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Canine Immunisation: The One Health Approach to Rabies Control

Opinion Editorial

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The relationship between animal and human diseases was clearly demonstrated by the famous vaccination work of Edward Jenner in 1796. His hypothesis used the zoonotic disease of cowpox to protect humans against the deadly disease smallpox.¹ In today's era of zoonotic threats such as Ebola,² it is worth considering if this hypothesis could be reversed, using the immunisation of animals to consequently decrease transmission of zoonotic diseases to humans. This strategy is emblematic of the One Health concept, where animal health and human health are linked when designing interventions. This opinion editorial will focus on the use of rabies vaccines for dogs as a One Health intervention,³ as well as the challenges facing this strategy.

According to the World Health Organisation (WHO),⁴ rabies is prevalent in more than 150 countries today. It is a deadly disease, with approximately one person dying every nine minutes.⁵ Forty percent of the world's rabies

deaths are children from Asian and African countries, but for many of these people, post-exposure prophylaxis is too expensive.⁵ In 2015, the World Bank recorded that 84.5% of people in Sub-Saharan Africa and 81.4% of people in South Asia live below the poverty line on less than \$5.50 USD per person per day.⁶ In contrast, the WHO states that the average cost of rabies post-exposure prophylaxis (PEP) is about eight times that amount in Africa, at \$40 USD, and almost in ten times as much in Asia, with an approximate cost of \$49 USD for PEP.⁴ Therefore, other strategies should be considered.

Dogs are the main source of human rabies deaths and this has generated interest in a canine rabies vaccination as an alternative or additional intervention to prevent the transmission of the rabies virus to humans.⁴ The cost-effectiveness of canine rabies vaccination as a public health intervention was previously investigated as early as 2014.⁷ Canine vaccinations in rural Tanzania



produced a reduction in human rabies fatalities. The result was found to be cost-effective, even when compared to the use of PEP in some settings. This research pointed to a potentially life-saving intervention that would prove to be financially accessible where rabies PEP is not. Consequently, it was suggested that an annual canine vaccination program should be implemented in rural Tanzania and extended to other areas of rural Africa.⁷

Another study in 2016 looked at the prevalence and transmission of rabies virus infection in urban dog populations in Bangui, in the Central African Republic. It would be expected that interventional measures like vaccination would control rabies transmission within the urban dog populations. However, the study demonstrated that it would actually be better if rabies control measures were targeted at the transmission of the virus from neighbouring populations and at the introduction of new strains of the rabies virus into the selected dog population.⁸

The WHO recommended in 2004 that the minimum target for canine immunisation should be 70% in areas where rabies is endemic.⁹ Two mass vaccination campaigns were conducted in 2012 and 2013 in N'Djamena, Chad with the aim of immunising 70% of the canine population. This was difficult to achieve due to the low confinement level of dogs among Christian populations with low socio-economic status, which has a higher density dog population. The Muslim populations had fewer dogs due to cultural beliefs that they are unclean animals. These dogs were described by the researchers as “potentially less accessible,” thereby also restricting their immunisation efforts. Therefore, it is important to incorporate cultural factors into intervention programmes, such as the attitudes of these two religious groups.¹⁰

Another study was conducted in N'Djamena in 2018. That study found that 70% vaccination coverage reduced the likelihood of major rabies outbreaks, although there would still be the possibility of minor outbreaks. However, the study did not record any contact with untagged owned dogs or with ownerless dogs.¹¹ This study limitation could potentially have biased the results. It is possible that these dogs may not have been immunised and thereby act as a potential infectious reservoir. That in turn would influence the success of the immunisation programme.

Therefore, it is important to compare this research against findings from other sources.

