## TOOLS TO ENABLE BETTER PLANNING OF MASS DOG VACCINATION PROGRAMS



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**Poxvirus and Rabies Branch** 

Photo credit: GARC

**U.S.** Centers for Disease Control and Prevention

# **Successful Elimination**

- How many dogs do we have?
- How much vaccine will we need?
- How many vaccinators do we need?
- What infrastructure do we need?
- What advances do we need?



Global Dog Rabies Elimination Pathway (GDREP): Phases for a dog rabies elimination program based on 70% dog population vaccination coverage.

| Implementation Phase:      | Phase I: Preparation      |       | Phase II: Scale-up dog vaccination |              |           | Phase III: Sustained 70% dog vaccination                     |            |          |           |       |    |    |
|----------------------------|---------------------------|-------|------------------------------------|--------------|-----------|--|------------|----------|-----------|-------|----|----|
| Program year               | 1 2                       | 3     | 4                                  | 5            | 6         | 7  | 8          | 9        | 10        | 11    | 12 | 13 |
| Expected dog vax coverage: | <18% (current rate)       | )     | 18% - 35%                          | 35% - 53%    | 53% - 70% |  |            |          | ≥70%      |       |    |    |
| Activities achieved        | Field studies             |       | Pilot implement                    | tation       |           | Mass va  | ccination  | of dog   |           |       |    |    |
|                            | Workforce training        |       | Scaling-up vaccination coverage    |              |           | Surveillance to establish disease burden and assess progress |            |          |           |       |    |    |
|                            | Strengthening lab capacit | ty    | Logistical impre                   | ovements     |           |  |            |          |           |       |    |    |
|                            |                           |       | Operational equ                    | ipment       |           |  |            |          |           |       |    |    |
| Cost estimates:            | Current vaccination cover | C     | Expected vaccin                    | Ũ            |           | Vaccinat   | tion of 70 | % of the | dog popul | ation |    |    |
|                            | Infrastructure improveme  | ents* | Infrastructure in                  | nprovements* |           |  |            |          |           |       |    |    |

# Identifying global data sources



| Continent      | Cluster  | World Bank<br>Human  | Percent Urban   | Human<br>Developmen   | Canine<br>Rabies  | Canine Rabies   |   | Urban<br>Population  | •   | •  |  |   |   |
|----------------|--|--|---|---|---|---|---|--|---|--|--|---|---|
| -              | ΨĪ   | Population 2 👻   | -   | t in 👻  | Hamp 🚽  | <b>v</b>  | Affect  | Affec 🚽  | Affec -   | Affec -  | (Da 🗸  | (Da. 🗸  | (Kno''  |
| Asia           | Eurasia  | 32,526,562   | 26.703  | 0.398   | 1   |   |   | 8.685.568  | 23,840,994  |  |  |   | 7.5   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 6.  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.   |
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|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 6.  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 7.  |
|                |  |  |   |   |   |   |   |  |   |  |  |   | 7.9   |
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|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 7.  |
|                |  |  |   |   | 1   |   |   |  |   |  | 4.0  |   | 7.  |
|                |  |  |   |   |   |   |   |  |   |  | 4.0  |   | 6.5   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   |   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 7.5   |
|                |  |  |   |   |   |   |   |  |   |  |  |   |   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
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|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 7.  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
| Asia           | China  |  |   |   | 1   |   |   | 762,590,291  |   |  |  |   | 48.   |
| Americas       | Andean   | 48,228,704   | 76.436  | 0.71  | 1   |   |   | 36,864,092   | 11,364,612  |  |  |   | 7.5   |
| Africa         | Congo Basin  | 4,620,330  | 65.38   | 0.533   | 1   |   |   | 3,020,772  | 1,599,558   |  |  |   | 21.3  |
| Europe         | EasternEurope  | 4,224,404  | 58.964  | 0.796   | 1   |   |   | 2,490,878  | 1,733,526   |  |  |   | 6.  |
| Americas       | Caribbean  | 11,389,562   | 77.074  | 0.776   | 1   |   |   | 8,778,391  | 2,611,171   |  |  |   | 7.5   |
| Europe         | EasternEurope  | 10,551,219   | 72.992  | 0.865   | 1   |   |   | 7,701,546  | 2,849,673   |  |  |   | 6.  |
| Asia           | Asia 2   | 25,155,317   | 60.875  | 0.766   | 1   |   |   | 15,313,299   | 9,842,018   |  |  |   | 7.5   |
| Africa         | Congo Basin  | 77,266,814   | 42.494  | 0.286   | 1   |   |   | 32,833,760   | 44,433,054  |  |  |   | 21.3  |
| Africa         | North Africa   | 887,861  | 77.343  | 0.43  | 1   |   |   | 686,698  | 201,163   |  |  |   | 21.3  |
| Americas       | Caribbean  | 10,528,391   | 78.98   | 0.689   | 1   |   |   | 8,315,323  | 2,213,068   |  |  |   | 7.5   |
| Americas       | Andean   | 16,144,363   | 63.742  | 0.72  | 1   |   |   | 10,290,740   | 5,853,623   |  | 7.2  |   | 7.5   |
|                | North Africa   |  |   |   | 1   |   |   |  |   |  |  |   | 21.   |
|                | Central America & Mexico   |  |   |   | 1   |   |   |  |   |  |  |   | 7.5   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.   |
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|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 7.9   |
|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 21.3  |
|                |  |  |   |   |   |   |   |  |   |  |  |   | 21.   |
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|                |  |  |   |   | 1   |   |   |  |   |  |  |   | 7.  |
|                |  |  |   |   |   |   |   |  |   |  |  |   | 7.1   |
| Europe<br>Acia | EasternEurope  |  | 71.227  |   | 1   |   |   | 7,012,074  | 2,832,612<br>881 720 811  |  | 12 0 - 35 0  | 37  | 6.1   |
|                | Asia<br>Europe<br>Africa<br>Africa<br>Arreicas<br>Europe<br>Asia<br>Europe<br>Africa<br>Europe<br>Africa<br>Arreicas<br>Europe<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa<br>Africa 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# Customizable GDREP Tool

