The social and environmental context of infectious diseases occurrence in Brazil (with emphasis in the group of neglected tropical diseases): interventions, policies and research needs

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Plan of the Presentation

• Brazil some characteristics

• Control of IDs: successes and failures
  
  **Successes** (Vaccine preventable diseases, diarrhoea, **Chagas’ disease**)
  
  **Partial successes**:(Leprosy, **Schistosomiasis**, Malaria, HIV/AIDS, Tuberculosis)
  
  **Failures** (Dengue, Visceral Leishmaniasis)

• Successes, partial successes and failures:
  
  What each group has in common?

• Research challenges

• Policy challenges

Fonte: IBGE. Anuário estatístico do Brasil, 1986, 1990, 1993 e 1997; Censo demográfico, 2000; Síntese
Fertility Rate, Brazil 1970-2000

Fonte: IBGE.

*População agregada por cinco anos.
National Income
Life expectancy at birth(years), 2006
Figure 4 Worldwide use of improved drinking-water sources in 2008.
Figure 1 Worldwide use of improved sanitation facilities in 2008

Use of Improved sanitation
- 91-100%
- 76-90%
- 50-75%
- <50%
- No or insufficient data
CONTROL OF IDs
Successes, Partial Successes and Failures

• For some infectious diseases the success is evident; for others, control is only a partial success; while others are clear failure in control.

• In this review we examined trends from 1980 to 2007 in selected IDs of public health importance, grouped as successes, partial successes and failures in control, and looked for common factors among each group.
Success – Vaccine Preventable Diseases

• The National Immunization Programme (PNI) created in 1973 to deliver a basic list of vaccines for universal use and others offered to selected risk groups.

• All vaccine are free at the point of use

• Universal vaccines are BCG, Poliomielitis, MMR, DPT+Hib, Hepatitis-B, Yellow Fever, and Rotavirus; (in 2011, a pneumococcal vaccine with 10 antigens will be added.)

• These are available in approximately 30 000 health units located all over the country.

• Every year there are two national vaccination days when vaccines are offered in an extra 100 000 temporary vaccination points.
Success – Vaccine Preventable Diseases

• Control of vaccine preventable diseases in Brazil is a clear success story:
  a) Between 1980 to 2007, number of tetanus deaths decreased by 81% and of pertussis deaths by 95%, and no deaths were registered from diphtheria, polio or measles in the last years of the period. Polio was eliminated in Brazil in 1990;
  b) measles transmission was interrupted in the last decade, and sporadic cases or small outbreaks have been reported from cases imported from Europe and Asia;
  c) the incidence and mortality by meningitis from H. influenza b in children was reduced dramatically after the introduction of the Hib vaccine in the routine schedule in 1999;
Success – Vaccine Preventable Diseases

• Domestic production of vaccines increased substantially in the last 20 years.

• In 1992, approximately 60% of the doses of vaccines used by PNI were imported;

• by 2002, 70% were produced in the country.
Success – Diarrhea (and intestinal helminths)

- Mortality by diarrhea in children under 1 year old fell from 11.7/1000 live births in 1980, to 1.5/1000 live births in 2005 (reduction of about 95%).

- There is also some evidence of a substantial fall in incidence of diarrhea, and that this resulted from the marked increase in provision of piped drinking water, and the less marked increase in provision of appropriate sewage disposal.

- In 2006, vaccination against rotavirus was introduced in the routine schedule, and the efficacy demonstrated in vaccine trials was confirmed in the first evaluation of efficacy of the vaccine in routine use.

- Health services and in special primary health care have had an important role in mortality reduction.
Effect of city-wide sanitation programme on reduction in rate of childhood diarrhoea in northeast Brazil: assessment by two cohort studies

Mauricio L Barreto, Bernd Genser, Agostino Strina, Maria Gloria Teixeira, Ana Marlucia O Assis, Rita F Rego, Carlos A Teles, Matildes S Prado, Sheila M A Matos, Darcy N Santos, Lenaldo A dos Santos, Sandy Cairncross

Summary
Background A city-wide sanitation intervention was started in Salvador, Brazil, in 1997 to improve sewerage coverage from 26% of households to 80%. Our aim was to investigate the epidemiological effect of this city-wide sanitation programme on diarrhoea morbidity in children less than 3 years of age.

