

## **REGISTERED NURSES' ROLE IN DIAGNOSING CHILDHOOD TUBERCULOSIS IN SOUTH AFRICA**

**W. Isaacs, MSc**  
University of Cape Town  
Division of Nursing and Midwifery

**S. Duma, PhD**  
University of Cape Town  
Division of Nursing and Midwifery  
Corresponding author: Sinegugu.duma@uct.ac.za

**P. Mayers, PhD**  
University of Cape Town  
Division of Nursing and Midwifery

### **ABSTRACT**

Childhood tuberculosis is an increasingly important public health problem and is a major cause of morbidity and mortality in developing countries, contributing to a significant increase in the burden of disease worldwide. TB is particularly difficult to diagnose in children. Sputum induction as a diagnostic method is feasible, effective and well tolerated in children and has become the preferred standard diagnostic investigation at most paediatric hospitals for suspected pulmonary TB.

This article describes registered nurses' experiences of their role regarding the induced sputum procedure to diagnose childhood TB. A sample of six South African registered nurses participated in the exploratory, descriptive, qualitative study. The main research question was: What are registered nurses' experiences regarding their role in sputum induction for diagnosing childhood TB in a secondary hospital setting in South Africa?

Data were collected using a semi-structured interview guide and field notes. The interview guide was pre-tested with two participants.

A qualitative thematic analysis method was used to analyse the transcribed interviews and field notes. The following six themes emerged from the analysed data pertaining to the roles of the registered nurses: involving the mother or caregiver, assessment and monitoring, controlling the spread of infection, active participation in diagnosing TB, teaching/training and saving money.

These findings highlight the important roles played by nurses in conducting the sputum induction procedure for the diagnosis of childhood TB, the need to train more nurses to perform

the procedure effectively, and to include the sputum induction procedure in the undergraduate nursing curriculum.

**KEYWORDS:** childhood Tuberculosis (TB) in South Africa, nurses' roles in childhood tuberculosis (TB) diagnosis, sputum induction procedure

## INTRODUCTION AND BACKGROUND INFORMATION

Childhood tuberculosis is an increasingly important public health problem and is a major cause of morbidity and mortality in developing countries, contributing to a significant increase in the burden of disease worldwide (Marais & Pai, 2006:249; Zar, Tannenbaum, Apolles, Roux, Hanslo & Hussey, 2000: 307). TB is particularly difficult to diagnose in children (Hatherill, Hanslo, Hawkrige, Little, Workman, Mahomed, Tameris, Moyo, Geldenhuis, Hanekon, Geiter & Hussey 2010:312; Zar et al., 2000:307). The Cape Town Metropolitan Region is a high-burden setting. A 2004 study reported that children under 13 years of age contributed 13.7% of the total TB caseload. In 2009, about 1% of children under five years old in the region were notified as having TB (Wood, Lawn, Johnstone-Robertson & Bekker, 2011:112). Infants and children under three years of age are at risk, particularly in poor socio-economic circumstances associated with overcrowding and malnutrition, as well as HIV infection (Cotton, Graham, Jaspán, Hesselning, Marais, Mehtar, Rabie, Schaaf & Zar, 2010:4). The global incidence, morbidity and mortality of childhood TB remain elusive due to the diagnostic challenges associated with the availability of resources (Moore, Schaaf, Nuttall & Marais, 2009:59) and the absence of a practical gold standard for diagnosing TB, as bacteriologic confirmation is rarely achieved due to the predominantly pauci-bacillary (containing just a few bacilli) nature of childhood TB (Swaminathan & Rheka, 2010:185). The ability to understand disease mechanisms and make a correct TB diagnosis can be enhanced by analysing body fluid samples (Djukanovic & Sterk, 2004:13).

Previously, Mycobacterium TB culture confirmation in infants and young children relied on specimens from sequential gastric lavages. Gastric lavage is a procedure whereby gastric secretions are withdrawn through a nasogastric tube from the child's stomach. This procedure could be done by registered nurses. This was regarded as the standard procedure to diagnose TB in younger children because children swallow their sputum and do not expectorate (Zar, Hanslo, Apolles, Swingler & Hussey, 2005:130).

