We're Christine Kreuder Johnson and Tierra Smiley Evans, from UC Davis. We developed an oral sampling technique to screen for pathogens in primates which allows researchers to samples previously missed primate populations- Ask Us Anything!

PLOSScienceWednesday [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Hi Reddit! My name is Christine Kreuder Johnson, I am a Professor of Epidemiology at the University of California School of Veterinary Medicine's One Health Institute. Joining me today is Tierra Smiley Evans, a veterinarian and graduate student in epidemiology at UC Davis who developed the primate sampling technique published recently in PLOS NTDs, "Optimization of a Novel Non-invasive Oral Sampling Technique for Zoonotic Pathogen Surveillance in Nonhuman Primates", that we will be discussing today. CHRISTINE KREUDER JOHNSON – My research focuses on ecological processes that impact wildlife and public health. I am especially interested in finding new ways to investigate disease in endangered species and identifying One Health solutions for protecting human and animal health. Most recently, I work with a consortium of partners on USAID's Emerging Pandemic Threats PREDICT project to develop global surveillance capabilities to detect infectious disease threats with pandemic potential. We focus on zoonotic viruses that spillover from animals to cause disease in humans and we work at the highest-risk interfaces around the world where new diseases are most likely to emerge. Our published study "Spillover and Pandemic Properties of Zoonotic Viruses with High Host Plasticity" highlights many of the epidemiologic circumstances promoting spillover, amplification, and spread of zoonotic viruses that we are investigating in order to direct interventions aimed at disease prevention. TIERRA SMILEY EVANS – My research focuses on zoonotic disease transmission in human and non-human primate communities in Africa and Asia. I have conducted field research in Uganda, Rwanda, Nepal and Myanmar and I am particularly interested in developing non-invasive diagnostics for wildlife that can enable us to understand disease dynamics in these remote settings. Our recent PLOS NTDS article describes a non-invasive sampling technique that involves distributing a rope for primates to chew on that can be retrieved and screened for pathogens that are present in the mouth. This method provides an alternative approach to anesthetizing wild primates to test for diseases and enables sampling of populations that otherwise would not be able to be sampled. Our methods can be applied to studies examining primates as sources of diseases that could affect humans in remote tropical settings. Our study and its implications for public health is also discussed in a post on the PLOS Student Blog. We are looking forward to answering your questions at 1pm ET today — Ask Us Anything!

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PLOSSCIENCEWEDNESDAY R/SCIENCE

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CORRESPONDENCE:

DATE RECEIVED:
January 07, 2016

DOI:
10.15200/winn.145208.82014

ARCHIVED:

What have you recently found is the most infectious way pathogens spread from primates to us? For example, bush meat, living in close proximity, etc? Are there any new methods of infection we should watch out for?

Inform2015

Chris and Tierra: we think this is such a great question worthy of a long discussion. There are so many ways for pathogens to spread from primates to humans, including direct contact with animals. Vectors, such as mosquitos and other arthropods, that bite both primates and humans, can transmit diseases

January 06, 2016

CITATION: PLOSScienceWednesday , r/Science , PLOS Science Wednesday: We're Christine Kreuder Johnson and Tierra Smiley Evans, from UC Davis. We developed an oral sampling technique to screen for pathogens in primates which allows researchers to s, *The Winnower* 3:e145208.82014 , 2016 , DOI: 10.15200/winn.145208.82014

indirectly. Vectorborne viruses that have been transmitted this way include yellow fever, which is endemic in many regions around the world, and zika virus, which is recently causing new outbreaks in Latin America. Viruses, especially environmentally resistant viruses, can also be transmitted when primates are in close proximity to humans. Primates that are well adapted to the presence of people often get into people's stashes of food or drink from people's stored water and can leave viruses shed from their oral cavity this way. Direct contact with primates is a major concern. Free-ranging habituated primates have been known to scratch and even bite people, transmitting certain pathogens may not cause any symptoms in primates but can be lethal in humans. Hunting and consumption of primate bushmeat poses a special risk for blood-borne zoonotic viruses, such as ebola viruses and primate retroviruses.

