The Atlas of human African trypanosomiasis

a WHO/FAO initiative in the framework of the Programme against African Trypanosomiasis (PAAT)

Pere P. Simarro[1], Giuliano Cecchi[2], Massimo Paone[2], Eric Fèvre[3], José R. Franco[1], Abdoulaye Diarra[4], Raffaele C. Mattioli[2]

[1] World Health Organization (WHO), Control of Neglected Tropical Diseases, Innovative and Intensified Disease Management, 1211 Geneva 27, Switzerland.

[2] Food and Agriculture Organization of the United Nations (FAO), Animal Production and Health Division, Viale delle Terme di Caracalla, 00153, Rome, Italy.

[3] Centre for Infectious Diseases, University of Edinburgh, Ashworth Laboratories, Kings Buildings, West Mains Road, Edinburgh EH9 3JT, UK.

[4] World Health Organization, Regional Office for Africa, Brazzaville.

Summary

Accurate and up-to-date information on the spatial distribution of diseases is of paramount importance to maximize impact and effectiveness of control measures. This is particularly true for human African trypanosomiasis (HAT), a parasitic disease unique to sub-Saharan Africa. HAT, like many other neglected tropical diseases, affects some of the poorest populations often living in remote rural areas, or in conflict-shaken zones. This poster describes input data and methodology that are being used to generate the Atlas of human African trypanosomiasis.

BOX 1
SLEEPING SICKNESS AND DEMOGRAPHIC AND CLIMATIC CHANGES

HAT, also known as sleeping sickness, is caused by two sub-species of the parasitic protozoan *Trypanosoma brucei* (*T.b. gambiense* and *T.b. rhodesiense*). The parasite is transmitted by the bite of the blood-feeding tsetse fly and it leads to death if the resulting disease is not treated. The two sub-species of trypanosome cause different variants of trypanosomiasis: a slow onset, chronic form (*gambiense*) that is most common in Central and Western Africa, and a fast onset, acute form (*rhodesiense*) that occurs in Southern and Eastern Africa. HAT owes its common name to the extreme lethargy that intervenes in the late stage of the disease when the parasite invades the central nervous systems and affects the brain.

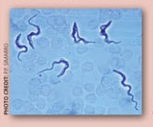


PHOTO CREDIT: P. SIMARRO

TRYPANOSOMA BRUCEI GAMBIENSE

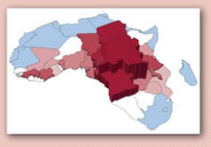
HAT epidemiology is shaped by the complex interplay between the parasite (trypanosome), the vector (tsetse fly) and the hosts (humans, domestic and wild animals). Demographic and climatic changes have affected the ecology of the disease and its distribution since ancestral times, and it is believed that they will also drive its future course, most especially through modifications of the tsetse habitat and changes in land use patterns.

BOX 2
WHO HAT SURVEILLANCE AND CONTROL PROGRAMME

The ultimate objective of the WHO HAT Surveillance and Control Programme is the elimination of the disease as a public health problem and the establishment of a sustained surveillance in all endemic countries.

The programme is based on three pillars: (i) access of people at risk to diagnosis and treatment through National Sleeping Sickness Control Programmes (NSSCPs) (ii) strengthened surveillance through mobile teams for active case-finding and the establishment of a network for passive surveillance (iii) elaboration of guidelines and policies jointly with health services of countries where the disease is endemic.

Web site:
http://www.who.int/trypanosomiasis_african/



HAT PREVALENCE BY COUNTRY (2000-2006)

Note: The volume of the 3D solids is proportional to the cumulative number of HAT cases reported. In white: 0 cases reported or no reporting. In blue: countries where the disease is not endemic. *Data source:* Simarro *et al.*, 2008

BOX 3
PAAT AND ITS INFORMATION SYSTEM (PAAT-IS)

PAAT is a forum to harmonize and coordinate the activities of its four mandated international organizations (FAO, WHO, IAEA and AU-IBAR), in relation to tsetse, human and animal trypanosomiasis and associated sustainable agriculture and rural development. The focal point of PAAT secretariat is based at FAO headquarters in Rome.

The PAAT-IS provides tools to guide strategic decisions on tsetse and trypanosomiasis management in sub-Saharan Africa; PAAT-IS includes web-based resources, publications and geospatial datasets (Cecchi & Mattioli, *in press*).

