NTDs Slated for Elimination and Eradication

Institute of Medicine
Forum on Microbial Threats
The Causes and Impacts of Neglected Tropical and Zoonotic Diseases
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Vice President – Health Programs
The Carter Center
Definitions

• *Eradication* = deliberate reduction of global incidence to zero, no further control measures necessary.

• *Elimination* = cessation of transmission in a country, continent or other limited geographic area; complete prevention of a clinical manifestation.

• *Control* = reduced incidence or prevalence, control measures still necessary.
World Health Organization
List of Neglected Tropical Diseases (NTDs)

- Ascariasis
- Buruli ulcer
- Chagas disease
- Dracunculiasis
- Hookworm
- Human African trypanosomiasis
- Leishmaniasis
- Leprosy
- Lymphatic filariasis
- Onchocerciasis
- Schistosomiasis
- Trachoma
- Trichuriasis

= targeted by WHO for eradication or elimination
NTDs Targeted by WHO for Elimination or Eradication

- **Dracunculiasis**: global eradication (WHA57.9) 2004
- **Onchocerciasis**: regional elimination (interrupting transmission of the parasite) (PAHO CD48.R12) 2008
- **Lymphatic filariasis**: global elimination as a public health problem (WHA50.29) 1997
- **Trachoma**: global elimination of blinding trachoma (WHA51.11) 1998
- **Leprosy**: global elimination (reduction of cases to less than 1 per 10,000 population) (WHA44.9) 1991; elimination as a public health problem (WHA51.15) 1998
- **Chagas disease**: regional elimination of transmission “as a technically feasible” (WHA51.14) 1998; “control and elimination” (WHA63.20) 2010
- **Visceral leishmaniasis**: regional elimination (WHA60.13) 2007
The Allure of Eradication

"YOU HAVE ERASED FROM THE CALENDAR OF HUMAN AFFLICTIONS ONE OF ITS GREATEST. YOURS IS THE COMFORTABLE REFLECTION THAT MANKIND CAN NEVER FORGET THAT YOU HAVE LIVED. FUTURE NATIONS WILL KNOW BY HISTORY ONLY THAT THE LOATHSOME SMALLPOX HAS EXISTED."

Thomas Jefferson to Edward Jenner

In even stronger, but that achievement has not yet been matched for any other disease (campaigns to eradicate Guinea worm disease and polio are underway), although not for lack of trying. It is useful to consider why.

Even before smallpox eradication was finally achieved, separate attempts to eradicate yellow fever, malaria and yaws earlier in the 20th century had already failed. The campaign against yellow fever discovered belatedly that the virus had an inexhaustible reservoir in wild monkeys.
GUINEA WORM (DRACUNCULIASIS) ERADICATION
Key Facts About Guinea Worm Disease

- Only transmitted by contaminated drinking water
- Crippling: health, agriculture, education
- Seasonal
- One year incubation period
- No vaccine or cure
- No animal reservoir
- Prevention: health education, filters, ABATE®, wells
Number of Reported Cases of Dracunculiasis by Year: 1989 - 2009

Cases ~ 3,500,000 –> 3,190

Internationally
154 –> 5
Exported Cases

GWD-Endemic
23,735 –> 629
Villages

GWD-Endemic
20 –> 4
Countries
Guinea Worm Reduction Over Time

1986

2009
Distribution of 3,185 Indigenous Cases of Dracunculiasis Reported during 2009

Number of cases

- Sudan: 2,733
- Ghana: 242
- Mali: 186
- Ethiopia: 24

Nigeria, Niger, Togo, Burkina Faso, and Cote d'Ivoire had no cases reported.

Benin: 2004\(^\wedge\): Certified by WHO
Mauritania: 2004\(^\wedge\): Certified by WHO
Uganda: 2003\(^\wedge\): Certified by WHO
Cent. African Rep.: 2001\(^\wedge\): Certified by WHO
Chad: 1998\(^\wedge\)
Cameroon: 1997\(^\wedge\): Certified by WHO
Yemen: 1997\(^\wedge\): Certified by WHO
Senegal: 1997\(^\wedge\): Certified by WHO
India: 1996\(^\wedge\): Certified by WHO
Kenya: 1994\(^\wedge\)
Pakistan: 1993\(^\wedge\): Certified by WHO

Excludes 5 cases exported from one country to another.

\(^\wedge\) Year last indigenous case reported.
Distribution By Country of 1,418 Reported Indigenous Cases of Dracunculiasis and During January - August 2010*

Number of cases

- **Sudan**: 1,382 (74%)
- **Ethiopia**: 15 (88%)
- **Mali**: 13 (85%)
- **Ghana**: 8 (100%)

* Provisional. Numbers in parentheses denote percentage of cases contained.

Overall, 75% of 1,419 cases reported during January - August 2010 were contained.

