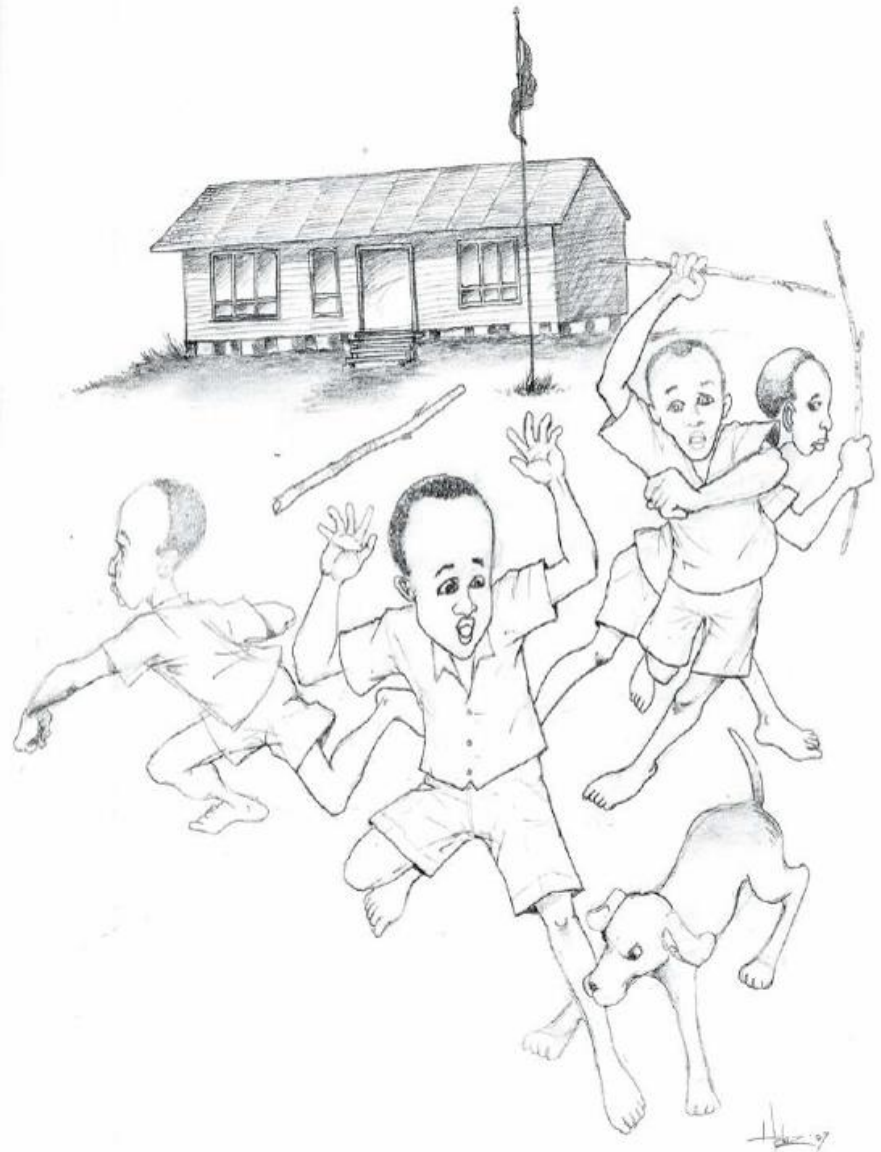
Experiences from Dog Vaccination Campaigns aiming to Eliminate Rabies

University of Glasgow
Katie.Hampson@glasgow.ac.uk

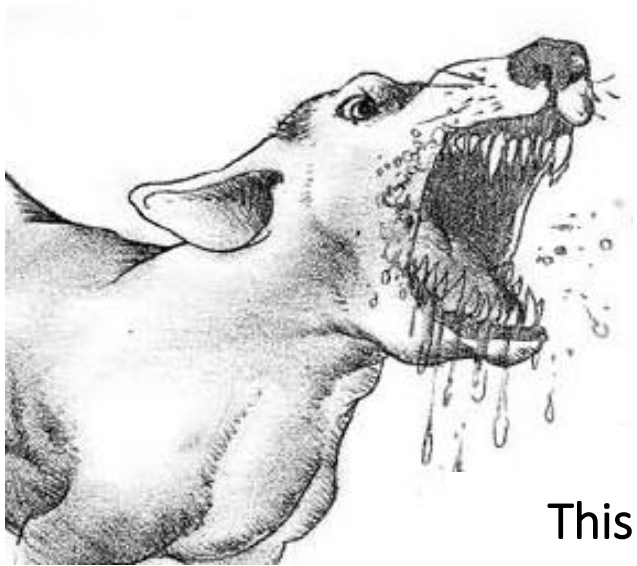


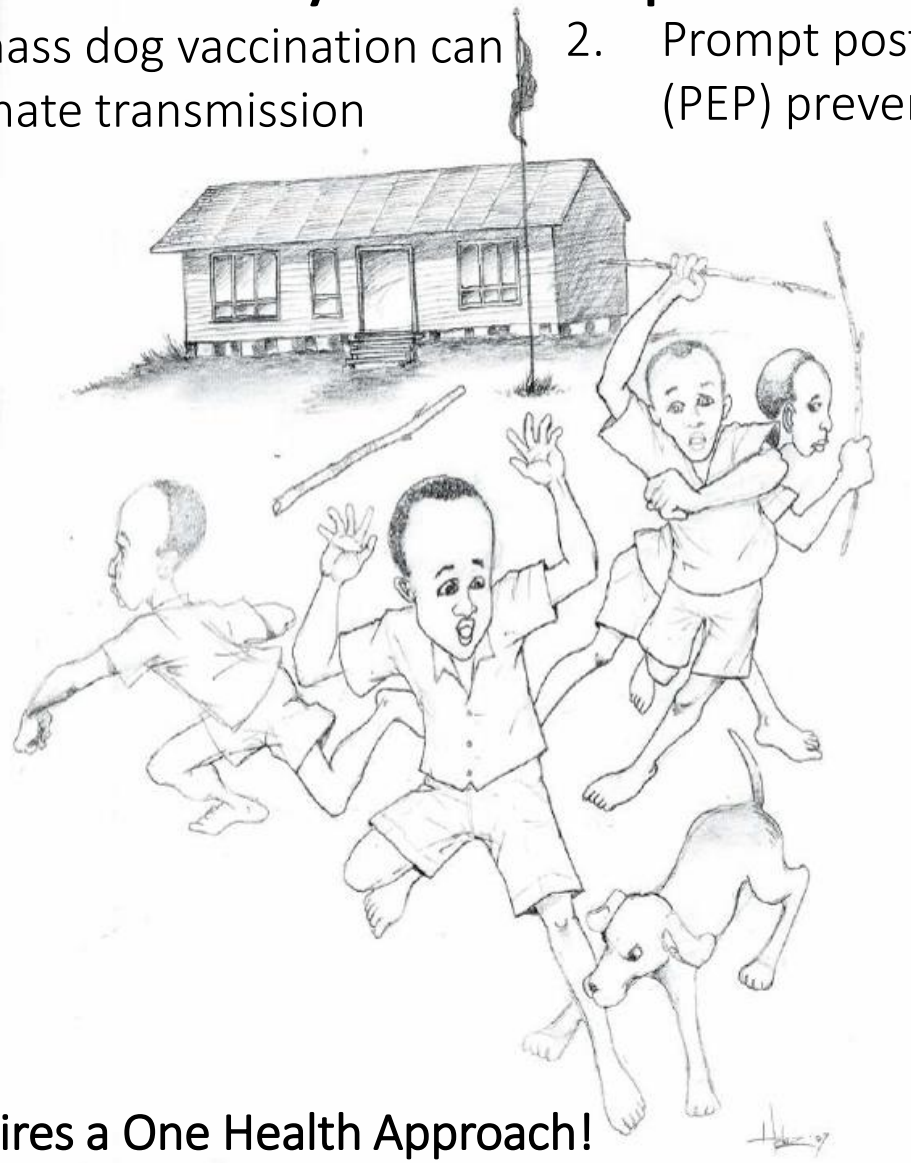
Rabies is a terrifying and fatal disease

Every year causing ~59,000 deaths, 3.7 million DALYs, $8.6 billion costs

But is entirely vaccine-preventable:

