



# Mantoux Positivity among Institutionalized Vulnerable Children

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## Abstract

**Background:** Vulnerable Children (VC) have various needs and challenges some of these are environmental, social, and health risk factors that have been associated with tuberculosis (TB). These risk factors coupled with challenges in diagnosis, treatment and the prevention of tuberculosis in the developing tropical countries like Nigeria, places VC at a higher risk of TB infection especially if they are institutionalized. This study therefore sought to describe the mantoux positivity and clinical profile of institutionalized VC living in House of Love, a Faith Based institution in Jos Plateau state North-Central Nigeria.

**Methodology:** All residents of the orphanage were interviewed with a structured questionnaire; afterward a clinical examination was done including measurements of weight and height. A mantoux test and HIV screening were carried out. All subjects with PPD reaction of  $\geq 10\text{mm}$  or  $\geq 5\text{mm}$  if immune-deficient (HIV, malnutrition, steroid) were considered mantoux positive. Thereafter subjects adjudged to be mantoux positive had a chest radiograph done.

**Results:** Forty people were resident in the institution, out of which 35 were VC and 5 were caregivers. Out of the 35 VC, 31 were orphans, 4 were non orphan vulnerable children, with a male female ratio of 1:0.7 and a mean, median age of 13.6 years and 15 years respectively.

Clinical features of either chronic cough, night sweat or weight loss was reported by 31.4%, a BCG scar was seen on 54.3% of VC. Twenty percent of the studied population were HIV positive, 5.8% had moderate malnutrition.

The range of the mantoux was between 0-20mm with a mean and mode of  $8.1 \pm 6.8$  and 7mm respectively. Based on gender, age group, VC type, presence of clinical features, HIV status, nutritional status and presence of BCG scar no difference was found in relationship with the mean mantoux reaction,  $P > 0.05$ .

The prevalence of mantoux positivity amongst the VC was 48.6%. Comparatively the prevalence was 17.1% in males against 31.4% in females, 8.6% in HIV positive VC and 11.4% in HIV negative VC, orphan had a 40.0% prevalence against 8.6% non-orphan VC, normal nourished and malnourished VC had 37.1% and 5.8% respectively, while VC with BCG scar and VC without BCG scar had 31.4% and 17.5% respectively. None of these differences was statistically significant.

**Conclusion:** This study showed that tuberculosis infection is a burden amongst institutionalized vulnerable children in the orphanage studied and therefore call for further in-depth research on the subject matter. Meanwhile Pre - placement and period screening of institutionalized VC and their caregivers should be emphasized.

**Keywords** - Vulnerable Children, Mantoux, Institutionalized

## 1. Introduction

One-third of the world's population is currently infected with Tuberculosis bacillus (Datta & Swaminathan, 2001). Of this number, about 1 million are children with seventy five percent of these cases residing in twenty two high incidence countries, including Nigeria, the third most global burden country (Datta & Swaminathan, 2001).

There is an upsurge in the incidence of tuberculosis, sustained by social and environmental factors that are modifiable (CDC 1995). These modifiable factors includes overcrowding, poverty, malnutrition and social exclusion as seen in orphanage and prison inmates (CDC, 1995; Boccia et al, 2011). The increasing burden of HIV infection and the development of resistance to both first and second line drugs by the TB bacillus are also major contributors (Munoz M F & Starke R J, 2007 p1242).

In children, the epidemic might have been under reported because of challenges in making a diagnosis as majority of infected and diseased children are smear negative (Jurcev-Savicević et al, 2011). However, tuberculin sensitivity test even though not without limitation, is a major tool in assessing TB infection, especially among high risk individuals; hence a useful tool in assessing TB epidemics (CDC 1995).

Vulnerable Children are known to have multiple problems that serve as high risk factor for tuberculosis (Hillis D S et al, 2012, Child Development Department 2009, UNICEF/USAID, 2006). The vulnerability of these children is directly related to the absences of their parents or caregivers. (Mangoma, Chimbari & Dhlomo 2008). Even though what may be considered as a vulnerable child differs between countries, the concept is the same; that of the child's right (Hillis D S et al, 2012, Child Development Department 2009, Mangoma, Chimbari & Dhlomo 2008, UNICEF/USAID 2006 UN nd).

