Case Study

A Case Study: Assessment of Extent of Utilization of MCS, For Screening of TB in Selected Hospitals in Kalutara District Sri Lanka

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Abstract
Background: Tuberculosis still remains one of the top 10 leading causes of death worldwide. In 2015, the estimated incidence of TB in the world was 10.4 million. In Sri Lanka annual reports show 6000 new cases. Meanwhile microscopic Centres (MC) are reported to underutilized. **Objectives:** To assess the extent of utilization of MC, for screening of TB in in selected hospitals in Kalutara district Sri Lanka. **Methods:** A descriptive cross sectional study was carried out in MCs in Kalutara district where the MC are available. Referral data on patients (n=1522) were extracted from all MC (Panadura, Horana, Beruwala, Ingiriya, Bulathsinhala including Chest Clinic Kalutara (CCK)) using a checklist-January 1st to 31st March of 2017. According to PAL guidelines, utilization of MC was categorized as underutilization, satisfactory utilization and excellent utilization. **Results:** Majority of MCs (80%, n=4) were under-utilized by OPD (<3 referrals per 1000 OPD attendees) and none of the MCs including CCK were utilized by close by public and private healthcare institutions. Nevertheless, MCs were satisfactorily utilized (> 3 referrals per 1000 inward attendees) by in-ward settings of same hospitals where MCs are located. Three consecutive sample submission of majority of MC (80%, n=4) remain below 50%. **Conclusions and Recommendations:** All MC were satisfactorily utilized by in-ward settings, majority of MCs were under-utilized by OPD and none of the MCs including CCK were properly utilized by close by public and private healthcare institutions. Continuous staff awareness, regulating private sector for TB screening, establishment of MC cluster laboratory system are recommended.
Keywords: Microscopic centres, Screening of tuberculosis, underutilization.

1. Introduction

Tuberculosis still remains one of the top 10 leading causes of death worldwide. Nearly one third of the world population is infected with Mycobacterium TB and baring the risk of developing disease. In 2015, the estimated incidence of TB in the world was 10.4 million. Annually, nearly 17,000 of TB cases are estimated in Sri Lanka but only around 11,000 new cases are reported, creating a gap of 6,000 undetected cases (WHO, 2016).

The objective of this study is to assess the extent of utilization of MC, for screening of TB in in selected hospitals in Kalutara district Sri Lanka. Of all the patients presenting with respiratory symptoms at hospitals, 1-2% are considered to have infected with TB. The NPTCCD emphasizes to improve referrals of suspects to MCs for sputum smear from all the Out Patient department (OPD) attendees and other units in order to detect the cases early. But the patients referred for screening remain remarkably low and there is significant underutilization of MCs established island wide (Ministry of Health, 2016). Also, in the research "factors affecting the case detection & contact tracing of TB patients in the western Province of Sri Lanka" (Dolamulla and Samaraweera, 2016) poor contact tracing and inadequate detection of new cases have been identified as major weakness in TB control program in western province. Therefore the level of utilization of MC is an useful for NPTCCD to take necessary actions targeting elimination of TB from Sri Lanka.

The MCs are primarily responsible for sputum examination for Acid Fast Bacilli (AFB). Single or more than single positives samples out of three sputum samples are referred to DCC for confirmation of the diagnosis with expert opinion by the chest physician and the staff. Single samples positives are diagnosed with CXR evidence or sputum culture evidence. Along with the diagnosis begins the notification, DOTS treatment and follow up (NPTCCD, 2010).

Screening for Pulmonary Tuberculosis in Sri Lankan setting

All patients suspected of PTB need to be screened with 3 sputum samples and chest x-ray (CXR). Sputum examination for AFB is the 1st screening method that is most suitable, reliable and cost effective for diagnosis of PTB which is usually used in insufficient resourced settings (NPTCCD, 2011). Patient must be referred by the Medical Officer, to microscopic centers in order to examine three sputum samples. The TB form 5 should be filled and recorded in TB suspect register before referral to microscopic center (Guneratne, 2017, personal communication, 12 March).

