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Improving Tuberculosis Systematic Screening at Remera Health Center

A dissertation submitted in partial fulfillment of the requirements for award of the Master's degree of Hospital and Healthcare Administration

BY

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Declaration

I, Jean Pierre MUHIRWA, hereby declare that this dissertation on ‘‘*Improving Systematic Screening of Tuberculosis at Remera Health Center*” is my original work and has not been presented for any degree award in any university.

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Dedication

This work is dedicated to my beloved wife Mrs. Bellancille N. MINANI and our Children Ellis Delys MUHIRWA and Elvis Davis MUHIRWA for their love, care, understanding, endless patience and constant encouragement during this academic process.

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Jean Pierre MUHIRWA

Abstract

Background: Tuberculosis (TB) is an infectious disease that result from the infection of pathogenic bacteria. Globally, the TB in the low-income country is among the top 10 causes of death. The bacillus mycobacterium tuberculosis (MTB) causes tuberculosis, which might be spread into the air when individuals cough. Even though other organs can be affected, the lungs are the predominant site of this disease. Infection with MTB affects about 25% of people worldwide.

Methods: This was a quality improvement case study on TB Systematic screening with a team of health providers of health center. Data was collected through key informant from TB systematic screening registers. Data analysis was conducted using Chi-Square Test. we considered every opportunity of presence of patients at Health Center (in Waiting room, Outpatient Consultation, Laboratory, TB units) by Information Education and Communication sessions every morning in all cervices, messages to Community Health Workers and meeting with local authorities where possible. All heads of units were informed, mobilized to report TB cases and suspects to the team of quality improvement. The data collected in all departments were presented in table and analyzed to find out the rate of TB infection and later after; to find out the level of TB Systematic Screening at Health Center.

Results: During the three months selected for the evaluation of intervention July 2021 up to September 2021, the TB Systematic screening was significantly increased from 60.7% in pre-intervention to 81.3% after intervention with a p value < 0.000. The TB screening in this time out was increased at 21% with a p value < 0.000 but for other variables there were notwith significant change. Although groups were different the staff training on TB Triage and screening increased the knowledge on an average score of 51.4 % pre intervention up to 87.1% post intervention.

Conclusion: Increase of knowledge through education, training and reinforcing the regular monitoring procedures were the key strategies to increase the level of TB systematic screening at Remera Health Center. To end tuberculosis as a global epidemic, we must find and treat all sick people, prevent transmission, and prevent the emergence of multidrug resistant TB. This is done by applying new ways such as reinforcing and expanding screening services and improving information flow for quality healthcare.

Key words: Tuberculosis, systematic screening.

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List of Abbreviations

ACF	: Screening for Active TB
AIDS	: Acquired Immune Deficiency Syndrome
ARV	: Anti Retrovirus
CEA	: Cost-Effectiveness Analyses
CHW	: Community Health Workers
CXR	: Photograph from a chest
DOT	: Direct Observation Treatment
HIV	: Human Immunodeficiency Virus
MMR	: Mass Miniature Radiography
MoH	: Ministry of Health
PCF	: Passive Case-Finding
PMTCT	: Prevention of Mother-to-Child Transmission.
RHC	: Remera Health Center
SS-TB	: Systematic Screening of Tuberculosis
TB	: Tuberculosis
WHO	: World Health Organization.

CHAPTER 1: INTRODUCTION

Tuberculosis (TB) is a communicable disease. It is among the leading causes of death globally. TB is caused by the bacillus mycobacterium tuberculosis (MTB), which is spread when TB infected people cough. The disease typically manifest itself as pulmonary TB or extra pulmonary TB. MTB infects about a quarter of the world's population (1). Although tuberculosis can affect anyone, the majority of patients are adults. Men are much more likely to be affected than women. Globally, approximately 30 high TB burden countries account for nearly 90% of all TB cases each year. People who are affected by TB frequently encounter economic distress, vulnerability, marginalization and discrimination since the disease brings poverty to the encountered family (2). Many tuberculosis patients are never given a diagnosis or treated which leads to a high mortality rate and disease transmission. There are clear indications that many tuberculosis patients present at health care facilities, however, it would not be noted that they require a TB evaluation. These undiagnosed tuberculosis patients who seek medical attention either recover on their own or develop more severe symptoms.

According to autopsy research findings, especially in African countries that have high HIV co-infection rates a large number of people lose their life without ever being diagnosed. In many places, TB screening is done by requesting people if their cough has persisted for longer than two weeks. Furthermore, it was further found that this methodology has a low susceptibility to identify TB. Since multi-symptom screening is more accurate, it is particularly advised for HIV patients (3).

In this capstone, we aimed to assess the TB systematic screening practice to detect TB among Health Center Outpatients at Remera. Patient file surveys was used as an approach to assess TB screening. People visiting the health center's outpatient department were subjected to a simultaneous cross-screen, and anyone demonstrating TB symptoms.

1.1.Hospital information

Remera Health Center (RHC) was established in 2014. It is in Gasabo District, Remera Sector, Rukiri II Cell, Amahoro Village. Catchment area of the health center is 76.523 Population from 3 Cells of Kimironko Sector, 4 Cells of Remera Sector, and 4 cells of neighboring sectors. The services offered to the public are mainly curative consultation, laboratory, maternity, small surgery, prenatal consultation, family planning, immunization, ARV, primary care of ophthalmology, mental health, hospitalization, dentistry, community health, and Hygiene.

RHC currently employs dedicated staff from different categories: 10 Nurses and Midwife (A1), 32 Nurse and others (A2), 5 Securities, 1 Plantar, 2 Patient Experts, 1 Community Health in charge, 1 Data manager, 1 Data entry which makes a total number of 53 Staffs. The sources of income of the health center are subsidies of the government, funds from various partners (AHF, Global Fund) and Revenues generated by the provision of health services. TB unity is one of RHC curative services which receives and serves patients from different services such as OutpatientDepartment, Hospitalization, and HIV units among others. The service has one permanent nurse on duty from Monday to Friday (day hours) and part time nurse in the weekend. With TB data from the health center in successive three years (2017-2019) we realize a low level of Systematic Screening for Mycobacterium Tuberculosis. A huge number of TB positive cases within small number of TB suspect was observed.

