Infectious Diseases in the U.S.-Mexico border

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U.S.-Mexico border

• 2,000 mile. 4 U.S. states and 6 Mexican states
• Larger frontier separating a developed and developing country.
• Largest gap in median incomes between countries.
• One of the busiest international boundaries
• 320 million people cross legally every year
• Enormous population growth:

<table>
<thead>
<tr>
<th></th>
<th>US border</th>
<th>Mexican border</th>
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</thead>
<tbody>
<tr>
<td>Growth</td>
<td>1.8% annually</td>
<td>4.3%</td>
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<tr>
<td>(0.8% U.S.)</td>
<td></td>
<td>(1.6% Mexico)</td>
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</tbody>
</table>

U.S.-Mexico border

• Challenges:
  • Large population movement
  • Areas of poverty
  • Limited public health infrastructure
  • Poor environmental and sanitation conditions
  • Access to healthcare
  • Differences in surveillance
  • Case definition
  • Availability of diagnostic tools
  • Underreport

• Increased risk for:
  • Foodborne
  • Waterborne
  • Vaccine preventable
  • Airborne diseases

• 2X-4X increase in Hepatitis A, Measles, Rubella, Shigellosis, Rabies

• 8X increase in Brucellosis

• Others: tuberculosis, syphilis

Infectious diseases at different stages of migration

- Interaction of factors:
  - Epidemiology of ID in their countries of origin
  - Health status
  - Barriers accessing adequate healthcare

- Early settlement period:
  - Crowded and unhygienic conditions during migration
  - Outbreaks of respiratory, gastrointestinal, skin infections and vaccine preventable diseases

- After re-settlement:
  - Undetected an untreated latent infections
  - Tuberculosis, viral hepatitis, HIV, chronic helminthiasis and Chagas disease
Overview of Infectious Diseases
Tuberculosis

- Concern in border areas in both countries
  - 15,000 cases on a yearly basis in both countries
  - Incidence in Mexico: 15 per 100,000
  - In the U.S: 4.7 per 100,000 population
- Higher incidences at the U.S-Mexico border: 26.3 in Mexican states and 7.9 in the U.S
- Concentrated in Non-US-Born population: Lat Am and Asia
- Gap between high and low burden countries is growing
Tuberculosis in the U.S.

- **New TB cases**: TB in non-US-born individuals
- **Total cost** U.S: 350 million per year
- **Most cases due to reactivation of Latent TBI**: 80%

>>first year. May last for 10 years or more (46.3%)

- **2/3 of all US TB cases arise from reactivation of LTBI**
- **20% of all cases in Non-US-born comes from Mexico**

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Menzies N.A; *THE IMPACT OF MIGRATION ON TUBERCULOSIS IN THE UNITED STATES*; INT J TUBERC LUNG DIS. 2018
## Tuberculosis

<table>
<thead>
<tr>
<th>Non-U.S-born individuals</th>
<th>U.S-born individuals</th>
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<tbody>
<tr>
<td><strong>2018</strong>: 9029 cases in the U.S.</td>
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<tr>
<td>2.8 per 100,000 persons: lowest ever reported</td>
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<tr>
<td><strong>2018</strong>: increase in hispanics</td>
<td></td>
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<tr>
<td>69% of cases</td>
<td></td>
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<tr>
<td><strong>2000-2016</strong>: incidence 9 times higher. <strong>2018</strong>: 14 x</td>
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<tr>
<td>Latent TBI: 20.5% (13.7 X higher)</td>
<td>1.5%</td>
</tr>
<tr>
<td>3 times higher resistant TB (86%)</td>
<td></td>
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<tr>
<td>Extrapulmonar disease</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;Prevalence of DM, smoking, HIV: reactivation of LTBI</td>
<td></td>
</tr>
<tr>
<td>7.5%</td>
<td>&gt;&gt;Recent transmission 27.4%</td>
</tr>
<tr>
<td><strong>Greater exposure to infectious Tb</strong> within their community</td>
<td></td>
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<tr>
<td><strong>Children: 6 times higher incidence</strong> of TB</td>
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</table>
Tuberculosis

