

OPERATIONAL RESEARCH REPORT

Entitle:

*EVALUATION OF SMEAR CONVERSION
(SPUTM MICROSCOPY SERVICE) IN
BHU WITH DECENTRALIZED DOTS
SERVICES*

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Abstract

Background: After introduction of DOTS in 1997, Bhutan has achieved case detection rate of 72% and cure rate of 78% (NTCP guidelines, 2005). To further increase both detection and cure rate; DOTS was proposed to reach at BHU level including the sputum microscopy service to increase easy accessibility of the service to rural population. A pilot feasibility study on sputum microscopy was conducted by PHL in the BHU's of the two districts.

Methods: Two districts having high burden of TB (Sarpang and Monggar) were selected for the pilot study. One health worker each from all BHU's of two districts was trained to carry out sputum microscopy. The BHU's carried out sputum microscopy for one year and evaluation was done by PHL.

Result: Sputum microscopy service at BHU had not contributed in increase of case detection or cure rate since most of the BHU's had very few TB suspected cases. Moreover sputum microscopy at BHU level is found technically unfeasible due to lack of health workers proficiency in carrying out sputum microscopy, logistic and quality assurance problems.

Conclusion: Decentralization of sputum microscopy service at all BHU's level is technically unfeasible.

Key Words: *Sputum microscopy at BHU level; Sputum microscopy feasibility at BHU level*

1. Background

Tuberculosis is one of the major public health problems in the SAARC Region with immense socio-economic impacts. SAARC Region contributes around 27.9% of the total global new TB cases (with 22.4% of Global population). Almost 50% of the adult population in the region has already been infected with *Mycobacterium tuberculosis* and is at risk of developing tuberculosis disease. In the year 2004, 2.5 millions of people were estimated to have developed TB disease (174/100000 population) and 1.11 million (78/100000) of smear positive cases capable for spreading the disease to others. About 470888 people (36/100000) were estimated to have died from TB in 2004, including those co-infected with HIV (20912). More than 75% of these cases and deaths were occurred among 15-54 years; economically the most productive age group.

Tuberculosis is also a public health concern in Bhutan and to combat the disease in the country, a national tuberculosis control program was established in the year 1976; one of the oldest public health programs in the health system. Bhutan is one of the first countries in the region to introduce DOTS (1997), a system adopted by WHO as global strategies to fight against the tuberculosis. After DOTS introduction, TB disease burden was significantly reduced in the country. However, for last 5-6 years (refer NTCP data) the reduction of tuberculosis disease burden remained stagnant despite nationwide DOTS coverage. Based on ARTI, 1.5% (ARTI survey conducted 1991), NTCP estimates the number of new smear-positive cases 74/100,000 populations which is equivalent to 481 new smear-positive cases annually based on country's population 650,000 (population and housing census conducted in 2004). The overall **case detection and cure rate** achieved remained marginally same around **69-72% and 75-78%** respectively against the **target set at 75% case detection rate and 85% cure rate** with mortality rate less than 5% in 9th FYP.

Sputum microscopy is one the main components of DOTS and quality of sputum microscopy service and its coverage largely determines the program's success in achieving high detection and cure rate in the country. To further increase the detection and cure rate, DOTS service was proposed to be decentralized from district hospitals to BHU level to increase easy access to rural people. The decentralization also looked at

providing sputum microscopy service to the people in the rural and remote area. The DOTS decentralization was accompanied with a strategy to form DOTS committee in every gewog to influence the suspected TB patients to visit BHU for sputum microscopy.

To evaluate the feasibility of sputum microscopy in BHU level, a pilot study was proposed and conducted by PHL in the districts Sarpang and Mongar.

2. Objectives

2.1 Primary objectives

1. Determine the number of case detected by sputum microscopy in BHU level for 2006-2007
2. Determine the number of smear conversion carried out as per the follow up schedule (2nd, 5th and 8th months) in BHU for 2006-2007.

