Risk Factors for Severe RVF Infection in Kenya, 2006-7: Role of Animal Exposures and Animal handling practices

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Preview of RVF Outbreak in Kenya

- In mid-December 2006 the Ministry of health in Kenya started received reports of unexplained human deaths in North eastern province

- Deaths coincided with reports of abortion and deaths in livestock within the same place

- Serum samples taken confirmed RVF outbreak by
  RT-PCR test

- Surveillance was intensified

Surveillance case definition

Suspected case

➢ acute onset of fever (>99.5ºF [>37.5ºC]) for more than 48hours with headache or muscle and joint pain since November 2006 in a person who had no other known cause of acute febrile illness (e.g., malaria)
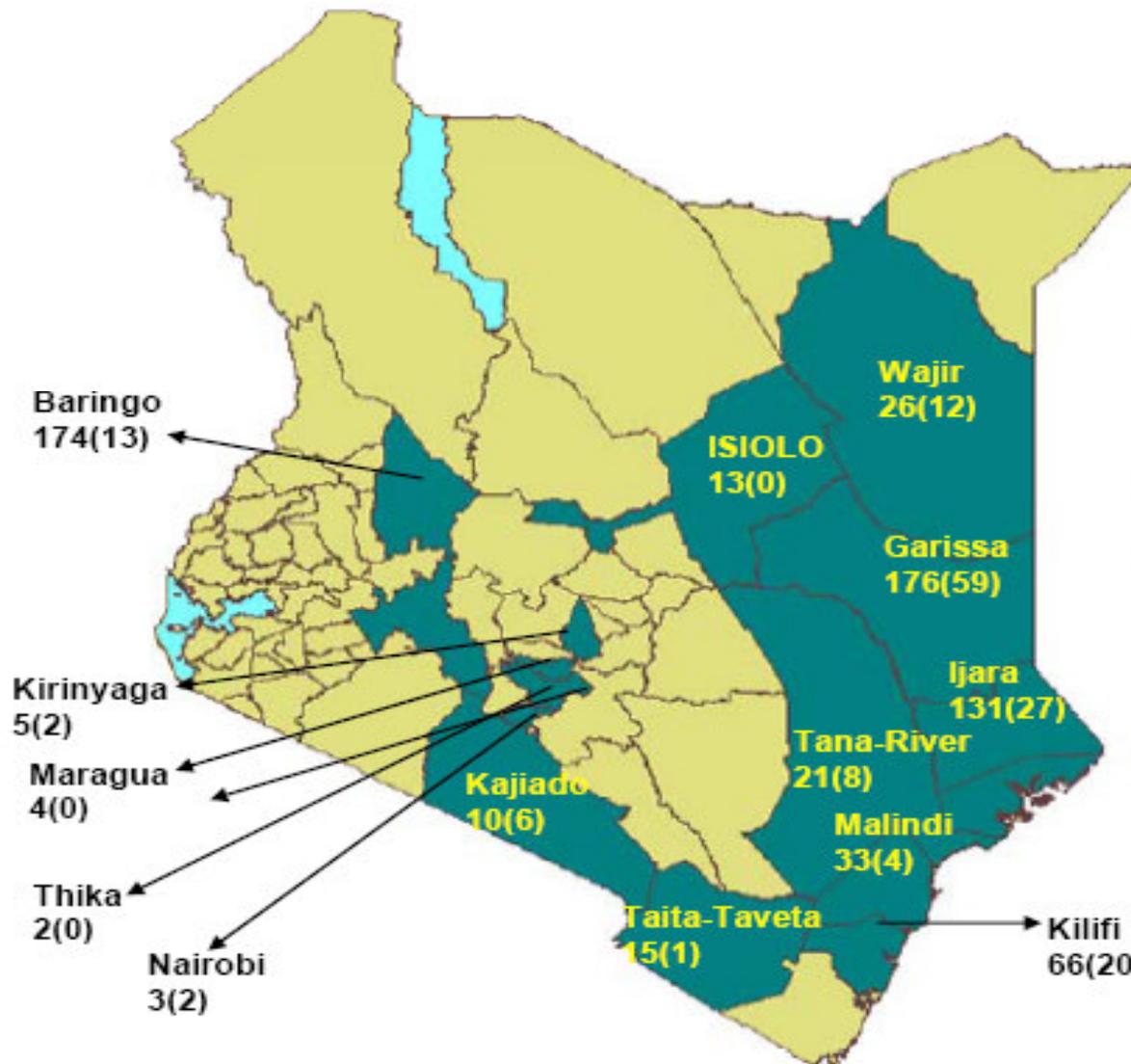
Probable case