Sputum induction was introduced in a hospital that is a site for ongoing clinical research on childhood TB. This non-invasive procedure may be performed by registered nurses trained in this technique (Zar, et al., 2000: 306). The patient is required to fast for 2-3 hours, whereafter a hypertonic saline (normal saline with a high osmotic pressure) solution inhalation is used to cause expectoration in children. It is a safe, simple, non-invasive, and repeatable diagnostic tool for obtaining secretions pooled from lower

airways from children with chronic inflammation and infections, especially in patients with cystic fibrosis (Mussaffi, Fireman, Mei-Zahav, Prais, & Blau, 2007:178-179).

Sputum induction is reported to have been safely performed by registered nurses in infants as young as one month of age in a tertiary children's hospital in the Western Cape Province of South Africa. It was reportedly well tolerated in hypoxic children who had AIDS (Zar et al, 2000:307). In another study in a community health day centre in the same province, the procedure was reportedly performed safely by trained nurses with good results (Hatherill, Hawkridge, Zar, Whitelaw, Tameris, Workman, Geiter, Hanekom & Hussey, 2009:199).

Sputum induction was widely used for the diagnosis of TB at least three decades ago because of its superior yield compared to gastric lavage and was preferred by patients due its non-invasiveness (Menzies, 2003:676). Menzies reported that a modest revival had been noted since the mid-1990s because of its lower risk of nosocomial TB transmission and much lower costs (2003: 676). A number of studies have demonstrated that the diagnostic yield of a single induced sputum sample is as effective as fiberoptic bronchoscopy, and the yield of sputum induction is better than two early morning gastric lavages (Hatherill et al, 2009:199; Zar et al, 2000;305-306; Zar et al, 2005:131). A recent systematic review reports that sputum induction will detect approximately three-quarters of Mycobacterium Tuberculosis (MTB) culture positive cases under study conditions (Gonzalez-Angulo, Wiysonge, Geldenhuys, Hanekom, Mahomed, Hussey & Hatherill, 2012:1619).

Previous studies have demonstrated that patients' tolerance of and nurses' preference for the sputum induction procedure, as well as its safety, are important considerations for making an accurate diagnosis of TB in young children. Sputum induction is feasible, effective and well tolerated in children, including infants or HIV-infected patients. As a result, sputum induction has become the preferred standard diagnostic investigation at most paediatric hospitals for suspected pulmonary TB (Zar et al, 2000:305-30; Zar, Tannenbaum, Hanslo & Hussey, 2003: 58-62; Zar et al 2005: 1316). Registered nurses play an important role in the treatment and care of people with TB in South Africa (Rice, 2001:13). Training of registered nurses in sputum induction was therefore appropriate in order to increase their role in the diagnosis and management of childhood TB in the research setting.

## **STATEMENT OF THE RESEARCH PROBLEM**

The sputum induction procedure was introduced at the research setting during 2009 as part of a major research project on Childhood TB management in South Africa. Registered nurses were trained to carry out the procedure as part of their day-to-day nursing care and management of ill children. Sixteen months after the introduction of

the procedure, no formal evaluation of the nurses' experiences had been conducted. It was therefore important to explore and describe the nurses' experiences of their role during sputum induction in diagnosing childhood TB. Such information would help to identify future implications for the extension of this procedure to other healthcare settings and to explore how the inclusion of this new procedure enhanced the registered nurses' role in childhood TB management.

## **PURPOSE AND OBJECTIVES OF THE STUDY**

The purpose of the study was to explore the registered nurses' experiences of their role regarding the induced sputum procedure to diagnose childhood TB. The objectives of this study were to describe the experiences of registered nurses trained to perform sputum induction and to explore their experiences and understanding of their role.

The main research question was: What are the registered nurses' experiences regarding their role in sputum induction for diagnosing childhood TB in a paediatric, secondary hospital setting in the Western Province of South Africa?

### **Definitions of key concepts**

Tuberculosis is an airborne infectious disease caused in most cases by MTB. Pulmonary tuberculosis is the most frequent form of the disease, usually accounting for over 80% of cases (Ait-Khaled, Alarcon, Armengol, Bissell, Boillot, Caminero, Chiang, Clevenberg, Dlodlo, Enarso & Fugiwara, 2010:5).

A child is a person younger than 15 years of age (Stop TB Partnership Childhood TB Subgroup, 2006: 1091).

A young child is an infant/child under the age of three years. "Risk of disease progression is increased in the very young children" (Stop TB Partnership Childhood TB Subgroup, 2006: 1091).

