Diseases of the Poor in Texas

New innovations for a diseases of poverty: Globally and in Texas

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“The Bottom 100 Million”
Latin American & Caribbean (LAC) Region

- Total population of LAC is 578 million people
  - 48 million people live on <US$1.25 per day (8%)
  - 99 million people live on <US$2 per day
  - 189 million “poor” according to CEPAL (UN Economic Commission for LAC)

## Human Development Indices in LAC equivalent to Sub-Saharan Africa or Asia

<table>
<thead>
<tr>
<th>Country</th>
<th>HDI</th>
<th>Comparator Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haiti</td>
<td>148</td>
<td>Sudan, Kenya</td>
</tr>
<tr>
<td>Guatemala</td>
<td>121</td>
<td>South Africa, Gabon</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>120</td>
<td>South Africa, Gabon</td>
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<tr>
<td>Honduras</td>
<td>117</td>
<td>Mongolia, Kyrgyzstan</td>
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<tr>
<td>Bolivia</td>
<td>111</td>
<td>Egypt, Indonesia</td>
</tr>
<tr>
<td>Guyana</td>
<td>110</td>
<td>Egypt, Indonesia</td>
</tr>
<tr>
<td>El Salvador</td>
<td>101</td>
<td>Algeria, Cape Verde, Vietnam</td>
</tr>
<tr>
<td>Paraguay</td>
<td>98</td>
<td>Sri Lanka, Iran</td>
</tr>
</tbody>
</table>

Millennium Development Goals

1. Eradicate extreme poverty and hunger.
2. Achieve universal primary education.
3. Promote gender equality and empower women.
4. Reduce child mortality.
5. Improve maternal health.
7. Ensure environmental sustainability.
8. Develop a global partnership for development.
NTD Disease Burden in the Americas: Higher than HIV/AIDS or Malaria?

## The NTDs of LAC

<table>
<thead>
<tr>
<th>Disease</th>
<th>DALYs</th>
<th>No. Cases</th>
<th>% Poor infected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hookworm</td>
<td>≤1.9 million</td>
<td>30 million</td>
<td>30%</td>
</tr>
<tr>
<td>Ascariasis</td>
<td>≤1.1 million</td>
<td>85 million</td>
<td>85%</td>
</tr>
<tr>
<td>Trichuriasis</td>
<td>≤1.1 million</td>
<td>71 million</td>
<td>71%</td>
</tr>
<tr>
<td>Chagas</td>
<td>0.7 million</td>
<td>10 million</td>
<td>10%</td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>0.1 million</td>
<td>2 million</td>
<td>2%</td>
</tr>
<tr>
<td>Dengue</td>
<td>0.1 million</td>
<td>1 million</td>
<td>1%</td>
</tr>
<tr>
<td>Leishmaniasis</td>
<td>0.1 million</td>
<td>&lt;100,000</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>LF</td>
<td>0.1 million</td>
<td>Not Determined</td>
<td>N.D.</td>
</tr>
</tbody>
</table>
NTDs and Poverty
17 Chronic & Disabling Conditions

• Reduce productive capacity
• Impair intellectual & physical development in children
• Cause adverse pregnancy outcomes


National School of Tropical Medicine
Intestinal Helminth Infections: Ascariasis, Trichuriasis, Hookworm
The most common diseases of the Bottom Billion children

Village of Paquila, Guatemala

Prevalence (%) of intestinal helminth infections by age class:
- **Ascaris**
- **Trichuris**
- **Hookworm**
- **Strongyloides**

Age Class (years):
- 0 – 3
- 4 – 7
- 8 – 12

Prevalence (%)
- **Ascaris**
- **Trichuris**
- **Hookworm**
- **Strongyloides**

Image: Children from the Village of Paquila, Guatemala.
Child growth, development, and Education

Intestinal Worm Infections

Hookworm, Ascariasis

Hookworm leads to 40% reduction in future wage earnings

Mental Retardation in Varying Intensity Groups of Hookworm Infestation

Treatment for 2 days

Property of the Global Network
Chagas disease
American Trypanosomiasis

- 10 million cases worldwide;
- 20,000 annual deaths
- >90% in Latin America
- $1.2 billion economic losses
Geographic distribution of Chagas disease
Globalization of Chagas Disease

