Sci-OAP Scientific Journal of Health Science Research

Analysis of tuberculosis cases notification and treatment outcomes in refugee camps in Kenya: Four-years retrospective study, 2014-2017

Tsegay Legesse[1], Stephen Mulesh[2], Dorothy Anjuri[3], Miriam Ngure[3], Salad Chiari[3], Fredrick Chepkwong[3], Job Okemwa[2], Adbirushid Diney[2], Abdillah Frah[2], Fathia Alwan[1] & Desta Kassa[1]*

[1]*Intergovernmental Authority on Development, Djibouti*

[2]*Ministry of Health, National TB program, Kenya*

[3]*Kenya Red Cross Society, Kenya*

Article Information

Article Type: Research Article

Article Number: SJHSR-0205

Received Date: 02 November, 2021 **Accepted Date:** 23 November, 2021 **Published Date:** 29 November, 2021

***Corresponding author:** Desta Kassa, Intergovernmental Authority on Development, Djibouti, Email: dkassa2003@gmail.com

Citation: Legesse T, Mulesh S, Anjuri D, Ngure M, Chiari S, et al. (2021) Analysis of tuberculosis cases notification and treatment outcomes in refugee camps in Kenya: Four-years retrospective study, 2014-2017. Sci J Health Sci Res Vol: 1, Issu: 1 (39-48).

Abstract

Background: Tuberculosis (TB) is more severe in refugee populations. Analyzing the key indicators of TB program performance is important to improve the TB control activities. The objective of this study was to assess trends in TB case notification, treatment outcomes and factors associated with unsuccessful TB treatment in Dadaab and Kakuma refugee camps in Kenya.

Methods: In this descriptive historical cohort study, demographic, type of TB, & patient, related clinical data and treatment outcome of all TB cases registered in the five health facilities at the refugee camps from January 1, 2014 to December 31, 2017 were extracted. Multivariable logistic regression analysis was used to identify factors associated with unsuccessful TB treatment.

Results: A total of 2055 TB cases were registered in Dadaab and Kakuma refugee camps. The annual TB case notification rate (CNR) per 100 000 population increased from 93.1 in 2015 to 130.9 in 2017. From 2014 to 2017, there was an increase in proportion of Extra pulmonary TB (EPTB) (16.2% to 21.1%) and contribution of children (<15 years) to total TB cases (20.3% to 25.8%). Proportion of bacteriologically confirmed new and relapse Pulmonary TB (PTB) patients increased from 49.5% to 60.9%. The annual treatment success rate was in the range of 92.6% to 94.4% over the four years. Overall, 2.2% were died (decreasing from 2.4% to 1.6%), 1.6% not evaluated (decreasing from 3.2% to 1.3%), 2.3% lost to follow-up (LTFU) (increasing from 1.3% to 3.2%), and 0.5% were treatment failed. Unsuccessful treatment outcome was significantly associated with pretreatment weight <40 Kg, male gender, smear positive PTB, and HIV infection.

Conclusions: From 2014 to 2017, there was a continuous increase in TB CNR, and in proportion of EPTB and childhood TB. Treatment success rate remained above global target (≥90%) as set by WHO, which should be maintained. Special support and close monitoring are required for TB patients who are at higher risk of unsuccessful treatment.

Key words: Tuberculosis, Refugees, Case notification, Treatment outcome

Introduction

Tuberculosis (TB) which is caused primarily by Mycobacterium tuberculosis [1] is the leading cause of death from single infectious agent by 2019 [2]. In 2019, there were an estimated 10.0 million incident TB cases and 1.4 million TB deaths (including HIV positives) in the globe [2]. TB is a major health problem in refugees and internally displaced populations (IDPs) due to poor shelter/housing, inadequate living conditions, limited health service access/use, poor nutritional status, coexistent illness like HIV and inadequate TB care and prevention [3-6]. Thus, TB infection and disease progression [4-6], acquiring or developing MDR-TB [7] and unsuccessful TB treatment outcome [8] is higher among refugees.

Studies show that risk of TB increases during armed conflicts and population displacements [6]. Globally, there were 70.8 million forcibly displaced populations including refugees in

2018 [9]. Of the refugee population, more than 85% were hosted in countries with high burdens of TB [10,11].

Reports also showed an association between continuous immigration and increase in TB prevalence [12] and in TB case notification [13,14]. Therefore, in order to address the TB burden in refugee populations and other high-risk groups, and also to end the global TB epidemic by 2035, special focus has been given to these high risk groups in the WHO Stop TB [15] and End TB [3] strategic documents.

