

# From risk to transmission: a contribution of anthropology to diarrheal disease epidemiology

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What does remoteness mean for disease?  
*How* does remoteness matter to disease?

The problem:

Risk is usually measured at the individual level (wash hands? Drink clean water?)

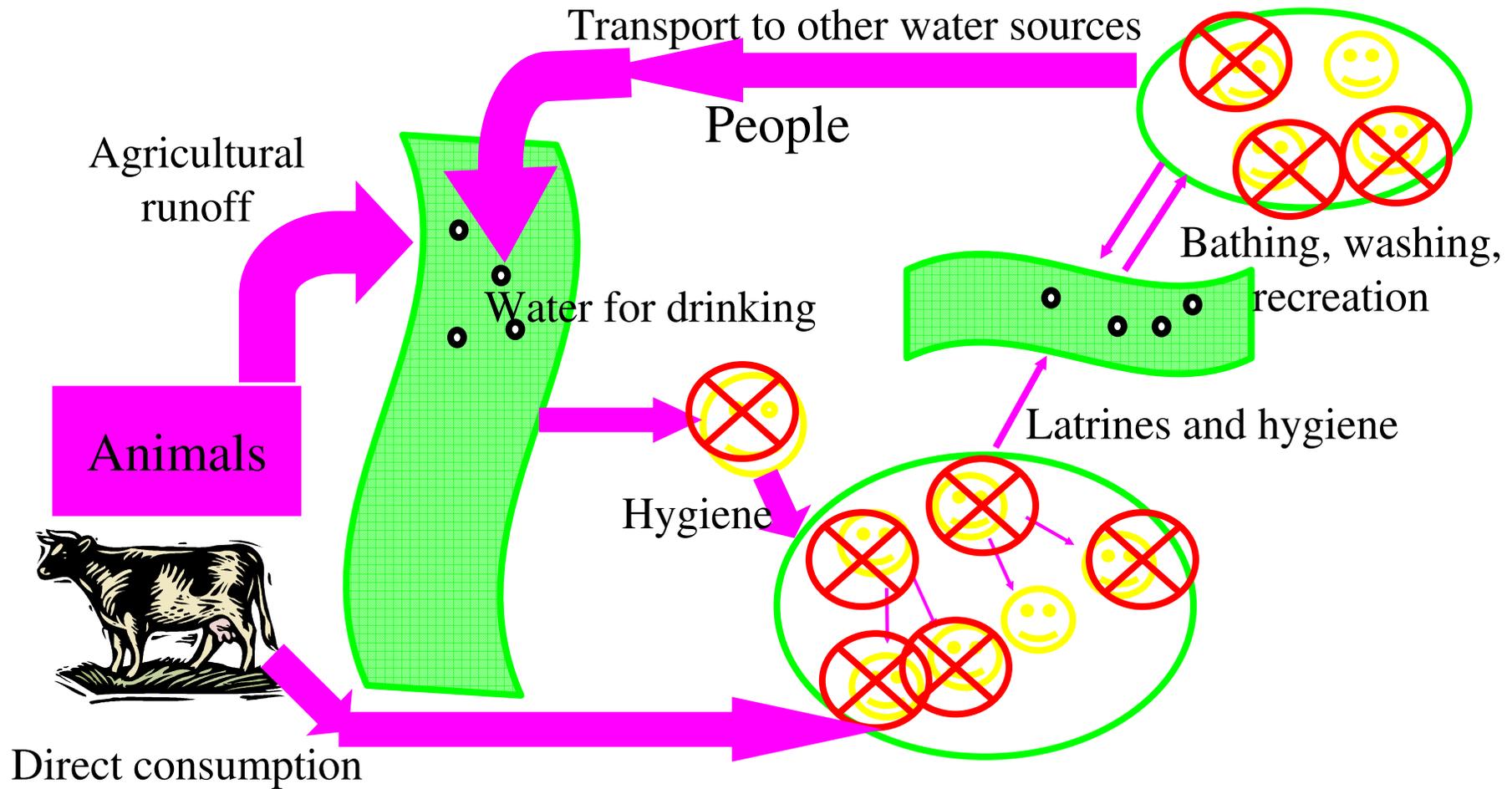
rather than the population level (social network density? House proximity? Village wealth?)

