

# Strengthening analysis of social determination of health within an Eco-Bio-Social (EBS) approach: Lessons from a dengue study pilot application in Machala, Ecuador

Spiegel JM <sup>1</sup>,



Breilh J <sup>2</sup>,



Beltrán E <sup>3</sup>,



Mitchell-Foster K <sup>1,4</sup>



1 -Global Health Research Program, University of British Columbia, Vancouver, Canada

2 - Universidad Andina Simón Bolívar Sede Ecuador, Quito, Ecuador

3 - Servicio Nacional de Control de Enfermedades Transmitidas por Vectores Artropodos, Ministerio de Salud, Machala, Ecuador

4 - Interdisciplinary Studies Graduate Program, University of British Columbia, Vancouver, Canada

**Jerry Spiegel** MA, MSc, PhD  
Professor

Liu Institute for Global Issues



School of Population & Public Health

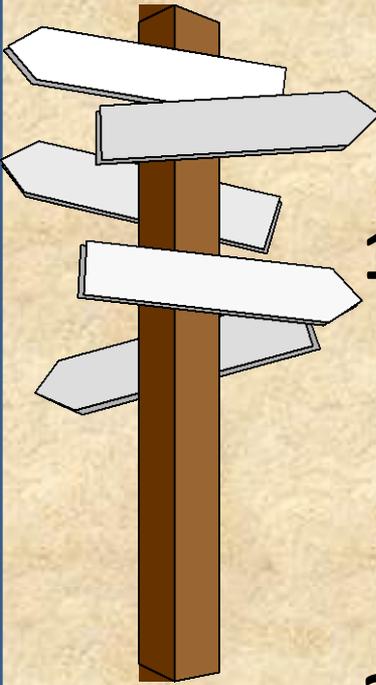
[jerry.spiegel@ubc.ca](mailto:jerry.spiegel@ubc.ca)

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Sustaining Ecosystems, Supporting Health