Kenya is among the 30 high burden countries for TB, TB/HIV and MDR-TB in the world [2]. The estimated TB incident, HIV negative TB mortality, and notified TB cases in 2019 in Kenya was 140, 000; 20,000 and 86,400 respectively [2]. In 2017, Kenya hosted 495,428 refugees and asylum seekers in Dadaab and Kakuma camps and in Nairobi town, which contribute to 48.1%, 38.8% and 13.1% of total refugees, respectively [16].

Daddab and Kakuma, which are included in this study, are among the largest refugee camps in the world. They started hosting refugees in 1991 and 1992, respectively. The number of refugees and asylum seekers hosted in both Daddab and Kakuma camps has decreased from 534,093 in 2014 to 423,306 in 2017. More than 90% of the refugees hosted in Dadaab and Kakuma from 2014 to 2017 originate from Somalia, South Sudan, DR Congo and Ethiopia [16].

As most of refugees originate from TB prevalent countries and also hosted in high TB burden country [2], TB is the major health challenge among the refugee populations. In support of this, a previous study done in the refugee camps in North-East Kenya in 1994 showed that the incidence of new infectious TB patients in the camps was four times higher than the rate in the local population [10]. A part from this, there is limited study driven evidence on the TB program in the refugee camps. TB case notification and treatment outcome are important indicators to monitor TB program performances [17,18]. In countries that have high-performance of monitoring and evaluation systems, notifications of TB cases provide good proxy information on TB incidence (TB burden), whereas TB treatment outcomes provide information on the effectiveness of TB treatment programs [18].

The TB program in Kenya, including in the refugee camps, is guided by the National TB, Leprosy and Lung Disease Programme (NTLD-P), in the Department of Disease Prevention and Control, under the Ministry of Health (MOH) [19]. The National TB program (NTP) has a surveillance system to monitor and evaluate the performance of TB program. However, there is no specific study conducted on the trends of TB case notification, treatment outcome and factors associated with unsuccessful treatment outcome in the refugee camps. Therefore, this study was designed to assess TB case notification, treatment outcome, and factors associated with unsuccessful treatment outcomes in refugee camps in Kenya from 2014 to 2017.

Methods

Study settings and populations

The health facilities in the refugee camps in Kenya (Dadaab, Kakuma and other urban areas) deliver general health care services including TB prevention and control to the refugee population. The TB program in the refugee camps is led by the NTLD-P according to the national guideline for integrated Tuberculosis, Leprosy and Lung diseases in Kenya [19].

Dadaab and Kakuma, which are among the world's largest refugee camps, hosted above 90% of the refugees in Kenya. Dadaab refugee camp, located in Gerissa County, has three camps, namely Dagahaley, IFO and Hagadera. Kakuma refugee camp, located in Turkana County, has two areas of operation which are Kakuma Camp and Kalobeyei Integrated Settlement [16].

There are three health facilites loacted in the three camps in Dadaab (Dagahaley, IFO1 and Hagadera) and two hospitals located in Kakuma refugee camp (IRC Kakuma General Hospital and Kalobeyei health center) which deliver health services to the refugee population. Hence, according to the inclusion criteria (health facilites which have both TB diagnosis and treatment services starting at least from January 2017), all the five health facilites in Dadaab and Kakuma refugee camp were included in this study (Supplement 1).

All TB cases of all forms registered in these five health facilities from January 1, 2014 to December 31, 2017 were included in the study.

Study design, data collection and management

This study was health facility-based historical cohort study of four years (2014-2017). Data collection was conducted from January 2019 to April 2019. As defined in our study conducted in the refugee camps in Ethiopia [20], we used a similar approach for training the data collectors and supervisors, data collection, quality assurance and data management for this study as both studies were conducted at the same time. Data collection was done by trained health care workers using pretested data collection forms. Basic demographic and clinical data of each TB case registered in these refugee camps were extracted from TB patient register.

Definitions of variables and terms

Case notifications and treatment outcomes were defined based on the standard definitions in the National guidelines for integrated TB, Leprosy and Lung diseases in Kenya [19] and the World Health Organization (WHO) guidelines [17] (Supplement 2).