1.2.Problem Statement

There is a low late of Tuberculosis systematic screening at Remera Health Center basing on data of TB service reports of three successive years 2017, 2018 and 2019, data of mentioned three years about TB case from people screened and those diagnosed should be as an alert and incite for analysis about TB situation management at RHC. In 2017, a number of 82 people screened (18.9%) with TB positive cases out of 433 people who came for consultation at RHC. Also, 72 (12.4%) cases screened out of 579 people in 2018 were TB positive. And 67 (17.9%) out of 374 people screened in 2019 were diagnosed TB Positive. All these people were specifically from HIV-AIDs infected, prostitutes and ordinary people who came for ordinary consultation.

Overall TB Infection of three consecutive years was 16.4% among of people suspected of TB Positive. TB systematic screening has the potential to expand and improve TB diagnostic testing. An estimated number of 3.6 million commonly known as missing patients who are undiagnosed or unnoticed cause an overwhelming consequences. TB infected people contaminate their entourage including their families leading to loosing life progressively.

1.3.Main objective

The main objective is to improve the low level of TB systematic screening at Remera Health Center. Low Systematic Screening for Mycobacterium Tuberculosis at Remera Health Center within one year of period (June 2020-June 2021).

1.4.Hypothesis

TB Systematic screening has the potential to expand and improve TB diagnostic testing and identify missing patients with TB who are currently not detected or notified and end up by causing numerous consequences. TB infected contaminate their entourage including their families leading to loosing life progressively. The main goal of systematic tuberculosis screening (STS) is not to improve health outcomes in tuberculosis patients, rather reduce MTB transmission in the community through better TB detection, reduce diagnostic delays, and earlier treatment. Hence, two hypotheses were considered:

- H1: Training of staff will improve the level of TB systematic screening at Remera Health Center.
- H0: Training of staff will not improve the level of TB systematic screening at Remera Health Center.

CHAPTER 2: LITERATURE REVIEW

Reaching all tuberculosis patients is a critical step toward global TB eradication. Every year, approximately 10 million people get contaminated with TB, and 1.4 million people die as a result of this preventable and curable disease. In 2019, an estimated number of 2.9 million out of 10 million people who were with TB were never diagnosed. In 2019, most people who developed TB were from the regions of South-East Asia, Africa, Western Pacific, Eastern Mediterranean, America and Europe. About eight (8) countries surveyed, about two thirds (2/3) of the global total number of TB were diagnosed (1).

In 2016, people who were with TB in the African region were estimated to 2.5 million, accounting for a quarter of new TB cases. In Africa, this disease is reported to have killed 417,000 individuals. Majority who were of the HIV-positive TB cases who died (360,000) were from sub-Sahara Africa. In Africa 2.5 million individuals got incapacitated with TB, addressing a fourth of new TB cases around the world. An ordinary 417,000 individuals kicked the can from the sickness in the African zone in 2016. More than 25% of TB passing happen in the African Area. In Sub Sahara Africa (SSA) region, the African local beers were the most raised in general TB/HIV bothers and most of TB cases in SSA are co-dirtied with HIV. An ordinary 1.5 million passed on from the TB all around the world in 2013. A greater piece of the 360,000 HIV-positive that kicked the holder were from Sub-Saharan Africa (9). In 2014, the WHO devised a post 2015 global TB plan which had the goal of eliminating tuberculosis. While an estimated 9 million persons were diagnosed with TB in 2013, 1.5 million of those died as a result of the disease.

The global aim is having a decrease in TB fatalities of 95% and a reduction in TB incidence of 90% by 2035 and with full TB elimination by 2050. Hence, efforts to control TB must be intensified (4). Treatment of every person identified with active TB in the population with short course directly monitored treatment, as highly advocated by the WHO, is one way to increase TB control. This consists of shortening the period between diagnosis and treatment, increasing the success of treatment, improving the rate of TB case identification through passive case finding (PCF), which needs patients to be knowledgeable for the TB symptoms. Additionally, the procedure includes having access to medical facilities, being assessed by volunteering or staff members who are specifically trained to recognize TB symptoms, plus gain access to an accredited laboratory. Target populations must be screened for TB and also for active CF, and high-risk groups should get preventative medication (5). Active TB screening, also commonly known as ACF, attempts to increase TB identification cases in a

specific community so that TB active patients can be detected and treated sooner than if they were recognized and treated only after they sought medical help due to symptoms. As a result, screening for TB active patients would decrease through prevention of secondary transmission of the disease to others. ACF comprises screening outside of established health-care facilities through an outreach effort. Improved CF community projects to increase public understanding of TB signs and encourage self-presentation to health care. Traditional TB control methods included improving PCF case detection and direct observed treatments to boost treatment have subsequently proved to be ineffective in lowering the long-term prevalence of TB (6).

Maintaining steady case detection levels of the TB might not lower TB incidence effectively further in places where a goal case-detection rate of 70% according to modeling research (7). According to the findings, case detection objectives of more than 70% must be achieved to eliminate tuberculosis using current tools. In order to present choices for ACF for TB, this research reviews the evidence for TB screening among various target groups through cost-effectiveness analysis. Screening for active tuberculosis can be done on a large scale commonly known as mass screening or on a smaller scale through target screening method.

