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Original Article

Evaluation of Borama tuberculosis control program in Somaliland, Somalia

Mohamed Gedi Qayad, Gianfranco Tarsitani

Department of Public Health and Infectious Disease, University of Rome-Sapienza, Rome, Italy

Abstract

Introduction: The Borama TB program in Somalia lost resources for TB operations in 2003. We evaluated the impact of the loss on the program.
Methodology: Pre-event (2002–2003) and post-event (2007) design were used. All TB patients registered in Borama and a sample of four months from Hargeisa (comparison) TB patients in both periods were abstracted. The following TB treatment outcomes were estimated: treatment success, treatment failure, case fatality, treatment interruption and transfer rates, along with percentage of patients with sputum specimen prior to treatment, percentage of patients from neighboring countries, and monthly average patients enrolled in treatment. The pre-event to post-event outcomes and measures were compared using descriptive and multivariate analyses.
Results: In total, 3,367 TB cases were abstracted. In Borama, the TB treatment success rate increased 6% in the post-event. The treatment failure and interruption rates both declined 75%. Monthly average TB patients declined 55%. Percentage of patients smear tested prior to the initiation of the treatment declined 9%. Percentage of TB patients from neighboring countries and other parts of Somalia declined 51%. Treatment interruption/transfer rates declined significantly in the post-event, compared to the pre-event period. Treatment failure/death rate did not change in the post-event period. In Hargeisa, the treatment success, failure/death, and interruption/transfer rates were similar in both periods. The RR did not change in these measures after adjusting for age and gender.
Conclusions: This study indicates a significant setback to the Borama TB control program in the majority of measures evaluated, except the TB success rate.

Key words: treatment; success rate; sputum test; Somalia; evaluation, tuberculosis.

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Introduction

In 2013, the World Health Organization (WHO) reported 9 million tuberculosis (TB) cases and 1.5 million TB deaths globally [1]. The majority of TB cases (56%) were from Southeast Asia and the Western Pacific region. Although a quarter of cases were reported from the African region, it has the highest TB incidence rate (280/100,000) in the world [1].

TB prevalence in Somalia has been high since colonial times [2,3]. The prevalence of TB in British Somaliland in 1956 was above 500/100,000 persons, with an 8% annual risk of infection. After independence in 1960 and before the start of the civil war that ravaged the country in the 1990s [4], the TB situation in Somalia improved. In the 1980s, the Finnish International Development Agency (FINIDA) provided tremendous assistance to the Somali National TB Control Program and introduced short-course chemotherapy to many regions of the country [5]. The prevalence of TB in Somalia remains high (300/100,000), with an estimated annual risk of infection (ARI) between 4% and 5% [4,6].

Somalia has been a failed state since 1991. Social services provided by the government, such as healthcare and education, collapsed. Currently, health services are mainly private. Public health programs, such as TB treatment and control, are supported by United Nations (UN) agencies, donor countries, and voluntary expatriates [7]. The country is disintegrated into mini-governments, Somaliland, Putland, and others. The main cities in Somaliland have TB control programs. Borama, one of the main cities in Somaliland, lies west of Hargeisa, the capital of Somaliland, and has borders with Ethiopia, Djibouti, and the Red Sea (Figure 1). The TB control program in Borama was revived and maintained by an Italian nun in 1996 [8]. The program supports the livelihood of TB patients and their immediate families. In addition, treatment adherence and sputum testing are strictly supervised. Community elders guaranteed patients' compliance with TB treatment and completion. The resources to support the program operations were mainly from the personal resources of the Italian nun, and others were solicited from UN agencies, donors,

and international non-governmental organizations (NGOs). Such personal initiatives were common in many health and non-health programs in developing countries in the 1960s, when many African countries gained their independence [9].

In October 2003, the program lost the enabling mechanism that was critical to the availability of resources that support the TB program operations when the Italian nun was assassinated. The social support and care for patients and their families, which were the main incentives for treatment compliance and attracted TB patients from other parts of Somalia, Ethiopia, and Djibouti, ended. Therefore, it became apparent that the loss of support would impact TB program performance in the future. This study aimed to evaluate the impact of the loss of resources and management on the performance of the Borama TB program.

