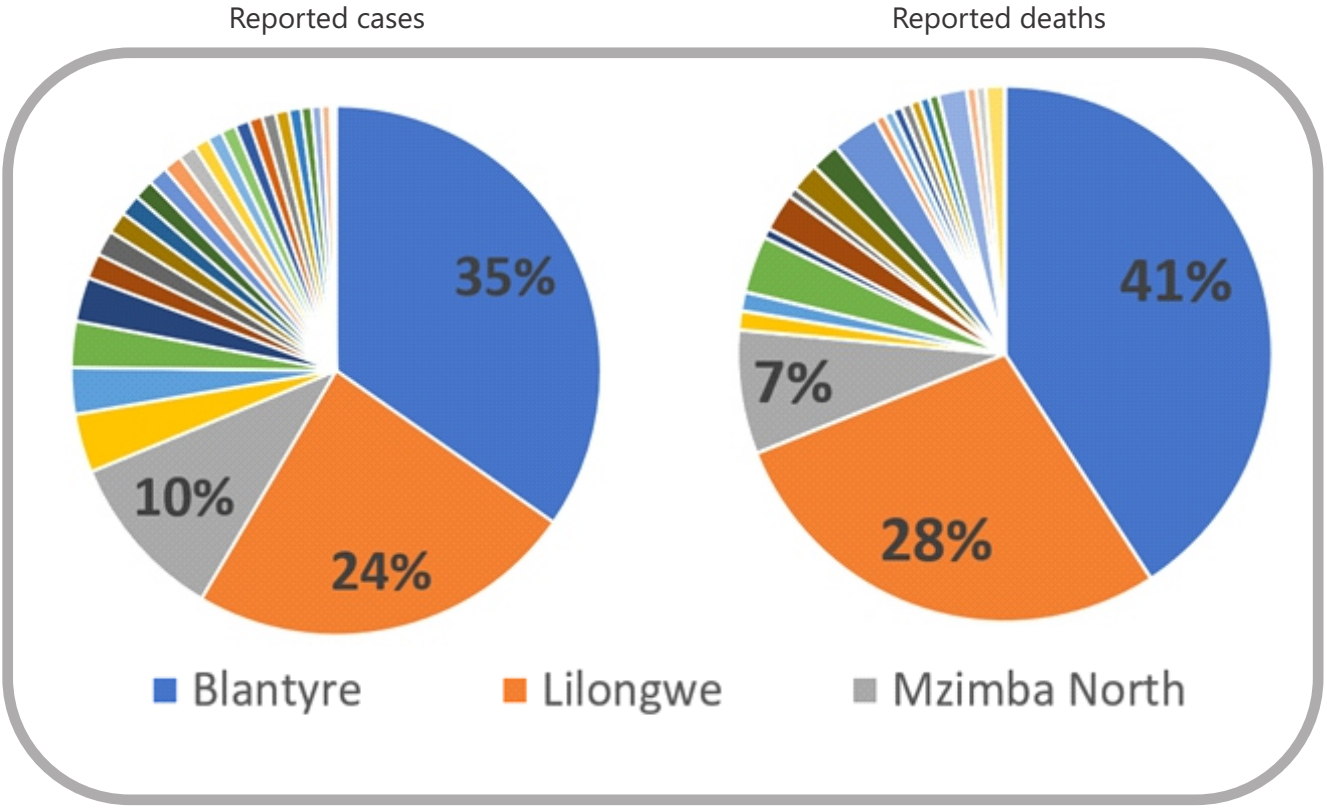

Figure 7: Blantyre, Lilongwe, and Mzimba North reported most of the documented cases and deaths

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WHO IS AFFECTED AND WHY ?

The only remaining concern that needs to be investigated to add confidence to the disease and death trend, is the severely low reporting in rural areas. Currently, 69% of all reported cases and 76% of reported deaths are from Blantyre, Lilongwe and Mzuzu(Figure 7). In other words, the entire national disease trend is being driven by Blantyre, Lilongwe and Mzuzu (Figure 7) and it may well be that this it only stands for the urban epidemic and a rural one is yet to come. If the low numbers are due to underreporting, then the national numbers we have just described remain valid and a true reflection of the Malawi epidemic status.