1. Sustained mass dog vaccination can eliminate transmission



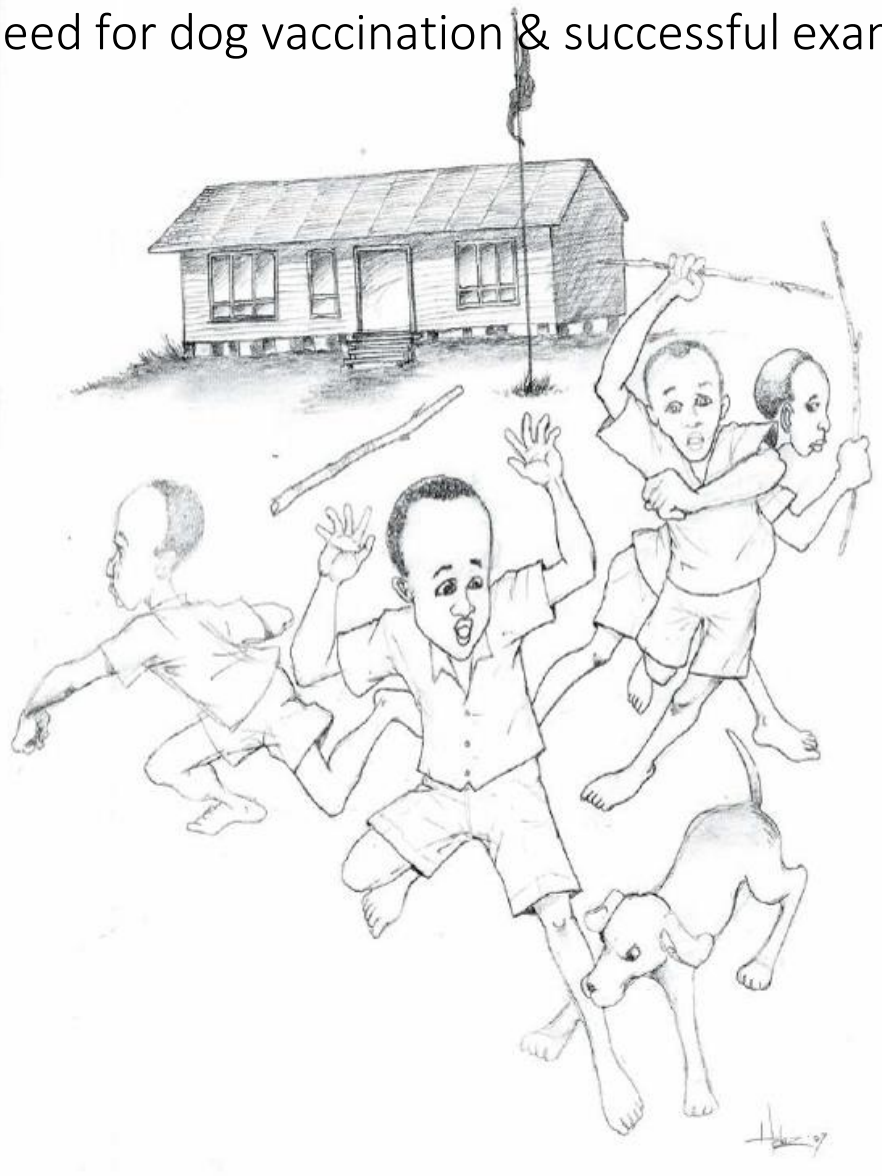


2. Prompt post-exposure prophylaxis (PEP) prevents disease onset

This requires a One Health Approach!

Outline:

- Background: disease burden in relation to control measures
- Dog vaccination
  - Theory – R, herd immunity, dog demography
  - Practice – Strategies, Planning & advertising, Achieving & maintaining coverage
- Zero by 30: the need for dog vaccination & successful examples



Current Spending on Rabies Vaccination

1.4¢ DOG VACCINATION cost per capita

15.2¢ PEP[1] cost per capita

14% DOGS VACCINATED

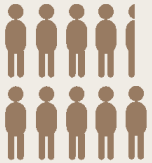
20.9 RABIES DEATHS per million population

1.0¢ DOG VACCINATION cost per capita

34.2¢ PEP cost per capita

16% DOGS VACCINATED

9.33 RABIES DEATHS per million population



11.4¢ DOG VACCINATION cost per capita

24.1¢ PEP cost per capita

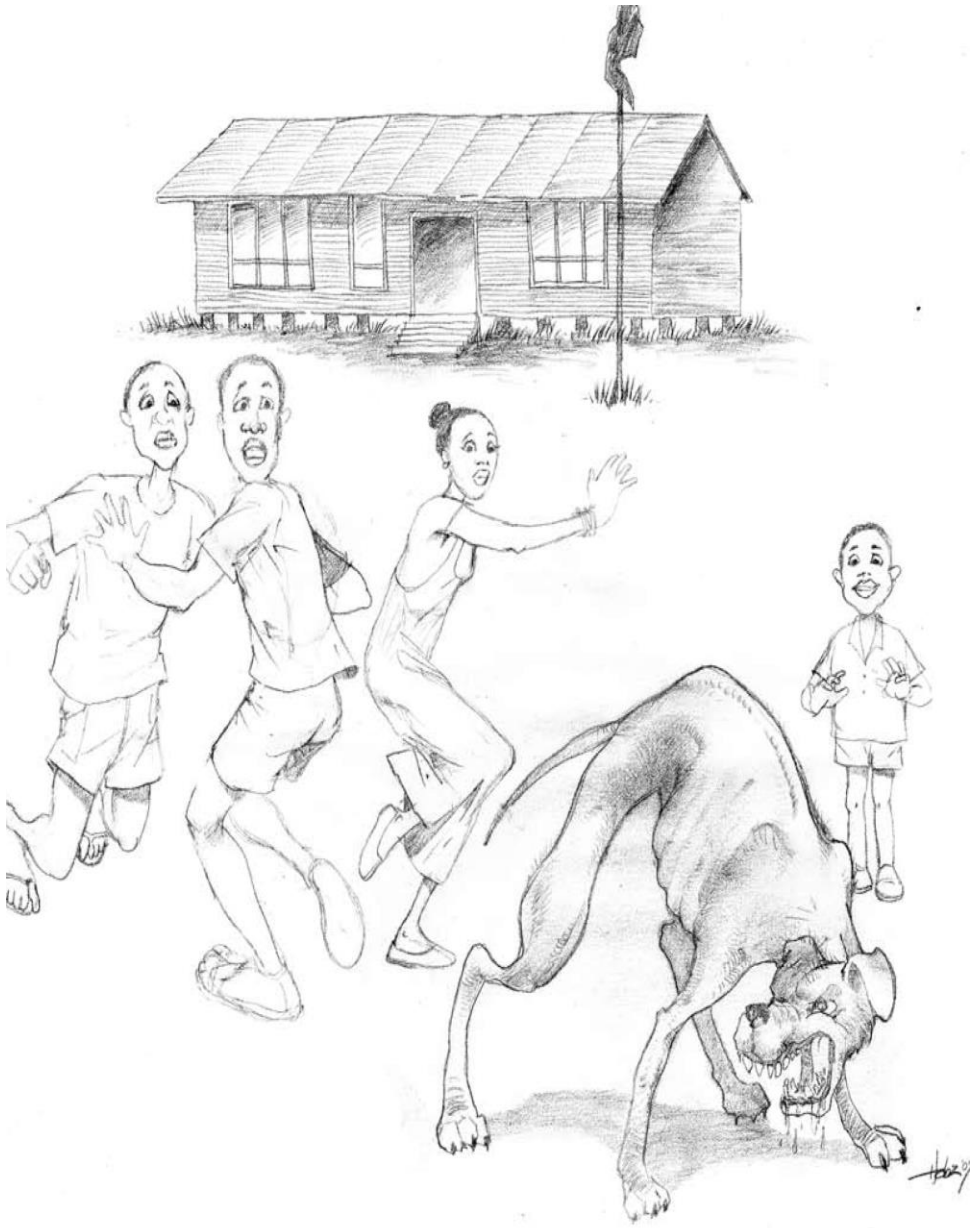
60% DOGS VACCINATED

.34 RABIES DEATHS per million population

1 PEP - Post Exposure Prophylaxis is a course of vaccinations that protects a person against rabies after exposure to the virus. Costs are in US currency.