Data entry and statistical analysis

Two trained data clerks entered the data independently into Epi-info statistical software version 7 [21] and then cross-checked for consistency. STATA version 13 (Stata Corp, College Station, TX, USA) was used for data analysis. Frequencies, proportions, ratios were calculated to describe case notification and treatment outcome variables. Case notification rate (CNR) per 100, 000 population was measured as the number of TB cases notified during a given year divided by the end year refugee population recorded in both the refugee camps (Daddab and Kakuma) [16]. The independent variables included in the bivariate logistic regression analysis were age, sex, baseline weight, type of TB, refugee camps, year of treatment, and HIV and antiretroviral therapy (ART) status. Variables with a P-value of <0.05 in the bivariate analysis were included in the multivariable model. Multivariable logistic regression analysis was used to identify factors associated with unsuccessful treatment outcomes. Statistical significance level was considered at a P-value <0.05.

Results

Demographic and clinical characteristics of the study subjects

The characteristics of all TB cases notified are shown in Table 1. Over the four years' study period, a total of 2,055 TB cases of all forms, 1167 (56.8%) males and 857 (41.7%) females were registered. The mean age (standard deviation, SD) was 27.0 (18.5) years. Children under 15 years and adults 15–44 years represented 23.8% and 57.8% of the total TB cases, respectively. Of the total TB cases, 1,685 (82.0 %) were PTB, 364 (17.7 %) EPTB, and 6 (0.3%), with no record showing the type of TB (PTB or EPTB). Among the new and relapse pulmonary patients, 988 (55.9%) were bacteriologically confirmed and 779 (44.1%) were clinically diagnosed (Table 1).

By refugee camps, 1,094 (53.2%) of the notified cases were from Dadaab; and 961 (46.8%) cases were from Kakuma camp. The number of TB cases registered in the refugee health facilities is shown in Supplement 1.

Trends of TB case notification (2014–2017)

Trends in TB case notification by diagnostic category

The annual CNR per 100 000 population in both Daddab and Kakuma camps increased from 93.1 in 2015 to 130.9 in 2017 (Table 2). By camp, CNR increased from 112.3 in 2014 to 159.9 in 2017 in Kakuma, and from 75.3 in 2015 to 108.3 in 2017 in Daddab. The CNR over the study period (2014-2017) was higher in Kakuma than in Daddab camp.

From 2014 to 2017, percentage of PTB among total TB cases decreased from 83.8% in 2014 to 78.3%, and that of EPTB increased from 16.2% to 21.1%. Among the total PTB cases, the percentage of clinically diagnosed (smear-negative pulmonary TB plus pulmonary smear unknown/not done) decreased from 42.1% in 2014 to 30.9% in 2017. Among the pulmonary new and relapse patients, those bacteriologically confirmed increased from 49.5% in 2014 to 60.9% in 2017 (Table 1).

Total end-year refugee population was from United Nations High Commissioner for Refugees (UNHCR), Kenya [16].

TB case notification by gender

In each year of the study period, the proportion of notified cases for men was higher than women, with the male-to-female (M: F) ratio of ≥1.2:1. The M: F ratio increased from 1.5 in 2015 to 1.2 in 2017 (Table 1).

HIV testing and antiretroviral treatment

Among the 2055 notified TB cases, HIV testing was done for 2015 (98.1%) cases, of whom 206 (10.0%) were HIV positive. During the study period, 97.1%-99.4% of the TB cases were tested for HIV. Among those tested for HIV, HIV positive rate has decreased from 11.8% in 2014 to 7.4% in 2017; and antiretroviral treatment (ART) coverage has increased from 67.7% in 2014 to 97.5% in 2017 (Table 1).

Trend in TB Treatment outcomes, 2014-2017

TB Treatment outcome was evaluated for TB patients of all forms registered from 2014 to 2017(Table 3). From 2014 to 2017, the overall treatment success rate was 93.3% (ranging from 92.6% to 94.9%). Overall, 41.7% were cured, 51.6% treatment completed, 2.3% LTFU (increasing from 1.3% to 3.2%), 2.2% died (decreasing from 2.4% to 1.6%), 1.6% not evaluated (decreasing from 3.2% to 1.3%), and 0.5% treatment failed. The percentage of cured patients increased from 34.8% in 2014 to 52.0% in 2016, and then decreased to 39.7% in 2017.

