Title

Inquiry in Ridding the Democratic Republic of the Congo of sleeping sickness, a dream at our fingertips: comparing to the Epidemiology of human African trypanosomiasis in the Democratic Republic of the Congo 2002-2003

Author

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Abstract

Background

In the Democratic Republic of the Congo, the international support was suddenly withdrawn after the massacre of students at the Lubumbashi University in May 1990. The interruption of the international aid from 1990 to 1991 would undoubtedly have a long-lasting negative effect on case load. So, the National Sleeping Sickness Control Programme—NSSCP (*Programme National de Lutte contre la Trypanosomiase Humaine Africaine*) (PNLTHA) remains vulnerable without international aid. Currently, the number of reported new cases decreased. These achievements prove that the elimination of this neglected tropical disease is possible when there is a strong commitment of public authorities accompanied by scientific research centers, civil society and the private sector. Without international aid, sleeping sickness remains a formidable disease difficult to cure because it is depending on continued financial support and drug availability.

Objectives

The objectives of this work were: 1. to profile the incidence of new cases of human African trypanosomiasis in the Democratic Republic of the Congo from 2002 to 2003, depending on the stage of disease progression (stages 1 and 2); 2. Compare the evolution of this profile from one household to another; 3. Compare the rate of confirmed parasitological diagnosis with positive CATT; 4. Calculate the discrepancy rate between CATT+ and parasitological diagnosis. All the above objectives are aiming to sustain the efforts made for the adoption of the 2018 Francophonie resolution on the ridding of human African trypanosomiasis that may renewed donor interest, including the government of the Democratic Republic of the Congo because the control of HAT is completely dependent on international aid.

Methods

Research is necessary on how to rationalize control activities so that control programs can adopt the most effective and efficient strategies. To assess it, we analyzed epidemiologic data collected by PNLTHA from 2002 to 2003.

Results

In all endemic areas, 1,970,101 people were tested in 2002 and 2,311,507 people in 2003. The national average coverage of the total population tested (TPT) represents 16.20% of the exposed population among which 13,853 new cases were detected in 2002 and 11, 481 new cases detected in 2003 with the national average coverage of the population tested that represents 19.10 %.

Conclusion

In short, we said that the number of people already infected is probably higher than the new cases reported in 2003. We are still far from the situation of 1958/60 when there was 1 new case declared by 10,000 people tested (i.e. 1,100 new cases out of 13,000,000 people screen). Therefore, the Congolese government must make long-term financial commitments to ensure the continuity of HAT control activities.

Keywords

Suddenly breaking of financial aid, African Human Trypanosomiasis, the Democratic Republic of the Congo

Author summary

For the past three decades, the frequency of sleeping sickness tends to become a large in the Democratic Republic of the Congo. This paper reviews the status of sleeping sickness in DRC between 2002 and 2003, with a focus on stage patterns. Epidemiological trends at the national and provincial level are presented. Today, this deadly fly-borne disease threatens more than 65 million people worldwide and most of the reported cases (more than 8 out of 10) are in the Democratic Republic of the Congo. Fortunately, after decades of hard work, we have never been so close to eradicating sleeping sickness in the Democratic Republic of the Congo. In 2009, the number of reported cases fell below 10,000, the first in half a century. In 2015, only 2,804 cases had been listed. The Democratic Republic of the Congo is determined to eradicate the disease by 2020, paving the way for its global eradication. Thanks to these decades of work. I submit this inquiry to recognize also the work that my last mentor coauthor of this search did, he hold his doctorate on this disease. This submission is an **appropriate way I found to honor and keep the memory of my supervisor who passed away!** In advance, many thanks for your best understanding of this particular circumstance. From my last mentor work, we have never been so close to the definitive elimination of sleeping sickness. The number of reported new cases decreased from 26,318 in 1998 to 11,481 in 2003 and later to 2,804 in 2015. These achievements prove that the elimination of neglected tropical diseases is possible when there is a strong commitment of public authorities accompanied by scientific research centers, civil society and the private sector**.**

Figures

None

Introduction

Trypanosomiasis is an endemo-epidemic disease caused for Africa by trypanosoma gambiense and rhodesiense.

It is transmitted from a parasitized individual to a healthy individual by the bite of a specific vector insect, the tsetse flies or tsetse fly.

The infection has a fatal evolution for lack of a specific treatment, it begins with the invasion of the blood and the lymphatic ways by the parasite and continues after a variable delay by the attack of the nerve centers of the encephalon [1].

Currently, sleeping sickness tends to become a great endemic by its frequency, it remains a formidable disease difficult to cure.

Another important fact is the appearance in the cities of this disease, considered until now rural [2].

In the Democratic Republic of the Congo, the break-up of Belgian-Congolese cooperation in 1990 would undoubtedly have hindered the national program for the control of human African trypanosomiasis (PNLTHA).

Research objectives

The objectives of this work were:

1) To profile the incidence of new cases of human African trypanosomiasis in the Democratic Republic of the Congo from 2002 to 2003, depending on the stage of disease progression (stages 1 and 2)

2) Compare the evolution of this profile from one household to another

3) Compare the rate of confirmed parasitological diagnosis with positive CATT

4) Calculate the discrepancy rate between CATT + and parasitological diagnosis

Research hypothesis

The characterization of this evolutionary profile will make it possible to evaluate the effectiveness of the national program against trypanosomiasis (PNLTHA). In the case where this action is effective, the rate of new cases (NC) in stage 2 must be able to decrease significantly.

