

Integration Challenges and Opportunity of Implementing Non-Communicable Disease Screening Intervention with Tuberculosis Patient Care: A Mixed Implementation Study

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Background: Despite the comorbidity, early detection and treatment of the two diseases are highly recommended; however, a few pilot studies were conducted, which are mainly focused on diabetes mellitus screening and the integration opportunity and challenges were not known. The study aimed to identify integrated implementation challenges and opportunities of non-communicable disease and risk factors screening intervention with tuberculosis patient care.

Methods: A mixed implementation study design was used. Data were collected from a sample of 443 tuberculosis patients, 21 key informants and facility observations. For quantitative data, descriptive statistics for proportion were summarized in tables and figures. Four distinct implementation frame was adapted for thematic analysis of audio recordings, daily verbatim transcription, and descriptive field notes.

Results: The prevalence of hypertension and diabetes mellitus among tuberculosis patients were 6.55% and 5.64%, respectively. Totally 9 subthemes and 21 new codes were developed, of which 13 and 8 new codes were developed for integrated implementation challenges and opportunities, respectively. The absence of medical equipment, skill and knowledge training, record and report system, cooperative integration, feedback, referral system, shortage of supporting agencies, and services not free were external challenges, whereas lack of trained health workers, focal persons, and increased workload and absence of awareness creation were internal challenges. Despite the challenges, the presence of health extension programs, non-governmental organizations, community health care insurance and associations for diabetes mellitus were external opportunities. Availability of assigned focal persons, trained stakeholders, guidelines, information systems and compatible tuberculosis program structure were internal opportunities.

Conclusion: The majority of TB patients were not comorbid with NCDs. We build a favourable system for integrated implementation developing an integration platform and structural authority at a different organization by addressing identified challenges and applying facilitators is crucial.

Plain Language Summary: Despite the comorbidity, early detection and treatment of the two diseases are highly recommended, and a few pilot studies were conducted, which are mainly focused on diabetes mellitus screening and the integration opportunity and challenges were not known.

This is the first mixed implementation study of integration challenges and opportunities of implementing non-communicable diseases by the two stages of WHO stepwise screening intervention.

The majority of TB patients were not comorbid with NCDs. The prevalence of hypertension and diabetes mellitus among tuberculosis patients was 6.55% and 5.64%, respectively.

The absence of medical equipment, skill and knowledge training, record and report system, feedback and referral system, drugs and laboratory services are not free, lack of cooperative integration, and shortage of supporting agencies were repetitively reported challenges for integrated screening intervention.

Even though the challenges, the availability of health extension programs, non-governmental organizations for TB detection at the community level, community health care insurance, associations for diabetes mellitus, assigned focal persons, trained stakeholders, guidelines, and compatible tuberculosis program structure were frequently suggested opportunities for integrated implementation of non-communicable disease screening intervention with tuberculosis care program.

Therefore, to operationalize systematically integrated screening intervention, the program manager should assign a focal person, train healthcare workers and develop internal and external referral systems through communication and coordination. The policy-makers should develop an integration platform and structural authority at a different organization by addressing identified challenges and applying facilitators to build a favourable system for integrated implementation of NCDs and risk factors screening intervention on TB program.

Keywords: prevalence, risk factors, challenges, opportunity, non-communicable diseases

Introduction

Tuberculosis disease (TB) is a major public health problem and the top list of causes of death in the world.¹ From 95% of tuberculosis deaths occurred in low-middle-income countries (LMICs), two-thirds of deaths happened in 8 LMICs and Ethiopia is one of the top 22 counties affected by tuberculosis (TB)² with a 2.1/1000 incidence and 2.0/1000 prevalence rate.³

The common comorbid non-infectious diseases comorbid with TB are diabetes mellitus (DM), hypertension, heart diseases, chronic obstructive pulmonary disease (COPD), and cancer.⁴ However, TB and non-infectious diseases share many essential socio-economic and socio-demographic determinants^{5–8} Moreover, concomitantly tuberculosis and non-communicable diseases (NCDs) increase the occurrence or consequence of each other.⁹

The common and shared risk factors for both diseases are cigarette smoking, alcohol drinking, physical inactive, and inadequate fruit and vegetable consumption.^{10–12} In Ethiopia, the estimated number of TB cases attributed to common TB risk factors are malnutrition, alcohol consumption, and smoking.¹³ Comorbid patients are not simple to diagnose and manage on a timely basis, contributing to TB transmission.¹⁴

In India, the prevalence of hypertension was 7%, DM at 8%, alcohol use at 34%, and use of smokeless tobacco at 33% were screened from routine tuberculosis patients.¹⁵ A total of 9651 patients with TB were identified in China, of whom approximately 61.4% had no chronic conditions, 17.4% had 1 chronic condition, and 21.3% had >2 chronic conditions.¹⁶

In South Africa, the prevalence of non-communicable diseases (NCDs) included hypertension (8.9%), ischemic heart disease or angina (7.5%), arthritis (4.5%), type 2 diabetes (4.1%), asthma (3.5%), cancer or malignant neoplasms (2.1%), chronic lung disease (1.9%) and dyslipidemia (1.6%). The overall comorbidity (with one NCD) was 26.9%, and multi-morbidity (with two or more NCDs) was 20.9%.¹⁷ The prevalence of DM among TB in the Amhara region of Ethiopia was 8.3%.¹⁸

NCDs and TB comorbidity and linkage to care study report that specifically 52% of hypertension patients liked TB care and 50% of TB linkage to the hypertension department, which indicated that almost half of the detected patients were linked to care for treatment.¹⁹

Integration needs a sustainable plan of health system resources, and the challenge is to design systems and processes in ways that reallocate resources to align with the objective of the integration reform.²⁰ For most integration efforts, a broader set of clinical skills may be required, and training of healthcare workers is an important facilitator to increase consciousness of the worth of integrating specific programs, and for building working proficiency, independence, and working drive for patient care.^{21–23}

The challenges of integration care quality are traditional norms, social beliefs, health information and distance for transport²⁴. Integration of non –non-communicable disease comorbidity into other care, especially in one department minimizes cost and it is the best model for patients' services quality and treatment success.^{25,26} Integration opportunity and challenges have two determinants, which are patient demand and organizational health system supply, and they are crucial for sustainable integration implementation.^{23,27–31}

In China and India, a piloted study was conducted in the context of bidirectional early detection for the two diseases; however, the integration opportunity and challenges are not addressed.^{28–30} Due to the burden of comorbidities, some countries, including our country Ethiopia, have initiated integration services.^{25–27}

Despite the comorbidity, early detection and treatment of the two diseases are highly recommended,^{22,23} World Health Organization (WHO),¹⁶ and Sustainable Development Goals (SDG),²⁴ the management is often limited to hospitals, service is provided separately, and there is limited experience from other continents in our study even country (Ethiopia) at large.

Implementation science supports innovative approaches to identifying, understanding, and overcoming barriers to the adoption, adaptation, integration, scale-up and sustainability of evidence-based interventions, tools, policies, and guidelines.³² Under this implementation science to explain comprehensively the integrated implementation challenges and opportunities, we applied the four distinct implementation frame of exploration, preparation, implementation, and sustainment (EPIS) frame.

We anticipate that the results will provide comprehensive evidence for policymakers and will be used as a tool to building a favourable system that improves TB treatment outcomes through applying this integrated implementation and education on NCD co-morbidities and risk.

