Pulmonary tuberculosis case detection in South Sudan

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Abstract

Background: The National Tuberculosis (TB) Control Programme in South Sudan was created in 2006, and non-governmental organizations (NGOs) are its main implementers. Pulmonary tuberculosis (PTB) is a major public health threat. Available literature describes case finding as very low, but treatment success as high. This study was conducted to establish the true picture of case detection and to suggest ways to improve on case finding.

Methods: Recent trends in routine TB case notification as well as case detection and treatment outcome rates were analysed. Approaches and methods utilized in PTB case finding by the involved NGOs were examined. Opinions on how best to improve on case detection were generated.

Results: There was an increase in the trend of notification from 2002 to 2009, but the sputum smear-positive proportion was stable for the same period. The case detection rates were very low, all below 50% of expected for the given years; treatment success rates were high and stable, at an average of 80%; the defaulter rate was on the increase, especially after 2006. The NGOs seemed to be using the recommended approaches and methods to find and diagnose PTB. There was variation in opinions on how to improve on case detection in the region, with overlap in some instances.

Conclusions: PTB case detection has been very low in South Sudan over the last decade; however, the DOTS treatment success rate is high. The high treatment success rate could mean that if more PTB cases could be found in the communities, more are likely to be treated successfully.

Introduction

Tuberculosis (TB) is a chronic inflammatory lung disease caused by *Mycobacterium tuberculosis*. Sick people with the TB germs (or bacilli) transmit the germs into the air during coughing, sneezing, talking, or spitting. Inhaling a small number of the bacilli leads to infection [1]. When a person with active pulmonary TB disease does not receive treatment, that person will infect on average between 10 and 15 people in a year.

TB is a major cause of morbidity and mortality in South Sudan. An estimated 18,500 people develop TB and 5,300 die annually [2]. In 2007, the National TB/Leprosy/Buruli Ulcer Control Programme (NTLBCP) reported 4,738 cases of TB, with 2513 of these being new sputum smear positive TB [2]. With an estimated population of 8 million in the same year, the burden of smear positive cases is estimated to be 13,130 cases annually, whereas for all forms of TB (including sputum smear negative and pulmonary cases) it is roughly 29,640 [3].

While increase in incidence of TB in sub-Saharan Africa is associated with HIV infection, in South Sudan factors that play a big role in the spread of TB include low income, meager resources, civil unrest, and displacement of populations [4].

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The study was conducted to establish the true picture of case detection and suggest ways to improve case finding.

Method

Using data from the national tuberculosis control programme, I analysed recent trends in routine TB case notification as well as case detection and treatment outcome rates. Using a questionnaire, I examined approaches and methods used in PTB case detection by the NGOs, the main implementers, and I asked the NGOs how to improve case detection.

Results

Case notification

I found an increase in the trend of notification from 2002 to 2009 (Table 1 and Figure 1) but the proportion of new sputum smear-positive was stable for the same time period, fluctuating between 40% and 55% from 2002 to 2009 (Table 2). The case detection rates were very low, all below 50% of expected for the given years (Figure 2); treatment success rates were high and stable, at an average of 80% (Figure 2). The defaulter rate was increasing, especially after 2006.

PTB diagnosis and case finding by organization

Out of 12 organizations that are involved in TB control in South Sudan, only 7 participated in the study. These were: Arkangelo Ali Association, Malteser International, Diocese of Wau/Don Bosco Missionary Sisters, Medair,

Table 1. TB case notification from 2002 to 2009

	2002	2003	2004	2005	2006	2007	2008	2009
New SM+	752	838	979	1656	2105	2513	1783	2023
New SM-	225	358	484	877	1311	1318	781	1211
P (ND or NA)	0	0	0	0	0	240	278	433
New EP	283	338	721	1278	1127	907	872	1023
Relapse	78	95	73	199	164	150	132	138
TAF	11	14	12	46	65	22	30	24
TAD	22	28	22	50	72	82	71	72
Others	0	0	0	0	0	5	220	104
Total	**1371**	**1671**	**2291**	**4106**	**4844**	**5237**	**4167**	**5028**

Merlin, Norwegian Peoples' Aid and Ministry of Health (Government of South Sudan) – TB Control Programme, Juba Teaching Hospital. I found that PTB diagnosis and case finding by the organizations were generally as recommended by the TB control programme.