- Higher TB incidence in undocumented migrants
- Different types of migrants = different types of TB
  - Previous exposure
  - Access to preventive and treatment services
  - Comorbid conditions
- Transmission mainly within migrant communities
- High LTBI burden in migrants challenges TB elimination
- Challenges:
  - Migrants: difficult to reach and treat
  - Length and complexity of treatment
  - Prevention
  - Resistant TB

Menzies N.A; THE IMPACT OF MIGRATION ON TUBERCULOSIS IN THE UNITED STATES; INT J TUBERC LUNG DIS. 2018
Tuberculosis prevention and tx

- Detect and treat LTBI among migrants
  - Consider the incidence rate in the country of origin
  - Symptoms, comorbidities
  - Contact with TB cases
  - TST, IGRA
  - Treatment: simplify

- Detect and treat active TB
  - Symptoms questionnaires
  - Chest X-ray
  - GeneXpert MTB/RIF or culture

- All individuals applying for immigration: examination for TB. Culture based diagnostic algorithm. (54% of positive cases were smear negative).
  - Reduction in new TB cases by 38%.

Rendon A; MIGRATION, TB CONTROL AND ELIMINATION: WHOM TO SCREEN AND TREAT. Pulm 2018.
Menzies N.A; THE IMPACT OF MIGRATION ON TUBERCULOSIS IN THE UNITED STATES; INT J TUBERC LUNG DIS. 2018
<table>
<thead>
<tr>
<th></th>
<th>Mexico</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A</td>
<td><strong>Endemic. Most cases in &lt;10 years old.</strong></td>
<td><strong>&gt;50% of cases traveled across the border during incubation. Most cases in &gt;30 years</strong></td>
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<tr>
<td>(same subgenotype in samples from the border IA)</td>
<td><strong>Gap in effective vaccination</strong></td>
<td><strong>Effective vaccination</strong></td>
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<td></td>
<td><strong>Shift form high to Intermediate endemicity</strong></td>
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<td></td>
<td><strong>Improvements: Socioeconomic, Sanitation, water supply</strong></td>
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<tr>
<td>Hepatitis B</td>
<td><strong>Similar prevalence in both countries 0.3%-2%</strong></td>
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<tr>
<td></td>
<td><strong>Sexual transmission, contaminated surgical equipment and body fluids</strong></td>
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<tr>
<td></td>
<td><strong>Effective vaccination</strong></td>
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<tr>
<td>Hepatitis C</td>
<td><strong>Prevalence 1-2.5%</strong></td>
<td><strong>Risk factors: IDU and cross border</strong></td>
</tr>
<tr>
<td></td>
<td><strong>IDU in northern México &gt;90%</strong></td>
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<tr>
<td></td>
<td><strong>IDU, blood transfusion, sexual transmission</strong></td>
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</table>
Viral Hepatitis prevention

- In the U.S: dramatic reductions in the burden of acute Hep A and B attributed to safe and effective vaccination
- Routine Hep A vaccination of young children in endemic settings: Mexico´s northern border
- Hepatitis B and C prevention programs
  - Vaccination Hep B
  - Sexually transmitted disease clinics
  - Drug treatment centers

HIV and STIs

• Tijuana and Cd Juarez: concentrated epidemic. Economically disadvantaged population

<table>
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<tr>
<th>At risk populations</th>
<th>Characteristics</th>
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<tr>
<td>Illicit drug use</td>
<td>2-3 times the national average</td>
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<tr>
<td></td>
<td>Starting early in life (12-29 y)</td>
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<td>Mainly in “Zona Norte”</td>
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| Sex workers                         | Sex tourism |
|                                     | Only 38% FSW using condoms for vaginal sex |
|                                     | “Zona Roja” overlaps with “Zona Norte” |

| Large transient populations         | Non native residents: Mexico. CA, SA |
|                                     | Temporary residents waiting to migrate |
|                                     | Recent deportees: Deportation from the U.S: 4X increase odds for males of being HIV-positive. |
Migrants