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# Outline



- 1. Background**

**The Challenge of analyzing social factors**

***Social Determination & the INSOC approach***

**Ecuador case study**

- 2. Objective & Methods**

- 3. Results**

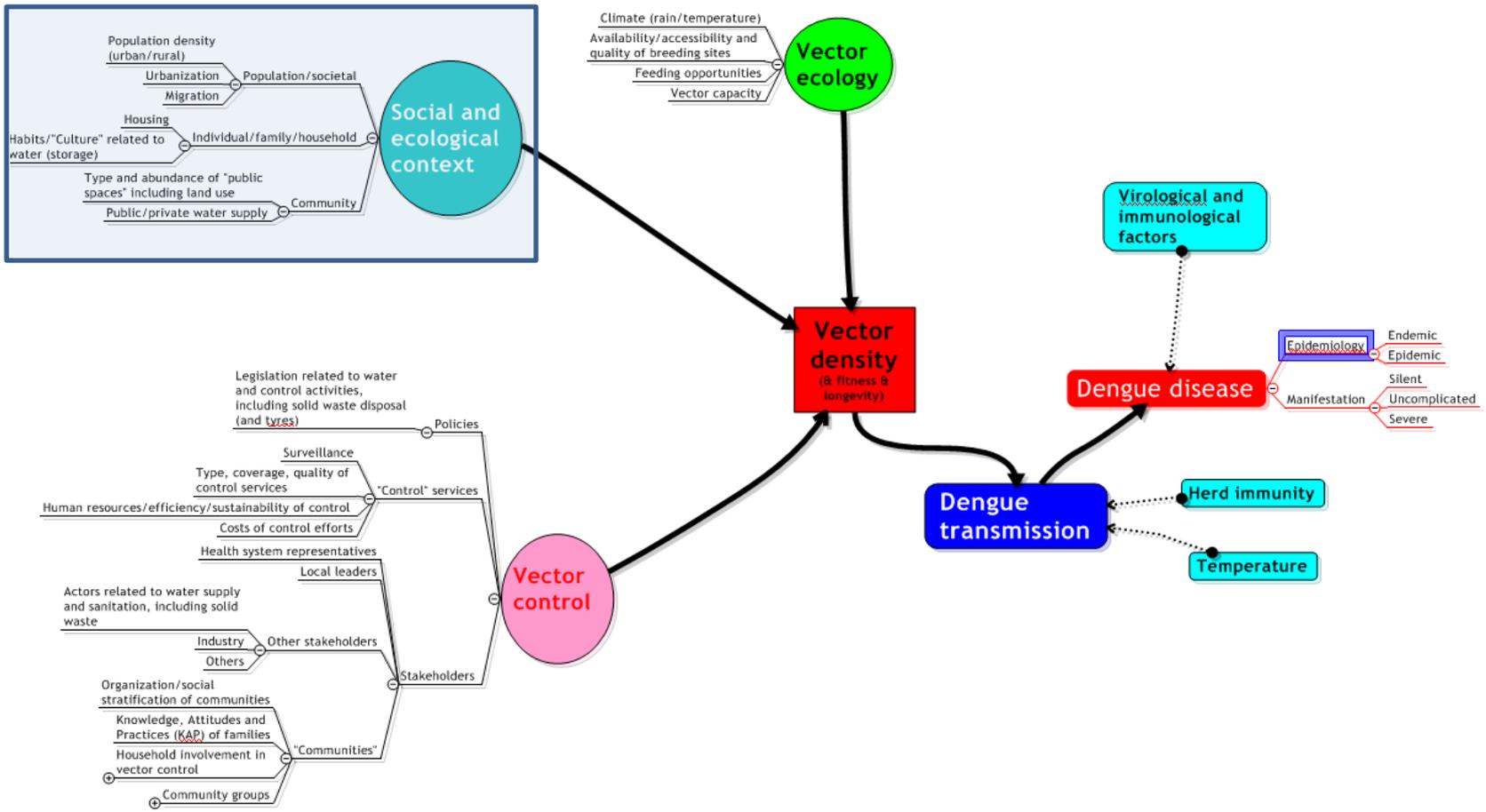
- 4. Discussion & Conclusions**

# Background

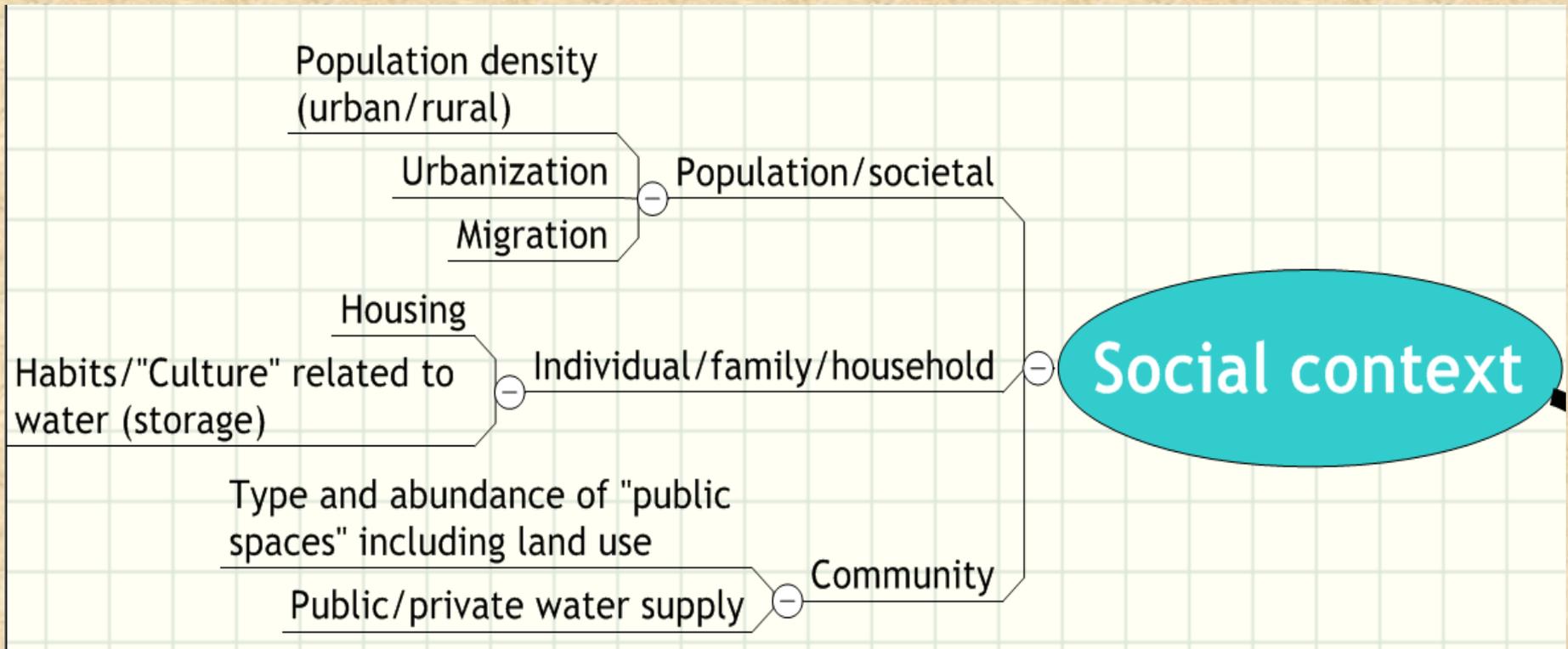
- Creation of networks of TDR/IDRC-funded Eco-Bio-Social projects [in the Latin America and Caribbean region (EBS-LAC) & Asia] is providing an opportunity to systematically examine benefits of applying an EBS approach
- **Analysis of social environments** appears to be only minimally developed – and **can benefit from further analysis**
- 2010 Situation Analysis for the “**Meeting capacity-building and scaling-up challenges to sustainably prevent and control dengue in Machala, Ecuador**” study provided an opportunity to pilot a more comprehensive approach to characterizing social environments