Material and methods

Material

We used the database established by the National Program for the Control of Human African Trypanosomiasis in the DRC (PNLTHA) of 2002 and 2003.

Methods

This work consisted in the counting of the reports of the national program against trypanosomiasis (PNLTHA) of 2002-2003 concerning the provinces of the Democratic Republic of the Congo with an accent for the provinces mentioned like centers of the development of *trypanosomiasis* notably Equateur, Kasaï, Bandundu, Bas -Congo, Maniema, Katanga while noting the following:

- The location (district or province) having a high incidence

- The years: 2002 and 2003

- The number of cases in stage 2

- The total number of cases (at stages 1 and 2)

Results

Table 1. Profile of the incidence of new cases of Human African Trypanosomiasis (HAT) in DRC from 2002 to 2003 following the stage of disease progression

A. In 2002

ENDEMICS AREAS	TPE	ST1	ST2	IR-ST1	IR-ST2	DELTA
BAS-CONGO	146,158	183	94	0.125	0.064	0.061
BANDUNDU	587,268	2,612	1,104	0.445	0.188	0.257
MANIEMA/KATANGA	99,184	329	191	0.332	0.193	0.139
KASAI	179,199	704	500	0.393	0.279	0.114
EQUATEUR NORD	**878,026**	**332**	**642**	**0.038**	**0.073**	**-0.035**
EQUATEUR SUD	80,266	27	19	0.034	0.024	0.010
TOTAL	1,970,101	4,187	2,550			

Legend: TPE: Total Population Examined; ST1 and ST2: stages 1 and 2; IR-ST1 and IR- ST2: Incidence Rate in stages 1 and 2; DELTA: difference of incidence between stages 1 and 2.

B. In 2003

ENDEMICS AREAS	TPE	ST1	ST2	IR-ST1	IR-ST2	DELTA
BAS-CONGO	180,080	162	106	0.090	0.059	0.031
BANDUNDU	758,600	2,046	1,059	0.270	0.140	0.130
MANIEMA/KATANGA	123,713	292	126	0.236	0.102	0.134
KASAI	205,256	561	368	0.273	0.179	0.094
EQUATEUR NORD	949,747	203	461	0.021	0.049	-0.027
EQUATEUR SUD	94,111	18	20	0.019	0.021	-0.002
TOTAL	2,311,507	3,282	2,140			

Legend: TPE: Total Population Examined; ST1 and ST2: stages 1 and 2; IR-ST1 and IR- ST2: Incidence Rate in stages 1 and 2; DELTA: difference of incidence between stages 1 and 2.

Table 2. Evolution from a household to another

A. In 2002

ENDEMICS AREAS	TPT	NC	IR	ENDEMICITY LEVEL
BAS-CONGO	146,158	760	0.52	Middle
BANDUNDU	**587,268**	**6,277**	**1.07**	**High**
MANIEMA/KATANGA	99,184	590	0.59	Middle
KASAI	**179,199**	**3,173**	**1.77**	**High**
EQUATEUR NORD	878,026	2,436	0.28	Low
EQUATEUR SUD	80,266	158	0.20	Low
TOTAL	1,970,101	13,394		

Legend:

TPT = Total Population Tested; NC = New cases; IR = Incidence Rate

B. In 2003

ENDEMICS AREAS	TPT	NC	IR	ENDEMICITY LEVEL
BAS-CONGO	180,080	522	0.29	Middle
BANDUNDU	**758,600**	**5,384**	**0.71**	**High**
MANIEMA/KATANGA	123,713	737	0.59	Middle
KASAI	**205,256**	**2,606**	**1.27**	**High**
EQUATEUR NORD	949,747	1,597	0.17	Low
EQUATEUR SUD	94,111	103	0.11	Low
TOTAL	2,311,507	10,949		

Legend:

TPT = Total Population Tested; NC = New cases; IR = Incidence Rate

158 **Table 3. Rate of confirmed parasitological diagnosis compared with positive CATT**

159 **from one household to another**

160 **A. In 2002**

ENDEMICS AREAS	TD+	CATT +	% CATT+ confirmed
BAS-CONGO	246	441	55
BANDUNDU	477	3,508	13
MANIEMA/KATANGA	158	168	94
KASAI	1,021	1,286	79
EQUATEUR NORD	1,066	2,816	37
EQUATEUR SUD	45	51	88

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162 Legend:

163 TD+ = Thick Drop positive (Parasitological diagnosis); CATT+ = Card Agglutination
164 Trypanosomiasis Test positive

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166 **B. In 2003**

ENDEMICS AREAS	TD+	CATT +	% CATT+ confirmed
BAS-CONGO	176	386	45
BANDUNDU	570	3,397	16
MANIEMA/KATANGA	363	286	126
KASAI	811	1,046	77
EQUATEUR NORD	647	1,089	59
EQUATEUR SUD	46	59	128

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168 Legend:

169 TD+ = Thick Drop positive (Parasitological diagnosis); CATT+ = Card Agglutination
170 Trypanosomiasis Test positive

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Table 4. Discrepancy rate between parasitological diagnoses and positive CATT from one household to another

