New ideas on the old concepts:

A proactive model for malaria and dengue control with Community Participation

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Prevention and Control of Vector Borne Diseases
National strategies for Malaria:


3. Focalized treatment (1999 - }
1. Eradication

Malaria and DDT spraying in Mexico, 1959 - 1988

METHODOLOGY:

- ERADICATION
- CONTROL
DIFFICULTIES.

- Investment Reduction = increment of incidence.

- Inappropriate timely = increment of incidence.

- Strikes and less working days = increment of incidence.

- Discentralization caused administrative confusion (1984)
2. Intensive and Simultaneous Actions

Malaria and DDT spraying in Mexico, 1959 - 1998

METHODOLOGY:

• ERADICATION
• CONTROL
• INTENSIVE AND SIMULTANEOUS CONTROL ACTIVITIES
DIFFICULTIES.

- High cost.
- When the funds decrease = incidence increases.
  - Inappropriate resources = incidence increases.
  - Strikes = incidence increases.
WHAT CHANGES MALARIA NEEDS?


In 1998 in Oaxaca State there were financial problems and consecutive developed an outbreak.
“However, malaria intensive affected communities differs at least in more than just number of cases and positive localities” (Hackett 1941)
Outbreak in Oaxaca State, 1998:

- One of the most important malaria areas in Mexico.
- *Vivax* malaria and *An. pseudopunctipennis* as main vector.
- In 1998, the outbreak represented 80% of total cases of the country.
General assumptions:

- There are different malarias: 4 parasites and many vectors.

- Geography features influence malaria patterns.

- The *vivax* malaria produces relapses with difficulties for a radical cure, therefore, there are persons and houses with frequent malaria attacks and asymptomatic cases. Natural infections can persist for almost three years.

- The habitats of anopheline mosquitoes are specific and different among the species, therefore the impact of control activities differ in each case.
Epidemic pattern assumptions in Oaxaca:

- The disease is not homogeneous within and between villages and households.

- *Vivax* malaria parasites, reservoirs and mosquitoes have some specific and constant interaction.

- Transmission`s pattern is influenced by the raining season.

- Repeated cases (re-infections and relapses) occur on raining season. The new period of transmission in the next dry season is provided by these carriers.

- In the first weeks of the year most of the new cases occur and the repeated cases are in rain season.
# Cases and villages with malaria, Oaxaca. 1992 – 2001

<table>
<thead>
<tr>
<th>Years w/ Persistent Transmission</th>
<th>Cases</th>
<th>%</th>
<th>Villages</th>
<th>%</th>
<th>ACV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 2</td>
<td>1,094</td>
<td>4.01</td>
<td>320</td>
<td>43.66</td>
<td>3.42</td>
</tr>
<tr>
<td>3 – 4</td>
<td>1,683</td>
<td>6.17</td>
<td>120</td>
<td>16.37</td>
<td>14.03</td>
</tr>
<tr>
<td>5 – 6</td>
<td>3,679</td>
<td>13.49</td>
<td>104</td>
<td>14.19</td>
<td>35.38</td>
</tr>
<tr>
<td>7 – 8</td>
<td>7,344</td>
<td>26.93</td>
<td>106</td>
<td>14.46</td>
<td>69.28</td>
</tr>
<tr>
<td>9 – 10</td>
<td>13,467</td>
<td>49.40</td>
<td>83</td>
<td>11.32</td>
<td>162.25</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>27,267</strong></td>
<td><strong>100.00</strong></td>
<td><strong>733</strong></td>
<td><strong>100.00</strong></td>
<td><strong>37.20</strong></td>
</tr>
</tbody>
</table>

**ACV**: Average of cases by village
Epidemiological stratification of malaria, based on altitude and communication via.

Weekly incidence patterns in the different 48 Micro-regions of the Coast of Oaxaca. 1997-1999

Cases

Weeks

1997 1998 1999
Candelaria Loxicha has an altitud of 200-400 meters above sea level.

Two picks were characteristic, regulated for the presence of water in breeding sites due to the dry up for seasonality changes.

Malaria in San Miguel del Puerto. 1998

San Miguel del Puerto has an altitud of 700-900 meters from the sea level.

