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Research Article

Research Article

Health system capacity for tuberculosis care in Ethiopia: evidence from national representative survey

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Abstract

Objective: The objective of this study was to evaluate the tuberculosis (TB) health system capacity and its variations by location and types of health facilities in Ethiopia.
Design: We used the Service Provision Assessment plus (SPA+) survey data that were collected in 2014 in all hospitals and randomly selected health centers and private facilities in all regions of Ethiopia. We assessed structural, process and overall health system capacity based on the Donabedian quality of care model. Multiple linear regression and spatial analysis were done to assess TB capacity score variation across regions.
Setting: The study included 873 public and private health facilities all over Ethiopia.
Participants: None.
Intervention(s): None.
Main outcome measure(s): None.
Results: A total of 873 health facilities were included in the analysis. The overall TB care capacity score was 76.7%, 55.9% and 37.8% in public hospitals, health centers and private facilities, respectively. The health system capacity score for TB was higher in the urban (60.4%) facilities compared to that of the rural (50.0%) facilities ($\beta = 8.0$, 95% CI: 4.4, 11.6). Health centers ($\beta = -16.2$, 95% CI: −20.0, −12.3) and private health facilities ($\beta = -38.3$, 95% CI: −42.4, −35.1) had lower TB care capacity score than hospitals. Overall TB care capacity score were lower in Western and Southwestern Ethiopia and in Benishangul-Gumuz and Gambella regions.
Conclusions: The health system capacity score for TB care in Ethiopia varied across regions. Health system capacity improvement interventions should focus on the private sectors and health facilities in the rural and remote areas to ensure equity and improve quality of care.

Key words: health system capacity, spatial variation, tuberculosis, Ethiopia

Introduction

Tuberculosis (TB) remains one of the top infectious killers worldwide despite considerable investment and interventions over the past two decades. The United Nations Sustainable Development Goals (SDGs) are aimed at reducing TB mortality and incidence rates by 90% and 80%, respectively by 2030 [1, 2]. Health system capacity and quality of TB care are vital to achieve the SDGs and the End TB Strategy of reducing TB deaths by 75% and TB incidence rate by 50% in 2025 [3].

Ethiopia is one of the 22 high-burden countries for the burden of TB despite over a decade of interventions through the directly observed treatment, short course (DOTS) [4]. The DOTS program is an internationally recommended strategy to control TB particularly in low-income countries including Ethiopia. It focuses on five components including political commitment, high-quality sputum-smear microscopy, short course anti-TB treatment under direct and supportive observation (DOT) and uninterrupted high-quality anti-TB drugs and standardized reporting. In 2015, there were 201 914 estimated new TB cases (all forms) with a case detection rate of 92.1% and a cure rate of 77.9% from bacteriologically confirmed TB [5]. The Health Sector Transformation Plan (HSTP) of Ethiopia (2016–2020) includes high quality of care and improves health system capacity as part of its major pillars to reduce the burden of major public health problems including TB [3].

Recently, there is a global focus to improve quality of care and health system capacity to achieve the SDG goals. The Lancet Global Health Commission on High-Quality Health Systems in the SDG Era (HQSS Commission) has emphasized that coverage and access will not be sufficient to achieve the SDG Goals unless the health system provides high quality of care [6, 7]. In Ethiopia, there is paucity of studies on the health system capacity for TB care. Most of the literature in TB quality of care in different parts of the world focused on few dimensions of quality such as diagnosis delay or providers' knowledge in limited geographic areas [6, 8]. Similarly, the available studies in Ethiopia are limited to small geographic areas and focused on either hospitals or health centers [9, 10]. A study in Addis Ababa showed that 67% of TB clients were satisfied with the DOTS, and factors contributing to satisfaction included timely availability of health care providers, DOTS service delivery process and general condition of health care facilities [10]. Mesfin and colleagues reported that TB treatment interruption and defaulting were associated with lack of training of personnel and supportive supervision from the district [10].

