

# What is the cost of diagnosing a new sputum smear positive TB case in children in low income settings?

February 2011

This rapid response was prepared by the Uganda country node of the Regional East African Community Health (REACH) Policy Initiative.

## Key messages

- Data on a single established cost for the entire process of diagnosing sputum positive Tuberculosis (TB) in children in low income countries is scarce
- Using the recommended approach to diagnosing TB in children, direct costs may be estimated.
- The cost of diagnosing a new sputum smear positive TB case in children in low income settings is HIGHLY dependent on where services are sought; one may incur almost no direct costs while these could be up to USD 125 for a single case.



## Who requested this rapid response?

This document was prepared in response to a specific question from a Senior Health policymaker in Uganda.

## ! This rapid response includes:

- Summary of research findings
- Relevance for low and middle income countries

## X Not included:

- Recommendations
- Indirect costs
- Results from qualitative studies
- Examples or detailed descriptions of implementation

## What is the SURE Rapid Response Service?

SURE Rapid Responses address the needs of policymakers and managers for research evidence that has been appraised and contextualised in a matter of hours or days, if it is going to be of value to them. The Responses address questions about arrangements for organising, financing and governing health systems, and strategies for implementing changes.

## What is SURE?

**SURE** – Supporting the Use of Research Evidence (SURE) for policy in African health systems - is a collaborative project that builds on and supports the Evidence-Informed Policy Network (**EVIPNet**) in Africa and the Regional East African Community Health (**REACH**) Policy Initiative (see back page). SURE is funded by the European Commission's 7th Framework Programme.

[www.evipnet.org/sure](http://www.evipnet.org/sure)

## Glossary

of terms used in this report:

[www.evipnet.org/sure/rr/glossary](http://www.evipnet.org/sure/rr/glossary)

## Background

Most children with TB have pulmonary TB but majority of it is sputum negative TB because cavitating TB is rare in children (1). The diagnosis of TB in children relies on careful and systematic assessment of all the evidence derived from a **thorough history, clinical examination and relevant investigations**, e.g. tuberculosis skin test (TST) also known as the tuberculin, mantoux or Purified Protein Derivative (PPD) test), chest X-ray (CXR) and sputum smear microscopy (2). The combination of a positive tuberculin skin test, radiographic and/or clinical manifestations consistent with TB, and establishing recent contact with a known infectious case of tuberculosis is the "gold standard" for diagnosis of TB in children (3).

Although bacteriological confirmation of TB is not always feasible, it should be sought whenever possible, for example by sputum microscopy for children with suspected pulmonary TB who are old enough to produce a sputum sample. The proposed or recommended approach to diagnosing TB in children is based on limited published evidence and relies heavily on expert opinion (2).

Data on a single established cost for the entire process of diagnosing sputum positive Tuberculosis (TB) in children in low income countries is scarce and so the cost given in this paper is that of the different procedures taken to make a diagnosis. What is given here is the direct cost, indirect costs that include time and impact on the economy, are not included.

### **World Health Organization (WHO) Recommended approach to diagnosing TB in children:**

1. Careful history (including history of TB contact and symptoms consistent with TB)
2. Clinical examination (including growth assessment)
3. Tuberculin skin testing
4. Bacteriological confirmation whenever possible
5. Investigations relevant for suspected pulmonary TB
6. HIV testing (in high HIV prevalence areas)

### **How this Response was prepared**

After clarifying the question being asked, we searched for systematic reviews, local or national evidence from Uganda, and other relevant research. We also sought international databases and spoke to authors and experts in the field. The methods used by the SURE Rapid Response Service to find, select and assess research evidence are described here:

[www.evipnet.org/sure/rr/methods](http://www.evipnet.org/sure/rr/methods)

---

## *Cost of each of the recommended steps*

- ***Careful history (including history of TB contact and symptoms consistent with TB) and Clinical examination (including growth assessment)***

This is usually included in consultation fees of a given health care provider as an individual or as a facility which varies depending on whether the services are of a public or private health facility, and then furthermore private-for-profit or private-not-for-profit. On average fees may range from being free to consultation fees of about USD 20.