How to assess disease transmission pathways across landscapes and networks?

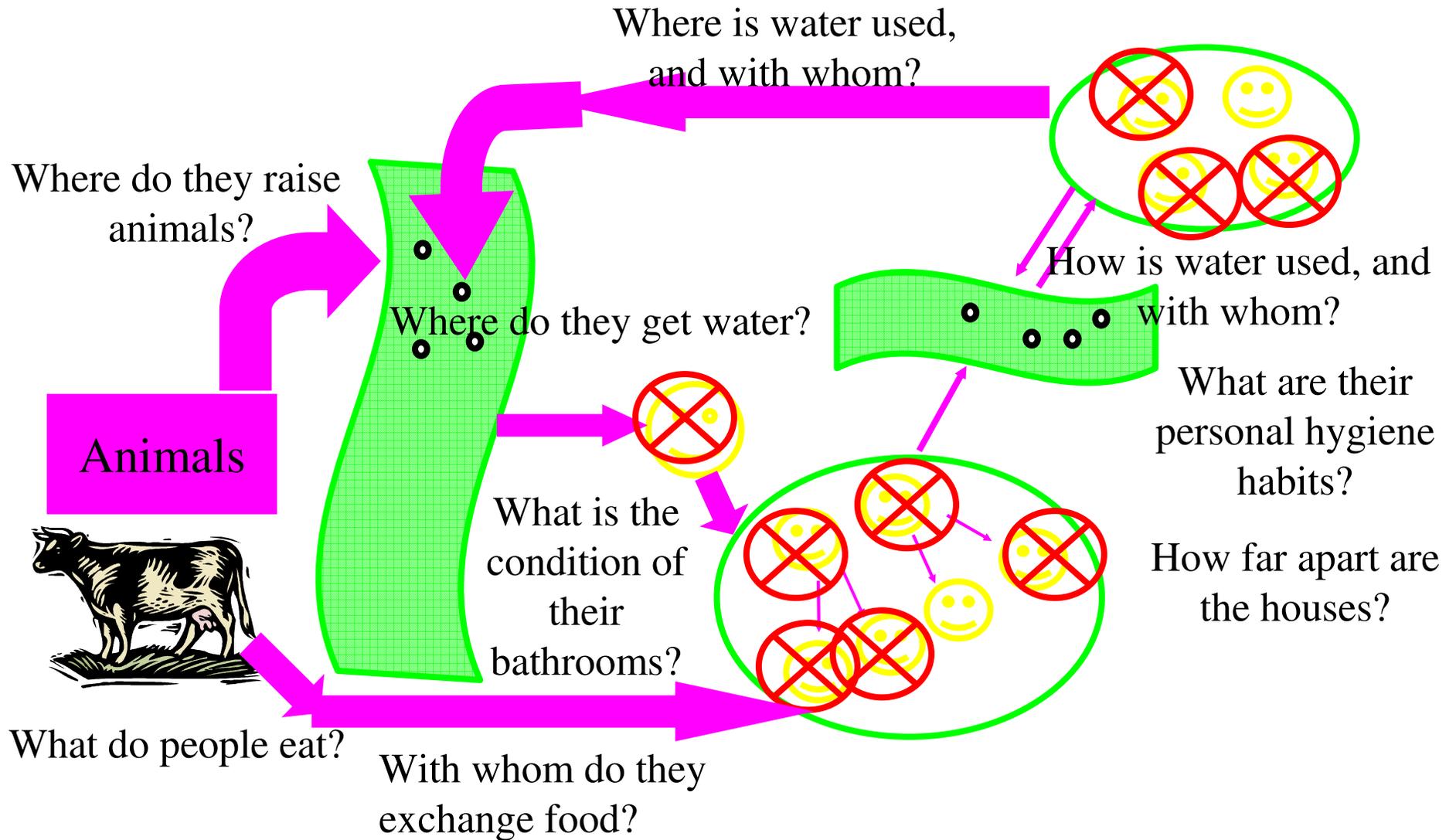
# Risk is Seen as Individual, not Social, in Eight CDC Cholera Transmission Studies