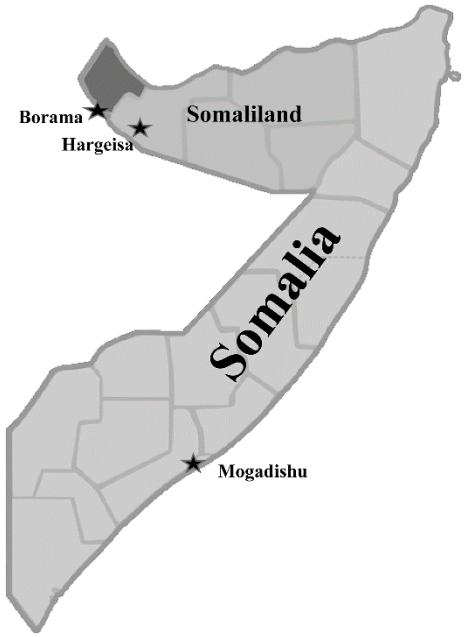
Methodology

The study was conducted in Somaliland, northern Somalia, in 2012. Pre-event and post-event design was used to evaluate the impact of the loss of resources and management on the performance of the Borama TB control program (Table 1). The Hargeisa TB control program was selected as a comparison. The study had no financial support from any agency, and the comparison site was chosen because of similar socio-demographics and proximity to the study site, which minimized the cost of the study.

Pre-event (2002–2003) was defined as the period before the loss of resources and management, and post-event (2007) as the period after the loss. TB data for 2004 and 2005 were not included in the study to avoid contamination of pre-event residual effects on the measures. TB cases in 2006 and 2008 were not collected from both TB programs, and were excluded from the analysis.

TB registry data were used to abstract all TB cases registered for treatment in Borama in the pre-event and post-event periods. Four months in the pre-event and in the post-event periods were selected randomly, one month from each quarter, from the cases registered in the Hargeisa TB program. The data in the TB registers was collected by three trained data collectors and entered into an Access database. Both programs had adopted the directly observed therapy strategy (DOTS) and were using short-course chemotherapy for TB treatment [10].

Figure 1. Map of Somalia showing the study sites.



The TB program in Borama had resources to provide support and care to TB patients and their immediate families, and to the program operation in the pre-event period. These included livelihood and social support to patients and their immediate families; financial support to hospital and program operations; strict monitoring and supervision of DOTS; sputum testing and recording; and involvement of community elders in the initiation, continuation, and completion of therapy. The logic model depicting these program inputs and measures that could be impacted is shown in Table 2.

Information collected from the TB registry included demographics; place of residence; treatment-related information; smear test prior to, during, and at end of treatment; treatment regimen; and patient attributes such as no prior treatment, relapsed or defaulted, and end-of-treatment patient status, although HIV status was not recorded in the registry.

Table 1. Study design: pre-event and post-event.

City	Time period		
	2002–2003 (pre-event)	Event	2007 (post-event)
Borama TB program	Before loss of resources and management	X	After loss of resources and management
Hargeisa TB program (comparison)	Comparison program	0	Comparison program

The percentages of patients who were cured (negative bacilloscopy), completed the treatment (clinically cured but had no bacilloscopy), or experienced treatment failure were calculated, along with case fatality rates and percentages of patients who interrupted treatment and who transferred out to other facilities. Other outcomes were also created by combining treatment outcomes above: treatment success rate, treatment failure/death, and treatment interruption/transfer rates. Treatment success rate was defined as the percentage of TB patients who were either cured and had negative bacilloscopy or completed the treatment but had no bacilloscopy examination. Treatment failure/death rate was defined as percentage of cases who either failed to convert to negative after treatment or died during treatment. Treatment interruption/transfer rate was defined as percentage of cases that interrupted treatment for two or more consecutive months or transferred out to another facility. The average monthly enrollment of TB cases, percentage of patients with sputum test prior to treatment, and percentage of patients from neighboring countries (Ethiopia, Djibouti, and other parts of Somalia), was also calculated.