Methods and Materials

Study Setting

This study was carried out at the Hadiya Zone tuberculosis treatment centre from January 2022 to April 2023 for three months. The Hadiya Zone Administration is one of the 14 of the South Nation Nationality People of Representative State (SNNPRS) Hosanna Town is the capital town which is located on the main road from Addis Ababa to Hosanna just 192 km apart from the capital city of Ethiopia. The administration Hadiya Zone has 7 urban towns administered with 29 kebeles and 303 rural kebeles within 10 rural districts. The zone has more than 1.7 million population of which 848,695 males and 857,225 females were found. The study area has four district hospitals, one referral hospital, sixty-one health centres, and around 305 health stations.

The Zone was to detect and treat tuberculosis patients based on WHO guidelines and in 2020. The total Pulmonary positive TB case was 781, pulmonary negative TB 579, Extra pulmonary TB 270, and the total all forms was 1630. The TB detection rate for all forms is 192/100,000. Currently, the Zone as a new initiative chronic care program was started in selected four hospitals and three health centres. In 2021, of 73,333 total individuals screened for hypertension, 397 new patients enrolled for hypertension care. However, the district program manager did not give the concentration, the HCWs have less motivation and most health facilities did not provide hypertension (HNT), diabetes mellitus (DM), cervical cancer and Mental Health Services programs (based on the 2021 Zonal Health Bureau's annual report).

Study Design

A mixed implementation study employed a cross-sectional study design for the quantitative method and a case study design for qualitative method data. While quantitative data were collected by structured interview questionnaire and the validated tool of two stages of the WHO stepwise screening procedure, the qualitative data were collected by observation checklist and in-depth interview guidelines from health managers, coordinators, and TB NCD comorbid patients.

Site and Populations Targeted for Implementation Strategy

This study was implemented in three general hospitals, one comprehensive hospital and three health centres. The implementation site selection eligibility criteria were the availability of both non-communicable and tuberculosis disease continuous detection, diagnosis and treatment services. The study focused on TB and NCD comorbid patients, tuberculosis focal persons, program managers, and/or coordinators.

Description of the Implementation Strategy

This study was planned after developing ownership of stakeholders in NCD and TB integration services by informing implementation sciences research. Through stakeholder response, and intervention implementer's feedback, the project strategy was developed to intervene in the two stages of screening. A first-time in-depth interview was conducted to explore the stakeholder perspectives, and five days of training was given to implementers during one month of pre-phase implementation. To explain the implementation challenges and opportunities, a second in-depth interview was conducted after one month of pre-phase and during post-phase two months of implementation.

Description of the Intervention

The two stages of the WHO-Stepwise screening approach for NCD and risk factors were applied to routine TB, which was piloted and validated in different countries,^{33,34} in which the prevalence of NCDs was determined. Before intervention, appropriate study site was selected according to eligibility criteria, and all newly enrolled tuberculosis in the direct observational treatment (DOT) program were screened by trained implementers. The implementation challenges and opportunities were assessed by two-time data collection in pre-phase (one month) and post-phases (two months) from stakeholders using interview guidelines.

Applying an Implementation Framework

To lead project planning and guide the implementation of its challenges, the implementation team prospectively employed an implementation framework. We adapted the four distinct phases to the implementation of the intervention from the existing frame of implementation research.³⁵ This frame includes exploration, preparation, implementation, and sustainment (EPIS) frame, and the reason for applying this frame is it comprehensively explains the critical points of implementation challenges. Within each phase, EPIS considers two determinants, the first one is outer factors (service environment, inter-organizational environment and consumer support), while the second factor is inner context factors (intra-organizational and adopter characteristics) on the process. Based on our implementation program in the pre-phase we achieved exploration and preparation within one month of the implantation period. In the post-phase, we addressed implementation and sustainability distinct in the next two months of implementation.

Study Population

For Quantitative

All adult newly diagnosed TB patients enrolled in the DOT program in Hadiya Zone tuberculosis health facilities were the study population. All TB patients whose age > 20 years, currently enrolled in the DOT programs, and living in the Hadiya Zone catchment were included. Unable to give informed consent, pregnant women, severely ill, comorbid with another infectious disease, transferred out from the catchment and referred for further investigation were excluded.

For Qualitative

Respondents who had more than six months of experience in diagnosis, treatment, and coordination and comorbid TB patients who are currently on treatment were included.

Study Variables

Socio-demographic variables, awareness towards comorbidity, treatment of NCDs and risk factors, and clinical variables (TB type, treatment initiation and health-seeking period). NCDs and risk factors include blood pressure status, glucose level status, physical inactivity, and nutritional status (fruit and vegetable variety status, abdominal obesity, BMI, smoking status and alcoholic intake).

Sample Size Determination and Procedure

For Quantitative

The required sample size was determined by using a single population proportion formula $(n) = [z^2 * p (1-p)]/w^2$ and considering a 95% confidence interval (CI) and 5% significance level. Due to the absence of similar research, we used

50% of the TB patients' comorbid with common NCDs. Based on these assumptions, the expected sample size was 403. By adding 10% of the total sample size for no response rate (NR) which was 40 participants, 443 TB patients were screened for common non-infectious diseases.

A single-stage cluster random sampling was used. Initially, the Hadiya Zone health facilities were identified as a sample cluster, based on both Non-communicable and Tuberculosis disease continuous detection, diagnosis and treatment services availability criteria. By using this eligibility criterion, three health centres, three general hospitals and one comprehensive referral hospital were study clusters. From an eligible health facility, all TB patients who started the treatment and enrolled on the DOT program were selected consecutively until the final sample size was adequate (Figure 1).

For Qualitative

Seven TB-NCD comorbid patients, four key informants and ten implementers (TB focal) were included with an intentional selection using a patient, caregiver, program manager, and/or coordinator intensity sampling technique. A purposive sampling technique was used to access people with a wealth of information to explore the full picture of the TB comorbid experience, the search for non-communicable co-morbidity cases, early integration, and management. These participants were selected on the basis that they represented those responsible for implementing the TB program and had relevant program and care information. An adequate sample was obtained with saturated information.

Health Sector Observation

All health facilities with resource availability for screening and diagnosing were selected purposely. We included all healthcare facilities to obtain comprehensive information on the barriers and facilitators of implementing TB and NCD screening intervention in routine tuberculosis care programs.

Data Collection Methods and Tools

For Quantitative

After the study cluster site and a total number of TB patients were identified, NCDs and risk factors were screened by the WHO Stepwise screening procedure. This tool was formerly validated and tested in different settings.^{33,34} The data were

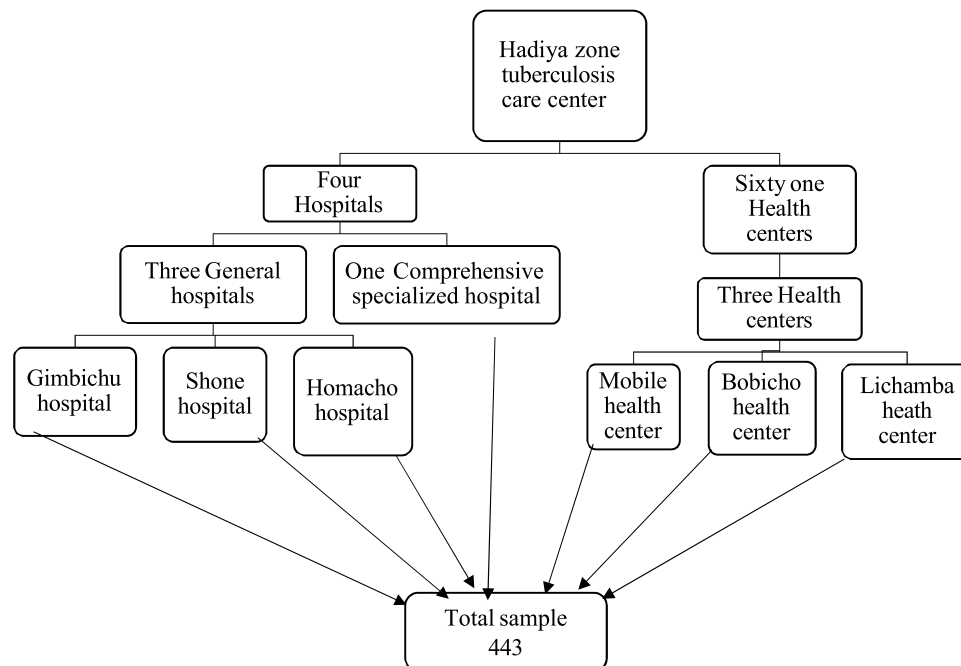


Figure 1 Cluster sampling schematic presentation of Hadiya Zone tuberculosis care center.