# Eco-bio-social research on dengue

## Common conceptual framework



# Dengue Conceptual Framework



# Characterization of previous studies

Study	How “social factors” analyzed	Comment
<p><b>Mondini &amp; Chiaravalloti (2007)</b> Socioeconomic variables and dengue transmission</p>	<p>socioeconomic factor <b>generated by principal component analysis</b> was used to group census tracts into four socioeconomic levels</p>	<p><b>lack of an association</b> between risk of occurrence of dengue and socioeconomic levels in almost all years studied indicates that this issue deserves further study</p>
<p><b>Ma et al. (2008)</b> Socioeconomic determinants of dengue incidence in Singapore</p>	<p><b>Social strata deduced from factor analysis</b> (associated with dengue incidence) of socio-demographic variables</p>	<p>DF/DHF incidence was ecologically <b>associated with some socioeconomic/demographic characteristics</b></p>
<p><b>Quintero et al. (2009)</b> An ecosystemic approach to evaluating ecological, socio-economic and group dynamics</p>	<p>High. Medium, Low socioeconomic <b>strata used – but not defined how derived</b></p>	<p><b>association between socioeconomic stratum</b> and presence of the vector was identified</p>
<p><b>Arunachalam et al (2010)</b> Eco-bio-social det.erminants of dengue vector breeding</p>	<p><b>Analysis of specific socio-demographic variables</b> (e.g. density); social strata referred to but not defined</p>	<p>Social stratum variables <b>associated with higher (but not significant) PHI</b> were middle or lower socioeconomic strata</p>
<p><b>Da Costa et al. (2010)</b> Determination of priority areas for dengue control actions</p>	<p><b>Strata were set according to socio-demographic conditions</b> (e.g. water, density); Explanatory social variables not the focus</p>	<p><b>Associations with dengue observed</b></p>

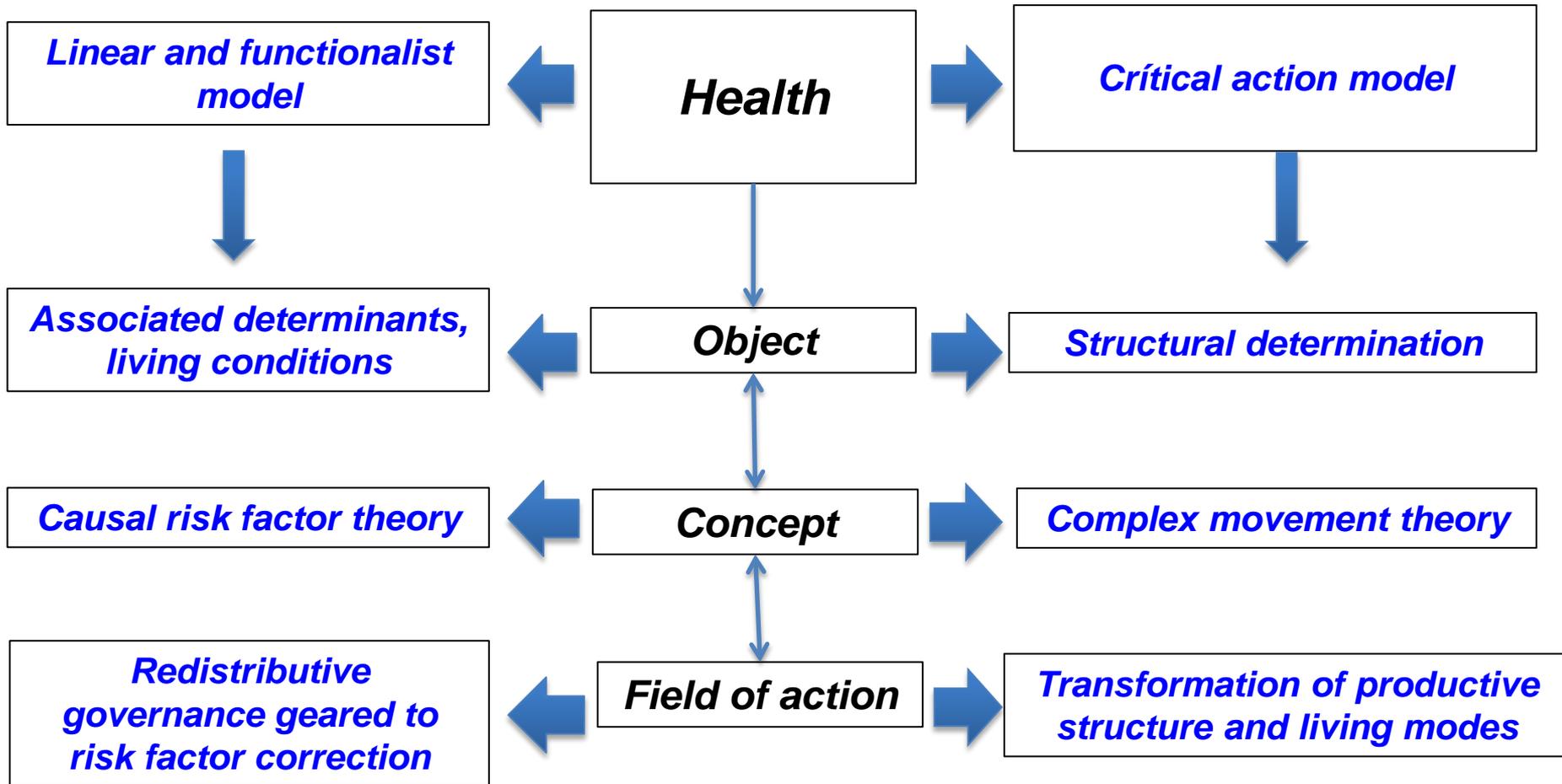
# Objective

To strengthen social analysis within an EBS investigation of dengue risk.....