1st spot sample, 2nd early morning sample and third spot sample is advised and facilitated to be taken at MC. Two or three positive sputum smear microscopy for AFB is diagnostic of PTB. Single positive sample is not diagnostic. But sputum culture positivity for the MTB bacilli or one positive sputum smear sample with CXR abnormalities such as consolidation, pulmonary infiltrates, cavitation and fibrosis is diagnostic of PTB. In situations where the three sputum samples are negative but CXR is abnormal and not responding to broad spectrum antibiotics, the decision of the diagnosis is at clinician's hand (WHO, 2015).

Microscopic centres in Sri Lanka

The laboratory network for TB screening consist of National TB Reference Laboratory (NTRL) at the central level, District chest clinic laboratories (DCCL) at district levels and Microscopic centers (MC) at peripheral levels. The DCCL and MC are under the administrative purview of provincial health services while the technical guidance is provided by the NTRL of National Program of Tuberculosis and Chest Diseases (NPTCCD).

Microscopic laboratories at district chest clinics, MC at peripheral levels have been established in order to examine sputum smear for AFB to make efficient diagnosis. Apart from that MCs examine blood films for malaria as well as microfilaria. Once patient is referred to MC, a spot sample is advised to be obtained. Then advised to obtain one early morning and a spot sample at home and bring in next day (NPTCCD, 2011).

Utilization of Microscopic Centers

Ministry of Health (MOH) Sri Lanka emphasizes, to improve the referrals of TB suspects to MCs by OPD setup and other units of public healthcare services in order to detect active TB patients. In Sri Lankan context the diagnosis of TB is made by examining sputum smear. Patients must be referred to MCs to perform sputum examinations. But the percentages of referrals of TB suspects are remarkably low and MCs are underutilized in spite of repeated awareness campaigns done by NPTCCD (Ministry of Health, 2016). The referrals for MCs can be done by public sector, private sector and as self-referrals by patients. All referrals must be subjected for three sputum sample examinations to reach the diagnosis according to standards.

2. Methodology

This is a hospital based descriptive cross sectional study based on secondary data obtained from the hospital and MCs which was carried out using secondary data from registers during January 1st to March 31st 2017.

Study setting Study was carried out at 6 government hospitals where the MCs are available such as District General hospital (DGH) Nagoda, Base hospital (BH) Panadura, Horana, District hospital (DH), Bulathsinhala, Ingiriya, Beruwala. At the time of data collection DH Mathugama was closed due to unavailability of staff. Data available in the registers in the selected hospitals mentioned, were examined retrospectively. The OPD treatment register and In-patient admission register (IPAR) were examined for the calculation of the total number of patients. The TB suspect register (TBSR) at OPD, the TBSR at Emergency Treatment Units (ETU), the TBSR at Preliminary Care Units (PCU), the TBSR at medical wards and pediatric wards where suspected patients for PTB are recorded and referred to microscopic centers, were examined. The TB Laboratory Register (TBLR) at MC were examined where the information of PTB suspected patients and sputum samples were available. All secondary data on attendees to OPD and in-ward treatment from January 1st to March 31st 2017 were obtained. All secondary data on referrals of PTB suspected patients to MCs, referred during above period, from above mentioned hospitals were obtained. All secondary data on referred patients to MCs from public, private and self-referrals and data about sputum samples during the same period were obtained.

