THE MENTOR initiative

DEVOTED TO REDUCING MALARIA DEATHS & SUFFERING IN HUMANITARIAN CRISIS
Human African Trypanosomiasis: Sleeping Sickness in Sub-Saharan Africa

Matthew Malone
3/9/2012
Learning Goals

- Understand the causes, risk factors, and modes of transmission for Human African Trypanosomiasis (HAT)

- Know the role of armed conflict in the rise of infection rates throughout Africa

- Use past HAT outbreak patterns and causes to understand the implications for future infection
The Problem

- Multiple HAT outbreaks have occurred over the last century.
- Armed conflict in Africa has escalated disease rates in recent years.
- Continued displacement of populations may cause many more outbreaks.
- Displacement widens the geographic disease spread.
Causal Agents

- Caused by the protozoan *Trypanosoma Brucei*
- Has three subspecies:
  - *Trypanosoma brucei gambiense*
  - *Trypanosoma brucei rhodesiense*
  - *Trypanosoma brucei brucei* (animals only)
The vector for HAT is the **tsetse fly**

- Biological Vector
- Inhabits rural areas
- Bites during daytime hours
- Both males and females are capable of carrying and transmitting the disease.
Vector Biology Cont’d

- Tsetse flies belong to the genus *Glossina*
- *Glossina* contains 3 subgroups
  - *Glossina* (includes *G. morsitans* group)
  - *Nemorhina* (includes *G. palpalis* group)
  - *Austenina* (includes *G. fusca* group)
Vector Biology Cont’d

- Vectors of *T.b. gambiense*
  - *G. palpalis* & *G. tachinoides* groups

- Vectors of *T.b. rhodesiense*
  - *G. morsitans*, *G. swynnertoni*, & *G. pallidipes* groups

---

**Table 1**  Species and subspecies of the two subgenera of *Glossina* which are vectors of *T. b. gambiense* and *T. b. rhodesiense*.

<table>
<thead>
<tr>
<th>Subgenus (group)</th>
<th>Species</th>
<th>Subspecies</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Nemorhina</em> (palpalis)</td>
<td><em>G. palpalis</em></td>
<td><em>G. p. palpalis</em></td>
</tr>
<tr>
<td></td>
<td><em>G. fuscipes</em></td>
<td><em>G. p. fuscipes</em></td>
</tr>
<tr>
<td></td>
<td><em>G. pallicera</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>G. tachinoides</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>G. caliginea</em></td>
<td></td>
</tr>
<tr>
<td><em>Glossina</em> (morsitans)</td>
<td><em>G. morsitans</em></td>
<td><em>G. m. morsitans</em></td>
</tr>
<tr>
<td></td>
<td><em>G. swynnertoni</em></td>
<td><em>G. m. submorsitans</em></td>
</tr>
<tr>
<td></td>
<td><em>G. longipalpis</em></td>
<td><em>G. m. centralis</em></td>
</tr>
<tr>
<td></td>
<td><em>G. pallidipes</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>G. austeni</em></td>
<td></td>
</tr>
</tbody>
</table>

*a* Vector of *T. b. gambiense.*  
*b* Vector of *T. b. rhodesiense.*
Reservoirs

*T.b. gambiense*  
*T.b. rhodesiense*
Health Assembly called on member states to sustain the effort to eliminate the disease as a public health problem, which led the WHO programme to intensify its coordinating efforts, bringing together national control programmes, non-governmental organisations, research institutions, and other concerned United Nations Agencies (under the Programme against African Trypanosomiasis, PAAT) [5], as well as private and public contributors (Sanofi-Aventis, Bayer HealthCare, the Bill & Melinda Gates Foundation, and the Belgium and French Cooperation). With this broad coalition, field activities were scaled up, leading to better knowledge of the disease distribution and a reduction in new cases by 2006, as described above. The current prevalence and incidence figures are believed to reflect the overall situation quite accurately, in contrast with the uncertainties surrounding the figures prior to 1997.

Given that in 2006, 20 out of 36 endemic countries achieved or were close to achieving the target of reporting no new cases, and eight countries reported less than 100 new cases per year, elimination has become a feasible objective in many countries endemic for HAT. With elimination in mind, in May 2007 WHO organised an Informal Consultation on Sustainable Sleeping Sickness Control, during which endemic country representatives debated the current disease landscape and concluded that elimination was possible.