| Demographic, epidemiological, and cost input varia | ahles        |                | Summary of results from the analysis: dog vaccination campai   | ίση                                       |                                    |
|--|--------------|----------------|--|---|------------------------------------|
| Model Variable                                     | Input values | Default values | summary or results nom the analysis dog facemation campar  |   |                                    |
| Select country Clear                               | Ethiopia     | ETH            | Resources needed (annual)<br>Total dog population  | 11,770,024                                |                                    |
| Discount rate (health outcomes & costs)            | 0%           |                | Dogs vaccinated<br>Dogs unvaccinated   | 11,770,024<br>117,700<br>11,652,324       | Dog vaccinations required          |
| Demographics                                       |              |                | Number of additional vaccinated dogs required  | 8,121,317                                 | <sub>ີ ຊຶ</sub> 8,000 -            |
| Human population                                   | 99,390,750   | 99,390,750     | Average cost per dog vaccinated  | \$1.50                                    | <u> 국</u> 7,000 -                  |
| Percent urban                                      | 19%          | 19%            | Estimated years until elimination  | 13  | 뛽 6,000 -                          |
| Urban population                                   | 18,884,243   | 19,353,367     | Vaccinators employed annually for a month  | 2,500                                     | -5<br>2 5,000 -                    |
| Rural population                                   | 80,506,508   | 80,037,383     | Total costs to eliminate   |   |                                    |
| Number of humans per dog, urban areas              | 21.2         | 21.2           | Net present value (NPV) Phase I  | \$4,184,244                               | ă i                                |
| Number of humans per dog, rural areas              | 7.4          | 7.4            | Net present value Phase II   | \$24,562,569                              | 3,000 -                            |
| Total dog population                               | 11,770,024   | 11,728,757     | Net present value Phase III  | \$86,509,676                              | 2,000 -                            |
|  |              |                | NPV of dog rabies elimination (average)  | \$115,256,488                             | 1,000 -                            |
| Dog vaccination                                    |              |                | NPV of dog rabies elimination (lower-upper) (\$76,8<br>Additional costs to government  | 837,659 - \$153,675,317)<br>\$112,961,333 |                                    |
| Current dog rabies vaccination coverage (%)        | 1.0%         | 0.5%           | Range (lower-upper) (\$75,3  | 307,556 - \$150,615,111)                  | 0 1 2 3 4 5 6 7 8 9 10 11 12<br>ve |
| Goal: annual coverage of dog population (%)        | 70.0%        | 70.0%          |  |   |                                    |
| Total dogs currently vaccinated per year           | 117,700      | 58,644         | Total annual cost of dog vaccination (discoun  | ated)                                     | Net dog vaccination capacity†      |
| Dogs to reach vaccination goal                     | 8,121,317    | 8,151,486      | 18,000 r   | itteuj                                    | 5,000.0 J                          |
|  |              |                |  |   | -                                  |
| Vaccination campaign logistics                     |              |                | i6,000 - <td></td> <td></td> |   |                                    |
| Vaccinators available                              | 2,500        | 2,494          | E 14,000 -   |   | E 5,000.0                          |
| Dogs vaccinated per vaccinator per day (rate)      | 20           | 100            | ž 12,000 -   |   | at 2,000.0 -                       |
| Campaign vaccination days                          | 90           | 25             | ······································   |   | -8 1,000.0 -                       |
| Estimated dogs vaccinated during campaign          | 4,500,000    | 6,235,000      |  |   |                                    |
| Additional vaccinators needed to reach goal        | 2,077        | 790            | te 6,000 - T   |   | .≧ -1,000.0                        |
| Vaccination rate needed to reach goal              | 37           | 132            | g 4,000 -  |   | eg -2,000.0 -                      |
|  |              |                |  |   | <sup>ع</sup> -3,000.0 -            |
| Vaccination campaign costs per vaccinated dog*     |              |                |  |   | -4,000.0 -                         |
| Average cost per dog vaccinated                    | Estimate     | value          |  | 11 12vax spending                         | -5,000.0 ]                         |
|  |              |                |  |   |                                    |