Methods The investigation was composed of two longitudinal studies done in 1997–98 before the intervention (the sanitation programme) and in 2003–04 after the intervention had been completed. Each study consisted of a cohort of children (841 in the preintervention study and 1007 in the postintervention study; age 0–36 months at baseline) who were followed up for a maximum of 8 months. Children were sampled from 24 sentinel areas that were randomly chosen to represent the range of environmental conditions in the study site. At the start of each study an individual or household questionnaire was applied by trained fieldworkers; an environmental survey was done in each area before and after introduction of the sanitation programme to assess basic neighbourhood and household sanitation conditions. Daily diarrhoea data were obtained during home visits twice per week. The effect of the intervention was estimated by a hierarchical modelling approach fitting a sequence of multivariate regression models.

Findings Diarrhoea prevalence fell by 21% (95% CI 18–25%)—from 9.2 (9.0–9.5) days per child-year before the intervention to 7.3 (7.0–7.5) days per child-year afterwards. After adjustment for baseline sewerage coverage and potential confounding variables, we estimated an overall prevalence reduction of 22% (19–26%).

Interpretation Our results show that urban sanitation is a highly effective health measure that can no longer be ignored, and they provide a timely support for the launch of 2008 as the International Year of Sanitation.

Áreas Sentinelas – Salvador, Bahia - 1999
Figure 1: Conceptual model to investigate the effect of the Bahia Azul sanitation programme on childhood diarrhoea
<table>
<thead>
<tr>
<th>Model Description</th>
<th>Total population*</th>
<th>Areas with high baseline risk†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR</td>
<td>95% CI</td>
</tr>
<tr>
<td>PR, unadjusted</td>
<td>0.79</td>
<td>0.75-0.82</td>
</tr>
<tr>
<td>Model A: PR adjusted for baseline sewerage coverage and potential confounders§</td>
<td>0.78</td>
<td>0.74-0.81</td>
</tr>
<tr>
<td>Model B: PR adjusted for variables of model A and indoor toilet, open sewage nearby, and household excreta disposal</td>
<td>0.81</td>
<td>0.78-0.86</td>
</tr>
<tr>
<td>Model C: PR adjusted for variables of model A and water supply, refuse collection, paving of the road, and satisfactory drainage system</td>
<td>0.80</td>
<td>0.76-0.84</td>
</tr>
<tr>
<td>Model D: PR adjusted for variables of model A and hygiene behaviour</td>
<td>0.76</td>
<td>0.72-0.79</td>
</tr>
<tr>
<td>Model E: PR adjusted for variables of model A and coverage of Bahia Azul sewerage</td>
<td>1.01</td>
<td>0.89-1.15</td>
</tr>
</tbody>
</table>

PR=prevalence ratio. MP=mediating proportion. Results of the hierarchical effect decomposition are presented as crude and adjusted prevalence ratios. *24 areas, 1848 children, median baseline diarrhea 4.5 days per child-year. †>8 diarrhoea days per child-year; 12 areas, 878 children, median baseline diarrhoea 6.0 days per child-year. ‡MP: risk reduction explained by changes in the mediating variables included in the model (MP=[PR_{adj} - PR_{adj}]/[1−PR_{adj}])×100; PR_{adj} and PR_{adj} are the crude and adjusted prevalence ratios, respectively). §Child’s mean age during the follow-up, birthweight <2.5 kg, exclusive breastfeeding till <6 months old, and height-for-age <-1 Z score; mother’s age at child’s birth <20 years, marital status (not married) and education (no schooling or <4th grade, or 5th to 8th grade, vs higher education); housing type (shack) and floor (dirt floor), no independent kitchen.

Table 2: Prevalence ratios of diarrhoea (after vs before intervention) obtained by different regression models
Impact of a City-Wide Sanitation Programme in Northeast Brazil on Intestinal Parasites Infection in Young Children

Mauricio L. Barreto, Bernd Genser, Agostino Strina, Maria Gloria Teixeira, Ana Marlucia O. Assis, Rita F. Rego, Carlos A. Teles, Matildes S. Prado, Sheila M.A. Matos, Neuza M. Alcântara-Neves, and Sandy Cairncross
TABLE 3: Prevalence ratios (PR) of infection with *A. lumbricoides*, *T. trichiura* and *G. duodenalis* (after vs. before the intervention) obtained by different regression models. 1,657 children aged 0-4 years, Salvador, Brazil, 1997-1998 and 2003/04.

