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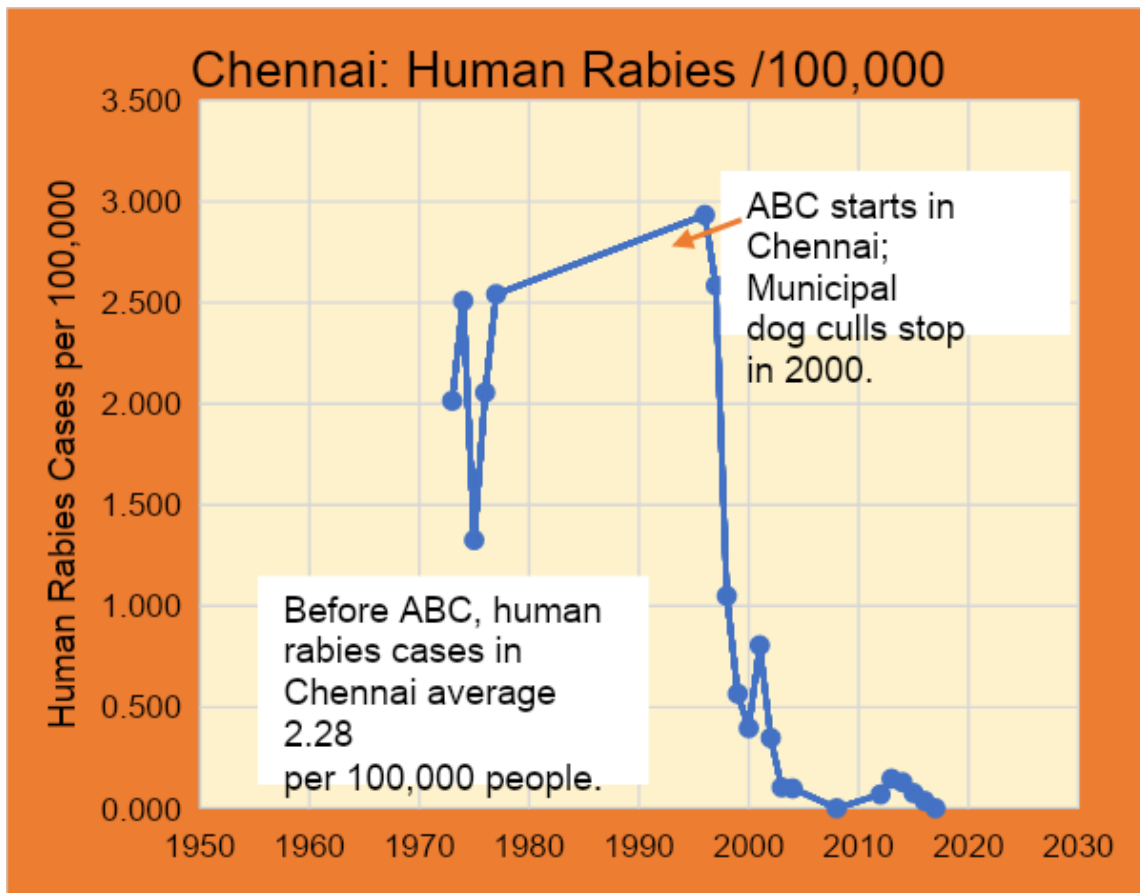
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Dec 25, 2019 Rabies in Chennai and in India

By Andrew Rowan, DPhil

One of the more important recent papers on the role of dogs in rabies transmission was the paper by Reece & Chawla (2006). It described the elimination of human rabies cases in the center of Jaipur due to a street dog sterilization and vaccination program (Animal Birth Control – ABC).

The sterilization project was launched in Jaipur's Pink City in 1994. By 2002, the number of human rabies cases in the area had fallen from around eight to ten a year to zero. Meanwhile, the number of human rabies cases in the area of Jaipur where street dog sterilization was not being carried out had doubled to around eight a year.

An even more dramatic outcome was observed in Chennai, where Dr. S. Chinny Krishna reported in 2010 that human rabies cases in the city had fallen from 120 a

year in 1996 to around five a year ten years later (and then to zero).

The Chennai Municipality (previously Madras) had been routinely culling street dogs for years. In 1996, the Blue Cross of India (BCI) persuaded the municipality to stop its routine street dog cull and instead allow the BCI to launch a dog sterilization and vaccination program in the city.