2.2 Secondary objectives

1. Evaluate the practicability of sputum microscopy service in BHU level
2. Evaluate the feasibility of smear transportation from BHU's to hospitals

3. Materials and Methods

3.1 Study design and sample size

The total number of BHU's included for the evaluation study was 16 BHU's, 6 BHU's from Sarpang district and 10 BHU's from Mongar districts. The inclusion of BHU's for evaluation study was based on the information provided by respective district about BHU status on sputum microscopy since some BHU's did not carry out sputum microscopy due to logistic problem. Under Mongar district only 10 BHU's have carried out sputum microscopy (*Report on supervisory visit to BHU submitted by Mongar hospital lab to NTCP; Reference No. MRH/Lab-19/2008/2387 dated 21/5/2008*), though all BHU's were expected to carry out the sputum microscopy. Sarpang district has identified only 6 BHU's to carry out sputum microscopy for evaluation study.

3.2 Data/information collection

The evaluation was conducted using questionnaires, physical observation and interview with BHU health workers. Evaluation was basically design to collect comprehensive information by:

- i) Data collection to know the number of detection and follow up cases done for one year.
- ii) Status of BHU health workers knowledge on sputum microscopy techniques
- iii) Status of supplies for sputum microscopy
- iv) Prevalence of TB cases in respective BHU's and feedbacks from health workers on sputum microscopy service in BHU's.

3.3 Limitation of study

Could not validate the information collected from BHU health workers through interview on sputum microscopy techniques since no sputum sample was available to conduct practical assessment.

Results of sputum microscopy cannot be validated since quality assessment is not covered in this evaluation study.

4. Results/Findings

BHU's evaluated in Mongar district has total of 109 suspected cases examined for AFB and 25 follow up cases in 2006 -2007. The number of smear positive detected was 7 by only 2 BHU's namely Gyelposhing (5 cases) and Shershong (2 cases). Sarpang district has 12 suspected and 9 follow up cases but no smear positive was detected in 2006-2007 (Table 1). Documentation was found poor in most BHU's and there was no standard format or TB registered developed for recording.

Most BHU health workers have fair knowledge on demonstrating and instructing patients to collect sputum sample, however they lack knowledge on judging the quality of sample required for sputum microscopy. About 50% of BHU health workers have acceptable

knowledge on smear preparation in principle since no practical assessment has been conducted due to unavailability of sputum sample in the BHU at the time of evaluation. About 90% of BHU health workers lack adequate knowledge and skill on staining technique and almost all BHU health workers have no skill to carry out microscopic examination (Table 2; Figure 1).