.... our team adapted previous work of Jaime Breilh for field-testing social position as a blend of class, social control and other factors.



# ***Need to overcome the linear reductionist perspective about health determination***



# Materials and Methods

- we created a Social Insertion Index [INSOC] and Housing Quality Index [HQI]) by coding responses from a randomized survey of 2000 families in 20 Machala clusters conducted.
- We then compared insights gained from using these indices with observation using the impressionistic social class designations of other studies.

# INSOC (Social Insertion Index)

New variable derived from coding these variables:

- Self-identified socio-economic status
- Ownership Status
- Relationship to work
- Most important source of income

## Versus

Impressionistic identification

Purely income characterization

Categories derived from social environment exposures

INSERCIÓN SOCIAL	FRACCIÓN SOCIAL	PREGUNTA DS0301	PREGUNTA DS0401	PREGUNTA DS0501	PREGUNTA DS0601	CHEQUEO INGRESOS
1ª	Capa-media-pudiente	1-2-3	1-2-3-4-5	1-2-3	6-5-1	☐
2ª	Capa-media-pobre	4-5	4-6	1-2-3	6-5	☐
3ª	Pequeño-productor-artesano	6ª	1-2-3-4-5	2-3	1-10-3	☐
4ª	Pequeño-productor-comerciante	7-8	3-1-5-42	2-3-1	1-10-3	☐
5ª	Pequeño-productor-agricultor	14	2-3-4-5	2-3-1	1-10-32	☐
6ª	Empresarios	8-14	1-2-3-4-5	2-3-1	1-36	☐
7ª	Obreros	9	6-4	1-3-2	8-67	☐
8ª	Sub-Asalariado	4-6-15-10	6-4	1	2-10	☐
9ª	Jubilado	11	2-34-5	1	4	☐
10ª	Militares	12	1-2-3-4-5	2-3-1	5-15	☐
11ª	Rentistas	10-13	1-2-3-4	1-4	1-3	☐
12ª	Subsidiado	13	6	4	13	☐
13ª	Desempleado	13	6	4	10-12-14	☐
14ª	No-Clasificable	☐	☐	☐	☐	☐
15ª	No-datos	☐	☐	☐	☐	☐

**Table 2.2 Social status stratification by Class Perception and measurement by Social Insertion Index**

Cluster No.	by Social Insertion Index*	by Perceived Social Strata**
		<b>ALL</b>
	<b>HIGHER</b>	<b>HIGHER</b>
7	46.7	Low-Middle
4	32.6	Upper-Middle
10	26.2	Low-Middle
13	21.1	Low-Middle
15	19.2	Low-Middle
6	17.8	Upper-Middle
	<b>MEDIUM</b>	<b>MEDIUM</b>
16	16.7	Low
8	16.1	Upper-Middle
1	15.8	Low-Middle
19	14.9	Upper-Middle
11	14.8	Low-Middle
5	14.3	Upper-Middle
	<b>LOWER</b>	<b>LOWER</b>
12	10.5	Low-Middle
3	10.4	Low-Middle
18	10.2	Low-Middle
14	6.8	Low
9	5.8	Low
17	5.5	Low-Middle
20	5.1	Low-Middle
2	4.7	Low-Middle

**NOTES:**

\* Association with highest education attained highly significant (Pearson chi-square  $p < .001$ )

\*\* Association with highest education attained not significant (Pearson chi-square  $p = .369$ )

Association with Education (a noted proxy) much stronger with INSOC than with PERCEIVED assessments

2.3a) Perceived Class Designation and Education\*\*

			Highest Education Attained*					
			Pre-school	Primary	High-School	Technical	University	Total
			1	2	3	4	5	
PERCEIVED	1-low	Count	6	77	62	5	5	159
		%-within PERCEIVED	3.8%	48.4%	39.0%	3.1%	3.1%	100.0%
	2-middle	Count	21	261	216	25	25	606
		%-within PERCEIVED	3.5%	43.1%	35.6%	4.1%	4.1%	100.0%
	3-upper middle	Count	8	102	85	7	7	231
		%-within PERCEIVED	3.5%	44.2%	36.8%	3.0%	3.0%	100.0%
Total		Count	35	440	363	37	37	996
		%-within PERCEIVED	3.5%	44.2%	36.4%	3.7%	3.7%	100.0%

NOTE: \*\* Association with highest education attained not significant (Pearson chi-square  $p = .369$ )