[Map showing distribution of Chagas Disease across the world with numbers indicating the number of cases (e.g., >5,500, >300,000, >80,000, >3,000, >1,500).]
Chagasic Cardiomyopathy

- Develops in 20-30% of seroconverted pts
- Heart failure from persistence of Trypanosoma cruzi in the heart
  - Conduction deficits (BBB)
  - Aneurysms
  - Thromboemboli
  - Sudden death
- Rx fails in patients with cardiac disease (children do better)
Congenital Chagas disease

-14,000-15,000 cases annually
  • 2,000 cases in North America including Mexico
-300,000 pregnant women with Chagas disease
  • 40,000 in North America including Mexico
-11% of pregnant women in Latin America
  • 34% of pregnant women in Bolivia
  • Pregnancy enhances parasitemia
  • Increased risk of miscarriage, preterm birth
-5% (2-10%) transmission to infants
- Two major drugs contraindicated in pregnancy

10 million Chagas cases (6 million in North America) 

2-3 million Chagasic cardiomyopathy

>20,000 deaths annually

11% Pregnant women in Latin America

Maternal-to-child transmission 5-10%

Transfusion associated cases

1.6 million HIV/AIDS cases

3.2 million DALYs lost

105,000 deaths

Maternal-to-child transmission 30%

Transfusion associated cases

National School of Tropical Medicine

Chagas Disease: “The New HIV/AIDS of the Americas”? 

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Chagas disease has emerged as an important health disparity in the Americas. As is well, we face a situation in both Latin America and the US that has a resemblance to the early years of the HIV/AIDS pandemic. Chagas disease is endemic in the Americas—making it a global public health concern. The high burden of disease in the US and the Americas has led to chagasic cardiomyopathy, cardiac arrhythmias, and death. The most common cause of death in the Americas is chagasic cardiomyopathy, which is a chronic progressive heart disease caused by infection with Trypanosoma cruzi. The disease is transmitted by the reduvid insect vector, the kissing bug. The infection is transmitted to humans through the bite of infected bugs that live in tropical and subtropical regions of the Americas. The disease can cause a wide range of symptoms, from mild to severe, including heart failure, stroke, and death. There is no cure for Chagas disease, but treatment can help manage symptoms and prevent complications. The World Health Organization estimates that there are 6 million Chagas cases in the Americas, with about 300,000 new cases reported each year. The disease is more common in low-income populations, and there is a higher prevalence in rural areas. Treatment with antiparasitic drugs can help prevent complications, but there is a lack of access to these drugs in many affected communities. There is an urgent need for increased funding and public awareness to combat this important global public health problem.
LAC poverty is not evenly distributed

- Mesoamerica
  - Central America
  - Southern Mexico
- Northeastern Brazil
- Chaco
  - Bolivia/Paraguay
- Mountainous areas of Bolivia, Peru, Ecuador
- Caribbean
  - Haiti/Guyana
To be sure, the other America is not impoverished in the same sense as those poor nations where millions cling to hunger as a defense against starvation. This country has escaped such extremes. That does not change the fact that tens of millions of Americans are, at this very moment, maimed in body and spirit, existing at levels beneath those necessary for human decency...They are without adequate housing and education and medical care.
Poverty in the United States

United States

- 46 million Americans (15%) live below the poverty line
- 20 million Americans live in extreme poverty (<50% below poverty line)
- 1.46 million families (2.8 million children) on less than $2 per day
- Texas and the Gulf Coast have the highest rates of poverty
Poverty in the United States

5 million Americans with NTDs
Toxocariasis 2.8 million
Chagas disease 1 million
Trichomoniasis 0.8 million
Cysticercosis 0.2 million
Poverty in Texas

Texas

- Almost five million Texans live in poverty (most in U.S.)
- One in five Texans
- Poverty approaches 30% in South Texas counties of Zapata, Brooks, Starr
- “Colonias”

Hotez P. 2012. PLoS NTDs
Sharing a legacy of poverty and disease

• NTDs in Texas and Mexico
  - Chagas disease
  - Cysticercosis
  - Dengue
  - Leishmaniasis
  - Leprosy
  - Murine Typhus
  - West Nile virus infection
Chagas disease in Texas

- Up to 267,000 human cases
- Endemic in dogs in South Texas (8%)
- Three major Triatoma spp
- Infected vectors in 82 of the 254 counties
Chagas Transmission in the U.S.

