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India, Infectious Diseases

India: Rabies Causing Death Tolls to Rise

Many people living in the United States do not consider rabies to be a serious health concern. As Americans, we are aware of the need to get immunizations for house pets, such as dogs and cats, but give little consideration beyond the yearly vaccination. In the United States, the prevalence of human rabies is extremely rare with only 1 to 3 cases reported annually. Since the 1970s, the number of human rabies deaths in the United States has steadily declined. A major factor in the decline is animal control and vaccination programs (World Health Organization). The rabies vaccination is given on a yearly basis to prevent the very common but preventable virus. Rabies is a zoonotic disease, which means that it is transmitted from animals to humans. It is a viral disease that affects the central nervous system and is nearly always 100 percent fatal to anyone who is bitten by a rabid animal and does not have the vaccine. The disease starts through the transfer of saliva from a rabid animal. The saliva from a rabid animal enters the human body through a wound such as a scratch or bite. In order for a person to become infected, the skin must be broken; the virus is unable to enter the body if the skin remains intact. Once inside the body, the virus begins to replicate and attack the central nervous system. If not treated in the first few days it can cause someone to go into a coma, paralysis, or even cause death in just two weeks (Children's Hospital of Philadelphia). Rabies is treatable if caught early. Post-exposure treatment recommendations from the World Health Organization (WHO) are divided into three categories based on rabies exposure. The first category, category I, is considered the least serious. This is when the victim has been touching or feeding infected animals, but shows no broken skin. The second category, category II, is when the victim sustained minor scratches without bleeding or licked by an infected animal on broken skin. The final category, category III, is the most serious. In this case, the victim has one or more bites, scratches or licks on broken skin (World Health Organization, Volume 87, 2009). For victims in categories two and three, immediate vaccination and administration of rabies immunoglobulin is required (World Health Organization, 2019).

Less than a year ago, I personally experienced the danger of rabies. I live on a small cattle farm in Northwest Arkansas. During the winter, my sister and I are responsible for feeding hay to our cattle. Typically during the winter, the sun begins to set early in the evening usually around 5:00 p.m. On this particular winter afternoon, my sister and I divided up the chores. She watered the cattle while I went to fetch hay from our barn. It was nearly dusk at the time and the light in the barn had diminished, but there was nothing unusual about this. I proceeded to the back of the barn to gather some square bales we had put up in the fall. (Square bales are easier to handle by one person than the large round bales.) I reached up and began to pull on the string of the hay when, out of nowhere, an animal jumped out from behind the haystack. As I tumbled backwards the creature fled, leaving scratches and bite marks on my face just inches away from my right eye. Once I got back to my house and told my parents, they immediately took me to the emergency room. Since I was only able to get a glimpse at the animal, I could not properly identify what animal attacked me. Therefore since we were not able to quarantine the animal to determine if it was rabid, the decision was made for me to receive anti-rabies antibodies and a series of vaccinations.

For this reason, the CDC in the United States follows basic procedures helping to prevent deaths. In my case, the hospital called the State Veterinarian of Arkansas and received advice from a professional who

deals with this disease on a regular basis. The hospital doctor came back into the room and said "The State Veterinarian of Arkansas suggested you get the rabies vaccine since we aren't positive what attacked you and whether the animal was infected with rabies." With this information from a professional, my parents and I could discuss if we wanted to get the series of injections. In the end, we didn't want to take our chances with my life, so I went through four rounds of injections. The first day is called day 0; they administer shots around the wound (in my case on my face) and one in each arm, then on day 3, I received an injection in the arm, on day 7 I received another injection in the arm, and on day 14 the vaccination is finally complete (NCBI). By the end of it you pay thousands of dollars including hospital costs to receive the series of injections.

In the United States today, we are fortunate to have the opportunity to know and seek out help when animal attacks happen. We know the dangers as well as what to look for in dealing with rabies. In addition, we know how to handle an animal with rabies and treatment options. In the United States, rabies in humans is relatively uncommon with 23 cases being reported from 2008 to 2017 (Centers for Disease Control and Prevention, 2017). In comparison in Southeast Asia and Africa rabies is a far greater problem with an estimated 59,000 deaths occurring yearly (World Health Organization, 2019). I was fortunate to be able to have the precautions and procedures the United States takes as it pertains to rabies. If I lived in Southeast Asia or Africa who knows if I would be here today advocating for a change. So I pose the question, how can the rabies virus be eliminated worldwide?