The mass miniature radiography (MMR) method was developed and initially utilized for screening. This method used a tiny (50-100 mm) image from a chest X-ray projected on a fluorescent screen. The method is less expensive than a large chest X-ray, and both the patients and operators are less exposed to radiation. When mobile MMR utilizing TB vans, the screening was later scaled up. This involved extended screening throughout the whole community and significantly improving the capacity for targeted and extensive community screening. Although MMR has been beneficial in identifying undiagnosed TB patients and identifying Incidence rate sooner, it is unknown how much of the significant decrease in incidence rate in regions like Europe was attributed to MMR.

In the 20th century it was not clear to estimate the attributed significance to this intervention in developed countries given that TB incidence was already declining. This was due to better nutrition and housing conditions. In addition, effective anti-TB treatment was introduced in the 1940s-1960s, which resulted in a significant decrease in TB. In resource poor nations, mass screening with MMR was challenging to implement because to the financial and logistical costs. New CF techniques, based primarily on the screening of symptomatic patients, were tested in developing nations (8). Given that many patients with TB that had been affirmed by bacteriologyencountered one severe TB-related symptom, a pivotal Indian study concluded that PCF should serve as the primary focus of TB control and prevention (9). Only until the health-care system had been sufficiently developed to care

for persons seeking medical for TB-related symptoms were ACF methods recommended as a supplementary intervention. Several studies found that screening persons with a strong cough as a deciding symptom was enough (10).

Thus, a solid healthcare system with high-quality diagnostic services were prioritized. Between 1960s and 1970s, investigations from Europe and Canada indicated that most instances of tuberculosis were diagnosed using PCF rather than routine MMR screening. Despite that the WHO's focus on PCF from 1974, later after, several studies have been developed to evaluate the ACF techniques across a community. Diagnostic methods together with screening algorithms were developed, with sputum-smear microscopy being a popular screening procedure in individuals with a cough that exceed one week. When compared to PCF alone, it was found that screening for tuberculosis presented several advantages including, 1) it boosts the number of TB cases detected and handled with anti-TB drug, 2) it detects cases at an early stage of disease, 3) it reduces TB-related mortality and 4) it has an impact on TB epidemiology.

The study found four (4) randomized trials studies to study the impact of screening on TB and cystic fibrosis, a total of 14 studies gave information on the impact of of TB cases diagnosed. In the short run, screening appears to increase the number of TB cases discovered, according to the research. In many places, more than half of the community's tuberculosis cases went untreated. However, on the contrary, the inverse relationship between false-positive diagnosis and TB prevalence leads to the risk of false-positive TB diagnosis which becomes higher in ACF-treated populations than that in PCF-treated communities. Based on 15 research from both high income and low-income (LMI) countries, there was no significant influence of TB screening (11).

Several significant study limitations in TB screening have been identified. These include lack of a control group that did not receive an intervention and the methodological concerns about calculating the standardized TB notification ratio. There is also a lack of historical trends data in TB incidence, along with a lack of clarity in assigning community members to randomization, as well as a study assessment that does not just look at the impact of detection (12). At the time of the systematic review, only preliminary results were available (13). The research, which took place in Zambia and South Africa, employed a design while comparing increased CF with a household intervention. Neither strategy resulted in a statistically significant decrease in tuberculosis cases.

Hence, there is inadequate evidence to warrant community ACF in high-incidence contexts. According to current WHO’s guidelines community-wide tuberculosis systematic screening for active may be explored based on geographically defined subpopulations (14). According to the WHO guidelines, TB

screening should be considered for population groups with restricted access to health services. Such people consist of those who live in slums, remote areas, indigenous peoples, and refugees. A trial was conducted in Vietnam to compare the prevalence of microbiologically confirmed pulmonary. Residents were visited at home and asked to provide a single spontaneous sputum sample for testing. The sputum sample was tested for TB using a fully automated polymerase chain reaction test (15), (16).

The WHO's guidelines contain strong recommendations for screening. These include 1) patients with tuberculosis infection and their relatives, 2) individuals living with HIV and 3) former and current workers in silica-exposed industries. However, the guidelines indicate that direct evidence supporting these strong recommendations was inadequate, and the recommendations were primarily influenced by the viewpoints of the guideline development. According to the guidelines, it is one in which the benefits of following the advice clearly outweigh the disadvantages. It was proved during investigating whether ACF among contacts of people with proven TB boosted case detection as compared to standard procedures (14). The review found only one randomized controlled trial looking at the effect of ACF in contacts, but this study also included the detection and treatment of latent tuberculosis infection in contacts.

In a cluster randomized trial, no substantial advantage of household screening. The results of a pragmatic, cluster-randomized, phased ACF study in Peru in infected individuals with sputum smear-positive TB cases. Results of a cluster-randomized study of ACF in positive sputum swabs. Evidence evaluating HIV infected people, current and former is insufficient due to that there aren't enough randomized controlled trials comparing ACF with PCF in these high-risk categories, despite WHO's strong recommendations for screening. In addition, the WHO recommends conditional screening for convicts, those with an untreated fibrotic chest X-ray lesion seeking for treatment if they belong to certain high-risk groups. The high risk here refers to diabetics, patients with chronic kidney failure, and orthoses in kidney dialysis. A good screening test has high throughput and favorable operating characteristics. These include the time it takes to complete the test, its technical simplicity or ease of use, user acceptability, and the stability of the test under the expected conditions of use. The ease of use of the test depends on how easy it is to obtain and maintain the equipment needed to administer the test and how difficult it is to train staff on how to use the test and correctly interpret the test results. In addition, the stability of the test under the intended conditions of use.

Previously, the lack of timely and accurate TB diagnostic techniques was the major challenge to achieving global TB control (17). Earlier diagnostic procedures, TB is still diagnosed using smear

microscopy and culture tests methods that perform poorly and for which infrastructure is usually unavailable in the health system's periphery. In LMI countries, sputum smear microscopy has been the primary approach for diagnosing pulmonary tuberculosis, but it has some important drawbacks. It has a wide range of sensitivity, ranging from 20% to 80%, with the lowest sensitivity in minors and HIV-positive patients (18). Serial sputum examinations are essential to improve sensitivity, however some patients refuse to return for more sputum examinations and become diagnostic defaulters.