collected by applying the two-stage WHO Stepwise screening procedure, and in the first stage all study participants were screened for behavioural risk factors using Nine (9) scaling items with a score of 20. While the score was more than 8 of 20 total scores, the participants were moved to the second stage. In the second stage, biological risk factors were screened and when the participants had more than 12 scores in the two stages were linked to the chronic clinic for further investigations of diabetes mellitus. However, for those tuberculosis patients who scored less than or equal to 12, the awareness of NCD prevention and control was given. All physical assessments were conducted in a private area, and they measured and determined its cut-off points in a standardized manner. From each of seven health facilities purposely at least one senior TB focal, who had at least six months of work experience, was recruited and trained for five days on the study screening procedure before the commencement of the study, and they were allocated to the respective study site. The data were collected by structured questionnaire and validated tool ([Supply 1](#)) for three months from January 5, 2022, up to April 7, 2023.

Measurement

Common NCDs and risk factors are hypertension, diabetes mellitus, overweight/obese and smoking, inadequate physical exercise, fruit, and vegetable consumption and alcohol drinking.³⁶

Overweight and obesity, BMI, and waist circumference were measured by standard methods for National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) recommendations.³⁷ Adequate consumption of fruit and vegetable was measured by using the previous study standards.³⁸ Alcohol drinking, physical inactivity, and smoking were also assessed using the former study categorizations,³⁹ hypertension,⁴⁰ and DM.¹⁵

The principal investigators developed a training manual that includes profile criteria for data collectors, a team guide, training content, a training schedule, a description of the data collection tool, sampling procedure, ethical concerns, and practical exercise on 5% sampled retest.

For Qualitative

A principal investigator and research assistant collected the data from patients, implementer/TB focal persons, program managers, or coordinators using in-depth interview guidelines. In-depth interview data were collected using audio recordings and verbatim transcribing, and the summary of the interview was written following each interview in the last 60 to 90 minutes by using field notes. In addition to this, the observation checklist was used to assess the current situation of the study sites that challenged and facilitated the screening intervention ([Supply 2](#)).

Data Analysis

For Quantitative

The data were analyzed using STATA v.14. The descriptive statistics, the proportion, the average, and the mean were presented by tables and figures. The result of socio-economic variables, behavioural variables, and biomedical variables were identified for study participants.

For Qualitative

Before thematic analysis, we adapted the existing implementation framework categorization, and based on this frame, we developed new themes and codes. The data were analyzed from data collection through daily transcription and preliminary analysis. Data were analyzed from identification of analysis, and description of deviant outlines and extreme cases. The summary of the data was categorized into the outer context and inner context of integrated implementation challenges and opportunities and codebook was developed ([Supply 3](#)). Under the outer context main theme of challenges 3 subthemes and 7 codes and in the inner context's main theme of challenges 2 subthemes and 6 codes were developed. Correspondingly, intra-organization challenges under 2 main themes of opportunity outer and inner context, we created 4 subthemes and 8 codes from patients, key informants and implementer interview results, using an atlas.ti version 7.1 software.

Trustworthiness

We achieved the credibility of this study by contacting for a long time with study subjects and the program manager on tuberculosis and NCD services and data transcribed feedback and comments were used from participants, the dependability was assured by accurate documentation, editing grammar and spelling errors, and detailed descriptions were produced from participants. Data triangulation was performed within the transcribed interview and document observation. The whole data management and analysis were reserved by the researcher.

Result

Characteristics of Participants in the Implementation

In the pre-phase after eligible site selection (three health centres and four hospitals); 14 stakeholders were selected for partnership on implementation. Among the stakeholders, 10 (71.43%) implementers or TB focal were selected from respective health facilities, and training was given on the WHO-Stepwise screening procedure for five days. Among the total stakeholder, 8(57.14%), and 10 (71.43%) were aged <30 years and had >3 years of working experience, respectively. Of the total interviewed NCD –TB comorbid patients (7), 3 (42.86%) of them were in the 35–49 years age category, 3 (42.86%) were students, 4 (57.14%) were sex in female, 4 (57.14%) were EPTB, 4 (42.86%) of them were comorbid with NCDs, 4 (42.86%) were drink alcohol (Table 1).

In contrast to qualitative data, in the quantitative study among the total of 443 participants with a 100% response rate, 234 (52.82%) were male, 265 (59.82%) were found in the age range of 20–34, 214 (48.31%) were lived in rural, and

Table 1 Socio-Demographic Characteristics of Participants in Implementing NCD and Risk Factors Screening Intervention in Southern Ethiopia

Variable	Category	Frequency	Per cent
Sex (n=443)	Male	234	52.82%
	Female	209	47.18%
Educational status (n=443)	Not read or write	150	33.86%
	Primary school	170	38.37%
	Secondary school	69	15.58%
	College and above	54	12.19%
Occupation (n=443)	Governmental worker	37	8.35%
	Private government worker	52	11.74%
	Farmer	94	21.22%
	Student	122	27.54%
	Housewife	118	26.64%
	Self-employer	12	2.71%
	Other	8	1.81%
Residence (n=443)	Urban	203	45.82%
	Rural	214	48.31%
	Sub-city	26	5.87%

(Continued)

Table 1 (Continued).

Variable	Category	Frequency	Per cent
Marital status (n=443)	Single	151	34.09%
	Married	270	60.95%
	Divorced	7	1.58%
	Widowed	15	3.39%
Monthly income (n=443)	< 1000 Birr	236	53.27%
	1001–3000 Birr	132	29.80%
	> 3000 Birr	75	16.93%
Family size (n=443)	< 5 Family number	312	70.75%
	> 5 Family member	129	29.25%
Age in year (n=443)	20–34 Years	265	59.82%
	35–49 Years	100	22.57%
	>50 Years	78	17.61%
Religion (n=443)	Protestant	345	78.05%
	Orthodox	54	12.22%
	Muslim	40	9.05%
	Other	3	0.68%

almost half 236 (53.27%) had <1000 ETB (Ethiopian Birr). The majority 270 (60.95%) were married, and 122 (27.54%) in occupation were students (Table 2).

Two Stages NCDs and Risk Factors Screening Intervention on TB Patients

Out of 443 participants who were screened by using a two-stage WHO step-wise procedure, 53 (11.96%) had a score >8 and were recruited in stage two for screening. Among the total who were screened in the second stage (53), 17 (32.08%) had a score of more than 12, 16 (94.12%) were linked to NCDs clinics, and the majority (87.5%) started the treatment (Figure 2).