- Low schooling, illiteracy
- Low knowledge on transmission and risk factors
- Low access to health, educational and social services
- Lost of social ties and family boundaries
- Homelessness

**High risk behaviors:**
- Migrant males: more likely to have sex with other men, pay for sex with males and females. (Ramos. 2009)
- Recent migrants to Tijuana: more likely to inject drugs with used needles. (Strathdee. 2008)

**During migration process:**
- **use of drugs and alcohol, prostitution, promiscuity**
  - Women: Sex as a way of negotiation for crossing the border
  - Migrant workers: 10 X higher risk of HIV.

**More sexual partners in migrant men and women:**
- 1.8 and 1.2 before (after migration 3.3 and 1.5).

**More IDU:**
- 9.8% vs 1.2%
HIV and STIs

- Prevalence of HIV in this area: highest in the country (0.2-0.3%)
  - IDU 3% (Frost. 2006)
  - FSWs 6% (Patterson. 2008).
  - Gonorrhea 6%, Chlamydia 13%, active syphilis 14%.
  - IDU + FSW 12% (Strathdee. 2008). 72% at least one STI.
  - Young MSM 19% (Sanchez 2004)
HIV and STIs

• Regional sub-epidemic in these cities “concentrated”

• Increase coverage of HIV and STI testing and treatment programs
  • Bringing clinics closer to high risk neighborhoods
  • Majority of affected population lives in remote areas

• Reduce high-risk environments:
  • Condoms use campaigns
  • Needle exchange programs
  • Access to sterile syringes
  • Registration of FSWs: condom use, STI screening
  • Drug abuse treatment programs
Vector-Borne Diseases

- **Dengue**: Most globally important mosquito transmitted-viral infection: *Aedes aegypti*
  - Urban-adapted
  - Day-biting, multiple individuals in a short period
  - Breeding in stagnant water in manufactured containers

- **Same mosquito for Dengue, Zika and Chikungunya**

- **35%** of global population live in an endemic area (tropical areas)

- **Climate change**: expands the area hospitable to this species

- **Vector spreading worldwide**: virus invading new areas

- **WHO**, yearly:
  - 50-100 million dengue infections
  - 500,000: severe dengue
  - 20,000 deaths (primarily pediatric cases)

Dengue in the U.S.

- Outbreaks of *autochthonous dengue*:
  - Philadelphia 1780
  - 1922: Texas (600,000 cases)
  - Louisiana 1954
  - Texas-Mexico border 1980
  - Southern Texas, Hawaii, Florida

- Since 2005, 2 outbreaks spread to Texas along the border:
- Temporally associated with large outbreaks in neighboring Mexican cities
  - 2005 Brownsville. 25 cases. 3 locally acquired.
  - 2013 Cameron, Hidalgo and Willacy: 53 cases. 26 locally acquired.
  - 2004: serosurvey of 300 residents of southern Texas: recent infection 2%. Past infection 40%.
Dengue in the U.S.

• Transmission regularly in Sonora (1982)
• 2007-2013: 3-10 dengue cases reported annually in Arizona. Travel-associated.
• September-December 2014: outbreak in Sonora Mexico. Local transmission in the Arizona-Sonora border. 93 travel associated cases in Arizona. 75% in Yuma County.
• Survey in Yuma County, Arizona:
  • 78% travelled to Mexico at least 1/month
  • 24% household water containers colonized with Aedes mosquito
• INCREASED RISK FOR LOCAL DENV TRANSMISSION
• California: arrival and spread of Aedes in 2013: surviving the mild Californian winter
Vector borne diseases

• 2 mechanisms for an outbreak in U.S.:
  • Spillover of carrier mosquitoes from nearby Mexico
  • Infected humans in areas infested by *Aedes*

• From San Diego in the west to Yuma, Arizona on the east

• Migrants: from countries where these are endemic

• Need for disease surveillance, vector control efforts, antiviral drugs and effective vaccines

• Epidemics come in 3-5 years waves

• 2019: Dengue: Nicaragua, Brazil, Colombia, Mexico, Honduras, Venezuela, Belize, Guatemala, El Salvador, Paraguay

Zika transmission in the U.S.