➢ acute onset of fever in a person with unexplained bleeding (i.e., in stool, vomit, or sputum or from gums, nose, vagina, skin, or eyes), vision deterioration, or altered consciousness.
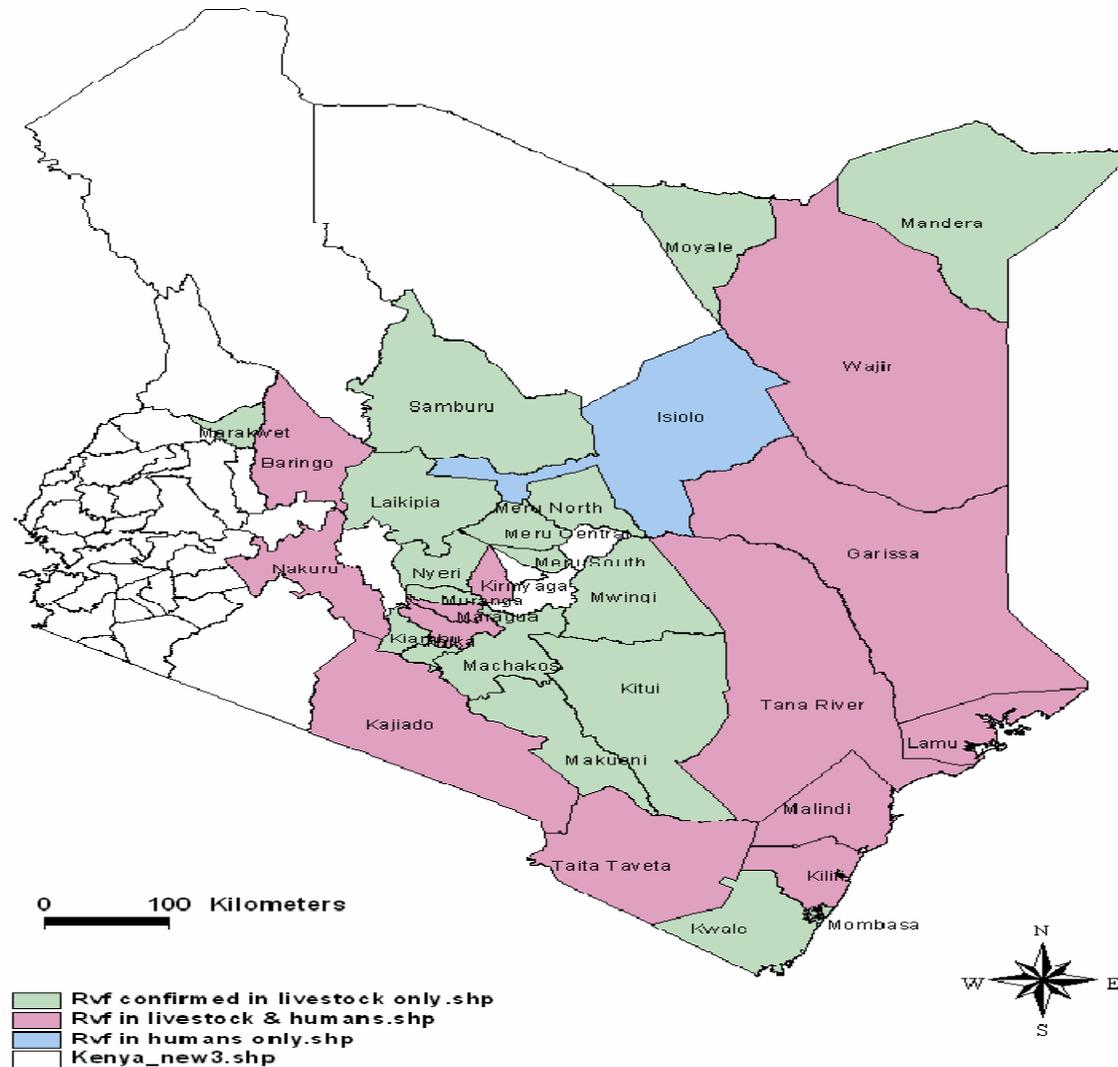
Confirmed case