Factors associated with unsuccessful TB treatment outcomes

Table 4 showed factors associated with TB treatment outcomes. As a result of multivariable analysis, factors associated with unsuccessful treatment outcome (LTFU, failed, and died) among TB patients of all forms were male gender (aOR 2.1, 95% CI:1.2–3.4, P =0.005), pretreatment weight < 40 Kg for adult (aOR = 1.8, 95% CI: 1.1–3.0, P =0.02), smear positive pulmonary TB (PTB+) (aOR = 2.1, 95% CI: 1.2–3.7, P =0.01) and HIV infection (aOR = 3.9, 95% CI:2.4–6.4, P <0.001).

Discussion

This study generates evidences on trends of case notification, treatment outcomes and factors associated with unsuccessful treatment outcomes in Dadaab and Kakuma refugee camps in Kenya.

In TB programs where surveillance system is well established (with very minimal underdiagnoses and underreporting of TB cases), TB case notifications can be used as a proxy for TB incidence estimates.

According to the WHO report, in countries where TB incidence was between 100 and 300 per 100,000 populations, TB CNR in migrants was 82.9 per 100,000 populations [22]. The national TB incidence rate in Kenya in 2017 was 158/100 000 population [2]. However, the TB CNR in the refugee camps in Kenya in 2017 (130.9) was lower than the CNR for Kenya in 2017 (172) [23], but higher than the CNR for immigrants (82.9) reported by WHO in 2013 [22].

TB CNR in Daddab and Kakuma refugee camps has continuously increased from 2015 (93.3) to 2017 (130.9) (Table 2). This is possibly due to the introduction of GeneXpert diagnostic in Dadaab and Kakuma camps since 2016,

Table 1: Characteristic of the notified TB cases of all forms in Dadaab and Kakuma refugee camps, Kenya, 2014-2017 (N=2055)

Characteristic	2014, N (%)	2015, N (%)	2016, N (%)	2017, N (%)	Total (2014-2017)
Total TB cases of all Forms notified	532	496	473	554	**2,055**
Mean age ±Standard deviation, years	28.5± 17.8	26.9± 18.5	26.8± 16.8	28.4± 20.3	27.7± 18.5
Age groups, years					
< 15	108 (20.3)	133 (26.8)	104 (22.0)	143 (25.8)	488 (23.7)
15-24	130 (24.4)	106 (21.4)	126 (26.6)	115 (20.8)	477 (23.2)
25-34	120 (22.6)	102 (20.6)	117 (24.7)	111 (20.0)	450 (21.9)
35-44	74 (13.9)	57 (11.5)	57 (12.1)	70 (12.6)	258 (12.6)
45-54	42 (7.9)	47 (9.5)	28 (5.9)	37 (6.7)	154 (7.5)
55-64	23 (4.3)	26 (5.2)	22 (4.7)	38 (6.9)	109 (5.3)
>= 65	28 (5.3)	20 (4.0)	17 (3.6)	39 (7.0)	104 (5.1)
Not recorded	7 (1.3)	5 (1.0)	2 (0.4)	1 (0.2)	15 (0.7)
Gender,					
Male	305 (57.3)	292 (58.9)	267 (56.4)	303 (54.7)	1167 (56.8)
Female	214 (40.2)	191 (38.5)	204 (43.1)	248 (44.8)	857 (41.7)
Not recorded	13 (2.5)	13 (2.6)	2 (0.5)	3 (0.5)	31 (1.5)
Male to Female (M:F) ratio	1.3	1.5	1.3	1.2	1.4
Type of TB					
Pulmonary TB (PTB)	446 (83.8)	425 (85.7)	380 (80.3)	434 (78.3)	1685 (82.0)
Extrapulmonary TB (EPTB)	86 (16.2)	68 (13.7)	93 (19.7)	117 (21.1)	364 (17.7)
Not recorded	0	3 (0.6)	0	3 (0.6)	6 (0.3)
Type of TB by diagnostic category:					
PTB+	222 (41.7)	225 (45.4)	283 (59.8)	263 (47.5)	993 (48.3)
PTB-	224 (42.1)	200 (40.3)	97 (20.5)	171 (30.9)	692 (33.6)
EPTB	86 (16.2)	68 (13.7)	93 (19.7)	117 (21.1)	364 (17.7)
Not recorded	0	3 (0.6)	0	3(0.5)	6 (0.3)
Type of TB Patients					
New and relapse	528 (99.2)	490 (98.8)	465 (98.3)	545 (98.4)	2028 (98.7)
Others previously treated	0	5	6	0	11
Treatment history unknown	0	0	0	5	5
Transfer in	0	0	0	1	1
Missed*	4	1	2	3	10
New and relapse PTB patients:	442 (99.1%)	420 (98.8%)	373 (98.2%)	427 (98.4%)	1662 (98.6%)
Bacteriologically confirmed.	219 (49.5)	224 (53.3)	282 (75.6)	261 (61.1)	986 (59.3)
Clinically diagnosed	223 (50.5)	196 (46.7)	91 (25.4)	166 (38.9)	676 (40.7)