However, if the reported numbers are a true reflection of the disease status in the rural districts, it may mean that the rural epidemic is yet to come and this would be critical because that is where most older adults live. It would have been easier to appreciate if epidemic management effort-indicators were high and consistent across all districts. One such indicator is testing rates, these are also very low beyond Blantyre, Lilongwe and Mzimba North. Another indicator that can help is the trend of test positivity rates broken down by district but this may not be easily done because testing data is not presented by district, but by laboratory (and some large capacity laboratories serve multiple districts).

7.3. Who is Affected and Why?

The data presented in tables 2,3 and 4 indicate that most of the reported cases and deaths are in adult males residing in urban areas. The section below will examine in more details the age, gender and location of the affected groups in more detail.

7.3.1 Age

Although national testing has been very limited and inconsistent, current numbers show very limited burden under the age of 40 (Table 2). The data show disproportionately high impact on older adults. After age 60, case fatality ratio (percentage of number who died out of all who tested positive) is extremely high. On the cumulative sums by age, while most of those who tested positive were aged between 20 and 49, over 40% of all deaths occurred in individuals aged 60 and above.

Table 2: Distribution of cases and deaths by age

Age group	Confirmed infections (cases)	Documented COVID-19 Deaths	Proportion of all documented deaths (percentage of number who died in each age group, out of all deaths) [Interpretation: what percentage has each age group contributed towards all the documented COVID-19 deaths?]	Case fatality ratio (percentage of all who died out of all who tested positive) [Interpretation: After being diagnosed COVID-19 positive, what is the risk of dying from COVID-19 in each age group?]
0 to 9	57	0	0%	**0%**
10 to 20	124	1	0.57%	**0.81%**
20 to 29	1471	6	3.45%	**0.41%**
30 to 39	1817	15	8.62%	**0.83%**
40 to 49	1123	36	20.69%	**3.21%**
50 to 59	482	44	25.29%	**9.13%**
60 to 69	208	43	24.71%	**20.67%**
70+	102	29	16.67%	**28.43%**
Summary				
Age 0-59	5074	102	58.62%	2.01%
Age 60+	310	72	41.38%	23.23%

One would also consider that the documented impact on the elderly is likely to be an underestimate having demonstrated (Figure 7) that 70% of all the documented cases and 80% of all the reported deaths were from Blantyre, Lilongwe and Mzuzu, areas dominated by the young population with the best access to health care. The underreporting concern is cemented by examining the COVID-19 data against the natural reporting pattern of deaths. While the National Registration Bureau indicates that 80% of recorded deaths happen at home, community deaths contribute only 20% towards current COVID-19 mortality numbers (MOH mortality study).

7.3.2. **Gender**

We examined gender because it has been identified as a key predictor of COVID-19 outcome. Table 3 shows that more men than women have been infected, but this is unlikely to be a true reflection of the situation because gender is not a big driver of COVID-19 susceptibility. The numbers in the Malawi epidemic may simply imply that more men than women had access to COVID-19 testing. But why would more men than women get tested? A key explanation is in the testing approach: from the very beginning, testing was limited to travellers and their contacts. Most Malawians involved in cross-border travel and their contacts are young and male (this can be seen in **tables 2** and **3**).

This difference in access to testing may then drive the rest of the differences such as those we see in deaths (no test access data was available by sex). A more stable measure, however, is case-fatality ratio, which as shown in table 3 shows very small difference in risk of death by gender (Table 3).

Table 3: Distribution of cases and deaths by gender

	New infections		Deaths		Case-fatality ratio
Gender	number	Percentage of total (Out of all infections, what proportion were male or female?)	number	Percentage of total (Out of all deaths, what proportion were male or female?)	percentage of all who died out of all who tested positive**)** **[Interpretation:** After being diagnosed COVID-19 positive, what is the risk of dying from COVID-19 in each gender?**]**
Gender	number	Percentage of total (Out of all infections, what proportion were male or female?)	number	Percentage of total (Out of all deaths, what proportion were male or female?)	percentage of all who died out of all who tested positive**)** **[Interpretation:** After being diagnosed COVID-19 positive, what is the risk of dying from COVID-19 in each gender?**]**
Female	1737	31%	40	23%	2.30%
Male	3783	69%	134	77%	3.54%

7.3.3. **Living in Urban Setting**

70% of confirmed infections and 80% of the documented COVID-19 deaths involved individuals from Blantyre, Lilongwe, and Mzuzu. While every Malawian is at risk of getting the virus, the risk is much higher in cities due to their connectedness with the original sources of disease: outside countries. The epidemic would then move outside the cities through the frequent interaction rural areas have with urban centres. It is unclear what shape the epidemic curve for rural Malawi has taken, especially whether it is similar to that shown from the national data, which is driven by the urban, or whether a rural epidemic is yet to come.