➢ a suspected or probable case with laboratory confirmation of the presence in serum of anti-RVF virus IgM by ELISA or RVF virus RNA by reverse transcription--PCR(RT-PCR)

Reported human RVF cases and (deaths) in Kenya, March 2007

Baringo
174(13)

Kirinyaga
5(2)

Maragua
4(0)

Thika
2(0)

Nairobi
3(2)

Wajir
26(12)

ISIOLO
13(0)

Garissa
176(59)

Ijara
131(27)

Tana-River
21(8)

Kajiado
10(6)

Malindi
33(4)

Taita-Taveta
15(1)

Kilifi
66(20)

- 18(25%) districts affected
- 6 (75%) of the provinces
- Initial districts affected were in North Eastern and Coast (December 2006)
- January 2007 ; Central Nairobi and Eastern
- Feb/March 2007; Rift Valley
- Total reported cases were 700
- Reported deaths 158 (23%)

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RVF in Kenya- Humans and Animal Detection

Legend:
- Rvf confirmed in livestock only.shp
- Rvf in livestock & humans.shp
- Rvf in humans only.shp
- Kenya_new3.shp

Introduction

- A population based survey was conducted to determining factor associated with

  1. Acute RVF infection

  2. Severe RVF disease

  3. Death (mortality)

  in humans between January - March 2007

- Study carried out in the three mostly affected districts - Baringo, Kilifi and Garissa

Materials and Methods (1)

Enrollment procedures

- Line lists were used to identify villages where **more than one** probable or confirmed RVF case occurred

- For each identified villages all households were enumerated using GPS mapping or village elders

- Households were selected using a random number tables

- A household was defined as constituting persons who eat food cooked from the same pot

- Statistically we required to enroll 20 controls per case village inorder to detect a RVF seroprevalence of 15%

Materials and Methods (2)

- Informed written consent was sought and obtained

- A standard questionnaire was administered to

  - All consenting individuals $\leq$ 16 years

  - An attempt was made to randomly enroll one child **/** household aged 5 - 14 years

  - Household head (separate questionnaire)

- Serum samples were taken and sent to CDC-KEMRI lab – RVFV specific IgM and IgG antibodies (ELISA)

Information collected in the Questionnaire

- Demographic (age ,sex, occupation, residential locality)
- Clinical (signs/symptoms and administered treatment)
- Contact with animals and mosquitoes
- Mosquitoes risk reduction behavior
- Animal sheltering practices
- Proximity of water source to house
- Housing structure (materials and windows)
- Environmental factors (flooding house)

Sample Size Used for the Final RVF analysis

Total Households = 605
Individuals = 1,380

"no lab results"
"IgM- and IgG+" → Excluded from analysis

404 (67%) HH survey
861 (62%) individual

Data HH linked to Individual survey

Total classified survey = 861

12

Definitions of terms used in final analysis

Acute RVF infection

- Persons whose serum specimen had IgM antibodies by ELISA **OR** had RVFV RNA by RT-PCR