Figure 1

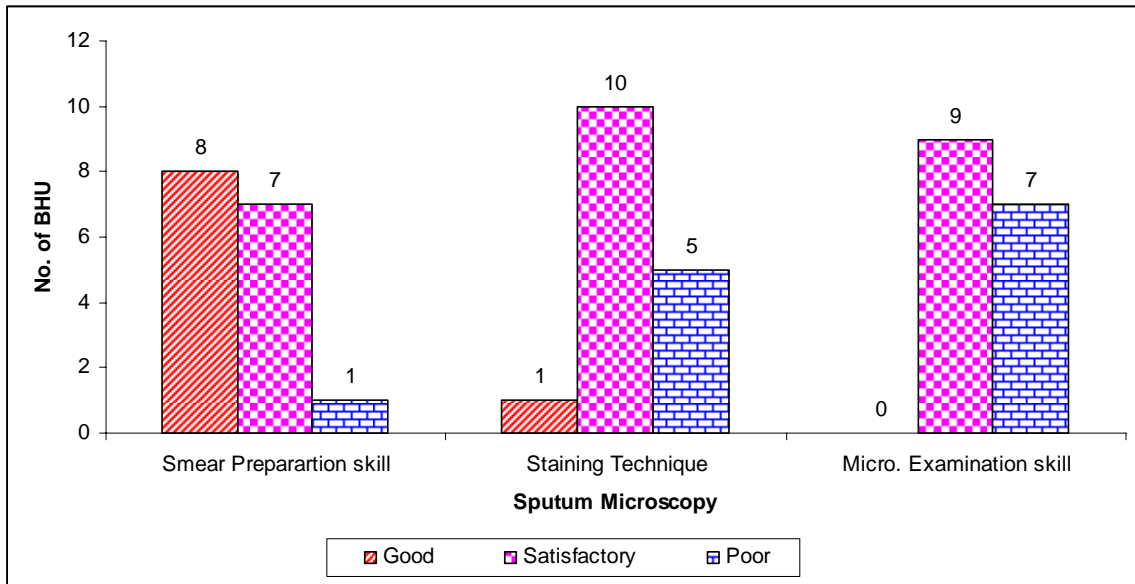


Table 1: Cohort data of TB cases registered in BHU's for 2006-07

Sl. No.	Name of BHU	Population	Estimated SS+ve cases	Diagnosis			Follow up				Transfer cases	
				No. of TB suspect cases screened for AFB	No. of SS+ve	No. of samples collected/patient	2nd month	5th month	8th month	No. of samples collected/patient	Transfer in	Transfer out
BHU under Mongar district												
1	Gyelposhing	2674	2	47	5	3	5	4	4	2	7	5
2	Ngatshang	875	1	3	0	3	0	0	0	0	3	0
3	Yadhi	1456	1	7	0	2	0	0	0	0	8	0
4	Ligmethang	2591	2	24	0	3	0	0	0	0	0	0
5	Tshamang	546	0	2	0	3	0	0	0	0	1	0
6	Bumpazor	1019	1	0	0	0	0	0	0	0	0	0
7	Shershong	1690	1	9	2	3	0	0	0	0	1	0
8	Dremitse	2424	2	0	0	0	0	0	0	0	0	0
9	Thangrong	1939	1	15	0	2	0	0	0	0	3	0
10	Balam	1118	1	2	0	3	0	0	0	0	2	0
	Total	3792		109	7							

BHU under Sarpang district

1	Jigmecholing	2590	2	1	0	3	0	0	0	0	9	0
2	Norbuling	2616	2	2	0	0	0	0	0	0	0	0
3	Chuzargang	1764	1	6	0	0	0	0	0	0	0	0
4	Umling	1460	1	3	0	0	0	0	0	0	0	0
5	Pankhey	1870	1	0	0	0	0	0	0	0	0	0
6	Gongdara	795	1	0	0	0	0	0	0	0	0	0
	Total			12	0							

Table 2: Status of knowledge on sputum microscopy in BHU's for 2006-07

Sl. No.	Name of BHU	Knowledge on Sputum Microscopy			Remarks
		Smear preparation technique	Staining technique	Microscopic examination technique	
BHU under Mongar district					
1	Gyelposhing	Good	Good	Satisfactory	The assessment was based on both principle and practical questions about each techniques
2	Ngatshang	Good	Satisfactory	Satisfactory	
3	Yadhi	Good	Satisfactory	Satisfactory	
4	Ligmethang	Good	Satisfactory	Satisfactory	
5	Tshamang	Good	Satisfactory	Satisfactory	
6	Bumpazor	Satisfactory	Satisfactory	Satisfactory	
7	Shershong	Good	Satisfactory	Satisfactory	
8	Dremitse	Satisfactory	Satisfactory	Satisfactory	
9	Thangrong	Good	Satisfactory	Satisfactory	
10	Balam	Poor	Poor	Poor	
BHU under Sarpang district					
1	Jigmecholing	Good	Satisfactory	Poor	
2	Norbuling	Satisfactory	Poor	Poor	
3	Chuzargang	Satisfactory	Satisfactory	Poor	
4	Umling	Satisfactory	Poor	Poor	
5	Pankhey	Satisfactory	Poor	Poor	
6	Gongdara	Satisfactory	Poor	Poor	