Interview data synthesis

These 7 organizations had experiences that ranged from 5 to over 25 years, and their representatives were all senior staff members (i.e. coordinators, team leaders, project managers), who were well-versed with their respective programmes, including activities and difficulties related to TB control in South Sudan.

Although the practical realities and challenges on the ground vary from area to area, to improve PTB case detection the general collective recommendations of the implementing NGOs were:

1. Increase laboratory outreach
2. Increase human resources
3. Strengthen community participation
4. Ensure that all primary health care centres and units are fully operational and well supported through logistics and capacity building
5. Standardize reporting format between government structures and NGOs
6. Create information sharing between implementing partners
7. Carry out regular stakeholders meetings
8. Increase health education/ awareness
9. Improve referrals from the communities
10. Integrate TB programmes into all primary health care facilities
11. Improve supplies (laboratory and other logistics).

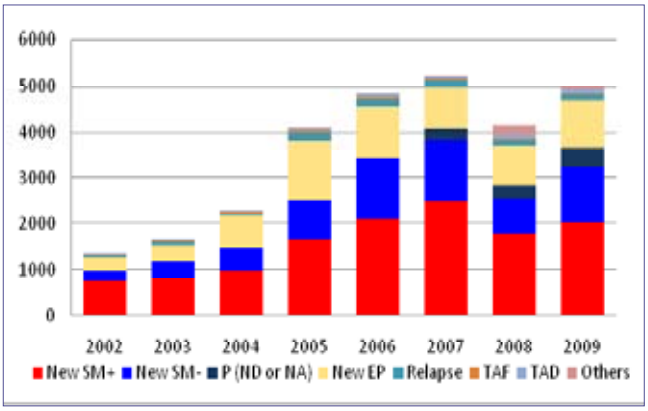

Figure 1. TB case notification in South Sudan from 2002 to 2009. Source: NTLBCP.

Discussion

Notifications

Between 2002 and 2009 there was a general increase in the trend of TB case notification, especially for the categories new sputum smear-positive, new sputum smear-negative, and new extra-pulmonary TB. The notifications for the remaining categories were generally low and far below 500 and stable, except for 'pulmonary with sputum smear microscopy not done or unavailable'. This could mean that suddenly from 2006 to 2009 there was a gradual increase in the number of pulmonary cases being started on TB treatment without the recommended sputum smear microscopy being done.

Therefore, although there was a rise in the trend, still far less than expected TB cases were reported to the WHO in the referred time period, reflecting far fewer cases detected in the communities.

Looking at the proportions of new sputum smear-positive cases (Table 2); these have been stable between 2002 and 2009 in the range 40% to 55%. Thus, although there is a general increase observed in the trend of the notification from 2002 to 2009, the proportions of sputum smear-positive cases compared to other categories

Table 2. Proportion of new sputum smear positive cases from 2002

	2002	2003	2004	2005	2006	2007	2008	2009
New SM+	742	838	979	1656	2105	2513	1783	2023
Total cases	1371	1671	2291	4106	4844	5237	4167	5028
New SM+ proportion	0.55	0.5	0.43	0.4	0.43	0.48	0.43	0.4

Table 3. Diagnostic Criteria for PTSD

	2002	2003	2004	2005	2006	2007	2008
SR	**80.6**	**81.2**	**83**	**85.1**	**79.6**	**79**	**78**
FR	**4.9**	**3.3**	**3.3**	**1.6**	**1.7**	**1**	**1**
DFR	7.1	3.9	3.8	4.2	4.7	11	12
DR	4.5	2.7	2.7	3.3	6.3	5	5
TOR	**0.7**	**0.1**	**0**	**0.7**	**0**	**3**	**3**

have been fluctuating between 40 and 55% for the same time period. Thus the increase in trend of notification could only be related to change in notification behaviour, meaning: more and more sputum smear-positive cases are being reported to the WHO and not that there is an upsurge of sputum smear-positive cases.

Calculations

As the exact burden of TB in South Sudan remains unknown, based on WHO estimates (with an estimated population of 13 million in 2007):

- the incidence of PTB (new smear positive/100, 000 population per year) is 101
- the incidence of all new TB cases (all new TB cases/100, 000 population/year) is 228
- the prevalence of TB (all TB cases/100, 000 population per year) is 456 and
- the mortality (deaths/100, 000 population/year) is 56 [5].

