MAKING NTDs VACCINE-PREVENTABLE: WHAT YOU CAN DO

Tuesday, June 30, 2015
1PM – 2PM (Central Time)
Housekeeping Items

- Slides from today’s presentations will be uploaded onto our website [www.immunizeUSA.org](http://www.immunizeUSA.org).
- Questions can be typed into the question box on the right-hand of your screen.
- Please take a moment to fill out the post-webinar survey.
- If for some reason you have to step away from the computer or phone, please do not place your phone on hold.
Community Immunity
An Interactive Group Exercise

By using the interactive Community Immunity exercise, TIP and its volunteers helped demonstrate the importance of immunization to more than 600 community members last year.
UPCOMING EVENTS

JULY 09, 2015

Making NTDs Vaccine-Preventable: What you can do

FREE WEBINAR
JULY 09, 2015 AT 1PM - 2PM

| REGISTER |

In 2014, immunization stakeholders from across the state of Texas identified the need for increased awareness of Neglected Tropical Diseases (NTDs) as a key priority for the immunization community. But what is currently being done to make NTDs vaccine-preventable? Why is it important for the immunization community as a whole to get involved in efforts to
Stakeholder Engagement
Stakeholder discussions and survey responses reinforced the need to pursue the following recommendations:

1. Promote strategies that reduce pertussis (whooping cough) incidence and protect mothers and infants.

2. Enhance the state immunization registry, ImmTrac, with specific features related to consent, retention of immunization records, and data exchange.

3. Reduce the number of exemptions that are claimed due to reasons of conscience through education and advocacy initiatives.

4. Increase immunization coverage rates among adults by improving vaccine access and affordability.

5. Continue to support efforts that protect college students against bacterial meningitis.

6. Improve uptake of human papilomavirus vaccine (HPV) among adolescents and young adults through education and the implementation of immunization best practices.

7. Increase awareness, research, and surveillance of tropical and emerging diseases.
Peter J. Hotez, MD, PhD
Tropical Infectious Disease Threats to Texas

Peter Hotez MD PhD

@PeterHotez
"Other Diseases"
The Neglected Tropical Diseases

The Global Burden of Disease Study 2010: Interpretation and Implications for the Neglected Tropical Diseases


Introduction
The publication of the Global Burden of Disease Study 2010 (GBD 2010) and development, agriculture (especially from zoonotic NTDs), and overall economic productivity [10-11]. Not de DALYs account for direct costs of treatment, Variations in DALYs

NTDs: The most common afflictions of the “bottom billion”
Expected number of cases in 2010 and 95% confidence intervals of the neglected tropical diseases (mean and uncertainty) as extrapolated from the Global Burden of Disease Study 2010.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Number of Cases</th>
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<tbody>
<tr>
<td>Ascariasis</td>
<td>819 million</td>
</tr>
<tr>
<td>Trichuriasis</td>
<td>465 million</td>
</tr>
<tr>
<td>Hookworm Disease</td>
<td>439 million</td>
</tr>
<tr>
<td>Dengue</td>
<td>390 million</td>
</tr>
<tr>
<td>Schistosomiasis</td>
<td>252 million</td>
</tr>
<tr>
<td>Lymphatic Filariasis</td>
<td>36 million*</td>
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<tr>
<td>Onchocerciasis</td>
<td>30 million</td>
</tr>
<tr>
<td>Food-borne Trematodiases</td>
<td>16 million*</td>
</tr>
<tr>
<td>Cutaneous Leishmaniasis</td>
<td>10 million</td>
</tr>
<tr>
<td>Chagas disease</td>
<td>7.5 million</td>
</tr>
<tr>
<td>Trachoma</td>
<td>4.4 million*</td>
</tr>
<tr>
<td>Cysticercosis</td>
<td>1.4 million*</td>
</tr>
<tr>
<td>Echinococcosis</td>
<td>1.1 million*</td>
</tr>
<tr>
<td>Visceral leishmaniasis</td>
<td>76,000</td>
</tr>
<tr>
<td>African Trypanosomiasis</td>
<td>37,000*</td>
</tr>
<tr>
<td>Rabies</td>
<td>1,100</td>
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<tr>
<td>Yellow Fever</td>
<td>100</td>
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<tr>
<td>Yaws</td>
<td>ND</td>
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<tr>
<td>Buruli ulcer</td>
<td>ND</td>
</tr>
<tr>
<td>Ebola</td>
<td>ND</td>
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</tbody>
</table>