Therefore VC are children who have loss either one or both parents. Other indicators of vulnerability based on Nigerian National Orphan and Vulnerable Child Policy include the following: a child who lacks either adequate access to education or health or other social support. A child who either has chronically ill parent(s), or lives in a house with terminally/chronically ill parent(s)/caregiver(s), or lives with old/frail grandparents(s)/ caregiver(s). Children who live outside of a family (Institutionalized and street children), and children who are infected with the Human Immunodeficiency Virus (Child Development Department 2007).

VC are known to face great challenges, especially in Nigeria which is economically challenged and does not prioritize care of its vulnerable population (Ahmed H, 2008). Studies have shown that majority of Nigerian VC lack basic needs like food and good nutrition, shelter, clothing, education, access to health care services and other benefits as stated in the Child's Right Act (Hillis D S et al, 2012, Child Development Department 2009, UNICEF/USAID, 2006). In addition, VC are more likely to have psychosocial, nutritional and health problems than non – VC (Hills et al, 2012).

It is increasingly difficult for the extended family set up to cater for these children, therefore many VC seek shelter on the street or in orphanages (Hillis D S et al, 2012). This is because of the increasing poverty in populace and an overwhelming increase in the population of VC in Nigeria. More so in Jos, Plateau state where there has been incessant communal and religious conflicts.

However, institutionalization of children has been associated with negative outcome in children for example young children in institutional care are more likely to suffer from poor health, physical underdevelopment and deterioration in brain growth, developmental delay and emotional attachment disorders (North American Council on Adoptable Children(n.d)). Consequently, these children have reduced intellectual, social and behavioral abilities compared

with those growing up in a family home. The estimated cost of institutional care might be five to ten times higher than caring for VC in households (Kristiansen M 2009; Amson B & Chama S 2008). This does not completely undermine the importance of orphanages which can be used as temporary home before a child is adopted into a home. Moreover, some studies in African have demonstrated better psychological and health outcome amongst institutional children than VC raised in the households (Whetten et al 2009).

It is therefore important to study these children because they may be invisible and excluded from health and social services needed for their proper growth and development. Secondly, some of the problems faced by VC are important social determinant of exposure to and infection by mycobacterium tuberculosis. If these children are to achieve full health potentials viz a viz these challenges it is imperative to screen them occasionally for highly endemic, transmissible diseases like tuberculosis. Thirdly, the diagnosis of TB in one of the VC by one of the authors presented an opportunity for all the other children to be screened. It is based on this premises that this study aims to determine the prevalence of mantoux positivity and the associated clinical characteristics among VC in an orphanage in Jos south Local Government Area of Plateau state, Nigeria.

## 2. Methodology

Forty residents in an orphanage in Jos South metropolitan area were studied. The orphanage is run by a Non-Governmental Organization (NGO) and funded primarily through local donations. This orphanage houses two children in a room that is well ventilated. Ethical approval for the study was obtained from the Jos University Teaching Hospital Ethical Committee. Informed consent was also sought from care givers of all the eligible children and only those who gave consent participated in the study. All subjects were evaluated by 1 out of 3 investigators.

Data was collected using a standardized questionnaire which included information such as age, sex, orphan status and type, current ill health and medication, history of chronic cough, weight loss, anorexia, night sweat and fever. The child's HIV status and most recent CD4 cell counts was obtained from the health records of the institution and a repeat HIV screening was done for all subjects using the HIV/HIV2 determine rapid diagnosis test kits.

Each child had his/her weight and height taken following standard procedures, inspection of the left deltoid area was done for the presence or absence of a BCG scar. General physical examination and complete systemic examination was done for all subjects. Signs suggestive of TB including generalized lymph-adenopathy, low weight for age were specifically looked for with emphasis on respiratory system.

A complete chest examination was done. The respiratory rate was determined by counting the respiratory movements for one minute. Auscultation for breath sound character and

quality was done while the presence of abnormal respiratory sounds (crepitation, rhonchi, reduced breath sounds) were also recorded.