Source: Estimating the Global Burden of Endemic Canine Rabies, K. Hampson et. al. PLoS Negl Trop Dis. 2015 May;9(5)

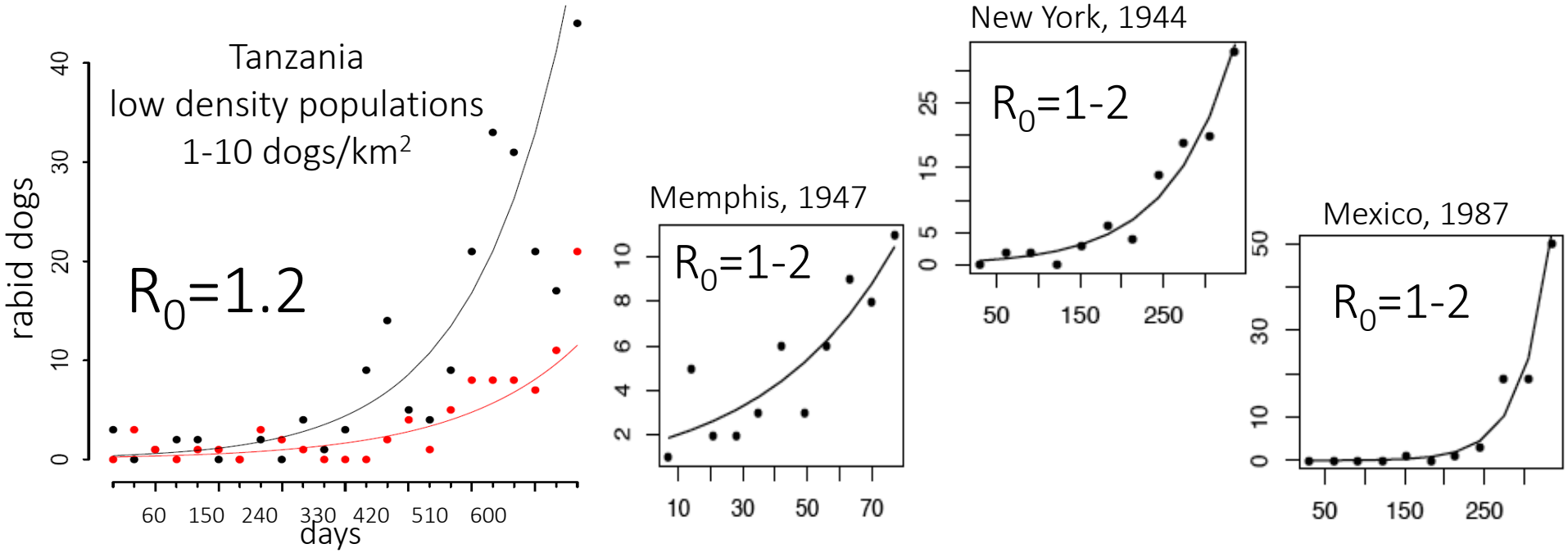
Dog vaccination prevents transmission but the impacts depend on vaccination coverage



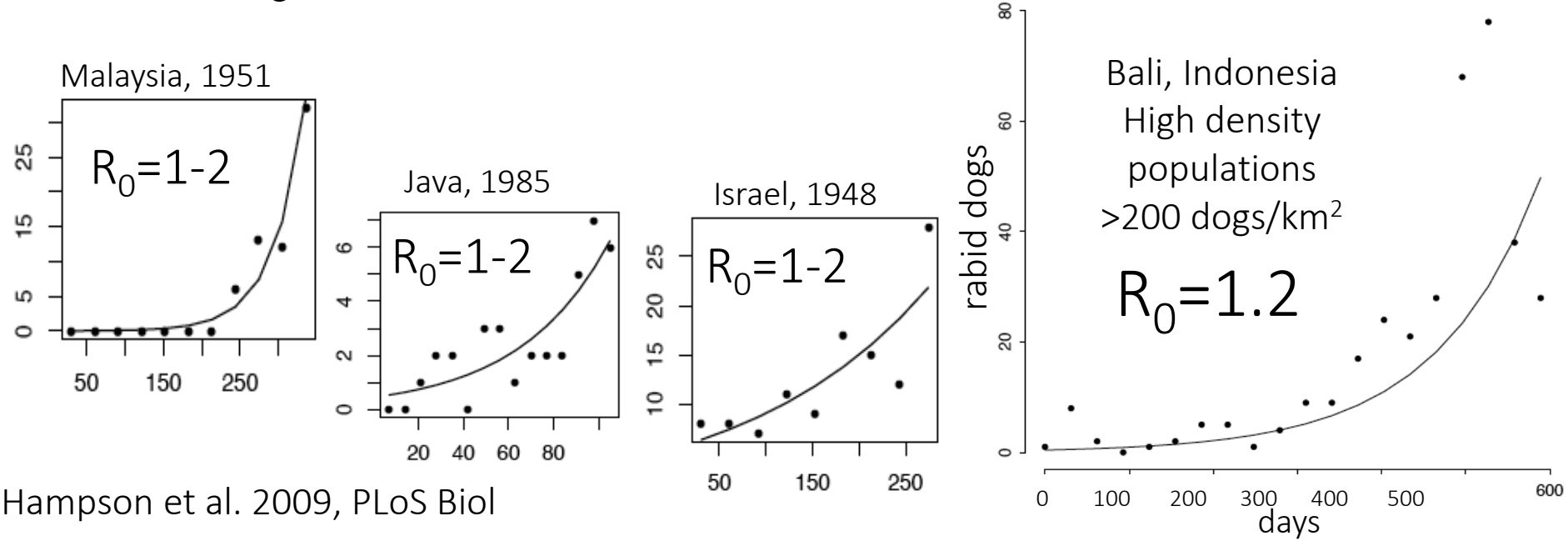
The Reproductive number: R_0

- R_0 is the number of secondary cases caused by an infected individual in an entirely susceptible population

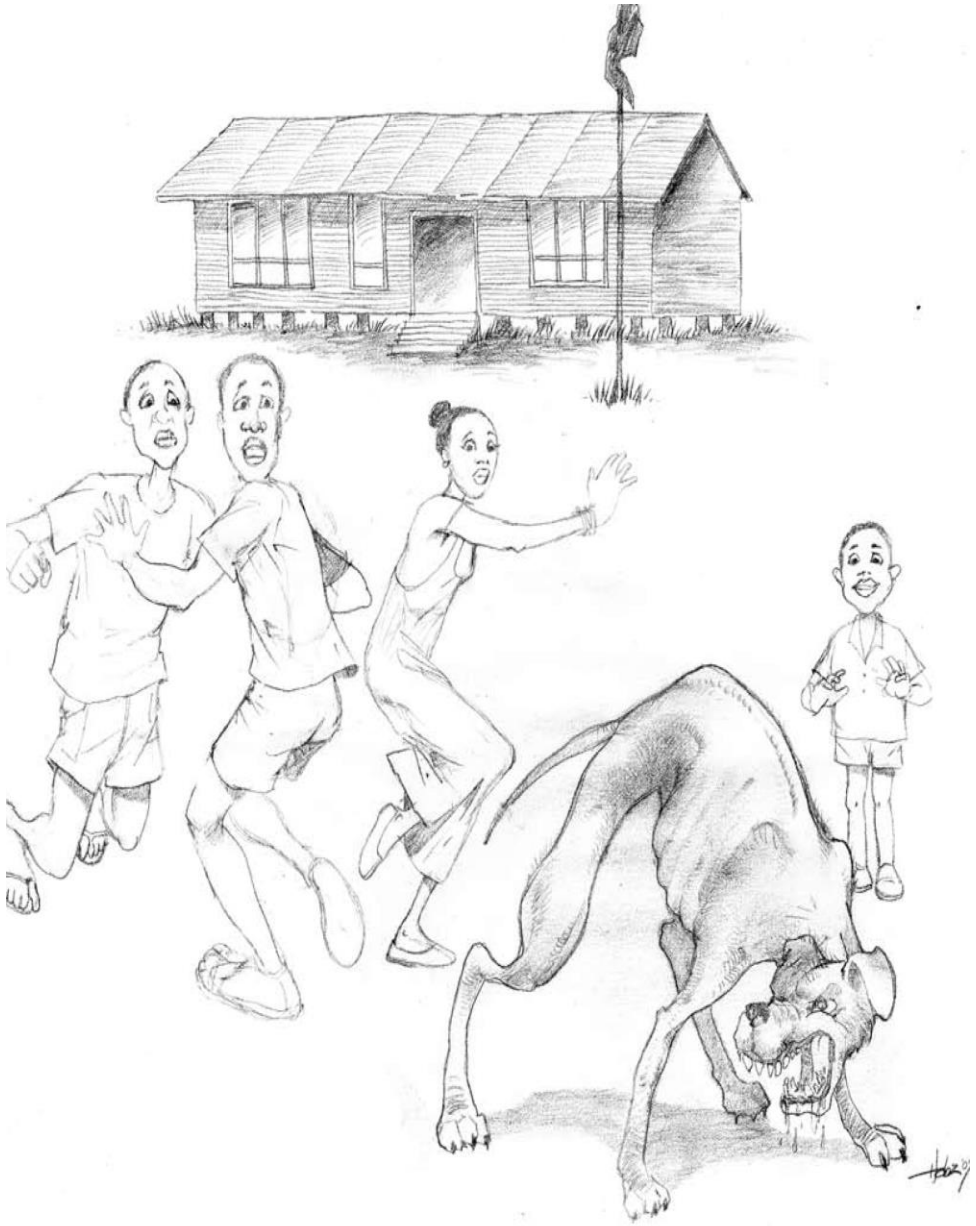
- Determines whether a disease can persist and is valuable for assessing management options