The majority of these patients who do not complete the diagnostic procedure are totally unaware that they have a positive sputum smear and are consequently contagious. Smear microscopy additionally requires skilled microscopes: sensitivities can differ by up to 28% between field and reference lab readings. Smear microscopy has a low sensitivity for extra pulmonary specimens because they usually include only a few unevenly distributed organisms. New TB diagnostics have been launched in recent years. The global adoption of Xpert MTB/RIF has been the most significant change in the TB diagnostic picture (19). An automated diagnostic test called the Xpert MTB/RIF uses polymerase chain reaction to detect MTB DNA and rifampicin resistance. When compared to sputum-smear microscopy, the Xpert technique offers a much higher sensitivity for detecting TB and it detects rifampicin resistance quickly and accurately.

Rifampicin resistance is highly suggestive of multidrug-resistant TB contaminated. The WHO approved Xpert MTB/RIF for use in TB-endemic countries, hailing it as a big step forward in worldwide TB diagnosis (20). According to the WHO, the public sector had purchased 3,763 GeneXpert instruments and above 10 million Xpert MTB/RIF cartridges in 116 of the 145 countries. The global success and adoption of MTB/RIF has sparked a surge in interest in novel TB diagnostics. It is reasonable to anticipate a significant increase in molecular technologies that will eventually replace smear microscopy. TB diagnostics applicable to TB screening include but not limited to 1) an easy triage evaluation to detect people with suspected TB who require confirmatory checking out, 2) a sputum-primarily based totally substitute for diagnosis of active pulmonary TB and then 3) extrapulmonary and childhood TB diagnosis. It is crucial to differentiate among checking out for active TB and latent TB infection.

Clinically, TB is asymptomatic, and microbiologically, TB is dormant. Approximately 5% of infected individuals developed primary tuberculosis 5% of LTBI patients develop active TB as a result of endogenous reactivation of LTBI, sometimes many years after initial infection (21). The tuberculin skin test (TST) and IFN release assays are two tests that can be used to detect LTBI. When a patient has a positive TST or IGRA, active tuberculosis must be ruled out first before preventative TB

treatment can begin. TST or IGRA results that are positive do not distinguish between LTBI and active TB illness. There is significant concern that TSTs and IGRAs are being utilized to diagnose active TB in some high-TB-incidence areas, such as in India (22).

East Africa countries consists of seven countries, in 2018 it was identified that countries such as Tanzania, Kenya, and Uganda were having high TB burden, where it was shown that the reported TB incidence rates were at 292, 253, and 200 per 100,000 populations respectively. The EAC's TB case detection rates remain low. The WHO's end TB strategic plan adopted by all East African countries, reinforces contact and risk group screening as essential aspects. Early TB detection and treatment challenges have been reported at all levels, from the individual to the health system. This is due to poor health-seeking behavior, limited access to medical care, and the high cost of TB treatment. Other difficulties include using less sensitive diagnostic tools, frequent stockouts of medicines and laboratory equipment, in addition, the lack of adequate education and motivation among hospital employees (23).

The TB/HIV syndrome is still a public health concern in Rwanda. However, in 2014 the TB incidence was estimated at 63 people per 100,000 populations. HIV was found in 25% of people with TB who were tested. According to recent data from Rwanda's national TB prevalence survey, that was carried in 2012, the prevalence of bacteriologically revealed TB was estimated to be 119.3 per 100,000 population (24). In response to the growing TB/HIV syndrome, Rwanda's Ministry of Health (MoH) developed a national policy on TB/HIV collaborative programs, formed a TB/HIV working group. The government policy included guidelines for developing one-stop TB/HIV services, such as HIV counseling, testing, and ARV treatment for people with TB who tested positive for HIV (25).

We underlined the urgent necessity to implement measures to improve diagnosis and the start of treating people with TB at the RHC in order to meet our aim during this research. One among these strategies is a systematic screening for TB as it is at the central to make sure early diagnosis for all with TB. The target of screening is to observe infectious disease early so as to decrease delays in diagnosis and treatment, thereby reducing the probability of undesirable treatment outcomes and social consequences of TB to individuals and their families. Furthermore, by getting people with prevailing illnesses and shortening the length of infectiousness, screening reduces TB transmission in a household, workplaces, and other community settings. This reduces the incidence of infectious disease, as a result, the frequency and prevalence of tuberculosis disease. The aim is to have reduction of TB incidence rate per 100 000 population up to 80% by 2030. In 2020 the milestone was 20% reduction while 50% reduction in 2025. This would result in reduction of 90% when considering the annual number of TB deaths by 2030 (1). The objectives and goals of screening for

active tuberculosis in 2013 have been determined by WHO Principles and Recommendations. Screening's primary goal is to detect active tuberculosis early, that can help with two long-term goals.

By lowering an individual's risk of poor treatment outcomes, the social and financial negative effects of tuberculosis is reduced. The same as well the prevalence of TB and its related death would be reduced. As a result, the prevalence of tuberculosis infection and, consequently, tuberculosis disease is reduced. In order to identify patients who can undergo treatment for a latent tuberculosis infection, such as HIV-positive individuals, the second objective is to check out active disease. Additionally, screening tests, including certain compatibility with TB but without a diagnosis of active disease at screening, can aid in determining individuals who may require repeat testing and are at a particularly high risk of subsequently getting the active disease. Combining TB screening with TB risk factor screening may aid in identifying individual community-level risk factors that need to be tackled in order to more effectively prevent the disease (26).

