Int J Public Health (2017) 62:305–315
DOI 10.1007/s00038-016-0934-5

REVIEW

Strategic analysis of tuberculosis prevention and control actions in Brazil and Ethiopia: one size fits all?

Gisela Cardoso · Elizabeth Moreira dos Santos · Yibeltal Kiflie · Kifle Woldemichael · Suzanne Wilson · Wuleta Lemma

Received: 14 February 2015 / Revised: 22 April 2016 / Accepted: 2 December 2016 / Published online: 18 December 2016

Abstract
Objectives This study aimed at conducting a strategic analysis of Tuberculosis prevention and control actions in Brazil and Ethiopia, looking at the potential of directly observed treatment short-course strategy (DOTS) and community DOTS in both countries.
Methods Literature review was conducted using PubMed, Medline-Ovid, EMBASE, and SCIELO databases. The reviewed terms were Tuberculosis, prevention and control and Brazil (or Brasil) or Ethiopia (or Etiopia). Study's eligibility included article's title or abstract in English or Portuguese and comprised the following Tuberculosis policy components: management; care; communication, and social mobilization; training and professional development; epidemiological surveillance, and monitoring and evaluation. The study identified, compared, and analyzed the challenges and recommendations reported in the literature.
Results Although DOTS was not able to address all the difficulties regarding Tuberculosis control and prevention, it contributes to overcome challenges identified in the literature review. Decentralizing DOTS in Ethiopia and implementing DOTS in Brazil were key recommendations to overcome problems of access and treatment default.
Conclusions DOTS and Community DOTS cannot solve every identified Tuberculosis challenge, but together they complement each other. Both strategies need to be tailored to site's challenges.

Keywords Tuberculosis · Evaluation · Strategic analysis · Brazil · Ethiopia · Literature review

G. Cardoso (✉) · E. M. dos Santos
Evaluation Laboratory (LASER), Department of Endemics, National School of Public Health, Fiocruz Foundation, Rua Leopoldo Bulhões, 1480/612, Manguinhos, Rio De Janeiro, RJ CEP 21.041-210, Brazil
e-mail: giselacardoso@ensp.fiocruz.br; gisela.cardoso@gmail.com

E. M. dos Santos
e-mail: betuca51@gmail.com

Y. Kiflie
Department of Health Systems Management, College of Public Health and Medical Sciences, Jimma University, Ginjo Kebele, Jimma, Ethiopia
e-mail: kibeltal@gmail.com

K. Woldemichael
Department of Epidemiology, College of Public Health and Medical Sciences, Jimma University, Ginjo Kebele, Jimma, Ethiopia
e-mail: bethy_kifle@yahoo.com

S. Wilson
Department of Sociology and Anthropology, Gustavus Adolphus College, 800 College Avenue, St. Peter, MN 56082, USA
e-mail: santafe@gustavus.edu

W. Lemma
Department of Global Community Health and Behavioral Science, Center for Global Health Equity, School of Public Health and Tropical Medicine, Tulane University, 1440 Canal Street, Ste. 1191, TB 46, New Orleans, LA 7012-2737, USA
e-mail: wlemma@tulane.edu

Introduction

This article conducts a comparative strategic analysis of tuberculosis (TB) control actions in Brazil and Ethiopia. Strategic appraisal is a post-factum analysis of an intervention's relevance and purpose and makes a coherent connection between its objectives and identified challenges. This analysis is an initial step of an implementation evaluation focusing on the directly observed treatment short-course (DOTS) in Brazil and Ethiopia. The two countries' similarities and differences prompted the authors to investigate how TB global policies translate to different settings.

Implementation analysis assumes that the selected intervention is the "best practice" and has the "best fit" with identified needs and problems (Champagne et al. 2011). Thus, implementation evaluation does not usually include discussions about the strategy's relevance and fit. Any theory that guides the design of an implementation evaluation, however, needs to account for "in situ" adaptation. Hence, monitoring systems need to be available to provide evidence for action and adjustments (Lusthaus and Rojas 2011). Clarifying the theory of change is crucial to documenting unfolding program innovation. For that, a strategic analysis must include an assessment of different problems, several possible causal chains, diverse mechanisms, and stakeholders/partners and their interests, required to resolve the identified problems. Pertinent literature (Champagne et al. 2011; Funnell and Rogers 2011a; Love 1991; Mintzberg 2007; Weiss 1997) indicates that this type of analysis can be performed through several approaches and methods such as literature review, document review, interviews, or institutional and network analyses. Given our cross-national scope, we utilized a literature review to conduct a strategic analysis of TB control actions in Brazil and Ethiopia to appraise the fitness of a global strategy to specific contexts. Describing how TB-related problems appear in different contexts and the ways DOTS strategy is able to ameliorate these challenges is essential for recommending adaptations of the intervention's theory for better responses (Funnel and Rogers 2011b; Rossi et al. 2004).

Tuberculosis: prevention and control interventions

In 1994, the World Health Organization declared TB to be a global emergency and adopted DOTS as its main strategy for TB prevention and control. DOTS is a set of best practices, based on five components: (1) political commitment to strengthening human and financial resources; (2) TB diagnosis through quality-assured bacteriology; (3) regular and uninterrupted supply of drugs; (4) surveillance and monitoring systems; and (5) the use of standardized treatment regimens along with direct observation (WHO 1994). In 2006, the Stop TB strategy was launched as an enhancement to DOTS, adding the following items: treatment of multidrug-resistant TB (MDR-TB) and TB/HIV co-infection, involvement of all care providers, strengthening of health systems, engagement of communities and TB patients, research and development for new diagnostics, and drugs and vaccines (World Health Organization and StopTB Partnership 2006).