Table 4: Distribution of cases and deaths by urbanisation status

	New infections		**Deaths**		**Case-fatality ratio**
Setting	number	Percentage of total (Out of all infections, what proportion were male or female?)	number	Percentage of total (Out of all deaths, what proportion were male or female?)	percentage of all who died out of all who tested positive**) [Interpretation:** After being diagnosed COVID-19 positive, what is the risk of dying from COVID-19 in each setting?**]**
Urban (Blantyre, Lilongwe, and Mzuzu**)**	3,661	68.76%	133	76.44%	3.63%
Rural (all other districts**)**	1663	31.24%	41	23.56%	2.47%

In general, the final distribution of cases and deaths also depends on the amount of effort that is raised: the more you test, the more you find. Blantyre was the earliest to respond and mounted perhaps the most aggressive response in the country, and that may in part explain the relatively large numbers in Blantyre versus very close districts of Chiradzulu, Thyolo, Neno and Chikhwawa. Similar experiences can be seen in districts surrounding Lilongwe and Mzuzu. The differential epidemic management efforts make it challenging to interpret with confidence that the epidemic is truly more deadly (high case fatality ratio) in the urban when compared to rural areas.

7.4. WHAT ARE THE SIGNIFICANT RISK FACTORS OF COVID-19 DEATH IN MALAWI?

7.4.1. Age

The numbers in Table 2 show that following infection, the risk of dying of COVID-19 is 12 times higher in individuals aged at least 60 compared to those aged 59 years and below (Risk Ratio 11.55 [95% Confidence Interval 8.74, 15.27], Risk Difference 21.23% [95% CI 16.50, 25.93], p value <0.001). This heightened risk in older age groups is consistent with international literature.

7.4.2. Gender

The impact of gender has been another strong and consistent risk factor of mortality globally, with males being at significantly higher risk than females. In Malawi however, the difference in infection fatality ratios between males and females is still significant but relatively small when compared to China and Europe. In Malawi, males were only 1.12 times more likely to die of COVID-19 than females (Relative risk 1.54 [95% CI: 1.09, 2.18], Risk Difference 1.24% [95% CI 0.32, 2.18], p value 0.01).

7.3.3. Living in Urban Setting

In this analysis, living in either Blantyre, Lilongwe, or Mzuzu, is associated with 1.12 times greater risk of COVID-19 death than living in the rest of the districts (Relative risk 1.47 [95% CI: 1.04, 2.08], Risk Difference 1.17% [95% CI 0.20, 2.13], p value 0.03). The elevated risk of death may follow the elevated risk of infection in urban areas and is in line with global body of evidence, but may at this time also be a reflection of either underreporting or delayed rural epidemic.

7.5. WHAT IMPACT HAS COVID-19 HAD ON THE POPULATION

7.5.2. Projected Impact of Covid-19 Based on Data Available orom China and Europe as of March 2020

Our epidemiological projections conducted in March 2020 showed that if the epidemic was to behave as it did in Wuhan (China) and Europe, Malawi would experience as many as 115,000 hospitalisations and that if the health system was strong enough to manage the cases including providing critical care to 29,000 patients, 26,000 would be the total COVID-19 deaths in a 3 months period (***Table 5***).

Table 5: Projected impact of COVID-19 in Malawi based on data available from China and Europe as of March 2020

Age group (years)	2018 Malawi Census	Hospitalization demand if 50% of the population is infected		Critical Care need if 50% population is infected		Deaths if 50% of the population is infected	
		Number	% of total	Number	% of total	Number	% of total
0-9	5,185,284	1,595	1.39%	72	0.28%	52	0.20%
10-19	4,569,248	3,221	2.80%	161	0.56%	137	0.53%
20-29	2,880,987	8,931	7.78%	447	1.54%	432	1.66%
30-39	2,076,224	19,113	16.64%	956	3.31%	830	3.19%
40-49	1,265,468	16,535	14.40%	1,042	3.60%	949	3.65%
50-59	694,733	16,353	14.24%	1,995	6.90%	2,084	8.01%
60-69	475,469	18,745	16.32%	5,136	17.767%	5,230	20.09%
70-74	144,788	8,796	7.66%	3,800	13.14%	3,692	14.18%
70+	271,548	21,576	18.78%	15,297	52.91%	12,627	48.51%
	17,563,749	114,705	>40% = 60+	28,905	>80% = 60+	26,034	>80% = 60+