<table>
<thead>
<tr>
<th></th>
<th><em>A. lumbricoides</em></th>
<th></th>
<th><em>T. trichiura</em></th>
<th></th>
<th><em>G. duodenalis</em></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR</td>
<td>95% CI</td>
<td>MP *</td>
<td>PR</td>
<td>95% CI</td>
<td>MP *</td>
</tr>
<tr>
<td>PR, unadjusted</td>
<td>0.49</td>
<td>0.39-0.62</td>
<td>-</td>
<td>0.28</td>
<td>0.20-0.39</td>
<td>-</td>
</tr>
<tr>
<td>Model A: PR adjusted for confounders b and baseline sewerage coverage</td>
<td><strong>0.57</strong></td>
<td><strong>0.45-0.74</strong></td>
<td>-</td>
<td><strong>0.38</strong></td>
<td><strong>0.27-0.53</strong></td>
<td>-</td>
</tr>
<tr>
<td>Model B: PR adjusted for variables of model A and drainage</td>
<td>0.57</td>
<td>0.44-0.73</td>
<td>-1.9</td>
<td>0.34</td>
<td>0.27-0.48</td>
<td>-3.7</td>
</tr>
<tr>
<td>Model C: PR adjusted for variables of model A and regularity of water supply</td>
<td>0.60</td>
<td>0.46-0.79</td>
<td>5.4</td>
<td>0.40</td>
<td>0.27-0.59</td>
<td>3.5</td>
</tr>
<tr>
<td>Model D: PR adjusted for variables of model A and absence of rubbish dumps</td>
<td>0.55</td>
<td>0.44-0.69</td>
<td>-5.7</td>
<td>0.35</td>
<td>0.25-0.47</td>
<td>-5.3</td>
</tr>
<tr>
<td>Model E: PR adjusted for variables of model A and paved road /sidewalk</td>
<td>0.64</td>
<td>0.50-0.81</td>
<td>14.2</td>
<td>0.38</td>
<td>0.26-0.54</td>
<td>-0.6</td>
</tr>
<tr>
<td>Model F: PR adjusted for variables of model A and hygiene behaviour</td>
<td>0.57</td>
<td>0.44-0.37</td>
<td>-1.7</td>
<td>0.38</td>
<td>0.28-0.52</td>
<td>-0.2</td>
</tr>
<tr>
<td>Model G: PR adjusted for variables of model A and indoor toilet, open sewage nearby and household excreta disposal</td>
<td>0.63</td>
<td>0.51-0.79</td>
<td>13.0</td>
<td>0.42</td>
<td>0.30-0.59</td>
<td>6.9</td>
</tr>
<tr>
<td>Model H: PR adjusted for variables of model A and coverage with programme sewerage connections</td>
<td>0.74</td>
<td>0.34-1.62</td>
<td>39.7</td>
<td>0.57</td>
<td>0.41-0.79</td>
<td>30.3</td>
</tr>
<tr>
<td>Model I: PR adjusted for variables of model A and all of the above</td>
<td>1.08</td>
<td>0.46-2.52</td>
<td>100.0</td>
<td>1.00</td>
<td>0.49-2.02</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* Mediating proportion; risk reduction explained by variable(s) in the model: \( MP = \frac{(PR_{\text{unadj}} - PR_{\text{adj}})}{(PR_{\text{adj}} - 1)} \times 100 \)

b Child’s mean age during the follow-up, gender, birthweight <2.5 kg, exclusive breastfeeding till <6 months old and height-for-age < -1 Z score; mother’s age at child’s birth <20 years, marital status (not married) and education (no schooling or <4th grade, or 5th to 8th grade, vs higher education); number of children <5 years old in the house; housing type (shack) and floor (dirt floor), no independent kitchen.
Reductions in the Prevalence and Incidence of Geohelminth Infections following a City-wide Sanitation Program in a Brazilian Urban Centre

Luciene Maura Mascarini-Serra\textsuperscript{1,2,*}, Carlos A. Telles\textsuperscript{2,3}, Matildes S. Prado\textsuperscript{2}, Sheila Alvim Mattos\textsuperscript{2}, Agostino Strina\textsuperscript{2}, Neuza M. Alcantara-Neves\textsuperscript{4}, Mauricio L. Barreto\textsuperscript{2}

1 Departamento de Parasitologia, Instituto de Biociências, Estadual University of Julio Mesquita Filho (UNESP), Botucatu, São Paulo, Brazil, 2 Instituto de Saúde Coletiva, Federal University of Bahia, Salvador, Bahia, Brazil, 3 Departamento de Ciências Exatas, Estadual University of Feira de Santana, Bahia, Brazil, 4 Instituto de Ciências da Saúde, Federal University of Bahia, Salvador, Bahia, Brazil
Table 3. Prevalence rate ratio (PR) of geohelminths before and after the city-wide sanitation intervention, adjusted for confounding and intervention variables.