Total number of cases:
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- Hookworm Disease: 439 million
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- Trachoma: 4.4 million*
- Cysticercosis: 1.4 million*
- Echinococcosis: 1.1 million*
- Visceral leishmaniasis: 76,000
- African Trypanosomiasis: 37,000*
- Rabies: 1,100
- Yellow Fever: 100
- Yaws: ND
- Buruli ulcer: ND
- Ebola: ND

Note: *Denotes cases included in the estimates. ND stands for Not Determined.
Comparison of worm index vs. HDI


http://127.0.0.1:8081/plosntds/article?id=info:doi/10.1371/journal.pntd.0003618
Looking beyond Africa: The Large Middle Income Countries in Asia and the Americas

Where do the NTDs occur?
Blue Marble Health: The poor living among the wealthy.

http://www.plosntd.org/article/info:doi/10.1371/journal.pntd.0002570
Poverty in the United States

46 million Americans living in poverty

20 million in extreme poverty

4-5 million on less <$2 per day

http://www.plosntd.org/article/info:doi/10.1371/journal.pntd.0001599
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.
Online database PubMed
1972-2007 (25 years)
MSHs: Neglected diseases, poverty, specific geographic regions, racial, ethnic, and socioeconomic groups
NTDs on the PLoS NTDs journal scope website page
Reference lists of identified articles
Hand-searched copies
Prevalence rates among selected communities multiplied by published estimates of at risk populations (in some cases the populations of one of the 8 Americas)
Parasitic Infections
- Chagas disease
- Cysticercosis
- Toxocariasis
- Trichomoniasis

Arbovirus Infections
- Chikungunya
- Dengue Fever
Trypanosoma cruzi

Cycle in bug
- Kissing bug bites and defecates; feces contain parasites
- Trypomastigotes enter bite wound and/or mucous membranes
- Trypomastigotes invade cells, transform into amastigotes

Chagoma (Romaña’s sign)
- Extracellular trypomastigotes
- Kissing bug acquires infection by biting

PATHOLOGY
- Intracellular amastigotes live in tissue
- Amastigotes within heart muscle cells
- Cardiomegaly with aneurysm
- Megacolon
- Megaesophagus

Vector Control Initiatives
- Andean Initiative (IEN)
  - Venezuela, Colombia, Ecuador, and Peru
- Central American Initiative (PCA)
  - Mexico, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama
- Southern Cone Initiative (INCCO)
  - Argentina, Bolivia, Brazil, Chile, Paraguay, and Uruguay

Map showing prevalence of infected people per 1000: <1%, 1%-2%, 2%-3%, 3%-4%, 4%-5%, 5%-7.5%, 7.5% and above.
Chagas Disease and Chagasic Cardiomyopathy

- Chronic Chagas Disease
  - Cardiomyopathy (Chamber enlargement)
    - 10-30% patients years after infection
    - Left Ventricular Aneurysm
    - Conduction defects
  - Megacolon and Megaesophagous
Maternal-to-Child-Transmission

- Maternal Chagas Disease
  - 40,000 pregnant women in North America
  - 5% vertical transmission
  - Rx contraindicated

- Congenital Chagas Disease
  - 1st documented US case (2010)
  - 10-40% symptomatic
  - LBW/Low APGAR Scores
  - Hepatosplenomegaly
  - Cardiac failure
  - Respiratory distress
  - Meningoencephalitis
  - Neonatal death

Diagnosis of Congenital Chagas
- Giemsa stain of blood
- PCR
- Repeat testing 4-6 weeks
- Maternal antibodies wane after 9-12 months