Childhood Tuberculosis is an infectious disease of children transmitted through the air in droplet nuclei that are produced by a person (mainly adults and adolescents) with active cavity lung disease. Children under the age of three years usually become infected with TB after household exposure to a person with smear-positive TB (Moore et al., 2009:57).

A registered nurse refers to a person who has undergone basic nursing education for four years and is registered as a professional nurse in South Africa under section 31 of the Nursing Act, No. 33 of 2005 (South African Nursing Council [SANC], 2005:25).

Role refers to “the function assumed or part played by a person (nurse) or thing in a particular situation (sputum induction)” (Oxford Dictionaries Online, 2012).

Sputum induction is the collection of an adequate amount of lower airway secretions (sputum) in patients who are not able to produce sputum spontaneously (Djukanovic & Sterk, 2004:15).

## **RESEARCH METHODOLOGY**

An exploratory, descriptive, qualitative study was conducted from June to December 2010. The design was appropriate because it allowed the researchers to contextualise how the participants perceived their activities and environment and their role within the context of the study and provided a picture of what naturally occurred (Flick, 2009:57).

### **The research setting**

The research setting was a secondary hospital within the Central Health District of the Cape Town Metropolitan Region in the Western Cape Province of South Africa. The hospital has four general paediatric units with 72 paediatric beds dedicated to children up to the age of 12 years, as well as adult medical and surgical units. About 78% of admissions in the paediatric wards are children with respiratory-related illnesses.

### **The study population and sampling method**

The study’s target population comprised all registered nurses who were permanently employed at the secondary hospital and had been working in the paediatric units since February 2009, when the induced sputum procedure was introduced to replace gastric lavage for diagnosing childhood TB. These registered nurses were identified from the researcher’s list of registered nurses trained in sputum induction and purposefully sampled, provided that these registered nurses:

- were permanently employed at the secondary hospital
- had completed their training in performing the sputum induction procedure
- were working in the paediatric units during the data collection phase of the study and
- were performing the procedure.

They had to be able to communicate in English, the medium of communication used in most healthcare facilities in the Western Cape (Stein, Lewin & Fairall, 2007:956). Purposive sampling enabled the interviewer, who had prior knowledge about the population, to select participants best suited to provide the required information (Flick, 2009:122).

## **The size of the sample**

The sample comprised six registered nurses. Small sample sizes are used in qualitative studies because the in-depth nature of the interviews yields rich data (Munhall, 2007:530-531). Preliminary data analysis showed that data saturation had been reached by the sixth interview and no further participants were recruited. Data saturation occurs when no new information is added to the emergent themes or patterns and no new insights are discovered that can shed light on the research question (Flick, 2009: 119).

## **Data collection**

Data were collected using a semi-structured interview guide and field notes. The semi-structured interview is a flexible method of data collection in which a number of carefully constructed questions are asked, while allowing enough flexibility to enable new questions to emerge as a result of what the interviewee says (Flick, 2009:157-158). The main research question was structured as follows: “The induced sputum procedure has been going on for more than 16 months in this hospital. Please tell me what you experienced in your role concerning the induced sputum procedure?” This was followed by a number of probing questions based on each participant’s responses in relation to the research purpose. Probing is the technique used by interviewers to elicit more useful detailed information from a respondent than was volunteered in the initial reply (Flick, 2009:171).

Each interview lasted approximately 45-60 minutes. The interview guide was tested with two participants who were not part of the study. This served to highlight deficits in the questions of the study, the interview techniques, and provided indications as to the expected duration of the interviews (Sampson, 2004:397). After each interview, the researcher made notes about her observations and interpretations gathered during the interview. Data were transcribed by the interviewer who used the same interview guide and interview techniques for all participants throughout the interviewing process.

## **Data analysis**

A qualitative thematic analysis method was used to analyse the transcribed interviews and field notes. Thematic analysis is a search for themes that emerge as being important to the description by the research participant of the phenomenon under study (Braun & Clarke, 2006:79-93). The process of qualitative data analysis commenced once the first interview had been conducted and continued throughout the process of data collection. Preliminary data analysis provided an initial overview of each participant’s experience. This was followed by a more focused reflection during the formal data analysis. The data analysis process followed the phases as detailed by Braun and Clarke (2006:79-

93): “familiarising self with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report”.

During the final phase, six final themes emerged from the data (see table 1) with respect to nurses’ experiences of their role in sputum induction for diagnosing childhood TB in a secondary hospital setting: role of involving the mother or caregiver, assessment and monitoring, controlling spread of infection, active participation in the diagnosis of TB, teaching/training and cost saving.