R_0 is between 1-2 around the world



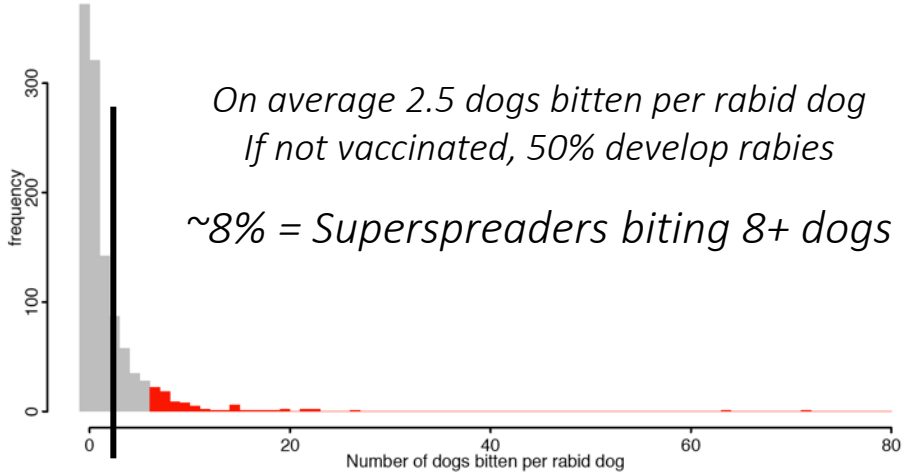
Hampson et al. 2009, PLoS Biol



The Reproductive number: R_0

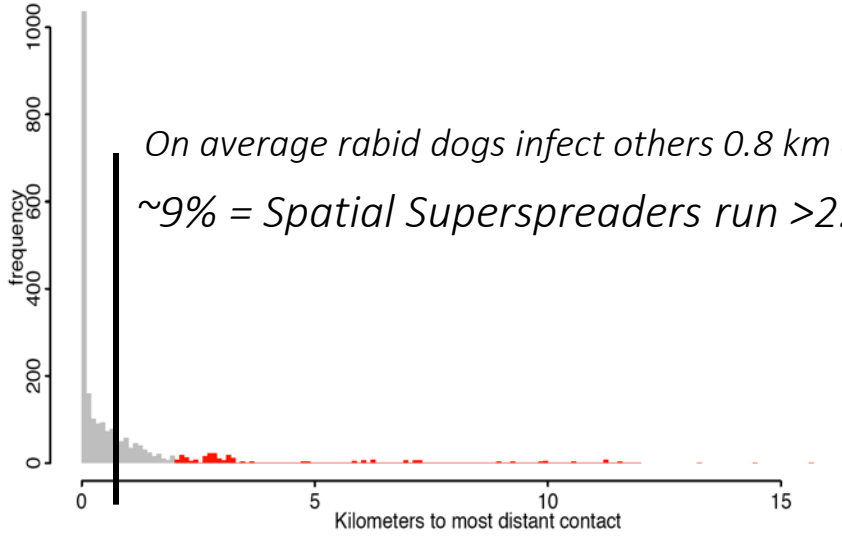
On average 2.5 dogs bitten per rabid dog
If not vaccinated, 50% develop rabies

~8% = Superspreaders biting 8+ dogs

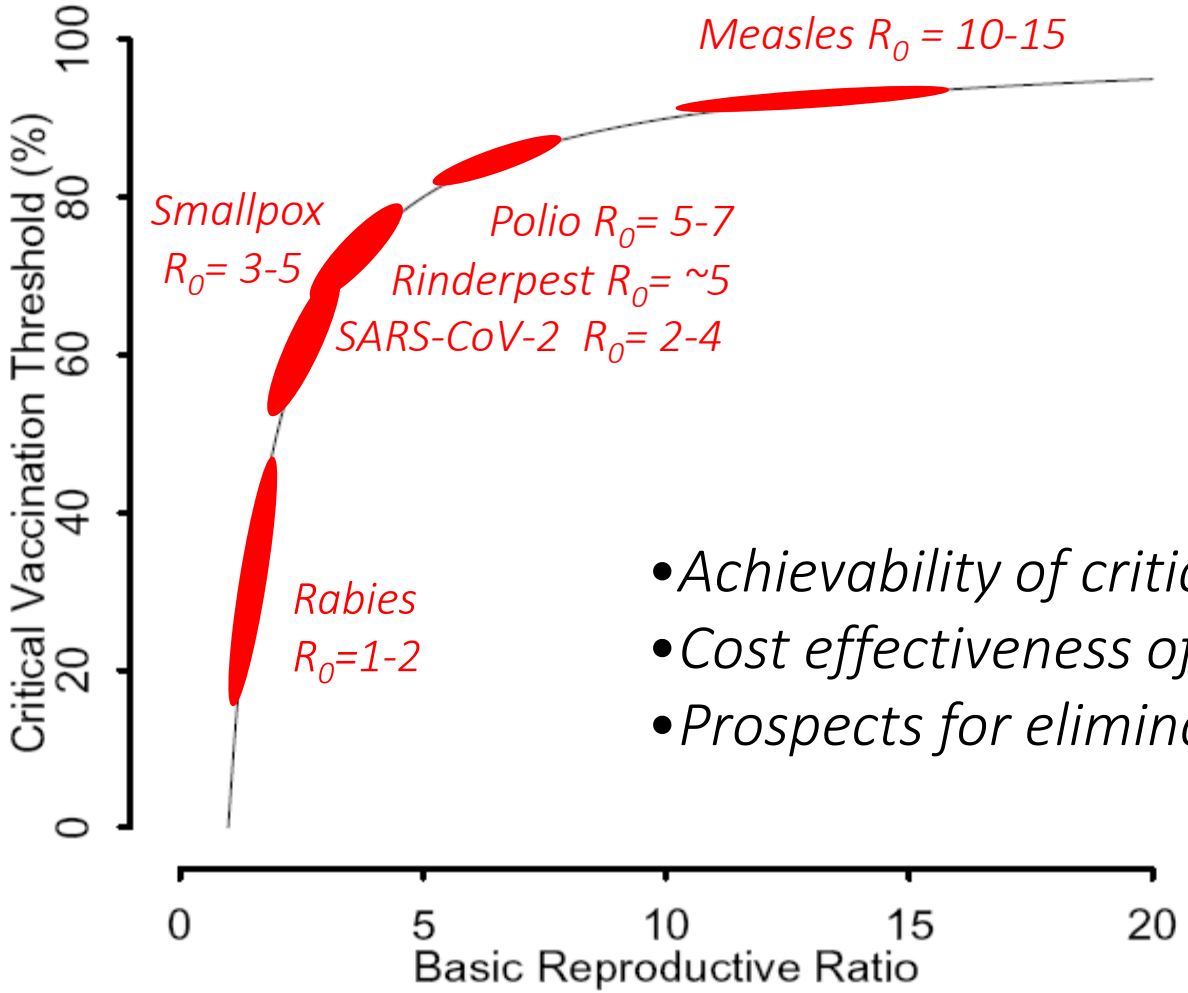


On average rabid dogs infect others 0.8 km away

~9% = Spatial Superspreaders run >2.5 km



Herd immunity depends on R_0

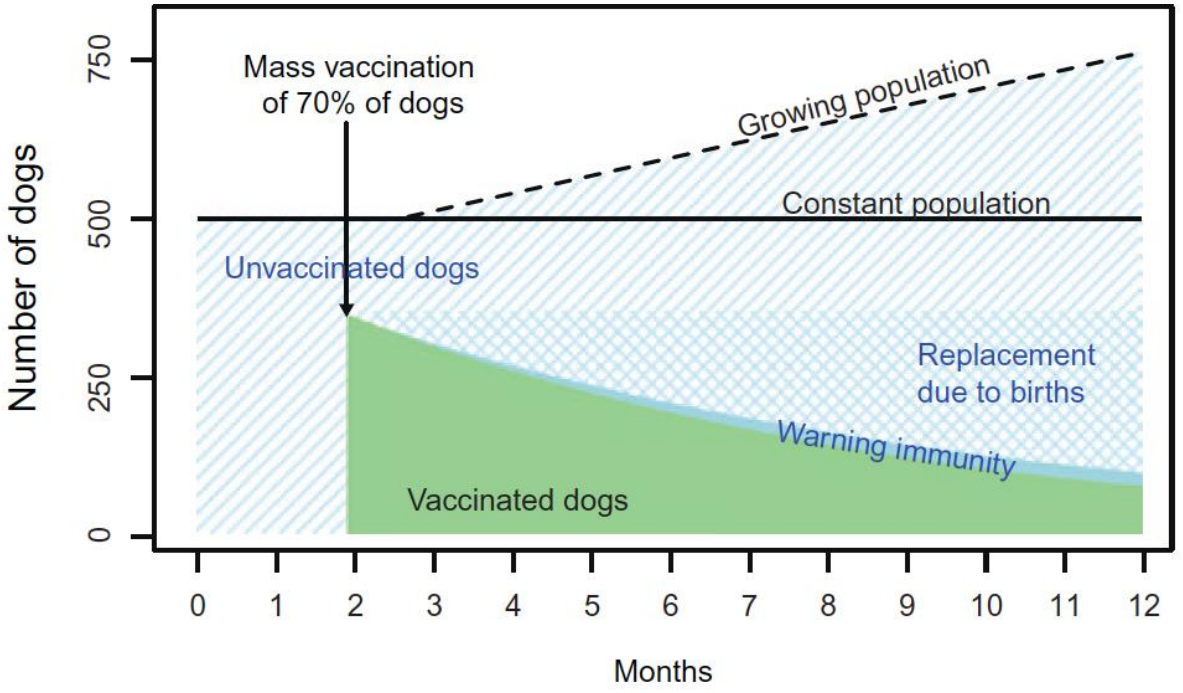


- *Achievability of critical coverage*
- *Cost effectiveness of control*
- *Prospects for elimination*