Rx >90% effective
- Benznidazole/Nifurtimox
- Not FDA approved
- Available through CDC protocols
Chagas Disease: The Costs

- Economic Costs
- Lost worker productivity
- Healthcare costs
  - $7.2 billion globally
  - $864 million USA
  - About one-half in Texas?
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*

Increased domesticity

Zoonotic transmission from dogs (8%)

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

Dr. Sahotra Sarkar, University of Texas at Austin

Lambert et al *Geospatial Health* 2008
Autochthonous Chagas Disease in Texas

GARCIA AND OTHERS

AUTOCLOTHONOUS CHAGAS DISEASE IN TEXAS

Case Report: Evidence of Autochthonous Chagas Disease in Southeastern Texas

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Abstract

Autochthonous transmission of Trypanosoma cruzi in the United States is rarely reported. Here, we describe five newly identified patients with autochthonously acquired infections from a small pilot study of positive blood donors in southeast Texas. Case-patients 1–4 were possibly infected area residents, while case-patients 5 had no diagnosed history of Chagas disease in the United States. Examination of our cases suggests that blood donors should be screened for Chagas disease, as these infections may be preventable. Our findings may have implications for blood donation in Texas and other states with high-risk populations.


doi:10.1017/S0141036614002349

SHORT REPORT

Trypanosoma cruzi screening in Texas blood donors, 2008–2012

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SUMMARY

Chagas disease is an important emerging disease in Texas that results in cardiomyopathy, atrial fibrillation, and stroke. The purpose of this study was to determine the prevalence of Trypanosoma cruzi infection among blood donors in Texas, USA, and to identify new cases of autochthonous transmission of the parasite. Blood samples from 2024 blood donors were tested for T. cruzi infection using a commercially available serologic assay (Ortho-Clinical Diagnostics, Raritan, New Jersey). The overall seroprevalence of T. cruzi infection was 0.43% (8/1868) among all blood donors. Four (0.21%) donors had positive serologic results for T. cruzi infection, and all four donors were from the same blood center in Harris County, Texas. These findings are consistent with previous reports of autochthonous transmission of T. cruzi in Texas. The results of this study support the implementation of a screening program for T. cruzi infection among blood donors in Texas, USA.
“A scientist who is also a human being cannot rest while knowledge which might reduce suffering rests on the shelf.”

–Dr. Albert B. Sabin
Sabin PDP Pipeline and Disease Portfolio

2000 to 2004
- Built structure
- Launched Hookworm Program

2004 to 2011
- Expanded Hookworm Program
- Schisto Program
- Relocated to TMC

2011 to 2015
- Added 7 additional programs
- Expansion of capabilities

Programs:
- Hookworm
- Schistosomiasis
- Leishmaniasis
- Chagas Disease
- Trichuriasis
- Ascariasis
- West Nile
- SARS
- Onchocerciasis
Chagas Disease Vaccine

• Bivalent recombinant protein
  – Tc24
  – TSA-1
  – Additional antigens
  – E6020/GLA-SE

• Status
  – Preclinical testing in Houston and Mexico
  – Supported by SWEEMRI, Carlos Slim Health Institute, TCH
Conduction deficits detected in 20% of animals by 70 days of infection

Altered Heart Rate

Ectopic activity

Atrial flutter
Severe heart failure seen in ~20% of animals by 180 DPI

Uninfected mouse

Chronically infected mouse
• Mobitz Type 2 conduction block
• Severe Heart Failure
Toxocariasis **(Toxocara canis)**

- Canine zoonosis
- Larval helminth infection
  - Visceral larval migrans
  - Ocular larval migrans
  - Covert toxocariasis
- Rise of Asthma?
- Developmental delays?
Toxocariasis and Developmental Delays

A group of neglected infections are emerging as an important cause of psychiatric and mental illness among vulnerable populations living in extreme poverty in the United States. These chronic infections may partially account for the achievement gap noted among socioeconomically disadvantaged students.