These measures were calculated in pre-event and post-event periods. These are standard measures that national TB control programs record in TB registries and monitor, according to the WHO [12]. The pre-event (2002–2003) and post-event measures (2007) within each program and between Borama and Hargeisa TB programs were compared. The statistical significance of the differences between the pre-event and post-event periods of these measures were calculated using the t-test. Univariate and multivariate analyses were used to

Table 2. Program inputs and indicators affected after the loss of resources and management in Borama TB program.

	Indicators					
Program resources and management	**Treatment outcome: success rate/completion**	**Average number of patients enrolled monthly**	**Percentage of patients sputum tested before initiation of therapy**	**Percentage of patients from outside program area**	**Percentage of sputum tested during treatment**	**Percentage of patients with negative bacilloscopy during treatment**
Livelihood and social support to patients and their immediate families	×	×		×	×	
Financial support to hospital and program operations	×	×	×	×	×	×
Strict monitoring and supervision of DOTS and sputum testing	×	×	×		×	×
Involvement of community elders in the initiation and continuation of therapy	×		×	×	×	×

DOTS: directly observed therapy strategy.

Table 3. Gender and age distribution of TB cases by city, 2002–2003 and 2007, Somaliland, Somalia.

	City	
Variables	**Borama (n = 1,707) %**	**Hargeisa (n = 1,660) %**
Gender		
Male	64.2	61.8
Female	35.8	38.2
	100.0	100.0
Age group		
0–19 years	27.6	29.4
20–39 years	40.5	44.3
40–59 years	18.9	16.2
≥ 60 years	12.9	10.1
	100.0	100.0
Disease classification		
Pulmonary	72.5	78.8
Extrapulmonary	26.2	15.9
Pulmonary and extrapulmonary	1.4	5.3
	100.0	100.0

Missing cases not included in % calculation.

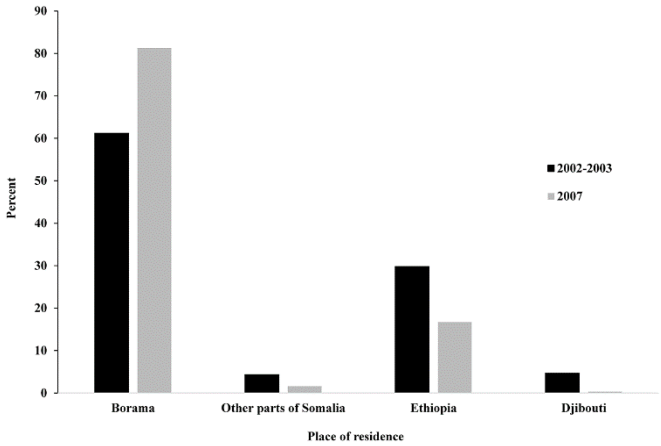
estimate the impact of the loss on these outcome measures.

The study was approved by the University of Rome-Sapienza, Department of Public Health and Infectious Diseases, the Somaliland Ministry of Health, and the TB control program directors for both programs.

Results

A total of 3,367 TB cases registered for treatment in Borama and Hargeisa TB control programs in the pre-event and post-event periods were abstracted; there were 1,707 cases from Borama and 1,660 cases from Hargeisa TB registries. The majority of the patients were males (64% for Borama and 62% for Hargeisa), and approximately one-third were 0–19 years of age in both programs (Table 3). The distribution of the cases by year of registration for treatment and by city is shown in Table 4. Around 75% of the cases were pulmonary TB. The percentage of patients cured (*i.e.*, with negative bacilloscopy) was 42% in Borama and 39% in Hargeisa (Table 4). The percentage of patients who completed the treatment (without bacilloscopy) in Borama was significantly lower than that in Hargeisa: 39% and 50%, respectively ($p < 0.05$). In Borama, the percentage of patients with treatment failure and those who interrupted the treatment (defaulters) was 3% for both measures, and 1% in Hargeisa for both measures. The case fatality rate was 6.8% in Borama and 4.6% in Hargeisa. The percentage of patients who transferred to another facility was 5.6% in Borama and 4.2% in Hargeisa.