The present study evaluated the structural, process and overall health system capacity for TB care nationally. Additionally, the study assessed the determinant factors of TB health system capacity and mapped the spatial variation in TB quality of care by zones in Ethiopia.

Methods

Study settings

The study used data collected by the Service Provision Assessment plus (SPA+) survey that were conducted in 2014 in all the nine regional states of Ethiopia: Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, SNNPR, Gambella, Harari and two city administrations, Addis Ababa and Dire Dawa [11]. The health system of Ethiopia is structured in a way that primary health care units (comprised of a health center and approximately five satellite health posts) and hospitals are linked each other to provide basic and advance level services for infectious diseases including TB [9]. All hospitals and health centers in Ethiopia provide basic laboratory services such as sputum examination and X-ray to diagnose TB [12]. TB culture is available in referral hospitals in Addis Ababa and other major cities [12]. The DOTS strategy is implemented at hospitals, health centers and some private hospitals as part of public–private partnership [13]. Regional and district health offices conduct fortnight, monthly and quarterly supportive supervision to each facilities that provide TB services.

Study design and sampling procedures

The SPA+ was a facility-based cross-sectional survey aimed to assess the quality of care of diseases of public health importance including TB, malaria, diarrheal diseases, pneumonia, HIV and non-communicable diseases. The detail SPA+ methodology is published elsewhere [14]. In brief, a combination of census and multistage sampling techniques were used to selected health facilities in all regions of Ethiopia. First, the list of all health facilities (hospitals, health centers, health posts and private clinics) was obtained from the Federal Ministry of Health. Second, all facilities in the country were assigned to a stratum according to their type (private vs. public) and level of health services (health centers or hospitals). Finally, health facilities were selected randomly from each stratum. The SPA+ survey included a total of 1327 health facilities (223 hospitals, 298 health centers, 321 health posts and 485 private facilities) in all regions of Ethiopia [15]. Among all the facilities that were included in the SPA+ survey, 873 of them (292 health centers, 214 hospitals and 367 private facilities) provided TB services. For the present study, we included all facilities that provided TB services. We excluded health posts, pharmacies and individual doctors' offices since they did not provide TB-related services.

Data collection procedures

The data were collected by trained nurses, midwives and doctors using structured questionnaires adopted from the Demographic and Health Survey and Service Delivery Indicator (SDI) tools [1]. The data collection instruments comprised of pretested facility inventory and health provider questionnaires. Facility inventory questionnaires and observation checklist were to assess several issues including the structural aspects of the facilities, presence of clinical and laboratory services and guidelines and availability of essential supplies and drugs. The health provider questionnaire was administered to 6125 health workers to assess training status, knowledge and skills toward TB.

Data processing and analysis

Capacity of health facilities was assessed using structural, process and overall indicators based on the Donabedian quality of care mode. Donabedian quality of care model has structure, process and outcome dimensions [16, 17]. The outcome indicators such as client satisfaction or mortality were not included in this study. We included five structural and eight process indicators (Fig. 1). A score of 1 (presence) or 0 (absence) was given for each indicator. Scores of structural, process and the overall capacity score were constructed by taking the average of the indicators rescaled to 100. The level of clinical knowledge of health care providers was one of the measures of process indicator of capacity score. A vignette/case was presented to service providers to evaluate their clinical knowledge related to the symptoms, diagnosis and treatment of TB. The overall clinical