**Risk Factors**

- **Triatomines in U.S.**
  - 26 states
  - Generally sylvatic
  - *Triatoma sanguisuga* (6% *T. cruzi* infection rate)
  - *T. protracta* (20% *T. cruzi* infection rate)
  - *T. leticularia*
  - Delayed defecation by Triatomine species
  - Contaminated foods or mucous membranes

- **Increased domesticity**
- **Zoonotic transmission from dogs**
- **Limited Physician Awareness**
- **Risk highest in lower latitudes in southern portion**
  - Transmission 64-100°F
  - Higher risk range upon 1.8°F increase in temp by 2030

Lambert et al. *Geospatial Health* 2008
Triatomine vector has broad range in U.S.
Cysticercosis (Taenia solium)

- Leading cause of epilepsy among Hispanic Americans
- (41,400-169,000 cases) based on 1.8% seroprevalence
- 10% of seizures presenting to ED in Los Angeles
Toxocariasis in the American South

21% Seroprevalence among African Americans in poverty

‘Covert Toxocarasis: Asthma Developmental delays
West Nile Virus Infection

One half of >1,000 WNV infections in Texas

A disease of poverty?

- Poverty positively associated with WNV incidence (Degroote & Sugumaran *Vector Borne Zoonotic Dis* 2012; 12: 657-65)

- Probability of fatal outcome depends on poverty rate (Tackett et al *Publ Health Res* 2006; 121: 666-73.

- Seroprevalence of 6.8% among homeless in Houston (Meyer et al *Emerg Infect Dis* 2007; 13: 1500-3)

- Homeless more likely to be hospitalized (Murray et al *Epidemiol Infect* 2006; 134: 1325-32)
Epidemic Curve of all Texas WNV Cases

Number of Cases

Epi Week

2011
2010
2009
2008
2007
2006
2005
2004
2003
2002
Viral Shedding in Urine

Further testing of the cohort: 45/131 (34%) patients shedding WNV RNA in the urine.

- 69% male, ages 19 to 87 years (median 54 yrs.)
- 27% had WNF or were asymptomatic
- 47% have proteinuria
- 80% have GFR < 90; 28% have GRF < 60
- Samples collected between 2 and 8 yrs. post infection
Houston: the Perfect Storm for Dengue

- Proximity to dengue-endemic areas
- Vast shipping; both air and ship travel entry points; NAFTA
- High proportion of its ~4 million residents who routinely travel to and from dengue-endemic areas
- Dense urban population
- Abundance of *Ae. aegypti* and *Ae. albopictus*
- Mild winters and year-round survival of mosquitoes
- Passive surveillance, lack of diagnostic testing available

Courtesy of Dr. Kristy Murray
Dengue in Houston, TX

Aleisha Elliot MPH thesis
Mission

To prevent, diagnose and treat common and neglected tropical diseases in the Houston metropolitan population and to improve occupational health for those working in regions where tropical diseases thrive.

The new clinic opened its doors Oct. 7, 2011
A Call for the Decade of Vaccines (DoV)

- The Bill & Melinda Gates Foundation asked donors, governments, the private sector and the general public to partner with them for action – everyone has a role

- Potential to save the lives of 6.4 million children with existing vaccines alone

- The foundation committed $10 billion towards the discovery, development and delivery of lifesaving vaccines

- This investment is not nearly sufficient to meet the needs for new vaccine research and delivery of existing vaccines

Bill and Melinda Gates’ call to action re-energized and mobilized the vaccine community around an ambitious agenda
The “10/90 Gap”

Deaths from Infectious and Parasitic Diseases

Research & Development

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