The major planning challenge upon looking at these figures was that the best known forms of lifesaving COVID-19 clinical management required facilities that are not available to the population. For example, while we projected 29,000 critical care need clustered in a 3 month period, the maximum bed capacity for this level of care for all illnesses is only 40. As expected, these 40 beds are always occupied to capacity.

An additional problem is human resource, assuming government or partners were able to procure thousands more critical care units Malawi would still not have managed to push capacity beyond 50 due to lack of well-trained staff. As many as 50% of needed staff (all cadres before COVID-19) are not available. So the health system was already running on just over 50% of needed human resource before COVID-19, which on its own and based on projections, would have needed many more workers.

7.5.2. Documented Impact of Covid-19 as Of 31 August 2020

As early as April 2020, as the epidemic was settling on the African continent, scientists observed a slow rise in daily number of deaths scientists started speculating that perhaps the epidemic was either less disastrous or was spreading at a far slower rate than it was in Wuhan. The hypothesis generation then was limited by testing capacity, which was too low across the African continent, to allow a detailed understanding and interpretations.

Surveys conducted in May and June in Malawi (Malawi Liverpool Wellcome Trust and College of Medicine), Mozambique and Kenya helped confirm that transmission was as high as expected but it was was death rate that was very low. The population level impact in the three hardest hit locations of Malawi, is described in **Table 6.**

Table 6: Documented impact of COVID-19 in Malawi based on data available from Public Health Institute of Malawi as of 31 August 2020

City	COVID-19 Deaths	2018 Population	Number of deaths per 100,000 population
Blantyre City	71	800,264	**9**
Lilongwe City	49	989,318	**5**
Mzuzu City	13	221,272	**6**
Total	**133**	**2,010,854**	**7**

While these numbers are very reassuring, the lack of a clear scientific explanation limits what can be recommended to Malawi and African governments as next steps. This subject therefore should be the top driver of scientific curiosity going forward. The emerging hypothesis is that most of Africa may have been exposed to other viruses that trigger immune responses similar to that mounted by persons infected by SARS-COV-2, allowing a successful fight against COVID-19 in most of the infected people. This and other potential explanations need to be put through rigorous scientific investigation.

7.5.3. Comparison of Covid-19 Versus Top Health Priorities in Malawi

Malawi uses a public health approach to achieve allocation of her limited resources towards the health system, a highly demanding and resource-intensive, yet vital component of the government machinery. The left side of Table 7 shows the most common illnesses and you can see that these are reflected on the right side which shows the essential health package, a list of programmatic areas that receive funding before any other program or illness is funded.

This approach to health financing allows the government to serve most of the population and save as many lives as possible. Comparing the population level impact of COVID-19 in Table 6 to those shown for the top 10 illnesses in Malawi, does not place COVID-19 in the essential health package. However, COVID-19 was allowed a lion's share of the national resource because the anticipated impact was much higher than any of the illnesses listed in Table 7. The 26,000 projected deaths (Table 5) would have translated to a population level burden of 148 deaths per 100,000, topping the top ten causes of disease list with a very wide margin.

Table 7: The top health priorities in Malawi

		Deaths in 2017	
	Cause	Number	per 100,000 population
1	HIV/AIDS	21,935	125
2	Neonatal disorders	11,081	63
3	Lower respiratory infections	9,425	54
4	Tuberculosis	7,224	41
5	Diarrheal diseases	7,060	40
6	Malaria	6,883	39
7	Ischemic heart disease	6,825	39
8	Stroke	5,197	30
9	Congenital defects	3,833	22
10	Diabetes	2,642	15
	All causes (most not listed)	129,414	

	The essential health package
1	HIV/AIDS
2	Reproductive, maternal, newborn and child health
3	Integrated management of childhood illnesses (IMCI)
4	Vaccine Preventable diseases
5	Tuberculosis
6	Malaria
7	Community Health
8	Nutrition
9	Non communicable diseases
10	Neglected tropical diseases
11	Oral Health

