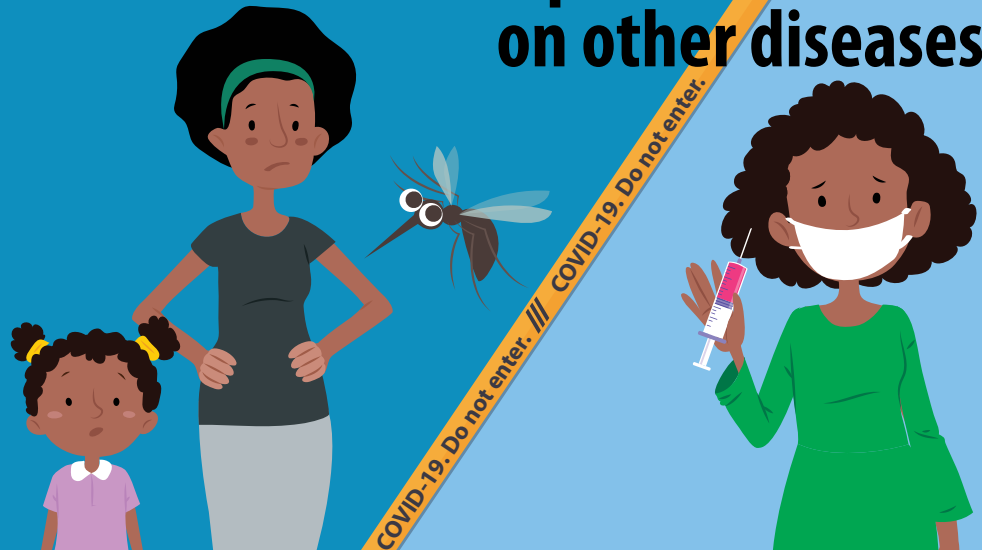# BIOMEDICAL SCIENCE JOURNAL FOR TEENS

What is the impact of COVID-19 on other diseases?

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Abstract

The new coronavirus has spread almost everywhere on our planet. Governments have taken various measures to try and control the disease – many of us are in lockdown, and lots of schools and businesses are closed. Some people have lost their jobs. These (and other) measures have consequences for other diseases as well. We wanted to assess what impact the coronavirus epidemic would have on three other current epidemics: HIV, tuberculosis (TB) and malaria. These three diseases are a major threat, especially in poorer countries.

We created mathematical models to estimate how the measures against COVID-19 are impacting people with these other diseases. Unfortunately, we found that deaths could increase by 10% for HIV, 20% for TB and 36% for malaria.

Our results show that governments should continue with the most important actions that help prevent and treat these three diseases.

Introduction

Are you studying from home? Closing schools is just one of the measures many countries have taken in their struggle against the new coronavirus epidemic. You probably know that the goal of these actions is to reduce the number of deaths from this new disease. They also aim to make it possible for healthcare systems to look after all the patients with severe COVID-19. However, the actions against the epidemic are having and will continue to have extra consequences.

The COVID-19 epidemic could cause real difficulty for people who already have other diseases or are at risk of catching them.

- Many people can't or won't go to the doctor to seek care.
- Others can't receive the medicine they need.
- Labs can't diagnose these other diseases in time.
- Health workers can't deliver the things people need to keep them safe.

This leads to more infections and delayed treatment, which can be fatal in some cases.

We wanted to investigate the impacts of the epidemic on three major health problems: HIV, TB, and malaria. Are the strategies against COVID-19 making it worse for patients with these diseases? Are healthcare systems able to take care of them?

Doctors usually diagnose TB with a chest x-ray. But if a patient cannot go to the hospital, the diagnosis will be delayed making the disease harder or even impossible to treat.
(Photo: Getty Images/Alamy)

Methods

To help us find those answers, we created mathematical models which describe different scenarios for the COVID-19 epidemic in lower-income countries:

- No action – there are no measures against the COVID-19 epidemic.

- Mitigation – countries take measures to reduce the coronavirus reproduction number by 45% for 6 months. (The reproduction number is also known as R_0 or the "average number of people one infected person will infect.")

- Short-term suppression – countries take measures to reduce the reproduction number by 75% for 2 months.

- Long-term suppression – countries take measures to reduce the reproduction number by 75% for one year.

We then made assumptions about the consequences of these measures on the health programs against these other three diseases.

→ HIV:

- 25-100% of people newly infected with HIV won't be able to start their therapy.

- 2-50% of the current patients won't be able to continue their therapy.

- Prevention might be unavailable.

→ TB:

- Diagnosis rates will decrease by 25-50%.

- Treatment will be delayed.

- Prevention might be unavailable.

→ Malaria:

- 25-50% of patients won't receive treatment.

- Prevention might be unavailable.

We applied these models to two different regions for each disease – one where the disease is more common, and one where it is less common.