Study instrument

A checklist is consisting of 3 parts. part-1:General Information, Part-2: Information on OPD and In-ward patient treatments and availability of registers for referral of PTB suspected patients, Part-3: Information on referral s for screening of PTB by OPD, Emergency Treatment Unit (ETU), Preliminary care unit (PCU), Medical wards, Pediatric wards, Intensive Care Unit(ICU) or any other units and Part-4: Information at TBLR at MC. Important factors were taken into account when the checklist was developed. PTB suspects from all patients having respiratory symptoms attending to OPD and other units are expected to refer for MC in order to improve active case surveillance (Ministry of Health 2016). Evaluation of patient referral patterns from public sector, private sector and self-referrals, sample submission patterns of patients and sample guided diagnoses are important when the

utilization of microscopic centers are concerned (Mabaera *et al.,* 2007, Katamba *et al.,* 2007, Gounder *et al.,* 2013). Sri Lankan context, the utilization of MCs in TB prevention program has been emphasized by the circular issued by the Ministry of Health (Ministry of Health, 2016).

Data collection
Pre testing of the check list was carried out at base hospital Homagama to check the feasibility, comprehensibility and appropriateness of the content. Data collection was done by the principal investigator during 1st of April to 15th of May 2017.

Quality of data
Extensive literature was carried out to get the back ground information about utilization of MCs in the world and local setting. Recently published circular of MOH and laboratory manuals were also referred. Expert opinion was taken from the Chest Physician, District Tuberculosis and Chest Disease Officer (DTCO), and Public Health Laboratory Technician (PHLT) to assure content validity of the check list. Secondary data collection was entirely done by the PI in order to secure data accuracy. All the secondary data during three months period were obtained without sampling in order to assure the accuracy of data. Data entry was done by the PI in order to reduce errors in entering data. All check lists containing secondary data were assessed carefully for completeness and accuracy before entering in the spread sheet.

Data analysis
Data was entered in to SPSS statistical analytical software on a personal computer and analyzed. The extent of utilization of MCs was measured by bellow mentioned indicators.

Measurement indicator-1
Total referrals to MC per 1000 OPD attendees (Utilization by OPD) =
Total attendees to MC referred by same hospital OPD during the period/ Total attendees to OPD during same period of time x 1000

Measurement indicator-2
Total referrals to MC per 1000 Inward attendees (Utilization by In-ward) =
Total attendees to MC referred by same hospital Inward-setting during the period/ Total admissions to Inward-setting during same period of time x 1000

Source of information
In 1st indicator, the enumerator is measured by TBLR and the denominator is measured by information of OPD register. In 2nd indicator the enumerator is measured by same TBLR while the denominator was measured by information of inward admission register.

Standards for the utilization of MC
Reference to Practical Approach to Lung disease (PAL) guidelines (Revised by WHO 2005) states that "Respiratory conditions account for up to one third or more of the demand for health care by patients aged five years and over in Public Health Care (PHC) settings. Of these conditions, approximately 80% tend to be identified as Acute Respiratory Illness (ARIs) and 1% to 2% as TB"

As the total number of patients at OPD and in-ward in each healthcare institution were obtained during the survey and the number of patients above five years of age were

calculated by deducting 10% from total attendees. The figure, 10% was obtained from "leading Causes of Hospital Morbidity" 2007 (Ministry of health, 2008).

Formula of minimum utilization standards
Estimated number of TB patients per 1000 OPD patients or 1000 inward patient =
Total public healthcare demand (1000 OPD attendees or 1000 inward patients) x 90% x 33.33% x 1%x=3

Estimated number of all non-acute respiratory infection patients per 1000 OPD patient attendees or 1000 inward patient attendees=
Total public healthcare demand (1000 OPD attendants or 1000 inward patient attendants) x 90% x 33.33% x 20%=60

If correct diagnosis of TB is made with proper history and examination by the Medical Officers, they must refer minimum of 3 patients per 1000 OPD or inward of hospital in order to identify TB patients. At least 60 patients per 1000 OPD or inward attendees must be referred to identify patients with non-acute respiratory conditions including TB according to PAL guidelines of WHO (Ottmani *et al.,* 2005).