- ***Tuberculin skin test(TST)***

A positive TST occurs when a person is infected with *M. tuberculosis*, but does not necessarily indicate disease. However, the TST can also be used as an adjunct in diagnosing TB in children with signs and symptoms of TB and when used in conjunction with other diagnostic tests. There are a number of TSTs available, but the TST using the mantoux method is the recommended and most commonly used in low income countries. The TST can be used to screen children exposed to TB, is useful in HIV-infected children to identify those with dual TB/HIV infection and as an aid in the diagnosis of TB, although fewer HIV-infected children will have a positive TST, as a normal immune response is required to produce a positive test and many HIV-infected children have immune suppression. There can be false-positive as well as false-negative TSTs. A negative TST never rules out a diagnosis of TB in a child. The mantoux test is free in a public health facility. However the cost of a kit that serves about 10 people costs about USD 40 and so the cost of about USD 5-10 in a private facility may be in reflection of this.

- ***Bacteriological confirmation***

It is always advisable to confirm diagnosis of TB in a child using appropriate specimens from the suspected sites of involvement, in this case, the lungs. Specimens should be obtained for microscopy and, where facilities and resources are available, for culture (and also histo-pathological examination). Appropriate clinical samples include sputum, for both staining of acid-fast bacilli and histology. In addition to increasing the yield of confirmed TB cases, mycobacterial culture is the only way to differentiate *M. tuberculosis* from other non-tuberculous mycobacteria. Bacteriological confirmation is especially important for chil-

dren who have suspected drug-resistant TB, HIV infection, complicated or severe cases of disease, and an uncertain diagnosis.

The cost of sputum microscopy in a public health facility is about USD 2.5 while that of a histopathology examination is USD 11. The cost of a culture test is USD 27. This is in the assumption that there are already established laboratory services for TB diagnosis, with a network of quality-controlled laboratory procedures. If these are not available then there are costs for setting up laboratory services.

Common ways of obtaining samples for smear microscopy include the following.

*a. Expectoration:* Sputum should always be obtained in older children (10 years of age or older) who are pulmonary TB suspects. Three sputum specimens should be obtained: an on-the-spot specimen (at first evaluation), an early morning specimen and a second on-the-spot specimen (at a follow-up visit). This should not cost anything aside from the cost of the container provided for specimen collection, which is usually borne by the laboratory.

*b. Gastric aspiration*

Gastric aspiration using a nasogastric feeding tube can be performed in young children who are unable or unwilling to expectorate sputum. The gastric aspirates are then sent for smear microscopy and mycobacterial culture. The cost of this procedure which should be done thrice to yield three samples costs about USD 9 for each time its done.

*c. Sputum induction*

Several recent studies have found that sputum induction is safe and effective in children of all ages and the bacterial yields are as good as or better than for gastric aspirates. However, training and specialized equipment are required to perform this procedure properly. The cost of this procedure on average is USD 9-10.

- ***Investigations relevant for suspected pulmonary TB***

Chest radiography is useful in the diagnosis of TB in children. In the majority of cases, children with pulmonary TB have chest x-ray changes suggestive of TB. Good-quality chest x-rays are essential for proper evaluation. Chest x-rays should preferably be read by a radiologist or a health-care worker trained in their reading. The costs involved here include those of having the x-ray taken which may include the ra-

diologist's fees or not. The radiologists' fees are often met by the facility. The average cost of an X-ray ranges anywhere between USD 4.5-11.5.

- ***HIV testing***

In areas with a high prevalence of HIV infection in the general population, where TB and HIV infection are likely to coexist, HIV counselling and testing is indicated for all TB patients as part of their routine management. In areas with lower HIV prevalence, HIV counselling and testing is indicated for TB patients with symptoms and/or signs of HIV-related conditions, and in TB patients having a history suggestive of high risk of HIV exposure. HIV testing costs anywhere from free services to about USD 5.