By 1998, the BCI was sterilizing over 10,000 dogs a year and the number of human rabies cases in the city had fallen from 120 to 44. By 2000, the number of cases was down to an annual average of 20 and then, in 2008, there were no cases of rabies. When the Municipality expanded to add some new districts, there was a spurt of human rabies cases (as many as 11 in 2013) but there were no cases in 2017 and 2018.

It is not clear why the number of human rabies cases fell so dramatically in Chennai following the launch of an Animal Birth Control (ABC) in the city or even if there is a causal connection between dog sterilization and the incidence of human rabies. But Chennai is not the only city where human rabies cases have fallen to zero following the launch of street dog sterilization and vaccination programs. Jaipur was the first city to document such a connection in 2006 and there have been other anecdotal reports of a connection.

It would not be a surprise if a dog management protocol had an impact on human rabies incidence. Over 90% of human rabies cases in the world today are the result of dog bites so a program that vaccinated dogs and maintained canine immunity to rabies should also lead to a reduced incidence of human rabies.

Traditionally, rabies has been virtually eliminated from countries and continents by vaccinating dogs (e.g., in North America in the 1950s and in Latin America in the 1990s). But the addition of sterilization has usually been considered an unwarranted expense by public health authorities.

In India, the rabies vaccine costs around \$1-2 but surgical sterilization and vaccination costs around \$20-22. However, this overstates the cost savings because it usually costs an additional \$5-6 to catch a dog to vaccinate and/or sterilize it. That cost is included in the sterilization but not the vaccination cost estimate.

Furthermore, when one sterilizes dogs, they tend to live longer and be healthier than unsterilized dogs. While the three-year canine rabies vaccine has been

established to confer immunity for three years, it probably confers immunity for longer than this.

Therefore, instead of having to conduct annual vaccination drives, a combination vaccination/sterilization drive could leave dogs to be immunized defenses against the spread of rabies for three years or longer. The sterilized dogs also have their ears notched so it is relatively simple to determine if a dog is sterilized and vaccinated just by sight.

While it is clear that sterilization and vaccination per dog treated is more expensive and time-consuming than vaccination alone, nobody has carried out a detailed trial to determine if adding sterilization is more expensive when one factors in the longer lifespan (and hence immunity) of sterilized dogs and the ability to identify vaccinated dogs by their notched ears meaning that those dogs do not have to be caught and boosted every year.

A recent theoretical paper that looked at the costs of vaccination alone compared to vaccination and sterilization for the state of Tamil Nadu (where Chennai is located) reported that street dog capture and vaccination alone would cost \$2.68 million in the first year for a target population of 200,000 dogs (Fitzpatrick et al, 2016, PNAS 113:14574-81: www.pnas.org/cgi/doi/10.1073/pnas.1604975113).

If sterilization was added to the equation, the total cost for the first year was estimated to be \$3.42 million. If the sterilized dogs do not need to be revaccinated for several years, it is apparent that vaccination plus sterilization may be less expensive in the long run.

In 2017, Taylor et al published a review of different dog population management approaches and concluded that the lack of data evaluating dog population management impacts was a serious gap in helping to determine which approaches might be most effective in which settings. (Front. Vet. Sci. 4:109. DOI: 10.3389/fvets.2017.00109). The paper suggests that large-scale dog population management success will likely require the development of a cost-effective and safe permanent sterilizing agent for female dogs.

Research on this issue is ongoing but it will be a challenge to produce an effective and safe female sterilant for around \$12-15 a dose (a cost-point for surgical sterilization in a number of developing countries). They also argue that delivering vaccination and sterilization to rural communities (where around half of the

world's one billion dogs currently live) will be a huge challenge.

One final point should be made about the dramatic decline in human rabies cases in Chennai this century. Given the various initiatives around the world to reduce the incidence of human rabies and the academic analysis of the situation, it is rather surprising that so little attention—if only a study to confirm the report by Dr. Krishna—has been paid to this change in rabies incidence in a major Indian city.

Most of the academic literature still repeats the WHO figure of 50,000-plus human rabies deaths every year with 21,000 occurring in India. And yet, it is likely that the number of human rabies deaths in India has declined dramatically since the 2003/4 WHO-supported study. Some experts put the figure at 2,000 or so annually. Most people acknowledge that human rabies cases in India have dropped and we badly need a new survey to provide a new estimate.