Categorization of Utilization of MC
Unsatisfactory utilization of MC was defined when total referrals to MC per 1000 OPD attendees or per 1000 inward patients of each public hospital is less than 3. Satisfactory utilization of MC was defined when total referrals to MC per 1000 OPD attendees or per 1000 inward patients of each public hospital is between 3 to 60. Excellent utilization of MC was defined when total referrals to MC per 1000 OPD attendees or per 1000 inward patients of each public hospital is more than 60.

Ethical clearance
Ethical clearance for this study was obtained by Post Graduate Institute of Medicine, University of Colombo.

3. Results
There was a total of 1522 MC attendees during 1st of January to 31st of March in 2017 at all functioning MCs in Kalutara district. Distribution of attendees in age categories were categorized in 10 years intervals. The highest percent was in the 61 to 80 years age group (37.2%, n=566), the lowest was in the less than 20 years age group (6.1%, n=93). Mean age of the attendees was 54.2 years (SD= 18.9 years) and the mode was 70 years (IQR=27). None of the wards and units of selected hospitals which receive and refer TB suspects to MC had TBSR.

Sources of referrals to MC
The majority of referrals arrived from the inward setting and OPD setting of the same hospital (inward referrals=38.1%, n=238, OPD referrals=43.9%, n=274). Referrals from different sources i.e. different public hospitals (1.3%, n=8) and different private healthcare providers (6.7%, n=42) in the same area remained very low (Table 1).

Sample receiving patterns in MC
Only 71.4% people have submitted (n=1086) all 3 sputum samples to MC out of 3 the compulsory sputum samples needed for screening of TB (Table 3). A single sample is submitted by 14% of people (n=213). The MC at BH Panadura has recorded the highest

number of patients who submitted three compulsory sputum samples (92.7%, n=228) and MC at DH Bulathsinhala recorded the lowest (30%, n=9) (Table 3).

Details of samples received by each MC
At least single sample, two samples or 3 samples positive cases was 4.3% (n=66) . The MC at Horana reports the highest of that value (7%, n=9) while Ingiriya reports the lowest (0.6%, n=1). The frequency of patients whose 1st sputum sample result was negative but subsequent sample results were positive was 1.44% (n=22).

Utilization by inward setting
The MC at Ingiriya had the highest utilization (32.03 referrals per 1000 inward attendees) while MC at Beruwala had the lowest (3.86 referrals per 1000 inward attendees). The MCs are utilized by inward settings of all the selected hospitals with more than 3 referrals for 1000 in-ward attendees.

Utilization by OPD
The CCK had the highest utilization (5.69 referrals per 1000 OPD attendees) while second highest utilization was observed at DH Ingiriya (4.53 referrals per 1000 OPD attendees). Lowest utilization was observed at DH Beruwala (0.12 referrals per 1000 OPD attendees).

OPD referrals of MC at BH Horana was 0.33 referrals per 1000OPD attendees, BH Panadura was 2.14 referrals per 1000 OPD attendees and DH Bulathsinhala was 1.04 referrals per 1000 OPD attendees (Table 2).

Table 1. Sources of referrals by each MC

Referred Unit**/	Horana		Panadura		Ingiriya		Beruwala		Bulathsinhala		CC-Kalutara	
Hospital	No	%	No	%	No	%	No	%	No	%	No	%
Same Hospital Inward Setting	83	64.3	89	36.2	47	27.5	9	20.0	10	33.3	330	37.2
Same Hospital OPD Setting	21	16.3	153	62.2	77	45.0	4	8.9	19	63.3	UI	UI
Different Public Hospital	7	5.4	0	0	0	0	0	0	1	3.3	24	2.7
Private Healthcare Providers	5	3.9	1	0.4	19	11.1	17	37.8	0	0	0	0
Self-Referrals	12	9.3	3	1.2	28	16.4	15	33.3	0	0	1	0.1
Mass screening	0	0	0	0	0	0	0	0	0	0	7	0.9
Source of referral unidentified*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	524	59.1
Missing	1	0.8	0	0	0	0	0	0	0	0	0	0
Total	129	100.0	246	100	171	100.0	45	100.0	30	100	886	100
*Data from CCK. Source of referral is not clear. But majority is from OPD												
**Mathugama MC is closed due to unavailability of staff												
UI-Un Identified												