Table 3: Status of supplies in BHU's for 2006-07

Sl. No.	Name of BHU	Logistic supplies						Electric supply to BHU	Remarks
		APB reagent	Sputum container	Slide	Slide box	Immersion oil	Microscopic		
	BHU under Mongar district								
1	Gyelposhing	Adequate	Adequate	Adequate	Adequate	Adequate	Functional (Olympus)	Yes	
2	Ngatshang	Adequate	No supply	Adequate	Adequate	Adequate	Functional	Yes	
3	Yadhi	Adequate	No supply	No supply	No supply	No supply	Functional	yes	
4	Ligmethang	Adequate	Adequate	Adequate	No supply	Adequate	Functional	Yes	I electricity and I natural light
5	Tshamang	Adequate	Adequate	Adequate	Adequate	No supply	Functional	No	I electricity and I natural light
6	Bumpazor	No supply	No supply	No supply	No supply	No supply	Monocular	Yes	
7	Shershong	Adequate	Adequate	Adequate	Adequate	Adequate	Functional	Yes	
8	Dremitse	Adequate	No supply	Adequate	No supply	Adequate	Functional	Yes	
9	Thangrong	Adequate	No supply	Adequate	No supply	Adequate	Functional	No	Light source natural light
10	Balam	Adequate	No supply	Inadequate	No supply	Adequate	2 no. Functional	Yes	No knowledge to care microscopic

BHU under Sarpang district

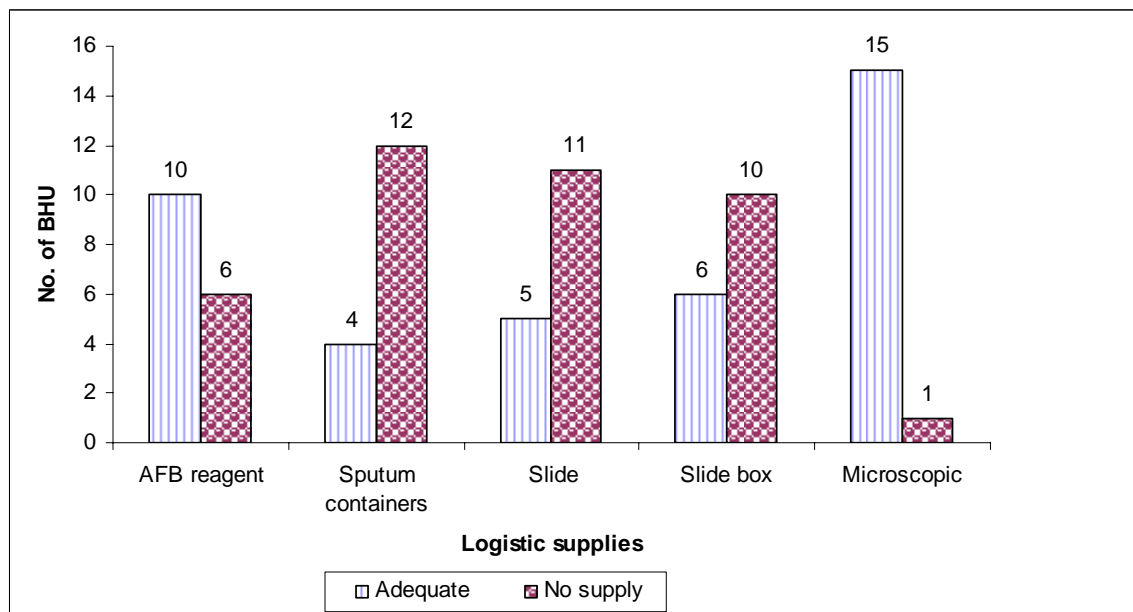
1	Jigmecholing	Adequate (old)	No supply	Adequate	No supply	Adequate	Not good	Yes	No knowledge to care microscopic
2	Norbuling	No supply	No supply	Adequate	Adequate	Adequate	Functional	Yes	
3	Chuzargang	No supply	No supply	Use malaria slide	No supply	Adequate	Functional	Yes	old one
4	Umling	No supply	No supply	Adequate	Adequate	Adequate	Functional	yes	No knowledge to care microscopic
5	Pankhey	No supply	No supply	No supply	No supply	No supply	Functional	No	1 monocular and 1 natural light
6	Gongdara	No supply	No supply	No supply	No supply	No supply	Functional	No	1 electricity and 1 natural light