Go aggies!

EpiTapHy

Go Aggies!

A number of professors and graduate students in my department work with wild primate populations so your work has been really interesting to follow. For the scholars who work with orangutans, their primary source of biological data has been gathering urine and feces which is...somewhat unpleasant. But also somewhat limited compared to what you can learn from more invasive techniques.

What can your tests tell us about pathogens and primate health that feces and urine cannot? And how well would this work with primates like orangutans who are rather different behaviorally from chimpanzees?

firedrops

Tierra: It's great to hear about another department studying primate populations. I have not worked directly with orangutans in the wild before (but have always wanted to!) so I am less familiar with their behaviors. This rope technique would be more appropriate for semi-habituated or captive orangutans that are used to being fed by people either in their enclosure or in scenarios where additional food is supplied on platforms such as in some sanctuary situations. I would imagine that distributing ropes to truly wild orangutans could be restricted by local wildlife authorities or logistically difficult unless they were used to coming down from the trees and used to being close enough for a researcher to distribute a rope. We did have success with semi-habituated arboreal species such as L'hoest's monkeys and red-tailed guenons. The challenge was in retrieving the ropes when they dropped them and they got stuck on tree branches. It was possible to collect samples using this method though.

Oral samples capture an alternative route of shedding compared to urine and feces. Some viruses are primarily shed through saliva or oral secretions such as some herpesviruses and therefore oral samples would be the best way to target these pathogens. In order to investigate the full picture, ideally you would collect all three types of specimens (feces, urine and oral samples). It would be important to evaluate the rope technique with orangutans for behavioral acceptance of the technique as well as for the specific virus you are looking to target. It's really important to evaluate this technique in a new population to make sure that this sampling protocol would be able to provide a high quality sample. Ideally you could conduct a pilot study in a clinical setting with your targeted virus before trying it in the wild. Are there specific viruses you are interested in?

If you had to guess, what's the next pathogen that will make the leap to humans and cause an Ebola-like scare?

PathToNowhere

Chris: If only we had a perfect answer to that! Many experts are working globally to try to understand what circumstances are most likely to allow a new pathogen to emerge and cause an outbreak in humans. As you've noted, the next emerging pathogen will likely have origins in animals, as have many of the recently emerged zoonotic diseases. The next pathogen is more likely to be an RNA virus and will probably be capable of infecting a large number of diverse animal hosts. We've found that viruses that have high host plasticity, ie have very broad taxonomic range in the hosts they are capable of infecting, are not only able to infect humans but are more likely to be able to amplify spillover by secondary human-to-human transmission, which is the main driver for large ebola-like outbreaks. We are fortunate to work on USAID's Emerging Pandemic Threats program, PREDICT, where we get to partner with experts in 30 countries to detect and strengthen capacity to prevent emerging pandemic threats. This work is taking a more proactive approach to identify potential zoonotic threats and human practices that increase the risk of disease spillover, to be able to prevent those prior to large outbreaks. We've found that biodiverse areas with a lot of anthropogenic activities, including dense human populations, constitute hotspots for disease emergence, and are settings where we need to be most prepared to detect new outbreaks.

Thanks for doing this AMA. What are some of your greatest challenges? What are some wins or what would be a huge win for you? I'm particularly interested in what you have to say due to antibiotic resistance and the increasing amount of animal-human flus we have seen over the years spread from/in Asia to elsewhere.

flux365

Tierra and Chris: One of our interesting challenges has been establishing culturally sensitive sampling techniques with primates when they are considered sacred animals. This has been the case in Kathmandu, Nepal where some of our field sites are located at temples and the rhesus macaques there are considered sacred. Darting and anesthetizing these monkeys to collect pathogen data would not be viewed favorably because it appears to be harming the monkeys. Implementing the rope technique was a good alternative because it is non-invasive and the monkeys appear to enjoy the sampling process. Having these discussions with local authorities is sometimes challenging but also very educational with regard to local belief systems and customs.