2.3b) Social Insertion Index Designation and Education\*\*

			Highest Education Attained*					
			Pre-school	Primary	High-School	Technical	University	Total
			1	2	3	4	5	
STRATA	1-low	Count	17	188	130	8	33	376
		%-within STRATA	4.5%	50.0%	34.6%	2.1%	8.8%	100.0%
	2-medium	Count	14	140	109	9	32	304
		%-within STRATA	4.6%	46.1%	35.9%	3.0%	10.5%	100.0%
	3-upper	Count	4	112	124	20	56	316
		%-within STRATA	1.3%	35.4%	39.2%	6.3%	17.7%	100.0%
Total		Count	35	440	363	37	121	996
		%-within STRATA	3.5%	44.2%	36.4%	3.7%	12.1%	100.0%

NOTE: \*\* Association with highest education attained highly significant (Pearson chi-square  $p < .001$ )

# Association with PPP Index

Table 2.9-Stratified cluster associations with PPP Index

Perceived Social Strata	Social-Insertion-Index	Cluster-No.	PPP-Index (rainy-season)
<b>ALL</b>	16.2		1.38
<b>HIGHER</b>	27.7		.080
HIGHER			
Low/Middle	26.2	10	1.34
Upper/Middle	32.6	4	1.19
Upper/Middle	17.8	6	1.10
Low/Middle	19.2	15	0.68
Low-Middle	21.1	13	0.60
Low/Middle	46.7	7	0.04
<b>MEDIUM</b>	15.5		1.66
Upper/Middle	14.3	5	3.74
Low	16.7	16	2.12
Upper/Middle	14.9	19	1.45
Low/Middle	15.8	1	1.30
Low/Middle	14.8	11	1.17
Upper/Middle	16.1	8	0.99
<b>LOWER</b>	-7.3		1.63
Low/Middle	4.7	2	2.56
Low	5.8	9	2.43
Low-Middle	10.2	18	2.31
Low/Middle	10.4	3	2.16
Low/Middle	10.5	12	1.40
Low/Middle	5.1	20	1.07
Low	6.8	14	0.72
Low/Middle	5.5	17	0.58

NOTE: One-way ANOVA  $p < .001$

→ Pearson chi-square  $p < .001$  between Higher and Other (Medium and Lower) strata

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**Table 1.8 Perceptions of dengue by stratified clusters**

Social Determination Index	Cluster No.	% of participants who have had dengue	% of Participants who are familiar with dengue	% of participants who believe dengue is a serious problem	% of participants who understand the dengue transmission cycle	% of participants who know of or have participated in a community-based control or clean-up effort
High or Low	Machala	11.9	99.7	81.4	88.5	22.1
	ALL	29.2	99.7			
	HIGHER	26.1	99.7	79.2		
Low-Middle	10	18.6	100	78	86	19
Upper-Middle	4	32.6	98	88	88	24
Upper-Middle	6	22.2	99	84	92	18
Low-Middle	15	25.0	100	85	93	29
Low-Middle	13	28.1	99	75	84	24
Low-Middle	7	31.7	100	76	84	19
	MEDIUM	29.1	98.7	83.9		
Upper-Middle	5	25.7	97	86	90	16
Low	16	31.5	100	79	84	38
Upper-Middle	19	42.6	100	85	82	23
Low-Middle	1	22.8	98	77	86	17
Low-Middle	11	25.9	99	79	90	18
Upper-Middle	8	27.4	97	85	78	18
	LOWER	31.9	99.7	81.2		
Low-Middle	2	23.3	99	79	86	13
Low	9	28.8	100	81	88	21
Low-Middle	18	34.7	99	79	82	15
Low-Middle	3	33.3	99	89	93	17
Low-Middle	12	34.2	98	75	85	23
Low-Middle	20	35.9	100	92	84	53
Low	14	27.1	100	86	86	13
Low-Middle	17	38.2	100	83	89	24

# INSOC drives the significance of association with PPP

Table 2.11-Standardized Coefficients of Regression Analysis for factors affecting PPP Index

Model	Education	Education + Housing Quality Index	Education + Housing Quality Index + Social Strata - Individual	Education + Housing Quality Index + Social Strata - Individual + Social Strata - Cluster
Education level Adjusted R <sup>2</sup> = .005	.08 (<.05)	.066 (<.05)	.026	.006
Housing Quality Index Adjusted R <sup>2</sup> = .013		<b>.093 (&lt;.01)</b>	<b>.087 (&lt;.01)</b>	.023
Social Strata - Individual Adjusted R <sup>2</sup> = .022			<b>.106 (&lt;.01)</b>	.034
Social Strata - Cluster Adjusted R <sup>2</sup> = .169				<b>.402 (&lt;.001)</b>

NOTE: A series of regression analyses were conducted in sequence adding additional explanatory factors; Statistical significance is noted in bold, indicating significance level. Adjusted R<sup>2</sup> for the explanatory model is indicated

# Association with Productive Container

Table 2.10-Stratified clusters and associations with Container prevalence and Housing Quality Index