<table>
<thead>
<tr>
<th>Prevalence Ratio</th>
<th>Any Geohelminth (95% CI)</th>
<th>AF(^{*})</th>
<th><em>Ascaris lumbricoides</em> (95% CI)</th>
<th>AF(^{*})</th>
<th><em>Trichuris trichiura</em> (95% CI)</th>
<th>AF(^{*})</th>
<th>Hookworms (95% CI)</th>
<th>AF(^{*})</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR (crude)</td>
<td>0.74 (0.57–0.89)</td>
<td>—</td>
<td>0.77 (0.64–0.92)</td>
<td>—</td>
<td>0.67 (0.56–0.79)</td>
<td>—</td>
<td>0.17 (0.09–0.29)</td>
<td>—</td>
</tr>
<tr>
<td>PR adjusted(^{A})</td>
<td>0.73 (0.66–0.81)</td>
<td>—</td>
<td>0.75 (0.63–0.87)</td>
<td>—</td>
<td>0.67 (0.58–0.79)</td>
<td>—</td>
<td>0.18 (0.09–0.33)</td>
<td>—</td>
</tr>
<tr>
<td>PR adjusted(^{B})</td>
<td>0.74 (0.66–0.83)</td>
<td>3.7</td>
<td>0.76 (0.63–0.91)</td>
<td>4.0</td>
<td>0.68 (0.58–0.75)</td>
<td>3.0</td>
<td>0.17 (0.09–0.29)</td>
<td>−1.2</td>
</tr>
<tr>
<td>PR adjusted(^{C})</td>
<td>0.72 (0.65–0.80)</td>
<td>−3.7</td>
<td>0.74 (0.62–0.87)</td>
<td>−4.0</td>
<td>0.66 (0.58–0.75)</td>
<td>−3.0</td>
<td>0.17 (0.09–0.31)</td>
<td>−1.2</td>
</tr>
<tr>
<td>PR adjusted(^{D})</td>
<td>0.77 (0.68–0.88)</td>
<td>14.8</td>
<td>0.81 (0.66–0.98)</td>
<td>24.0</td>
<td>0.71 (0.59–0.86)</td>
<td>12.1</td>
<td>0.20 (0.11–0.37)</td>
<td>2.4</td>
</tr>
<tr>
<td>PR adjusted(^{E})</td>
<td>0.96 (0.89–1.04)</td>
<td>85.2</td>
<td>1.14 (0.97–1.36)</td>
<td>100</td>
<td>0.83 (0.74–0.91)</td>
<td>48.5</td>
<td>0.23 (0.09–0.56)</td>
<td>6.1</td>
</tr>
<tr>
<td>PR adjusted(^{F})</td>
<td>1.24 (0.98–1.58)</td>
<td>100</td>
<td>1.72 (1.26–2.34)</td>
<td>100</td>
<td>1.06 (0.72–1.58)</td>
<td>100</td>
<td>0.37 (0.12–1.09)</td>
<td>23.2</td>
</tr>
</tbody>
</table>

\(^{*}\)AF = Proportion of reduction attributable fraction of intervention variable.

\[
AF = \frac{PR \text{ adjusted for confounding} - PR \text{ adjusted for intervention variables}}{PR \text{ adjusted for confounding} - 1} \times 100
\]

\(^{A}\)Ratio adjusted for confounding: age and sex of child, paving of street, number of children <5 years in household, mother’s education and presence of sewage in 1997.

\(^{B}\)Ratio adjusted for variable of intervention = presence of drainage system of rainwater and for confounding \(^{A}\).

\(^{C}\)Ratio adjusted for variable of intervention = absence of open refuse collection points and for confounding \(^{A}\).

\(^{D}\)Ratio adjusted for variable of intervention = frequency of water supply and for confounding \(^{A}\).

\(^{E}\)Ratio adjusted for variable of intervention = proportion of households connected to the *Bahia Azul* sewage system and confounding \(^{A}\).

\(^{F}\)Ratio adjusted for all variables of intervention \(^{B+C+D+E}\) and for confounding \(^{A}\).
Table 4. Incidence rate ratio (IR) of geohelminths before and after the city-wide sanitation intervention, adjusted for confounding and intervention variables.