It follows from the above estimates (particularly the total population) as well as the definition of notification rate, if we look at Table 1 and carry out some calculations, the notification rates of PTB per 100,000 population are:

11 for 2002 (i.e. 1371 x 100, 000/13, 000, 000)

13 for 2003

18 for 2004

32 for 2005

37 for 2006

40 for 2007

32 for 2008

39 for 2009.

The figures range from 11 to 39 per 100,000 population per year and none is even 50% of expected incidence of 101 per 100, 000 population per year.

Therefore, although there was a rise in the trend of TB case notification in the country between 2002 and 2008, still far less than expected TB cases were reported to the WHO in the referred time period, reflecting far fewer cases detected.

However, the figure of 101 per 100,000 and the population of 13 million are just estimates; so, maybe the incidence of PTB in the country is exaggerated. The latest census conducted in the Sudan was in 2008. Although rejected by the then Government of Southern Sudan (when it was still part of the Sudan) for political reasons, the population figure for the region was found to be about 8,260 490. From this "more accurate" population figure, we can compute a new and "better" PTB incidence, which is roughly 64 cases per 100,000 population per year.

It follows then that, if we do some calculations as previously, the notification rates of PTB per 100,000 population for South Sudan change to the following figures:

9 for 2002

10 for 2003

12 for 2004

20 for 2005

25 for 2006

30 for 2007

22 for 2008

24 for 2009.

Again, the assumption is that the total population is

constant at 8, 260, 490, from 2002 to 2009. Even so the new figures are still below 50% of the expected incidence of 64 per 100,000 population per year.

Sex

Males dominate the list of smear-positive cases for almost all age groups, with the exception of the 5 to 14 year age group. On the one hand, this could mean that males have more access to health facilities and therefore diagnosis, which could be related to occupation (e.g. the army) in the context of a post-conflict region. On the other hand, social stigma associated with diagnosis of PTB and dedication to household responsibilities could explain why fewer smear positive cases are detected in females.

As South Sudan is largely rural, perhaps more health education and more outreach activities will enable more women of different ages to be reached in their communities and therefore more cases of TB could be detected amongst females.

State

New sputum smear-positive cases reported for Central Equatoria and Northern Bahr-el-Ghazel states were more than double those for each of the other eight states. Also, there were many more sputum smear-negative cases notified for Central Equatoria. We could attribute these higher figures to the fact that these are states with major towns or cities; not only do we expect larger populations in these urban settings, but also we expect more healthcare facilities, easier access to these facilities, and better diagnosis in terms of personnel and laboratories. Also a higher HIV prevalence could explain the figures, including higher sputum smear-negative for Central Equatoria; since this is the state that borders Uganda, a country with a higher HIV prevalence than South Sudan.

Trend of treatment success rate

The high DOTS treatment success rate (Figure 2) is consistent with the earlier findings cited from the USAID website. This could mean that if more TB cases in the communities could be found, more are likely to be treated successfully.

A rising defaulter rate should be a cause for concern (Table 3) as non-drug compliance is one factor that contributes to drug resistant TB; two cases were already reported in Kajo Keji in Central Equatoria in 2005 [3]. Reasons for a rising defaulter rate should therefore be addressed.

Implementing organizations and TB case detection

Each of the 7 participating organizations had been represented by a senior staff member and all these organizations have experiences in South Sudan ranging from 5 to more than 25 years.

Doctors, clinical officers, nurses and community health workers are involved in the diagnosis of PTB in these organizations, with doctors dominating, implying that the likelihood of cases being missed is low.

Overall, the methods used by the 7 organizations to diagnose PTB include clinical findings (signs and symptoms) and sputum smear microscopy, with X-ray as an addition in some cases where the facility is available. This is in line with the recommendation from the policy and guideline document for TB control in the region [3]. Five of the 7 organizations find cases both passively and actively, which is a positive finding; with two limited to passive detection. Passive case finding involves detecting cases from symptomatic clients attending facilities, whereas active case finding involves looking for, diagnosing, treating and following-up cases in the community.

In summary, the organizations in the study are well-experienced and are utilizing the recommended approach to detect TB cases.

Conclusion

As mentioned already, there was a general increase in the trend of TB case notification in South Sudan between 2002 and 2009, but PTB case detection has been very low over the same time period. The increase in case notification could be related to development of better recording and reporting systems. As far as TB treatment outcome is concerned, the DOTS treatment success rate is high, with the implementing partners all treating and following up TB cases in the facility. The high treatment success rate could mean that if more PTB cases could be found in the communities, more are likely to be treated successfully. The prevalence of PTB would thus reduce and so would related mortality, and TB as a public health threat would be contained. However, defaulting is an issue that should be taken into consideration, because of the risk of drug resistant tuberculosis.