### **Trustworthiness**

The four criteria for judging trustworthiness (credibility, confirmability, dependability and transferability) were adhered to throughout the study. The transcribed interviews and analysed data were shared with two expert qualitative researchers. Informal and formal member checking was done with the participants immediately after data collection and at the completion of the data analysis. The participants confirmed that the data accurately reflected their experiences of sputum induction. Prolonged engagement with the participants and with data was ensured. An audit trail of all procedures was kept as a record of all steps and procedures followed during data collection and analysis.

## **ETHICAL CONSIDERATIONS**

The protection of human subjects as outlined in the Declaration of Helsinki (World Medical Association, 2008) was adhered to throughout the study. This included obtaining ethical clearance from the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee, permission to conduct the study from the medical and nursing managers of the hospital, obtaining informed consent for voluntary participation from all participants and the support from the principal investigator of the main study and her research team.

## **RESEARCH FINDINGS**

Six registered nurses participated in the study. Their ages ranged from 35 to 59. The average number of months of working experience, following their training in the sputum induction procedure for diagnosing childhood TB, was 13 months. This period of work experience allowed sufficient time for these nurses to develop the necessary experiences for providing rich data for this study.

**Table 1:** Themes: registered nurses' experiences of their role with regard to sputum induction

Theme	Examples of excerpts from participants' statements
<b>The role of involving the mother or caregiver</b>	<p>"We also involve the mothers and, during the day the mothers are here to help us, so we involve them..."</p> <p>"Mothers want to participate... they have the right to participate in the care of their children and they are happy if they can...therefore, I allow the mother or caregiver to be involved in the induced sputum procedure"</p> <p>"As the nurse..., I prepare and explain everything that is going to happen to the mother...so that she doesn't feel scared, I show the mother how to hold the child, as this is a totally new environment in which we do the induced sputum..."</p>
<b>The role of assessment and monitoring</b>	<p>"We first see how the saturation oxygen of the child is..., how all observations are before we do the induced sputum and only when we know how the observations are will we proceed..."</p> <p>"During the procedure we make sure that the observations are stable..."</p> <p>"We ensure the safety of the child in that... we do the observations and if the observations are stable then we know it is OK to do the induced sputum"</p>
<b>The role of controlling the spread of infection</b>	<p>"We follow infection control policies... therefore it is more sterile and the infection rate is less to staff, patients and mothers..."</p> <p>"We control infection... by waiting 10 minutes for the extractor fan to clean the room in between patients"</p>
<b>Active participation role in diagnosis of TB</b>	<p>"We feel that we have a very important role than what we had before with gastric lavage ...as now we can manage to do so many more induced sputum [samples] and diagnose so many more babies with TB than before"</p> <p>"...the whole process of making a diagnosis of TB in children is now nurse-driven. You prepare the patient by doing induced sputum..."</p> <p>"...now it is us, nurses who are taking part in the diagnosis of TB for children... by doing induced sputum"</p> <p>"...but now our role has changed... we are more involved in diagnosing TB"</p> <p>"...now you feel part of the investigation for TB"</p>
<b>Teaching and training role</b>  <b>Teaching of a mother or a caregiver role</b>  <b>Teaching and training of other nurses role</b>	<p>"We have a teaching role... for mothers about the spread and containment of TB..."</p> <p>"When the child is diagnosed with TB by induced sputum...mothers are also educated as they may spread the TB germs..."</p> <p>"We protect the other children from getting TB by teaching mothers and caregivers about the spread of TB germs by asking them to wear masks..."</p> <p>"We also teach the mothers and caregivers about the spread of TB when we ask them to wear masks while they are helping us with induced sputum...even if they just hold the baby..."</p> <p>"The new nursing staff that come into the ward...I also teach them the induced sputum because it is an easy procedure..."</p> <p>"I showed one other new staff member how to do induced sputum by training her..."</p> <p>"Now we feel that we also helping the enrolled nurses...as we teach the procedure to them as well"</p> <p>"I can teach other nurses induced sputum it is easy like one, two, three."</p>

<p><b>Cost saving role</b></p>	<p>Yes, we can do it quicker and many in one day so we save time and costs for the hospital and patients”                  “...in management side, the budget is less as the children stay shorter with this new procedure.....”                  “..if the baby is positive he can quickly start the TB treatment and if he is negative for TB he can go home...so it is also cost effective”                  “It has changed our role of diagnosing TB in children... as now it is quick and effective”.</p>
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**DISCUSSION OF THE RESEARCH FINDINGS**