Excludes one case (contained) imported into Ethiopia from Sudan in May 2010.
Distribution of Villages Reporting Cases of Dracunculiasis in Southern Sudan: 2009 and Jan. – May 2010

- Lakes State
- Eastern Equatoria
- Central Equatoria
- Warrab State

- Endemic village 2009
- Endemic Village 2010
Sudan Guinea Worm Eradication Program
Number of Cases of Dracunculiasis Reported from Sudan: 1994-2009
SUDAN GUINEA WORM ERADICATION PROGRAM
STATUS OF INDICATORS IN ENDEMIC VILLAGES (EVS) DURING 2006 - 2009*

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Villages reporting indigenous cases</td>
<td>3,137</td>
<td>1,765</td>
<td>947</td>
<td>584</td>
</tr>
<tr>
<td>No of endemic villages</td>
<td>3,137</td>
<td>3,023</td>
<td>2,301</td>
<td>1,283</td>
</tr>
<tr>
<td>No. of cases</td>
<td>20,582</td>
<td>5,815</td>
<td>3,618</td>
<td>2,733</td>
</tr>
</tbody>
</table>

- % Cases Contained
- % EVS Reporting
- % EVS. Hlth. Ed.
- % EVS cloth Filters
- % EVS with 80% pipe filter coverage
- % EVS Vector Control
- % EVS 1+ safe water
RIVER BLINDNESS (ONCHOCERCIASIS) ELIMINATION
Key Facts About Onchocerciasis

- Parasitic worm transmitted by blackflies
- 123 million persons at risk
- 37 million infected
- 0.8 million blind
- 37 endemic countries
- Annual or semi-annual mass drug administration
Onchocerciasis Elimination Program for the Americas

- OEPA began in 1993
- Partnership of 6 countries
- River Blindness Foundation/The Carter Center, CDC, PAHO
- Twice a year mass drug administration
- **85% coverage**

GOAL: 2012
Geographic distribution and transmission status of the 13 foci of the Americas 2010

Regional Population at risk: 542,148
Population eligible for treatment: 328,729
# Current situation of ocular morbidity and transmission of onchocerciasis within the Americas region, 2010

<table>
<thead>
<tr>
<th>Focus</th>
<th>Has blindness been eliminated?</th>
<th>Has ocular morbidity disappeared?</th>
<th>Transmission status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Rosa, GU</td>
<td>Yes</td>
<td>Yes</td>
<td>Eliminated in 2010</td>
</tr>
<tr>
<td>Lopez de Micay, CO</td>
<td>Yes</td>
<td>Yes</td>
<td>Interrupted in 2007</td>
</tr>
<tr>
<td>Escuintla, GU</td>
<td>Yes</td>
<td>Yes</td>
<td>Eliminated in 2010</td>
</tr>
<tr>
<td>North Chiapas, MX</td>
<td>Yes</td>
<td>Yes</td>
<td>Eliminated in 2010</td>
</tr>
<tr>
<td>Huehuetenango, GU</td>
<td>Yes</td>
<td>Yes</td>
<td>Interrupted in 2008</td>
</tr>
<tr>
<td>Oaxaca, MX</td>
<td>Yes</td>
<td>Yes</td>
<td>Interrupted in 2008</td>
</tr>
<tr>
<td>Esmeraldas, EC</td>
<td>Yes</td>
<td>Yes</td>
<td>Interrupted in 2010</td>
</tr>
<tr>
<td>South Chiapas, MX</td>
<td>Yes</td>
<td>Yes</td>
<td>Suspected suppressed</td>
</tr>
<tr>
<td>Central, GU</td>
<td>Yes</td>
<td>Yes</td>
<td>Suspected suppressed</td>
</tr>
<tr>
<td>Northcentral, VZ</td>
<td>Yes</td>
<td>Yes</td>
<td>Suspected suppressed</td>
</tr>
<tr>
<td>Northeast, VZ</td>
<td>Yes</td>
<td>No (1.0%)</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Amazonas, BR</td>
<td>Yes</td>
<td>No (6.5%)</td>
<td>Ongoing</td>
</tr>
<tr>
<td>South, VZ</td>
<td>Yes</td>
<td>No (16.3%)</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
Status of OEPA 1990 vs. 2009

Endemic countries 6 → 4

Foci with on-going or suppressed transmission 13 → 6
Onchocerciasis in Africa

- Onchocerciasis Control Program 1974–2002
  - 11 countries
  - Vector control, then annual mass drug administration starting in 1987

- African Program for Onchocerciasis Control 1995-2015
  - Annual mass drug administration with ivermectin
  - 65% coverage
African Program for Onchocerciasis Control

- Ultimate Treatment Goal 90 million in 19 countries
- 57 million (63%) treated in 15 out of 19 countries in 2008
- Onchocerciasis prevalence 47% in 1995, 29% in 2008
Onchocerci... in Africa

• Blocked by *Loa loa* in 10 countries
• Mali and Senegal evidence that 15-17 years of annual mass drug administration can stop transmission
• Uganda launched twice a year elimination effort in January 2007
• Abu Hamad (Sudan) focal elimination since 2006
• Cameroon?
LYMPHATIC FILARIASIS
ELIMINATION
Key Facts About Lymphatic Filariasis