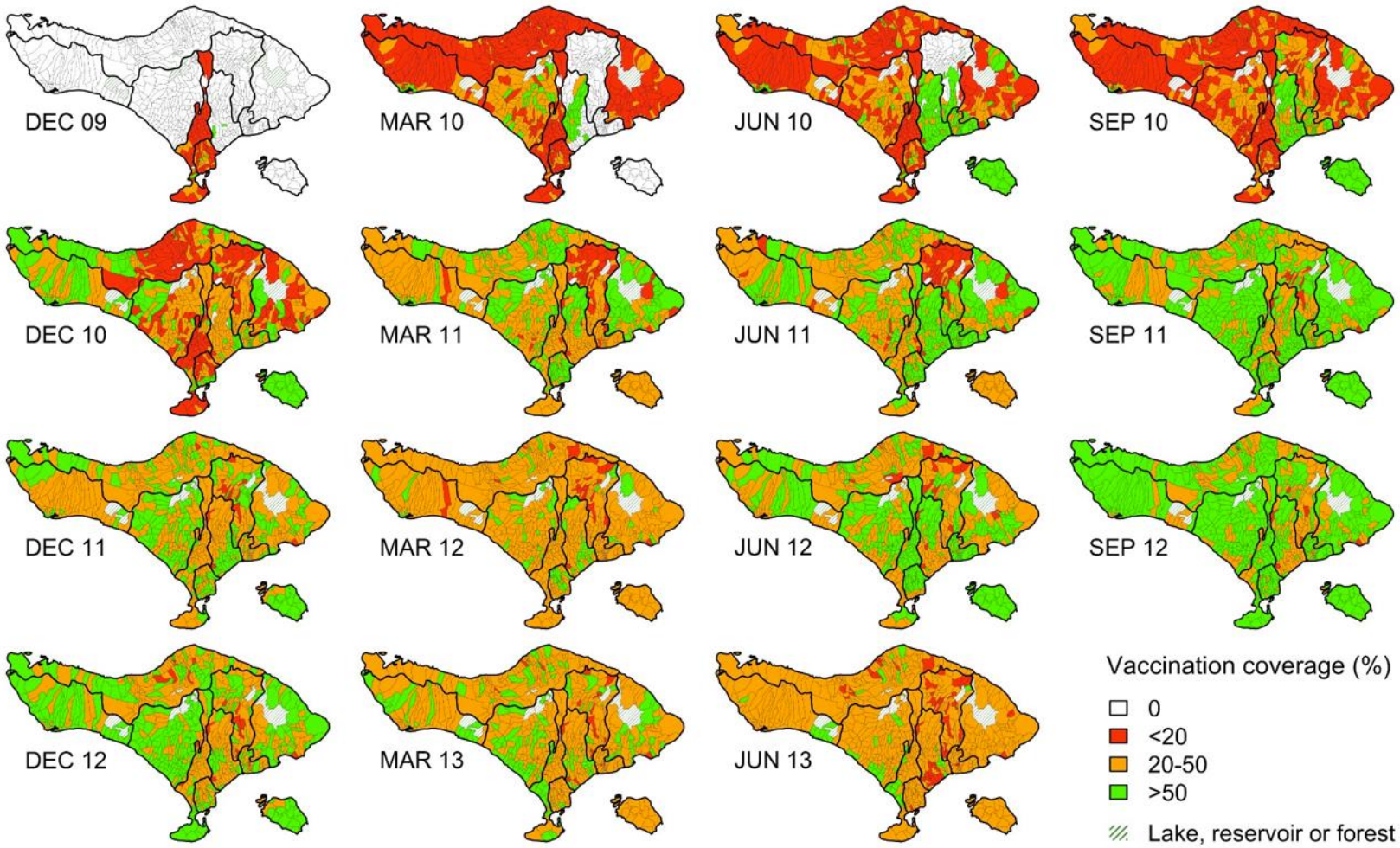
Demography influences herd immunity

Vaccination coverage declines as vaccinated dogs die, susceptible dogs are born and vaccine-induced immunity wanes

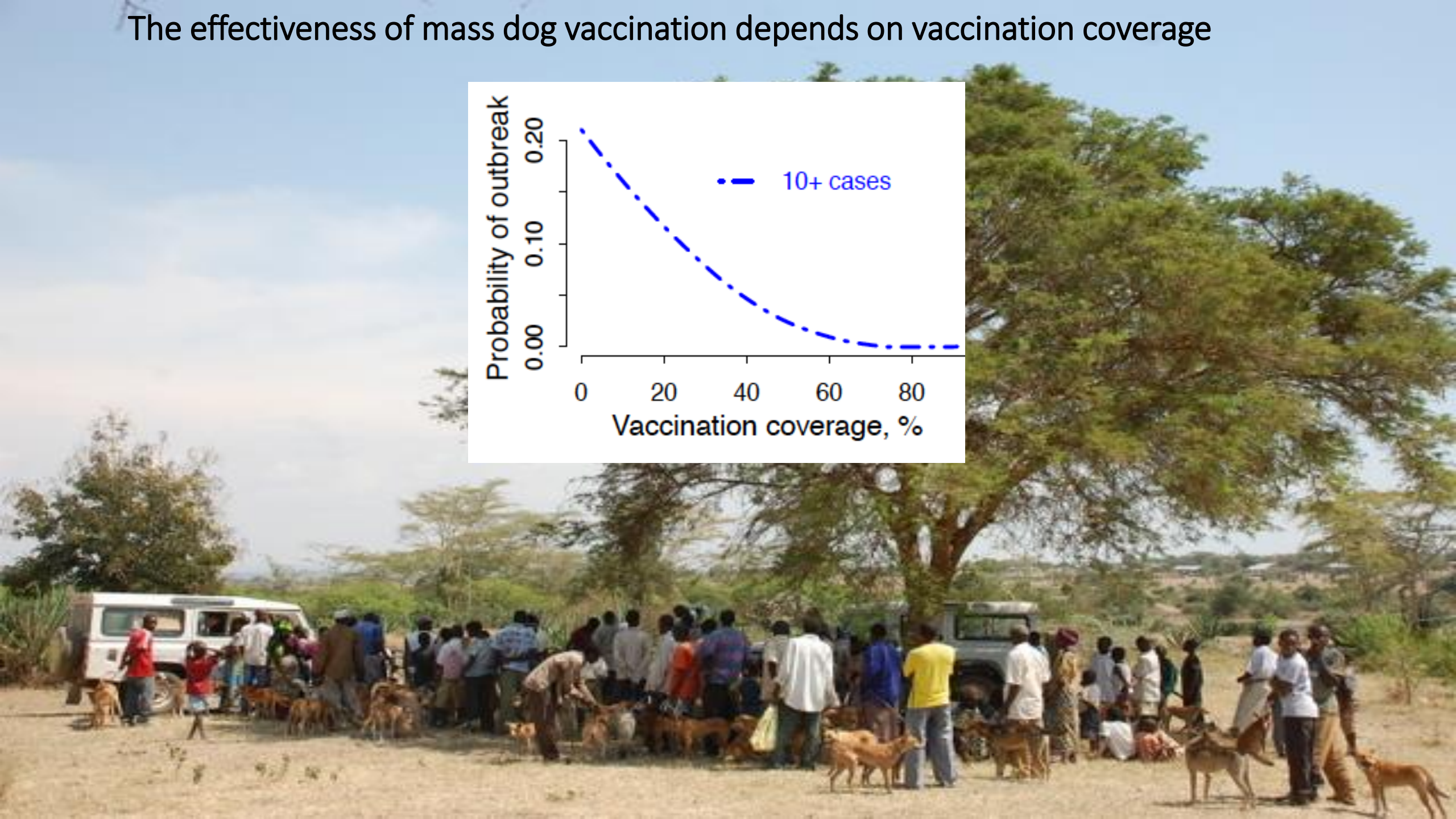
A greater proportion must be vaccinated to prevent coverage falling to dangerous levels in between campaigns



Vaccination coverage declines between campaigns and is often incomplete if not well planned and monitored



The effectiveness of mass dog vaccination depends on vaccination coverage



Vaccination strategies need to be tailored to the local population - Local knowledge is essential


Most dogs are owned and accessible for vaccination!