HIV status**					
Positive	62 (11.8)	50 (10.4)	54 (11.5)	40 (7.4)	206 (10.2)
Negative	464 (88.2)	433 (89.6)	414 (88.5)	498 (92.6)	1809 (89.8)
Undocumented/unknown	6 (1.1)	13 (2.6)	5 (1.1)	16 (2.9)	40 (1.9)
Antiretroviral treatment (ART) initiation***					
Yes	42 (67.7)	49 (98.0)	54 (100)	39 (97.5)	184 (89.3)
No	20 (32.3)	1 (2.0)	0	1 (2.5)	22 (10.7)
TB cases by refugee camps					
Dadaab	332 (62.4)	262 (52.8)	242 (51.1)	258 (46.6)	1094 (53.2)
Kakuma	200 (37.6)	234 (47.2)	231 (48.9)	296 (53.4)	961 (46.8)

PTB+ = Smear-positive pulmonary TB

PTB- = clinically diagnosed PTB, which includes smear negative pulmonary TB, smear not done/unknown and PTB diagnosed by medical practitioner based on suggestive clinical signs and abnormal chest radiograph but not bacteriologically confirmed.

Missed: patients with no information about previous treatment history of TB in the unit TB register or in the data collection format

** The percentages for HIV positive and HIV negative are based on those with a known and documented HIV test results; and the percentages for "undocumented/unknown" group is based on the total number of TB cases enrolled.

*** Data on the timing of ART initiation in people living with HIV was not available.

Table 2: Trends of TB Case Notification Rate (CNR) per 100,000 population per year in Daddab and Kakuma refugee camps, Kenya (2014-2017)

Refugee Camps	Year	Total end-year refugee population	Total TB cases notified	TB case notification rate (CNR)/100,000 population per year
Daddab	2014	356,014	332	93.3
	2015	347,980	262	75.3
	2016	272,764	242	88.7
	2017	238,152	258	108.3
Kakuma				
	2014	178,079	200	112.3
	2015	184,550	234	126.8
	2016	154,947	231	149.1
	2017	185,154	296	159.9
Daddab and Kakuma	2014	534,093	532	99.6
	2015	532,530	496	93.1
	2016	427,711	473	110.6
	2017	423,306	554	130.9

Table 3: TB treatment outcome for all TB cases registered in Dadaab and Kakuma refugee camps, Kenya, 2014–2017 (N=2055)

Treatment outcomes	Years				
	2014 (N=532)	2015 (N=496)	2016 (N=473)	2017 (N=554)	Total (N=2055)
Cured	185 (34.8)	206 (41.5)	246 (52.0)	220 (39.7)	857 (41.7)
Treatment completed	309 (58.1)	265 (53.4)	192 (40.6)	295 (53.2)	1061 (51.6)
Treatment Failed	1 (0.2)	4 (0.8)	1 (0.2)	5 (0.9)	11 (0.5)
LTFU	7 (1.3)	9 (1.8)	14 (3.0)	18 (3.2)	48 (2.3)
Died	13 (2.4)	10 (2.0)	13 (2.8)	9 (1.6)	45 (2.2)
Not evaluated	17 (3.2)	2 (0.4)	7 (1.5)	7 (1.3)	33 (1.6)
Success rate	494 (92.9)	471 (94.9)	438 (92.6)	515 (92.9)	1918 (93.3)

Table 4: Factors associated with unsuccessful TB treatment outcomes among TB cases of all Forms in Dadaab and Kakuma refugee camps, Kenya, 2014– 2017