Challenges

The external determinants were addressed by assessing organizational need, program applicability, funding/supporting organization, institutional observation and site selection. The internal dimension of challenges was identified as the integration implementation barriers concerning health worker perspective, health system and intra-organizational communication. These were assessed by the research team during the exploration, preparation, implementation and sustainability phase after forming the partnership. The absence of medical equipment, shortage of skill and knowledge training, drug and lab tests were not free, absence of records, reports, feedback and referral system, and shortage of cooperative organization were external challenges for integrated implementation. Lack of internal linkage and referral, shortage of skilled focal persons, Absence of early detection and management, lack of skilled health professionals, and shortage of awareness creation were internal determinant factors of integrated implementation (Table 3).

This in-depth interview result was supported by an organizational observation report. We observed 7 (seven) implementation health facilities by using the standard observational checklist. The overall information described that all institutions as per national guidelines TB and NCD care programs were undergoing separately; however, for TB-NCD patients screening and management there were inadequate blood glucose and blood pressure diagnostic tools and

Table 2 Distribution of in-Depth Interview Participants in the Implementation of Non-Communicable Disease and Risk Factor Screening Intervention in Hadiya Zone, Southern Ethiopia

Variables	Category	Frequency	Percent
Implementation site	Urban	4	57.14%
	Rural	3	42.86%
Implementation facility (n=7)	Hospital	4	57.14%
	Health centre	3	42.86%
Sex of stakeholder r(n=14)	Male	7	50%
	Female	7	50%
Age of stakeholder (n=14)	< 30 years	8	57.14%
	>30years	6	42.86%
Years of work experience (n=14)	< 3 years	4	28.57%
	>3 years	10	71.43%
Type of stakeholder (n=14)	Manager	1	7.14%
	Coordinator	3	21.43%
	Tb focal/implementer	10	71.43%
Age of patients (n=7)	20–34	2	28.57%
	35–49	3	42.86%
	>50	2	28.57%
Sex of patients (n=7)	Male	3	42.86%
	Female	4	57.14%
Educational status (n=7)	Not read or write	1	14.29%
	Primary education	3	42.86%
	Secondary education	2	28.57%
	College and above	1	14.29%
Marital status (n=7)	Single	2	28.57%
	Married	4	57.14%
	Divorced	1	14.29%
Occupation (n=7)	Governmental	1	14.29%
	Private	1	14.29%
	Student	3	42.86%
	Housewife	2	28.57%
Tuberculosis category (n=7)	Pulmonary tuberculosis	3	42.86%
	Extra pulmonary tuberculosis	4	57.14%

(Continued)

Table 2 (Continued).

Variables	Category	Frequency	Percent
Types of comorbid non-communicable disease (n=7)	Diabetes mellitus	2	28.57%
	Hypertension	4	57.14%
	Heart disease/stroke	1	14.29%
	More than one comorbidity	3	42.86%
Types of comorbid risk factors (n=7)	Tobacco smoker	1	14.29%
	Not smoker	6	85.71%
	Alcohol use	3	42.86%
	Not drink alcohol	4	57.14%

health workers were not trained in non-communicable disease surveillance and new diagnostic algorithms. The patients did not have a flow system in the clinics. The system does not enable patient tracking and access to treatment. Screening is done only when non-communicable diseases are suspected in tuberculosis patients, not routinely. In OPD (outpatient department) triage in an institution, cough screening is done for tuberculosis. However, tuberculosis patients' non-communicable diseases comorbid is not known. Non-communicable diseases are not recorded as human immune deficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) in the registry of tuberculosis patients.

Similar to qualitative data, in the quantitative study among a total of 443 participants, the majority 290 (65.46%) had pulmonary tuberculosis 279 (62.98%) and 245 (55.30%) had health information knowledge of the common NCDs and risk factors, respectively. The majority of participants, 328 (74.04%) and 327 (73.81%), did not have awareness about stroke and COPD, respectively. Concerning the comorbidity, 287 (64.79%) and 248 (55.98) did not have awareness of tuberculosis comorbidity with NCDs and risk factors, correspondingly. The total mean time delay was 67.05, among this health-seeking delay (50.67 days), treatment initiation delay (16.38 days) (Table 4).

Main Theme I: External Factors

Under this theme, 3 subthemes were categorized into 7 codes of integrated implementation challenges.

Subtheme I: Service Environment

Code I: Absence of Medical Equipment

Almost all key informants reported that the absence of diagnostic materials for diabetes mellitus, high blood pressure Electro cardiogram (ECG), Computed Tomography (CT) Scans and Waist circumferences, shortage of skill and payment for drugs and laboratory services were major challenges for integration implementation of NCDs and risk factors screening intervention with TB care program.

A 33-year-old, female TB focal, said

It is feasible to perform this screening procedure because all screening procedures have been performed except continuous random blood sugar (RBS) and blood pressure (B/P) and waist circumference measurements. In addition to this, health professionals and patients are given prior awareness creation so that the work can be done more effectively and payment is free for RBS requests and medicines. And there is no problem with reception as HIV/AIDS

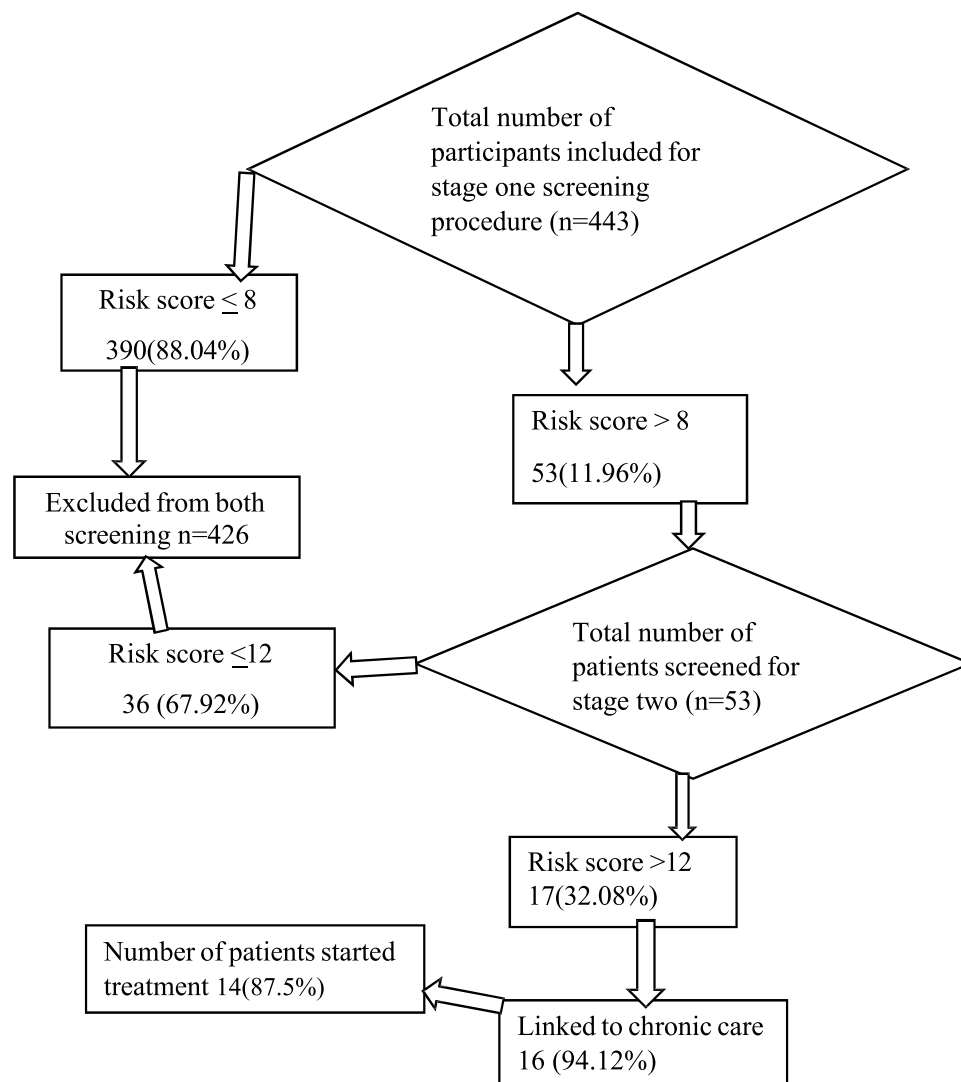


Figure 2 Classic flow chart diagram of the two stages of WHO step-wise NCDs and risk factors screening procedure from routine tuberculosis patients in Hadiya Zone, Southern Ethiopia.