Study Limitations

1. Only 7 out of 12 organizations involved in TB control in South Sudan participated in the study.
2. It would have been more inclusive to involve all the 46 TB treatment centres in the region, no matter how many may be under one organization, as the realities and the challenges vary from one location to the other.
3. Communication was difficult with some of the intended respondents as they were based in remote locations.
4. Time was a limiting factor, as the study time frame was roughly 6 weeks with actual data collection done in just under two weeks.
5. Focus was on adult PTB patients only, as it is

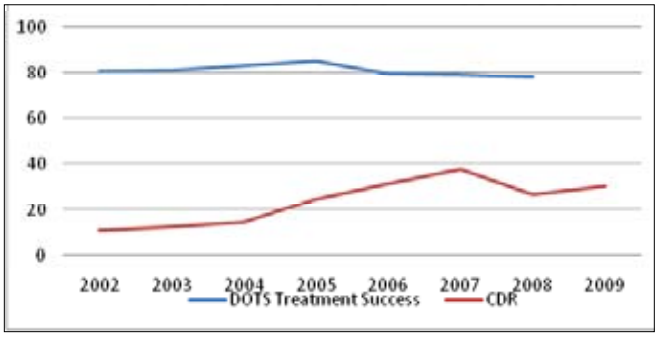

Figure 2. Trends of treatment success rate and case detection rate in South Sudan from 2002 to 2009

easier to diagnose PTB in this age group than in children.

6. Data were not collected directly from the organizations but from the National TB/Leprosy/ Buruli Ulcer Control Programme, the recipient of quarterly reports from all organizations involved in TB control in the region.

Author's note

This qualitative and quantitative study was carried out in 2010 and submitted in part fulfillment of the requirements for the degree of Master of Science in Tropical Medicine and International Health, at the London School of Hygiene and Tropical Medicine (LSHTM); University of London. Approvals for the study were granted by the LSHTM Ethics Committee and the Department of Research and Planning at the Ministry of Health, South Sudan. Special thanks to Drs Joseph Lasu and Joseph Lou of the National TB Control Programme, the NGO representatives in the study, as well as my supervisor, Professor Peter Godfrey-Faussett.

References

1. WHO. Tuberculosis. 2010 [cited 2010 18th September 2010]; Factsheet. http://www.who.int/mediacentre/factsheets/fs104/en/index.html.
2. USAID. 2009. Infectious Diseases, Southern Sudan. 22nd September 2009 April 25th 2010.; http://www.usaid.gov/our_work/global_health/id/tuberculosis/countries/africa/ssudan_pro file.html.
3. MoH G. Policy and Guidelines for Tuberculosis Control Programme in Southern Sudan. 2009, MoH, (GoSS): Juba, Southern Sudan.
4. EDCTP. 2009.The burden of tuberculosis in eastern Sudan: Epidemiology and drug resistance patterns of mycobacterium tuberculosis isolates. 31st January 2009 [cited 19th August 2010]; http://www.edctp.org/Our_Work.180.0.html?&no_cache=1&tx_viprojects_pi1%5Baction%5 D=show_project&tx_viprojects_pi1%5Bid%5D=14.
5. NTBLCP, M.G. 2008. Summary of TB Programme in Southern Sudan. NTLBCP, MoH (GoSS). 6. NTBLCP, M.G., TB Treatment Centres. 2010, MoH (GoSS). p.1.
6. El Sony AI, B.O., Enarson DA, Bjune G. 2000. Tuberculosis control in Sudan against seemingly insurmountable odds. *International Journal of Tuberculosis* and Lung Disease. 4(7):657-64.
7. El Sony AI, K.A., Enarson DA, Baraka O, Mustafa SA, Bjune G. 2002. Treatment results of DOTS in 1797 Sudanese tuberculosis patients with ot without HIV co-infection. *International Journal of Tuberculosis and Lung Cancer.* 6(12):105-66.
8. Bohler M, M.S., Morkve O. 2005. Tuberculosis treatment outcome and health services: a comparison of displaced groups in Khartoum, Sudan. *International Journal of Tuberculosis and Lung Cancer.* 9(1): 32-6.
9. Ahmed Suleiman MM, A.A., Sodermann M 2009. Evaluation of tuberculosis control programme in Khartoum State for the year 2006. *Scandinavian Journal of Public Health.* 37(1): 101-8.
10. WHO. 2010.Tuberculosis detection rate under DOTS (percentage. [cited 2010 18th August]; http://www.who.int/whosis/indicators/2007TBCasesDetectedDOTS/en/print.html.
11. Uganda MEMS. 2009. Performance Indicator Reference Sheet:TB Case Notification Rate. 9th April 2009 [cited 2010 30th August]; http://ugandamems.com/templates/pirs/S08/2.%20PIRS%208.1/9.%20TB%20Case%20Notifi cation%20Rate.pdf.
12. WHO.2008.Tuberculosistreatmentsuccessunder DOTS (percentage). [cited 2010 24th August]; http://www.who.int/whosis/indicators/compendium/2008/4tsr/en/index.html.
13. Gurtong. 2009. South Sudan Census Results Officially Released
14. Eglisesoudan. 2010. Diocese of Wau. [cited 2010 23rd August]; http://www.eglisesoudan.org/english/Wau.htm.
15. International, M. 2010. Rumbek, Yei, Maridi/ Sudan; Tuberculosis and HIV control programme. [cited 2010 23rd August]; http://www.malteser.de/61.Malteser_International/en/61.05.Projects/61.05.02.Africa/ald_projekt_detailansicht.asp.
16. Medair. 2009. Medair, Emergency Relief and Rehabilitation, Southern Sudan. [cited 2010 21st August]; http://www.medair.org/en/where-we-work/southern-sudan/
17. Medair. 2009. First steps; Sudan (Southern Sudan). 19th June 2009 [cited 2010 23rd August]; http://www.

