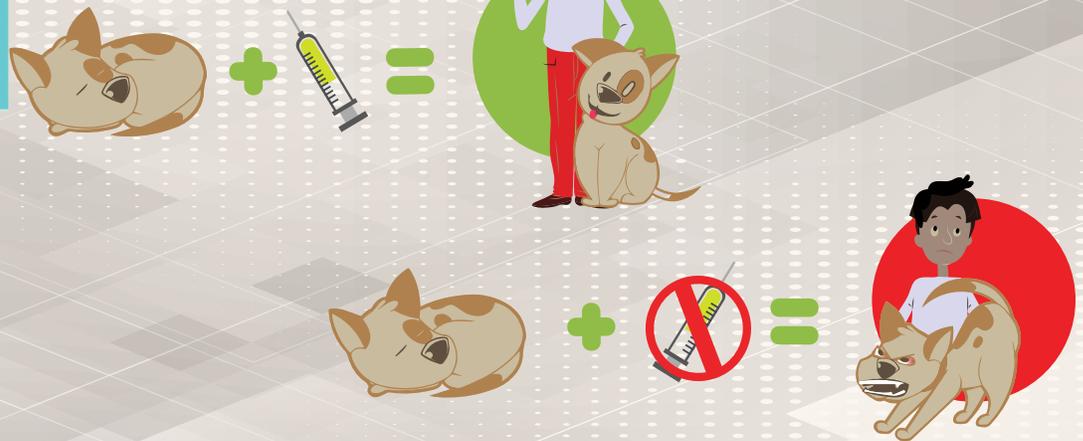


How to prevent rabies in India?



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Abstract

Do you know any people who got infected with rabies? If you live in North America or Europe, the answer most likely is no. However many countries in Asia and Africa are still struggling to prevent this deadly disease. Rabies usually gets transmitted to humans when they are bitten by a rabid dog. Therefore, controlling rabies in dogs would make it easier to prevent humans from getting sick.

In this study we focus on the vaccination of dogs in India. We created a computer model which showed that by vaccinating dogs against rabies, we can control the disease in both dogs and humans. We also found that spending money on vaccinating dogs is a worthwhile way to control rabies compared to the ways it is currently prevented and treated.

Introduction

Rabies kills over 59,000 people (mainly children) in Africa and Asia every year. 99% of bites that lead to rabies are from rabid dogs (Fig. 1). But rabies infection from any kind of animal can cause violent aggression, wild hallucinations, and fear of water. Once symptoms appear, death is almost impossible to avoid

Before symptoms appear, rabies can be prevented by *PEP* (*post-exposure prophylaxis*): rapid wound treatment and four shots of the rabies vaccine.



Figure 1:

Stray dog lying around in Tamil Nadu, India. (Photo: Abhishek Pandey)



Over 29 million people receive PEP every year. However, PEP is not available worldwide. In some places people don't know to seek care or are unable to get to good care quickly enough for PEP to work. Sadly, these challenges mean that in some rural areas, as little as 65% of the bitten people get PEP.

About one third of all people who die of rabies each year live in one country: India! A big obstacle there is that the responsibility for rabies control is shared by several government offices. Coordination requires demonstration of *cost-effectiveness* (money being spent on something

worthwhile). Vaccinating humans is expensive—and no one wants an extra shot when they go to the doctor! Instead, dogs can be vaccinated so that they don't get sick and pass it on to humans. Dog vaccination eliminated canine rabies in many countries—including the United States. However, many people argue that vaccinating dogs could be a waste of money in India. Thus, we created a computer model to predict the impact of dog vaccination on rabies transmission and human deaths, and to determine how many dogs need to be vaccinated in order for the program to be cost-effective.

Methods

We first calculated how many people become infected by a rabid dog, using health records from Tamil Nadu. We then calculated how many people would become infected if dogs were vaccinated. We also assumed that a few animals with rabies would constantly be coming into the area from outside. This immigration means that it would be impossible to achieve zero human death—even with perfect vaccination of humans and dogs.