- Travel-related cases
- Local transmission: mosquitoes that carry Zika are present in the US. (Texas and Florida)
- Sexual transmission (3-6 months)

Cases per year:
- **2015**: 62 cases (100% imported)
- **2016**: 5168 cases (4897 in travelers, 224 local transmission, 45 sexual, 1 lab, 1 person to person unknown)
- **2017**: 452 cases (437 imported, 7 local, 7 sexual, 1 lab)
- **2018**: 72 cases (100% imported)
- **2019**: 5 cases. 100% imported

- Complications: Guillain-Barré syndrome (prevalence 1.23%)
- Congenital Zika Syndrome: 1/7 babies born to mothers with Zika
- Underreport: misdiagnosed as dengue, malaria

CDC, Division of Vector-borne diseases, August 2019
Figure 2  Map of high- and low-risk areas for infection.
Vector borne diseases

- Surveillance for the mosquito
- Research on mosquito behavior
- Vector control
  - Public education campaigns
  - Source reduction: avoid water containers
  - Avoid mosquito bites
  - Insecticides: larvicides, adulticides
    - Resistance
    - Long-lasting impact
  - Inside-house strategies
- Research on antiviral and vaccine development
Rocky Mountain Spotted Fever

• Life-threatening and rapidly progressing tickborne disease: *Rickettsia rickettsia*

• Initial unspecific symptoms: Progressive damage to vascular endothelium: organ failure

• Fatal without appropriate treatment in the first days 50% of deaths: first week

• Emerging public health concern in the border

• Epidemic levels in areas of eastern and southern Arizona and northern Mexico: perpetuated by brown dog ticks


Rocky Mountain Spotted Fever

- Epidemic in portions of northern Mexico
  - 2009-2016: 967 cases, 132 deaths in Mexicali
  - 2004-2015: 1,129 cases, 188 deaths in Sonora
  - Also increase in cases in states of Coahuila and Chihuahua
- In the U.S:
  - Most cases in mid-Atlantic states
  - Increasing in certain areas of Arizona. 2003-2016: 360 cases. 21 fatalities.
- Transborder cases exist
- Need for improved clinical awareness on both sides of the border
- Ongoing communication between health authorities

Typhoid fever:

- Poor sanitation and hygiene
- Recent outbreaks in Honduras (100 cases), Guatemala (60 cases), Mexico (110 cases)
- Growing resistance to quinolones
- Cases in migrants, detected when arriving to the U.S.

Parasitosis:

- Prevalence in Central Americans seen at Los Angeles: 53%
- U.S. born Central American children: 14%
- Most common pathogens: *Trichuris trichuria, Giardia lamblia, Ascaris lumbricoides*
- Prevalence in children in Texas Border: 22-25%. Main risk factors: personal hygiene habits and consumption of foods bought in Mexico.
Vaccine preventable diseases

• Migrants: lower immunization rates
• Low vaccination coverage in country of origin
• Limited access to vaccination:
  • Movable population: vaccines that require multiple doses at regular times
  • Information of immunization status is lacking
  • Refuse registration for fear of legal consequences