medair.org/en/infochanel/news/detail/article/first_steps/?no_cache=1&tx_ttnews%5BbackPid%5D=0&cHash=6e9364e918.

18. Merlin. 2010. Merlin, Sudan. [cited 2010 22nd August]; http://www.medair.org/en/where-we-work/southern-sudan.

19. NPA. 2003. Norwegian People's Aid, Southern Sudan. [cited 2010 22nd August]; http://www.npaid.org/English/Organization/External_offices_online/Africa/Southern_Sudan/

20. WHO. 2009. Global Tuberculosis Control, WHO Report 2009, Uganda., WHO: Geneva. p153-6.

21. USAID. 2009. Infectious Diseases; Kenya. September 22nd 2009 [cited 2010 28th August]; http://www.usaid.gov/our_work/global_health/id/tuberculosis/countries/africa/kenya_prof ile.html.

22. CDC. 2008. TB and HIV/ AIDS. [Website] 28th January 2008 [cited 2010 24th August] http://www.cdc.gov/hiv/resources/factsheets/hivtb.htm

23. WHO. 2007. Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents. [cited 2010 24th August]; http://www.who.int/hiv/pub/tb/pulmonary/en/

A QUIZ FOR OUR READERS

Based on articles in the August 2012 issue of the South Sudan Medical Journal. For each of the following 5 questions only one answer is correct. How many can you answer correctly? [Answers are on page 94]

A. In complicated malaria an impaired level of consciousness may indicate:

1. Hyperglycaemia
2. Hypoglycaemia
3. No need to observe carefully
4. Haemoglobin of 7g/dl

B. Which one of the following statements is true for the management of malaria:

1. Trials have shown that quinine is still more effective than artesunate.
2. If coma occurs in malaria the possibility of meningitis must be considered.
3. Diclofenac is useful in hyperpyrexia of malaria.
4. Observations are the responsibility of the doctors only.

C. Which one of the following is true?

1. Cardiovascular risk factors are not high in urbanised African populations.
2. If a patient trusts his / her doctor the outcome of care is improved.
3. Cancer deaths each year in Africa are about 200,000.
4. About 10% of cancer deaths are preventable in Africa.

D. Which one of the following statements is true?

1. Only 20% of patients with haemorrhagic stroke in Africa have a history of hypertension.
2. The reduction in salt intake has no part in the management of hypertension in Africa.
3. Reducing alcohol consumption helps in the control of hypertension.
4. Obesity is a problem only in Western countries.

E. Which one of the following statements is true?

1. A hypodense area on a brain CT-scan may suggest a cerebral infarct.
2. Guinea worm disease is uncommon in South Sudan.
3. Boiling drinking water has no effect on acquiring guinea worm disease.
4. Iron supplements are useful in the treatment of diarrhoea.