To facilitate access to TB care, WHO and the International Union Against Tuberculosis and Lung Diseases have promoted the integration of National Tuberculosis Programs (NTP) with the activities of primary health services. Underutilization of health services is described as important barriers due to the following: (1) lack of infrastructure, drugs and training; (2) difficulties with patient access in rural and urban areas; (3) insufficient number of health care workers; (4) inefficient decentralization of TB activities; (5) stigma; and (6) poor knowledge about services for TB diagnosis and treatment (World Health Organization 2003; World Health Organization and StopTB Partnership 2006). A community approach to TB programs has the potential to overcome many of these limitations because it allows wider access, reaches more cases, and promotes adherence to treatment. Based on successful past experiences, WHO has provided support to countries for the development and implementation of community DOTS (CDOTS) within their NTPs. Community agents have central roles in the implementation of TB strategies, since they live in communities, share the same local culture and values, and build bridges between the community and the health services. They contribute to TB care by (1) supporting patients throughout TB treatment, (2) promoting health education, (3) helping with TB case tracing, (4) strengthening government commitment to TB control, and (5) increasing accountability of local health services to the community (World Health Organization 2003).

Brazil and Ethiopia belong to the list of 22 countries with the highest-burden of TB cases. Ethiopia also has a high MDR-TB load (World Health Organization 2012). In the past two decades, both countries have made important progress in TB prevention and control. Although TB is a national health problem for the two countries, they have distinct epidemiological TB profiles and cultural contexts.

Thus, the objective of this study was to conduct a strategic analysis of tuberculosis prevention and control actions in Brazil and Ethiopia, looking at the potential of Directly Observed Treatment Short-Course Strategy (DOTS) and Community DOTS (CDOTS) in both countries.

Methods

Literature review

To account for the two countries' differences, we undertook a literature review (Onwuegbuzie et al. 2012). Review's focus was to identify the major challenges of TB programs' in Brazil and Ethiopia. Since CDOTS started at different moments in both countries, the literature review time period varied. The review time period for Ethiopia review was from 1990 to 2006, and for Brazil from 1990 to 2004. We employed PubMed, Medline-Ovid, EMBASE, and SciELO databases. The reviewed terms were Tuberculosis, prevention and control and Brazil (or Brasil) or Ethiopia (or Etiopia). Eligibility criteria comprised titles or abstracts published in English or Portuguese. Titles and abstracts had to include at least one of the following TB policy components (Ministério da Saúde 2011; World Health Organization 1994): (1) TB management; (2) TB care; (3) epidemiological surveillance and M&E; (4) training and professional development; and (5) communication and social mobilization. Our search included retrospective and cross-sectional studies.

To answer our strategic question "What is DOTS strategy's potential to respond to the challenges of TB control in Brazil and Ethiopia?" we analyzed the articles, following the topics as described by Champagne et al. (2011):

1. What are the challenges regarding TB programs in Brazil and Ethiopia? Based in the articles, this question sought to describe problems with TB programs in both countries.
2. Is there a causal model linking the planned interventions and the described problems? This question aimed to address, via the articles, if the intervention theory of change (Rogers 2011) was consistent with the countries' identified problems. We explored the authors' perceptions of the problems and challenges' causal processes, and the suggested recommendations. Additionally, we verified how DOTS and CDOTS responded to these problems. Although we tried to analyze the consistency between the stated problem and the selected intervention in all the articles, we were not able to ascertain this relationship in some articles.
3. Are monitoring and evaluation in place to document the expected outcomes? Since strategies usually produce a series of results at different stages along the intervention causal chain, M&E should be in place to unpack the theory of change's effects and the implementation progress. We searched for evidence of M&E systems to articulate the strategy's choice and its implementation in context.

Quality assessment

A quality assessment of the 59 selected articles was undertaken before data extraction. Criteria for quality analysis were consistency between the research question and methods, and reference to the study's ethical implications. Additionally, we consulted the Journal Citation Reports (JCR), looking at each journal's impact factor for 2012 and its 5-year JCR average (2007–2012). Despite certain limitations, JCR is worldwide-recognized tool to evaluate scientific and technical journals (Magri and Solari 2000). As the JCR's coverage excluded several Ethiopian and Brazilian journals, we examined the Scopus' h index for the article's first author as an alternate measure of impact. Every article had either a JCR score for its journal or an h index score for its first author.

Data extraction and analysis

The information was organized according to the following: title, author(s), country, journal, type of study, date, study's objective, methods, results, conclusions, and identified challenges and recommendations. The challenges and recommendations were classified following the described TB program components. Then, we performed a content and thematic analysis (Bardin 1977). Article's major challenges and recommendations were grouped by their similarities, establishing different theme categories, ordered by frequency of appearance. We analyzed and contrasted the findings (challenges and recommendations) between Brazil and Ethiopia, which were then matched to DOTS and CDOTS guidelines.

Study settings

Brazil

Brazil has the largest population in South America (197 million people) and a TB incidence of 43/100.000 in 2011 (World Health Organization 2012). It has great disparities among regions, with TB being mostly concentrated in the Northern and Southern regions (Ministério da Saúde 2012). Treatment success for new smear positive cases improved from 17% in 1995 to 74% in 2010 (World Health Organization 2011). TB/HIV co-infection's magnitude varies among regions. DOTS coverage in 2010 was 75% (Ministério da Saúde 2012). Last available official data are depicted in Table 1.

Table 1 Comparative data on tuberculosis: Ethiopia and Brazil, 2008–2012 Source: CORE Group (2008), Ministério da Saúde (2012), Ministry of Health (2011), Pan American Health Organization (2012), Szwarcwald et al. (2008), World Health Organization (2012)

Indicators	Brazil	Ethiopia
TB incidence	43	258
TB prevalence	46	237
Mortality	2.9	18
TB case detection sputum smear positive	66%	47%
TB treatment success rate for new smear positive cases	74% (2010)	83% (2010)
% new TB cases with MDR-TB	0.91% (0.55–1.4)	1.6% (0.9–2.7)
HIV-positive incident TB patients	20%	8%
TB prevalence in HIV cases	14.1% up to 25.0% in major cities (e.g., São Paulo and Rio de Janeiro)	41% (2008)
HIV prevalence	Stable since 2006, around 0.6%; 0.8% among males and 0.4% among females	2.4%
HIV testing coverage	36.5% (15 up to 64 years old); 46% women and 27% men (2008)	36% of women and 38% of men (EDHS 2011)
DOTS coverage	75% (2010)	95% (2010)

Indicators are per 100,000 inhabitants in 2011, unless otherwise stated

In the past two decades, important progress has been made in TB prevention and control. Between 2002 and 2006, the budget for TB control actions in Brazil more than doubled, due to a political commitment to expand DOTS as the official TB policy (CORE Group 2008). Since 2004, one of the key strategies of the National Tuberculosis Control Plan has been the expansion of Community Health Workers Program and Family Health Strategy, and the decentralization of prevention and control actions for all municipalities (Santos 2007). Innovative actions from the public health system have supported the decentralization of TB and HIV activities to primary health care (Kritski et al. 2007).