### ***Conclusion***

The cost of diagnosing a new sputum smear positive TB case in children in low income settings varies and is HIGHLY dependent on where services are sought; one may incur almost no direct costs while these could be up to an estimated USD 125 for a single paediatric case, basing on the cost of steps recommended for diagnosis of a paediatric TB case.

---

## **References**

1. A. D. Harries, Dermot Maher, Stephen Graham. TB/HIV: a clinical manual: Stop TB Initiative (World Health Organization), World Health Organization. Dept. of HIV. Geneva; 2004.
2. World Health Organization. Guidance for national tuberculosis programmes on the management of tuberculosis in children. 2006 [cited 2011; Available from: [http://whqlibdoc.who.int/hq/2006/WHO\\_HTM\\_TB\\_2006.371\\_eng.pdf](http://whqlibdoc.who.int/hq/2006/WHO_HTM_TB_2006.371_eng.pdf)
3. Jeffrey R. Starke M. Tuberculosis in Children. Seminars in Respiratory and Critical Care Medicine; Baylor College of Medicine, and Texas Children's Hospital, Clinical Care Center, Division of Infectious Diseases, Houston, Texas. 2004;25(3).
4. MSH International Drug Price Indicator Guide. [http://erc.msh.org/dmpguide/index.cfm?search\\_cat=yes&display=yes&module=dmp&language=english&year=2008](http://erc.msh.org/dmpguide/index.cfm?search_cat=yes&display=yes&module=dmp&language=english&year=2008)

---

## This summary was prepared by

Dr. Rhona Mijumbi, Supporting Use of Research Evidence for Policy (SURE Project), Office of the Principal, College of Health Sciences, Makerere University, New Mulago Hospital Complex, Administration Building, 2nd Floor, P.O Box 7072, Kampala, Uganda

## Conflicts of interest

None known.

## Acknowledgements

The following people provided comments on a draft of this Response: *Dr. Achilles Katamba*, College of Health Sciences, Makerere University, Uganda; *Mr. Sam Nyole*, Mulago National Referral Hospital, Uganda; *Mr. Alfred Andama*, Mulago, National Referral Hospital, Uganda; *Ms Karin Stenberg*, Dept. of Health Systems Financing, World Health Organization, Geneva; *Ms Andrea Pantoja*, Stop TB Dept., World Health Organization, Geneva.

## This Rapid Response should be cited as

Rhona Mijumbi, *MPH, MSc*. **What is the cost of diagnosing a new sputum smear positive TB case in children in low income settings?** A SURE Rapid Response. February 2011.

## For more information contact

Dr. Rhona Mijumbi, [mijumbi@yahoo.com](mailto:mijumbi@yahoo.com)

The logo for REACH (Regional East African Community Health Policy Initiative) features the word "REACH" in large, bold, blue capital letters. Below the letters are three horizontal lines in blue, yellow, and red.

Regional East African Community  
Health Policy Initiative

The **Regional East African Community Health-Policy Initiative (REACH)** links health researchers with policy-makers and other vital research-users. It supports, stimulates and harmonizes evidence-informed policymaking processes in East Africa. There are designated Country Nodes within each of the five EAC Partner States.

[www.eac.int/health](http://www.eac.int/health)

The logo for EVIPNet (Evidence-Informed Policy Network) features the word "EVIPNet" in red, with "EVIP" in a larger font than "Net". Below it, the text "EVIDENCE-INFORMED POLICY NETWORK" is written in a smaller, red, sans-serif font.

The **Evidence-Informed Policy Network (EVIPNet)** promotes the use of health research in policymaking. Focusing on low and middle-income countries, EVIPNet promotes partnerships at the country level between policymakers, researchers and civil society in order to facilitate policy development and implementation through the use of the best scientific evidence available.

[www.evipnet.org](http://www.evipnet.org)