Table 2. Extent of Utilization of MC by OPD and Inward setting of same public hospital
Level of utilization is defined as follows:
Excellent Utilization=>60 referrals per 1000 attendees
Satisfactory Utilization=3-60 referrals per 1000 attendees
Unsatisfactory Utilization=<3 referrals per 1000 attendees

Microscopic Center Location	Inward Referrals	Total Inward admission	Utilization by Inward	Level of utilization	OPD Referrals	Total OPD admission	Utilization by OPD	Level of utilization
Horana	83	15627	5.31	Satisfactory	21	63296	0.33	Un Satisfactory
Panaduara	89	16681	5.34	Satisfactory	153	71230	2.14	Un Satisfactory
Ingiriya	47	1467	32.03	Satisfactory	77	16967	4.53	Satisfactory
Beruwala	9	2327	3.86	Satisfactory	4	31330	0.12	Un Satisfactory
Bulathsinghala	10	1449	6.9	Satisfactory	19	18282	1.04	Un Satisfactory
Nagoda	330	22963	14.37	Satisfactory	524*	92051	5.69	Satisfactory

Table 3. Sample receiving patterns by each MC

Sample received for examination	Horana		Panadura		Ingiriya		Beruwala		Bulathsinhala		CC-Kalutara		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Consecutive 3 sample not received	65	50.4	18	7.3	92	52.9	25	55.6	21	70	210	23.4	436	28.6
Consecutive 3 samples received	64	49.6	228	92.7	82	47.1	20	44.4	9	30	688	76.6	1086	71.4
Total	129	100.0	246	100.0	174	100.0	45	100	30	100	898	100	1522	100

4. Discussion

Extent of utilization of MC The Ministry of Health (MOH) has emphasized in its circular dated 20.07.2016 to maintain a TBSR at each OPD to evaluate number of referral done to MC. But PI found that neither OPDs nor other units in any of hospitals maintain a TBSR. All units refer patients to MC through TB form 5 or a piece of paper. Only records are maintained at TBLR at MC. Therefore, the estimates of drop outs from healthcare institution to MCs cannot be measured.

Excluding all referrals sent to CCK, entire OPD referrals (43.9%, n=274) remains at a higher rate than inward referrals (38.1%, n=238) sent to MC. But referrals from surrounding public hospitals (1.3%, n=8), private healthcare institutions (6.7%, n=42) and self-referrals (9.3%, n=58) remain at a very low rate. According to utilization by OPD, except MC at Ingiriya all the other MCs are underutilized (Table 2). This confirms the fact that "In spite of repeated awareness programs carried out, there is mass reduction of referrals reaching MC" revealed by the circular issued by the MOH dated 20.07.2016. But all the MC including CCK are satisfactorily utilized by the inward setting. On average 17.4% of household population seeks treatment from government hospitals while 15% from a private healthcare centers (Annual health Bulletin, 2013). When considering the above, the MCs are underutilized even by the private healthcare providers.

Referring to Table 3, 71.4% (n=1086) of cases submitted consecutive 3 samples. But all the MCs except Panadura (92.7%, n=228) & CCK (76.6%, n=688) it was below 50%. 14.1 % (n=215) of cases submitted two samples for examination while 14 % (n=213) submitted only single sample for examination. Similar cross sectional study have been done in Moldova and Uganda (Katamba *et al.,* 2007) using 24 and 30 randomly selected laboratories. The percentage of all 3 sample submission was 67.5 % in Moldova & 41.2% in Uganda, 2 sample submitted cases were 13.3 % in Moldova & 10.6% in Uganda and single sample submitted cases were 19.2 % in Moldova and 48.3 % in Uganda.