	Peru (Trujillo)	Peru (Piura)	Peru (Iquitos)	Ecuador (Guayaquil)	El Salvador	Bolivia (rural)	Brazil (rural)	Guatemala (G. City)
<b>Waterborne</b>								
<b>Municipal water</b>	+	+		+				
<b>Surface water</b>			+		+	+	+	
<b>Putting hands in vessel</b>	+	+						
<b>Foodborne</b>								
<b>Street vendors' foods</b>		+						+
<b>Street vendors' drinks</b>		+		+				+
<b>Street vendors' ice/ices</b>		+						+
<b>Leftover rice</b>		+	+					+
<b>Fruits/vegetables</b>			+					
<b>Seafood</b>								
<b>Uncooked seafood</b>				+				
<b>Cooked seafood</b>				+	+			

# Transmission Chains



# Transmission Chains



# Anthropological collaboration with epidemiology

Helps develop appropriately complex  
theoretical models

Helps define variables and measures

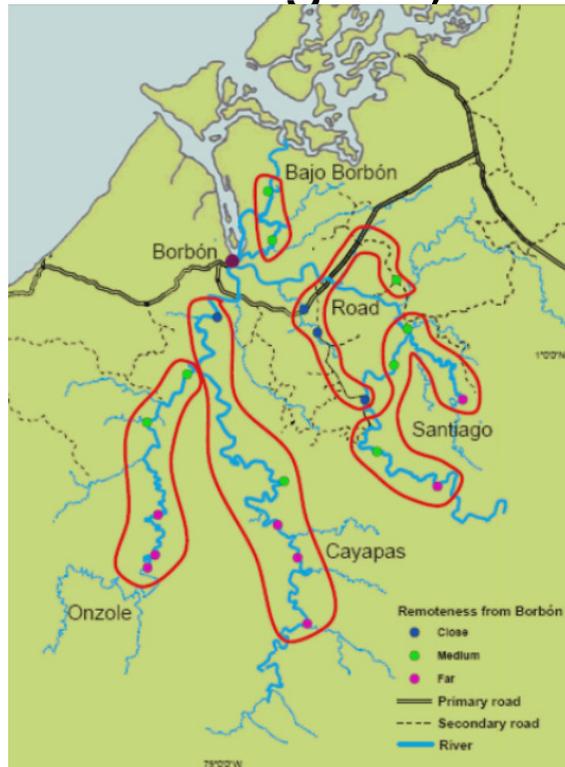
Helps produce and interpret quantitative  
data

