Who is at risk for cholera in Africa?

Authors: Justin Lessler, Sean Moore, Andrew Azman, Elizabeth Lee, Heather McKay, et al.
Associate Editors: Gogi Kalka & Rachel Watson

Can you believe that one of the oldest infectious diseases is still one of the deadliest? People have tried for a very long time to get rid of cholera, a dangerous bacterial infection, but it always manages to return somewhere. Even though it has been largely eliminated in more developed countries, it still threatens millions (and kills hundreds of thousands) of people each year, mostly in sub-Saharan Africa.

We wanted to figure out where most cases of cholera occurred in sub-Saharan Africa, to see where people were at the highest risk. We saw that the disease does not affect people equally in all countries; instead, cholera epidemics occur most often in limited areas. If we focus our efforts on these “high-risk” areas, we could prevent cholera much more efficiently. In fact, we could get rid of half of all cholera cases by targeting only 4% of the population!

Introduction

Cholera is a dangerous disease that can kill within hours if not treated. It is caused by the bacterium Vibrio cholerae (Fig. 1), which infects people’s intestines and is spread through contaminated water or food. Infected people can have mild symptoms or quickly develop severe diarrhea, losing up to 1 liter of liquid from their body each hour. That’s like half a big bottle of soda! Losing this much fluid from your body can cause otherwise healthy people to die. Millions of people are still at risk for cholera, mostly in areas that don’t have good water infrastructure, such as sewage treatment plants or access to clean and safe drinking water.

Scientists, doctors and public health officials have undertaken many efforts to reduce the risk of a cholera infection all over the world. These prevention efforts mainly focus on providing access to clean drinking water, sanitation, and teaching people about hygiene (often abbreviated as WaSH).

Despite all these efforts, many regions are still under high levels of cholera threat, especially in sub-Saharan Africa (Fig. 2). In the last 15 years, over 80% of all cholera cases reported by the World Health Organization (WHO) occurred there.

A recently developed cholera vaccine can also help reduce the risk of infection, but it is only effective for a short amount of time, and not available for everybody who is at risk. We wanted to figure out if it might be possible to fight cholera more effectively by focusing prevention efforts on regions within sub-Saharan that are at highest risk for infection.

Figure 1: Vibrio cholera, the bacterium that causes cholera. People catch it when they come into contact with contaminated water or food. Symptoms of cholera range from none to severe watery diarrhea that can be deadly within hours if not treated properly.

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Methods

To do so, we first had to understand better where and when the disease occurred (its epidemiology). Did it occur everywhere at the same rate, or were there “high risk areas” where people were more likely to get it?

To find these potential high-risk areas, we obtained information from various sources* on cholera cases that occurred between 2010 and 2016 in sub-Saharan Africa (except for the countries of Djibouti and Eritrea, because data from these places were unavailable). We then divided this enormous study area into squares that were 20 km long and 20 km wide and used mathematical techniques to estimate the number of cholera cases for each square.

We also added population sizes (# of people living in each area) to the squares, which allowed us to calculate 3 different risk levels for each area:

- high risk (>1 cholera case per 1000 people per year)
- moderate risk (≤1 case per 1000 people and > 1 case per 10,000 people)
- low risk (≤1 case per 10,000 people and > 1 case per 100,000 people)

Results

- We included 279 data sets and 2283 locations in our analysis.
- We found that over 140,000 cholera cases per year were reported in sub-Saharan Africa during our 6-year study period.
- Our efforts gave us a detailed map that showed us where people were most at risk of getting cholera (Fig. 3)
- Interestingly, the risk of cholera is not spread out evenly over the African continent: only a small fraction of it (about 4%) is at “high risk” for cholera infection.
- Roughly 87 million people live in these high-risk areas.

Can you name 3 countries that are hotspots for cholera in sub-Saharan? Which countries have very low risk for cholera epidemics?

Figure 3: Our map shows the average number of reported cholera cases in sub-Saharan Africa per 100,000 people per year between 2010 and 2016. The more red the color, the more people got infected with cholera.

*WHO, Medecins Sans Frontieres, ProMED, ReliefWeb, country ministries of health and the scientific literature.
Discussion

Our detailed “risk of cholera” map shows that the most cases of cholera mainly occur in a small part of sub-Saharan Africa.

If we specifically targeted these hotspot areas with our WaSH interventions and vaccines, we could prevent cholera much more effectively: we could get rid of half of the region’s cholera by covering less than 4% of its entire population. That’s roughly 35.3 million people out of over 880 million!

Disease prevention campaigns are very costly and time consuming. Studies like ours can therefore make them more effective and efficient by focusing on areas where we help as many people as possible with our limited amount of resources.

Conclusion

You might not live in a place where you’re at a high risk for cholera, but it is still easy to catch a bacterial infection. For example, infections of E. coli (another nasty bacterium that is passed on through contaminated food) can have very serious consequences, and are getting more and more common all over the world.

So, what can you do to best protect yourself from bacterial infections? Don’t drink water from sources that you don’t know are safe. For example, city water that is treated for drinking or a drinking well are safe, but it’s not usually safe to drink from a stream or river. Always wash your hands before you eat or handle food! Also wash your food well before you eat it. Don’t leave refrigerated food (especially raw meat or milk) sitting out on the counter too long, and make sure you really clean everything well after handling them.

Glossary of Key Terms

- **Epidemic** – a widespread occurrence of an infectious disease (in our case, cholera) in a community at a particular time.
- **Epidemiology** – the study of the health of populations. Epidemiologists are scientists who study health in groups of people, including analyzing past and present epidemics so that they can predict and hopefully help to prevent future ones.
- **Hotspot** – in our case: an area that is under higher threat of infectious disease.
- **Infectious disease** – a disease that is caused by an infection. An infection is created when an organism’s body is invaded by a disease-causing agent (here, the bacterium Vibrio cholera).
- **Infrastructure** – the basic physical and organizational structures and facilities (e.g. buildings, roads, and power supplies) needed for the operation of a society.
- **Intervention** – an action taken to improve something (like the sanitary conditions or access to safe drinking water).
- **Prevention** – measures to keep something from happening (in our case, to prevent people getting cholera).
- **Sanitation** – conditions relating to public health, especially providing clean drinking water and adequate disposal of sewage.
- **Sub-Saharan Africa** – parts of Africa that are situated south of the Saharan Desert.
- **Invasive species** – a type of organism that is not native to (not originally from) a particular area and can cause harm – the number of individuals of a species in a given area.
WHO IS AT RISK FOR CHOLERA IN AFRICA?

What is cholera, and how can you get it?

Why do you think it has been so difficult to get rid of cholera globally?

What other factors can contribute to people getting cholera?

What methods are usually used to prevent cholera?

How can we make these efforts more efficient and effective?

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