Table 4: General information on sputum microscopy service in BHU for 2006-07

Sl. No.	Name of BHU	Confident in performing sputum microscopy	Last training on sputum microscopy	Continue sputum microscopy	Replicating sputum microscopy in all BHU	Problems for slide transport to district hospital
BHU under Mongar district						
1	Gyelposhing	Yes	2008	Yes	Yes	No problem
2	Ngatshang	Yes	No trained	Yes	Yes	No problem
3	Yadhi	Yea	2006	Yes	Yes	No problem
4	Ligmethang	Yes	2008	Yes	Yes	No problem
5	Tshamang	Yes	2007	Yes	Yes	No problem
6	Bumpazor	Yes	2006	Yes	Yes	No problem
7	Shershong	Yes	2006	Yes	Yes	No problem
8	Dremitse	Yes	Not trained	Yes	Yes	Transportation
9	Thangrong	Yes	2006	Yes	Yes	No problem
10	Balam	Yes	Not trained	Yes	Yes	No problem
BHU under Sarpang district						
1	Jigmecholing	Yes	2005	Yes	No	No problem, BHU is not far from hospital
2	Norbuling	Yes	2005	Yes	Necessary	Problem during monsoon
3	Chuzargang	Yes	2006	Yes	Yes	Problem during monsoon
4	Umling	Yes	2006	Yes	Yes	Problem during monsoon
5	Pankhey	Yes	2006	Yes	Yes	Transportation problem
6	Gongdara	Yes	1982	Yes	Yes	Transportation problem

The logistic was the main problem in the BHU that has affected the sputum microscopy services. Most BHU's in Mongar could not perform sputum microscopy due to lack of necessary supplies. Most BHU have been supplied with adequate AFB reagents from respective hospital and had adequate slides but very few BHUs had the supply of sputum containers and slide boxes. Microscopes were found functional in all BHU's except one BHU that has monocular microscope; no more recommended for screening AFB. All BHU's have microscopes that work both on electricity and natural light. From 16 BHU's visited, 12 BHU's have electricity (Table 3; Figure 2)

Figure 2



The main problem with sputum microscopy service in BHU was the health workers proficiency in carry out sputum microscopy. All Health workers in BHU were trained in sputum microscopy only during their training period in RIHS and never got opportunity to attend any refresher training. All BHU health workers do not have competency in performing sputum microscopy at the moment (Table 4) but all BHU health workers expressed their willingness and enthusiastic to continue the sputum microscopy provided they are given structured refresher training in sputum microscopy and logistic required.

All BHU health workers strongly supported to have sputum microscopy service at BHU level to enable them in diagnosing the suspected TB patients to control the infection in the community. However, they expressed their concerns regarding the treatment of patients since intensive phase of treatment has not been decentralized to BHU and referring the patients to hospital often do not work especially with patients from far places.

5. Discussion

The overall case detection and cure rate achieved by Bhutan in the past six years was 69% - 72% and 75%-78% respectively. The detection and cure rate did not show much increase in the past 5-6 years despite vigorous implementation of DOTS by NTCP. To increase the detection and cure rate, the NTCP proposed decentralization of DOTS services to BHU level. To look at the feasibility of decentralization of DOTS at BHU level pilot study was carried out in BHU's of Sarpang and Mongar by PHL.

5.1 Case detection

BHU's included in the evaluation study has the population coverage ranging from 750 – 2700. Base on the NTCP estimate smear positive rate of 74 /100,000 population annually, each BHU's are expected to detect 1-2 smear positive cases per annum (Table 1). To detect 1-2 smear positive cases there should be enough suspected TB patients in BHU's. However, since most of the BHU's have very low suspected case (Table 1), it would be impossible to detect the expected smear positive cases and maintain health workers proficiency in carry out sputum microscopy. Thus, technically there is no scope of having sputum microscopy service at BHU level. Moreover, most BHU's get only few follow up cases from district hospitals. As per the WHO standard, one sputum microscopy centre is recommended for every 100,000 populations or 50,000 population in the difficult terrain area but Bhutan has already 29 hospitals/BHU-I providing sputum microscopy service just for total population of 6,38,000 only which is more than sufficient.