Political will. During the July 2000 Organization of African Unity (now the African Union) summit held in Lomé, Togo, the African Heads of State and Government adopted the decision to collectively embark on a Pan African Tsetse and Trypanosomosis Eradication Campaign (PATTEC). This campaign was based on the realisation that (1) solving the tsetse fly and disease problem would be an important contribution to Africa’s development, and (2) this could not be done by a single country acting alone. A task force of African experts concluded that such a campaign was not only technically feasible, but economically productive [6]. Implementation is on its way; six countries have recently received financial support from the African Development

Figure 2. HAT Transmission Cycle
In T. b. gambiense, the cycle is mostly human-to-human (central circle); occasionally transmission may occur from animal to human. In T. b. rhodesiense, the animal reservoir plays an important role in the cycle, thus sustaining parasite transmission and human infections.
Risk Factors

- Civil Disturbance/War
- Cattle Movements
- Population Movements/Migrations (Refugees)
- Reduced Health Program Financing
- Rural Living Environment
Case Study: Uganda HAT Outbreak

- Began in the late 1980s and persisted through 2005

- Refugees migrated from Uganda to Zaire and Sudan → acquired infection

- Refugees migrated back to Uganda accompanied by infected Sudanese refugees → spread infection
Case Study Cont’d

Figure 1: Sleeping sickness in south-eastern Uganda, 1905-2001
Epidemiology

- In 1986, it was estimated that approx. 70 million people lived in areas conducive to disease transmission
- HAT affects 36 countries in sub-Saharan Africa
- According to the World Health Organization, HAT causes ~40,000 deaths in Africa annually

THE MENTOR initiative
DEVOTED TO REDUCING MALARIA DEATHS & SUFFERING IN HUMANITARIAN CRISIS
The total amount of reported HAT cases has decreased substantially over time.

1998: ~40,000 reported cases; >250,000 actual cases

2004: ~18,000 reported cases; between 50,000 and 70,000 actual cases

2010: ~7,000 reported cases; ~30,000 actual cases

Cases involving *T.b. rhodesiense* are much rarer than those involving *T.b. gambiense*. 
Epidemiology Cont’d

Figure 2: Trypanosoma brucei gambiense: comparison between population placed under active surveillance and new cases
Geographical Distribution

• 1998- World Health Organization states that there are over 200 active foci of HAT between latitude 15 degrees north and 15 degrees south (“tsetse belt”).
• *T.b. gambiense* is mostly found in **western** and **central** Africa.
  – Over 95% of the cases of human infection found in the Democratic Republic of Congo, Angola, Sudan, Central African Republic, Chad, and northern Uganda.
• *T.b. rhodesiense* is found mostly in **eastern** and **southern** Africa.
  – Over 95% of the cases of human infection occur in Tanzania, Uganda, Malawi, and Zambia.
Geographical Distribution Cont’d

Figure 3. Map of Africa Showing the Epidemiological Status of Countries Considered Endemic for the Disease

doii:10.1371/journal.pmed.0050055.g003
The resurgence of HAT in several countries has been attributed to conflict and/or war.

Cases of HAT have been seen to occur significantly more often in countries where there is conflict, internationalized civil war, and/or high political terror.
Geographical Distribution/Conflict Cont’d

The bar charts illustrate the average HAT cases per year (1976-2004) for different levels of conflict severity and political terror scale. The data shows that:

- In the absence of conflict (No conflict), the average number of HAT cases is 82 per year.
- In minor conflict (Minor), the average number of cases is 722 per year.
- In major conflict (Major), the average number of cases rises significantly to 3269 per year.

Similarly, for the political terror scale:

- A low level of terror (1) corresponds to an average of 69 cases per year.
- A medium level of terror (2) corresponds to an average of 160 cases per year.
- A high level of terror (3) corresponds to an average of 472 cases per year.
- A very high level of terror (4) corresponds to an average of 920 cases per year.
- The highest level of terror (5) corresponds to an average of 2835 cases per year.

These trends highlight the significant impact of conflict and political instability on the incidence of HAT.
Geographical Distribution/Conflict Cont’d

- Forced population movement increases transmission.
- Migration causes trypanosomes to circulate from high-incidence to low-incidence areas.
- Conflict causes breakdown of control measures and surveillance, increasing disease spread.
References


References Cont’d