Ethiopia

Ethiopia has the second-largest population in Africa (85 million inhabitants). TB incidence (258/100,000) is higher than that in Brazil and the infection is spread throughout the country. Ethiopia also has a high MDR-TB burden (World Health Organization 2012). Successful treatment of new smear positive cases improved from 61% in 1995 to 83% in 2010. The decentralization of TB care from tertiary care institutions to primary care units improved TB treatment outcomes. DOTS coverage is 95%. The results, however, are still inadequate (Mesfin et al. 2009) (Table 1). As the HIV/AIDS epidemic grows in Ethiopia (2.4% prevalence), it is likely that TB cases will also increase.

TB control program operates as an integral part of the public health system, having management structures at regional and district levels. The district health system is usually composed of health posts, one health center and a district hospital. TB treatment is managed at health posts. All patients have free access to diagnosis and treatment services in public health facilities (Mesfin et al. 2009).

Results

Results are presented in two parts: first, the literature review findings, and second, the answers to the highlighted questions.

Literature review findings

The Brazilian search identified 1,449 papers in PubMed, EMBASE, Medline-Ovis, and SciELO. Excluding duplicated titles and articles that did not meet the inclusion and data quality criteria, we selected and read 80 abstracts. Thirty-six were analyzed and included in the review. More than half of the articles (21) were published in Brazilian journals and 15 articles in international journals.

The Ethiopian search identified 645 papers. Thirty-seven abstracts were selected and read. Thirty-three articles were analyzed and 23 included in the review. The majority of the articles (18) were published in international journals, and five were published in the Ethiopian Medical Journal.

Fifteen (65%) of the 23 journals that published the 59 selected articles had JCR scores for 2012 and 14 (61%) had 5-year average JCR scores. Forty-seven (98%) of the 48 first authors of the selected articles had an h index score in Scopus. The impact measures' means were as follows: (1) 2.22 (range 0.62–5.85) for the 2012 JCR; (2) 2.62 (range 0.90–6.42) for the five-year JCR; and (3) 8.23 (range 1–23) for the Scopus h index.

Strategic question 1: What are the challenges regarding TB in Brazil and Ethiopia?

Data are presented according to TB program components, emphasizing the most frequent challenges.

TB program management

The difficulties identified in the Brazilian review are mostly related to the integration of TB and HIV/AIDS prevention and control. These problems led to a recrudescence and increase in TB mortality (Antunes and Waldman 1999, 2001; Santo et al. 2003), low-cure treatment rates (Aerts and Jobim 2004; Liberato et al. 2004), and the development of acquired TB-MDR (Ferrazoli et al. 2000). Poor supply of TB drugs and reagents, difficulties integrating different logics and/or models (e.g., preventive and clinical models), and inadequate program organization and lack of political commitment were also reported as important barriers in achieving TB programs' goals.

In Ethiopia, the HIV/AIDS epidemic has been hard to overcome (Abate 2002; Bruchfeld et al. 2002; Lambert et al. 2003; Mitike et al. 1997a; Yassin et al. 2004). The growing caseload of TB and AIDS put a considerable strain on an already overburdened health care system with several obstacles related to program organization (Demissie and Kebede 1994; Gelaw et al. 2001; Madebo and Lindtjørn 1999; Vecchiato 1997).

TB care

In Brazil, TB care challenges included first poor quality of TB diagnosis and treatment. Non-compliance of prescribed drugs/default is associated with insufficient supply of TB drugs, rigor of medical speech regarding TB treatment, stigma, poorness, alcoholism, and substance abuse, leading to retreatment, MDR, HIV co-infection, low-case detection, and low care treatment rates (Moreira et al. 2004; Natal et al. 2003; Oliveira et al. 1995; Oliveira and Moreira Filho 2000; Pôrto and Nascimento 1995; Ribeiro et al. 2002; Selig et al. 2003).

For Ethiopia, TB care challenges included first non-compliance with prescribed drugs related to insufficient supply of TB drugs, medication side-effects, costs regarding transport, level of education, lack of family support, and stigmatization (Demissie et al. 2003; Demissie and Kebede 1994; Gelaw et al. 2001; Getahun and Aragaw 2001; Tekle et al. 2002; Woldemichael et al. 2004). Access and delay were associated with socio-economic factors and living conditions of the population, mostly pastoralists and rural residents. These difficulties have led Ethiopians to seek care from alternative providers such as traditional healers or non-formal health providers, as well private medical providers (Cambanis et al. 2005; Demissie et al. 2002; Getahun and Maher 2000; Madebo and Lindtjørn 1999; Shargie et al. 2006; Yimer et al. 2005).

Communication and social mobilization

In the case of Brazil, communication and social mobilization challenges were barely discussed in the articles. Only one article discussed the fragile organization of civil society and the lack of NGOs involved with TB issues (Kritski and Ruffino-Netto 2000).