- Person who died while meeting the surveillance probable case definition

Severe RVF disease

- Persons with evidence of acute RVF infection

- Persons who died or reported hemorrhagic phenomenon i.e. nose bleeding, bleeding gums, bloody stool, vomiting blood, skin purpura, cough with blood

861 Classified survey

Analysis 1   202 (23%)   659 (77%)

(acute RVF infection)   (no acute RVF)

Analysis 2   52 (26%)   150 (74%)

(Severe illness)   (Mild /asymptomatic)

Demographic characteristics of acute RVF infection sero positivity

Characteristic	Seropositive*	(%)	95% CI
District			
Baringo	56/168	(33)	26-41
Garissa	76/254	(30)	24-36
Kilifi	70/439	(16)	13-20
Total	202/861	(23)	21-27
Gender			
Male	108/399	(27)	23-32
Female	92/444	(21)	17-25
Age-group in years			
≤ 14	22/114	(19)	13-28
15-29	78/335	(23)	19-28
30-49	58/236	(25)	19-31
≥ 50	37/142	(26)	19-34
Occupation			
Herdsperson	53/150	(35)	28-44
Housewife	52/219	(24)	18-30
Farmer	31/134	(23)	16-31
Student	35/180	(19)	14-26
Formal employment	21/135	(16)	10-23

Proportion of participants with severe RVF disease

Characteristic	n with severe disease/N with acute RVF infection	Proportion of those with acute RVF with severe disease (%)	95% CI for proportion with Severe RVF
District			
Baringo	**19/56**	**(34)**	**22-48**
Garissa	21/76	(28)	18-39
Kilifi	12/70	(17)	9 -28
Total	52/202	(26)	20-32
Gender			
Male	**32/108**	**(30)**	**21-39**
Female	20/92	(22)	14-32
Age-group in years			
≤ 14	**8/22**	**(36)**	**17-32**
15-29	19/78	(24)	15-35
30-49	16/58	(28)	17-41
≥ 50	9/37	(24)	12-41
Occupation			
Herdsperson	**20/53**	**(38)**	**25-52**
House wife	13/52	(25)	14-39
Farmer	6/31	(19)	8-38
Student	9/35	(26)	13- 43
Formal Employment	4/21	(19)	5- 42

Factors associated with acute RVF infection

Exposure	Acute RVF n = 202	Controls n = 659	OR (95% CI)	Adjusted OR (95% CI)
	Univariate comparisons			Multivariable model
Consumed or handled products from sick animals	75(37)	117(18)	2.74(1.93-3.88)	2.53 (1.78-3.61);p< 0.0001
Herdsperson	53(26)	97(15)	2.06(1.41-3.01)	1.77 (1.20-2.63);p= 0.0042
Slaughtered animals	50(25)	89(14)	2.11(1.43-3.11)	NS
Skinned animals	51(25)	88(13)	2.19(1.49-3.23	NS
Milked animals	74(37)	44(22)	2.07(1.47-2.91)	NS
Contact with animal blood	62(31)	114(17)	2.12(1.48-3.04)	NS
Animal birth care	34(17)	55(8)	2.22(1.40-3.52)	NS
Consumed raw milk	57(28)	123(19)	1.71(1.19-2.46)	NS
Water source ≤ 100 m of home	141(70)	403(61)	1.47(1.05-2.06)	NS
Slept outside with herd	33(16)	60(9)	1.95(1.23-3.08)	NS
House flooded previous month	95(51)	247(39)	1.57(1.13-2.18)	NS
Male	108(54)	291(45)	1.42(1.03-1.95)	NS

Factors associated with severe RVF disease among persons with acute RVF infection