<table>
<thead>
<tr>
<th>Incidence Ratio (IR)</th>
<th>Any Geohelminths (95% CI)</th>
<th>AF* %</th>
<th>A. lumbricoides (95% CI)</th>
<th>AF* %</th>
<th>Trichuris trichiura (95% CI)</th>
<th>AF* %</th>
<th>Hookworms (95% CI)</th>
<th>AF* %</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR (crude)</td>
<td>0.71 (0.57–0.89)</td>
<td>—</td>
<td>0.74 (0.56–0.98)</td>
<td>—</td>
<td>0.80 (0.54–1.17)</td>
<td>—</td>
<td>0.60 (0.28–1.28)</td>
<td>—</td>
</tr>
<tr>
<td>IR adjusted(^A)</td>
<td>0.66 (0.55–0.79)</td>
<td>—</td>
<td>0.68 (0.51–0.90)</td>
<td>—</td>
<td>0.74 (0.54–1.02)</td>
<td>—</td>
<td>0.58 (0.35–0.93)</td>
<td>—</td>
</tr>
<tr>
<td>IR adjusted(^B)</td>
<td>0.68 (0.55–0.82)</td>
<td>5.9</td>
<td>0.70 (0.51–0.94)</td>
<td>6.2</td>
<td>0.73 (0.52–1.02)</td>
<td>−3.8</td>
<td>0.59 (0.34–1.0)</td>
<td>2.4</td>
</tr>
<tr>
<td>IR adjusted(^C)</td>
<td>0.64 (0.54–0.76)</td>
<td>−5.9</td>
<td>0.67 (0.50–0.88)</td>
<td>−3.1</td>
<td>0.75 (0.56–1.0)</td>
<td>3.8</td>
<td>0.51 (0.30–0.88)</td>
<td>−16.6</td>
</tr>
<tr>
<td>IR adjusted(^D)</td>
<td>0.71 (0.56–0.89)</td>
<td>14.7</td>
<td>0.71 (0.49–1.03)</td>
<td>9.4</td>
<td>0.82 (0.58–1.15)</td>
<td>30.8</td>
<td>0.64 (0.34–1.18)</td>
<td>14.3</td>
</tr>
<tr>
<td>IR adjusted(^E)</td>
<td>0.79 (0.66–0.94)</td>
<td>38.2</td>
<td>0.82 (0.60–1.10)</td>
<td>44.0</td>
<td>0.85 (0.19–1.57)</td>
<td>42.3</td>
<td>1.31 (0.84–2.04)</td>
<td>100</td>
</tr>
<tr>
<td>IR adjusted(^F)</td>
<td>1.00 (0.59–1.66)</td>
<td>100</td>
<td>1.09 (0.65–1.81)</td>
<td>100</td>
<td>0.95 (0.19–2.16)</td>
<td>80.8</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

\(^A\) AF = Proportion of reduction attributable fraction of intervention variable.

\[ AF = \frac{IR \text{ adjusted for confounding} - IR \text{ adjusted for intervention variables}}{IR \text{ adjusted for confounding} - 1} \times 100 \]

\(^A\) Ratio adjusted for confounding: age and sex of child, paving of street, number of children <5 years in household, mother’s education and presence of sewage in 1997.

\(^B\) Ratio adjusted for variable of intervention = presence of drainage system of rainwater and for confounding \(^A\).

\(^C\) Ratio adjusted for variable of intervention = absence of open refuse collection points and for confounding \(^A\).

\(^D\) Ratio adjusted for variable of intervention = frequency of water supply and for confounding \(^A\).

\(^E\) Ratio adjusted for variable of intervention = proportion of households connected to the Bahia Azul sewage system and for confounding \(^A\).

\(^F\) Ratio adjusted for all variables of intervention \(^B+C+D+E\) and for confounding \(^A\).
Trend of the coverage of the Family Health Program by Municipality.
Reducing Childhood Mortality From Diarrhea and Lower Respiratory Tract Infections in Brazil

AUTHORS: Davide Rasella, MPH, Rosana Aquino, MD, PhD, and Mauricio L. Barreto, MD, PhD

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KEY WORDS
primary health care, family health program, Brazil, health services evaluation, under-5 mortality, diarrhea, lower respiratory infections

ABBREVIATIONS
PHC—primary health care
FHP—Family Health Program
BR—Brazilian reais

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WHAT’S KNOWN ON THIS SUBJECT: The FHP, one of largest PHC programs in the world, was created in Brazil in 1994 and experienced a dramatic expansion, but few studies have analyzed its general impact, and none has analyzed specific causes of preventable mortality.