So at what point do we consider these three diseases very prevalent (common)? And at what point do we consider them a bit less prevalent (although still significant)? These are the scenarios we used which reflect real-world countries:

HIV:
Very prevalent – 200,000 per million adults have HIV
Prevalent – 90,000 per million with HIV

TB:
Very prevalent– 5,200 people per million have TB
Prevalent– 450 people per 1 million with TB

Malaria:
Very prevalent– 400,000 cases per million people
Prevalent– 7,000 cases per million people

Results

First, we used our model to estimate how many people would die in lower-income countries due to COVID-19 in the four different scenarios (Fig. 1).
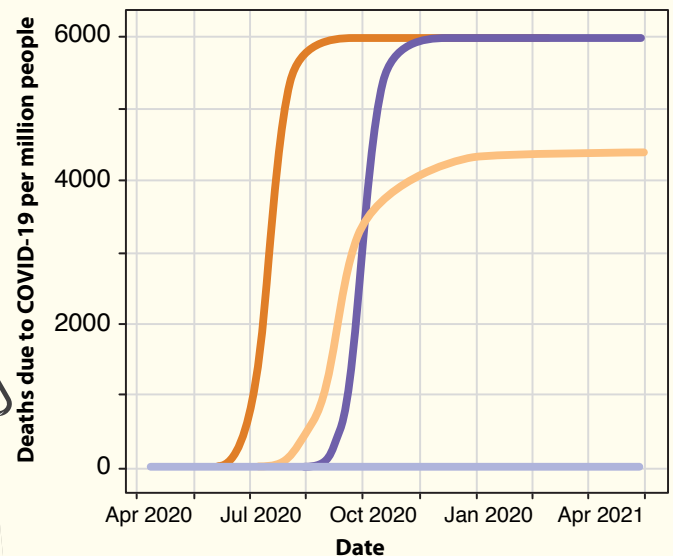
We also tried to work out what problems the different scenarios could cause. We then used these data to estimate how many extra deaths there would be due to HIV, TB, and malaria under each scenario. Table 1 shows the combined data.

Figure 1:
Deaths due to COVID-19 under each epidemic scenario.

How are the "No Action" and "Short-Term Suppression" scenarios different?

Legend:
- No Action
- Short-Term Suppression
- Mitigation
- Long-Term Suppression

Table 1:
Death per million people in the population due to COVID-19 under the different scenarios and the problems they could cause. Additional deaths per million people for a five year period due to HIV, TB, and malaria.

Scenario	Deaths due to COVID-19	Expected problems	Additional deaths due to HIV		Additional deaths due to TB		Additional deaths due to malaria	
			Very prevalent	Prevalent	Very prevalent	Prevalent	Very prevalent	Prevalent
No action	6000	6 weeks of overwhelmed healthcare systems	600	300	Below 50	~0	2000 in 2020*	1000 in 2020
Mitigation	4400	Disrupted measures against other diseases; heavy burden on health systems	150	100	350	10	2000 in 2020	1000 in 2020
Short-term suppression	6000 (delayed)	2 months of disruptions; then 6 weeks of overwhelmed healthcare systems	600	300	100	~0	2000 in 2020	1000 in 2020
Long-term suppression	None	12 months of disruptions; no burden on healthcare systems	50	Below 50	750	Below 50	Below 100	Below 100

* In all scenarios and settings: Additional malaria deaths happen in 2020. There are no additional malaria deaths for the following four years, assuming that the COVID-19 epidemic is over and governments resume their malaria control measures.

Discussion

The impacts of the new coronavirus will go much further than the initial responses to this one disease. Our models show that HIV could take 10% more lives over the next five years because of the COVID-19 epidemic. This is mainly because some people may not get anti-HIV therapy during the pandemic. As for TB, extra deaths may increase by 20%. The main reason would be delayed diagnosis and thus, treatment.

The impact of COVID-19 on malaria is slightly different. This mosquito-borne disease might take 36% more lives because of the coronavirus epidemic. Under coronavirus epidemic conditions, governments might not be able to distribute bed nets and mosquito-killing chemicals (usually sprayed on household walls). Without these essential prevention techniques, deaths will rise. We assume, though, that once the epidemic is over in 2021, governments will resume giving out bed nets and spraying the chemicals. So there would be no extra deaths from 2021 to 2024.

These indirect impacts of the COVID-19 epidemic sound scary, but they are only predictions. We believe health services and governments can take action to avoid these extra deaths.

- For HIV, it's important that every patient can continue to access therapy.
- For TB, it's important that the disease can still be diagnosed promptly.
- For malaria, mosquito populations must be controlled using the same measures.

Conclusion

Mathematical models are a very useful tool in science. Still, we have to keep in mind that they can't tell the future and different outcomes are always possible.

We shouldn't forget the threat of other diseases during the COVID-19 pandemic. You can support the fight against malaria, TB, and HIV by donating, raising money or petitioning for local or international charities that combat these diseases.