CHAPTER 3: METHODOLOGY

3.1. Data collection

Together with the Head of health center, in-charge of activities of community and environment, Data Manager, In-charge of TB, OPD, Laboratory, and HIV units had a meeting. The meeting aimed at discussing the problems being faced by RHC. The discussions centered on TB systematic screening activities with the help of RHC's Health Management Information System (HMIS) of three successive years (2017-2019). We used every opportunity of the presence of patients on Health Center (in Waiting, Outpatient Consultation, Laboratory, TB, and hospitalization units) by information education and communication sessions every morning in all cervices, mobilization of community health workers and meeting with local authorities where possible. All heads of units were informed, mobilized to report TB cases and suspects to the team of quality improvement. The data collected in all departments were presented in table and analyzed to find out the rate of TB infection. We collected the data from the registers, files checking and by interviews. Those data were from the database service (database of health center), Laboratory (TB suspect cases register), and OPD and TB service (TB Patients register, TB treatment follow up and TB Screening register). By relieving all cases presented and unregistered in one of these documents with signs of TB Suspects from the list below, coughing for three weeks or more, blood in the cough, difficulties while breathing, or pain when breathing or coughing, unexpected weight loss, fatigue, fever and night sweats.

3.2.Tools to collect data

Detailed patient forms are filled up at the time of care and summarized in the laboratory and medical registers as part of the WHO reporting system. Rwanda Ministry of Health (MoH) recommends the use of the following tools including laboratory registers, register of TB suspects, register of TB contacts and TB treatment (27). In our quality improvement, we used register of TB cases and suspects, laboratory registers and TB suspect and cases registers by tracing every case unregistered with at least three sings of TB, coughing for three or more weeks, coughing up blood or mucus, fever, night sweating and for selected risk groups, such as close contacts of people with TB.

A meeting to identify the root causes of the problem was held in August 2020 and it consisted of Head of health center, responsible of TB, responsible of OPD, responsible personnel of HIV program, Member from Laboratory Service, In charge of Community Health Program, Data Manager. All together had a debate to provide each one's opinions about what causes the low level of systematic screening of TB then proceed by recording them using a Fishbone. The steps to identity root causes

included (1) Collecting possible root causes by recording the suggested root causes, (2) Fishbone to verify each suggested root cause information to prove or to disprove, (3) Flow chart to understand the work process. During team discussions, it was revealed that there were different problems about systematic screening especially TB high-risk suspects at primary healthcare centers level. Thereafter, all together by brain storming, we discussed about what causes the low level of systematic screening of TB. Hence, we used SPSS for analyzing the data collected. The chi-square test was applied on the data for the analysis and evaluation.

CHAPTER 4: RESULTS

According to 2020's WHO reports, there were approximately 2.5 million people with tuberculosis in the African region in 2016. This was accounting for one-quarter of all worldwide new TB cases. In 2016, an approximate of 417,000 people died from the disease in Africa. In 2019, the South-East Asian region had the highest number of new TB cases accounting 44% of all new cases. The African region with 25% was next and then the Western Pacific which had 18% of the cases. The vast majority of the 360,000 HIV-positive TB deaths happened in SSA. Rwanda's national tuberculosis prevalence survey conducted, revealed that TB prevalence rates was high.

4.1. Magnitude of the problem before intervention

At Remera Health Center, our team for quality improvement selected randomly three successive years (2017-2019) and realized a high level of TB Infection of 16.4% within only 60% of people screened from all TB suspects 1.386. A Tally was designed to assess if TB-Systematic Screening is done regularly at Remera health center. With RHC's team members on improving systematic TB screening we discussed about data of three successive years (2017-2019). TB Infection of (16.4%) On a level of screening (60%) made us realize a low level of TB Systematic Screening at RHC. The three consecutive years (2017, 2018 and 2019) indicate that there were 433 (72%) out 600, 579 (57.6%) out of 1.005 and 374 (53.5%) screened out of 698 patients admitted with TB Signs and Symptoms. The TB screening for period of 2017 to 2019 is almost 61%, this implies that the number of patients screened for tasting was low compared with number of TB suspected cases that was not screened. Table 1 depicts the comparison of both the TB signs and symptoms with TB patients screened at Remera Health Center's reports during the period of three years (2017-2019).

Table 1: Comparison of people having TB signs and symptoms between 2017-2019

Period	Admitted patients with TB signs and symptoms	Admitted patients with TB signs and symptoms screened	Percentage (%)
2017	600	433	72
2018	1.005	579	57.6
2019	698	374	53.5
Total	**2.303**	**1.386**	**61**

The number of TB positive after diagnosis is high with an average of 16.4 TB+ cases per year (2017-2019) comparing with 2012 where TB prevalence and incidence were estimated to 0.1 % of population. TB Screening at a level of 60.7% at a health facility is low comparing to the recommendations of WHO to screen a 100% of patient present at health facility with TB suspect signs and symptoms and in risk group. Table 2 shows the comparison of Patients with TB signs and symptoms diagnosed for TB against to those with TB Positive after screening. Table 3 shows the data of TB Systematic screening before intervention period of third term of 2019 from July to September 2019 at RHC.

Table 2: Patients with TB signs and symptoms before and after TB diagnosis

Period	Patient Screened for TB	TB + after diagnosis	Percentage (%)
2017	433	82	18.9
2018	579	72	12.4
2019	374	67	17.9
Total	**1.386**	**221**	**16.4**

Table 3: Data of TB Systematic screening before intervention period

No	Variables	Character	Frequency	Percentage (%)
1.	Sex	Female	383	50.5
		Male	376	49.5
	Total		**759**	**100**
2.	Cough	Yes	737	97.1
		No	22	2.9
	Total		**759**	**100**
3.	Fever	Yes	364	48
		No	395	52
	Total		**759**	**100**
4.	Night Sweat	Yes	92	12.1
		No	667	87.9
	Total		**759**	**100**
5.	Weight loss	Yes	625	82.3
		No	134	17.7
	Total		**759**	**100**
6.	TB contact	Yes	40	5.3
		No	719	94.7
	Total		**759**	**100**
7.	HIV +	Yes	46	6.1
		No	713	93.9

	Total		**759**	**100**
8.	Prisoner	Yes	23	3
		No	736	97
	Total		**759**	**100**
9.	Screening	Yes	461	60.7
		No	298	39.3
	Total		**759**	**100**

In Figure 1, fish bone was used to collect the possible root cause participative every one of members gives his/her thinking reason randomly. Then after, we proceed by eliminating the majority supporters of point.