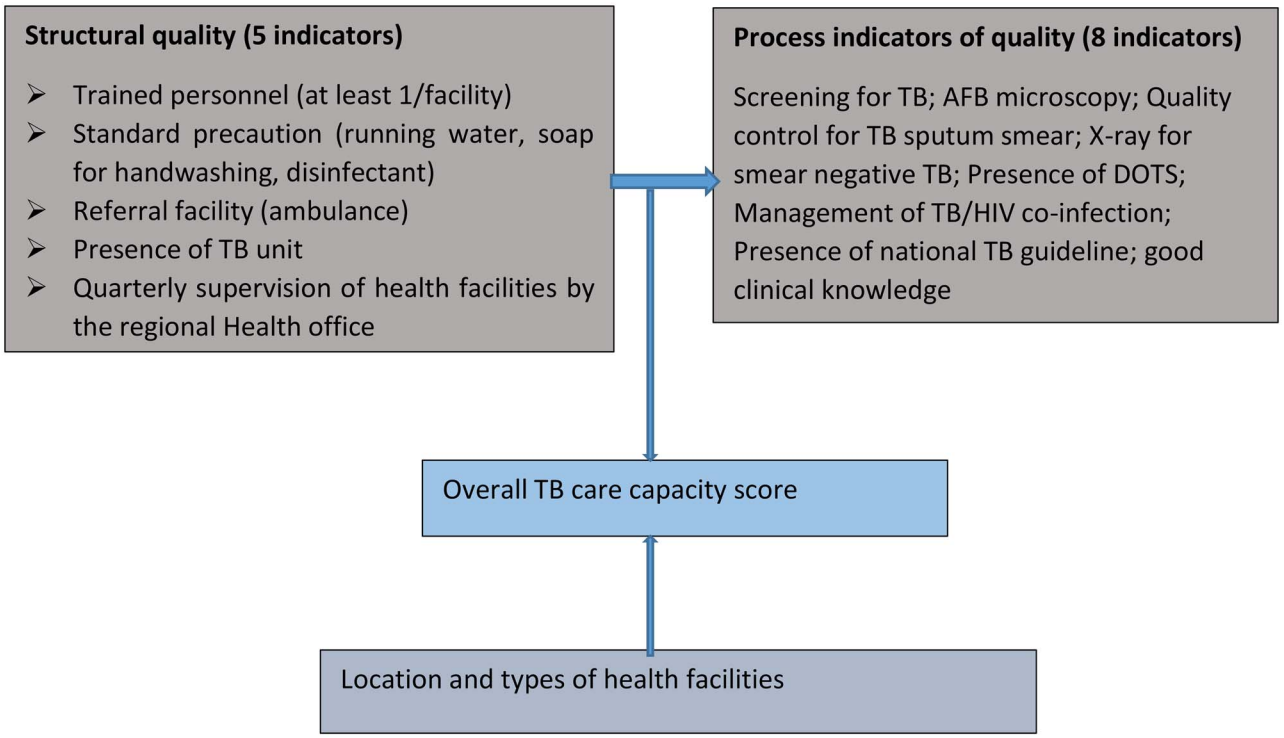

Figure 1 Conceptual framework that shows factors associated with overall TB quality care index.

knowledge of health workers was assessed using 48-item questionnaire. Correct answers were given a score of 1 and incorrect answers were given a score of 0. Facilities with at least one staff with above-average clinical knowledge score of 24 was considered as having staff with good clinical knowledge. In this paper, we prefer to use health system capacity assessment (capacity score) rather than quality of care since we did not assess the detail quality of care during the service provision. The capacity score for each component of TB care such as management of TB/HIV co-infection and drug-resistant TB was not observed.

We used unweighted descriptive and bivariate analysis. Multiple linear regression was done using Stata 14 to assess the association of the location and types of health facilities with overall capacity score:

$$Y_i = \alpha + \beta_1 X_1 + \cdots + \beta_p X_p + \varepsilon_i.$$

where Y is the capacity score and X_s are proposed predictor variables dummies such as residence, region and facility type. The capacity score index was a continuous outcome variable that fulfilled the normality assumption. The major independent variables included types of health facility, regions and location of health facilities (urban vs. rural). Bivariate analysis was done to see the association between each independent variable with the outcome variable. Variable that showed significant association with the outcome variable ($P < 0.05$) was included in the final model using stepwise multiple linear regression.