Code 2: Shortage of Skill and Knowledge Training

A 42-year male key informant reported.

If an integrating system training is available simply we can detect the case and we can identify the missed diagnosis in one room. Because integration requires additional labour and skills unless we are unable to provide services to clients in a timely fashion

According to a report of 30-year-old male key informants,

There is screening, but it is not integrated, particularly tuberculosis screening in diabetic and hypertensive patients. Patient reports drive us towards diagnosis. Chronic disease screening is not currently applied in the community because healthcare workers are overworked and busy with separate report systems. The diagnosis of tuberculosis and chronic diseases is made after management and after the patient suffers from a disease or is not healed or after a complicated phase.

Code 3: Drugs and Laboratory Services Not Free

All respondents reported that the drug and laboratory services were not free for DM and Hypertension comorbid patients, however, the TB and HIV/AIDS services are cost-free.

Table 3 Description of Implementation Challenges Themes in Integration of NCD and Risk Factors Screening Intervention Among Routine Tuberculosis Patients

Main Theme	Sub-Themes	Codes
External factors	Service provision	Code 1: absence of medical equipment
		Code 2: absence of skill and knowledge training
		Code 3: Drugs and laboratory services not free
	Inter-organizational communication	Code 1: absence of feedback and referral system
		Code 2: lack of record and reporting system
	Consumer support organization	Code 1: lack of cooperative integration
		Code 2: shortage of supporting agencies
Internal factors	Intra-organizational communication system	Code 1: lack of linkage and referral system
		Code 2: shortage of skilled focal person
		Code 3: absence of early detection and management system
	Adopter character	Code 1: lack of trained health worker
		Code 2: Increased work load
		Code 3: Absence of awareness creation

Table 4 Distribution of Tuberculosis Patient's Awareness Towards Non-Communicable Disease and Risk Factor in Hadiya Zone, Southern Ethiopia

Variable	Category	Frequency	Percent
Tuberculosis types	Pulmonary tuberculosis	290	65.46%
	Extra-pulmonary tuberculosis	153	34.54%
The meantime of health-seeking delay mean=50.67 days, std. 3.15)	< 50.67 days	314	70.88%
	> 50.67 days	129	29.12%
The meantime of treatment initiation delay (mean=16.38 days, std. 2.52)	< 16.38 days	389	87.81%
	> 16.38 days	54	12.19%
Having awareness of common non-communicable disease	Yes	279	62.98%
	No	164	37.02%
Knowledge of hypertension	Yes	277	62.53%
	No	166	37.47%
Awareness of diabetes mellitus	Yes	256	57.79%
	No	187	42.21%
Awareness of stroke	Yes	115	25.96%
	No	328	74.04%
Knowledge of chronic obstructed pulmonary disease	Yes	116	26.19%
	No	327	73.81%

(Continued)

Table 4 (Continued).

Variable	Category	Frequency	Percent
Awareness of cancer	Yes	179	40.41%
	No	264	59.59%
Awareness of non-communicable disease risk factors	Yes	245	55.30%
	No	198	44.70%
Smoking is a risk for non-communicable disease	Yes	217	48.98%
	No	226	51.02%
Alcohol use is a risk for non-communicable disease	Yes	228	51.47%
	No	215	48.53%
Obesity is a risk for non-communicable disease	Yes	207	46.73%
	No	236	53.27%
Physical inactivity is a risk for non-communicable disease	Yes	200	45.15%
	No	243	54.85%
Malnutrition is a risk for non-communicable disease	Yes	176	39.73%
	No	267	60.27%
Family is a risk for non-communicable disease	Yes	109	24.60%
	No	334	75.40%
Do you know tuberculosis and non-communicable disease comorbidity?	Yes	156	35.21%
	No	287	64.79%
Do you know tuberculosis and risk factors comorbidity?	Yes	195	44.02%
	No	248	55.98%
Can we prevent non-communicable disease?	Yes	303	68.40%
	No	140	31.60%
Can we treat non-communicable disease?	Yes	307	69.30%
	No	136	30.70%

Abbreviation: std, standard deviation.

A 40-year male and six years of work experience was the key informant report.

Patients are delaying diagnosis and treatment due to unavailability of ECG and CT Scans for organ function testing and are simply referring to other hospitals for diagnosis. The price of a bottle of insulin is not possible to pay it for patients. Comorbid Patients are not screened for non-communicable diseases in routine tuberculosis care. So that the patients develop complication and die.

Sub-Theme 2: Inter-Organizational Environment

Code I: Absence of Feedback and Referral System

A 35-year female key informant report.

Tuberculosis information is provided to the community by a health extension worker through a reporting form. Tuberculosis data is reported by senior officials on a regular base, however, there is an interruption and weak supportive supervision with

feedback on diabetes mellitus and hypertension surveillance data. In our catchment, the new demography health information system (DHIS) report format talks about the screen and separately reports TB and NCDS, and this format did not indicate integration, specifically TB- NCD comorbidity status even if the guideline recommends reporting integrate.

Code 2: Lack of Record and Reporting System

Almost all key informants did not know whether TB patients are comorbid or not comorbid with diabetes mellitus and/or hypertension. Even their report did not mention the condition of comorbidity.

A 33-year-old female TB focal person and implementer reported that

...in Hosanna Town health centres there is no internal referral system, linkage and focal person communication, in addition to this medical equipment's shortage like B/P, RBS kit are the main obstacle for service provision. I think these problems can be solved if and only if the routine data collection or surveying and report mechanism developed on patients registration format

Sub-Theme 3: Consumer Support Organization

Code 1: Lack of Cooperative Integration

39-year male participants said that

index TB searching or contact TB address support organizations are challenge TB program and Rich TB program. For NCDs family health programs on key affected populations, especially pregnant women, prisoners and migrants at the community level with the cooperation of health extension workers (HEWs), however, these organizations are not focused on an integrational report system, so any supporting organization has a plan to integrate the two disease can be sustained by giving training for lab technician, health informatics technology (HIT) and TB focal and NCD focal person through patient and community awareness creation a developing communication system

Code 2: Shortage of Supporting Organization

A 33-year-old, male program manager said

This integration will reduce costs because when the patients seek treatment for TB screening, the provision of care for both diseases simultaneously minimizes the transport cost and the follow-up time or schedule. Also, it reduces the health professional working load and the service provision time by examining NCDs and infectious diseases at the same time on a single patient in a single contact at outpatient department triage. Although the drug is expensive and not free, we have established community health care insurance in our area so that the needy have access to services. Another thing is that by establishing an association for diabetes patients, we have prepared an ID so that they can get a drug for free, but this association is limited only in Hospital.

Main Theme 2: Internal Factors

Below this theme, 2 sub-themes were categorized into 6 codes for integrated intervention challenges.