Sample submission pattern for examination in Moldova is almost similar to this study but remains at a lower level. But Uganda remains at a lower rate for 3 sample submission compared to the present study. The reason behind would be, that TB is never diagnosed with single positive sample in Sri Lankan setting while in countries such as Moldova, Uganda, Mongolia and Zimbabwe, the diagnosis is made only with a single positive sample due to poor resource setting for radiological examination (Mabaera *et al.,* 2007). A similar study done using1940 sample records in Fiji (Gounder *et al.,* 2013) which is a low TB prevalent country (Prevalence rate 33/100000 population) revealed that only 32.9 % people have submitted three samples, 15.7 % submitted two samples and 51.4% of patients submitted single samples for examination. They have found as a reason for failure of submitting 3 samples, is the lower prevalence of smear positive cases and poor attention.

Excluding the data from CCK, more than two sample submission remains at a higher value in other sources of referrals (87.4%, n=334) than inward setting (79.83%, n=190) where as in Fiji significantly higher submission was reported at in ward setting compared to OPD (p < 0.001). The patients being discharged from wards before completion of sending all 3 samples to MC, is a probable cause for this difference in Sri Lanka. The percentage of at least single sample positive cases was 4.3 % (n=66) where this figure is 9.10 % in Moldova and 20.19 %in Uganda. This is likely to be due to higher prevalence of TB in African region.

The frequency of patients whose 1st sputum sample result was negative but subsequent sample results were positive was 1.44% (n=22) found in the present study and this figure is 0.67 % (n=84) in Moldova and 1.35 % (n=487) in Uganda (Katamba *et al.,* 2007). This figure is a result of 1309 of two or more than two sample submitted referrals in the study and hence additional yield of 3.6 positive cases can be simply predicted from single sample submitted referrals. Limitations When formulating indicators of utilization of MCs, the number of referrals from each unit were assed using TBLR at MC assuming there were no drop outs from the point of referrals to MCs. Utilization by different public and private healthcare providers couldn't be exactly measured as total the attendees of those institutions were not known and it was not feasible to assess during the limited study period.

5. Conclusions and recommendations

All the MCs including CC-Kalutara were satisfactorily utilized by inward setting of all selected hospitals. But except MC at Ingiriya and CCK, none of the MCs (Panadura, Horana, Beruwala, Bulathsinhala) were satisfactorily utilized by OPD of selected hospitals. None of the MCs including CCK were adequately utilized by private healthcare providers and close by public healthcare institutions. Microscopic center cluster laboratory system should be initiated to improve this. As close by public healthcare institutions do not properly utilize MC, geographically closely located institutions can be assigned to each MC in a district which can be implemented through a circular. Particular hospital authorities should be held liable through periodic review meetings at RDHS levels.

None of referral units or any hospitals maintained TBSRs which has been already enacted by the circular issued on 20.07.2016 by MOH. This fact has to be taken in to minutes of periodic review meetings with unit In-charges (MO In-charge OPD & Ward sisters) at hospital levels and RDHS levels. The figures of TB suspects, extracted from TBSRs must be incorporated in OPD returns and IMMR. Continuous awareness about TBSR & importance of referrals must be bring to attention at review meetings and in-service training programs in all levels of physicians and nursing officers. Implementation of TBSR must be done at Private sector and this must be included in checklist for annual license of private healthcare institutions.

Consecutive three sample submission, recommended by the WHO was below 50% in all MCs (except MC- Panadura and CCK). However, this was considerably higher in in-ward setup. This can be improved at 3 levels: at the level of physicians, at the level of in-charge officers and at the level of patients.

At the level of in-charge officers, a checklist attached to BHT on TB suspects can be introduced and assure completion of 3 samples before discharge. Routine health education sessions should be introduced to patients incorporating the necessity of three sputum sample submission. Continuous advocacy at review meeting, awareness through guidelines can be introduced for physicians.

6. Conflicts of Interest
The authors declare that they have no conflicts of interest.

7. Acknowledgement

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