Dogs are considered the main source of infections in all of the human rabies deaths. In India, about 15 million people are bitten by animals, mostly dogs, every year and need treatment (Rabies in India, 2008). "Roughly 36% of the world's rabies deaths occur in India each year, most of those when children come in contact with infected dogs" (India's ongoing war against rabies, World Health Organization, 2009). When dog populations become out of control, which is this case in rural India, rabies becomes an even more difficult problem to control.

The majority of people who die of rabies in India are people of poor or low-income socioeconomic status. India is a country in South Asia and is the seventh largest country by area with more than 1.3 billion people, making it the second most populous country worldwide (World Atlas, 2019). Children under the age of 15 are the most likely to be affected by the disease and this population makes up 35.3 percent of India's population. One reason for this is that children are often found playing outside and feeding stray dogs. India has approximately 25 million dogs, with the majority being community dogs and feral dogs. In India about 20,000 individuals die from rabies each year, which is more than a third of the rabies total globally (New York Times, 2019). According to the World Health Organization, each year about 36% of the world's rabies deaths occur in India.

India's major religions such as Hinduism, Buddhism, Sikhism, and Jainism have a significant influence on how approaches to rabies in this country. Hindus and Buddhists are opposed the killing of animals. In 2001, India passed a law which forbid anyone killing dogs. As a result, the stray dog population has increased so much that officials across the country have begun to express alarm (The New York Times, 2012). Since this law passed rabid animals can not be euthanized allowing this disease to spread at steadily increasing rates, resulting in more deaths through rabies than any other country.

The family unit is an important part of Indian culture, and within the family religion plays an important role. Hinduism is the country's most practiced religion, with nearly 80% of the country identifying as Hindus (World Atlas). Even though the government provides freedom to practice religion, many of their laws are based on Hinduism. For example, the constitution prohibits the slaughter of cows (an animal

Hindus hold sacred). For most Indian's family is the most important social unit. The family systems are large, made up of 3 or more generations living in one household.

Rabies has a significant impact on human lives as well as livelihoods. India has one of the largest and most diverse economies globally which impacts the affordability of the rabies vaccination (Britannica). In India, communities can not afford treatment especially the poor farmers. When livestock die from rabies, the farmer loses an important source of food and source of income. A study by researchers at the University of Glasgow estimated that the "economic impact of rabies is enormous at US \$8.6 billion annually, of which 6% of that is due to livestock losses." (Food & Ag Organization of the US).

There are several countries that have implemented ways to reduce the occurrence of rabies or totally eliminate this disease. In 2002, Korea had 78 human cases in total, and at the last reporting date in 2011, rabies in humans had dropped to four cases (National Center for Biotechnology Information, 2018). This is over a 94 percent drop. How was Korea able to successfully reduce the number of rabies cases? Their solution was to tackle the problem at the source. They were able to address the problem by enacting legislation. By law the owner of a dog that is 3 months of age has to go into a veterinarian clinic and have the dog vaccinated for rabies. When this program started in 2002, the law was limited to domestic animals. Since that time, Korea has expanded the law to include animals such as cats, ferrets, and raccoons. This is an effort to eliminate rabies in wildlife as well. Ultimately the government is not having to use money for the pricey vaccinations of humans but rather focus on the low cost vaccination of animals. This is a case where an ounce of prevention is worth a pound of cure.

Another country that has successfully reduced the number of deaths from rabies is Tanzania. Unfortunately, many people in Tanzania died before change occurred. A heartbreaking example is the story of a young girl, Asha. "In early October, Asha told her mother that her healed leg was aching. Two days later, when she became feverish and had trouble swallowing, her mother took her to the hospital (Inside the Global Campaign to get rid of Rabies, 2017)." The author continues the story of Asha's rabies infection, and ultimately tell the story of her death, a death that was preventable. Ultimately, not getting your dog vaccinated and not getting the rabies shots in the hours needed is crucial to a loved ones survival. The hardship of losing a loved one to rabies is devastating. In addition to losing a loved one, rabies can infect livestock which for most families is an important food source or source of income. Rabies result in a loss of \$280 million a year in Africa (Inside the Global Campaign to get rid of Rabies, 2017). The Bill and Melinda Gates Foundation has been able to significantly reduce rabies in humans in Tanzania. The campaign set up a system consisting of three changes: surveillance system, switching to an intradermal vaccination, and aiming for 70% coverage of canine populations (Rabies Control in Tanzania, 2017). The first change that was implemented was through surveillance. The surveillance allowed citizens to post where they were infected with rabies in Africa. This allows for tracking of the virus and acting on potential hot spots. The second change was through intradermal vaccination. The intradermal vaccine switched from muscular shots allowing for a cheaper price for the individuals of the community. Before, a five dose treatment for rabies cost over 100 dollars and for the many people living below the poverty line and earning less than one dollar a day they were only getting two to three of the needed doses. Tanzania patients were charged with a down payment of fifteen dollars, and twenty dollars per visit for intramuscular injections of the vaccine (Evaluation of Cost-Effective Strategies for Rabies Post-Exposure Vaccination in Low-Income Countries, 2011). This cost caused a strain on these families. The third and final changes was aiming for 70% coverage of canine populations. This goal was to make sure fewer animals had rabies. With less animals infected there would be less chance for animal to human transmission. The long term goal of the foundation is eliminating rabies from domestic animals worldwide by 2030 (Rabies Control in Tanzania, 2017).