Sub-Theme 1: Intra-Organizational Environment

Code 1: Lack of Linkage and Referral System

A 35 years male and 3 year-experienced respondent said

Normally, tuberculosis, diabetes mellitus, and hypertension are diagnosed based on the standard guideline, but diagnosis of chronic disease is not feasible for patients. Because of the unavailability of the system just like tuberculosis, the patient reappears to the outpatient service for perverted card access.

A 33-year-old male program manager said

We can integrate and create sustainable solutions by being programmatic, If we create awareness among all stakeholders, designate a service department, assign a qualified focal person, and develop a monitoring and evaluation system, we can easily integrate it. If we create awareness of HEWs, if there is an internal referral system, by linking it to the health facility, and also

by establishing an internal referral system for the screen from where we provide OPD services in the health facility, and by screening at the triage, we will be able to be treated in one place.

Code 2: Shortage of Skilled Focal Person

A male 30-year disease prevention and health promotion coordinator reported

If this integration work is to be accepted, it is necessary to have full training and to be assigned to a qualified trained health professional. For example, we have assigned all focal person medical doctors at our health centre to increase the service and the needs of the patients. Because patients always have the intention of choosing and respecting the assigned professional to get services. Therefore, making a better professional classification as a focal person brings acceptance. Community acceptance can be achieved by creating community awareness, Community cooperation and multidisciplinary health team formulation

Code 3: Absence of Early Detection and Management System

One of the respondents explained his feelings:

Because of my kidney problem, the healthcare worker could check for only diabetes and hypertension, it was negative at the time. Meanwhile, none of the health care workers (HCWs) verified, not even considering incorporating TB testing and management. However, currently, I am positive for tuberculosis. If I was screened early for TB, I did not suffer or delay treatment.

The 45-year-old TB heart failure comorbid patient responded

The first time my complaint was weight loss, coughing with hemoptysis, the doctor confirmed TB and I began treatment. After a week, I returned to the hospital due to serious symptoms, and I was admitted for heart failure). I continue treatment for tuberculosis and heart failure. Due to gastritis and blurred vision caused by medications, I stopped treatment after five months, but the severity of my case increased on a day-to-day basis. Finally, I went to the hospital a third time, Healthcare workers advised me to continue treatment, and my small child has also been confirmed for TB.

Sub-Theme 2: Adopter Character

Code 1: Lack of Trained Health Worker

One of the stakeholders, whose age is 37 years male program coordinator, said

Integration can be effective and safe because both diseases are recognized in one place by trained professionals in one evidence-based system. For example, this is the result we saw in TB/HIV integration. In addition, by assigning a trained professional as a focal person for both programs, quality will be improved if there is consensus among experts. If this integration is done as a professional job and if patients are made aware of it, appointment and follow-up time will be reduced and service satisfaction will increase. Providing training for HCWs and their commitment can bring the patients' treatment success and the program effectiveness

Code 2. Increase Workload

A 29-year-old male TB focal and implementer reported that "this integration intervention can increase the quality of service by reducing follow-up time, the workload of health workers and poor treatment outcomes because the TB-NCD patients screened and treated in one contact and professionals use their time effectively. However, the HCWs believe this intervention increases the workload because there is no awareness and training.

Code 3: Absence of Awareness Creation

A 38-year TB officer said

Even if integration maximizes the service quality, there is no community, patients and HCWs awareness on TB-NCD integration so it better to provide service, program and quality improve training for HCWs and awareness creations for patients and community. And even assigned TB and NCD focal persons are not aware to communicate the work and integrate the report.

Opportunity

We assessed the current available external and internal factors using in-depth interview guidelines from stakeholders, implementers and TB patients, which focused on the facilitator of the integrated implementation of non-communicable disease screening intervention. While the presence of health extension workers, Nongovernmental organizations (NGOs) and supporting organizations like community health care insurance and diabetes mellitus association at the community level were external opportunities, the presence of compatible tuberculosis program structure, trained focal person, guidelines, and information for each program was an internal opportunity for integrated implementation (Table 5).

Main Theme I: External

Under this theme, 2 sub-themes were coded into 4 codes for integrated implementation opportunities.

Sub-Theme I: Community Health System

Code 1: Availability of NGOs

A 39-year-old male participant said

In our site, there is no institutional organization for integration in the community. But there have been TB and NCD differences, for example for index TB searching or contact TB there are challenge TB programs and Rich TB programs. For NCDs family health programs for key affected populations, especially pregnant women, prisoners and migrants at the community level with the cooperation of HEWs.

Code 2: Presence of Health Extension Program

One participant said,

HEW guided me on screening Diabetes mellitus after I increased body weight when I was on Tuberculosis treatment. Then, I went to the hospital for a diagnosis of DM, and at that time my glucose level was increased. Currently, I am on both disease treatments. However, using both diseases drug at the same time is difficult for continuing and completing unless and otherwise minimizing the drug

Sub-Theme 2: The Presence of Consumer Support Organization

Code 2: Association for Diabetes Mellitus

A 30-year male disease prevention and health promotion coordinator said

Table 5 Description of Implementation Opportunity Themes in Integration of NCD and Risk Factors Screening Intervention Among Routine Tuberculosis Patients

Main Theme	Sub-Theme	Code
External factors	Community Health system	Code 1: Presence of health extension program
		Code 2: availability of NGOs
	Presence of Consumer support organization	Code 1: community health care insurance
		Code 2: association for diabetes mellitus
Internal factors	Availability of man power	Code 1: Assigned focal persons
		Code 2: trained stakeholder
	Readiness of organization	Code 1: availability of guidelines and information system
		Code 2: compatible tuberculosis program structure

Basically in health institutions, there is no free drug for NCD patients, however in our health facilities especially in Hospitals for DM and other NCDs we established the DM association. Based on this association any patients who have identification numbers and are registered in the list of members he/she can get drugs or other services for free charge. And it is better to extend these experiences to community and health centres to access for all.

Code 2: Community Health Care Insurance

All key informants reported that currently community health care insurance program was available for all poor rural people and for all people willing to register in the system to get free health services. However, all members, who are linked to the program would have a small money contribution every year.

A 30-year-old male key informant said that

...especially chronic non-communicable disease patients unless they are not a member of community health insurance initiatives, they cannot get free treatment services. However, tuberculosis and cervical cancer patients took service free of charge

Main Theme 2: Internal Factors

During internal factors of opportunity identification, we assessed the favourable system and organization's capacity to facilitate implementation and deliver the screening intervention for mutual self-interests, and building relationships. Under this theme, 2 sub-themes were coded into 4 codes for integrated intervention opportunities.

Subtheme 1: Availability of Manpower

Code 1: Assigned Focal Persons

One of the stakeholders, whose age is 37 years male program coordinator, said

Integration can be effective and safe because both diseases are recognized in one place by trained professionals in one evidence-based system. For example, this is the result we saw in TB/HIV integration. In addition, by assigning a trained professional as a focal person for both programs, quality will be improved if there is consensus among experts. If this integration is done as a professional job and if patients are made aware of it, appointment and follow-up time will be reduced and service satisfaction will increase. Providing training for HCWs and their commitment can bring the patients' treatment success and the program effectiveness

A male, 30 years disease prevention and health promotion coordinator, said about community, patients and HCW acceptance

If this integration work is to be accepted, it is necessary to have full training and to be assigned to a qualified trained health professional. For example, we have assigned all focal person medical doctors at our health centre to increase the service and the needs of the patients. Because patients always have the intention of choosing and respecting the assigned professional to get services. Therefore, making a better professional classification as a focal person brings acceptance. Community acceptance can be achieved by creating community awareness, Community cooperation and multidisciplinary health team formulation.