Web site: www.fao.org/ag/paat.html

PAAT INFORMATION SYSTEM

Note:
IAEA: International Atomic Energy Agency
AU-IBAR: African Union-Interafrican Bureau for Animal Resources

References

Cattand, P., Jannin, J., Lucas, P. 2001. Sleeping sickness surveillance: an essential step towards elimination. *Tropical Medicine and International Health*, 6: 348-361.

Cecchi, G., Mattioli, R.C. In press. Creating, harmonizing and sharing the information: the role of the Programme against African Trypanosomiasis (PAAT) and its Information System. In *Proceedings of the 29th Meeting of the International Scientific Council for Trypanosomiasis Research and Control*, Luanda, Angola, 1-5 October 2007.

Simarro, P.P., Jannin, J., Cattand, P. 2008. Eliminating Human African Trypanosomiasis: Where Do We Stand and What Comes Next? *PLoS Medicine*, 5: 174-180.

World Health Organization Regional Office for Africa. 2005. Control of human African trypanosomiasis: A Strategy for the African region. World Health Organization.

Introduction

Sleeping sickness epidemics often develop from areas of ancient parasite persistence called foci. Foci of HAT endemicity have historically received their names from geographical features such as valleys, rivers, villages or towns, and their size can range from a single populated place to an entire region (Cattand, 2001). While some of these areas have been known for over a century, human population dynamics and the associated socio-economic and environmental modifications have always had a major impact on where the disease manifest itself at alarming levels.

The advent of the Global Positioning System (GPS) and of Geographic Information Systems (GIS) has given healthcare workers and epidemiologists unprecedented opportunities to map the spatial distribution of HAT. Geographical coordinates of screened areas are now routinely collected by mobile teams undertaking monitoring and control activities. Technical advances as well as the need for accurate spatial information prompted WHO to set the mapping of disease distribution as a priority in its strategy for the control of HAT (WHO, 2005).

Materials and methods

Data collection and reporting: National Sleeping Sickness Control Programmes (NSSCPs), Non-Governmental Organizations (NGOs) and research institutes

In the last ten years, financial and technical support from WHO has allowed NSSCPs in the affected countries to scale up screening of population at risk, as well as diagnosis and treatment (Figures 1 and 2). Important contributions to disease monitoring also come from NGOs and research institutes. Epidemiological data collected by WHO provide the input data for the Atlas of HAT (Figure 3).

PHOTO CREDIT: P. SIMARRO

PHOTO CREDIT: P. SIMARRO

FIGURES 1 AND 2. MOBILE TEAMS CARRYING OUT HAT SCREENING AND TREATMENT ACTIVITIES.

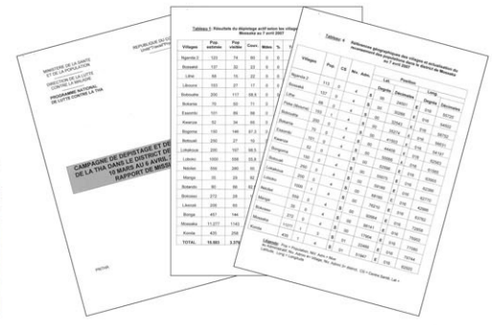


FIGURE 3. EXCERPT FROM ONE OF THE EPIDEMIOLOGICAL REPORTS USED AS INPUT FOR THE ATLAS OF HAT.

Data collation, screening and processing: WHO/FAO

The vast body of information on the occurrence of HAT is collated by WHO, which is also in charge of screening datasets for relevance and accuracy. All datasets so selected are included in a centralized "Repository" (Figure 4A). Subsequently, key information is extracted from epidemiological reports to be included in the geo-database of HAT. Disease and geographic data are stored in two separate tables of the database (DB); a third table describes data sources (Figure 4C). In the epidemiological table the following fields are available: year, census, number of people screened, number of new HAT cases detected/reported, surveillance type (either active or passive), parasite species (either *T.b. gambiense* or *T.b. rhodesiense*), and disease stage (either early or late). In the geographical table names and coordinates of the locations of epidemiological interest are recorded. Importantly, screened villages that resulted in no HAT case are included in the DB. Geographic coordinates are either extracted from reports or derived from gazetteers (i.e. dictionaries of geographical information that list name and coordinates of geographical entities). The flow chart below shows the geo-location methodology in more detail (Figure 4B).