In contrast, in the Ethiopian articles, communication and social mobilization were among the most significantly identified challenges, including lack of information and stigma towards TB among both patients and the population (Cambanis et al. 2005; Demissie et al. 2003; Getahun 1999; Getahun and Aragaw 2001; Shimeles et al. 2005; Tekle et al. 2002; Vecchiato 1997; Woldemichael et al. 2004). Quoted difficulties were as follows: (1) patients' low level of education (Tekle et al. 2002); (2) patients' lack of knowledge about the disease process and treatment (Woldemichael et al. 2004); (3) the practice of drinking raw milk in rural areas (Cambanis et al. 2005); (4) dietary beliefs (Getahun 1999); and (5) misconception about TB (Getahun 1999). Lack of knowledge about the disease produced negative attitudes towards patients and their families (Getahun and Aragaw 2001). In some communities, TB was the most feared disease, as the use of the word for TB, *balamo*, as an insult illustrates (Vecchiato 1997). Sometimes, because of TB's social stigma, patients were pressured to take their medication quickly and silently, or to interrupt their treatment when their symptoms disappeared (Demissie et al. 2003). In many cases, stigma and a lack of knowledge were directly linked to a delay in diagnosis (Cambanis et al. 2005) and treatment default (Demissie et al. 2003; Tekle et al. 2002; Woldemichael et al. 2004). Lack of information about TB treatment among private practitioners was also a problem (Shimeles et al. 2005).

Institutional and Professional Development

For both countries, a few articles discussed obstacles related to training and professional development. In the Brazilian case, one article signalized the lack of dialogue between academic researchers and health services (Ruffino-Netto 2002) and two pointed to problems with delays in modifying health professionals' practices (Selig et al. 2003; Teixeira et al. 2001). One Ethiopian article highlighted this topic (Mitike et al. 1997b).

Epidemiological surveillance and M&E

Brazilian articles stressed the importance of integrating information systems, especially for planning actions and M&E activities (Mota et al. 2003; Ruffino-Netto and Souza 2001; Souza et al. 2000). They used time series methodology to analyze TB's epidemiological profile (Antunes and Waldman 1999) as well as employing analyses of TB-attributed deaths to evaluate TB control programs (Santo et al. 2003). Socio-economic factors and living conditions of the population were important issues in several analyses. TB is especially a problem in urban, poor, overcrowded centers.

The Ethiopian articles underscored the need for assessing the HIV's impact on the spread of anti-tuberculosis resistance (Mitike et al. 1997a), the changing clinical presentation of TB (Yassin et al. 2004; Shargie and Lindtjørn 2005), the importance of periodic drug resistance surveys (Mitike et al. 1997b), and the evaluation of the contribution of "TB Club" to TB control (Demissie et al. 2003; Getahun and Maher 2000). TB is found mainly in rural, poor, and remote areas in Ethiopia. Table 2 summarizes our findings.

Table 2 Frequency of tuberculosis quoted challenges in Brazilian and Ethiopian articles, 1994–2006

Program components	Identified challenges	Number of articles-Brazil	Number of articles-Ethiopia	Addressed by
Tuberculosis program management	1. HIV/AIDS epidemic and co-infection	8	6	CDOTS
	2. MDR-TB	6	5	CDOTS
	3. Inadequate TB program organization/non-functional	4	3	DOTS
	4. Poor supply of TB drugs/lack of reagents	5	2	DOTS
	5. Difficulty to integrate different health logics and/or models	5	nr	CDOTS
	6. Lack of political commitment	3	nr	DOTS
	Total	31/36	16/23	
Tuberculosis care	1. Non-compliance/default	9	6	DOTS
	2. Poor quality of TB diagnosis and/or treatment	11	3	DOTS
	3. Access	1	5	CDOTS
	4. Delay in TB diagnosis and/or treatment	–	5	CDOTS
	5. Low case detection/no contact control	2	1	CDOTS
	6. Difficulty to go beyond formal approaches	3	1	CDOTS
	7. Prior attendance by traditional healers or private physicians	–	2	CDOTS
	Total	26/36	23/23	
Communication and social mobilization	1. Lack of knowledge/information and/or stigma	nr	7	CDOTS
	2. Poor organization of civil society	1	nr	CDOTS
	Total	1/36	7/23	
Institutional and professional development	1. Lack of dialogue between academy and health services	1	nr	DOTS
	2. Health professional training	2	1	DOTS
	Total	3/36	1/23	
Epidemiological surveillance and monitoring and evaluation	1. Socio-economic factors and living conditions	5	5	CDOTS
	2. Poor quality and/or lack of linkage among information systems	2	1	DOTS
	3. High incidence/prevalence	2	1	DOTS
	4. High mortality	4	nr	DOTS
	5. Low notification	1	nr	DOTS
	Total	14/36	7/23	

nr not reported

Strategic question 2: Is there a causal model that links the planned interventions and the described problems?

We contrasted challenges and recommendations tracing the causal link between the problems and control strategies for DOTS and CDOTS. As Table 3 demonstrates, the majority of the challenges discussed in the Brazilian articles were related to DOTS strategy (43/77) and focused on two TB program components, TB care (20/28) and epidemiological surveillance and M&E (9/14). DOTS initiative could solve TB care challenges centered on non-compliance/treatment default and the poor quality of TB diagnosis and/or treatment with the use of direct observed standardized treatment regimens and quality-assured TB bacteriology diagnosis. The articles also highlighted the importance of DOTS implementation for specific populations such as indigenous groups (Marques and Cunha 2003), homeless populations, and co-infected TB/HIV patients (Laguardia and Merchan-Hamann 2003; Liberato et al. 2004). According to Table 2, the predominant approaches of M&E in Brazil centered on three areas. First, five out of 14 articles emphasized social-economic factors and the importance of monitoring in the urban context. Second, six out of the 14 addressed population epidemiologic indicators: TB incidence, prevalence and mortality. One article noted the low case notification and two articles pointed out the lack of linkage among national information systems. Some articles (Mota et al. 2003; Ruffino and Souza 2001; Selig et al. 2003; Souza et al. 2000) analyzed the setup of the National M&E Network, focusing on the integration of government, civil society and international partners as part of growing efforts towards accountability. Third, although the articles reported inadequate TB program organization as a challenge, they did not mention monitoring systems in regards to the quality of their service provision, or patient and information referring systems.