Helps suggest new questions and develop  
culturally sensitive interventions

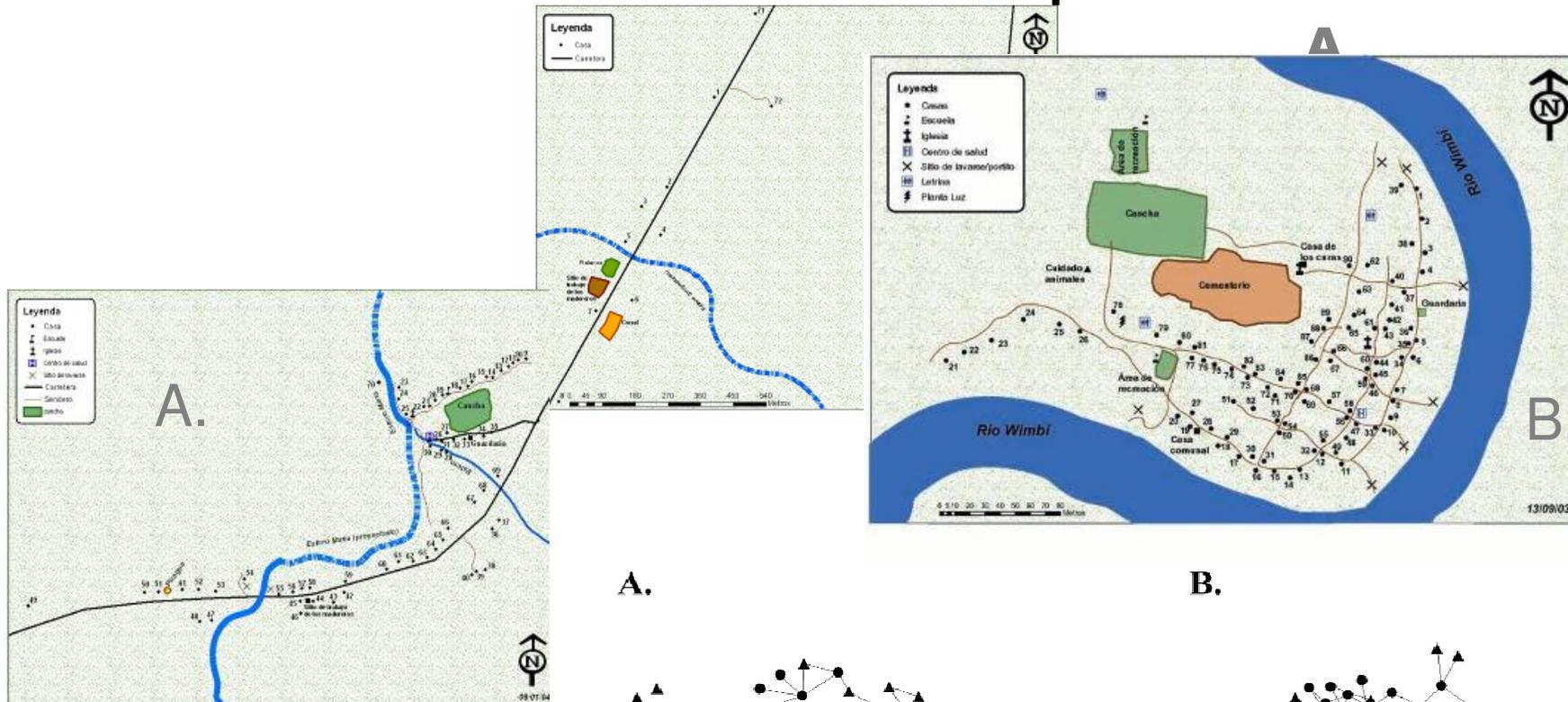
# Study Site: Esmeraldas, Ecuador



Coastal rainforest  
(Choco region)

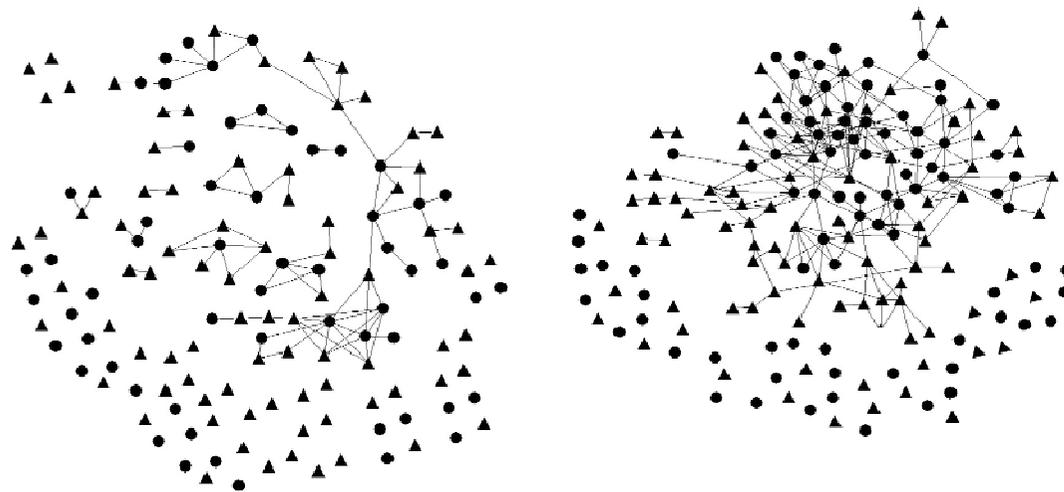


# Social networks: Explore geographic versus social space



A.

B.