7.6. STUDY LIMITATIONS

7.6.1. Data Access and Limitations of Available Data

The national response has been consistently sharing COVID-19 data with the public in two forms: one report with key summaries (Facebook, WhatsApp, Twitter) and the other report containing epidemic curves and distribution by age, sex, district and testing laboratory (PHIM website and WhatsApp). These reports enriched our research. However, the available data do not provide room to interrogate clinical conditions known from other studies to increase risk of death such as diabetes, hypertension, lung disease, heart disease, HIV infection, and cancer. It was also not possible with available data to evaluate factors related to mortality following hospitalisation, or general access to care variables such as time between onset of severe illness and hospitalisation, and available resources at health facilities. Examination of current individual level data showed that it was mostly incomplete

7.6.2. **Efforts to Improve Data Management**

Conversations between the College of Medicine (Titus Divala, Mphatso Phiri), Clinical Services Department of the Ministry of Health (Jonathan Chiwanda), and Public Health Institute of Malawi (Daniel Mapemba) indicate that data collection forms have been available, appropriate training was conducted, but district level inconsistencies in applying the data tools and limitations in capacity may have led to poor data capture practices. These conversations have ignited additional efforts towards updating the national database as far as possible to allow these analyses (Titus Divala provided £2000 towards this exercise that has already started for Blantyre, Lilongwe and Mzuzu). There is need for the national response and development partners to support an additional wave of efforts aimed at ensuring that future data management yields good quality and complete data. The activities have already been planned and include refresher trainings for district teams and re-examination of data transmission and utilisation processes. Data quality and long-term evidence-based management of COVID-19 and future epidemics will be assured if detailed data management, analysis and utilisation capacity building is achieved from as low a level as subdistrict centres.

8. CONCLUSION

COVID-19 is a new disease caused by SARS-COV-2. In Malawi, COVID-19 started with a slow phase following first documented infection on 02 April 2020, then positivity rate rose sharply in June 2020, peaking at the end of July and took and maintained a comfortable descent since mid-August. Our analysis shows that factors that increase the risk of COVID-19 death in Malawi are being aged at least 60, being male, and living in urban areas. Of these factors, age appears to be the most important: being a confirmed case aged at least 60 increases carries a 12 times higher risk of dying from COVID-19 compared to those aged 59 years and lower. Current data limitations are that it is all mostly from urban settings and is too incomplete to allow evaluation of patient and health system characteristics beyond age and gender. The population level burden of COVID-19 in Malawi has remained low relative to projected burden and against top ten health priorities.

9. RECOMMENDATIONS

9.1. Adapt the Response to Known Disease Burden and Minimize Collateral Damage

The national response planning and management needs to urgently move from pre-epidemic modelling projection-based disease burden and adapt to metrics based on observed data. The discrepancy between pre-epidemic modelling projections of disease burden and observed data is substantial and may have led to what we can now interpret (with observed data) as over preparation. However, in reality, not many changes should be expected considering that except for a few areas, the response was generally suboptimal.

The key areas for urgent consideration include the health system and the education sector. In the health system, there is urgent need to reclaim the much needed grip on the essential health package, a task that will involve reclaiming resources originally redirected from it to COVID-19. These changes will however have to be implemented while maintaining critical COVID-19 management practices such as infection prevention, facility-based case finding, isolation and treatment at facility level and community engagement.

Figure 8 shows a model (developed by College of Medicine) of how the COVID-19 response at district level can be transformation to sustain both high and low transmission stages of COVID-19 while achieving three important goals:

1. Achieving community ownership of the epidemic, prevention strategies, case identification, management, triage and referral
2. Creating a community-connected and safe resource prioritization system: phone clinic.
3. Establishing a robust and community-led surveillance system capable of tracking all COVID-19 metrics and other key health indicators

This model system, if tested and integrated to the district health system, can easily adapt to both high and low transmission stages of the epidemic: it is what districts can put in place to keep an eye on a declining or near extinct epidemic or can use to run triage and generally prioritise limited resources at the height of transmission.