CDOTS best met the Brazilian TB program management challenges (19/31), when combining health models, TB-HIV/AIDS programs, and including vertical and integrated program strategies.

Several of their recommendations emphasized civic responsibility, and community and civil society participation contributing to case detection (Lima et al. 2001; Ruffino-Netto and Souza 2001), TB control goals' achievement (Moreira et al. 2004) and assurance of treatment compliance (Liberato et al. 2004). Intersectional and intersectoral partnership were recommended as alternatives (Kerr-Pontes et al. 1997; Dias 1998; DeRiemer et al. 2000; Lima et al. 2001; Ruffino-Netto and Souza 2001), including: (1) a broad interaction between work organizations, churches, universities, and social leaders (Dias 1998); (2) public–private sector partnerships; and (4) municipal health councils' participation (Ruffino-Netto and Souza 2001). In regards to epidemiological surveillance and M&E, the articles (10/15) suggested health professional training and political commitment as ways to improve surveillance and monitoring systems' implementation.

In the articles about Ethiopia, the majority of the identified challenges are related to CDOTS intervention (37/54). The challenges focused on almost all of TB programs' components such as TB management (13/16), TB care (12/23), communication and social mobilization (7/7), and epidemiological surveillance and M&E (5/7). The articles presented HIV/TB co-infection and MDR-TB as TB management's challenges, and access and delay in TB diagnosis and/or treatment as major obstacles for TB care. In respect to communication and social mobilization, lack of knowledge and stigma were strong impediments for TB diagnosis and treatment adherence. M&E systems emphasize social-economic and epidemiological indicators.

The recommendations identified in the articles comprised the following: (1) finding new ways to deliver services; (2) incorporating community educational strategies (Cambanis et al. 2005; Demissie et al. 2002; Demissie and Kebede 1994; Gelaw et al. 2001; Madebo and Lindtjørn 1999; Vecchiato 1997); (3) including peer-encouragement mechanisms (e.g. TB Clubs) (Getahun, 1999) and patient-centered approaches; and (4) implementing Health Extension Workers programs (Shargie et al. 2006). As Table 3 shows, these issues are best addressed by CDOTS guidelines (37/54).

The DOTS strategy only addressed 17/54 of the articles' challenges and recommendations: availability of resources

Table 3 Comparative strategic tuberculosis analysis: Brazil and Ethiopia, 1994-2006

Tuberculosis challenges	Brazil	Addressed by DOTS	Addressed by community DOTS	Ethiopia	Addressed by DOTS	Addressed by community DOTS
Tuberculosis program management	31	12	19	16	5	13
TB care	26	20	6	23	11	12
Communication and social mobilization	1		1	7		7
Training and professional development	3	2	1	1	1	
Epidemiological surveillance and monitoring and evaluation	14	9	5	7	2	5
Total	77	43	32	54	18	37

(Madebo and Lindtjørn 1999), free distribution of drugs (Demissie and Kebede 1994), continuous supply of anti-TB drugs (Woldemichael et al. 2004), laboratory reagents supply (Getahun, 1999), and TB diagnostic tests (Yimer et al. 2005).

Strategic question 3: Are Monitoring and Evaluation in place to document expected outcome?

Articles from both countries emphasized the importance of monitoring social and economic factors, especially as they are related to a specific context. The articles about Brazil stressed the need to monitor social inequities, overcrowded living conditions, the greater vulnerability of immigrant populations living in big cities, HIV patients, and indigenous populations (Antunes and Waldman 1999 2001; Gonçalves et al. 1999; Kerr-Pontes et al. 1997). In contrast, the articles about Ethiopia highlighted the importance of monitoring rural settings (Getahun 1999; Getahun and Aragow 2001; Vecchiato 1997; Yassin et al. 2006) and HIV populations (Getahun 1999; Bruchfeld et al. 2002).

In both countries, the focus of monitoring was on population indicators, such as incidence, prevalence, and mortality. The articles described operational indicators, and cure and abandon rates as part of TB care components. Since integrated monitoring systems were not in place, the articles did not discuss issues such as costs, allocative efficiency, and the interventions' sustainability. The articles discussed how impact and accountability studies were not followed up with self-appraisal efforts and institutional-learning-oriented processes.

Discussion

This article has presented a panoramic overview of the challenges, proposed recommendations and contexts that evaluators must take into account before evaluating DOTS strategy. TB control actions' challenges are numerous in Brazil and Ethiopia. Despite changes in TB programs taken place in both countries, health service coverage in Ethiopia and health service organization in Brazil are important obstacles to overcome. Our findings emphasized that both countries are unique culturally, politically, geographically, and socio-economically. In Brazil, TB is mostly found in urban, poor, and overcrowded centers. In contrast, it is mainly present in rural, poor, and remote areas in Ethiopia.

How has this literature review analysis helped appraise DOTS as a global strategy and its ability to fit with a specific context? Although implementation evaluation often takes for granted the chosen intervention, it can clarify several parts of the implementation process, adding to a better understanding of the relationship between intervention and context (Brousselle and Champagne 2011).

TB prevention and control actions have to take into account the context in which interventions take place. According to Rogers (2011), equity-focused programs, suitable to the appraisal of TB prevention and control initiatives, must truly engage and reflect the needs of vulnerable population in its context. This issue aligns well with the commitment of CDOTS strategy, which tries to go beyond formal approaches to improve equal access in both countries, including rural areas in Ethiopia and urban violent settings in Brazil.

Despite not addressing all the problems regarding TB, standard DOTS strategy provides a good place for beginning to resolve many of the management challenges that the articles identified. Implementing standard DOTS as a simple and unique guideline, however, appears not to be enough (Table 3). The articles also recommended or proposed innovative approaches, such as TB networks in Brazil and "TB Clubs" in Ethiopia. To improve TB program adherence and cure rates, these initiatives have included governmental, civil participation, and public–private mix, as well as integration of national level initiatives.