Perceived Social Strata	Social Insertion Index	Cluster No.	PPP Index* (rainy season)	Housing Quality Index*	Most-productive container for Aedes (rainy season)			Most-ubiquitous container		
					1st	2nd	3rd	1st	2nd	3rd
<b>ALL</b>	16.2		1.38	2.48	Ground Tank	Cubeta	Bote	Cubeta	Bote	Bote (derelict)
<b>HIGHER</b>	27.7		0.80*	2.69*	<b>BOTE (563, 28%)</b>			<b>BOTE (1058, 30%)</b>		
Low/Middle	26.2	10	1.34	2.78	Bote	Ground Tank	Cubeta	Bote	Cubeta	High Tank
Upper/Middle	32.6	4	1.19	2.86	Bote	Tires	Bote (derelict)	Bote	Cubeta	Bote (derelict)
Upper/Middle	17.8	6	1.10	2.56	Cubeta	Ground Tank	Bote	Cubeta	Bote	Ground Tank
Low/Middle	19.2	15	0.68	2.62	Bote	Ground Tank	Bote (derelict)	Bote	Cubeta	Cubeta
Low/Middle	21.1	13	0.60	2.60	Bote	Ground Tank	Cubeta	Bote	Cubeta	High Tank
Low/Middle	46.7	7	0.04	2.72	Bote	Ground Tank	Cubeta	Bote	Cubeta	Cubeta
<b>MEDIUM</b>	15.5		1.66	2.40	<b>CUBETA (805, 31%)</b>			<b>CUBETA (1233, 35%)</b>		
Upper/Middle	14.3	5	3.74	2.29	Cubeta	Vases/Houseplants	Misc. derelict	Cubeta	Bote	Bote (derelict)
Low	16.7	16	2.12	2.42	Ground Tank	Bote	Cubeta	Cubeta	Bote	Ground Tank
Upper/Middle	14.9	19	1.45	2.09	Ground Tank	Bote (derelict)	Tires	Cubeta	Bote	Ground Tank
Low/Middle	15.8	1	1.30	2.63	Cubeta	Ground Tank	Bote	Cubeta	Bote	Ground Tank
Low/Middle	14.8	11	1.17	2.54	Bote	Cubeta	Ground Tank	Cubeta	Bote	Bote (derelict)
Upper/Middle	16.1	8	0.99	2.39	Cubeta	Ground Tank	Bote (derelict)	Cubeta	Bote	Ground Tank
<b>LOWER</b>	7.3		1.63	2.39	<b>GROUND-TANK (966, 30%)</b>			<b>CUBETA</b>		
Low/Middle	4.7	2	2.56	2.67	Bote	Ground Tank	Tires	Cubeta	Bote	High Tank
Low	5.8	9	2.43	2.10	Ground Tank	Bote	Cubeta	Cubeta	Bote	Bote (derelict)
Low/Middle	10.2	18	2.31	2.43	Ground Tank	Cubeta	Bote	Cubeta	Bote	Ground Tank
Low/Middle	10.4	3	2.16	2.47	Bote	Cubeta	Tires	Cubeta	Bote	Ground Tank
Low/Middle	10.5	12	1.40	2.72	Cubeta	Bote	Bote (derelict)	Cubeta	Bote	Bote (derelict)
Low/Middle	5.1	20	1.07	2.00	Tires	Bote (derelict)	Bote	Bote	Bote (derelict)	Cubeta
Low	6.8	14	0.72	2.36	Ground Tank	Tires	Garbage	Cubeta	Bote	Ground Tank
Low/Middle	5.5	17	0.58	2.45	Ground Tank	Cubeta	Misc. derelict	Cubeta	Bote	Ground Tank

NOTE: Pearson chi-square  $p < .001$  between Higher and Other (Medium and Lower) strata

# Summary of Results

- **Greater validity of INSOC in providing an evidence-based means for examining the social ecology** (stratified as “high”, “medium” and “low”) was revealed when associations with education (often considered as a proxy for class in the absence of other information) was analyzed.
- Distinct relationships by INSOC social class designations (in contrast to impressionistic categorization) were then also observed with regard to **housing quality** and the type of **water containers at greatest risk** for dengue infestation.
- Stronger basis for targeting messages and interventions to characteristics of identified populations.