One such example would be a current research project in India. The team is working to vaccinate 70% of the dog population.^{12,13} However, they have had a number of factors opposing this achievement, which differ from the challenges that affected the 2012 and 2013 Chadian immunisation programmes. These limitations include sparse information about dog populations (both domestic and free-ranging) in India and the added challenge of first capturing stray dogs before vaccinating them.^{12,13}

In light of these challenges, a more comprehensive approach is needed to address the transmission and eradication of the rabies virus. This was addressed by the WHO in 2015, by incorporating canine vaccinations into a framework alongside other proposed actions. The proposed framework consists of five pillars: socio-cultural, technical, organisation, political and resources. Vaccination of dogs and humans was listed as an activity under the “technical” pillar of this framework. Also, the “organisation” pillar included promotion of the One Health approach for combatting rabies.¹⁴ Other activities of this framework are particularly relevant to global health professionals. For example, one can raise awareness of rabies by organising a local event for World Rabies Day.^{14,15} Another example would be being politically active to ensure that national governments support countries with endemic rabies virus, enabling them to further control measures such as dog vaccinations.^{14,15}

The most recent WHO plan to eliminate rabies is called “Zero by 30.” As the name implies, the aim is to end human deaths from dog-mediated rabies by 2030. The plan was conceived as a One Health project between the WHO and a number of other global bodies, such as the World Organisation for Animal Health. It consists of three objectives: reduce human rabies risk with vaccines and medicines; provide data to determine effective policies and governance; and engage stakeholders through the United Against Rabies collaboration. This plan is an insightful look into the complex global health problems facing the world today, such as zoonotic disease transmission, and how they can be effectively targeted by multi-faceted interventions.⁵



As the world becomes more interconnected, zoonotic outbreaks transform from a national to an international concern.² The research work regarding rabies canine vaccinations demonstrates an exciting avenue for the eradication of rabies, as well as an invaluable model for future global health infectious threats. Global health professionals should therefore be active and engaged in the One Health mission to educate people about zoonotic diseases and strive to protect both human and animal populations against infectious disease transmission. We as individuals can achieve change using strategies from the “Zero by 30” plan, like raising awareness on World Rabies Day or encouraging greater investment in animal and thereby human health. I encourage you all to step out into the future as One Health campaigners for global health

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Obstetrical Risk Factors for Neonatal Malaria in The Democratic Republic of Congo

Research Article

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Abstract

Neonates in the Democratic Republic of Congo are challenged by a low resource health care system and endemic malaria. Current practices to reduce malaria rates involve widespread blood smear testing and administration of antimalarials to febrile infants. However, the ongoing threat of resistance and associated cost indicate the need for targeted guidelines on malaria treatment amongst neonates. The present study investigates obstetrical risk factors for neonatal malaria in order to guide current practices. Factors investigated included febrile illness, hypertension, premature rupture of membranes (PROM), urinary tract infections, placental complications and diabetes during pregnancy and their association with neonatal malaria. Chi-squared analysis and odds ratios with a 95% CI revealed that PROM had a significant association with neonatal malaria.

Introduction

Each year, malaria kills more than one million children in sub-Saharan Africa.¹ Studies conducted across the continent have revealed that malarial parasites can be found in 7-10% of newborns.¹ Several studies conducted over the last two decades have revealed an increase in this percentage, with a more recent review reporting that malaria is responsible for up to 25% of infant mortality in countries such as Nigeria.^{2,3}

The risk of malaria increases threefold during the second and third trimesters of pregnancy, as a result of alterations in the balance of Th1 and Th2 immune factors.^{4,5} Along with increased frequency

of malaria in pregnancy, there is an increase in severity of individual infections, most notably in primigravids.⁶ The increased risk of severe malaria has significant adverse consequences on the developing child.⁷ It is estimated that 6% of all infant deaths in malaria-endemic areas are a result of malaria infection that occurred in the child's prenatal life.¹ In addition to maternal malaria during pregnancy, primigravidity and fever during pregnancy are obstetrical factors known to have an association with neonatal malaria. Previous studies have also demonstrated that use of insecticide treated bed nets are protective against neonatal malaria.^{8,9}