Figure 2. Percentage of TB patients treated in Borama by residence and period.



In Borama, the treatment success rates in the pre-event and post-event periods were 80% and 85% ($p < 0.05$), respectively (Table 5). The treatment failure and

Table 4. Tuberculosis treatment outcome and percentage point differences between Borama and Hargeisa, Somaliland, Somalia.

	City						
	Borama		Hargeisa		Total	%	Percentage point difference
Treatment outcome	No.	%	No.	%			
Cured (bacteriologically negative)	723	42.4	649	39.1	1,372	40.7	3.3
Treatment completed (no sputum test)	661	38.7	828	49.9	1,489	44.2	-11.2
Treatment failure	56	3.3	15	0.9	71	2.1	2.4
Case fatality rate	116	6.8	76	4.6	192	5.7	2.2
Treatment interrupted	56	3.3	23	1.4	79	2.3	1.9
Transferred out	95	5.6	69	4.2	164	4.9	1.4
Total	**1,707**	**50.7**	**1,660**	**49.3**	**3,367**	**100**	

Table 5. Treatment outcomes and average number of TB cases enrolled per month by year and city, Somaliland, Somalia.

	Borama			Hargeisa		
Treatment outcome rates	2002–2003 (n = 1,401)	2007 (n = 306)	Differences [2007-(2002–2003)]	2002–2003 (n = 1,109)	2007 (n = 551)	Differences [2007-(2002–2003)]
Success rate	80.2	85	4.8*	89	88.9	-0.1
Failure rate	3.7	1.3	-2.4*	0.8	1.1	0.3
Case fatality rate	6.8	6.9	0.1	4.5	4.7	0.2
Percentage interrupted (defaulters)	3.8	1	-2.8*	1.5	1.1	-0.4
Percentage transferred out	5.5	5.9	0.4	4.1	4.2	0.1
Percentage of patients sputum tested before treatment initiation	67.1	61.4	5.7*	83.4	100	16.6*
Average number of cases per month	58.4	25.5	-32.9*	117.1	137.8	20.7*

* Statistically significant ($p < 0.05$).

treatment interruption rates declined significantly, from 4% in the pre-event to 1% in the post-event period for both measures ($p < 0.05$). The case fatality rate remained 7% in both periods. The average monthly TB patients enrolled in treatment also declined by 55% ($p < 0.05$), from 58 cases in the pre-event period to 26 in the post-event period. In the comparison program (Hargeisa), only the average number of TB cases enrolled for treatment per month increased by 18% ($p < 0.05$), from 117 cases in the pre-event period to 138 cases in the post-event period (Table 5). All other outcome measures were similar in both periods.

The percentage of TB patients receiving a sputum smear test prior to the initiation of treatment declined by 9% in the post-event period in Borama, from 67% in the pre-event period to 61% in the post-event period ($p < 0.05$), but increased by 20%, from 83% in the pre-event period to 100% in the post-event period, in Hargeisa (Table 5). Similarly, the percentage of patients coming from Ethiopia, Djibouti, and other parts of Somalia, combined, declined by 51% ($p < 0.05$), from 39% in the pre-event period to 19% in the post-event period (Figure 2). The TB cases from Ethiopia declined by 44%, from 29.8% in the pre-event period to 16.7% in the post-event period, the TB cases from Djibouti declined by 94%, from 4.7% in the pre-event period and 0.3% in the post-event period, and the TB cases from other parts of Somalia declined by 20%, from 4.3% in the pre-event period to 1.6% in the post-event period.

In Borama, the treatment success rate increased by 6% in the post-event period compared to pre-event period (relative risk [RR] = 1.06, 95% CI = 1.01–1.1) (Table 6), and changed slightly after controlling for age group and gender (RR = 1.05, 95% CI = 1.01–1.09). The relative risk of treatment failure/death rate and interruption/transfer rates remained the same in both periods. In the comparison program (Hargeisa), no differences were observed between the pre-event and

Table 6. Adjusted and unadjusted relative risk of TB treatment outcome in Borama TB program, Somaliland, Somalia.