An intradermal injection of 0.1mls of tuberculin Purified Protein Derivative (PPD) was then administered to each child on the volar aspect of the left forearm by a trained laboratory scientist. After administration of PPD, each subject was instructed not to touch or scratch the marked site where the PPD was injected. The PPD reaction was read after 72 hours. Indurations of 10mm and above was recorded as positive, however, for children who are HIV infected and malnourished 5mm and above was considered positive.(Osinusi K, pp634-43, 2007; Charnace G & Delacourt C.(2001) ). Each child with a positive mantoux test had a chest radiograph done. The chest radiograph was assessed independently by Researchers and reviewed by a Radiologist for features suggestive of TB such as; hilar adenopathy, reticular and or nodular shadows on the lung fields, cavitations and pleural effusion. Those with positive mantoux and radiologic features were diagnosed to have probable Tuberculosis disease and

treated appropriately.

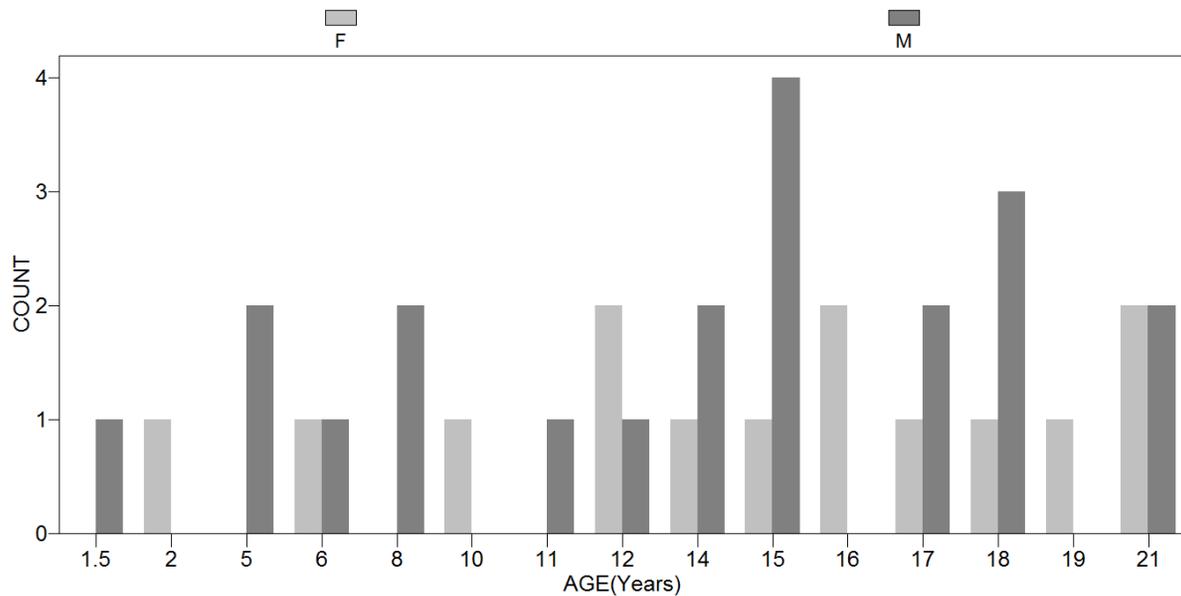
The data collected was entered into Microsoft Excel and analyzed using Epi info version 3.6.5. Student t test and chi square were used for comparison of continuous and categorical variables respectively. A p value of <0.05 was considered statistically significant.

### 3. Results

There were forty people resident in the orphanage, 35 VC and 5 caregivers. Of the 35 VC 31 were orphans (14 double orphans, 10 paternal orphans, 7 maternal orphans), and 4 were previously street children. There were 14 females and 21 males giving a male female ratio of 1: 0.7. The age range of the VC was 1.5 -21 years with a mean and median age of 13.6  $\pm$  5.5 and 15 years respectively. No statistical difference was found between mean age of males and female VC (14.2years compared 13.2 years).  $p > 0.05$ . Table 1 and Fig. 1