A. In 2002

ENDEMICS AREAS	TD+	CATT +	DISCORDANCE
BAS-CONGO	246	441	55 (discordance)
BANDUNDU	477	3,508	13 (discordance
MANIEMA/KATANGA	158	168	94 (concordance)
KASAI	1,021	1,286	79 (discordance)
EQUATEUR NORD	1,066	2,816	37 (discordance)
EQUATEUR SUD	45	51	88 (concordance)

Legend:

TD+ = Thick Drop positive (Parasitological diagnosis); CATT+ = Card Agglutination Trypanosomiasis Test positive

B. In 2003

ENDEMICS AREAS	TD+	CATT +	DISCORDANCE
BAS-CONGO	176	386	45 (discordance)
BANDUNDU	570	3,397	16 (discordance
MANIEMA/KATANGA	363	286	126 (discordance)
KASAI	811	1,046	77 (discordance)
EQUATEUR NORD	647	1,089	59 (discordance)
EQUATEUR SUD	46	59	128 (discordance)

Legend:

TD+ = Thick Drop positive (Parasitological diagnosis); CATT+ = Card Agglutination Trypanosomiasis Test positive

Table 5. Percentage of stage 2 cases from one period to another

ENDEMICS AREAS	2002	2003	DIFFERENCE
BAS-CONGO	183	162	21
BANDUNDU	2,612	2,046	566
MANIEMA/KATANGA	329	292	37
KASAI	704	561	143
EQUATEUR NORD	332	203	129
EQUATEUR SUD	27	18	9
TOTAL	**4,187**	**3,282**	**905**

Discussion

Case discussion for the year 2002

Impact

In all endemic areas, 1,970,101 people were tested. The national average coverage of the population tested (TPT) represents 16.20% of the exposed population among which 13,853 new cases were detected.

The coverage of the TPT varies from province to province between 4.74% for Maniema / Katanga and 51.11% for Equateur Nord, the overall infection rate is 0.69%.

Compared with the year 2002, the IR decrease from 0.89% to 0.69% and Bandundu took the lead with 46.31% of new cases from all over the country, followed by Kasai 23.41% and Equateur Nord 17.97% with 16.6% new cases. 4 new mobile units were installed in December 2002 including 2 in Bandundu, 2 in Kasaï (**Supportive information 1**).

Of the 13,853 patients reported in 2002, of which 5,636 in the first stage is 52.70% and 7,844 in the 2nd stage is 47.30% with 2.74% unknown stage and the data of Maniema are partial. The unknown or undetermined stage are related to the pregnant woman and the bleeding lumbar puncture (LP) (**Supportive information 2**).

Serum screening or CATT on whole blood is a strategy that the PNLTHA advocates for generalization (3 consecutive years) especially in a household with a high level of endemicity i.e. IR> 1%.

For the year 2002: 1,815,022 people were seen with CATT on whole blood or 92% of the examined population and 9,128 people were confirmed positive in this group is 67% of new cases; 148,019 or 8% of 1,815,022 people had a positive result at CATT (**Supportive information 3**). Cases diagnosed by other methods in Maniema and Equateur Sud do not have a known method of diagnosis.

PNLTHA recommends the use of Pentamidine and Bayer for the treatment of patients in the first phase, Melarsoprol for the second phase while DFMO and LAMPIT are reserved as relay drugs (**Supportive information 4**).

The lumbar puncture performed was 28,253 or 58.6% of the controls performed. PLC abnormal 7,187 is 25.4% i.e. the elements are not the normal limits i.e. <5 / mm^3, this explains the difficulty the PNLTHA have for the post-therapeutic follow-up. Most patients, once out, if they feel better do not come back. An effort should be made to identify relapse cases (**Supportive information 8**).

Extent of the problem at the national level.

The population at risk is estimated at 12,600,000 people representing more than 20% of the population of the Democratic Republic of the Congo and 23% of the total population at risk of Africa which is estimated by the WHO to 60 million.

To date, DRC continues to bear the heaviest burden of gambiense HAT, having reported 84 % of all African cases in 2012 (i.e., 5,968/7,106). Therefore, achieving the international goal of gambiense HAT elimination [3], will depend to a large extent on the progress that DRC will be able to make [4] in ridding gambiense HAT following the Yerevan resolution on neglected tropical diseases (https://www.who.int/neglected_diseases/news/OIF-commit-to-strengthening-the-fight-against-NTDs/en/).

The monthly average of new cases in the country was 1,154 in 2002, the at-risk population covered by specialized services and primary health care in 2002 represents 16% of the total population at risk, or 2,040,927 persons, of which 88% is 1,815,022 were tested with CATT, which represents approximately 14.4% of the exposed population. Of these 88% came out 9,128 new cases. This coverage varies from province to province. It ranges from 4.74% in Maniema to 51% in Equateur Nord.

Extent of the problem at the provincial level

The following provinces reported 87% of new cases in 2002: 46.3% Bandundu; 23.4% in Kasaï and 17.9% in Equateur Nord.

Case discussion for the year 2003

Impact

In all endemic areas, 2,405,991 people were examined. The national average coverage of the TPT represents 19.10% of the exposed population. The number of new Human African Trypanosomiasis (HAT) cases is 11,481 (**Supportive information 9**). Among the 11,481 new HAT patients declared:

- 4,339 or 37.8% at the 1st stage (lymphatic-blood)

- 6,913 or 60.22% at the 2nd stage (meningoencephalopathic)

- 229 or about 1.98% whose stadium diagnosis was not made because of:

* refusal of the lumbar puncture or haemorrhagic not repeated

* The gravid status of the patient

- 5,786 new cases were detected by specialized units

- 5,695 new cases were detected by fixed structures (CDTC and health facilities) (**Supportive information 10**).