			Treatment success rate		Treatment failure rate (failure/death)		Interruption rate (treatment interruption/transferred)	
Independent variables	**Number**	**%**	**Unadjusted RR (95% CI)**	**Adjusted RR (95% CI)**	**Unadjusted RR (95% CI)**	**Adjusted RR (95% CI)**	**Unadjusted RR (95% CI)**	**Adjusted RR (95% CI)**
Period								
Pre-event (2002–2003)	1,401	82	Referent	--	--	--	--	--
Post-event (2007)	306	18	1.06 (1.01–1.1)	1.05 (1.01–1.09)	0.8 (0.5–1.2)	0.8 (0.5–1.5)	0.3 (0.1–0.8)	0.3 (0.1–0.8)
Age group								
0–19 years	466	27.4	Referent	--	--	--	--	--
20 + years	1,235	72.6	0.9 (0.87–0.94)	0.91 (0.88–0.94)	2.0 (1.4–3.0)	2.1 (1.4–3.1)	2.6 (1.2–5.8)	2.8 (1.3–6.0)
Gender								
Female	608	64.2	Referent	--	--	--	--	--
Male	1,089	35.8	0.95 (0.92–0.99)	0.97 (0.93–1.0)	1.35 (0.99–1.9)	1.4 (1.0–1.9)	1.4 (0.8–2.5)	1.4 (0.8–2.5)

Table 7. Adjusted and unadjusted relative risk of TB treatment outcome in Hargeisa TB program (comparison), Somaliland, Somalia.

			TB treatment success rate		Treatment failure rate (failure/death)		Interruption rate (treatment interruption/transferred)	
Independent variables	**Number**	**%**	**Unadjusted RR (95% CI)**	**Adjusted RR (95% CI)**	**Unadjusted RR (95% CI)**	**Adjusted RR (95% CI)**	**Unadjusted RR (95% CI)**	**Adjusted RR (95% CI)**
Period								
Pre-event (2002–2003)	1,109	66.8	Referent	--	--	--	--	--
Post-event (2007)	551	33.2	1.0 (0.97–1.03)	1.01 (0.98–1.03)	1.1 (0.7–1.6)	1.03 (0.7–1.6)	0.7 (0.3–1.8)	0.6 (0.2–1.6)
Age group								
0–19 years	481	29	Referent	--	--	--	--	--
20 years +	1,172	71	0.96 (0.93–0.99)	1.0 (0.9–1.0)	1.6 (1.0–2.6)	1.5 (0.9–2.5)	4.4 (1.1–18.7)	4.6 (1.1–19.6)
Gender								
Females	632	61.8	Referent	--	--	--	--	--
Males	1,021	38.2	0.96 (0.94–0.99)	1.0 (0.9–1.0)	2 (1.2–3.2)	1.9 (1.2–3.1)	1.2 (0.5–2.8)	1.1 (0.5–2.6)

post-event periods in the treatment success rate, failure/death rate, and interruption/transfer rate (Table 7).

Discussion

The TB control program in Borama suffered after the loss of resources and management. Among the measures used to evaluate the impact of the loss on the performances of the program, the TB treatment success rate was the only measure that showed an improvement. This could be related to the continuity of the TB drug supplies and adherence to the DOTS strategy recommended by the WHO. The supply of TB drugs to the program was taken over by the Global Fund for AIDS, TB and Malaria (GFATM) before the 2003 event. The increase in the success rate could also be caused by the continued elder involvement in the treatment initiation and completion. This measure, which is an indicator monitored by national TB programs, affirms that the TB programs in Borama and Hargeisa met the required benchmark for treatment completion of new TB patients in the post-event period [1,11,12].

The treatment success rate in the comparison program, Hargeisa, increased more than that of Borama in the post-event period, indicating a setback to the Borama TB program despite the program's achievement of the WHO targets. A study in Uganda showed that involving the community in DOTS supervision improved the TB treatment success rate, decreased the proportion of defaulters, and increased the proportion of patients submitting sputum samples for testing [13], which was also found in the TB program in Borama. In addition, the decline in treatment failure and defaulter rates could be explained by the loss of strict supervision and monitoring of the treatment progress. Thus, recording of patients with failed and defaulted status may have been compromised, which could also support the explanation mentioned above for the increase in the treatment success rate.