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Foreign born</th>
<th>US-born</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza</td>
<td>34%</td>
<td>40.4%</td>
</tr>
<tr>
<td>Pneumococcal polysaccharide vaccine</td>
<td>14%</td>
<td>21%</td>
</tr>
<tr>
<td>Tetanus</td>
<td>51%</td>
<td>65%</td>
</tr>
<tr>
<td>Tdap</td>
<td>9%</td>
<td>16%</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>28%</td>
<td>37%</td>
</tr>
</tbody>
</table>
Vaccine preventable diseases

- Diseases with similar vaccine coverage: Mumps, Measles, Rubeola, Polio, rotavirus, HiB
  - Residents at the US border lower H1N1 coverage than residents in other locations
  - 2010: 23.4% vaccinated. 2012: 33.7% vaccinated.
  - Seasonal influenza vaccination in Mexican migrants: 19% (Ejebe 2015)
- Outbreaks in illegal migrants:
  - May 2019: McAllen. 32 cases positive for influenza. 16y died. Easily spread
Vaccine preventable diseases

• Meningococcus:
  • No universal vaccination in Mexico
    • Rare condition in the whole country. 2 cases per year.
  • Passive surveillance and underreporting.
    • Tijuana: 2005-2016. active surveillance: 51 cases (<15 years old), median age 36 months. Only 6% predisposing condition. Lethality 25.5%. Survivors: 30% sequelae.
    • 86% of cases were caused by serogroups included by the tetravalent conjugate vaccinate.
    • Meningococcal disease: endemic in Tijuana. Leading cause of bacterial meningitis.
  • 2013: outbreak with high mortality in Tijuana, Mexico. 19 cases. Fatality rate of 40%.
Illegal Migrants

- October 2018-July 2019
- 535,000 people from 37 countries have been arrested
  - Most of them children and families from countries south of Mexico

- Outbreaks and ID:
  - Mumps
  - Measles
  - Chickenpox
  - Scabies
  - Legionnaire’s disease
  - Meningococcocc
  - Influenza
  - Shingles
  - Staphylococcus, streptococcus
  - Necrotizing fascitis
Illegal Migrants

- Migrants:
  - Countries of origin endemic for diseases

During migration exposed to
- **Overcrowding**: acute respiratory diseases
  - Measles, mumps, chickenpox, influenza, Legionella
- **Close-contact settings**
  - Scabies, *Staphylococcus* infections, shingles
- **Poor sanitation and hygiene**
  - Lice infestations, diarrhea, scabies
- **Poor access to health care**
- **Improper use of isolation and quarantine**
ID model of care

- **Universal access** to ID care
  - Medical examination, provision of drugs
  - Removal of Institutional barriers to care
- **Education** on ID
  - Trained physicians on migrant health issues
  - Community education
    - Reduce stigma, facilitate detection and treatment
    - Inform migrants of available health-care resources
- **Migrant-sensitive health systems**
  - Language: interpretation services, educational materials
  - Culture
- **Screening (pre-arrival, on-arrival, post-arrival)**
  - Early diagnosis: benefit for the individual
  - Protect the society: avoid spreading
- **Promote** **bilateral and multilateral cooperation** among countries
  - Ensure the continuity of care
- **Active case finding: innovative diagnostic tools** in high mobile groups
- **Research**
Conclusions

• Border: One community
  • Physical borders does not stop diseases

• Different resources

• Public health at both sides should address the same needs
  • Vaccination coverage
  • Environmental and sanitation programs
  • Detecting and treating
  • Surveillance: case definitions, availability of lab tests, precise and timely report

• Health promotion adapted to specific needs
  • Improve the individual health status
  • Prevent the occurrence of secondary cases
  • Education
Conclusions

• Health promotion and disease prevention among migrants contributes to overall public health

• ID:
  • Recognize: timely diagnosis.
  • Screen: availability of tests
  • Treatment: effective and simple
  • Report

• Surveillance and bilateral collaboration

• Effective strategies for prevention:
  • Vaccination
  • Medical evaluation: trained physicians
  • Tests for diagnosis (Fast results)
  • Detecting and treating latent infections
  • Vector control
Thank you