For the year 2003; 2,166,835 people were seen with CATT test on whole blood or 94% of the population examined (**Supportive information 11**).

Cases diagnosed by other methods in Maniema and Equateur Sud have no known diagnostic method (**Supportive information 12**).

PNLTHA recommends the use of Pentamidine and Bayer for the treatment of patients in the first phase, Melarsoprol for the second phase while the DFMO and Lampit are reserved as relay drugs. Arsobal remains the most used drug (**Supportive information 13**).

Extent of the problem at national level

The monthly average of new cases in Democratic Republic of the Congo was 957 in 2003. (**Supportive information 14**)

TPE coverage varies from province to province the other between 8.17% for Equateur Sud and 52.69% for Equateur Nord.

The overall infection rate decreased from 0.89% to 0.48% in 2003. 4 new mobile units (MU) were installed in December 2002, including 2 in Bandundu and contributed to the work during 2003. Thanks to the funding of the WHO for the 3 MU and Belgian Technical Cooperation for 1 MU.

The eastern province provided after ISANGI survey 251 NC out of 4,140 people tested with a detection rate of 6.06 highlighting the severity of the endemic and calling for an organization to fight the Human African Trypanosomiasis in the Democratic Republic of the Congo following the resolution of 2018 French Summit Committee in Yerevan (Armenia) on the Neglected Tropical Diseases (https://www.who.int/neglected_diseases/news/OIF-commit-to-strengthening-the-fight-against-NTDs/en/).

Extent of the problem at the provincial level

Bandundu is in the lead with 47% of new cases from across the country, followed by Kasai 22.6% and Equateur Nord 14.80%

Case discussion for 2002 and 2003

Table 1 shows that the infection rate decreased from 2002 to 2003 in all households except Equateur Nord, while Table 2 reports the severity of sleeping sickness in the Bandundu provinces. and from Kasai, Table 3 extended the discrepancy between the parasitological test (thick drop) and the serological test and raised the problem of CATT sensitivity; finally, Table 4 showed that the number of cases detected in stage 2 has decreased (4,187 cases detected in 2002 against 3,282 cases

detected in 2003, a difference of 905 cases), hence we encourage the PNLTHA to continue in this direction of the reduction of HAT-related morbidity.

The total number of new cases of Human African Trypanosomiasis (HAT) in the Democratic Republic of the Congo declined sharply from 17,322 in 2001 to 13,853 in 2002, a decrease related to the number of new cases in Equateur Nord. In the provinces of Bandundu and Kasaï, however, the problem of Human African Trypanosomiasis (HAT) remains important.

We see a growing evolution of the population examined from year to year. This would be even higher if the wars had not caused the slowdown in active screening because of insecurity in the combat zones. The new cases detected show the effort deployed by the heroes of the shadows, and once the peace is restored, the work's breadth (**Supportive information 7 and 14**).

Serum screening or CATT on whole blood is a strategy that the PNLTHA advocates for generalization (3 consecutive years) especially in a household with a high level of endemicity i.e. IR> 1%.

Conclusion

In short, we say that the actual number of people already infected is probably higher than the new cases reported. We are still far from the situation of 1958/60 when there was 1 new case declared by 10,000 people examined (i.e. 1,100 new cases out of 13,000,000 people seen). Therefore, the Congolese government must make long-term financial commitments to ensure the continuity of HAT control activities.

References

313 1. Kennedy P.G. Clinical features, diagnosis, and treatment of human African trypanosomiasis
314 (sleeping sickness*). Lancet Neurol*., **2013**, 12, 186-194.

315 2. Lutumba P, Robays J, Miaka mia Bilenge C, et al. Trypanosomiasis control, Democratic
316 Republic of Congo, 1993-2003. *Emerg Infect Dis*. **2005**;11(9):1382-8.

317 3. WHO. Report of a WHO meeting on elimination of African trypanosomiasis (*Trypanosoma*
318 *brucei gambiense*). Geneva: World Health Organization; 2013. p. 2013. Available
319 from: http://apps.who.int/iris/bitstream/10665/79689/1/WHO_HTM_NTD_IDM_2013.4_eng.pdf
320 ?ua=1

321 4. Lumbala C, Simarro PP, Cecchi G, et al. Human African trypanosomiasis in the Democratic
322 Republic of the Congo: disease distribution and risk. *Int J Health Geogr*. 2015;14:20. Published
323 2015 Jun 6. doi:10.1186/s12942-015-0013-9

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SUPPORTIVE INFORMATION

1. RESULTS OF HAT ACTIVITIES IN 2002 BY ENDEMIC ZONE

S 1: Distribution by Endemic Area of Total Registered Population (TRP), Total Enrolled Population (TEP) of New Cases (NC) and Infection Rate (IR) in 2002