# The context: demographic changes

In 2003

Population	4204
Houses	892

In 2004

Population	4144
Houses	960

In 2005

Population	3732
Houses	922

Changes during  
the year

Changes during  
the year

Births	103
Deaths	12
Departures	734 (18%)
Arrivals	557 (15%)

Births	118
Deaths	20
Departures	864 (23%)
Arrivals	566 (15%)

**Reasons for population movement:**

**Studying, working, “new house”, “problems”**

# Demographic changes

## Departures versus Arrivals

“Race”: more “mestizos” arriving than leaving

Literacy: more illiterates arriving than leaving

Age: more adolescents (13-18) leaving, more children (< 5) arriving

## Patterns by remoteness

% mestizo: more “mestizos” in near communities (12%) than far ones (4%)

Years lived in the town: lower in near communities (13 years) than far ones (21 years)

# Changes in services

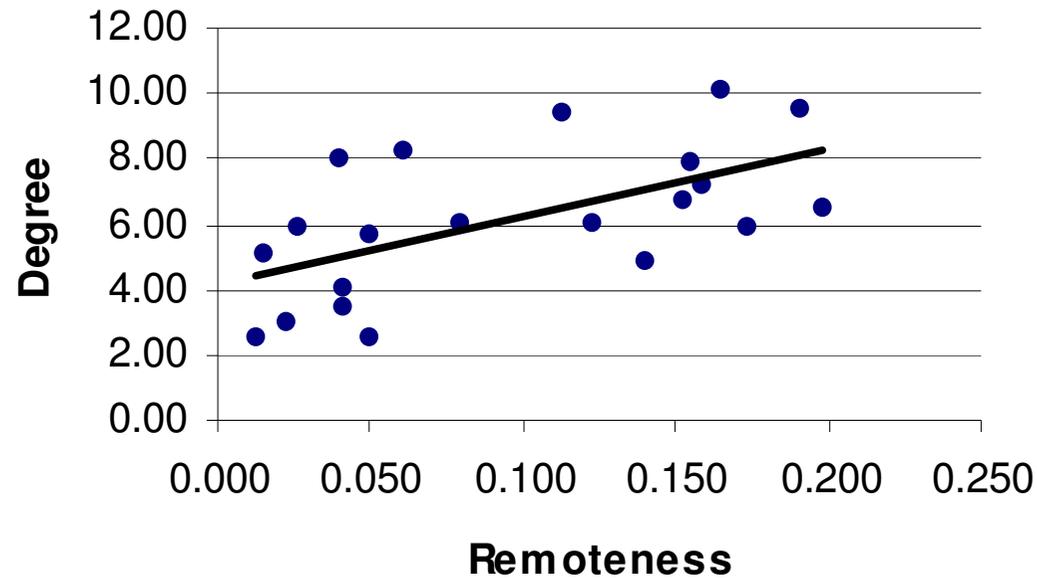
**Comparing 21 towns in 2003 with 2007:**

	<b>2003</b>	<b>2007</b>
<b>Cell phone service:</b>	<b>0</b>	<b>8</b>
<b>Electricity:</b>	<b>10</b>	<b>11</b>
<b>Treated/piped water:</b>	<b>2</b>	<b>4</b>

# Sociodemographic data for 21 towns

	Mean Age	Mean Educ.	% Afro	Mean Years Resid.	% Local Origin
21 Towns	35.1	4.8	90.6	23.3	51.3
Range	32-43	3.1-6	32-100	7-33	0-79