Solutions:

There will never simply be one solution to solve rabies worldwide. Fortunately, places like the United States, Korea and Tanzania have implemented solutions that have yielded great success. The biggest hurdle India faces is overcoming economic shortages and respecting the longstanding religious beliefs in the community. Through campaigns and rallies, India is battling rabies slowly.

Even though in India, rabies is a significant problem, there is one small state, Goa, that could lead the country in eradicating rabies. Mission Rabies, which is part of Worldwide Veterinary Service and supported partly by Dogs Trust Worldwide, both nonprofits, has been working in Goa to stop the spread of canine rabies. Mission Rabies spends about \$300,000 per year and has vaccinated 100,000 dogs a year since 2017. When the campaign started in 2014, there were 15 deaths of people from canine rabies. This number fell to zero last year and so far in 2019 there have been no reports of canine rabies in Goa.

“The Mission Rabies program has three aspects: vaccination, education and data gathering (NY Times, 2019).” An important part of the vaccination process is understanding that in India, the dog population is much different than in the United States or Western Europe. The street dogs in India aren’t wild but yet they aren’t owned either. The dogs that roam the streets in India are supported by the people living in the community, they feed them and the children play with them but no one really owns the dog. In other countries, rabies campaigns often have the owners to bring in their dogs to a central vaccination point. However, because of the lack of ownership in India, the vaccination process needed to look different. As a result, Mission Rabies send out teams to find and vaccinate street dogs. The teams work in a grid pattern so that they cover as much of the area as possible. In order to distinguish between the dogs that have been vaccinated from the ones that are not, all vaccinated dogs get a paint marking that lasts for about a week. After the first team covers an area, another team will make a second pass through the neighborhood looking for any dog that hasn’t been marked. The vaccination teams track their progress using a smartphone app which allows the team to see each day’s progress and plan for the following day. Mission Rabies “estimates the vaccination cost per dog, including salaries and other costs, at \$2.50, far lower than the cost of treating humans, which involves not only a more expensive vaccine, but also potential hospital stays. By that accounting, every dog in India could theoretically be vaccinated for under \$90 million. India now spends \$490 million a year on post-bite treatment, Dr. Gibson estimated” (NY Times, 2019)

Another component of Mission Rabies is education. Vaccination is just a part of the solution. People must understand the seriousness of this disease. The highest risk population are children. Forty percent of reported rabies cases worldwide are children under the age of fifteen. Through education, Mission Rabies “empowers children, their teachers and their families with the knowledge to protect themselves from bites, preventing rabies and save lives” (Mission Rabies website)

Mission Rabies model of eliminating dog bite transmitted rabies is an ideal model for India. By applying the vaccination and education model created by Mission Rabies, India could prevent needless deaths from the devastating disease of rabies. Through experienced educators, Mission Rabies deliver the “Rabies Prevention” lessons directly to children in their classes. The ages range from five up to sixteen, focusing primarily on elementary school age. The Rabies Prevention lesson teaches five key messages: 1) Rabies is serious, 2) How to be safe around dogs, 3) First aid, 4) Community protection, and 5) Dog population management (Mission Rabies website).

The model developed by Mission Rabies could be utilized effectively throughout the country of India to eliminate or at least reduce the number of deaths from rabies.

Bibliography

“People and Rabies | CDC Rabies and Kids.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 5 Apr. 2010, www.cdc.gov/rabiesandkids/people.html.

“Rabies.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 23 Aug. 2017, www.cdc.gov/rabies/location/usa/surveillance/human_rabies.html

“Rabies.” *Mayo Clinic*, Mayo Foundation for Medical Education and Research, 4 Nov. 2016, www.mayoclinic.org/diseases-conditions/rabies/symptoms-causes/syc-20351821.