Exposure	Univariate comparisons			Multivariable model
	Severe RVF n = 52	Controls n =150	OR (95% CI)	Adjusted OR (95% CI)
Touched aborted animal fetus	13 (25)	12 (8)	3.83(1.62-9.07)	3.83(1.62-9.07);p=0.002
Herdsperson	20 (39)	33 (22)	2.22 (1.12-4.37)	NS
Herded animals	23 (44)	42 (28)	2.04 (1.06-3.92)	NS
Birth Cared for animals	15 (29)	19 (13)	2.80 (1.30-6.03)	NS
Clothing covering legs/arms	5 (10)	4 (3)	3.88 (1.00-5.06)	NS

Factors associated with death among persons with acute RVF infection

Died

(n = 12)
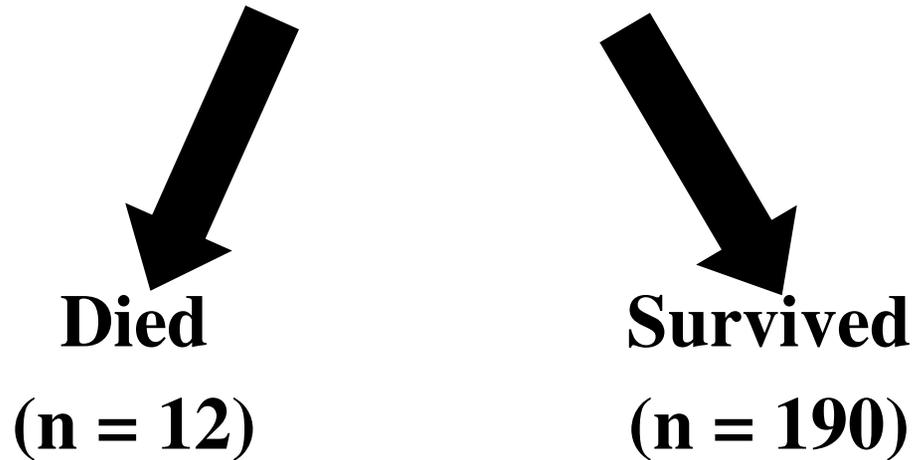
Survived

(n = 190)

Univariate analysis of factor associated with death						
Exposure	Died (n = 12)	Survived (n =190)	OR	(95% CI)	P-value	PAR%
Consumed/handled sick animal products	8(67)	67(35)	3.67	(1.07-12.64)	0.0039	47%

Discussion-1

- Animal contact provides greater inocula of RVFV that result in death compared to mosquito bite

- Low dose RVFV innoculum only stimulates immunity

Baringo district had

> ➢highest RVF seroprevalence (acute and severe RVF)

> ➢lowest case-fatality ratio

> ➢lowest occupations linked with animal care practices

> ➢highest mosquito density

Discussion-2

- High risk groups for RVF

    ➤ Herders - Contact with sick animals

           - Bitten by mosquitoes which have bitten

           infected animals

    ➤ Males - related to the occupation hazard

    ➤ House wives - related to handling sick animal products during food preparation procedures

    ➤ Under 14 years old - high proportion of severe disease

    ➤ Over 50 years - high sero positivity of acute RVF

Discussion-3

- Health education to prevent transmission

- Pictorial narratives with messages translated in local languages:

  ➢ Do not slaughter, skin, milk, or provide birthing care

    to sick animals

  ➢ Bury or burn carcasses during an outbreak

  ➢ Boil all milk

  ➢ Avoid contact with infected tissues, blood, milk, meat , aborted fetuses

  ➢ Wear personal protective equipment when handling sick animal products

Discussion-4

Proximity to water source

- Significant factor during univariate analysis

- Posting these RVF preventive messages - near animal drinking water sources such as rivers and streams

- Place public health officials or CHWs

- Perhaps larvicides should be part of the public health effort

Epidemiology triad for RVF

Humans

√

?