The role of the nurse in involving the mother or caregiver in the care of hospitalised children is in line with a family-centred approach in nursing practice (Paliadelis, Cruickshank, Wainohu, Winskill & Stevens, 2005:31). The parents are acknowledged as being central to their child’s existence, and seen as fundamental in the decision-making process regarding the care of their child. This role has been reported to alleviate fear and anxiety of the mother or caregiver (Paliadelis et al., 2003:36; Shields, Kristensson-Hallstrom & O’Callaghan, 2003:180).

The importance of the assessment and monitoring role, such as the monitoring of arterial oxygenation saturation prior to the induced sputum procedure, has also been highlighted in previous studies (Castagnaro, Cheta, Foresi, D’Ippolito, Malargio & Olivieri, 1999:943-944; Marias, Hesseling, Gie, Schaaf & Beyers, 2006:259; Paggiaro, Chanez, Holz, Ind, Djukanovic, Maestrelli & Sterk, 2002:4s). Although the induced sputum procedure is well tolerated and described as a safe, non-invasive procedure, its safety depends on the nurses’ realisation of their assessment and monitoring role to ensure that adequate precautions are taken in cases of respiratory distress (Pizzichini, Pizzichini, Leigh, Djukanovic & Sterk, 2002:15).

The findings with regard to the role of controlling TB infection are vital and correspond with ‘The Childhood Tuberculosis Guidelines of the Southern African Society for Paediatric Infectious diseases’ (Moore et al., 2009: 57-68). These guidelines promote the use of infection control policies to curb the spread of TB among nurses who perform hazardous procedures such as sputum induction (Moore et al., 2009:62). Informing the mothers and caregivers and other nurses about infection control should be encouraged to curb the spread of nosocomial infections such as TB in healthcare settings.

Interrupting the infection chain of TB involves the rapid diagnosis and treatment of smear positive TB patients. South African nurses are making a significant contribution to the TB control programme as they are equipped to take on more specialised roles in a cost effective manner (Maciel, Brotto, Sales, Zandonade & Sant’anna, 2010:742).

## **CONCLUSION**

The introduction of sputum induction for diagnosing childhood TB provided the registered nurses with opportunities to broaden their role in childhood TB diagnosis and management. These roles, although supported by international literature, have not been described within the South African context. The experiences of the nurses demonstrate that nurses can have roles other than just monitoring of patients during sputum induction; they are able and confident to take up this new role. They also informed the mothers or caregivers and other nurses about the procedure and infection control. The cost saving role is valuable for both families and hospitals. This procedure can be safely extended to other health settings, provided that nurses receive appropriate training and support to perform the sputum induction procedure safely and effectively.

## **RECOMMENDATIONS**

The multiple roles played by nurses when conducting the induced sputum procedure for diagnosing childhood TB makes this an extension of their role and function in this setting. It is recommended that more nurses should be trained in conducting the procedure as it is cost effective and encourages a family-centred approach to care for children in hospitals. Considering that this is a safe and non-invasive procedure and allows the nurse to exercise multiple roles, and to decrease the high burden of childhood illness in South Africa, the procedure should be included in the basic pre-registration nursing curriculum for training nurses.

## **LIMITATIONS OF THE STUDY**

Data collection required direct contact with participants, as it is common in qualitative studies. This required prior appointments. Cancellations of appointments occurred in some cases due to unforeseen circumstances, which created delays in data collection. This time was used to conduct preliminary data analysis of the transcribed interviews. This is highlighted as a limitation only to encourage those wishing to embark on qualitative studies to know how best to use unexpected unscheduled time. The delay in data collection can have negative implications for qualitative studies and such strategies could help to enhance the productive use of available time.

The interviewer was viewed as an authoritative figure because of her known position as a research nurse and trainer of the induced sputum production programme. The researcher's role might have been incorrectly perceived to be an evaluator of the induced sputum training programme. This was recognised when some potential participants, who were identified as key informants, showed reluctance to participate in the study. This required the interviewer to clarify her role as a researcher. The lesson from this experience was that the researchers have to be sensitive to different situations that

expose the vulnerability of potential participants. Clear communication and the use of information sheets were useful for explaining the role of the researcher and allaying assessment of learning anxiety among participants.

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