Queensland Health. “Rabies Vaccine and Human Rabies Immunoglobulin.” *Health Conditions Directory*, CorporateName=The State of Queensland; Jurisdiction=Queensland, 10 Oct. 2017, conditions.health.qld.gov.au/HealthCondition/condition/14/119/117/Rabies-vaccine-human-rabies-immunoglobulin

“Ask the Experts.” *Vaccination Photos--Images of Infants, Children, Teens, and Adults Getting Vaccinated*, Immunization Action Coalition, www.immunize.org/askexperts/experts_rab.asp

“Rabies.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 21 Sept. 2018, www.cdc.gov/rabies/location/world/index.html.

Dr. Knobel. “Controlling Rabies Outbreaks in Developing Countries.” *Morris Animal Foundation*, 2014, www.morrisanimalfoundation.org/article/controlling-rabies-outbreaks-developing-countries.

“Rabies.” *World Health Organization*, World Health Organization, 4 Jan. 2016, www.who.int/ith/diseases/rabies/en/

StokstadJan, Erik, et al. “Inside the Global Campaign to Get Rid of Rabies.” *Science | AAAS*, American Association for the Advancement of Science, 26 Oct. 2018, www.sciencemag.org/news/2017/01/inside-global-campaign-get-rid-rabies

Ellerington, Alina. “Rabies Encephalitis.” *The Encephalitis Society*, 2015, www.encephalitis.info/rabies-encephalitis.

Makungu S, et al. *Rabies Control in Tanzania*, *Frontiers in Veterinary Science*, 2017, www.who.int/rabies/control/Tanzania_Project_Summary_310317.pdf.

Sambo, Maganga, et al. “The Burden of Rabies in Tanzania and Its Impact on Local Communities.” *PLOS ONE*, Public Library of Science, 2013, journals.plos.org/plosntds/article?id=10.1371%2Fjournal.pntd.0002510#s1

August 29, 2014 International Agricultural Trade Reports. "India's Agricultural Exports Climb to Record High." *Home | USDA Foreign Agricultural Service*,
www.fas.usda.gov/data/india-s-agricultural-exports-climb-record-high

"CDC - Cost of Rabies Prevention - Rabies." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 11 June 2019,
www.cdc.gov/rabies/location/usa/cost.html

Subrahmanyam, Sanjay, and T.G. Percival Spear. "India." *Encyclopædia Britannica*, Encyclopædia Britannica, Inc., 17 July 2019, www.britannica.com/place/India/Demographic-trends

"How Much Does the Rabies Vaccine for Dogs Cost?: Canna-Pet®." *Canna*, 20 Aug. 2018,
canna-pet.com/how-much-does-the-rabies-vaccine-for-dogs-cost/

Mittal, Manoj K. "Revised 4-Dose Vaccine Schedule as Part of Postexposure Prophylaxis to Prevent Human Rabies." *Pediatric Emergency Care*, U.S. National Library of Medicine, Oct. 2013,
www.ncbi.nlm.nih.gov/pubmed/24084614

Offit, Paul A. "A Look at Each Vaccine: Rabies Vaccine." *Children's Hospital of Philadelphia*, The Children's Hospital of Philadelphia, 21 Aug. 2014,
www.chop.edu/centers-programs/vaccine-education-center/vaccine-details/rabies-vaccine

Mattyasovszky, Miklos. "The Largest Countries in the World." *WorldAtlas*, 11 May 2015,
www.worldatlas.com/articles/the-largest-countries-in-the-world-the-biggest-nations-as-determined-by-total-land-area.html

Editors, History.com. "Buddhism." *History.com*, A&E Television Networks, 12 Oct. 2017,
www.history.com/topics/religion/buddhism

"First Rabies Vaccine: History Channel on Foxtel." *History Channel*, 9 June 2017,
www.historychannel.com.au/articles/first-rabies-vaccine/

"Compendium of Animal Rabies Vaccines, 1985 Prepared by: The National Association of State Public Health Veterinarians, Inc." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 5 Aug. 1998, www.cdc.gov/mmwr/preview/mmwrhtml/00000460.htm

Harris, Gardiner. "Where Streets Are Thronged With Strays Baring Fangs." *The New York Times*, The New York Times, 7 Aug. 2012,
www.nytimes.com/2012/08/07/world/asia/india-stray-dogs-are-a-menace.html

"India's ongoing war against rabies", *Bulletin of the World Health Organization*, Volume 87:2009

Menezes R. Rabies in India. *CMAJ*. 2008;178(5):564–566. doi:10.1503/cmaj.071488

Gorman, J. (2019, July 22). Rabies Kills Tens of Thousands Yearly. Vaccinating Dogs Could Stop It. Retrieved from <https://www.nytimes.com/2019/07/22/science/rabies-dogs-india.html>