#### • INPUT

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- Country-specific parameters
- Direct comparison to values used in GDREP

#### • <u>OUTPUT</u>

- Time to elimination
- Cost per GDREP Phase
- Vaccination personnel needed

vear

vear

### **Customized GDREP Tool: Kenya**

| Model Variable   | Input values  | Default values                                     |
|--|---|--|
| Select country Clear   | Kenya   | KEN  |
| Discount rate (health outcomes & costs)  | 3%  |  |
| Demographics   |   |  |
| Human population   | 46,050,302  | 46,050,302   |
| Percent urban  | 26%   | 269  |
| Urban population   | 11,973,079  | 11,799,008   |
| Rural population   | 34,077,223  | 34,251,294   |
| Number of humans per dog, urban areas  | 21.2  | 21.2   |
| Number of humans per dog, rural areas  | 7.4   | 7.4  |
| Total dog population   | 5,169,798   | 5,185,110  |
|  |   |  |
| Dog vaccination  |   |  |
| <b>Dog vaccination</b><br>Current dog rabies vaccination coverage (%)  | 11.0%   | 0.5%   |
| -  | 11.0%<br>70.0%                                      | 0.5%   |
| Current dog rabies vaccination coverage (%)  |   |  |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)   | 70.0%   | 70.0%  |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)<br>Total dogs currently vaccinated per year<br>Dogs to reach vaccination goal   | 70.0%<br>568,678                                    | 70.0%<br>25,926                                    |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)<br>Total dogs currently vaccinated per year   | 70.0%<br>568,678                                    | 70.0%<br>25,926                                    |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)<br>Total dogs currently vaccinated per year<br>Dogs to reach vaccination goal<br><b>Vaccination campaign logistics</b><br>Vaccinators available   | 70.0%<br>568,678<br>3,050,181                       | 70.0%<br>25,926<br>3,603,652                       |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)<br>Total dogs currently vaccinated per year<br>Dogs to reach vaccination goal<br><b>Vaccination campaign logistics</b><br>Vaccinators available<br>Dogs vaccinated per vaccinator per day (rate)                              | 70.0%<br>568,678<br>3,050,181<br>1,207              | 70.0%<br>25,926<br>3,603,652<br>1,207              |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)<br>Total dogs currently vaccinated per year<br>Dogs to reach vaccination goal<br><b>Vaccination campaign logistics</b><br>Vaccinators available   | 70.0%<br>568,678<br>3,050,181<br>1,207<br>100       | 70.0%<br>25,926<br>3,603,652<br>1,207<br>100       |
| Current dog rabies vaccination coverage (%)<br>Goal: annual coverage of dog population (%)<br>Total dogs currently vaccinated per year<br>Dogs to reach vaccination goal<br><b>Vaccination campaign logistics</b><br>Vaccinators available<br>Dogs vaccinated per vaccinator per day (rate)<br>Campaign vaccination days | 70.0%<br>568,678<br>3,050,181<br>1,207<br>100<br>25 | 70.0%<br>25,926<br>3,603,652<br>1,207<br>100<br>25 |

Vaccination campaign costs per vaccinated dog\*

Average cost per dog vaccinated

Estimate value



# GDREP: Country Report

• Who is the intended audience?



- High-level stakeholders, policy-makers, national rabies control programs
- What are the goals?
  - Highlight the monetary and fiscal commitment that are required for rabies elimination
  - Initiate discussions about funding continuity
  - Establish a strong foundation for multi-year government commitment

# GDREP Tool: How can it be used?

#### WORKSHOPS



#### • SARE

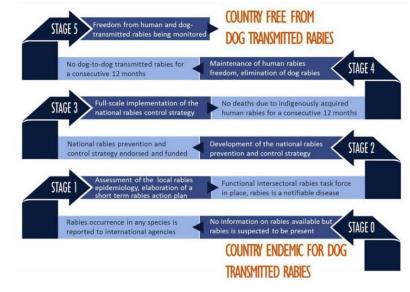
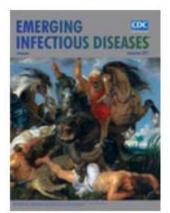


Fig 1. Diagram of SARE

#### • ONLINE

### caninerabiesblueprint.org

a blueprint for the control of rabies in dog populations



# Thank you!

- Government Partners
  - Haiti Ministry of Agriculture
  - Haiti Ministry of Health
  - Ethiopia Public Health Institute
  - Vietnam Department of Animal Health
  - Kenya ZDU
- Universities
  - University of the Valley Guatemala
  - Ohio State University
  - Georgia State University

- Partners
  - GARC
  - Christian Veterinary Mission
  - Mission Rabies
  - Humane Society International
  - World Health Organization
  - OIE
  - PAHO