ENDEMICS AREAS	EXPOSED POP	Nbr HZ	HZ HAT	Nbr MU		TPC	TPE	% cover	TP	NC	IR	Level of Endemicity
				1st Sem	2nd Sem							
BAS-CONGO	1,700,000	27	19	5	5	228,431	146,158	13.44	63.98	760	0.52	Middle
BANDUNDU	3,800,000	38	31	12	14	767,966	587,268	20.21	76.47	6,277	1.07	Severe
MANIEMA /KATANGA	1,200,000	81	16	4	4	81,994	99,184	6.83	120.96	590	0.59	Middle
KASAI	2,000,000	58	35	5	7	294,764	179,199	14.74	60.79	3,173	1.77	Severe
EQUATEUR NORD	2,000,000	20	15	9	9	1,022,219	878,026	51.11	85.89	2,436	0.28	Low
EQUATEUR SUD	1,000,000	13	6	2	2	77,743	80,266	7.77	103.25	158	0.20	Middle
KINSHASA	600,000	22	8	2	2	80,644	70,826	13.44	87.83	459	0.65	Middle
PROVINCE ORIENTALE	300,000	47	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTALS	12,600,000	306	133	39	43	2,553,761	2,040,927	**16.20**	79.92	13,853	0.68	Middle

Legend: HZ = Health Zone; HZ HAT = Health Zone at risk of trypanosomiasis; MU = Mobile Unit; TPC = Total Population Counted; NA=Not Available or missing data

PTE = Total Population Examined; NC = new cases; IR = Infection Rate

358 **S2: Distribution by endemic area of new cases recorded according to the screening circumstances**
359 **and stage of the disease in the DRC in 2002**

Circumstances of screening / Endemics areas	TPT	TPT AS	TPT PS	ACTIVE SCREENING				PASSIVE SCREENING				TOT NC
				1st stage	2nd stage	Unk own	Total	1st stage	2nd stage	Unko wn	Total	
BAS-CONGO	146, 158	142, 321	3, 837	183	94	NA	277	175	308	NA	483	760
BANDUNDU	587, 268	551, 568	35, 700	2, 612	1, 104	163	3,879	605	1, 783	10	2, 398	6, 277
MANIEMA/KATANGA	99, 184	97, 929	1, 255	329	191	7	527	17	46	NA	63	590
KASAI	179, 199	165, 532	13, 667	704	500	88	1, 292	251	1, 615	15	1, 881	3, 173
EQUATEUR NORD	878, 026	822, 283	55, 743	332	642	50	1, 024	211	1, 190	11	1, 412	2, 436
EQUATEUR SUD	80, 266	79, 213	1, 053	27	19	1	47	11	100	NA	111	158
KINSHASA	70, 826	67, 170	3, 656	141	88	26	255	38	164	2	204	459
PROVINCE ORIENTALE	0	0	0	NA	NA	NA	0	NA	NA	NA	0	0
TOTALS	2,040, 927	1,926, 016	114, 911	4, 328	2, 638	335	7, 301	1, 308	5, 206	36	6, 552	13, 853
PERCENTAGE (%)							52.70				47.30	

360 Legend: TPT = Total Population Tested; TPT AS = Total Population Tested by Active Screening; TPT PS = total
361 population tested by passive screening; NA=Not Available or missing data, NC = new case

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375 **S 3: CATT test results in relation to ganglia in 2002**

	POSITIVE CATT									NEGATIVE CATT									TOTALS
ENDEMICS AREAS	Ggl palpated			Ggl not palpated			Tot catt positive			Ggl palpated			Ggl not palpated			Tot negatif catt			
	Tryp+	Tryp-	S/TOT	Tryp+	Tryp-	S/TOT	Tryp+	Tryp-	S/TOT	Tryp+	Tryp-	S/Tot	Tryp+	Tryp-	S/Tot	Tryp+	Tryp-	S/Tot	
BAS-CONGO	238	757	995	203	4,707	4,910	441	5464	5,905	8	6,231	6,239	28	106,225	106,253	36	112,456	112,492	118,397
BANDUNDU	1,947	8,947	10,894	1,561	17,491	19,052	3,508	26,438	29,946	212	21,403	21,615	143	441,108	441,251	355	462,511	462,866	492,812
MANIEMA/KATANGA	NA	NA	0	NA	NA	0	168	778	946	NA	NA	0	NA	NA	0	1	0	1	24,494
KASAI	848	1,315	2,163	438	5,800	6,238	1,286	7,415	8,401	11	8,096	8,107	2	148,639	148,641	13	156,735	156,748	165,149
EQUATEUR NORD	825	2,436	3,261	1,056	45,047	46,103	2,816	86,856	89,672	4	7,885	7,889	18	785,691	785,709	22	793,576	793,598	883,270
EQUATEUR SUD	12	257	269	39	3,873	3,912	51	4,130	4,181	NA	1,979	1,979	NA	93,188	93,188	0	95,167	95,167	99,348
KINSHASA	201	299	500	230	8,238	8,468	431	8,537	8,968	NA	1,640	1,640	NA	20,944	20,944	0	22,584	22,584	31,552
PROVINCE ORIENTALE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
TOTALS	4,071	14,011	18,082	3,527	85,156	88,683	8,701	139,318	148,019	235	47,234	47,469	191	1,595,795	1,595,795	427	1,643,029	1,643,456	1,815,022
PERCENTAGE (%)	22.51	77.49	NA	3.98	96.02	NA	5.88	94.12	NA	0.50	99.50	NA	0.01	99.99		0.03	99.97	NA	

376 Legend: Tryp + = presence of anti-trypanosome antibodies; Tryp = absence of anti-trypanosome antibodies Ggl =
377 ganglia; CATT = card agglutination test trypanosome; NA=Not Available or missing data

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S4: Distribution by endemic area of new cases detected according to the mode of diagnosis in the DRC in 2002