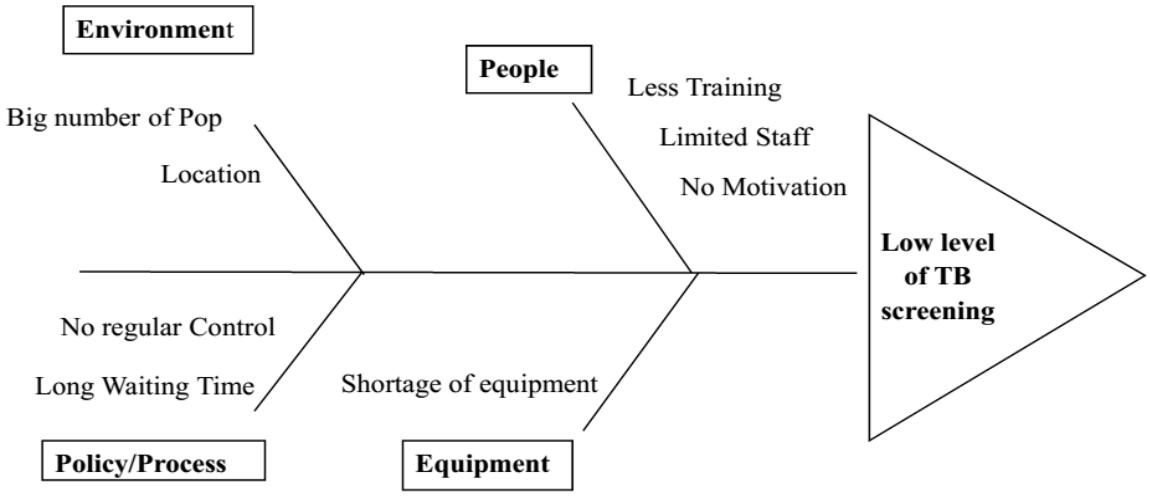

Figure 1. Fish bone diagram adapted from Ishikawa

Table 4: Suggested root causes of poor systematic screening

No	Suggested root cause	Information provided	Respondents	Score (%)
1.	Number of patients	Number of patients is big	6	85.7
2.	Big Pop.in Catchment	H.C has a big number of Pop	5	71.4
3.	High TB Exposed Zone	H.C is in high-risk zone of TB	5	71.4
4.	Insufficient Information	Staff are not informed about triage	6	85.7
5.	Level of Monitoring	The monitoring and regular control	6	85.7
6.	Waiting Time	The waiting time is long	4	57.1

It was observed that six out of seven (6/7) suggested root cause scored above 50% and among of these six, three of them that were with a high percentage were considered as main cause of poor systematic

screening 85.7%. The average of results about knowledge and information of staff team member about TB systematic screening was at 51.4% in pre-test and 87.1% after training. The increase of 35.7% was observed. Before proceeding with Quality improvement at RHC, we had sciences of training of staff member of the team about TB Systematic improvement. Evaluation of the knowledge about TB systematic screening before and after shown an improvement of knowledge at 35.7%.

Table 5: Knowledge of Remera Health center staff on triage and TB systematic screening

Participants	Max pre-test	Percentage	Max post test	Score	Comment
1	4	40	8	80	Improved
2	7	70	10	100	Excellent
3	4	40	9	90	Improved
4	6	60	9	90	Improved
5	4	40	7	70	Improved
6	6	60	10	100	Excellent
7	5	50	8	80	Improved
Average		**360/7=51.4%**		**610/7=87.1%**	Improved

The number of population of RHC is extremely high (140.000 population) comparing to the standard whereby a total number of public and private health posts, health centers, per 10.000 population. We cannot do anything at our level but government is committed to reduce the overloading with some health posts in Remera and Kimironko.

Table 6: Record of the suggested root causes during Brainstorming

No	Suggested RC	Information to prove or disprove	Number of staff	Percentage (%)
1	Big Number of Patients	Number of patients is big.	4	57.1
2	Insufficient information	Staff are not trained about triage.	7	100
3	Level of monitoring	Monitoring level is low.	4	57.1

About the level of monitoring, we observed a lacking monitoring at specific services (TB, OPD and Laboratory) where the monitoring was almost inexistent. It was done only in TB by the in charge of data and once per term by an agent from the district hospital. The monitoring is low comparing to the standards of internal monitoring of once per week and once per month from district hospital. By

brainstorming when selecting the suggested root cause; one of three root cause which is insufficient information about TB systematic screening was selected and supported by all members of the team at a level of 100%.

4.2.Solutions to address the root causes

The key solutions realized were to provide information about screening of TB to the staff of health center especially those working in concerned services, together with improving work habits of staff of the health center by including triage/screening of TB in their daily agenda. Also, reinforcing monitoring on screening of TB in services with exposition was required. This was realized by finding solutions to three specific questions how much will the intervention improve the problem (impact)? How expensive the intervention is to carry out (annual cost)? How long the intervention will take to work (time to effect)? and is there capacity financially, culture and staff understanding (feasibility)?

On each of criteria we gave score out of five points (1-5) where 5 was the most ideal and 1, the least ideal. Then after we calculate the total and chose the ones with big score. Table 7 shows a comparative analysis of the impact, cost, time, and feasibility of the intervention strategies from the brainstorming.