## Appendix 1 Piloting of the Dengue Elementary School Education Program (DESE)

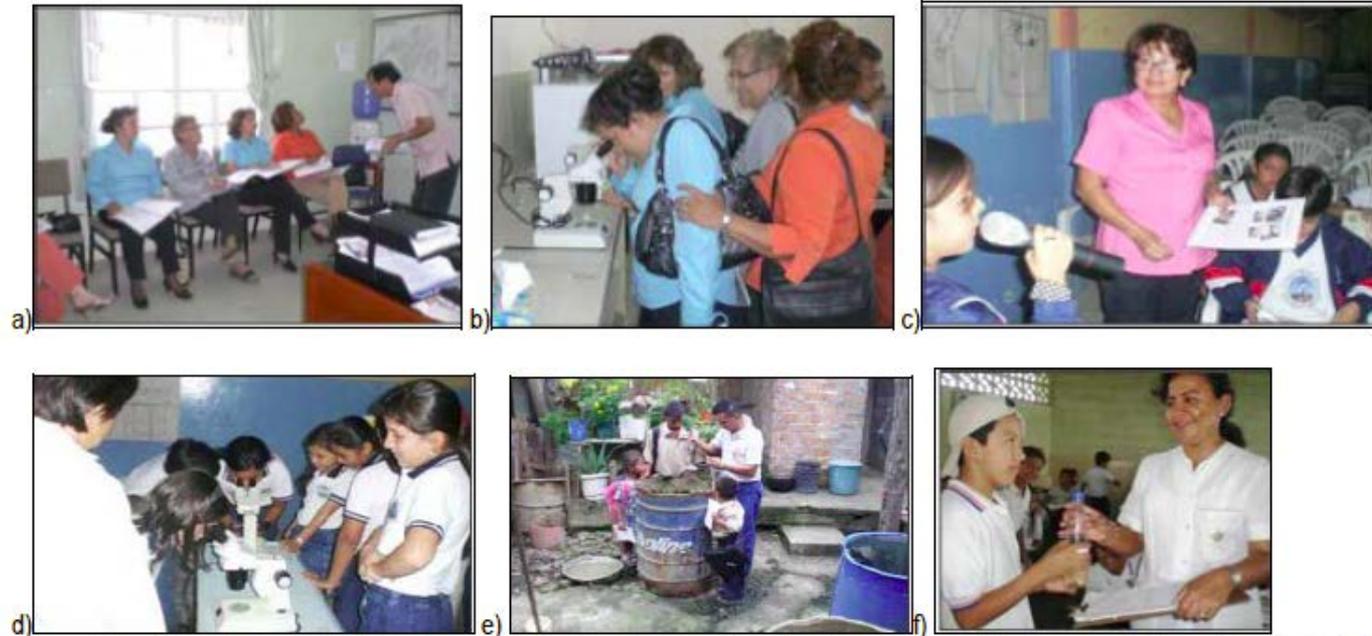


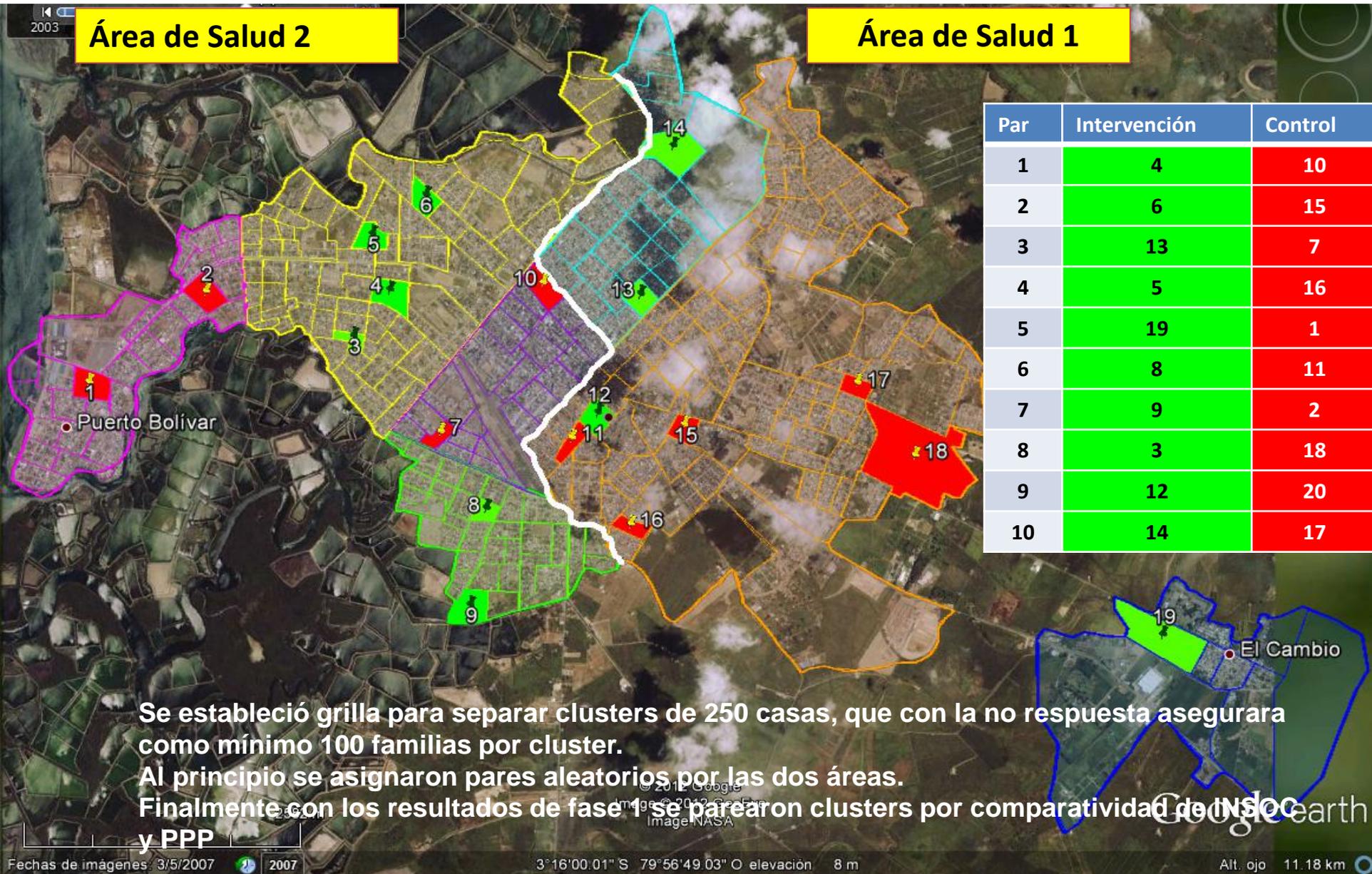
Figure 3.1a Theoretical and, b) laboratory teacher training in preparation for c) theoretical, d) laboratory and e) practical student classes with f) homework assignments to follow.