WHAT THIS STUDY ADDS: The FHP succeeded in reducing mortality rates for children younger than 5 years in Brazil; it had a stronger effect on diarrheal diseases and lower respiratory infections, even after controlling for environmental, social, and economic variables.

abstract

OBJECTIVE: To evaluate the effects of the Family Health Program (FHP), a strategy for reorganization of primary health care in Brazil, on mortality of children younger than 5 years, particularly from diarrheal diseases and lower respiratory tract infections.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Mortality From Diarrheal Diseases, RR (95% CI)</th>
<th>Mortality From Lower Respiratory Infections, RR (95% CI)</th>
<th>Mortality From Injuries, RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mortality From Diarrheal Diseases, RR (95% CI)</td>
<td>Mortality From Lower Respiratory Infections, RR (95% CI)</td>
<td>Mortality From Injuries, RR (95% CI)</td>
</tr>
<tr>
<td>Crude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FHP coverage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No FHP^a</td>
<td>0.84 (0.75–0.94)</td>
<td>0.84 (0.78–0.91)</td>
<td>1.04 (0.96–1.13)</td>
</tr>
<tr>
<td>Low^b</td>
<td>0.75 (0.66–0.85)</td>
<td>0.75 (0.68–0.82)</td>
<td>0.91 (0.83–1.00)</td>
</tr>
<tr>
<td>Intermediate^c</td>
<td>0.61 (0.53–0.70)</td>
<td>0.74 (0.66–0.83)</td>
<td>0.99 (0.89–1.11)</td>
</tr>
<tr>
<td>High^d</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted^e</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FHP coverage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No FHP^a</td>
<td>0.89 (0.79–1.00)</td>
<td>0.87 (0.80–0.94)</td>
<td>1.05 (0.97–1.13)</td>
</tr>
<tr>
<td>Low^b</td>
<td>0.82 (0.73–0.94)</td>
<td>0.80 (0.72–0.88)</td>
<td>0.92 (0.84–1.01)</td>
</tr>
<tr>
<td>Intermediate^c</td>
<td>0.69 (0.60–0.80)</td>
<td>0.81 (0.72–0.92)</td>
<td>1.01 (0.89–1.14)</td>
</tr>
<tr>
<td>High^d</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CI indicates confidence interval; RR, rate ratio.

^a Coverage equal to 0% of the population.

^b Coverage of <30% of the municipal population.

^c Coverage of 30% to 69.9% of the municipal population.

^d Coverage of ≥70% of the municipal population.

^e Models adjusted for total fertility rate, per capita income (monthly), percentage of functional illiterates among individuals older than 15, percentage of individuals living in households with running water, percentage of individuals living in households with sewerage, and local hospitalizations.
Success – Diarrhea (and intestinal helminths)

• In summary, the marked reduction of mortality by diarrhea is attributed to provision of ORT and access to health services, the reduction in diarrhea incidence are attributable to increased provision of water and sanitation and in the specific case of rotavirus-diarrhea to a vaccine.

• Improvement in Water Supply and Sanitation is reducing markedly intestinal helminths (A lumbricoides, T trichiura and hookworm) and G. duodenalis infections
Success - Chagas’ Disease

• Until the 1970s, two thirds of the Brazilian territory with intense transmission of *T. cruzi* – estimated 5 million people infected.
• Intensive vector control programme eliminated the main vector of the disease and vectorial transmission has been interrupted;
• Testing of blood used for transfusion eliminated this route of transmission.
Success - Chagas’ Disease

• However due to its long latency, and the lack of adequate treatment, individuals with the chronic form of the disease continue.
• Persists, some residual vertical transmission from mothers infected much earlier (seroprevalence of *T.cruzi* infection in children under 5 - 0.0005/1000; 
• Cases or small outbreaks of food related transmission has been reported
Partial Successes - Leprosy

- Leprosy is detected in all States in the country, but the highest detection rate is in the Amazon region and in a few urban centers in other regions;
- more than 50% of the cases are reported in areas where 17.5% of the country population lives.
- Because the incubation period of leprosy is long, the geographic pattern of occurrence reflects both past and current social determinants (which are not well understood), and the accumulation of cases as potential sources of infection with *M. leprae* in some areas.
Partial Successes - Leprosy

• The role of migration from rural high prevalence areas to urban centers is no clear, but probably relevant.