# Relation between social network (passing time network) and remoteness

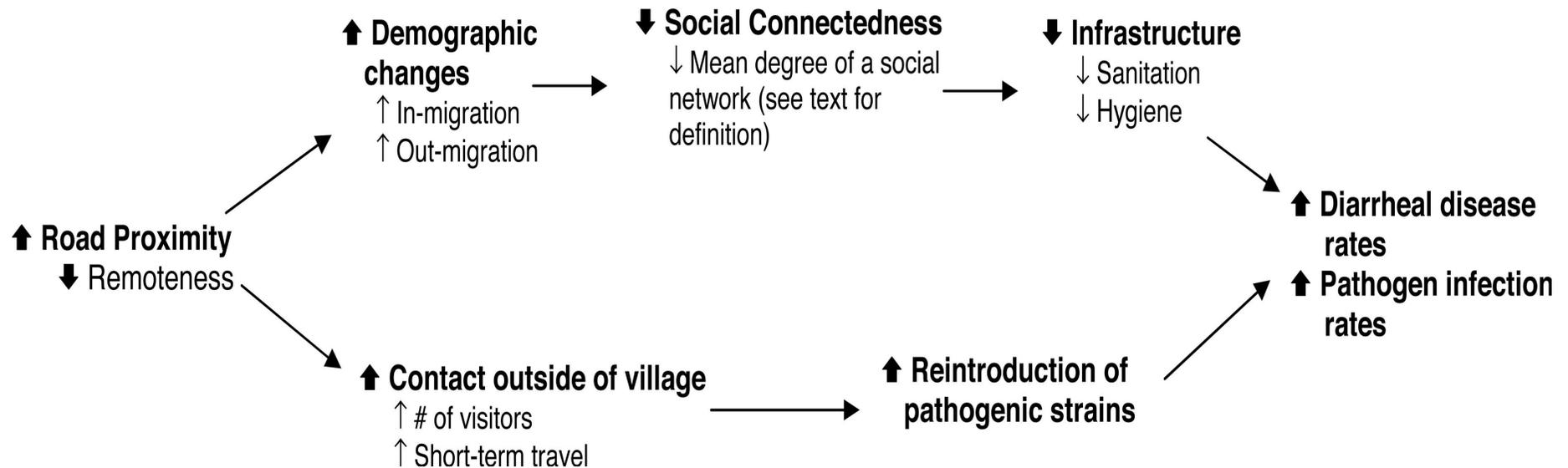


$$R^2 = 0.50, p \leq 0.05$$

# Infection as a Function of Remoteness

	<i>E. coli</i>	Rotavirus	<i>Giardia</i>	Diarrhea
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Remote	1.00	1.00	1.00	1.00
Medium	3.0 (0.8, 11.9)	1.3 (0.5, 3.2)	1.2 (0.7, 2.0)	1.8 (1.1, 3.0)
Close	3.9 (1.1, 13.6)	4.1 (2.0, 8.4)	1.6 (1.0, 2.4)	1.8 (1.2, 2.6)
Continuous	8.4 (1.6, 43.5)	4.0 (1.3, 12.1)	1.9 (1.3, 2.7)	2.7 (1.5, 4.8)

# A possible causal diagram



# Conclusions

Individual behavior does not explain all diarrhea risk

Social context and transmission dynamics matter (house proximity, network density, migration patterns, physical environment)

Anthropological concepts and methods assist measurement of context and transmission

Findings from multi-method studies may yield more effective and appropriate interventions

# With thanks to:

## Institutions

- Centro de Biomedicina UC.
- Universidad San Francisco
- University of Michigan
- Trinity College
- Ministerio de Salud Pública
- Asociación de Promotores



## Field team

- Carmen Campaña
- Karina Ponce
- Jeanneth Yépez
- Simón Quimi
- Junior Mina
- Ana Estupiñan
- Maritza Rentería
- Geovanny Hurtado
- Denny Tenorio
- Liliana Requene
- José Ortiz



## Quito team

- Gabriel Trueba
- Mauricio Espinel
- Elizabeth Falconi
- Pablo Endara
- Nadia Veira
- Rossana Segovia
- Patricio Rojas
- Juan Carlos
- Maria Eloisa Hashin
- Deisy Parrales
- Manuel Baldeón
- Nancy Castro

**And especially the local communities**



# Diarrheal Disease Worldwide

- Major cause of childhood death in developing countries.
  - Causes about 1.5 million of the 10.8 million annual deaths worldwide in children under age five (Victora et al. 2000, Jones et al. 2003)
- Causative agents: *Giardia*, *Rotavirus*, *E. Coli*, *Cholera*
- Transmission routes
  - Contaminated water or food sources
  - Hygiene
  - Sanitation
- Susceptibility increased through
  - Overcrowding, poverty, malnutrition, hyperinflation, underinvestment
- Varying levels of research attention
  - Pre-ORT; post-ORT; child survival; integrated management of the sick child; millenium development goal