Coordinates of all public (hospitals and health centers) and private (hospitals) health facilities in all zones were obtained from the SPA+ survey. Maps displaying the average structural, process and overall capacity score at Zonal level were produced using ArcGIS Desktop v10.3.

Ethical consideration

The ethical committee of the Ethiopian Public Health Institute approved the study. Informed consent was obtained from the study institutions and individuals. We used summary data without individual identifiers to ensure confidentiality. We followed the international standard of strengthening the reporting of observational studies in epidemiology (STROBE) [1].

Results

Overall 873 health facilities were included in the analysis. At the time of the survey, TB screening, TB diagnosis and treatment and management of multidrug-resistant TB (MDRTB) were conducted by 23.0, 75.5 and 32.2% of the study health facilities, respectively. Tuberculosis screening and referral were done in nearly one-third of hospitals (32.7%) and health centers (35.6%). Only 7.4% of the private facilities had TB screening and referral services. There is also geographical variation in the services provision; small proportion of health facilities in Benishangul-Gumuz (8.3%), Gambella (10.0%), Amhara (15.6%) and Harari (17.0%) had offered TB screening and referral services. More than 50% health facilities in all regions provided TB diagnosis and treatment services except in Gambella where only a quarter of them provided the same service. In all, 61.1% of hospitals, 40.4% of health centers and 8.7% of the private facilities had a service to diagnose and treat MDRTB. Few number of facilities in Gambella (5.0%) provided MDRTB diagnosis and treatment service. Less than a quarter of health facilities in Benishangul-Gumuz (19.4%), Southern Nation and National Peoples Region (SNNPR) (24.0%) and Afar (21.4%) provided diagnosis and treatment service for MDR TB (Table 1).

Health system capacity for TB care was assessed among the health facilities that had one or more TB services as shown in Table 2.

Table 1 TB services by types of health facilities and regions in Ethiopia

Facility characteristics	TB screening and referral *n* (%)	TB diagnosis and treatment *n* (%)	MDR TB diagnosis and treatment *n* (%)	Number of facilities
Types of health facility				
Health centers	104 (35.6)	265 (90.8)	118 (40.4)	292
Hospitals	70 (32.7)	209 (97.7)	131 (61.2)	214
Private facilities	27 (7.4)	185 (50.4)	32 (8.7)	367
Location of health facilities				
Urban	121 (22.5)	435 (80.9)	201 (37.4)	538
Rural	80 (23.9)	224 (66.9)	80 (23.9)	335
Regions				
Tigray	34 (37.4)	78 (85.7)	30 (33.0)	91
Afar	14 (33.3)	28 (66.7)	9 (21.4)	42
Amhara	20 (15.6)	98 (76.6)	50 (39.1)	128
Oromia	47 (28.7)	118 (72.0)	62 (37.8)	164
Somali	7 (14.9)	34 (72.3)	13 (27.7)	47
Benishangul-Gumuz	3 (8.3)	18 (50.0)	7 (19.4)	36
SNNP*	27 (20.9)	105 (81.4)	31 (24.0)	129
Gambella	4 (10.0)	10 (25.0)	2 (5.0)	40
Harari	6 (17.1)	32 (91.4)	10 (28.6)	35
Addis Ababa	25 (22.5)	97 (87.4)	40 (36.0)	111
Dire Dawa	14 (28.0)	41 (82.0)	27 (54.0)	50
Total	**201 (23.0)**	**659 (75.5)**	**281 (32.2)**	**873**

*Southern Nations Nationalities and Peoples Region.