Because stray dogs make up almost half of the Tamil Nadu dog population, dog catchers will be hired to capture and

vaccinate the dogs. This operation is expensive, and we want to know the most efficient number of dogs to catch each year. We tested a range between 100,000 and 400,000 dogs. After adding each set of 100,000 dogs, we calculated the extra money spent per additional life saved, compared to the next-lower number of vaccinated dogs (Fig. 2). The *World Health Organization* suggests that a country like India would efficiently spend about \$100,000 to avoid one death from rabies, so this amount is our upper limit.

Results

We found that a rabid dog will typically infect one or two other dogs when not vaccinated, which is enough to keep disease happening among dogs. We also found that vaccination of dogs will prevent not just dog infection, but also infections of humans. Higher levels of vaccination would protect more humans than lower levels. For example, without vaccination about 820 people would die of rabies in ten years. If 200,000 dogs were vaccinated each year, only 156 people would die, and if 300,000 dogs were vaccinated, only 121 people would die. However, vaccinating 300,000 dogs would cost 8 million dollars more than vaccinating 200,000 dogs. The cost per life saved would be \$225,000, which is above our target (Fig. 2). The cost per life saved for vaccinating 200,000 dogs (compared to 100,000 dogs) is just below our target, and is therefore a cost-effective strategy for Tamil Nadu.

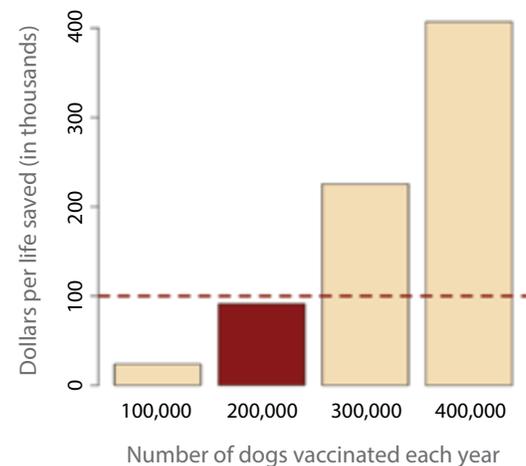


Figure 2:
The cost of dog vaccination in Tamil Nadu, India. (The red line marks the cost limit recommended by the World Health Organization.)

If vaccinating 200,000 dogs would prevent 664 people from dying from rabies (see Results section), how much would the program cost? (Hint: y-axis shows the cost of saving one person's life.)

Discussion

Our results demonstrate that dog vaccination is a cost-effective approach toward the prevention of human rabies. Importantly, not every dog has to be vaccinated to have a large effect on the number of rabies cases. The World Health Organization recommends that at least 7 out of every 10 dogs receive a vaccination in order to have a major impact. Therefore we shouldn't be discouraged by the large number of stray dogs in India.

Additionally, our results show that providing PEP is cost-effective compared to doing nothing about rabies. Such programs, however, are not enough and the second crucial step for controlling rabies is to vaccinate dogs. Fortunately, a good canine vaccine is available. Experience from more developed countries shows that if rabies is eliminated in dogs, it would basically disappear in humans as well.

Conclusion

Do you have a dog as a pet? Do you know if it was vaccinated against rabies? It is your responsibility as a pet owner to make sure your dog and every person around it is safe from this deadly disease. If you live in a

country where the disease is already eliminated, then it's even more important to be *diligent* and keep your pets vaccinated. This is the only way to make sure this deadly disease never returns.

Glossary of Key Terms

Cost effectiveness – Whether money spent on something is worth spending, or if its effect is great enough.

World Health Organization – a branch of the United Nations devoted to directing and coordinating international health.

Post-exposure prophylaxis – a treatment given after exposure to a disease but before it is diagnosed, that helps to prevent the disease before symptoms appear.

Diligent – paying attention to what's around you, as well as your duties.

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American Veterinarian News: A scientific model to help countries eradicate rabies

<http://www.americanveterinarian.com/news/new-tool-helps-countries-eliminate-dogmediated-rabies?p=1>

Check your understanding

1 Which are some countries struggling to prevent rabies?

2 How can vaccinating dogs prevent humans from getting rabies?

3 What percentage of bites that lead to rabies are from rabid animals other than dogs?

4 Typically, how many other dogs will one rabid dog infect?

5 Typically, how many other dogs will one rabid dog infect?