Environment

Sick animal

Vector (mosquito)

? ?
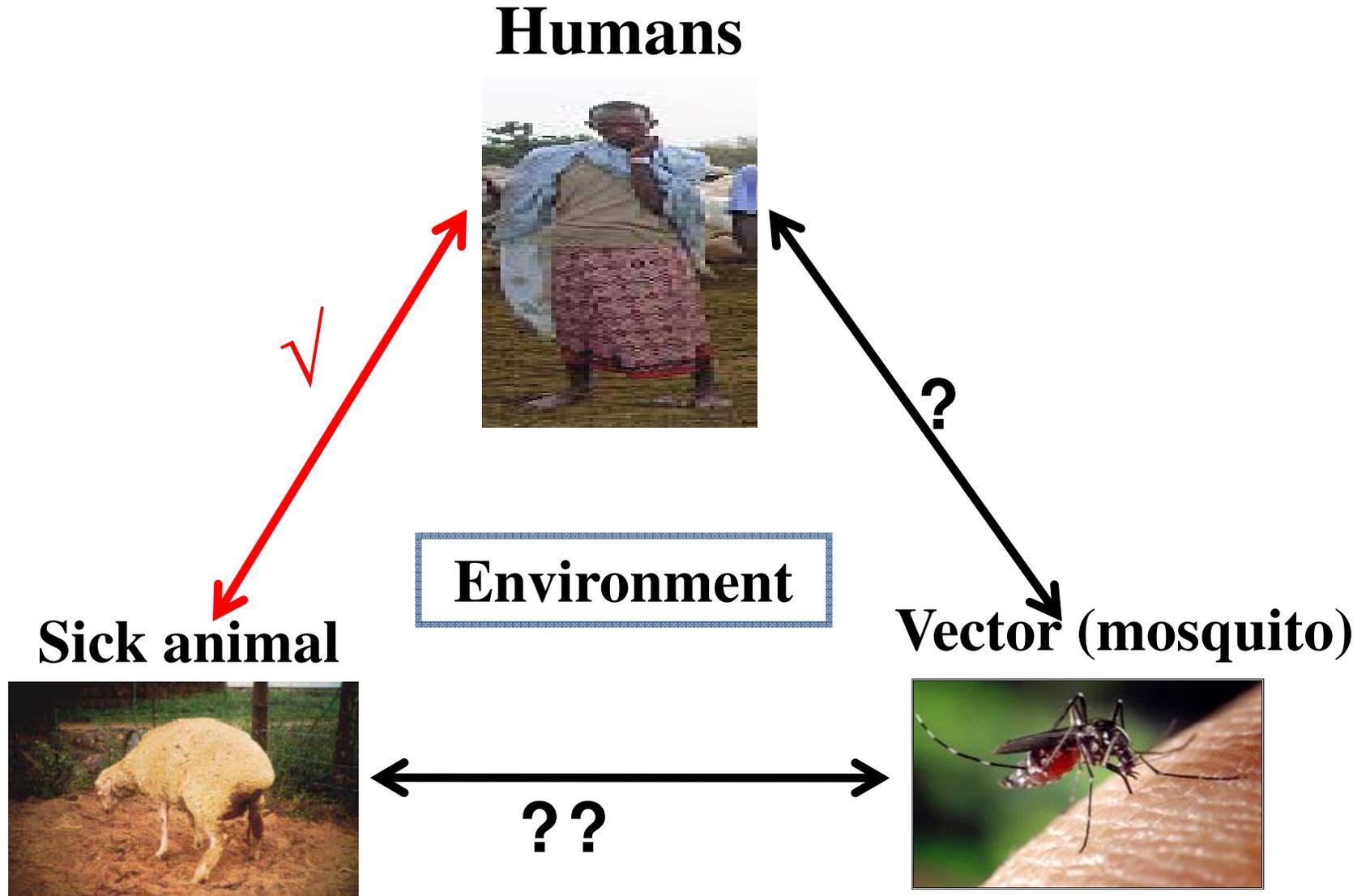
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THANK YOU