**Table 1.** Socio-Demographic and Clinical Features of Vulnerable Children by Mantoux Reaction (N=35)

Mantoux test Characteristics	0-4mm	5-9mm	$\geq$ 10mm	Total
Age Group				
< 5 year	1(2.8)	0 (0.0)	1(2.8 )	2(5.7)
5- 10	4(11.4)	1(2.8)	2(5.7)	7(20.0)
>10 years	8 (22.9)	5(14.3)	13 (37.1)	26(74.3)
Gender				
Males	7 ( 20.0)	4 (11.4)	10 (28.6)	21(60.0)
Female	6 (17.1)	2 (5.7)	6 ( 17.1)	14(40.0)
Clinical features (chronic cough or night sweat, weight lost)				
Yes	4 (11.4)	2 (5.7)	5 (14.3)	11(31.4)
No	9 (25.7)	4 (11.4)	11(31.4)	24 (68.6)
HIV				
Positive	4 (11.4)	0 (0.0)	3 (8.6)	7( 20.0)
Negative	9 (25.7)	6 ( 17.1)	13 (37.1)	28(80.0)
Nutrition status(WAZ)				
Normal (-2 – +2)	13( 37.1)	5 (14.3)	15(42.9)	33 (94.2)
Malnutrition(< -2)	0 (0.0)	1 (2.8)	1 (2.8)	2(5.8)
BCG SCAR				
Yes	7 ( 20.0)	2 (5.7)	10 (28.6)	19 (54.3)
No	6 (17.1)	4(11.4)	6( 17.1)	16 (45.7)



**Fig. 1.** Age, Sex Distribution of VC

**Table 2.** Relationship Socio-Demographic Characteristic, Clinical Features and Mantoux Test (N=35)

	MANTOUX REACTION		$\chi^2$	df	p-value
	Positive Frequency (%)	Negative Frequency (%)			
Age Group					
<5 years	1(2.9)	1(2.9)	1.412 <sup>#</sup>	2	0.49
5- 10 year	2 (5.7)	5 (14.3)			
>10 year	14(40.0)	12(34.2)			
Gender			0.580	1	0.30
Females	6 (17.2)	8 (22.9)			
Males	11(31.4)	10(28.5)			
Vulnerable children type			1.263 <sup>#</sup>	1	0.27
Orphans	14(40.0)	17(48.5)			
Non orphans	3 ( 8.6)	1(2.9)			
Clinical features			0.062	1	0.41
Yes	5 (14.3)	6(17.2)			
No	12(34.3)	12(31.2)			
HIV			0.114 <sup>#</sup>	1	0.53
Positive	3(8.6)	4(11.4)			
Negative	14(40.0)	14(40.0)			
Nutrition status(WAZ)			2.250 <sup>#</sup>	1	0.22
Normal	2 (5.7)	0 (0.0)			
Malnutrition	15(42.9)	18 (51.4)			
BCG SCAR			1.44	1	0.13
Yes	11 (31.4)	8 (22.9)			
No	6 (17.1)	10 (28.6)			

<sup>#</sup>=fisher exact score

Symptoms suggestive of TB reported amongst the study population were chronic cough (23.5%), night sweat (14.3%) and weight loss (8.6%).

BGC scar was present in 19 (54.3%) of the VC, even though. higher frequency of BCG scar was observed among males compared to females (10 compared to 9) and HIV negative VC compared to HIV positive (5 compared to 14) these differences were not statistically significant.  $p > 0.05$

None of the VC had lesion on the skin that will suggest

immune suppression like measles rash, chicken pox rash, or herpes labialis, however, 2 (5.3%) VC had moderate malnutrition (weight for age z score  $< -2$  SD  $> -3$ SD) while 7 (20%) of the VC 7 were HIV infected and had been on antiretroviral therapy.

The size of the mantoux reaction was  $< 5$ mm in 13(37.1%) subjects, 5-9mm in 7 (17.1%) subjects (this included one child with moderate malnutrition) and  $> 10$ mm in 16 (45.7%) VC this included 3 HIV infected children.