Table 2 Tuberculosis quality of care by type of health facilities in Ethiopia

Capacity dimensions	Health centers *n* (%)	Public hospitals *n* (%)	Private hospitals *n* (%)
Structural quality			
Availability of trained personnel (at least one)	203 (76.0)*	160 (78.8)	59 (31.7)
Standard precautions	36 (13.5)	85 (41.9)	76 (40.9)
Referral capacity (e.g. ambulance)	255 (95.5)	191 (94.1)	82 (44.1)
Presence of TB unit/room	250 (93.6)	195 (96.1)	157 (84.4)
Quarterly supervision from region or federal	199 (74.5)	194 (95.6)	119 (64.0)
Process indicators of quality			
Screening of TB	193 (72.3)	199 (98.0)	111 (59.7)
AFB smear microscopy	155 (58.1)	166 (81.8)	93 (50.0)
Quality control for TB sputum smears	151 (56.6)	183 (90.1)	60 (32.3)
X-ray for smear negative TB	0 (0.0)	139 (68.5)	28 (15.1)
Management of TB–HIV co-infection	209 (78.3)	175 (86.2)	44 (23.7)
Management or referral for multidrug resistance (MDR)TB	118 (44.2)	131 (64.5)	32 (17.2)
Availability of national guideline for TB	155 (58.1)	146 (71.9)	40 (21.5)
Good clinical knowledge	16 (6.0)	61 (30.0)	12 (6.5)
Quality index score	*Mean (SE)*	*Mean (SE)*	*Mean (SE)*
	55.9 (1.1)	76.7 (1.0)	37.8 (1.5)
Total number of facilities (unweighted)	267	203	186

*$P < 0.001$.

Few (13.5%) health centers and nearly 40% of hospitals and private facilities had standard precautions for TB. Nearly one-third (31.7%) of the private facilities, 76.0% of health centers and 78.8% of hospitals had at least one trained person on TB. Less than 10% staff in the health centers and private facilities had good knowledge on the diagnosis and management of TB. 56.6% of health centers, 90.1% of hospitals and 32.3% of the private facilities had internal or external quality control for TB sputum smears. Only one in five of the private facilities had the national TB guideline. On the other hand, only a quarter of the private facilities had TB/HIV co-infection management. The overall TB care capacity score was lower for private health facilities (mean/SE = 37.8/1.5) than that of the health centers (mean/SE = 55.9/1.1) and hospitals (mean/SE = 76.7/1.0) (Table 2).

The TB care capacity score was higher in the urban facilities compared to that of the rural facilities ($\beta = 8.0$, 95% CI: 4.4, 11.6). Health centers ($\beta = -16.2$, 95% CI: −20.0, −12.3) and private health facilities ($\beta = -38.3$, 95% CI: −42.4, −35.1) had lower TB

Table 3 Determinants of facility capacity to treat TB in Ethiopia 2014

Variable	Mean	SE	Crude model			Adjusted model¥			*P*-Value
			Beta	95% CI		Beta	95% CI		
Residence									
Urban	60.4	1.1	9.4	5.7	13.1	**8**	**4.4**	**11.6**	**0.001**
Rural [***Ref***]	51	1.4							
Facility type									
Health center	55.9	1.1	−20.8	−24.1	−17.5	**−16.2**	**−20**	**−12.3**	0.001
Private facilities	37.8	1.5	−39	−42.6	−35.4	**−38.8**	**−42.4**	**−35.1**	0.001
Hospital [***Ref***]	76.7	1							
Region									
Oromia [***Ref***]	62.7	2.2							
Tigray	64.4	1.8	1.7	−5	8.4	0.9	−4.2	5.9	0.74
Afar	54.9	4.5	−7.8	−17.3	1.7	−2.1	−9.4	5.1	0.56
Amara	58	2.4	−4.7	−10.9	1.5	0.5	−4.2	5.2	0.83
Somali	52.3	4.1	−10.4	−19.2	−1.6	**−8.3**	**−14.9**	**−1.6**	**0.02**
Benishangul-Gumuz	57.7	4	−5	−16.5	6.4	−1.5	−10.4	7.3	0.73
SNNP	49	2.4	−13.7	−19.8	−7.7	**−5.6**	**−10.2**	**−1**	**0.02**
Gambella	49.2	7.3	−13.5	−28.4	1.4	−8.7	−20.1	2.6	0.13
Harari	49.9	4	−12.8	−21.7	−3.9	0.7	−6.3	7.7	0.85
Addis Ababa	57.2	2.5	−5.5	−11.7	0.8	−2.9	−7.9	2.1	0.25
Dire Dawa	60.4	3.4	−2.3	−10.4	5.9	**8.3**	**2**	**14.7**	**0.01**