Code 2: Trained Stakeholders

A female 28 years TB officer said

This integration is a new initiative in our organization and there is adequate manpower and trained stakeholders in the community to screen TB from NCD patients and NCD from TB patients on key affected populations (prisoners and migrants), however in routine TB patients no integration. Now these trained stakeholders had planned to give community awareness and cooperate the work as a new initiative, integration is still a work in progress. A chronic disease-focal person has been assigned to the startup to work on these diseases

Sub-Theme 2: Readiness of Organization

Code 1: The Presence of Guidelines and Information System

One of the implementers whose age is 28 years female participants said on Facilitator and Opportunity for integration

Now there is no shortage of professionals in our institution, but if we create awareness and prepare them to work with information communication, training and skills, the integration will be successful. We do have NCD and TB integration guidelines and DHIS even if it has no integration system at the organizational and community level.

Code 2: Compatible Tuberculosis Program Structure

A 28 year, female TB focal said,

This work of integration strengthens the work of TB, not replaces it, because it is compatible with TB's structure and functionality. In addition, in my institution, there is no refusal, while I implement this screening intervention.

A 35 year, male TB focal implementer said

WHO-Stepwise screening intervention for integration is very useful and it is practical, problem-solving and suitable for timely screening and treatment without other related problems. It is feasible for me to put it into practice and it meets my approval because TB disease is susceptible to NCD and NCD disease is susceptible to TB, We screen both at one place and at one time, it will be more effective.

Prevalence of Risk Factors in Tuberculosis Patients

Among the total (443) screened by the WHO Stepwise screening procedure, the prevalence of smokers was 39 (8.80%), and we are 95% confident the true population prevalence will fall between 6.5% and 11.8%. Concerning alcohol use, 47 (10.61%) were alcohol drinkers, and the true population prevalence will fall within a 95% confidence interval of 8.1% and 13.9%. The majority of participants consumed fruit less than five times in a week 391 (88.26%), 95% CI [0.849, 0.910] and less than 3 vegetables in a day 368 (83.07%), 95% CI [0.793, 0.863] (Table 6).

Table 6 Prevalence of Risk Factors Among Routine Tuberculosis Patients, in Southern Ethiopia

Variable (n=443)	Category	Frequency	Per Cent	[95%, CI]
Age in year	20–34	265	59.82%	[0.552, 0.643]
	35–49	100	22.57%	[0.189, 0.267]
	>50	78	17.61%	[0.143, 0.215]
Smoking	Yes	39	8.80%	[0.065, 0.118]
	No	404	91.20%	[0.882, 0.935]
Alcohol consumption	Yes	47	10.61%	[0.081, 0.139]
	No	396	89.39%	[0.861, 0.919]
Physical activity per day	<10 minutes	38	8.58%	[0.063, 0.116]
	> 10 minutes	405	91.42%	[0.884, 0.937]
Fruit consumption in a week	< 5 times	391	88.26%	[0.849, 0.910]
	>5 times	52	11.74%	[0.090, 0.151]

(Continued)

Table 6 (Continued).

Variable (n=443)	Category	Frequency	Per Cent	[95%, CI]
Vegetable consumption in a day	< 3 services	368	83.07%	[0.793, 0.863]
	> 3 services	75	16.93%	[0.137, 0.207]
BMI	< 23	330	74.49%	[0.702, 0.783]
	23–24.9	70	15.80%	[0.127, 0.195]
	> 25	43	9.71%	[0.073, 0.128]
Waist circumference in centimetres	<72 female/78male	298	67.27%	[0.627, 0.715]
	72–79 female/78-89male	126	28.44%	[0.244, 0.328]
	>80femal/90male	19	4.29%	[0.027, 0.066]
History of non-communicable disease in the family	Yes	44	9.93%	[0.075, 0.131]
	No	399	90.07%	[0.869, 0.925]

Abbreviation: CI, confidence interval.

Prevalence of Common NCDs in Tuberculosis Patients

From the total participants (443), the prevalence of TB-NCDs comorbidity status, 32 (7.22%), 95% CI [0.051, 0.101], and 22 (4.97%), 95% CI [0.033, 0.074] tuberculosis patients comorbid with one NCDs and >2 NCDs, respectively. The prevalence of DM was 25 (5.64%), and we are 95% confident that the true population prevalence will be within 3.8% and 8.2% intervals. Similarly, hypertension in tuberculosis patients was 29 (6.55%), which is the population prevalence that will lie between 4.6% and 9.3% intervals, at 95% confidence (Table 7).

The contradiction with the qualitative result is because of the difference in the selected patients and the number of study populations. Among seven (7) TB-NCD patients interviewed 3 (42.86%) were comorbid >2 NCDs, the majority had hypertension 4 (57.14%), 3 (42.86%) were drinking alcohol (Table 1).

Table 7 Prevalence of Common NCDs Among Routine Tuberculosis Patients, in Southern Ethiopia

Variable	Category	Frequency	Per Cent	[95%, CI]
Diabetes mellitus	Yes	25	5.64%	[0.038, 0.082]
	No	418	94.36%	[0.918, 0.962]
Hypertension	Yes	29	6.55%	[0.046, 0.093]
	No	414	93.45%	[0.907, 0.954]
Stroke	Yes	5	1.13%	[0.005, 0.027]
	No	438	98.87%	[0.973, 0.995]
Heart disease	Yes	6	1.35%	[0.006, 0.030]
	No	437	98.65%	[0.970, 0.994]
Cancer	Yes	4	0.90%	[0.003, 0.024]
	No	439	99.10%	[0.976, 0.997]

(Continued)

Table 7 (Continued).

Variable	Category	Frequency	Per Cent	[95%, CI]
COPD	Yes	8	1.81%	[0.009, 0.036]
	No	435	98.19%	[0.964, 0.991]
1st stage risk score	<8 score	393	88.71%	[0.854, 0.914]
	> 8 score	50	11.29%	[0.086, 0.146]
2nd stage risk score	< 12 score	430	97.07%	[0.950, 0.983]
	> 12 score	13	2.93%	[0.017, 0.050]
TB-NCD comorbidity status	Not comorbid	389	87.81%	[0.844, 0.906]
	One comorbid	32	7.22%	[0.051, 0.101]
	Multi-comorbidity	22	4.97%	[0.033, 0.074]

Abbreviation: CI, confidence interval.

Discussion

This study revealed mixed quantitative and qualitative findings on the integrated implementation challenges and opportunities of non-communicable disease and risk factors screening intervention on tuberculosis patients.

Our study results showed that out of the total screened, 11.96% had a risk score of more than 8 of which, 32.08% had a risk score of more than 12, 94.12% had linked to NCDs clinics, and the majority (87.5%) had started the treatment. This result is higher and contradicts the study conducted in Delhi, India, where 82% reached the clinic and 83% started the treatment.¹⁵ This might be, because of the variation in the implantation site and the number of the study population: in India 403 sample sizes and two DOT centres, but in our study 443 sample sizes and seven DOT centers.

In this study, the comorbidity status of one NCD with TB was 7.22%, and with at least two NCDs being 4.97%. This prevalence is less than in South Africa (26.9%),¹⁷ Indonesia (35.5%)⁴¹ and the Philippines (40%)⁴². This contradiction might be due to a sample size difference, our study sample size is 443, but the South Africa sample size is 4207, and because of non-communicable diseases comorbidity assessment method variation.