# Cambios socioeconómicos por casa, de acuerdo con lejanía

Pueblo	Television			Finca		
	T1	T2	p	T1	T2	p
<b>Cercano</b>	<b>42%</b>	<b>34%</b>	<b>0.36</b>	<b>80%</b>	<b>74%</b>	<b>0.27</b>
<b>Mediano</b>	<b>26%</b>	<b>21%</b>	<b>0.55</b>	<b>89%</b>	<b>82%</b>	<b>0.37</b>
<b>Lejano</b>	<b>8%</b>	<b>20%</b>	<b>0.03</b>	<b>95%</b>	<b>77%</b>	<b>0.01</b>

**T1=3-10/2004**

**T2=8/2005-3/2006**

# **A Truncated History of Causal Models of Diarrhea in Medical Anthropology, I**

**1970s-80s: cultural construction of illness**

**Weiss (1988) for diarrheal diseases:**

**Patterns of distress (signs, symptoms, seriousness)**

**Explanatory models (meaning attributed to illness)**

**Patterns of help seeking**

**Specific treatments (ORT, medicine, magico-religious)**

**Diarrhea as disease (biomed diagnosis, epid., outcome)**

**Social context: education, income, sanitation**

# **A Truncated History of Causal Models of Diarrhea in Medical Anthropology, II**

**Weiss 1988**

**Some common explanatory models of diarrhea causation worldwide**

**Food types (fatty, undercooked...)**

**Imbalance of heat and cold**

**Quality of breast milk**

**Physical insult (fall, injury)**

**Supernatural factors (possession, evil eye)**

**Ritual pollution (exposure or contact w. the impure)**

**Moral misbehavior (deeds of child or parent, esp. promiscuous sex or pregnancy while breastfeeding)**

**Natural milestones (teething, crawling, walking)**

**Infection (sanitation and hygiene)**

# A Truncated History of Causal Models of Diarrhea in Medical Anthropology, III

1970s-80s: ethnomedical construction of illness

Kendall et al., 1983, 1984, 1990

e.g., Latino (Honduran!) indigenous categories

*Empacho*: common, fatal, explosive

*Mal de ojo*: fever, upset stomach, among children

*Caida de mollera*: fallen fontanelle, incomplete development of palate (infants)

*Lombrices*: worms. Common, normal.

Green 1986, Bangladesh

*Dasto*: 1) undifferentiated; 2) w. vomiting and weakness (cholera?); 3) bloody; 4) with green or yellow mucous

# **A Truncated History of Causal Models of Diarrhea in Medical Anthropology, IV**

**1990s+ biocultural, ecological, political-economic, interpretive**

**Mixed anthropological and epidemiological methods & models:**

**Jenkins and Howard 1992: Risks of diarrhea in New Guinea**

**Kaltenthaler and Drasar 1996: Hygiene behavior in Botswana**

**Beria et al. 1998: MD prescribing for diarrhea in Brazil**

**Briggs 2003: cholera in coastal Venezuela**



# Prevalence of resistance by river basin and road status

<b>River basin/Road status</b>	<b>Overall (infections/100)</b>	<b>Cases (infections /100)</b>	<b>Controls (infections /100)</b>
<b>Bajo Borbon</b>	35	54	33
<b>Santiago</b>	30	54	29
<b>Cayapas</b>	26	42	26
<b>Onzole</b>	24	37	23
<b>Road Borbon</b>	35	42	35
	35	55	33
<b>Road village</b>	35	45	34
<b>River village</b>	28	48	27

# Antibiotic resistance for individuals in categorized communities

<b>Remoteness Category</b>	<b>Sulfamethoxazole, Tetracycline, and Ampicillin OR (95% CI)</b>	<b>All Antibiotics* OR (95% CI)</b>
<b>Road village</b>	1	1
<b>River village</b>	0.38 (0.18, 0.83)	0.54 (0.39, 0.75)
<b>Road</b>	1	1
<b>Santiago</b>	0.28 (0.07, 1.1)	0.46 (0.28, 0.79)
<b>Cayapas</b>	0.41 (0.21, 0.83)	0.53 (0.34, 0.81)
<b>Onzole</b>	0.27 (0.14, 0.49)	0.46 (0.32, 0.65)
<b>Bajo Borbon</b>	0.25 (0.07, 0.91)	0.31 (0.13, 0.70)