When collecting evidence about stakeholders and partners, and their roles in Brazil, it is important to consider that the government (Ministry of Health) developed the TB National Program organized by different levels of service provision, including federal, states, and municipalities. In Brazil, government accountability for TB prevention and control is a priority (Ministério da Saúde 2013). In this context, then, civil society's participation is key. Ethiopia also has different levels of provision, coordinated by the Ministry of Health. Several organizations such as NGOs and foreign universities, however, are also active and important participants in TB-related activities. Therefore, in Ethiopia, external accountability plays a more important role. In both countries, an urgent involvement and commitment to TB prevention and control actions from their Health Ministries is required to change their epidemiological scenarios.

Aiming to identify the relevance of an intervention, our strategic analysis examined if there is coherence between the intervention's objectives and the problem to be solved. The analysis revealed that neither DOTS nor CDOTS could solve every TB challenge identified for Brazil and Ethiopia. DOTS intervention components (such as a regular supply of TB drugs and reagents, political commitment, the training of health professionals, TB diagnosis through bacteriology, surveillance and monitoring systems, and the use of standardized treatment regimens along with direct observation) are essential, but not sufficient.

It is important to understand what the intervention is trying to achieve and how it works: in other words, not

only what activities an intervention carries out, but also how they are understood to bring about change (Rogers 2011). 'How it works can be enough for certain contexts, but wanting in other settings. Our analysis showed that while Community DOTS can resolve or "fit better" with the majority of the challenges identified in Ethiopian articles, standard DOTS addresses or "fits better" with the challenges described in the Brazilian literature. Therefore, both strategies, DOTS and CDOTS, are complementary. Each one works better in certain situations, dependent upon the specific challenges, available resources, and context. For example, the Brazilian case argues for a wider implementation of standard DOTS, while the Ethiopian case suggests the decentralization of TB prevention and control activities with strong peer encouragement mechanisms (CDOTS). This finding is critical and is a point often overlooked in M&E, the topic of our third question. M&E is usually conceived as a mere landscape where a disease, its prevention, and its control take place. Monitoring systems, however, are also tools that allow for systematized follow-up, in situ learning, and management accountability. This review's results underscore this point, revealing the specificities of TB control dynamics in each country.

Therefore, the evidence strongly suggests the unlikelihood that any one strategy or operational model will be able to provide for all of a particular context's needs. Models and strategies, are more likely to succeed when they are adapted and suited to a particular context, and its needs and purposes.

Acknowledgements The first author received a post-doctoral scholarship from CAPES Foundation/Ministry of Education, Brazil and had support from Tulane University, USA, for developing the study.

References

Abate G (2002) Drug resistant tuberculosis in Ethiopia: problem scenarios and recommendation. Ethiopia Med J 40:79–86

Aerts D, Jobim R (2004) The epidemiological profile of tuberculosis in southern Brazil in times of AIDS. Int J Tuberc Lung Dis 8:785–791

Antunes JL, Waldman EA (1999) Tuberculosis in the twentieth century: time-series mortality in Sao Paulo, Brazil, 1900–97. Cad Saúde Pública 15:463–476

Antunes JL, Waldman EA (2001) The impact of AIDS, immigration and housing overcrowding on tuberculosis deaths in Sao Paulo, Brazil, 1994–1998. Soc Sci Med 52:1071–1080

Bardin L (1977) Análise de conteúdo. Edições 70, Lisboa

Brousselle A, Champagne F (2011) Program theory evaluation: logic analysis. Eval Program Plann 34:69–78

Bruchfeld J, Aderaye G, Palme IB, Bjorvatn B, Britton S, Feleke Y, Källenius G, Lindquist L (2002) Evaluation of outpatients with suspected pulmonary tuberculosis in a high HIV prevalence setting in Ethiopia: clinical, diagnostic and epidemiological characteristics. Scand J Infect Dis 34:331–337

Cambanis A, Yassin MA, Ramsay A, Squire B, Arbide I, Cuevas LE (2005) Rural poverty and delayed presentation to tuberculosis services in Ethiopia. Trop Med Int Health 10:33–35

CORE Group (2008) The expansion of community-based tuberculosis programming: critical program design issues for new partners. http://www.coregroup.org/storage/documents/Workingpapers/CORE_TB_web.pdf. Accessed Oct 2011

Demissie M, Kebede D (1994) Defaulting from tuberculosis treatment at the Addis Abeba Tuberculosis Centre and factors associated with it. Ethiop Med J 32:97–106

Demissie M, Lindtjorn B, Berhane Y (2002) Patient and health service delay in the diagnosis of pulmonary tuberculosis in Ethiopia. BMC Public Health 2:23

Demissie M, Getahun H, Lindtjorn B (2003) TB care, community tuberculosis care through ''TB clubs'' in rural North Ethiopia. Soc Sci Med 56:2009–2018

Champagne F, Brousselle A, Hartz Z, Contandriopoulos AP, Denis, JL (2011) A análise estratégica. In: Brouselle A, Champagne F, Contandriopoulos AP, Hartz Z (orgs) Avaliação: conceitos e métodos. Ed. Fiocruz, Rio de Janeiro, pp 95–104

DeRiemer K, Soares ECC, Dias SMO, Cavalcante SC (2000) HIV testing among tuberculosis patients in the era of antiretroviral therapy: a population-based study in Brazil. Int J Tuberc Lung Dis 4:519–527

Dias JCP (1998) Problemas e possibilidades de participação comunitária no controle das grandes endemias no Brasil. Cad Saúde Pública 14(supl.2):19–37

Ferrazoli L, Palaci M, Marques LR, Jamal LF, Afiune JB, Chimara E, Martins MC, Silva Telles MA, Oliveira CA, Palhares MC, Spada DT, Riley LW (2000) Transmission of tuberculosis in an endemic urban setting in Brazil. Int J Tuberc Lung Dis 4:18–25

Funnel S, Rogers P (2011a) The essence of program theory. In: Funnel S, Rogers P (eds) Purposeful program theory: effective use of theories of change and logical models. Jossey-Bass, San Francisco, pp 3–13

Funnel S, Rogers P (2011b) Process to identify or develop a program theory. In: Funnel S, Rogers P (eds) Purposeful program theory: effective use of theories of change and logical models. Jossey-Bass, San Francisco, pp 95–148