Diagnosis mode / Endemic areas	GP	FB	TD	TBC	CSF	CLIN	OTHERS WOO + DC LC	TOTAL
BAS-CONGO	419	51	246	NA	1	NA	43	760
BANDUNDU	3,158	2,018	477	23	553	1	47	6,277
MANIEMA/KATANGA	235	153	158	NA	23	21	0	590
KASAI	1,782	54	1,021	2	291	17	6	3,173
EQUATEUR NORD	875	174	1,066	NA	267	48	6	2,436
EQUATEUR SUD	27	21	45	1	11	NA	53	158
KINSHASA	176	21	174	6	61	1	20	459
PROVINCE ORIENTALE	NA	NA	NA	NA	NA	NA	NA	0
TOTALS	6,672	2,492	3,187	32	1,207	88	175	13,853
DETECTION RATE	48.16	17.99	23.01	0.23	8.71	0.64	1.26	

Legend: GP = ganglionic puncture; FB = fresh blood; TD = thick drop (parasitology diagnosis); TBC = triple blood centrifugation; CSF = cerebrospinal fluid, NA=Not Available or missing data

403 **S5: distribution by endemic area of patients treated according to the therapeutic regime in**
404 **2002**

Drugs	PENT	BAYER205	PENT + BAY	ARSOBAL				DFMO				LAMPIT				OTHERS (ARS+LAMPIT)				TOTAL			
Endemic areas	NC	NC	NC	NC	AC	BT	TOT	NC	AC	BT	TOT	NC	AC	BT	TOT	NC	AC	BT	TOT	NC	AC	BT	TOT
BAS-CONGO	194	135	6	34	3	9	406	7	8	NA	15	NA	NA	NA	0	NA	NA	NA	0	736	11	9	756
BANDUNDU	2,806	227	2	3,127	19	4	3,150	1	2	2	5	NA	NA	1	1	5	2	1	8	6,168	23	8	6,199
MANIEMA/KATANGA	121	17	0	235	7	0	242	0	0	0	0	0	0	0	0	0	0	0	0	373	46	0	419
KASAI	849	18	NA	1,898	60	25	1,983	NA	62	24	86	NA	8	79	87	237	244	105	586	3,002	374	233	3,609
EQUATEUR NORD	215	321	1	1,894	437	43	2,374	2	167		169	1	162	11	174		112	3	115	2,434	878	57	3,369
EQUATEUR SUD	32	0	0	139	5	0	144	0	0	0	0	0	0	0	0	0	14	1	15	171	19	1	191
KINSHASA	155	0	0	309	15	0	324	1	25	0	0	0	0	0	0	28	2	0	30	498	42	0	535
PROV. ORIENT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0
TOTALS	4,372	718	9	7,996	546	81	8,623	11	264	26	275	1	170	91	262	270	374	110	754	1,377	1,393	308	15,078

405 Legend: PENT = Pentamidine; DFMO = Difluoro-methyl-ornithin; ARS = Arsobal ; BAY = Bayer; BT = put
406 back into treatment for treatment failure; NA=Not Available or missing data

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S6: Distribution of the cases following the control structures in 2002

Endemic areas / Control Structures	BAS-CONGO	BANDUNDU	MANIEMA/ KATANGA	KASAI	EQUATEUR NORD	EQUATEUR SUD	KINSHASA	PROVINCE ORIENTALE	TOTALS
MU	316	3,936	463	1,267	1,024	54	257	0	7,317
CDTC	374	978	109	951	1,402	183	191	0	4,108
FS	70	1,363	18	955	10	1	11	0	2,428
TOTAL	760	6,277	590	3,173	2,436	158	459	0	13,853

Legend: MU= Mobile Unit

446 **S 7: Evolution of HAT in the last six years in the DRC; TPE / 1NC report and monthly**
447 **average of NC by year**

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YEAR DATA COLLECTED	1996	1997	1998	1999	2000	2001	2002
TPT	1,297,778	1,168,404	1,472,674	1,298,933	1,605,816	2,028,238	2,040,927
NC	19,485	25,094	26,318	18,684	16,975	17,322	13,853
Infection rate	1.50	2.15	1.79	1.44	1.06	0.85	0.68
Monthly average New cases	1,624	2,091	2,193	1,557	1,415	1,444	1,154

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450 Legend: TPT = Total Population Tested; NC = new cases; IR=Infection Rate

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S 8: Lumbar punctures for diagnosis and control in 2002

LP					2002			
Endemics Areas	NC 2000	NC 2001	NC 2002	Prevision LPC 2002	PLDA-DB	TLPC	TPLCN	TLPAC
BAS-CONGO	816	736	760	2312	760	1,926	1,664	262
BANDUNDU	5,588	7,190	6,277	19,055	6,104	5,289	5,232	57
MANIEMA/KATANGA	323	711	590	1,624	286	NA	NA	0
KASAI	2,810	2,905	3,173	8,888	3,070	3,854	1,697	2,157
EQUATEUR NORD	6,673	4,990	2,436	14,099	2,375	15,988	11,769	4,219
EQUATEUR SUD	139	106	158	403	157	565	173	3,992
KINSHASA	NA	NA	NA	NA	NA	NA	NA	NA
PROVINCE ORIENTALE	16,975	17,319	1,385,553	48,147	13,183	28,253	21,066	7,187
TOTALS								