Table 7: Comparative analysis of impact, cost, time, and feasibility of the intervention strategy

(a) Impact

Intervention	Impact	Score
Improving work habits	Work habits change will improve about Triage, Systematic screening as confirmed by 80% of team members.	4
Providing Information	Providing information by training all staff about triage and systematic screening of TB will improve about 80% of staff.	3
Reinforcing Monitoring	Monitoring of doing triage, systematic screening of TB will impact about 80% of staff.	4

(b) Cost

Intervention	Cost	Score
Improving work habits	Work habits change will engage cost as confirmed by 60% of participants.	3
Providing Information	0% of staff conform that training will engage cost.	5
Reinforcing Monitoring	20% of participants rise an issue of cost about monitoring.	4

(c) Time

Intervention	Time	Score
Improving work habits	Work habits change will take time as confirmed by 40% of members	4
Providing Information	80% of participants confirm that time is not an issue about Training (It can be part of daily activity).	4
Reinforcing Monitoring	Monitoring need time as confirmed by 60% of participant.	4

(d) Feasibility

Intervention	Feasibility	Score
Improving work habits	Only 80% of team members confirmed that work habits change is feasible.	4
Providing Information	100% of team members agreed that providing information by Training is feasible.	5
Reinforcing Monitoring	80% of team members agreed that Monitoring for triage, systematic screening of TB is feasible.	5

Table 8. Brief comparison of possible interventions

Interventions/ Criteria	Impact	Cost	Feasibility	Time	Total
Providing information about TB Systematic Screening	3	5	5	4	17
Improving work habits of Staff of Health center about SS of TB	4	3	4	4	15
Reinforcing Monitoring about Systematic Screening of TB	4	4	5	4	17

CHAPTER 5: DISCUSSIONS

Systematic TB screening especially at high-risk such as at the primary healthcare centers level is challenging. By comparing data about sex before and after intervention, we realized no statistically significant difference while tested from both groups, where the p-value was 0.022. Before female was on proportion of 50.5%, male 49.5% then after intervention female were 44.4 %, and male 55.6%. In (28) where Fernandes, P., et al. aimed at seeing if there are potential gender differences in TB infection from a Brazilian household contact study. From secondary data analysis, it was revealed that the prevalence of tuberculosis disease is higher in males than in females with a p-value 0.07 (66.9%). Comparing data about cough before and after intervention, a p-value became 0.095 which shows no statistically significant difference while tested from both groups presenting cough as sign was on proportion of 97.1% before and 98.4 % after intervention. Comparing data about fever a p-value of 0.000 shows a statistically significant difference while tested from both groups presenting fever as sign was on proportion of 48% before and 29.1 % after intervention.

Comparing data about night sweat, with a p-value of 0.281 it shows no statistically significant difference while tested from both groups presenting night sweat as sign was on proportion of 12.1% before and 10.4 % after intervention. Night sweats are a prominent symptom of tuberculosis. Night sweats are a common outpatient complaint based on associated symptoms (29). Comparing data about weight loss, a chi-square test of 0.847 shows no statistically significant difference while tested from both groups presenting weight loss as sign was on proportion of 82.3% before and 18 % after intervention. Comparing data about TB contact, chi-square test of 0.892 shows no statistically significant difference while tested from both groups presenting TB Contact as sign was on proportion of 5.3% before and 5.1% after intervention. Comparing data about HIV+, chi-square test of 0.496 shows no statistically significant difference while tested from both groups as HIV+ was on proportion of 6.1% before and 5.2% after intervention. A suboptimal accuracy in HIV-positive hospital patients was observed among the potential screening tests. HIV infected people seem to be more likely to contract tuberculosis (30), (31). Screening for TB was carried among the clinical encounters among the HIV-infected, the P-value for trend < 0.001 (32). Comparing data about prisoner, a chi-square test of 0.375 shows no statistically significant difference while tested from both groups as prisoner was on proportion of 3% before and 2.3% after intervention. According to a study conducted in a Dutch prisons, prisoners with TB identified through x-ray screening had a higher rate of pulmonary TB than those diagnosed with TB outside of the screening program with 96% and 64% respectively with a p value of 0.01 (33).

Lastly, comparing data about screening systematically before and after intervention, a chi-square test became 0.000 which shows statistically a significant difference. Hence, there was an increase from 60.7% to 81.3% after intervention. TB Screening after the period of intervention was 81.3%. The increase of 20.6% was made from 60.7 before intervention to 81.3 at post intervention impacted on TB-SS increase which confirms our Hypothesis "Training of staff will improve the level of TB systematic screening at RHC". Table 9 shows the data of TB Systematic screening after intervention for 3rd term which started from July to September 2021. Table 10 shows also a comparison made about screening in pre and post intervention whereby; most of variables do show not big change happened even though groups are different but significant change was observed about Systematic screening where it was before intervention at a level of 60.7 and at a level of 81.3 after intervention. A difference of 20.6% is significant and confirms the impact of quality improvement.

Table 9: Data of TB Systematic screening after intervention for third term

No	Variables	Character	Frequency	Percentage (%)
1.	Sex	Female	331	44.4
		Male	412	55.6
2.	Cough	Yes	731	98.4
		No	12	1.6
3.	Fever	Yes	216	29.1
		No	527	70.9
4.	Night Sweat	Yes	77	10.4
		No	666	89.6
5.	Weight loss	Yes	134	18
		No	609	82
6.	TB contact	Yes	38	5.1
		No	705	94.9
7.	HIV +	Yes	39	5.2
		No	704	94.8
8.	Prisoner	Yes	17	2.3
		No	726	97.7
9.	Screening	Yes	604	81.3
		No	139	18.7

Table 10: Description of the differences between pre intervention and post intervention