5.2 Sputum microscopy technique

The sputum microscopy is still considered as ‘gold standard’ test for diagnosis and treatment monitoring. However, the test has lot of limitation since the quality of result is largely influence by pre-analytical and analytical factors. The pre-analytical factor includes proper sputum collection by patient and receiving quality samples by health workers for sputum examination. Sputum quality is a critical factor in determining the quality of the sputum microscopy test result. Nevertheless, analytical factors like smear preparation, staining and microscopic examination are also critical in generating quality result. Thus, it is imperative for health workers of all categories in BHU to know the principle and scientific reasons for every test procedures to carry out properly and rectify problems during the trouble shooting. The competency in carrying out sputum microscopy will be only developed through constant practice with enough workload and periodic refresher training. As per the WHO guidelines, establishment of sputum microscopy and competency to carry out ZN technique will depend on workload. Either high or less workload will affect the quality of sputum microscopy. Thus, the proficiency of smears reading can only be maintained by examining at least 10-15 sputum smears per week i.e. a minimum of 2 -3 smear examination per day. In BHU, it will be very difficult to maintain proficiency of sputum microscopic examination because most of the BHU’s do not get suspected cases to carry out sputum microscopy per month and few BHU’s never get a case (Table 1). Therefore, decentralization of sputum microscopy service at all BHU’s is technically unfeasible. However, BHU’s can prepare smears and send to respective hospital to help improving both detection and especially cure rate. The frequency of smear shipment from BHU to hospital need not be time bound since fixed smear can be stored for indefinite time but time frame must be dawned to facilitate timely recording and reporting.

5.3 Logistic

To keep sputum microscopy service functional in BHU, necessities must be supplied continuously (Table 1). However, to maintain uninterrupted supplies to most BHU’s in the country will be difficult due to geographical terrain and inaccessibility to motor road

yet supplies required for the sputum microscopy can be stocked except AFB reagents which get precipitated especially in high humid and hot places.

5.4 Microscope

Microscope is the life line for sputum microscopy and knowledge on microscope, its care and maintenance is very critical to keep microscope functional. Most BHU health workers do not know how to take care and maintain the microscope. The light source used for microscope will also affect quality of results since optimum light intensity is required for microscopic examination. The preferable light source for microscopic examination is the electricity and binocular microscope that has electricity power supply is generally recommended for smear examination. However, places where electricity is not available, natural light source can be used but studies have shown that natural light do not provide enough light intensity required for microscopic examination especially during bad light day. The supply of 12 volt-battery to light up external lamp is now recommended to places where there is no electricity. The Global Drug Facility organization deals with the TB diagnostic laboratory kits in which binocular microscope is supplied with 12 volt-battery and accessories to re-charge it.

5.5 Disinfection of sputum

BHU's do not have beaching powder to prepare disinfecting solution. Since *Mycobacterium tuberculosis* is infectious agent, proper procedure must be followed to dispose the sputum samples.

6. Conclusion

The following findings of the pilot study indicate that decentralization of sputum microscopy to all BHU is technically not feasible.

1. Very few or no cases are registered in BHU's to perform sputum microscopy
2. Health workers lack adequate knowledge and skill to perform sputum microscopy

3. Proficiency testing of sputum microscopy by the health workers cannot be maintained due to very few or no cases
4. Quality assessment program do not look feasible at BHU level because of transportation problem in shipping panel testing samples and sharing feedback on time

7. Recommendations

1. Blanket decentralization of sputum microscopy service in all BHU is technically not feasible however introduction of sputum microscopy service in few BHU with high TB burden may be necessary.
2. Instead of carrying out entire sputum microscopy test procedures, BHU could focus on smear preparation (from suspect and follow up cases), storage and shipment to respective hospital. Shipment could be arranged by respective BHU's on monthly or quarterly basis.
3. BHU must be supplied with adequate slides, sputum containers, slide boxes and other essentials for smear preparation, storage and shipment. Beaching powder should also be supplied to all BHU for sputum disinfection.
4. Standard TB register must be developed and distributed to BHU for proper recording and reporting including the form for shipment of smears.
5. Periodic supervisory visit to BHU from district is necessary to assess the status of TB patient follow up.
6. Structured refresher training course must be instituted for all health workers involved in sputum microscopy to maintain their proficiency level, and knowledge updates. Such training is advisable to only BHU health workers designated to carry out sputum microscopy.
7. If BHU's are advice to prepare and send smear to district hospitals, the health workers need to be trained in smear preparation to maintain the quality.
8. Proper communication between gewog DOTS committee (if functional) and BHU health workers must be established in case finding and following up patients.

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