We consider anytime we are able to sample a new primate population, which would otherwise not be able to be sampled a win!

Hello to both of you and thank you for participating in this AMA.

What specifically led you to develop this new sampling technique? Did it involve personal experience in the field?

What are your general predictions for future epidemics caused by zoonotic viruses? Are we likely to see worse outbreaks in the future?

invitroveritas8

Tierra: In response to your first questions, my research has been focused on zoonotic disease transmission between humans and primates in various remote locations around the world. Traditional sampling techniques to collect invasive samples such as blood and directly swabbed saliva can be challenging. Collecting these types of samples involves anesthetizing the animals. Primates are very intelligent and often evade researchers and will rarely let scientists collect a sample more than once. This causes a problem when repeated sampling is necessary to get a full picture of disease trends and

overall health of a population. We were looking for alternative ways to get information in these primate populations. Ropes have been used previously in primate behavioral studies to measure salivary cortisol. They have also been used to test for respiratory pathogens in domestic swine in the United States. I piloted a similar rope collection technique with captive mountain gorillas to see if saliva could be readily collected (http://zoowildlifejournal.com/doi/abs/10.1638/2009-0015R.1). The technique worked well for the collection of saliva but we did not test for viruses. In this current study we went much further and were able to test laboratory colony macaques in a controlled setting and collect a paired oral swab in order to compare the two techniques for detection of viruses. We also were able to test several different primate species to test behavioral acceptance.

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We had an opportunity to address a similar question regarding future outbreaks just above. Epidemics from zoonotic viruses certainly remain a threat to global health security. Viruses have jumped from animals to people throughout our co-evolution together and will likely continue to do so until we find ways to minimize risky behaviors and practices that underlie most spillover events.

Would it be possible to use the same sampling method to distribute some needed cure or inoculation to primate populations to effectively counteract a potential new threat? Or, is that considered unethical in some manner?

Bayho

Tierra: That's an interesting idea…. Ropes could theoretically be used to distribute an inoculation if it was an oral based vaccine. The ethics of this varies widely depending on the type of vaccine and the species it is being implemented with. If any live vaccine were being used, distributing ropes would likely be risky because the primate is not consuming the rope and there could be left over vaccine that could end up with a non-targeted species.

How does publishing a co-authored study work? Does each author write a bit here and there? Does one write it, and the others discuss it to see if it works with everyone's vision?

swillamilla

Tierra: We find that it is different for every paper but always a highly collaborative process.

I recently graduated with a degree in biology. I am starting my first day working for a very large life science company where I will be working in a lab. What advice would you give to me?

MonteCristo4673

Tierra: Congratulations on the new job! I have started out in several different labs and what I have

found is that everyone has a different way of doing things. Taking the time to absorb new lab's techniques and to ask as many questions as you can up front has always served me well. Also, it's important to get to know what different people's area of expertise is so that you can learn from them.

It seems to me that the likeliest way humans would be contaminated with virus's found in non-humans would be through the mis-handling of the non-humans blood (and not through sex with monkeys). The best opportunity for this cross contamination would be by poachers not dressing their kill while properly protected (latex gloves, masks, etc.) Have you discovered any diseased humans that were likely infected this way?

torpedomon

Tierra: We have conducted human behavioral studies with communities that live in close proximity with primates. The types of studies we have done have involved collecting a human biological sample for testing as well as conducting a behavioral questionnaire in which we ask people questions about their interaction with wildlife. This has allowed as to link human exposure with particular behaviors surrounding wildlife. In the communities I have worked with, exposure to primate diseases have largely been through bite or scratch wounds. Some of these bites and scratches have occurred through hunting but also other scenarios such as when people defend their crops from primate crop raiding, or defend their food stashes.