care capacity score than hospitals. Facilities in Somali ($\beta = -8.3$, 95% CI: −14.9, −1.6) and SNNPR ($\beta = -5.6$, 95% CI: −10.2, −1.0) regions had lower overall capacity score than facilities in the Oromia region. However, the TB care capacity score in Dire Dawa ($\beta = 8.3$, 95% CI: 2.0, 14.7) was higher than that of the Oromia region (Table 3).

Most of the zones in Ethiopia are homogenous in terms of structural capacity for TB care. However, process indicators and overall TB care capacity score were lower in western and southwestern part of the country. Benishangul-Gumuz, Gambella, and part of SNNP have lower quality index (Fig. 2).

Discussion

The present study presents a comprehensive evidence on health system capacity for TB care in Ethiopia at national level. Overall TB care capacity is poor in the private facilities and health centers compared to hospitals, particularly for process capacity indicator. Facilities in the rural areas have lower TB care capacity score. The evidence indicated that there is geographically heterogeneous distribution of TB care capacity score. The process and overall capacity score of TB services were found to be lowest in the western and southwestern part of the country. Emerging regions such as Gambella and Benishangul-Gumuz have poor TB care capacity score than other regions. These emerging regions have hard-to-reach districts with poor road infrastructure and high staff turnover that affects availability of basic health services (Fig. 3).

The International Standards for TB Care (ISTC) recommends that all persons who have productive cough for 2 or more weeks should be evaluated/screened for TB [18, 19]. In the current study, significant number of health centers (30%) and private facilities (40%) do not have TB screening services which are a missed opportunity to identify and treat infectious TB cases. Our study reveals that less than 10% of health centers and private facilities have trained and qualified staff for the diagnosis and management of TB. Previous studies in Ethiopia using ISTC show that TB quality of care is affected by lack of trained staff [10, 20]. A study conducted in south Ethiopia also indicates that better TB notification rate is associated with availability of trained TB focal person [21]. Satyanarayana and colleagues in India used ISTC and reported that public health facilities have better capacity or quality of care than the private health facilities which is in line with our findings [22]. The same authors also showed that health workers in the private facilities have poor knowledge compared to the health workers in the public health facilities [22].

Our findings indicate that TB care capacity score was poor in rural health facilities and in health facilities that are located in remote zones in the emerging regions. A study in Nigeria also shows that rural health facilities have suboptimal TB care including absence of standard precautions, limited HIV Counseling and Testing (HCT) services and lack of trained personnel [23]. The poor health system capacity in the rural, remote zones and private facilities could be explained by several factors. First, the number of trained personnel in rural areas, private sectors and remote zones could be inadequate to provide TB-related services. Second, TB resources and materials including laboratory facilities could not be distributed equitably in these areas.

Ethiopia is one of the countries in the three high-burden country list for TB, TB/HIV co-infection and MDRTB [24]. In the current study, more than 50 and 80% of the health centers and private facilities, respectively, do not have MDRTB management. The absence of TB/HIV and MDRTB management in the private and peripheral health facilities will likely pose serious challenge for Ethiopia to achieve the SDG and End TB Strategy target [10].