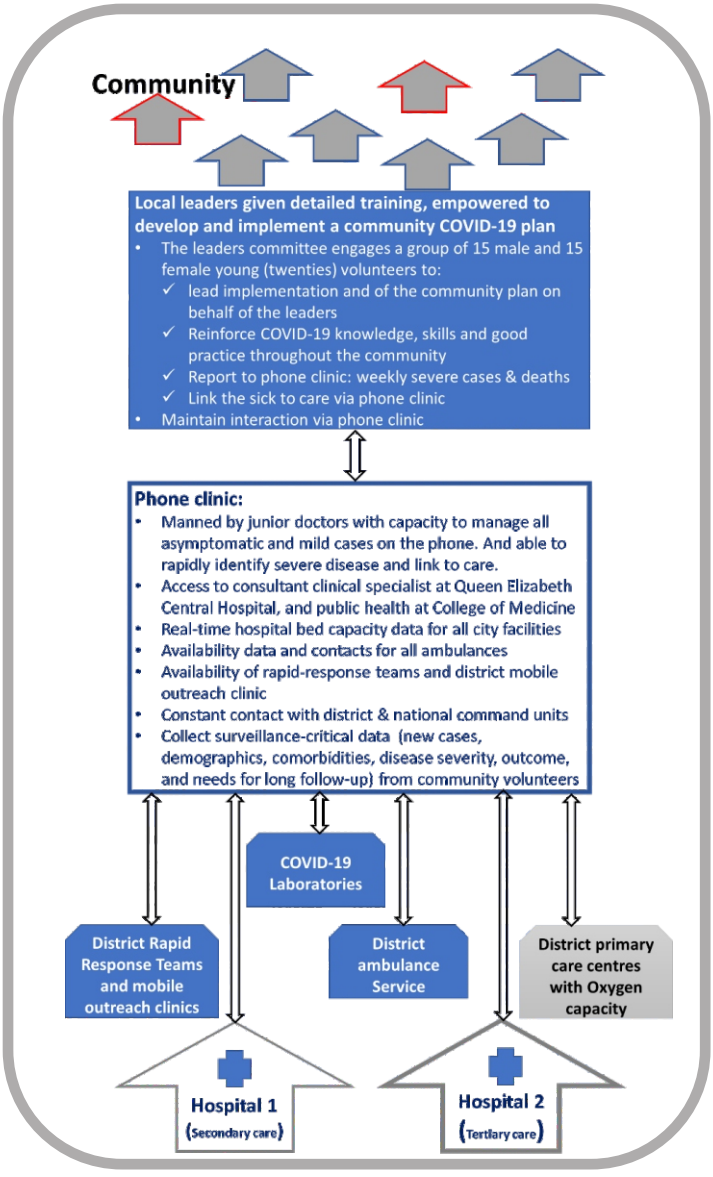

Figure 8: Adapting the district health system to ensure efficient COVID-19 management both at high and low disease burden levels

9.2. **Collect Detailed Data and Identify Who To Target With Prevention Measures**

Other areas of concern would be social and economic burdens secondary to population level restrictions. The amount of observed disease burden may at this point not justify implementation of draconian measures of preventing COVID-19. Apart from universal mask use, frequent hand wash, and physical distancing, it is now time to switch to more targeted than blanket COVID-19 transmission prevention measures. Analysis and documentation of what factors increase one's risk of developing severe disease, and death is urgently needed as it will guide both the national response and scientific investigation going forward.

- For the national response: The epidemic has a low population level impact but it affected some people leading to hospitalisation and death. Knowing why those people and not the others will help the national response allocate resources more efficiently. The national response will then know who to save and who does not need much effort to support.
- For scientists: This very knowledge will speed up efforts at identifying the protective factors that keep some safe from severe disease and death. These can then be share with the national response and other responders globally for to enhance their actions but also to strengthen efforts at identifying cures and vaccines.
- For the public: this will help them know how to modify their behaviour and protect those at highest risk. Employers, community leaders and others in positions that involve managing people would then put in place mechanisms for shielding those at highest risk.

9.3. **Covid-19 is Still Here, Observing Prevention Measures is What Will Assure the Safety of Our Journey Towards Co-existence with it**

For the public, while COVID-19 transmission is fast decreasing, it is important to realise that it has not stopped. To keep transmission on a downward trend, everyone must always observe these prevention measures: universal mask use, frequent hand wash, and physical distancing. Unfortunately, all these measures work only if most people in the population are following them, so everyone must ensure that all people around them are observing all these measures.

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