The neglected tropical diseases (NTDs) are a group of chronic, parasitic, and related infections that can last decades or even the lifetime of an individual. During this time, they produce long-lasting and debilitating effects that impair productive capacity and child development. Indeed, the NTDs have actually been shown to trap people in poverty through these adverse effects.

The NTDs are not rare diseases. Quite the opposite—these NTDs are now recognized as the most common afflictions of impoverished people living in low- and middle-income countries of Africa, Asia, and Latin America. The NTDs are also considered a major reason why the “bottom billion,” i.e., the 1.3 billion people living below the poverty line cannot escape poverty. In 2008, I identified a group of neglected parasitic and related infections of poverty among the extreme poor in the United States that closely resemble the NTDs in terms of their ability to produce chronic, debilitating, and poverty-promoting effects. A new review reveals that these neglected infections remain widespread and disproportionately affect vulnerable populations, including African American and Hispanic populations living in poverty and their homes. These are the Gulf Coast region, and other parts of the southern United States represent the major affected areas, mostly because of their association with the extreme poverty in these regions.

Additional information has determined that the neglected infections of poverty also cause important psychiatric and neurological effects on vulnerable populations in the southern United States (Table). Toxocariasis is a larval parasitic worm infection of the brain and viscera that results from accidental ingestion of Toxocara species eggs shed by dogs and cats. The eggs are nearly ubiquitous in disadvantaged urban and rural environments—the seroprevalence among disadvantaged African American populations exceeds 20%. An estimated 2.8 million African American individuals have toxocarasis. In a large survey of the US population, it was recently found that children who are exposed to Toxocara infection (a marker of exposure and infection) scored significantly lower on the Wechsler Intelligence Scale for Children-Revised and the Wide Range Achievement Test–Third edition than did seronegative children. Toxocarasis is also associated with epilepsy and may be an important cause of epilepsy among African American children.

Persons with toxocarasis are also more likely to be co-infected with Trypanosoma cruzi, a parasitic protozoan that causes Chagas disease, both of these chronic infections can be acquired from cats. Like toxocarasis, toxoplasmosis also disproportionately occurs among non-Hispanic black individuals and is linked to poverty. Approximately 1 million new cases occur annually in the United States. A recent body of literature has identified provocative associations between toxoplasmosis and adult psychiatric illness, possibly a long-term consequence from congenital Toxoplasma infection.

In pregnancy, non-Hispanic black women are at substantially increased risk of acquiring primary CMV infection compared with non-Hispanic white women, especially during teen pregnancies. An estimated 270,000 new cases of congenital CMV infection occur annually.

Beyond African American individuals, 2 neglected infections of poverty also affect other vulnerable populations in the United States. Neurocysticercosis, a larval pork tapeworm infection, is an important cause of epilepsy and chronic headaches in mostly Hispanic individuals. My previous estimates indicate that between 40,000 and 100,000 people are living with cysticercosis in the United States. Several studies have identified cognitive impairments in patients with neurocysticercosis and seizures. In addition, the largest numbers of new cases of West Nile virus (WNV) infections are currently found in Texas during the WNV outbreak there, almost 2000 cases were reported. Homeless populations are considered at risk for acquiring WNV infection. Neuroinvasive WNV infections has now been linked to chronic depression in high proportions of patients.

The links between these neglected infections of poverty and psychiatric and neurological illnesses have potentially important implications for mental healthcare providers. The neglected infections outlined here are not one disease in the United States, and millions of people in this country are estimated to be living with chronic toxoplasmosis, toxocarasis, CMV infection, neurocysticercosis, and WNV infection. Together, they likely account for a substantial yet hidden burden of mental illness in the United States. These infections can be extremely challenging to diagnose, manage, treat, or prevent. A national awareness program should implement.
Cysticercosis (*Taenia solium*)

Leading cause of epilepsy among Hispanic Americans (41,400-169,000 cases) based on 1.8% seroprevalence in Ventura County, CA and 9.4 million HAs living in poverty. 10% of seizures presenting to ED in Los Angeles.
The Global Dengue Pandemic