Legend: LP = lumbar puncture; NC = new case; PLC LPC= lumbar puncture control; TLPC = Total Lumbar Puncture Control; TLPNC = total lumbar puncture normal control; TLPAC= total lumbar puncture of abnormal control, NA=Not Available or missing data

2. RESULTS OF 2003 THA CONTROL ACTIVITIES BY ENDEMIC ZONE

S 9: Distribution by Endemic Area of Total Registered Population (TRP), Total Enrolled Population (TEP) of New Cases (NC) and Infection Rate (IR) in 2003

ENDEMICS AREAS	EXPOSED POPULATIONS	Nbr HZ	HZ THA	**Nbre MU**	TPC	TPT	% covert	TP	NC	IR	Endemicity level
BAS-CONGO	1,700,000	27	19		236,469	180,808	13.91	76.46	522	0.29	Middle
BANDUNDU	3,800,000	38	31		926,675	758,600	24.39	81.86	5,384	0.71	Severe
MANIEMA/KATANGA	1,200,000	81	16		130,124	123,713	10.84	95.07	737	0.59	Middle
KASAI	2,000,000	58	35		286,365	205,256	14.32	71.68	2,606	1.27	Severe
EQUATEUR NORD	2,000,000	20	15		1,053,798	949,747	52.69	90.13	1,597	0.17	Middle
EQUATEUR SUD	1,000,000	13	6		81,726	94,111	8.17	115.15	103	0.11	Low
KINSHASA	600,000	22	8		63,060	89,619	10.51	142.11	286	0.32	Middle
PROVINCE ORIENTALE	300,000	47	3		0	4,140	0.00	NA	251	6.06	Very severe
TOTALS	12,600,000	306	133		2,778,167	2,405,991	19.10	86,60	11,481	0.40	Middle

Legend: HZ = Health Zone; HZ HAT = Health Zone at risk of trypanosomiasis; MU = Mobile Unit; TPC = Total Population Counted; TPT = Total Population Tested; NC = new cases; IR = Infection Rate

503 **S 10: Distribution by endemic area of new cases recorded according to the screening**
504 **circumstances and stage of the disease in the DRC in 2002**

Circumstances of screening / Endemics Areas	ACTIVE SCREENING				PASSIVE SCREENING				TOT NC
	1st stage	2nd stage	Unkown	Total	1st stage	2nd stage	Unkown	Total	
BAS-CONGO	162	106	2	270	67	185	0	252	522
BANDUNDU	2,046	1,059	77	3,182	547	1,646	9	2,202	5,384
MANIEMA/KATANGA	292	126	25	443	58	231	0	289	732
KASAI	561	368	41	970	157	1465	14	1,636	2,606
EQUATEUR NORD	203	461	16	680	75	835	7	917	1,597
EQUATEUR SUD	18	20	2	40	12	50	1	63	103
KINSHASA	43	40	22	105	18	163	0	181	286
PROVINCE ORIENTALE	34	54	8	96	46	104	5	155	251
TOTALS	3,359	2,234	193	5,786	980	4,679	36	5,695	11,481
PERCENTAGE (%)				50.40				49.60	

505 Legend: NC = new cases

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522 **S 11: CATT test results for ganglia in 2003**

	POSITIVE CATT									NEGATIVE CATT									TOT
ENDEMICS AREAS	Ggl palpated			Ggl not palpated			Tot positive catt			Ggl palpated			Ggl not palpated			Tot negative catt			
	Tryp+	Tryp-	S/TOT	Tryp+	Tryp-	S/TOT	Tryp+	Tryp-	S/TOT	Tryp+	Tryp-	S/Tot	Tryp+	Tryp-	S/Tot	Tryp+	Tryp-	S/Tot	
BAS-CONGO	232	547	779	154	5,943	6,097	386	6,490	6,876	0	4,003	4,003	2	137,257	137,259	2	141,260	141,262	148,138
BANDUNDU	1,823	5,333	7,156	1,574	14,879	16,453	3,397	20,212	23,609	114	35,577	35,681	52	650,289	650,341	166	685,866	686,032	709,641
MANIEMA/KATANGA	164	470	634	122	1,847	1,969	286	2,317	2,603	11	5,525	5,536	2	65,953	65,955	13	71,478	71,491	74,094
KASAI	641	943	1,584	405	5,467	5,872	1,046	6,410	7,456	11	8,096	8,107	2	148,639	148,641	13	156,735	156,798	164,204
EQUATEUR NORD	487	1,660	2,147	602	35,532	36,134	1,089	37,192	38,281	6	5,284	5,290	26	779,921	779,941	32	785,205	785,137	823,518
EQUATEUR SUD	19	103	122	40	1,118	1,158	59	1,221	1,280	0	1,068	1,068	0	71,847	71,847	0	72,915	72,915	74,195
KINSHASA	151	270	521	210	3,020	3,230	461	3,290	3,751	1	737	738	2	114,577	114,579	3	115,314	115,317	119,068
PROVINCE ORIENTALE	209	0	209	0	0	0	209	0	209	0	431	431	0	3,337	3,337	0	3,768	3,768	3,977
TOTALS	3,826	9,326	13,152	3,107	67,806	70,913	6,933	77,132	84,065	143	60,864	60,864	86	971,820	1,971,906	229	2,032,541	2,032,770	2,116,835
PERCENTAGE (%)	29.09	70.91		4.38	95.62		8.25	91.75		0.23	99.77		0.00	100.00		0.01	99.99		