Gelaw M, Genebo T, Dejene A, Lemma E, Eyob C (2001) Attitude and social consequences of tuberculosis in Addis Ababa, Ethiopia. East African Med J 78:382–388

Getahun H (1999) Medical and social consequences of tuberculosis in rural Ethiopia. Ethiopia Med J 37:147–153

Getahun H, Aragaw D (2001) Tuberculosis in rural Northwest Ethiopia: community perspective. Ethiopia Med J 39:283–291

Getahun H, Maher D (2000) Contribution of 'TB clubs' to tuberculosis control in a rural district in Ethiopia. Int J Tuberc Lung Dis 4:174–178

Gonçalves H, Costa JSD, Menezes AMB, Knauth D, Leal OF (1999) Adesão à terapêutica da tuberculose em Pelotas, Rio Grande do Sul: na perspectiva do paciente. Cad Saúde Pública 15:777–787

Kerr-Pontes LR, Oliveira FA, Freire CA (1997) Tuberculose associada à AIDS: situação de região do Nordeste brasileiro. Rev Saúde Pública 31:323–329

Kritski AL, Ruffino-Netto A (2000) Health sector reform in Brazil: impact on tuberculosis control. Int J Tuberc Lung Dis 4:622–626

Kritski AL,Villa TS, Trajman A, Lapa e Silva JR, Medronho RA, Ruffino-Netto A (2007) Duas décadas de pesquisa em tuberculose no Brasil: estado da arte das publicações científicas. Rev Saúde Pública 41(supl. 1):9–14

Laguardia J, Merchan-Hamann E (2003) Risk Factors for tuberculosis in the AIDS cases reported in Brazil, 1980–2000. Rev Esp Salud Pública 77:553–565

Lambert ML, Sugulle H, Seyoum D, Abdurahman S, Abdinasir A, Frieden M, Matthys F, Van der Stuyft P (2003) How can