Characteristics	Successful outcomes; Frequency (%)	Unsuccessful outcomes; Frequency (%)	Bivariate analysis		Multivariable analysis ≠	
			OR (95%CI)	P value	Adjusted OR (95%CI)	P value
Gender						
Female	811 (96.4)	30 (3.6)	1			
Male	1076 (93.6)	74 (6.4)	1.9 (1.2-2.9)	0.005	2.1 (1.2-3.4)	0.005
Age						
15-24*	442 (94.4)	26 (5.6)	1			
25-34	417 (94.8)	23 (5.2)	0.9 (0.8-1.7)	0.82	0.8 (0.4-1.4)	0.44
35-44	229 (90.2)	25 (9.8)	1.9 (1.0-3.3)	0.03	1.7 (1.0-3.2)	0.06
>= 45	337 (93.6)	23 (6.4)	1.1 (0.6-2.1)	0.62	1.3 (0.7-2.3)	0.45
Pre-treatment weight, kg *§						
>40	1078 (94.2)	66 (5.8)	1			
< 40	292 (91.2)	28 (8.8)	1.5 (0.9-2.4)	0.05	1.8 (1.1-3.0)	0.02
Type of TB						
PTB-	664 (97.1)	20 (2.9)	1			
PTB+	894 (92.0)	78 (8.0)	2.9 (1.7-4.8)	<0.001	2.1 (1.2-3.7)	0.01
EPTB	354 (98.3)	6 (1.7)	0.6 (0.2-1.4)	0.22	0.3 (0.1-1.2)	0.10
HIV status						
Negative	1714 (96.0)	72 (4.0)	1			
Positive	167 (84.8)	30 (15.2)	4.2 (2.7-6.7)	<0.001	3.9 (2.4-6.4)	<0.001
ART initiated?						
Yes	145 (85.3)	25 (14.7)	1			
No	19 (79.2)	5 (20.8)	1.5 (0.5-4.5)	0.44		
Refugee camps						
Daddab	1033 (95.5)	49 (4.5)	1			
Kakuma	885 (94.2)	55 (5.8_	1.3 (0.9-1.9)	0.20		
Year of treatment						
2014	494 (95.9)	21 (4.1)	1			
2015	471 (95.3)	23 (4.7)	1.1 (0.6-2.1)	0.65		
2016	438 (94.0)	28 (6.0)	1.5 (0.8-2.7)	0.17		
2017	515 (94.1)	32 (5.9)	1.5 (0.8-2.6)	0.19		

PTB+ = Smear-positive pulmonary TB

PTB- = clinically diagnosed PTB, which includes smear negative pulmonary TB and smear not done/unknown

OR = Odds ratio

CI = Confidence interval

1:00= Reference

* = Analysis done for adults age ≥ 15 years old.

§ = Weight rather than body mass index (BMI) was used due to height data were not available

≠ = A total of 1413 patients with age ≥15 years were included in the multivariable analysis

updating national guideline which considers GeneXpert as initial diagnostic test in refugee settings, introduction of community TB care programs, and fostering linkage with the national TB program [24]. In summary, the trend in TB CNR in Daddab and Kakuma refugee camps needs to be carefully interpreted as the denominator (refugee population) fluctuates with mobility and reporting time in the year.

Bacteriologically confirmed diagnostic approach is a priority of TB programs as it helps to have accurate diagnosis of TB, to diagnose drug resistance TB and initiate treatment on time. Clinical diagnosis, which has lower specificity, is common in many areas where bacteriologic diagnostic services are limited, and in conditions where suggestive symptoms and chest X ray are obtained though the bacteriological results are negative.

In the refugee camps, the percentage of bacteriologically confirmed cases among new and relapse pulmonary patients has continuously increased from 2014 (49.5%) to 2017 (60.9%) (Table 1). However, by 2017, the percentage of bacteriologically confirmed patients (60.9%) was lower than the WHO 2018 report for Kenya (67%) and for Africa Region (66%) [25]. The increased trend in the proportion of bacteriologically confirmed TB cases could be due to the improvement in diagnostic service and more reliance on bacteriological examination, improvement in recording and reporting, and identification and referral of presumptive cases through house to house by the community health care workers [24]. The low proportions of bacteriologically confirmed TB cases in 2017 in the refugee camps (60.9%) in comparison to the national report (67%) may reflect the gap in diagnostic service and capacity in the refugee setting as they are located in the periphery. The low proportion of bacteriological confirmation TB cases in the refugee camps can be addressed by increasing the availability and utilization of advanced diagnostic such as GeneXpert, strengthening referral system, enhancing active case finding, and continuous capacity building of health care providers.