Other measures used to evaluate the impact of the changed resource situation on the Borama TB program, which included average number of TB cases enrolled monthly, percentage of cases offered a sputum smear test prior to the initiation of the treatment, and percentage of patients coming from Ethiopia, Djibouti, and other parts of Somalia, showed a significant decline in the post-event period. Conversely, the first two measures above increased significantly in Hargeisa, indicating the impact caused by the loss of resources and strict management on the Borama TB program.

These measures are associated with the loss of resources and management in the post-event period, which is the support and care to patients and their immediate families, particularly TB patients coming from outside the program areas in Somalia and neighboring countries. The loss in tenacity of the supervision of sputum testing before the initiation of the therapy also contributed to this decline. The significant decline on the monthly enrollment for TB treatment could be mainly attributed to the disappearance of continuous livelihood assistance offered to these patients and their immediate families.

One of the most salient measures indicating the impact of the loss of resources and management in the Borama TB program was the substantial decline of the proportion of patients from Ethiopia, Djibouti, and other parts of Somalia in the post-event period. These patients constituted two-fifths of the total patients who attended the Borama TB program in the pre-event period, but this number dropped to one-fifth in the post-event period. In addition, the decline of the proportion of sputum samples for testing is related mainly to the loss of supplies and the strict supervision by TB program management. In some countries, TB programs involved community participation and volunteerism with some success [14,15], which the program evaluated shows.

The setback to the TB program in Borama could adversely affect the achievement of the Millennium Development Goals (MDG) for TB control in the program area and beyond, such as Somalia and other neighboring countries that benefitted from the program. The World Health Assembly committed to sustainable funding for TB control globally in 2005 [16] and continues to fund such programs, but bureaucratic hurdles could undermine its effectiveness and proper distributions. The TB program evaluated reached some success prior to receiving such funds because of the efforts of dedicated volunteers and community elders. Thus, social upheavals will continue and dedicated NGOs and individuals could make differences in health and humanitarian and development assistance in chronic disaster situations such as Somalia.

There are some limitations to this study. It was conducted in Somaliland, which has been stable since early 1992 compared to other parts of Somalia, and may have limited generalization to other TB control programs in Somalia. However, the study used a large dataset, and the TB treatment success rate in both programs was similar to that reported from overall Somalia [17]. The study used a pre-event-post-event design with a comparison site, which guarded against

threats to the validity of the results of the evaluation study. Thus, findings are less likely to be explained by other factors. Also, the proportion of extrapulmonary TB cases in both TB programs was similar to the global distribution of these cases [18]. There were many inputs into the TB program in Borama that cannot be evaluated singly, but the essential aspects of the program, compared to the comparison site, were involvement of community elders in TB treatment, social and livelihood support to patients and their families, strict supervision of program activities, and funding of the operations. These were the main aspects lost in the post-event period that differentiate the pre-event and post-event measures in the Borama TB control program, and could have contributed to the observed differences between the two periods.

Conclusions

This study highlights the importance of access to resources and dedicated manpower in the management of disease control programs in developing countries, particularly countries with prolonged disaster such as Somalia. Some NGOs and civil society organizations may have semi-voluntary dedication, but often rely entirely on donor support. The findings of the study underline the importance of voluntary human resources in the fight against diseases, particularly TB, malaria, HIV/AIDS, and other public health threats. The study also affirms that the attribute of manpower is as critical, if not more so, than are other aspects of health promotion, disease prevention, and control programs, particularly in poor nations.

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Corresponding author
Mohamed Gedi Qayad, MD, MSc, MPH, MSPH, PhD
Department of Public Health and Infectious Disease
University of Rome-Sapienza, Rome, Italy
Mailing address:
3160 Mercer University Dr
Atlanta, GA 30341
Phone: +1-678-557-8336
Email: mohamedqayad@msn.com

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