Variables	Character	Frequency	Percentage	Variables	Character	Frequency	Percentage	P-values
Sex	Female	383	50.5	**Sex**	Female	331	44.4	0.022
	Male	376	49.5		Male	412	55.6	
Cough	Yes	737	97.1	**Cough**	Yes	731	98.4	0.095
	No	22	2.9		No	12	1.6	
Fever	Yes	364	48	**Fever**	Yes	216	29.1	0.000
	No	395	52		No	527	70.9	
Night Sweat	Yes	92	12.1	**Night Sweat**	Yes	77	10.4	0.281
	No	667	87.9		No	666	89.6	
Weight Loss	Yes	625	82.3	**Weight Loss**	Yes	134	18	0.847
	No	134	17.7		No	609	82	
TB Contact	Yes	40	5.3	**TB Contact**	Yes	38	5.1	0.892
	No	719	94.7		No	705	94.9	
HIV +	Yes	46	6.1	**HIV +**	Yes	39	5.2	0.496
	No	713	93.9		No	704	94.8	
Prisoners	Yes	23	3	**Prisoners**	Yes	17	2.3	0.372
	No	736	97		No	726	97.7	
Screening	Yes	461	60.7	**Screening**	Yes	604	81.3	0.000
	No	298	39.3		No	139	18.7	

Limitation of the study

1. The sample of our quality improvement was limited to TB suspect case presented at RHC within period of January 2019 to December 2021, everybody suspected with signs of TB and meeting the criteria of TB screening was systematically screened.
2. A sample of three months July 2019 to September 2019 was selected and considered as base line for evaluation, then other three months July 2021 to September 2021 was considered as evaluation.
3. The year of 2019 focused on presenting to the staff the previous data about TB systematic screening of their health center, comparing the data with the recommended, providing, training, mobilizing, and involving the staff in TB systematic screening practices. The year of 2020 and first six months of 2021were for quality improvement then; from July to September 2021 was for an evaluation period.
4. We got by random a sample of 750 people within period of July, August and September 2019 as base line and a sample of 743 people for the period of July, August, and September 2021.

5. We had difficulties to find previous research and studies about TB Systematic Screening as most of them are related to TB as a disease, prevalence and incidence, treatment, and its relationship with other diseases.
6. We had to take long time of period (all the year of 2020 and first half of 2021) for Quality improvement because of the Covid -19 pandemic which disturbed most of activities and limited the normal movement of people.
7. The staff has basic knowledge about TB screening and was motivated but they need updates, refreshing, monitoring and follow-up also a kind of individual initiative.
8. Community seems to do not have enough knowledge about TB Systematic Screening especial Community Health Workers but based on our experience; apparently when they are approached, they can help in increasing the late by facilitating health center and people within their respective area.
9. The major objective of this quality improvement was to increase the level of TB screening system systematically (TB-SSS) at a health facility. The feasibility of this Quality improvement revealed a great importance and improvement of the TB health care from the community level to the Central level. Finding of the undertaken research has shown its relevance in omitting TB screening gaps among the Rwandan communities and the health system. Challenges in identifying TB Cases, delays in screening suspected TB cases and burden of workload to community health workers will found a duly solution. The results of the present quality improvement emphasizes that irregularity to systematically screening practice might result to a big number of TB case lost and finally contribute to failing of achieving the goal in times of fighting TB.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSION

Recommendations

1. TB systematic screening should be among priorities activities of daily at health center.
2. Regular provision of information, training, monitoring, and periodical evaluation about Systematic screening at health center is with big importance.
3. Risk groups should be targeted within their specific service such as pregnant women, diabetic people and other non-communicable disease may be targeted by the services wherever they are present in service with TB suspect signs.
4. The role of community health workers in finding and accompanying suspect case from their respective area should be considered.

Conclusion

According to the information collected from staff of health center and discussion made when finding route cause analysis, majority of staff confirmed lacking information about triage and systematic screening of TB. Basing on results both of Increase of staff knowledge of 35.7% after their training and the increase of TB-SS of 20.6% we can confirm our Hypothesis. The solutions proposed by majority of group members to work on were to providing information about systematic screening of TB to the staff of health center, training of staff of concerned services and, improving work habits of staff of health center about SS of TB. Reinforcing monitoring about systematic screening of TB from most of concerned services such as OPD, HIV, Hospitalization, and TB services is required. After series of discussion and training, the staff were convinced and interested by their implication to achieve the objective and keep improving even beyond the target. By quality improvement practice for a period of twelve months whereby all together as team were focused on improving TB Systematic screening by determined activities. Providing the information about TB systematic screening, most especial to every one of the staff the risks of TB when not well screened and the importance of reinforcing monitoring about systematic screening of TB.

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Appendices

- **Annex 1: Interventions and actions timing**

Activities/Time	Week 1-2 (01-14/01/2021)	Week 3-4 (15-31/01/2021)	Week 5-6 (01-14/02/2021)	Week 7-24 (15/02-30/06/2021)	Responsible
Providing information about TB Systematic Screening	X	X			UR Student
Improving work habits of Staff of Health center about SS of TB	X	X			UR S/HHC
Reinforcing Monitoring about Systematic Screening of TB	X	X	X		Head Of HC
Staff involvement in Systematic Screening of TB improving		X	X	X	All Team M
Daily triage Reporting about SS of TB		X	X	X	Focal P
Weekly report about Triage and TB Case		X	X	X	Focal P
Monthly Report and Evaluation about Triage and TB Service management		X	X	X	Head Assistant

Annex 2: Evaluation Plan

Indicator	Definition	How	Time	In charge
Number of P. admitted with TB signs and symptoms.	People with TB signs admitted	DS-TB Triage book	July 1st to 31 September 2021	Focal P/UR Student
Proportion of people screened for TB among those eligible.	People with TB Signs screened	DS-TB Triage book	July 1st to 31 September 2021	Focal P/UR Student
Number of Daily triage Reporting about SS of TB	People screened of TB every day	DS-TB Triage book	July 1st to 31 September 2021	Focal Point
Systematic Screening Periodical Reporting.	Data reported about triage and screening	DS-TB Triage book	July 1st to 31 September 2021	Focal Point/UR Student