The epidemiological pattern was regulated by temperature at the beginning of the year, and after, by abundance of mosquito breeding sites and the raining season in the mountains.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Yerbasantá</th>
<th>Las Cuevas</th>
<th>Totolapa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>863</td>
<td>319</td>
<td>872</td>
</tr>
<tr>
<td>Household</td>
<td>256</td>
<td>199</td>
<td>234</td>
</tr>
<tr>
<td>Cases</td>
<td>169</td>
<td>133</td>
<td>166</td>
</tr>
<tr>
<td>*Household w/ malaria</td>
<td>30%</td>
<td>22%</td>
<td>37%</td>
</tr>
<tr>
<td>*Household &gt; 1 case</td>
<td>52%</td>
<td>45%</td>
<td>39%</td>
</tr>
<tr>
<td>*Ill person &gt; once</td>
<td>26%</td>
<td>34%</td>
<td>11%</td>
</tr>
<tr>
<td>*Relatives +</td>
<td>82%</td>
<td>72%</td>
<td>81%</td>
</tr>
<tr>
<td>Concentrate malaria in household + had household</td>
<td>52%</td>
<td>64%</td>
<td>64%</td>
</tr>
<tr>
<td>had 90% of cases</td>
<td></td>
<td>85% of cases</td>
<td>85% of cases</td>
</tr>
</tbody>
</table>

*Between 1997 to April of 1999*
Squeme of household incidence of malaria. Some houses presented a nest malaria incidence.

21% OF ALL HOUSEHOLD, PRESENTED 78% OF THE CASES
Incidence of malaria and repeating cases in Sirena Miramar, San A. Loxicha, Oaxaca. 1997-1999

<table>
<thead>
<tr>
<th>Week</th>
<th>Dry season</th>
<th>Rain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1998</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>1999</td>
<td>30</td>
<td>10</td>
</tr>
</tbody>
</table>

New cases: blue dots, Repeating cases: red dots.
Patterns of *An. pseudopunctipennis* changed with altitude and with the season.

Probably these differences should influence the efficacy of impregnated bed net.

*An. pseudopunctipennis* are influenced by the raining season, due to the characteristic green algae in breeding sites that persist in the dry season, however, the rain devastate this habitat and that is when larvae disappear.

The dry season in Oaxaca was starts in the first months of the year and raining in the second half.
Casos de malaria y densidades de *An. ophles spp.* a <200 msnm, 1998

Casos de malaria y densidades de *An. pseudopunctipennis*, 200-400 msnm, 1998

Casos de malaria y densidades de *An. pseudopunctipennis*, 200-400 msnm, 1998

Casos de malaria y densidades de *An. pseudopunctipennis*, >600 msnm, 1998

*Mosquito Index: Man/Hour/Mosquito Capture*
The breeding sites of are influenced by presence of water in streams and rivers.

The typical environment are in the mountains, between canyons.

The breeding sites are characterized by the presence of low flow streams and green algae, that gives protection and food to larvae.

The aquatic habitat of *Anopheles pseudopunctipennis*: 
WHAT SHOULD BE A NEW MODEL FOR MALARIA CONTROL?
THE MODEL OF DISEASE: process of malaria is limited by the host, parasites, vectors and environment’s own frontiers.

No Interaction:
Better well-being
Good hygiene
Sanitation

Disease transmission is absent or not frequent.

Scarce Interaction:
Oversight, but with regular hygiene and sanitation

Disease transmission is low, sporadic and normally disappear alone as endemic area.

Frequent Interaction:
Unsuitable patterns for individual and family hygiene and sanitation

Disease transmission is constant and for long time.

High Interaction:
It is related with poor hygiene and sanitation of households

Disease transmission is hard, permanent and intensive. Normally affects a complete family every year.
**Malaria frontiers.**

HOST SUBMODEL. In a case - control type study we found:

- Daily bath, change of clothes, sweeping of the house and patios, cut the peridomestic vegetation, use of bednet, use a commercial insecticides, continuous walls, participation in breeding site elimination

<table>
<thead>
<tr>
<th>Behavior</th>
<th>OR</th>
<th>IC 95%</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO to take a daily bath</td>
<td>21.8</td>
<td>2.5-182.9</td>
<td>0.0001</td>
</tr>
<tr>
<td>NO to daily change of clothes</td>
<td>3.5</td>
<td>1.0-11.9</td>
<td>0.041</td>
</tr>
<tr>
<td>NO to sweeping the house and patios</td>
<td>7.4</td>
<td>1.4-39.2</td>
<td>0.007</td>
</tr>
<tr>
<td>NO cut the peridomestic vegetation</td>
<td>27.9</td>
<td>5.8-133.5</td>
<td>0.0000</td>
</tr>
<tr>
<td>NO to use of bednet</td>
<td>3.7</td>
<td>1.5-8.8</td>
<td>0.003</td>
</tr>
<tr>
<td>NO to use a commercial insecticides</td>
<td>7.6</td>
<td>1.0-60.9</td>
<td>0.027</td>
</tr>
<tr>
<td>Discontinious walls</td>
<td>5.6</td>
<td>2.1-14.5</td>
<td>0.0002</td>
</tr>
</tbody>
</table>

Agrees with solid knowledge of other international studies from Asia, Africa and America (1930-2000)
VECTOR CONTROL SUBMODEL:

1. Mosquito densities are not constant and similar, a preventive insecticide spraying can be apply before the increments.