Evidence on type of TB by anatomical sites (PTB and EPTB) is important to intensify prevention and care activities. In this study, percentage of EPTB increased from 16.1% in 2014 to 21.2% in 2017 (Table 1). By 2017, EPTB contributed 21.1% to the total cases notified which is higher than the global (14%) and national/Kenya (16%) share of EPTB reported by WHO 2018 [25]. The reasons for the increased trend in EPTB in the refugee camps need to be investigated.

We further disaggregated the notified TB cases by gender which is important for targeted intervention. Several studies evidenced gender inequity in TB cases [26-29]. In this study, the M: F ratio for notification by 2017 (1.2) was lower than WHO's 2018 report for the globe (1.7) and for African countries (2.7) [25]. Based on the views of the health care workers in the refugee camps, which they shared to us during the discussion on the findings of this study, there is no barrier to physical access to TB services for women as all men and women live in the camp where health facilities are located within one to three kilometers. This could be one of the reasons for the lower M: F ratio of TB cases in this study compared to the African countries [25].

Though all age groups are vulnerable to TB, people in the age group 25-34 years globally [25] and in Kenya [22] were disproportionately affected by TB. Similarly, in our study the first and second largest proportion of the TB cases notified were age 15-24 (23.2%) and 25-34 (21.9%) years old (Table 1). Since people in the age group 15-34 years is of reproductive age and represents an active component of the workforce, TB programs should strengthen interventions and case finding efforts focused on this age group.

Usually, the source of infection for children is an infectious adult, mainly in the household. Therefore, paediatric TB has been considered as a sentinel marker for TB transmission [30,31]. In this study, the proportion of childhood TB (< 15 years) among the overall annual notified cases was high (20.3%- 25.8%) (Table 1).

The contribution of childhood TB has increased from 20.3% in 2014 to 25 .8% in 2017 (27.1% increase in four years). By 2017, the percentage of childhood TB in this study (25.8%) was higher than that reported in 2017 for the globe (10%) [25], and for Kenya (9%) [23]. The increase in childhood TB in the refugee camps could be due to increase in TB transmission (missed TB cases), increase in number of children (> 70% of refugees in the region are women and children), introduction of improved diagnostics like GeneXpert, or improved contact tracing.

It has been a global target to test everyone diagnosed with TB for HIV infection. By 2017, HIV testing was performed in 97.1% of the TB cases in the refugee camps, among those 7.4% were HIV positive, which is lower than the 28% TB/

HIV co-infection in Kenya in 2017 [23]. Moreover, 97.5% of the HIV positive TB patients in the refugee camps in 2017 were on ART. This is comparable to the 95% ART coverage for HIV positive TB cases in Kenya in 2017 [23]. Together, results of this study evidenced the strong collaboration between TB and HIV programmes in the refugee camps which need to be maintained.

Treatment success rate is the most important global indicator to monitor the overall quality of TB care, and the effectiveness of TB treatment program in particular. According to WHO global target, at least 90% treatment success rate need to be achieved by 2020 among people on TB treatment in order to end TB by 2035 [3]. TB treatment success rate (cured and treatment completed) in Daddab and Kakuma refugee camps (2014-2017) remained higher at a range 92.6% to 94.9% (Table 3). This is higher than the treatment success rate among refugees in different parts of the world, ranging from 63.6% to 77.5% [31,32-36], the treatment success rate for new and relapse TB cases registered in 2016 in the global (82%) and in Kenya (81%) [25], as well as the global target for 2020 (≥90%) set by WHO [3]. The higher treatments success rate in the refugee camps could be linked to improved adherence to treatment, quality of care, laboratory capacity, availability of adequate treatment regimens, and follow-up and support to patients. There are practical activities implemented in the refugee camps that can increase the treatment success including accessibility of TB diagnostic and treatment service which are located one to three km from the residence of the refugee communities, and enrollment of about 250 community health care workers which are actively engaged in patient follow up (tracing of lost to follow-up patients, daily directly observed treatment) and educating the refugee community about TB (symptoms, prevention, diagnosis, treatment).

From 2014 to 2017, there was a continuous decline in percentage of death (from 2.4% to 1.6%) and not evaluated (for 3.2% to1.3%) but an increase in LTFU (from 1.3% to 3.2%) and treatment failed (from 0.2% to 0.9%) (Table 3). Overall, death, LTFU, and treatment failed in the refugee camps (Table 3) were far lower than the reports from other refugee camps in different countries which showed 4.6% to 10.9% death rate, 7.1% to 27.3% LTFU, and 1.3%-2.0% treatment failed [8,35,36]. It was also lower than death rate (6%), “not evaluated” (4%), and LTFU (5%) of the 2016 cohort of TB cases in Kenya [23]. This can be further improved by enhancing tracing, improving recording systems, regular monitoring and evaluation, and nutritional support [8,33].