In the current study, the prevalence of diabetes mellitus and elevated blood pressure among tuberculosis patients were 5.64% and 6.55%, respectively. This finding is varied from those studies conducted in India,¹⁵ where the hypertension prevalence is 7% and 8% for DM and lower than Amhara, Ethiopia (8.3%),¹⁸ Nigeria (12%).⁴³ The variation might be because of different study populations and sample sizes, in Nigeria 4000 persons aged above 12 years were included. However, it is similar to the study conducted in Luanda, Angola (44), where the diabetes mellitus prevalence among tuberculosis patients is 6%, this might be due to having a similar number of DOT centres and an equal sample size.

In a study in Luanda, Angola, the prevalence of hypertension among newly diagnosed TB patients was 19.6%⁴⁴ and in Northern Angola was 23%,⁴⁵ it contradicts our finding and might be different in the study design (community-based) and large sample size (1464 adults).

Our study showed that the prevalence of TB-NCDs risk factors, smokers 8.80%, alcohol drinkers 10.61%, consuming inadequate fruit (88.26%), and vegetables (83.07%) and BMI > 25⁺/obesity (9.71%), were lower and contradicted with other setting studies. In Semnan City, cigarette smokers were 16.9%, and consumed alcohol was 1.3%,⁴⁶ in Nepal tobacco was 23.7%, alcohol 19.1%, obesity 24.8%,⁴⁷ and in Delhi, India, inadequate vegetables (80%) and fruits (72%).¹⁵ This variation might be due to the difference in risk measurement techniques, follow-up time and enrollment of TB patients for the study, and other studies enroll new TB patients from outpatient departments, but for our study, we selected TB patients from routine care.

In our study site, almost all key informants and patients reported that the absence of diagnostic materials for diabetes mellitus, blood pressure, and ECG and CT scans for organ function tests and Waist circumferences measurements,

shortages of skill and payment for drugs and laboratory service were major challenges for integration implementation of NCDs and risk factors screening intervention with TB care program. The finding is supported by the former different areas of research report on barriers to integration.^{48–58} Similar to our country (Ethiopia), the Amhara region studied on challenges of integration TB NCDs,⁵⁹ and the major barriers to the implementation of the bidirectional screening pilot study in Delhi, India.¹⁵

In our study site, when we assessed inter-organization challenges of integrated implementation, absence of a record, feedback, referral, and reporting system, lack of cooperative integration, and shortage of supporting organization were repeatedly raised by our participants. This impression which was reported by our participants contradicted the integration health care program requirement at different levels of the healthcare system,^{60,61} however, it is similar to a pilot study conducted in China and India.^{62,63}

Lack of linkage and internal referral system, shortage of skilled focal persons absence of early detection and management system were highly suggested intra-organization challenges of integrated implementation of the screening intervention by program managers and coordinators in our study sites. This finding is supported by Northern Ethiopia and Addis Ababa report; the absence of monitoring and evaluation systems for NCD services, lack of professionals and blood glucose monitoring were observed as barriers to DM care.^{64,65}

Additionally, when we saw the adopter perception about integrated implementation lack of trained professionals, absence of awareness creation and increased workload were commonly raised challenges of integration intervention of non-communicable disease from tuberculosis patients. This result is well suited with the other studies' reports for most integration efforts, a broader set of clinical skills may be required, and training in healthcare workers is an important facilitator to increase consciousness of the worth of integrating specific programs, and for building working proficiency, self-confidence, and working drive.^{21–23}

Despite the identified challenges, this study showed a good opportunity to implement the integration of the NCDs and risk factors with tuberculosis care.

When we evaluated the opportunity for facilitating the integrated implementation of NCDs and risk factors screening intervention on TB patients, the external opportunity in the community health system was the availability of NGOs and consumer support organizations like Health Care Insurance Agencies and DM associations for NCD patients to have free drugs and lab test, which undergo with health extension program to support tuberculosis care program. This finding is supported by the Southern Amhara region study,⁵⁹ and a systematic review study in sub-Saharan Africa.⁶⁶

Based on our key informants and patients interviewed report, drug expensiveness and NCD care cost is not free were serious concerns raised by all participants. This result is similar to developing country studies and systematic review studies in sub-Saharan Africa.^{66,67}

In the current study, the internal opportunity related to manpower and readiness of the organization to facilitate the integrated implementation of NCDs and risk factors screening intervention with TB patients were the availability of assigned focal persons, trained stakeholders, guidelines, DHIS and the compatible program implementation structure. This is similar to the global TB report³ and quality for integration achievement study,⁶⁰ however, it varies with the studies conducted in different cities of Ethiopia and low-income country studies.^{68,69}

Limitation

Our strong side is we used both quantitative and qualitative methods, and we collected data by standard measurements tool prospectively through interviewing and screening TB patients for non-communicable diseases, so that the validity of data is more than the record-based data. However, the only weak side is that we included only routine TB patients in the DOTs centre for screening TB patients. Suspected TB in the outpatient department was not included, those representing the community population and we screened most risk factors by self-report, which might introduce biases.

Conclusion

In general, the findings of this study revealed that the majority of participants did not have an awareness of comorbidity NCDs and risk factors. The prevalence of hypertension, DM, smoking and alcohol drinking, obesity, and inadequate fruit and vegetable consumption among TB patients were lower than in other previous studies.

We identified external and internal health organization challenges and opportunities that should be used to implement the two stages of WHO-Stepwise screening intervention in routine tuberculosis care program.

Under the external health system service provision absence of medical equipment and training and not free drug and lab tests were repetitively reported challenges of integrated implementation of NCDs screening intervention. Lack of records, reports and feedback were major challenges of inter-organizational communication, while consumer support organization challenges were lack of cooperative integration and shortages of supporting organization. The internal health system challenges were categorized under the intra-organizational communication system were a lack of an internal referral and linkage system, a shortage of skilled persons and an absence of an integrated screening and management system for TB-NCD. Lack of trained health workers, awareness creation and perceived increased workload were adopted challenges for integrated implementation.

On the other hand, organization readiness and the existence of strong TB control programs at the community level, which were supported by different NGOs and functioning by health extension workers, and the presence of consumer support organizations like health care insurance and diabetes mellitus association, presence of assigned focal person and trained stakeholder were identified as good opportunities for integrated implementation of NCDs screening intervention from TB.

Therefore, to operationalize systematically integrated screening intervention, the implementer should assign a focal person, train healthcare workers and develop internal and external referral systems through communication and coordinating the work. The policymakers should develop an integration platform and structural authority at a different organization by addressing identified challenges and applying facilitators to build a favourable system for integrated implementation of NCDs and risk factors screening intervention on TB program.

Abbreviations

NCDs, non-communicable diseases, TB, tuberculosis, DM, diabetes mellitus, CVD, Cardiovascular disease, COPD, chronic obstructive pulmonary disease, HMIS health management information system, ETB, Ethiopian birr, WHO, World health organizations, HCW, health care worker, LMIC, low and middle-income country.

Data Sharing Statement

Datasets which support this finding can be accessed based on reasonable justification from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Ethics Approval and Consent to Participate

Ethical principles related to protecting human subjects in research were followed as outlined in the Declaration of Helsinki. Before the study was conducted, Wolaita Sodo University's ethical review committee approved the study protocol (with approval number: Ref. no WSU/41/33/1356). Using this approved letter the research team communicated with the study site administration Hadiya Zone office to secure permission before starting the data collection. Informed written voluntary consent, which was accepted and approved by the Ethics Committee, was obtained from the participants after securing the confidentiality and rights of participants.

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Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, analysis and interpretation of data; or in all these areas; took part in drafting the article or revising it critically for important intellectual content; agreed

to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work.

Disclosure

The authors declared that they have no competing interests in this work.

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