This study is the first of its kind to assess the health system capacity for TB care nationally at the private and public health facilities. It also included most of the indicators of the International Standards for TB Care [18]. Only few studies in Ethiopia and India had used ISTC indicators [10, 20, 22]. The study has some limitations. First, the study used self-reported data based on interview of health workers and facility audit and did not observe the practical experience of

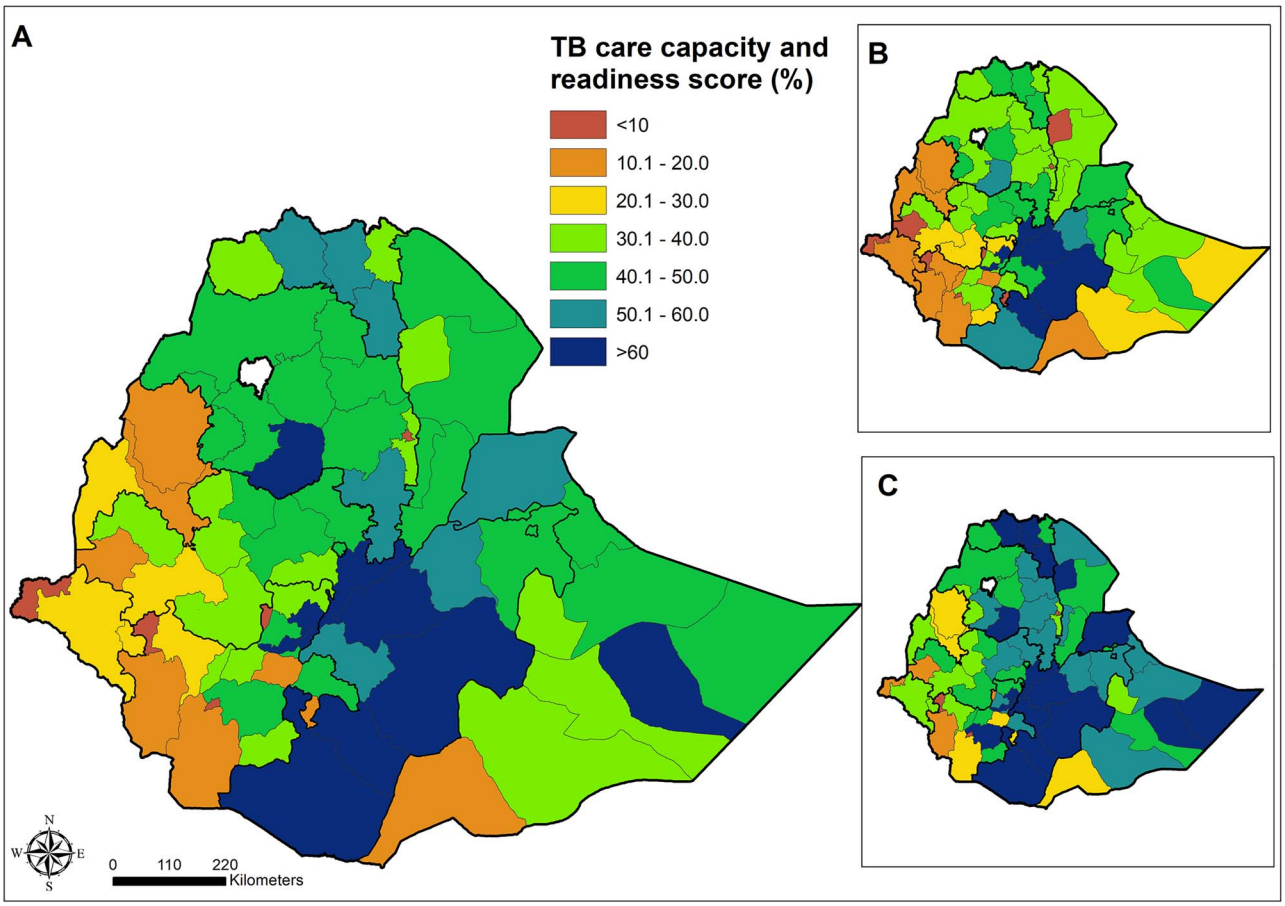

Figure 2 (A) Overall (B) process and (C) structural tuberculosis capacity score variation by Zones in Ethiopia.

