

PLOS Science Wednesday: We're Drs. Albert Ko and Federico Costa; our PLOS Neglected Tropical Diseases paper examines the burden of leptospirosis, a disease that impacts urban slum dwellers and rural su

PLOSScienceWednesday ¹ and r/Science AMAs¹

¹Affiliation not available

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Abstract

Hi Reddit, My name is Albert Ko and I am a Professor at Yale School of Public Health. My research focuses on identifying solutions for health problems that have emerged as a consequence of rapid urbanization, social inequity and the growth of slum settlements. I am joined by my colleague, Federico Costa, who is an Associate Professor at the Universidade Federal da Bahia in Brazil. His research centers on how the ecology of the slum communities influences the disease emergence and transmission in such environments. Federico and I recently published a study, titled “Global Mortality and Morbidity of Leptospirosis: A Systematic Review”, in PLOS Neglected Tropical Diseases. This study estimated the health burden caused by leptospirosis, a bacterial disease that is transmitted by rats, livestock and other animals in environments that lack basic sanitation. We found that leptospirosis accounts for one million cases and 60,000 deaths each year, most of which occur in regions where its impact on subsistence farmers, pastoralists and slum dwellers has been “neglected”. Furthermore, the burden of leptospirosis is projected to rise as the global expansion of shantytowns and climate change-associated extreme weather events create the environmental conditions for intensified transmission. We invite you to ask questions about leptospirosis, and how changes in the world’s demographics and environment are creating new health challenges and neglected diseases which impart their greatest impact on vulnerable populations. We’ll be taking your questions at 1pm ET (10 am PT, 6 pm UTC) – Ask Us Anything! NOTE from PLOS: Albert and Federico are presenting at a conference in Brazil today, and will answer questions as they are able, sometimes before or after the 1-2pm ET live chat hour.

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ABSTRACT

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Dr. Ko, have you looked at the potential downside of treatment for leptospirosis in overpopulated areas compared to using the funding to create a better housing situation and reducing focused over population. Is there a cost benefit analysis associated with treatment and its contributions to overpopulation versus shifting a focus to balancing treatment and improving overall population dynamics?

[lukedehart](#)

Albert_ you are correct that prevention, which targets the underlying structural determinants, whether social and environmental, will likely achieve the greatest benefits in addressing the disease.

Unfortunately no formal cost benefit analysis of intervention strategies have been done but this burden of the disease study is the first step in this process.

High population density (perhaps what you mean by overpopulation) is a prominent feature urban slum

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communities where endemic transmission of leptospirosis occurs, but not necessarily specific feature of these shantytowns since cities in industrialized countries, as well as upper income neighborhoods in resource poor countries are also densely populated.

Is this the only disease that is in dogs and humans? My dog has to get this booster shot every couple years.

[mattdahack](#)

Federico_ No, there are several other diseases you can get from dogs (Rabies, worms, etc) depending of the country you live. But nothing that a regular visit to the vet can not solve.

Where are out breaks seen in developed countries? I have heard of out breaks in triathletes after swimming in small lakes.

[nallen](#)

Federico_ Yes, water-based activities, such as swimming, triathlons and canoeing have been related to outbreaks. Also, there are risk groups for leptospirosis, in developing countries, as farmers and persons that have contact with animal tissues as veterinarians and abattoir workers.

Hello, Dr. Ko and Dr. Costa, thank you for this AmA.

I'm a medical student in Brazil and I can't help but be frustrated by the lack of rigorous studies that can help us understand the many tropical diseases that are threat to tropical countries: in my Parasitology courses I consistently came across the lack of epidemiological data in brazilian territory, lack of specific understanding about how the parasite interacts with the host, little known drug targets in the parasite's organism and many other loose threads. I therefore must thank you for taking up the challenge to help changing that.

However, my question is: how can Brazil, which has a substantial GDP, and other tropical countries, better improve the as of yet low impact scientific research on these tropical diseases that cause such a high burden in ours and other tropical countries? What are we missing? Is there anything us individuals can do to help? I find our scientific community to be lacking in structure and funding.

Thank you very much!

[vasavasorum](#)

Federico_ Happy to have also Brazilians participating of AmA.

Leptospirosis, as other many parasitic diseases from poor populations are considered "neglected". This means that they suffer of inadequate strategies to control them. Leptospirosis is one of the most clear examples, because it lacks a vaccine, point of care diagnostic tools and appropriated strategies for prevention.

Brazil has invested largely in leptospirosis studies and is one of the pioneer countries in the study of urban leptospirosis, developing diagnostic tests candidates and testing candidates for vaccines. However, there is a lacuna between those studies and the production of technologies that can be available for the population. This is because leptospirosis affects "neglected populations" or the poorest segment of the population. So the lack of visibility of this disease is a barrier on the investment from governments and industries. One of the goals of this Systematic review was to increase awareness

and visibility of the impact of the disease and make a call for action for governments and industries. One of the most important and first action we can do (and you as a doctor) is to have high suspicion for leptospirosis cases which will improve surveillance.