- Parasitic worm transmitted by mosquitoes
- 1.3 billion persons at risk
- 120 million infected
- 81 endemic countries
- Annual mass drug administration with albendazole and ivermectin or albendazole and diethyl carbamazine
- **80% coverage**
- Mosquito nets
Global Elimination of LF

- 1993: global elimination proposed by the International Task Force for Disease Eradication
- 1997: World Health Assembly resolution
- 2000: Global Alliance to Eliminate Lymphatic Filariasis
- Annual treatments 10 million in 2000
- 496 million treatments in 2008

GOAL: 2020
Impact of Annual Carter Center-Assisted Mass Drug Administration on Onchocerciasis Nodule Prevalence

**Uganda***

- 1993: 48%
- 2005: 9%

*Ivermectin only (cross sectional survey)

**Plateau & Nasarawa States, Nigeria**

- 1992/3: 68%
- 2009: 0.2%


$n = 330$  
$n = 6623$
In Africa

- **Millions infected**
  - 212 m
  - 36 m
  - 37 m
  - 170 m

- **% of Global Burden**
  - 90%
  - 30%
  - 99%
  - 85%

- **Disease**
  - Malaria
  - Lymphatic Filariasis
  - Onchocerciasis
  - Schistosomiasis

- **Interventions**
  - LLINs (long-lasting insecticidal nets)
  - IMDA (integrated mass drug administration)

- **Potential Mechanism**
  - CDT (community-directed treatment)
ELIMINATION OF LF & MALARIA FROM HISPANIOLA

- Only malaria in the Caribbean
- More than 90% of lymphatic filariasis in the Americas
Hispaniola Initiative

- In 2008, The Carter Center began a 18-month, $379,000 bi-national project against malaria in adjacent border towns: Dajabon, Dominican Republic, and Ouanaminthe, Haiti.
- Dajabon is the highest malaria endemic district in the Dominican Republic.
- Standard protocol: free malaria diagnosis and treatment; added primaquine to chloroquine treatment, intensified surveillance, microscopy, LLINs.
- In 2009, both governments announced a $194 million bi-national plan to eliminate malaria by 2020.*
- Haiti announced a $49.4 million plan to eliminate lymphatic filariasis by 2020. The Dominican Republic expects to eliminate LF by 2010.

*NB: An outbreak of malaria in 2004 cost the Dominican Republic an estimated $200 million in lost tourism revenues.
ELIMINATION OF BLINDING TRACHOMA
Key Facts About Trachoma

- *Chlamydia trachomatis* bacteria transmitted by flies, contaminated fingers or cloth
- 540 million persons at risk
- 84 million persons infected
- 6 million blind
- 57 endemic countries
- 10 countries with 75% of cases
- Mapping incomplete (no data for 15 out of 57 countries)
SAFE

- Surgery
- Antibiotics
- Facial Cleanliness
- Environmental Improvement

80% coverage goal for azithromycin
GOAL

• Eliminate blinding trachoma by 2020
  – Less than 1 case trachomatous trichiasis per 1,000 population
  – Less than 5% trachomatous inflammation follicular in children 1-9 years old
Number of new household latrines built in Amhara Regional State
Ethiopia 2002-2010

Year
2002 2003 2004 2005 2006 2007 2008 2009 2010*
Number of latrines
1,333 2,151 89,096 144,750 75,621 41,228 373,677 544,205 516,933

*as of July 2010
Provisional Zithromax Donation, 1999-2020*

*2011 – 2020 figures are provisional estimates.
Prevalence of TF in children 1-9 years of age

Ghana
Prevalence of TF in children 1-9 years of age

Ethiopia
Prevalence of TF in children 1-9 years of age

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghana</td>
<td>12.2</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td>71.8</td>
<td></td>
<td>54.9%</td>
<td>32.4</td>
</tr>
</tbody>
</table>
### Four NTDs Slated for Eradication or “Elimination”

<table>
<thead>
<tr>
<th>Disease – Program</th>
<th>Dracunculiasis</th>
<th>Onchocerciasis</th>
<th>Lymphatic Filariasis</th>
<th>Trachoma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Eradication 2009</td>
<td>Elimination (interrupt transmission) 2012</td>
<td>Control (public health problem) 2015</td>
<td>Elimination (blinding trachoma) 2020</td>
</tr>
<tr>
<td><strong>Endemic Countries Known?</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Mostly</td>
</tr>
<tr>
<td><strong>Status of Surveillance</strong></td>
<td>Very Good</td>
<td>Excellent</td>
<td>Good</td>
<td>Incomplete</td>
</tr>
<tr>
<td><strong>Coverage Target for Intervention</strong></td>
<td>100%</td>
<td>&gt;85% x 2</td>
<td>65%</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Extent of Intervention</strong></td>
<td>98% filters (2009)</td>
<td>93% (2009) (0.626m/0.672m)</td>
<td>63% (2008) (57m/90m)</td>
<td>37% (2008) (496m/1.333b)</td>
</tr>
<tr>
<td><strong>Monitor Disease/Intervention</strong></td>
<td>Monthly</td>
<td>Monthly</td>
<td>Annually</td>
<td>Annually</td>
</tr>
</tbody>
</table>