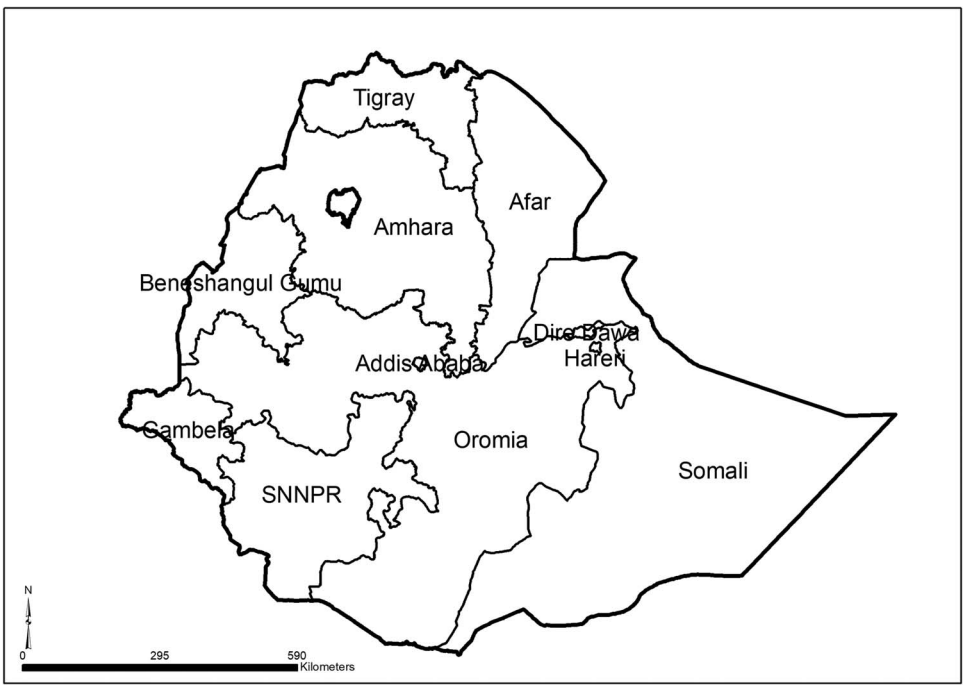

Figure 3 Maps of Ethiopia by regions.

TB diagnosis and care. Second, the study did not assess quality of care from clients' perspective such as satisfaction and client–provider interactions.

Our findings demonstrated substantial deficiencies in the capacity of the health system for TB care in Ethiopia. Through the health extension program and expansion of health facilities, basic TB care is broadly accessible to Ethiopian population. Nonetheless to achieve the ambitious TB goals set in SDG and Health Sector Transformation Plan, the focus on accessibility of service will not be sufficient. To increase case detection, reduce morbidity and mortality and to achieve the desired goal, the system should address the poor health system capacity for TB services available to those in rural areas and emerging Regions. The private health facilities suffer from the lack of trained health provider on TB. Therefore, it is important to build the capacity of private provides through public–private partnership. Ethiopia is still among the high TB burden countries with a mortality and incidence rate of 22 and 151 per 100 000 population, respectively [25]. To achieve the global targets of a 90% reduction in TB mortality and an 80% reduction in TB incidence by 2030, improving the health system capacity and quality of TB care must be the health system priority as stipulated in the HSTP. Improving health system and TB quality of care should be at the forefront to correct geographical disparity and urban rural inequality. Further studies on why the private facilities have poorer quality should be conducted.

Conclusions

Overall health system capacity for TB care in general and management of TB/HIV co-infection and MDRTB were poor in the private facilities and health centers compared to hospitals. The TB care capacity score is poor in remote zones of emerging regions such as Afar, Gambella and Benishangul-Gumuz. TB/HIV interventions should focus on the private sectors and the rural and remote areas to ensure improved health system capacity, equity and high quality of care.

Author contributions

AD conceived the study, interpreted the data and wrote the paper. TD analyzed the data. SB, DB, AD and KD wrote some parts of the paper. All authors assisted in the design, provided data, assisted in data interpretation and critically reviewed the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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