And most dogs can be easily brought for vaccination

Temporary Vaccination Stations can be quickly set up

Local knowledge is crucial for identifying locations and advertising effectively

Well-planned advertising is critical to engage participants

Even in settings with many unowned dogs effective vaccination strategies are available

Some communities (& some dogs) are harder to reach than others & approaches need tailoring

- Remote, dispersed communities with seasonal movement
- Dogs less used to handling and restraint
- Different cultures and attitudes
- Different costs

Vaccinating puppies is essential for high coverage, but is often neglected

Kaare et al. 2009 Vaccine

Vaccinating dogs is cost-effective
and also raises awareness about rabies risks

Too many dogs?

Often culling is carried out in response

JP/I.B. Diwan

Beware of rabies: A stray dog scavenges in a pile of garbage. Bali Governor Made Mangku Pastika said on Thursday that the provincial Husbandry Agency must implement the 2009 Bylaw on the prevention of rabies to curb rabies on the island.

Stray dogs must be culled, Bali governor says

Ni Komang Erviani
THE JAKARTA POST/DENPASAR

Bali Governor Made Mangku Pastika said Thursday that the provincial husbandry agency's rabies team mHst implement the 2009 rabies prevention bylaw firmly in

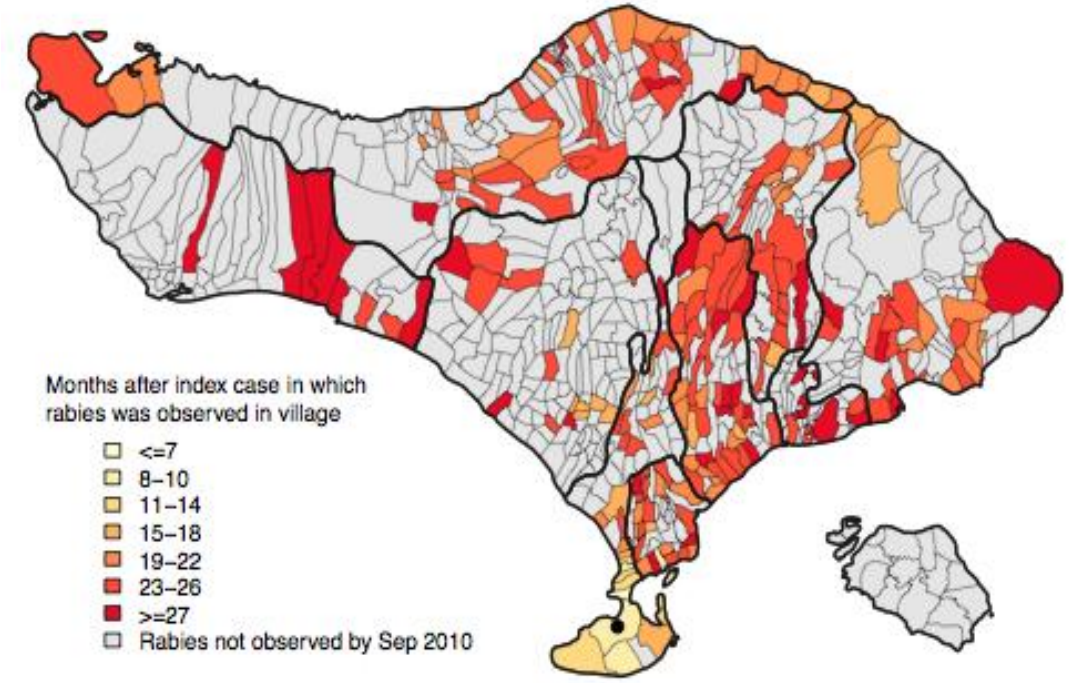
» Bali rabies team must implement bylaw firmly in an attempt to curb rabies on the island
» Violation of the bylaw carries a maximum six months in prison or a fine of Rp 50 million

unaware of the rules. This had resulted in a high cost for rabies prevention.

The epidemic led the Bali administration to provide free vaccines for dogs and affected humans. For 2009, the administration allocated Rp 600 million from its provincial budget to distribute free vaccines to all re-

Culling is almost always counterproductive:

Moving dogs away from culling spreads rabies faster
Replacement dogs often introduce rabies
Culling breaks trust with communities
Effective vaccination campaigns build trust – essential for surveillance!



Collaring dogs is a quick and easy way to assess vaccination coverage and assess if remedial vaccination needed

Livestock paint/ spray also works very well for temporary marking

ZERO BY 30

THE GLOBAL STRATEGIC PLAN

TO END

HUMAN DEATHS FROM DOG-MEDIATED RABIES BY 2030

Food and Agriculture Organization of the United Nations

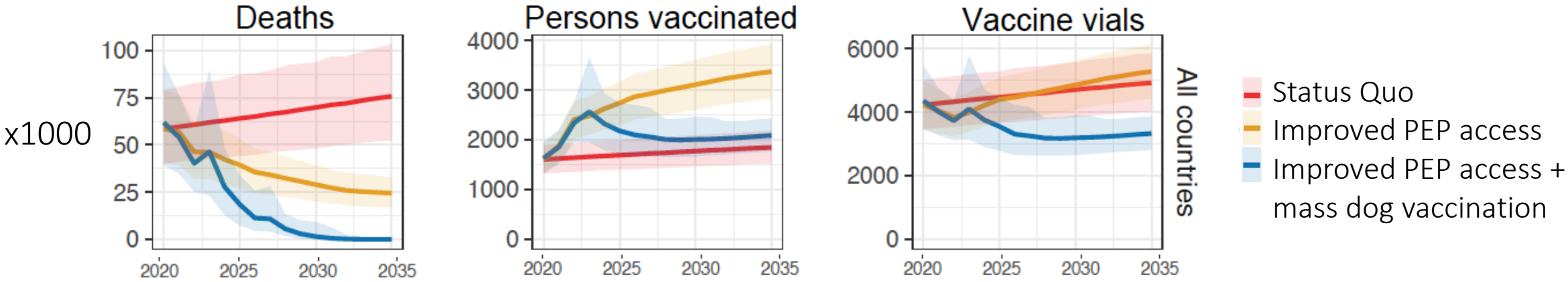
World Organisation for Animal Health

World Health Organization

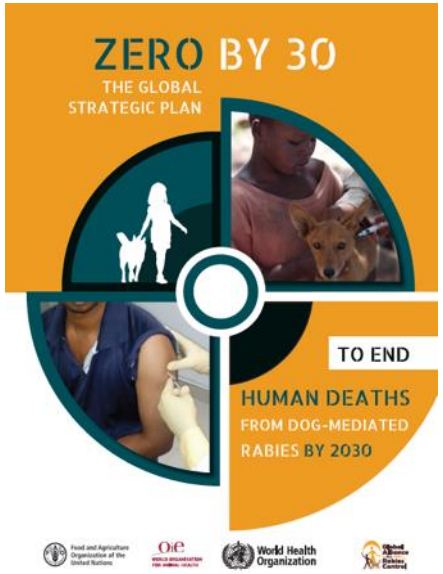
Global Alliance for Rabies Control

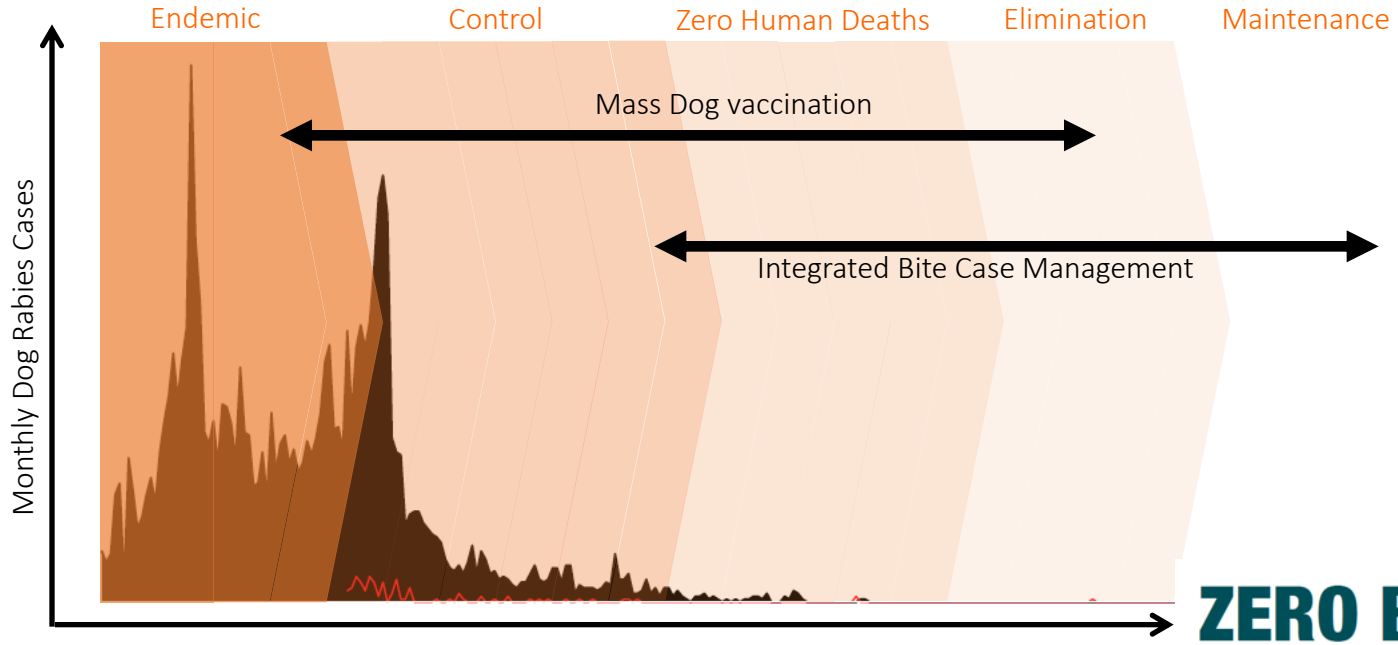
Predictions from 2020-2035:

- Improved access to post-exposure vaccines predicted to save >500,000 lives by 2035 in 67 low-income countries
- Abridged regimens can reduce stockouts, improve compliance and save costs
- Extremely cost-effective but cannot eliminate deaths or interrupt transmission
- Dog vaccination is the ONLY way to eliminate rabies & will save >300,000 more lives!
- Dog vaccination can reduce PEP costs by 20-70% with IBCM



WHO modeling consortium, Lancet Infect Dis (2019)





ZERO BY 30

Phase 1: START UP
2018-2020
29 countries

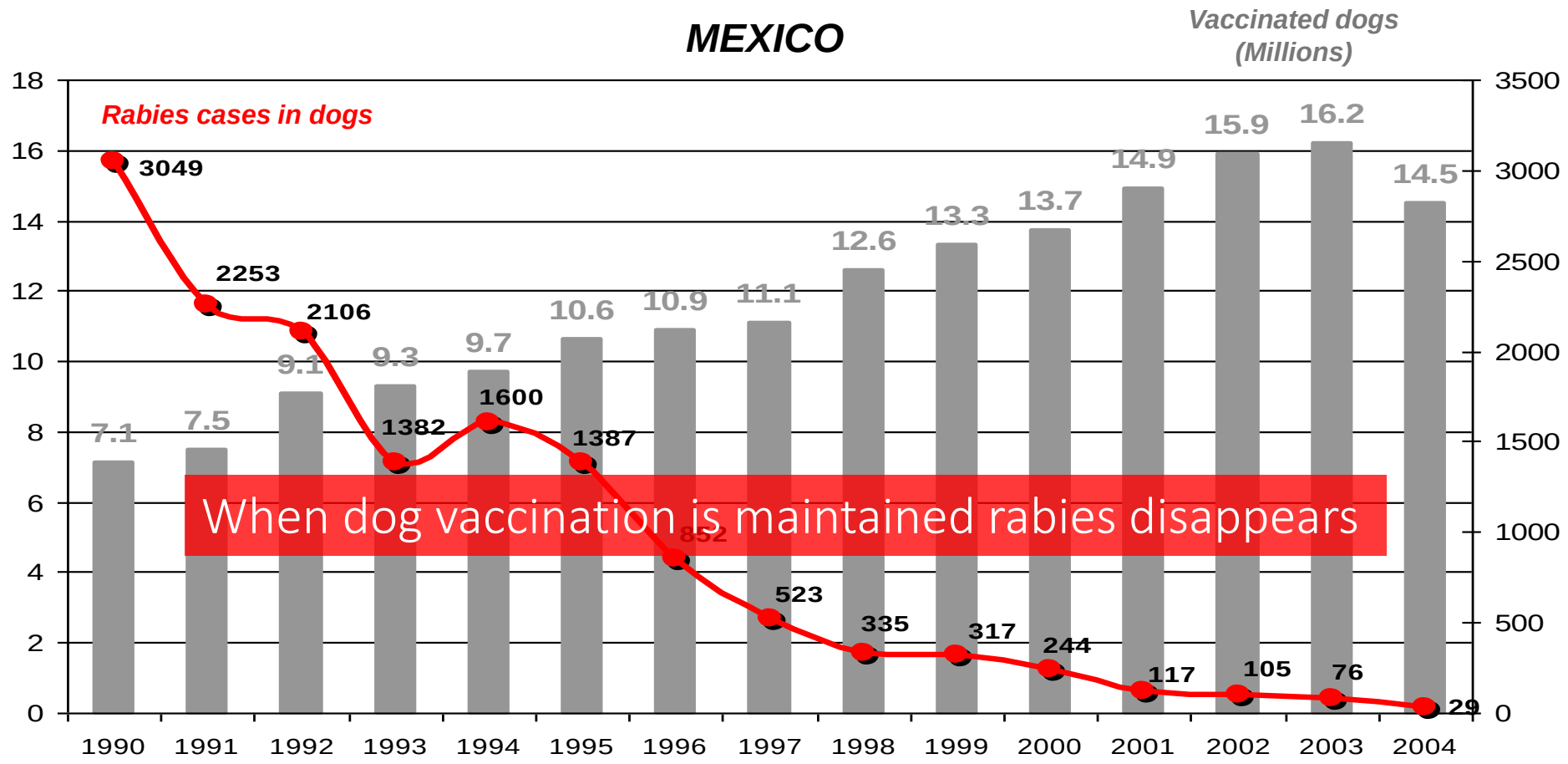
Phase 2: SCALE UP
2021-2025
+52 countries

Phase 3: MOP UP
2026-2030
+19 countries

Progress towards rabies elimination:

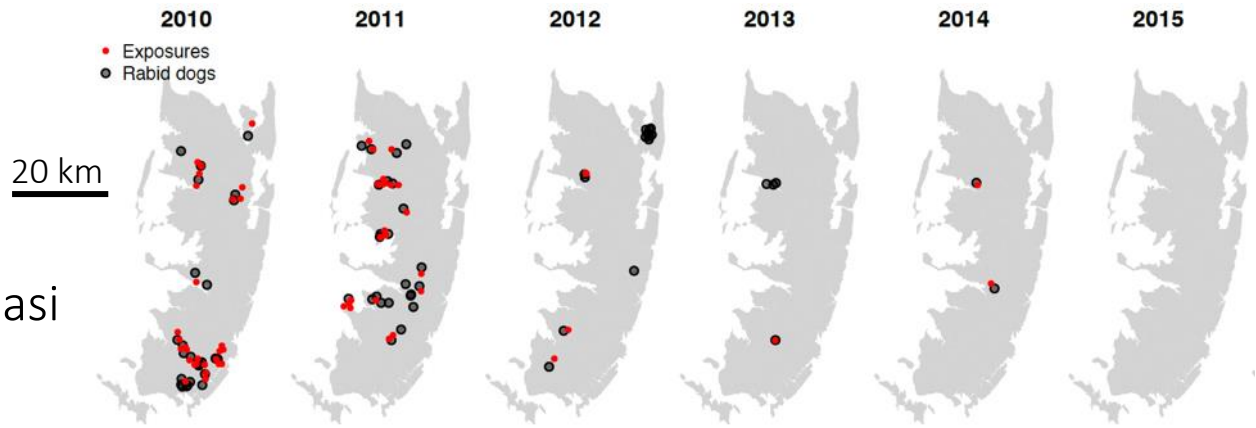
>99% reduction in canine rabies in Latin America

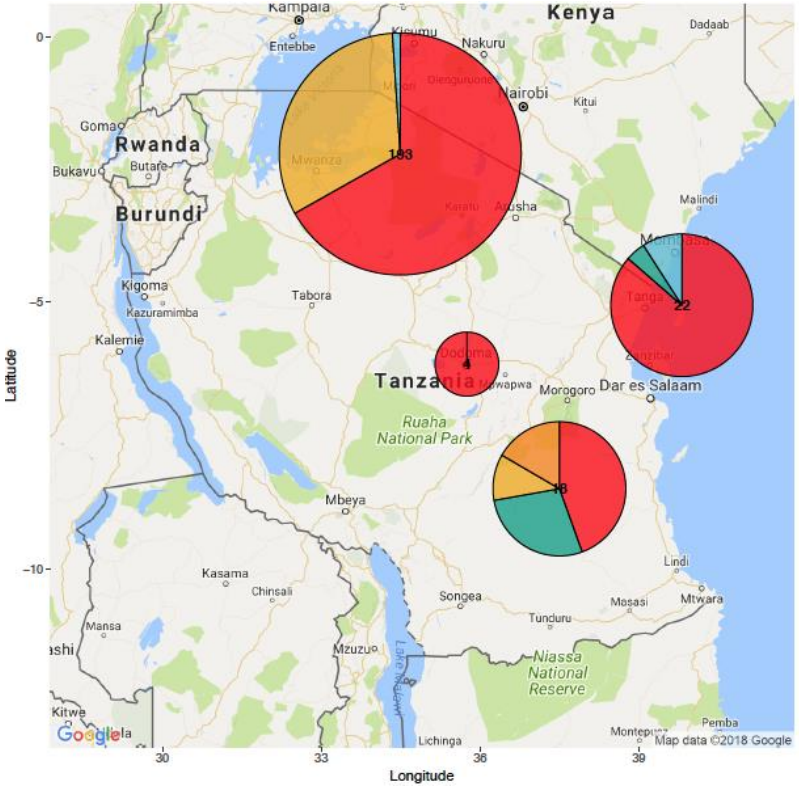
Rabies only remains in the poorest parts of countries where dog vaccination has not been well implemented