• After the introduction of multidrug therapy (MDT) there was marked reduction of prevalence. For Brazil as a whole, leprosy prevalence decreased from 180 cases per 100 000 in 1988 to 26 cases per 100 000, in 2008.

• Unfortunately, the reduction in prevalence did not appear to be a consequence of a decrease in incidence, since the case detection rate in under 15 years old has been stable during the period, around 7/100 000 per year.
Partial Successes - Leprosy

- This picture raises serious concern regarding the possibility of leprosy elimination in Brazil. Finding new ways to deal with leprosy (i.e., shortening treatments and interrupting transmission) are necessary; as are keeping leprosy as a world priority in the public health and research agenda in order to avoid reduction in interest and financing for research, prevention and care.
Leprosy prevalence and detection rate (total and for <15 years). Brazil 1985-2009

Source: Ministry of Health, Brazil
Partial Success - Schistosomiasis

• The only species of *Schistosoma* in Brazil is the *Schistosoma mansoni*.
• Transmission is spread over a large area mainly in the Northeast region.
• Transmission occurs in rural and poor peri-urban areas where contact with wild water bodies is still part of the way of life.
• By the end of the 1990s, six million people were estimated to be infected.
• The schistosomiasis control programme started in 1975 in Brazil, was vertical and based on mass treatment. In 1993 it was decentralized to States, then to municipalities and eventually integrated into primary health care.
Partial Success - Schistosomiasis

- Different sources of data show a decline in schistosomiasis occurrence and severity. From 1995 to 2006: a) positivity at stool examination decreased from 8.4% to 5.5%; b) hospitalization decreased from 2.1 to 0.4 per 10 000 population per year and c) mortality decreased from 0.38 to 0.27 per 100 000 population per year.

- This reduction is likely to be a consequence of an increase in access of clean water and sanitation, and reduction in contact with water bodies, although mass treatment could also have contributed.

- A remaining challenge is integrating the schistosomiasis control programme into the activities of the primary health care programme.
S. mansoni transmission, Brazil
Other Partial Successes

- Malaria
- HIV/AIDS
- Tuberculosis
Failure - Dengue

• Successive dengue epidemics (Figure) have affected the main urban centres in Brazil since 1986, with an increasing proportion of cases presenting with severe disease.

• Three serotypes (DENV1, DENV2, DENV3) have circulated all over the country and DENV4 was isolated in one city in July 2010.

• The recurrent epidemics are far from being controlled, and at least 75% (4 137/5 507) of the Brazilian municipalities are infested with the *Aedes aegypti*.

• Between 2000 and 2009, 3.5 million cases of dengue fever have been reported, 12 625 of them of dengue hemorrhagic fever (DHF), with 845 reported deaths.

• Despite the increase frequency of DHF cases, the causes and mechanisms involved in the evolution of a DF case to DHF is not understood.
Failure - Dengue

• The amount of resources invested in the vector control is over half billion dollars per year; however, the impact has been modest.

• Prospects for the future control are far from optimistic. The reduction of the density of A. aegypti, the single vulnerable link in the transmission chain, remains a challenge. Vector densities that are low enough to effectively curb or reduce the spread of dengue have been difficult to achieve in a sustained manner;

• Currently there is no safe vaccine and limited expectation of one in the short term.

• During epidemics, public health efforts were directed towards increasing awareness of symptoms to improve early presentation to health services and to enable early diagnosis and treatment of severe forms to reduce mortality.
Figure 6. Annual distribution of Dengue incidence rates per 100,000 inhabitants, number of *Aedes aegypti* infested municipalities and those with Dengue cases. Brazil, 1985-2009.

Source: Ministry of Health, Brazil
Number of reported dengue fever cases and number of hospitalized dengue cases, Brazil 1986 – 2009

- Casos notificados
- Hospitalizações

Epidemic DENV1
Epidemic DENV2
Epidemic DENV3
Number of cases and fatality rate of Dengue Hemorragic Fever, Brazil 1990 – 2009*

*Dados até a s.e 52, sujeitos à alteração
Visceral leishmaniasis (VL), also known as kalaazar, is a protozoonosis caused by *Leishmania chagasi* and transmitted to man by phlebotomines mosquitoes.

In Brazil, incidence is relatively high, with an average of 2 cases per 100,000 inhabitants per year. There are two areas of concern: the increase in incidence and the expansion of the area where transmission occurs.