2. If malaria concentrates in a few households, insecticide can use only in these cases.

3. The breeding sites of *An. pseudopunctipennis* are susceptibles to seasonal strategy WITH COMMUNITY PARTICIPATION, and this way obtain an adult population control without insecticides.
Pre and post density patterns of *An. pseudopunctipennis* ABSE, Paso Limón, Oaxaca. April - 1999

Pre and post density patterns of *An. pseudopunctipennis* ABSE, Corozal, Oaxaca. March - 1999

Pre and Post larval density index of *An. pseudopunctipennis*, in localities with different altitud, Oaxaca. November-December, 2000

\[ x^2 = 67.84 \]
\[ OR = 14.33 \]
\[ p = >0.0000 \]
\[ CI 95\% = 6.04-36.33 \]
Examples of community participation cleaning streams for malaria mosquito larvae control.

The activity can be learned and evaluated by the community itself.

Our results in this sense showed, in over 600 villages worked monthly in Oaxaca and more than 1,500 in the country, that it can be sustainable and it is an effective community practice.

The cleaning of streams and rivers should be a good alternative for reduction of insecticides.
PARASITE-HOST SUBMODEL:

1. Not all the cases we can detect. Asinthomatics, sub-clinics, repeters, relapses, nex cases.

2. Not all of Radical Cure Treatment are successful treatment. In Mexico about 80% of 5 days RCT are not successful.

3. We have evidences that relapses are associated with opportunity and dose of primaquine tratment.
New strategy for control for vivax malaria transmitted by *Anopheles pseudopunctipennis* in Oaxaca, 1999-2001:

- To reduce the great parasite density in the community: Mass treatment with a single dose of Chloro-primaquine, plus nebulization for outbreak control.

- Permanent elimination of breeding sites based on green alga and trashes remove with community participation.

- 3 consecutive monthly treatment with single dose (chloro-primaquine) with 3 months without medication, to all malaria positive families from 1997 for 3 years.

- Discontinue the insecticides spraying.

<table>
<thead>
<tr>
<th>Week</th>
<th>Casos</th>
<th>Semana</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>17,855</td>
<td>320.7</td>
</tr>
<tr>
<td>99</td>
<td>4,848</td>
<td>93.2</td>
</tr>
<tr>
<td>00</td>
<td>671</td>
<td>12.9</td>
</tr>
<tr>
<td>01</td>
<td>289</td>
<td>5.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>98</th>
<th>99</th>
<th>00</th>
<th>01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>17,855</td>
<td>4,848</td>
<td>671</td>
<td>289</td>
</tr>
<tr>
<td>Average cases per week</td>
<td>320.7</td>
<td>93.2</td>
<td>12.9</td>
<td>5.5</td>
</tr>
<tr>
<td>Cases per locality</td>
<td>16.2</td>
<td>5.9</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>% of positive samples</td>
<td>7.0</td>
<td>2.1</td>
<td>0.3</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Legend:
- **Intensive**: 02-03,'99
- **Consolidate**: 04-05,'99
- **Focalization**: 06-08,'99
- **Maintenance**: 1999 - 2001
Malaria in Mexico: Change of patterns of transmission. 1990-2001

1990
(44,513 cases)

2000
(7,362 cases)

2001
(4,785 cases)

Stratum
> Thousand cases
500 - 999 cases
100 - 499 cases
< 100 cases
What was new in community participation?

Establish a direct agreement with the local health committee.

Community learn directly from natural history of malaria in own environment (observation of breeding sites and larvae and from household characteristics of the families with malaria).

They get qualification and formal organization for breeding sites elimination.

Personnel of the Malaria Control Program advise and evaluated jointly with community the control activities.
Finally we learned that:

*The people can be poor, but they can also be clean !!!!*

*The people can be illiterate, but they can learn !!!!*

*Official Programs had underestimated the power of the community, since they have remaining in different levels.*
WHAT IS HAPPENED WITH COMMUNITY PARTICIPATION IN DENGUE
Designing a very simple model for community participation based in very simple assumptions:

1. Dengue is originated in household and recipients within the house.

2. *Aedes aegypti* is the better pet of the families.

3. We can organize a community from the vecinal organization and give the guidance for it.
Dengue has a higher interrelation between the hosts, dengue viruses and the environment. So, it needs to get a total households and the villages as universe to mosquito control. The dengue model include a basic strategies:

- Clean patio, and
- Water protection
CLEANING THE PATIO:

A every day exercise