523 Legend: Tryp + = presence of anti-trypanosome antibodies; Tryp = absence of anti-trypanosome antibodies; Ggl =
524 ganglia; CATT = card agglutination test trypanosome

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S 12: Distribution by endemic area of new cases detected according to the diagnostic method in the DRC in 2003

Diagnosis mode / Endemic areas	GP	FB	TD	TBC	CSF	CLIN	OTHERS WOO + DC LC	TOTAL
BAS-CONGO	276	26	176	0	44	0	0	522
BANDUNDU	2,679	1,455	570	519	21	0	140	5,384
MANIEMA/KATANGA	240	63	363	65	0	1	0	732
KASAI	1,317	38	811	0	393	18	29	2,606
EQUATEUR NORD	586	94	647	0	208	55	7	1,595
EQUATEUR SUD	36	7	46	0	14	0	0	103
KINSHASA	114	13	65	5	43	0	46	286
PROVINCE ORIENTALE	125	3	100	0	21	0	2	251
TOTALS	5,373	1,699	2,778	589	744	74	224	11,881
DETECTION RATE	46.80	14.80	24.20	5.13	6.48	0.64	1.95	

Legend: GP = ganglionic puncture; FB = fresh blood; TD = thick drop; TBC = triple blood centrifugation; CSF = cerebrospinal fluid

552 **S 13: distribution by endemic area of patients treated according to the therapeutic regime**
553 **in 2003**

Drugs	PENT	BAYER205	PENT+BAY	ARSOBAL				DFMO				LAMPIT				OTHERS (ARS+LAMPIT)				TOTAL		
Endemics areas	NC	NC	NC	NC	AC	RT	TOT	NC	AC	RT	TOT	NC	AC	RT	TOT	NC	AC	RT	TOT	NC	AC	BT
BAS-CONGO	208	17	1	2822	3	13	2998	5	9	5	19	0	0	0	0	0	0	0	0	513	12	18
BANDUNDU	1,843	456	3	2,914	12	6	2,932	4	5	5	14	0	0	0	0	0	0	6	6	5,220	17	NA
MANIEMA/KATANGA	330	0	0	344	55	1	400	0	28	0	28	0	0	0	0	0	0	0	0	674	83	1
KASAI	714	3	0	1,685	28	35	1,748	0	178	4	182	0	0	0	0	0	186	80	266	2,402	392	NA
EQUATEUR NORD	148	128	0	1,308	186	20	1,514	0	140	4	144	6	253	4	263	2	237	22	261	1,592	816	NA
EQUATEUR SUD	30	0	0	71	3	1	75	0	1	0	1	0	0	0	0	0	4	1	5	101		NA
KINSHASA	124	0	0	335	9	6	350	10	23	5	38	0	0	0	0	16	0	0	0	485	32	NA
PROVINCE ORIENTALE	80	0	0	155	0	0	155	1	0	0	1	0	0	0	0	0	0	0	0	236	0	NA
TOTALS	3,477	604	4	7,094	296	82	7,472	20	384	23	427	6	253	4	263	18	427	109	538	11,223	1,360	NA
PERCENTAGE	27.16	4.72	0.03	55.42			58.37				3.34				2.05				4.20			

554 Legend: PENT = pentamidine; DFMO =Difluoromethylornithine; ARS = Arsobal; BT=Back to Treatment; NA=Not
555 Available or missing data

S 14: Evolution of HAT in the last eight years in the DRC; PTE / NC ratio and monthly average of NC by year

YEAR DATA COLLECTED	1996	1997	1998	1999	2000	2001	2002	2003
TPT	1,297,778	1,168,404	1,472,674	1,298,933	1,605,816	2,028,238	1,973,885	2,400,673
NC	19,485	25,094	26,318	18,684	16,975	17,322	13,553	11,481
IR	1.50	2.15	1.79	1.44	1.06	0.85	0.69	0.48
MANC	1,624	2,091	2,193	1,557	1,415	1,444	1,129	957

Legend: TPT = Total Population Tested; NC = New Case; IR= Infection Rate; MANC= Monthly average New cases

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578 **S15: The lumbar punctures of diagnosis and control carried out in 2003**

LP Endemics areas	NC 2001	NC 2002	NC 2003	Prevision LPC 2003	2003			
					TLPNC	TLPC	TLPNC	TLPAC
BAS-CONGO	736	760	522	2,018	520	746	685	61
BANDUNDU	7,190	6,277	5,384	18,851	5,299	5,289	5,232	57
MANIEMA/KATANGA	711	290	732	1,733	705	628	490	138
KASAI	2,905	3,171	2,606	8,684	3,070	3,854	1,697	2,157
EQUATEUR NORD	4,990	2,436	1,597	9,023	1,574	11,651	8,178	3,473
EQUATEUR SUD	106	158	103	367	118	565	173	392
KINSHASA	681	459	286	1426	431	631	531	100
PROVINCE ORIENTALE	NA	NA	251	251	78	0	0	0
TOTALS	17,319	13,553	11,481	42,353	11,795	23,364	16,986	6,378

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580 Legend: LP = lumbar puncture; NC = new case; PLC LPC= lumbar puncture control; TLPC = Total Lumbar Puncture Control;
581 TLPNC = total lumbar puncture normal control; TLPAC= total lumbar puncture of abnormal control, NA=Not Available

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