Over one-third of the Brazilian municipalities have reported autochthonous cases from 1999 to 2008.
Failure - Visceral Leishmaniasis

- The transmission cycle of *L. chagasi*, formerly restricted to the wilderness and rural areas, has changed, affecting urban centres. Small, middle-size and large cities have been affected, including capitals.
Municipalities by the level of VL transmission
Successes, partial success and failures: why?

• The main successes achieved in the control of infectious disease can be ascribed to successful public policies, many quite efficient, even when their implementation was delayed or incomplete. Such policies have dealt with key determinants (e.g. the quality of water and basic sanitation, vector elimination); or have provided access to preventive resources, such as vaccines; or expanded the primary health care, extending access to basic health services.

• VL control has been focused on the elimination of the transmitting mosquito and reservoirs, but available strategies and technologies have so far had low effectiveness. The available treatment is long, and must be taken under medical supervision because of its toxicity, making the treatment costly and inconvenient, mainly for patients from isolated rural areas.
Successes, partial success and failures: why?

- Diseases for which control was considered as partial successes have in common complex transmission often related to unresolved environmental, social, economic or unknown determinants. They are chronic infectious diseases with long infectious periods, and in some cases transmitted by vectors which are difficult to control. In addition, leprosy, AIDS and tuberculosis require treatment adhesion over many months and have strong socio-economic differentials. Success in the control of these diseases would require strengthened health services support for sustained treatment; in addition to more effective strategies for prevention such as reduction of poverty and social inequalities, early diagnostic tests and more effective vaccines.
Successes, partial success and failures: why?

- Failures have been basically related to vector-borne diseases recently introduced or undergoing a change in its epidemiological pattern. For both treatment is not simple: no specific treatments exists for dengue fever, and treatment is only partially effective and is associated with pronounced toxicity for visceral leishmaniasis. Both diseases lack an effective vaccine.
For the subgroup of IDs for which the initiatives implemented so far have achieved modest or no success, there is a pressing need to develop new technologies aiming to minimize the morbidity and mortality associated with such diseases. Biomedical research in Brazil is thriving and is characterized by nuclei of excellence in the different areas of basic and clinical science and public health. Investments in public health related research have been on the rise, and the country is developing partnerships in international collaborative efforts targeting infectious diseases;
Research Challenges

• Some of the areas where further research is recommended:
  a) biomedical research for the development of vaccines, shorter and safer treatment schemes, quick diagnostics, innovative vector control methods;
  b) population based research with a double role to evaluate new technologies before adoption in the health system and to investigate the social determinants of diseases such as leprosy and tuberculosis;
  c) health services research to develop and evaluate new strategies to deliver efficiently diagnostic and treatment of chronic infectious diseases (such as leprosy, visceral leishmaniasis, HIV, tuberculosis) or severe acute disease such as dengue.
Policies challenges

- In the last years, major changes have taken place in the country due to a profound reorganization of the Brazilian health system.
- Such changes have had a marked impact on the structure and operations of initiatives aiming to control infectious diseases, especially concerning the dilemma between vertical versus horizontal approaches; The transition which started in the 1990s and still ongoing, from a highly centralized structure functioning at the level of the federal government towards a decentralized set of actions implemented at the level of over 5500 Brazilian municipalities, continues to be a major challenge to be carefully addressed.
Policies challenges

• This challenge has been greater due to the pronounced heterogeneity in terms of size, infra-structure and technical capacity of this vast network of municipalities. It seems clear that even in the context of successful actions implemented at the local level, support and expertise provided by the central level, either at the federal government or at the level of the States, remains a fundamental asset to be preserved.

• This process should incorporate preparedness studies and pilot projects addressing emergent questions and renewed challenges. For instance, the series of dengue fever epidemics in Brazil’s major urban centres has repeatedly challenged the health system to provide quality care to a growing number of severe cases, to be managed in specialized units staffed by well-trained professionals.
Policies challenges

• Another key issue refers to the pressing need to harmonize broad social and economic policies and the specific demands and needs required for proper control of infectious diseases. In the last years, access to potable water and sewage systems has been a top priority of public policies. The full attainment of such goals will be key to the sustainable control of diseases dependent from the fecal route.

• In the past few years, programmes specifically devoted to income transfer to the most disenfranchised strata of Brazilian population, have contributed to reduce poverty and for the first time but to a small degree, to reduce social and economic inequalities. More substantial improvements in education and further actions towards decreasing poverty and social inequalities might accelerate the control of diseases such as tuberculosis and leprosy.
THANK YOU!!