Hey folks, what I find most interesting about lepto is the disease potential to become an issue in more developed nations as a result of its spreading fly vector expands its range as a result of a warming climate. Is this a situation that northern countries are at all prepared to deal with?

[doocot](#)

Federico_Hey. Mammals are the reservoirs for leptospirosis and they shed leptospirae in the urine. Rats are one of the most important reservoirs (specially the brown rat) and they are already sprayed all across the world (flies do not play a role in the transmission of leptospira).

Warming climate may potentially increase the time that leptospirae survive in the environment (but this is not well known). Climatic changes may also affect rainfall and the chances of flooding which are also important factors for transmission.

Dear Prof Ko, are there places where leptospirosis has been under-appreciated as a cause of morbidity and mortality until now, and where do you think the burden of disease is likely to increase in the short-medium term?

Also, leptospirosis causes different clinical presentations and has a range of complications, which are most important/most neglected?

[hypermodernism](#)

Albert_yes, there are large parts of the world where the disease is either under-appreciated or not recognized at all due to the lack of surveillance systems and investigations. These regions include large populous parts of the world such as South Asia (eg India), Southeast Asia (Philippines and Indonesia) and Sub-Saharan Africa.

We expect that it will be in these exact regions that the burden of disease will rise in the short-medium term. Part of this may be due, we hope, to increased recognition and prioritization by governments of the problem. It is also in these countries where rapid urbanization will occur, where poor rural based populations move to shantytowns where rat-borne leptospirosis occurs. We have seen similar trends in countries of Latin America which has already undergone this dramatic urbanization process over the past 30 years.

Perhaps the most important of the clinical presentations are the severe life-threatening manifestations such as Weil's disease (acute renal failure, jaundice and bleeding) and Pulmonary Haemorrhagic Syndrome for which the case fatality (proportion who die among those who have these manifestations) reaches similar levels as Ebola and other causes of hemorrhagic fever.

Perhaps the most neglected are the many acute neurological manifestations of leptospirosis which include meningitis and encephalitis (the tissues surrounding the brain and the brain itself respectively) and inflammation of the peripheral nerves. In areas where transmission occurs, leptospirosis may be an important cause of acute neurological disease but seldom recognized by clinicians.

Is leptospirosis really a threat in N America? I think my vet is profiteering

[lostfuture](#)

The risk of leptospirosis among humans is likely low but that said it is a notable public health problem in Hawaii, among travelers, and in certain risk groups (including vets). In contrast, it is a significant animal health problem in the US, such as dogs (and yes vets routinely give vaccines for leptospirosis) cattle pigs and other livestock.

What interventions are available and ready for scale-up in high-burden settings that can help alleviate the burden of leptospirosis in vulnerable populations?

[sarark](#)

Federico_ Great a difficult question. Interventions need to focus on preventing transmission. Chemical control is being used in urban poor resource settings from Brazil and other countries however their impact to control disease has not been evaluated. Additionally they are costly and sustainability is a challenge. Wearing boots and protective cloths may decrease the risk of entry of leptospires. Other interventions, as oral doxycycline chemoprophylaxis have been also used but their effectiveness is controversial. The best interventions to prevent leptospirosis are environmentally based, improving sanitation to decrease exposure to open sewers and flooding.

Are you seeing any regional based genetic variants (that is, the variant only occurs in specific regions) of the disease that produce different mortality rates?

[Weaselbane](#)

Federico_ Glad you raised this point. There is variation in clinical disease and mortality across regions- for example pulmonary hemorrhage syndrome which causes death in >50-70% occurs in many but not all regions of the world.

This may be due to differences in the bacterial pathogen due to genetic variation. There are many (9) species of the bacteria that cause leptospirosis, and there appears to be differences in their ability to cause severe manifestations and death-we didnt look into this question for the study but several researchers in the field are doing so.

Is there increased risk of leptospirosis in North America among those exposed to stagnant fresh water, such as swimmers who swim in small lakes in tropical climates (i.e. Gulf Coast)?

[p1percub](#)

Albert_ yes there is a risk for leptospirosis associated with exposure to fresh water. As an example there were large outbreaks among triathletes in Illinois and Florida in the past as well as cases of swimmers in water holes. These have been sporadic occurrences so the risk may not be high and constant, but leptospirosis does occur associated with these exposures

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[p1percub](#)

Federico_ There is not a trend of increasing risk of leptospirosis for those exposed to stagnant fresh water. But there is an increasing awareness of this risk which allows to identify those outbreaks that in the past were not identified.

Tropical? We have it in more temperate climates

[primal-matter](#)

Albert_ yes you are right-the paper does account for the disease burden in temperate climates but found that the burden of leptospirosis is significantly higher in settings more proximal to the equator.