## Appendix 2 Materials from Clean Patio and Safe Containers Program (CPSC)

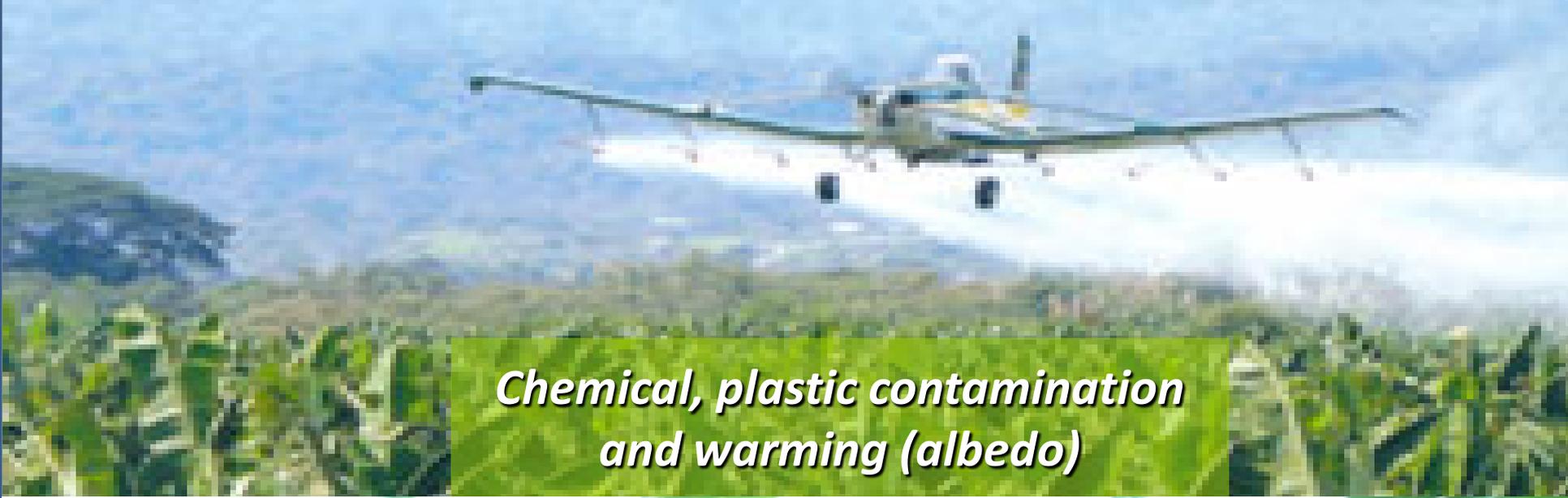


Figure x-a) Example map of participant homes in a CPSC intervention neighbourhood, b) Patio inspection procedure

# Paired Intervention and Control Design (*Machala*)



# + CONSIDERATION OF BROADER *DRIVERS* of Social Determination

An aerial photograph showing a large agricultural plane flying over a vast green field, likely a cornfield. The plane is releasing a thick white spray of chemicals or pesticides. The background shows rolling hills under a blue sky with light clouds.

*Chemical, plastic contamination  
and warming (albedo)*

A close-up photograph of a banana plantation. The plants are lush green with large, broad leaves. Several blue plastic bags are visible, hanging from the plants, likely used for pest control or protection.

*BEFORE:  
Agro-ecological processes,  
Biodiversity (polycrops),  
No chemicals, No plastic*

# ... + CONSIDERATION OF BROADER *DRIVERS* of Social Determination

Fruit agribusiness, neoliberal urban growth and the entomological, environmental conditions of dengue transmission

## ➤ BANANA PRODUCTION

➔ agrotoxins

➔ kill fish, amphibians (frogs) and other mosquito predators (larvae and adults)

## ➤ AGRO INDUSTRY

➔ forest destruction

➔ liquidates mosquito predator habitat

## ➤ AGRIBUSINESS

➔ destroys biodiversity and biomass

➔ contributes to warming

➔ shortens mosquito's life cycle and viral replication time

➔ accelerates rate of transmission

## ➤ URBAN INEQUITY AND DEGRADATION / URBAN LIVING MODES OF THE POOR

➔ infective source development

➔ multiplication of household breeding sites

➔ multiplication of contact patterns and susceptible cases

# Conclusion

- **This information is now being used to appropriately target the social character of the neighbourhoods** for the dengue control interventions in Phase 2 of the study.
- This **analysis will be developed further and published**, as there is a serious risk that applying impressionistic criteria may introduce misclassifications in the EBS framework.
- **Refinement of social analysis is called for, to consider social system complexities and scalar (global) influences.**
- **INSOC now being applied to 2011 Census data** for other analyses.