Dog vaccination can rapidly control and locally eliminate rabies

Kennedy Lushasi





Diversity of rabies on Pemba suggests frequent historical introductions

- NA
- Tz1
- Tz2
- Tz3
- Tz4
- Tz5

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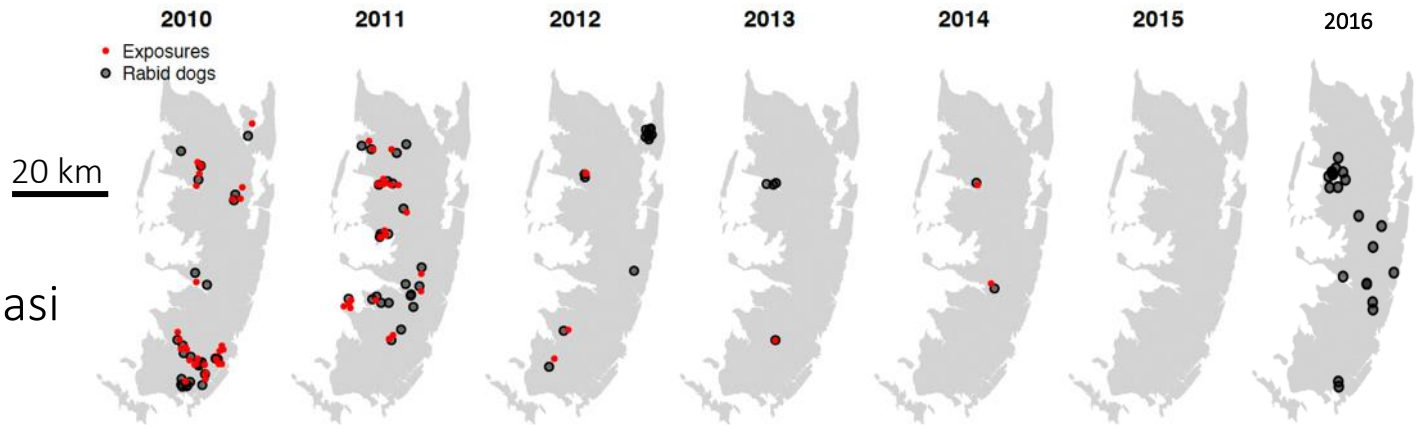
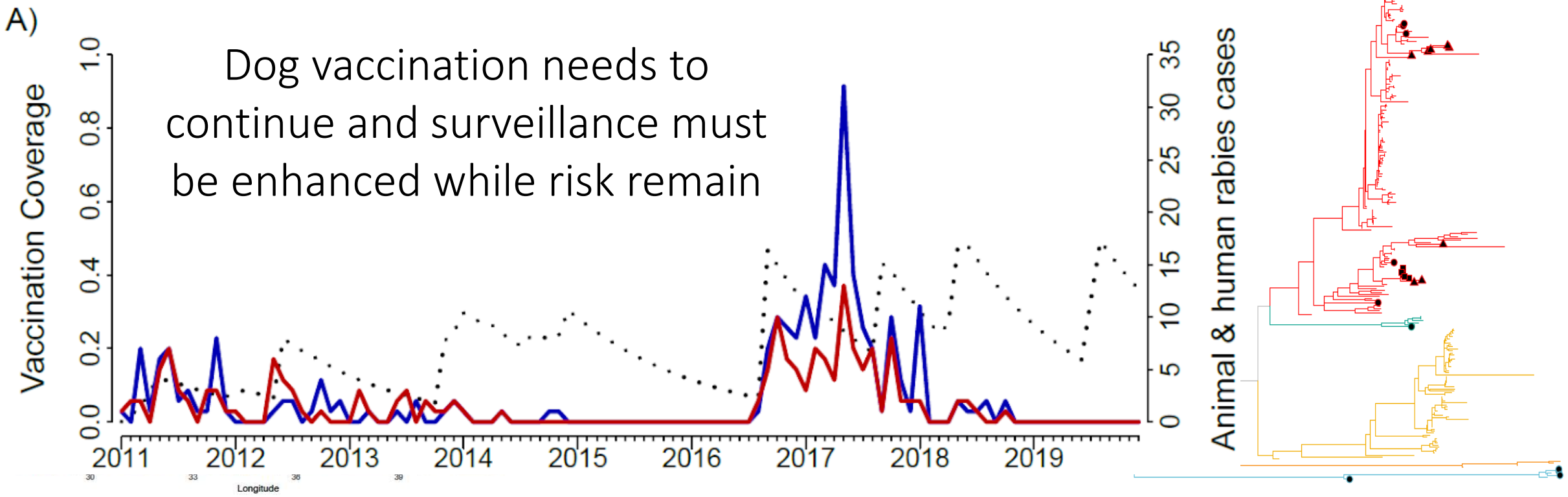


2016 outbreak due to 2 introductions from mainland when vaccination coverage low

- Pre–elimination
- Outbreak2016: initial surveillance
- Outbreak2016: continued surveillance

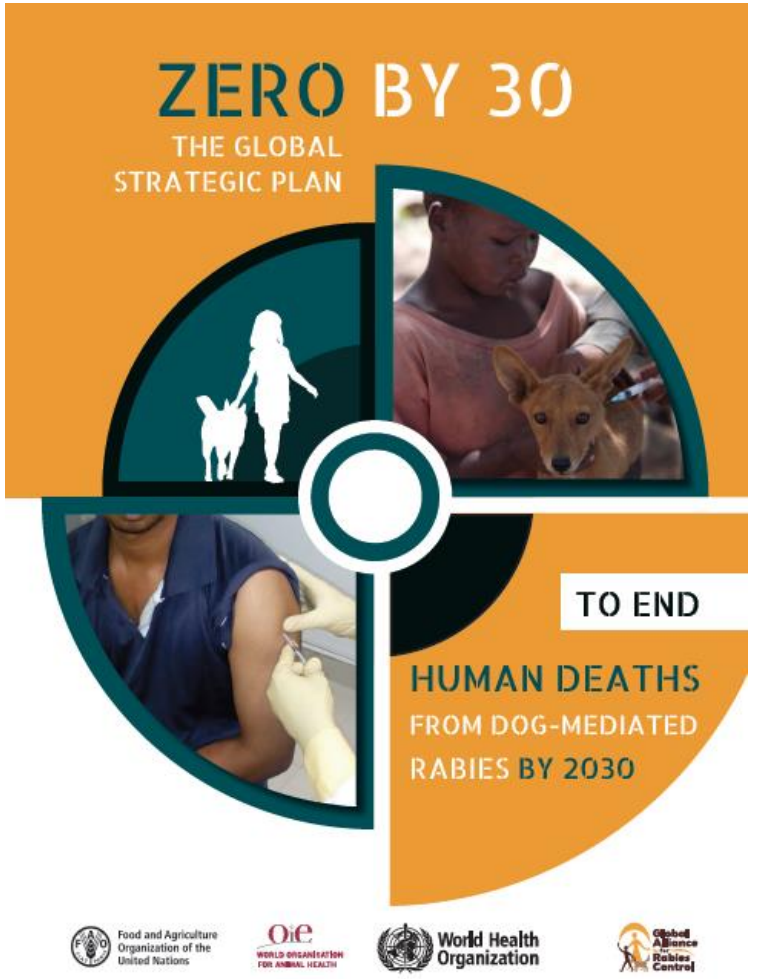
Dog vaccination needs to continue and surveillance must be enhanced while risk remain



Conclusion

- Investing in dog vaccination:
  - saves lives of those with poor access to health services
  - can rapidly control disease & save expenditure on PEP
- When approaching elimination:
  - Supporting problem endemic areas to vaccinate dogs (typically the poorest) will eliminate disease and result in long-term savings
- Rabies requires a One Health approach
  - Builds intersectoral partnerships
  - Builds trust in communities
  - Is low cost but requires investment!

By working together, engaging communities and committing to sustain dog vaccinations, rabies can be eliminated



Questions?