detection of TB be improved? Experience in the Somali region of Ethiopia. Int J Tuberc Lung Dis 7:485–488
Liberato IRO, Militão de Albuquerque MFP, Campelo ARL, Melo HRL (2004) Characteristics of pulmonary tuberculosis in HIV seropositive and seronegative patients in a Northeastern region of Brazil. Rev Soc Bras Med Trop 37:46–50
Lima MB, Mello DA, Morais APP, Weber CS (2001) Estudo de casos sobre abandono do tratamento da tuberculose: avaliação do atendimento, percepção e conhecimentos sobre a doença na perspectiva dos clientes (Fortaleza, Ceará, Brasil). Cad Saúde Pública 17:877–885
Love A (1991) Internal evaluation: building organizations from within. SAGE Publications, London
Lusthaus C, Rojas K (2011) Evaluating organizational performance. In: Emerging practices in development evaluations. http://mymande.org/eleaming/course-details/3. Accessed Jun 2015
Madebo T, Lindtjørn B (1999) Delay in treatment of pulmonary tuberculosis: an analysis of symptom duration among Ethiopian patients. MedGenMed 18:E6
Magri MH, Solari A (2000) A new approach to the SCI Journal Citation Reports system for evaluating scientific journals. Scientometrics 47:605–625
Marques AM, Cunha RV (2003) A medicação assistida e os índices de cura de tuberculose e de abandono de tratamento na população indígena Guaraní-Kaiwá no Município de Dourados, Mato Grosso do Sul, Brasil. Cad Saúde Pública 19:1405–1411
Mesfin M, Newell JN, Walley JD, Gessessew A, Tesfaye T, Lemma F, Madeley R (2009) Quality of tuberculosis care and its association with patient adherence to treatment in eight Ethiopia districts. Health Policy Plan 24:457–466
Ministério da Saúde (2011) Manual de recomendações para o controle da tuberculose no Brasil. http://bvsms.saude.gov.br/bvs/publicacoes/manual_recomendacoes_controle_tuberculose_brasil.pdf. Accessed Jan 2013
Ministério da Saúde (2012) Boletim Epidemiológico, março 2012, v. 43. http://portal.saude.gov.br/portal/arquivos/pdf/bolepi_v43_especial_tb_correto.pdf. Accessed Jun 2013
Ministério da Saúde (2013) Planejamento estratégico do Ministério da Saúde 2011-2015: resultados e perspectivas, 2ª edn. Ministério da Saúde, Brasília
Ministry of Health (2011) Ethiopia demographic and health survey (EDHS). http://dhsprogram.com/pubs/pdf/SR191/SR191.pdf/gtbr11_full.pdf. Accessed on Jun 2013
Mintzberg H (2007) Tracking strategies: toward a general theory of strategy formation. Oxford University Press, New York
Mitike G, Kebede D, Yeneneh H (1997a) HIV infection and antituberculosis drug resistance among pulmonary tuberculosis patients in Harar Tuberculosis Centre, Ethiopia. East Afr Med J 74:154–157
Mitike G, Kebede D, Yeneneh H (1997b) Prevalence of antituberculosis drug resistance in Harar Tuberculosis Centre, Ethiopia. East Afr Med J 74:158–161
Moreira AC, Sanchez MS, Moreira SS, Lopes CM (2004) The prevalence of tuberculosis in the state of Acre. Re. Bras Enferm 57:691–697
Mota FF, Vieira-da-Silva LM, Paim JS, Costa MCN (2003) Spatial distribution of tuberculosis mortality in Salvador, Bahia, Brazil. Cad Saúde Pública 19915–922
Natal S, Valente JG, Sánchez AR, Penna MLF (2003) Isoniazid and rifampicin resistance and prior treatment for tuberculosis. Cad Saúde Pública 19:1277–1281
Oliveira HB, Moreira Filho DC (2000) Tuberculose no sistema prisional de Campinas, São Paulo, Brasil. Rev Saúde Pública 34:437–443
Oliveira HB, Marin-León LM, Gardinali J (1995) Analysis of treatment outcomes related to the tuberculosis control program in the city of Campinas, in the state of São Paulo, Brazil. J Bras Pneumol 31:133–138
Onwuegbuzie AJ, Leech NL, Collins KMT (2012) Qualitative analysis techniques for the review of the literature. Qual Rep 17. http://www.nova.edu/ssss/QR/QR17/onwuegbuzie.pdf. Accessed Jun 2015
Pan American Health Organization (2012) Informe de la reunión regional de jefes de programas nacionales de control de la tuberculosis. http://new.paho.org/hq/index.php?option=com_docman&task=doc_view&gid=20111&Itemid. Accessed May 2014
Pôrto A, Nascimento DR (1995) Tuberculosos e seus itinerários. Hist Ciênc Saúde-Manguinhos 1:129–141
Ribeiro VM, Amado AA, Camelier A, Fernandes MMA, Schenkman S (2002) Estudo caso-controle de indicadores de abandono em doentes com tuberculose. J Pneumol 26:291–296
Rogers PJ (2011) Implications of complicated and complex characteristics for key tasks in evaluation. In: Forss K, Marra M, Schwartz R (eds) Evaluating the complex: attribution, contribution and beyond. Transaction Publishers, New Jersey, pp 33–51
Rossi PH, Lipsey MW, Freeman HE (2004) Evaluation: a systematic approach, 7th edn. SAGE Publications, London
Ruffino-Netto A (2002) Tuberculose: a calamidade negligenciada. Rev Soc Bras Med Trop 35:51–58
Ruffino-Netto A, Souza AMAF (2001) Evolution of the health sector and tuberculosis control in Brazil. Rev Panam Salud Pública 9:306–310
Santo AH, Pinheiro CE, Jordani MS (2003) Multiple-causes-of-death related to tuberculosis in the State of São Paulo, Brazil, 1998. Rev Saúde Pública 37:714–721
Santos J (2007) Resposta brasileira ao controle da tuberculose. Rev Saúde Pública 41(supl. 1):89–94
Selig L, Belo MT, Teixeira EG, Cunha AJ, Brito R, Sanches K, Luna AL, Muller M, Gamba C, Belo C, Vento F, Trajman A (2003) The study of tuberculosis-attributed deaths as a tool for disease control planning in Rio de Janeiro, Brazil. Int J Tuberc Lung Dis 7:855–859
Shargie EB, Lindtjørn B (2005) DOTS improves treatment outcomes and service coverage for tuberculosis in South Ethiopia: a retrospective trend analysis. BMC Public Health 5:62
Shargie EB, Mørkve O, Lindtjørn B (2006) Tuberculosis case-finding through a village outreach programme in a rural setting in southern Ethiopia: community randomized trial. Bull World Health Organ 84:112–119
Shimeles E, Aseffa A, Yamuah L, Tilahun H, Engers H (2005) Knowledge and practice of private practitioners in TB control in Addis Ababa. Int J Tuberc Lung Dis 10:1172–1177
Souza W, Ximenes R, Albuquerque MF Lapa TM, Portugal JL, Lima ML, Martelli CM (2000) The use of socioeconomic factors in mapping tuberculosis risk areas in a city of northeastern Brazil. Rev Panam Salud Pública 8:403–410
Szwarcwald CL, Barbosa Junior A, Souza Junior PRB, Lemos KRV, Frias PG, Luhm KR, Holcman MM, Esteves MAP (2008) HIV testing during pregnancy: use of secondary data to estimate 2006 test coverage and prevalence in Brazil. Br J Infect Dis 12:167–172
Teixeira L, Perkins MD, Johnson JL, Keller R, Palaci M, do Valle Dettoni V, Canedo Rocha LM, Debanne S, Talbot E, Dietze R (2001) Infection and disease among household contacts of patients with multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 5:321–328
Tekle B, Mariam DH, Ali A (2002) Defaulting from DOTS and its determinants in three districts of Arsi Zone in Ethiopia. Int J Tuberc Lung Dis 6:573–579
Vecchiato NL (1997) Sociocultural aspects of tuberculosis control in Ethiopia. Med Anthropol Q 11:183–201

Weiss CH (1997) Theory-based evaluation: past, present and future. In: Rog DJ, Fournier D (eds) Progress and future directions in evaluation: perspectives on theory, pratcice and methods. Jossey-Bass, San Francisco, pp 41–55 (New Directions for Efvaluation, n. 76)

Woldemichael K, Belachew T, Jira C (2004) Tuberculosis defaulters from the "DOTS" regimen in Jimma Zone, Southwest Ethiopia. Ethiopia Med J 42:247–253

World Health Organization (1994). Tuberculosis programme: framework for effective tuberculosis control. http://whqlibdoc.who.int/hq/1994/WHO_TB_94.179.pdf?ua=1. Accessed Nov 2011

World Health Organization (2003) Community contribution to TB care: practice and policy. World Health Organization, Geneva

World Health Organization (2011) Global tuberculosis control. http://apps.who.int/iris/bitstream/10665/44728/1/9789241564380_eng.pdf. Accessed Feb 2013

World Health Organization (2012) Global tuberculosis report 2012. http://apps.who.int/iris/bitstream/10665/75938/1/9789241564502_eng.pdf. Accessed Nov 2013

World Health Organization, Stop TB Partnership (2006) DOTS expansion working group strategic plan 2006–2015. World Health Organization, Geneva

Yassin MA, Takele L, Gebresenbet S, Girma E, Lera M, Lendebo E, Cuevas LE (2004) HIV and tuberculosis coinfection in the southern region of Ethiopia: a prospective epidemiological study. Scand J Infect Dis 36:670–673

Yassin MA, Datiko DG, Shargie EB (2006) Ten-year experiences of the tuberculosis control programme in the southern region of Ethiopia. Int J Tuberc Lung Dis 10:1166–1171

Yimer S, Bjune G, Alene G (2005) Diagnostic and treatment delay among pulmonary tuberculosis patients in Ethiopia: a cross sectional study. BMC Infect Dis 5:112