**Eisenberg et al. 2007, unpublished data**

# Taxonomía de la enfermedad

	Symptoms							Treatment							Age		Causes					
	Diarrhea	Fetid, smelly	Greenish	Bloody	Fever	Vomit	Lack of appetite	What?			Where or who?				< 5 years	> 5 years	Excessive eating	Lack of hygiene	Presence of spirits	Fear or strong impression	Unexpected fall in the water	Activities between dusk and dawn
								Herbal	Biomedical	Secret prayers	Home	Curandero	Promotor	Doctor								
Ojo	+/-				+	+	+	+		+		+			+	+						
Espanto Seco	+/-				+	+	+	+	+/-	+		+	~		+	+			+			
Espanto de Agua	+/-				+	+	+	+	+/-	+		+			+	+				+		
Malaire	+?	+				+	+	+	+/-		+/-	+			+	+		+				+
Almorranas	+/-			+				+	+/-						+	+						
Sereno	+		+					+							+							+
Colerín	+							+	+/-		+/-	+										
Bicho/Parasito	+				+	+		+				+		+	+	+	+					
Infección	+	+			+	+	+	+/-	+				+/-	+	+	+		+				
Indigestión	+							+/-	+		+/-					+	+					

# Contrastes en causas locales vs. biomedicas

**‘Infección’ esta causada mas por *giardia* (42%)  
que la rotavirus (19%) o *E. coli* (9%).  
(Diferencias en síntomas?)**

***E.coli* es atribuido mas frecuentemente a la  
‘infección’ (~29%, pero los números son bajos).**

**Se escogió ‘no sabe/no responde’ en casi 50%  
de los casos de rotavirus, and 40% de los casos  
de giardia.**

# Términos locales para males diarreicos por lejanía del pueblo

	<b>Infec- ción</b>	<b>Mal- aire</b>	<b>Mal de Ojo</b>	<b>Bich os</b>	<b>Sere no</b>	<b>Almor- ranas</b>	<b>Espa nto</b>	<b>Otro</b>	<b>No Sabe/NR</b>	<b>Per- dido</b>	<b>Total</b>
<b>Close</b>	81	4	5	23	4	4	2	29	116	7	275
	29.7%	1.5%	1.8%	8.4%	1.5%	1.5%	0.7%	10.6%	42.1%	2.2%	100%
<b>Med</b>	16	4	3	7	3	0	1	4	41	3	82
	19.5%	4.9%	3.7%	8.5%	3.7%	0	1.2%	4.9%	50%	3.7%	100%
<b>Far</b>	20	7	1	5	0	6	2	15	57	8	121
	16.7%	5.0%	0.8%	4.2%	0%	5.0%	1.7%	12.5%	47.5%	6.7%	100%

**Use of nonbiomedical terms is more heavily skewed towards infección in the close villages compared to medium and far.**

**In medium villages, more diarrhea cases identify with malaire, mal de ojo, sereno, and espanto than in close villages.**

**In far villages, more identify with malaire, almorranas, espanto and otro compared with close villages.**

**$X^2 = 36.79, p = 0.0056$**

# Historical context of anth-epid collaboration in diarrheal diseases

1970s-80s, cultural construction of illness

Help-seeking, meaning, local definition, treatments, intervention design, prevalence measurement

1990s+ biocultural, ecological, political-economic, interpretive. Mixed anthropological and epidemiological methods & models:

Jenkins and Howard 1992: Risks of diarrhea in New Guinea

Kaltenthaler and Drasar 1996: Hygiene behavior in Botswana

Beria et al. 1998: MD prescribing for diarrhea in Brazil

Briggs 2003: cholera in coastal Venezuela

Eisenberg et al. 2006; Trostle et al. 2009: diarrhea in coastal Ecuador