The Mantoux reaction ranged between 0-20mm, with a mean and median size of  $8.1 \pm 6.8$  mm and 7mm respectively. The mean mantoux reaction was greater but not statistically different ( $p>0.05$ ) between adolescent compared with preadolescent, VC with normal WAZ compared with those with moderate malnutrition, HIV negative compared with HIV positive, VC with BCG scar compared to those without. Table 2

Seventeen VC had a positive mantoux reaction given a prevalence of 48.6%. Comparatively the prevalence was 17.1% in males against 31.4% in females, 8.6% in HIV positive VC and 40.0% in HIV negative VC, orphan had a 40.0% prevalence against 8.6% non- orphan VC. VC who were nourished had a prevalence of 37.1% compared to 5.8% in malnourished VC, while VC with BCG scar and VC without BCG scar had 31.4% and 17.2% respectively. None of these differences was statistically significant. See Table 2

Of 17 VC who had positive TST result 6 had abnormal chest radiologic features that will suggest Tuberculosis. The chest radiologic features observed were Hilar opacities in 3 of the subject, reticular and nodular opacities in 2 and reticular opacity in 1.

The caregivers were aged between 23 and 27 years with 3 females and 2 males. Their Mantoux test reaction was between 7-18mm with a mean of  $14.4 \pm 4.2$  mm. Out of 5 caregiver 4 (80%) had a mantoux reaction  $> 10$ mm. Only 1 caregiver had probable TB based on chest radiologic examination.

## 4. Discussion

This study demonstrated the prevalence of mantoux positivity among institutionalized OVC in our environment. The 48.6% prevalence of mantoux positivity amongst VC found in this current study is comparable to forty four percent reported amongst Haitian OVC residing in an orphanage. (Francis et al 2008). This however contrasts to a more recent study in India where a lower prevalence of 15.3% was reported (Srivastav et al 2009). The probable reason for this difference might be linked to the size of mantoux reaction that was considered positive. In this current study 10mm and above was used for children adjudged to be immune-compentent while 5 mm was used for patient thought to be immune-compromised based on Nigerian TB guideline. This was smaller compared to 14mm and above used in the Indian study which also sampled subjects across 19 orphanages, thus minimizing selection bias.

Earlier studies that found this high mantoux positivity among children resident in their homes or children residential homes like orphanages, boarding home or even in hospital also revealed the presence of individual(s) that have active Tuberculosis (Filia et al 2009; Sterling RT, Haas WD 2006; Christian et al, 2003). In this current study eight subject were diagnosed with Tuberculosis including two adult caregivers who had features of an active TB infection excluding a VC who was been treated for Pulmonary tuberculosis during the study period.

This current study also suggests that overcrowding might not be a problem encountered in all orphanages. In our study only two OVC were housed in a well ventilated room. This finding differs with that of Francis et al, where overcrowding was a major challenge. Overcrowding is a known risk factor for TB infection and may explain the high mantoux positivity among the Haitian OVC( Francis et al 2002).Viz a viz this current study adequate ventilation needs to be supplement with other TB control measures in order to achieve good TB control amongst institutionalized children.

HIV and malnutrition both heighten the risk of TB infection and also cause a low response to PPD. (Osinusi, pp634-43, 2007; Charnace G & Delacourt C.(2001) ). This study however, showed that some of the HIV infected patient had a mantoux reaction greater or equal to ten. This finding is not surprising because majority of HIV infected VC in this study had a CD4 count that was greater than five hundred cell per micro liter.

Even though the use of Mantoux test is not without limitation, it however remains the best method of screening for Tuberculosis in developing countries. One of its limitation is that it administration and interpretation depends on operator training and experience.( Charnace G & Delacourt C 2001) However, this is an unlikely problem in this study as a single trained technician with up to ten year experience administered and interpreted the TST in all children thus minimizing inter observer bias and error.

In order to have a global picture of the problem amongst institutionalized OVC it is necessary to sample different orphanage in Jos Plateau as the finding of this study maybe unique to the orphanage studied. Despite this, the finding of this study calls for more in-depth research into this subject if TB is to be controlled. Meanwhile effort should be put in place to make pre placement screening for Tuberculosis and other communicable disease part of the standard and routine care of children in residential homes/ orphanages. It is equally important to screen the caregivers because adults play a major role in transmission of TB to children.

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