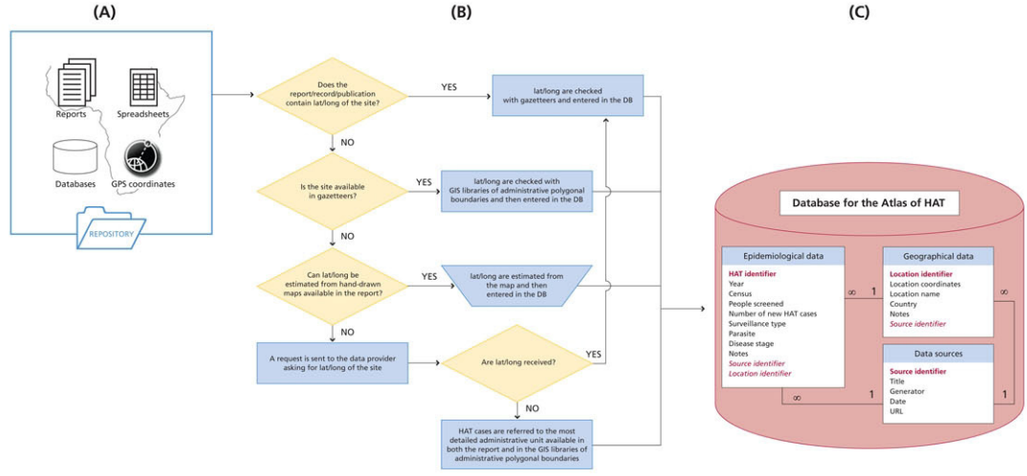


FIGURE 4. (A) HAT ATLAS DATA REPOSITORY (B) FLOW-CHART OF THE GEO-LOCATION METHODOLOGY (C) STRUCTURE OF THE HAT GEO-DATABASE.

Results and outreach activities

The geo-database of HAT can be considered as the central output of this activity (Figure 4C). It will be a dynamic, regularly updated tool which will form the basis for a number of derivative products. Regional, national and local maps of the distribution of sleeping sickness cases will be easily derived from the DB. Preliminary outputs (e.g. focus-level and country level maps of HAT distribution, Figures 5 and 6) will be shared with NSSCPs with a view towards validating and consolidating them. Ultimately, the Atlas of HAT will be widely distributed by WHO both as a digital and as a printed publication. Input data will also be made available in the public domain for the benefit of all those concerned with this disease.

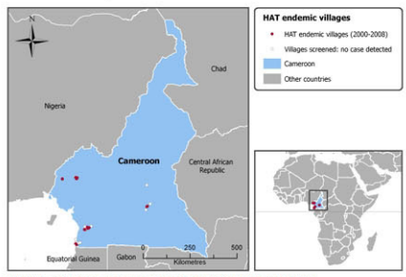


FIGURE 5. NATIONAL LEVEL MAP OF HAT DISTRIBUTION: CAMEROON.

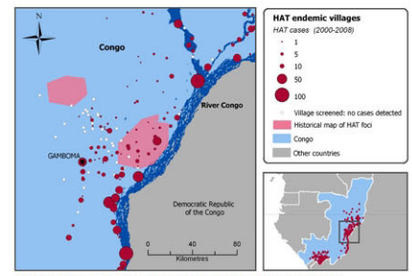


FIGURE 6. FOCUS-LEVEL MAP OF HAT DISTRIBUTION: GAMBOMA, CONGO.

Conclusions

The Atlas of HAT will greatly contribute to streamlining ongoing efforts to control sleeping sickness. Highly accurate, village-level information on disease occurrence will help plan and implement surveillance operations in a more efficient fashion. Calculation of up-to-date, evidence-based estimates of population at risk and disease burden will become possible. Georeferenced, GIS-compatible data on HAT will also allow a range of studies to be undertaken by combining accurate epidemiological information with satellite-derived environmental data. It is believed that the Atlas will represent an indispensable tool all along the way towards the elimination of the public health problem posed by HAT.

Contact: SimarroP@who.int

http://www.who.int/trypanosomiasis_african/

International Conference "Demographic and climatic changes: impacts on vector borne diseases in West Africa", Cotonou, Benin, 24-27 November 2008.