Glossary of Key Terms

Assumptions – in a mathematical model, an assumption is something that we think is, or will be, true. So for example, one of our assumptions was that the diagnosis of TB would be delayed while countries were dealing with COVID-19. We make assumptions based on emerging information and our knowledge about how things have gone in the past.

Bed nets – in areas where there is a lot of malaria, people are encouraged to sleep under a thin mesh net that covers them at night. These nets often have chemicals in them which kill any mosquitoes that land on them. Most mosquitoes that carry malaria prefer to bite in the late evening and at night, so bed nets are a particularly good way to reduce malaria.

COVID-19 – Coronavirus disease 2019, a disease caused by SARS-CoV-2. Symptoms may include fever and dry cough in milder cases and difficulty breathing in more severe cases.

Epidemic – A sudden increase in the number of cases of a particular disease within a population.

HIV (Human Immunodeficiency Virus) – the virus that can lead to Acquired Immunodeficiency Syndrome (AIDS), if not treated. AIDS weakens the infected person's immune system so that it can't fight off diseases, making it more likely for the infected person to die. Unlike some other viruses, the human body can't get rid of HIV completely, even with treatment. So once you get HIV, you have it for life.

Malaria – a blood disease caused by a *Plasmodium* parasite, transmitted by the bite of infected mosquitoes. The severity of malaria varies based on the species of *Plasmodium*. Symptoms include chills, fever, and sweating, usually occurring a few weeks after being bitten.

Mitigation of the epidemic – the aim is to reduce spread while protecting the most vulnerable people - older people and those with other diseases stay at home. It only slows down the epidemic, allowing herd immunity to build up more slowly than without mitigation.

[Basic] Reproduction number – How many other people one infected person spreads the virus to, on average, in a population with no immunity to the disease. As the epidemic progresses we use the reproduction – or "R_O number" – to track how many infections are continuing in the population. Each person needs to infect less than one new person for the epidemic to decline. We want to make sure that the reproduction number stays below 1.

Suppression of the epidemic – the aim is to minimize the transmission of the virus (and keep the Ro number below 1). There will only be a few new cases while the suppression measures are in place, but when the measures are lifted, the epidemic could restart. The measures are stronger than with mitigation, with "lockdowns" of the entire population being the most important one.

TB (tuberculosis) – an infectious disease caused by *Mycobacterium tuberculosis* bacteria. It generally affects the lungs. Many people carry it without getting sick.

Therapy for HIV – called antiretroviral therapy (ART). People with HIV take a mix of medicines every day, which keeps the virus weak. This helps them live a longer and healthier life.

REFERENCES

Alexandra B. Hogan, Britta Jewell, Ellie Sherrard-Smith, Juan Vesga, Oliver J Watson, Charles Whittaker, Arran Hamlet, Jennifer Smith, Kylie Ainslie, Marc Baguelin, Samir Bhatt, Adhiratha Boonyasiri, Nicholas F Brazeau, Lorenzo Cattarino, Giovanni Charles, Laura V Cooper, Helen Coupland, Gina Cuomo-Dannenburg, Amy Dighe, Bimandra Djaafara, Christl A Donnelly, Ilaria Dorigatti, Jeff W. Eaton, Sabine L van Elsland, Richard FitzJohn, Han Fu, Katy Gaythorpe, Will Green, David J Haw, Sarah Hayes, Wes Hinsley, Natsuko Imai, Edward Knock, Daniel Laydon, John Lees, Tara Mangal, Thomas Mellan, Swapnil Mishra, Gemma Nedjati-Gilani, Pierre Nouvellet, Lucy Okell, Alison Ower, Kris V Parag, Michael Pickles, Isaac Stopard, Hayley A Thompson, H. Juliette T Unwin, Robert Verity, Michaela Vollmer, Caroline Walters, Haowei Wang, Yuanrong Wang, Lilith Whittles, Peter Winskill, Xiaoyue Xi, Neil M Ferguson, Thomas Churcher, Nimalan Arinaminpathy, Azra Ghani, Patrick Walker, & Timothy B Hallett (2020) *The Potential Impact of the COVID-19 Epidemic on HIV, TB and Malaria in Low - and Middle-Income Countries*. The Lancet Global Health.
https://doi.org/10.1016/S2214-109X(20)30288-6

Deutsche Welle: Coronavirus: COVID-19 shouldn't make us forget other major infectious diseases
https://p.dw.com/p/3c7li

The Guardian: Millions predicted to develop tuberculosis as result of Covid-19 lockdown
https://www.theguardian.com/global-development/2020/may/06/millions-develop-tuberculosis-tb-covid-19-lockdown

Check your understanding

1 What consequences might the COVID-19 epidemic have for those with HIV?

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2 What is the worst impact of the COVID-19 epidemic on TB infections?

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3 Why are the predictions for malaria-related deaths (due to COVID-19) so high for 2020?

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4 If a government closes schools and tells everyone to stay at home, what kind of strategy are they taking against the epidemic?