• 390 million dengue infections annually
  – Bhatt et al 2013 *Nature*
  – India 132 million
  – Indonesia 31 million
  – China 26 million
  – Brazil 22 million
  – Bangladesh 16 million
  – Pakistan 14 million
  – Middle East: Egypt, Saudi Arabia, Syria, Yemen
Dengue and Bollywood

Priyanka Chopra
Ranveer Singh

Yash Chopra
Dengue/Chik Mosquito Vectors

**Ae. aegypti**
- Yellow Fever Mosquito
- Best Dengue Mosquito
- Prefers humans
- House dwelling
- Primary vector

**Ae. albopictus**
- Asian Tiger Mosquito
- Nonspecific preference
- Invasive species
- Vector in 2001 Hawaii Outbreak

Aleisha Elliott
UTSPH
U.S. Distribution – *Ae. aegypti*

Source: Exotic and Invasive Vectors Database 2010
Symptoms

- Influenza-like symptoms, retro-orbital pain, severe joint and muscle pain, thrombocytopenia.

- Dengue Hemorrhagic Fever (DHF)
  - Dengue Shock Syndrome (DSS)
    - capillary leakage
    - severe bleeding
    - organ failure and death
Dengue in U.S.

- Endemic prior to 1940’s
- Generally travel-associated cases
- Vector eradication efforts mid-1940’s
- Ae. Albopictus documented 1987
- Texas-Mexico Border: 7 outbreaks since 1980
- Houston: 2003-2005?
- Hawaii: 2001, Ae. albopictus
- Florida: 2009-2010

Vector eradication “successful” Efforts stopped 1972

Aleisha Elliott
UTSPH
Emergence of Dengue Fever in Houston

Epidemic Curve of Dengue IgM Positive Cases

Month and Year of Symptom Onset
* = History of travel to Mexico; X = Fatal Case

Harris County - Houston, TX

Kristy Murray DVM PhD BCM
Aleisha Elliott MPH UTSPH
The National School of Tropical Medicine at Baylor College of Medicine
NTDs and You.. Next Steps

Rekha Lakshmanan, MHA
The Immunization Partnership
What can we do?

- Bring AWARENESS to yourself and your peers

- 4 things you can do:
  - **START** the conversation
    - Have a message- why are NTDs important and why they need to be vaccine preventable
  - **EDUCATE** yourself and your peers
    - Seek out information. Inform yourselves
  - **SHARE** information
    - Facebook, twitter, blog posts
    - Organizations consider providing literature and information on how to diagnose and treat
    - Professional associations and coalitions can have NTD outreach project
What can we do?

- **TAKE ACTION**
  - Community based activities
    - Health fairs
    - Provider education meetings
    - Promote with other programs
  - Organization activities
    - Quality metrics
    - Training programs
    - Grand Rounds focus
  - Policy activities
    - Advocate for legislation
      » E.g., surveillance
Resources- Where to go?

- **Websites:**
  - Sabin Institute- [http://www.sabin.org/programs/vaccine-development](http://www.sabin.org/programs/vaccine-development)
  - Rice University’s Baker institute- [http://bakerinstitute.org/](http://bakerinstitute.org/)
  - PLOS (Public Library of Science) NTDs- [http://journals.plos.org/plosntds/](http://journals.plos.org/plosntds/)
  - United to Combat NTDs- [http://unitingtocombatntds.org/why-ntds](http://unitingtocombatntds.org/why-ntds)
Resources- Where to go?

- Twitter:
  - Gates Health @gateshealth
  - Children Without Worms @CWWDirector
  - Drugs for Neglected Diseases initiative @DNDi
  - PLOS NTDs @PLOSNTDs
  - London School of Hygiene & Tropical Medicine Press Office @LSHTMpress
  - Liverpool School of Tropical Medicine @LSTMnews
  - The Carter Center @CarterCenter
  - FHI 360 @fhi360
  - Schistosomiasis Control Initiative @sci_ntds
Thank you!

Rekha Lakshmanan, MHA
rlakshmanan@immunizeusa.org
Q&A with Speakers

- Questions can be typed into the question box on the right-hand of your screen.
Thank you!