Identifying factors associated with unsuccessful TB treatment outcomes (treatment failed, died and LTFU) can help to design evidence-based interventions to reduce morbidity and mortality. This study showed that the risk factors for unsuccessful treatment outcomes were pretreatment weight ≤ 40 Kg for adults ≥ 15 years, male gender, smear positive PTB, and HIV infection.

Our study showed that male patients were more likely to have unsuccessful treatment outcome compared to female (OR=2.1) (Table 3). Other studies also showed gender variation in treatment outcomes [37-39], which could be due to gender specific sociocultural factors which influence response to treatment outcome [38,39]. Although poorly understood and need to be investigated, other biological reasons (gender-specific pharmacodynamics in particular) could contribute to the observed differences in the treatment outcome [39]. In addition, the fact that women are more likely to adhere to full course of treatment could result in better treatment outcomes [39].

In this study, HIV infected patients were more likely to have high probability of unsuccessful treatment outcomes compared with HIV negative TB cases, which is in line with other reports [40]. This could be due to less adherence of HIV patients to TB treatment due to drug burden, or due to less drug absorption related to drug-drug interaction, or due to HIV patients having advanced disease and comorbidities.

In summary, our multivariable analysis showed the need for special support and monitoring that can improve treatment outcome for patients at higher risk for unsuccessful treatment outcomes who are adults age ≥15 years with pretreatment weight < 40 Kg, male gender, smear positive pulmonary TB (PTB+), and HIV infected.

There are limitations in this study that need to be considered: Data incompleteness could be an issue as the study was conducted based on secondary data. Maximum effort was made to maintain the data quality through provision of training to data collectors and supervisors, regular supervision during data collection, 10% data re-entry in the field to check completeness, and verification of data during data entry. As our data were secondary, we were not also able to include other variables that have been found to be risk factors for unsuccessful treatment outcomes in other studies, including socioeconomic factors such as occupation and lower education level [9,26] and patient related factors such as being a smoker [41], having diabetes [42]. As we did not know the time of the ART initiation among HIV positive patients from the collected secondary data, this could influence the result of the treatment outcome. Moreover, analysis of MDR-TB was not included because data collection system for DR-TB has not been fully established in the refugee camps during the study period. Likewise, weight rather than body mass index (BMI) was used in the risk factor analysis due to height data were not available.

Strength of the study: Despite these limitations, we have generated useful information of four years TB case notification and treatment outcomes as well as factors associated with unsuccessful treatment outcomes. These will help for evidence-based planning of TB interventions in Dadaab and Kakuma refugee camps.

Conclusions

This study has generated information which will help improve TB care and prevention in the refugee camps. There was continuous increase TB CNR per 100 000 population from 93.1 in 2015 to 130.9 in 2017. There was an increasing trend in percentages of EPTB and in childhood TB (<15 years) among total TB cases notified over the study period. Proportion of bacteriologically confirmed new and relapse pulmonary patients increased overtime. TB treatment success during the study period was at rage of 92.6%- 94.4%, which is higher than the national rate (81%) as well as the the global target (≥90%) which needs to be maintained. There was a declining trend in death and not evaluated treatment outcomes but an increase in LTFU. Special support, follow-up and monitoring that can improve treatment outcome is recommended for patients at higher risk for unsuccessful treatment outcomes who are adults age ≥15 years with pretreatment weight < 40 Kg, male gender, smear positive pulmonary TB (PTB+), and HIV infected.

Acknowledgements

The authors sincerely acknowledge the facility managers for the administrative support which contributed to the success of this study.

Authors' contributions

TL, DA, MN, and DK designed the research and analyzed the data. TL, SM, DA, MN, SC, FC, JO, AD, AF, FA, and DK develop the manuscript. All authors read and approved the final manuscript.

Declaration of conflicting interests

The authors declared that they have no conflicts of interest related to the research, authorship, and publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article. This work was supported by The Global Fund to Fight Aids, Tuberculosis and Malaria, The Global Health Campus Chemin du Pommier 40, 1218, Le Grand-Saconnex, Switzerland.

Ethical approval

Ethical approval was obtained from AMREF Health Africa Ethics and Scientific Review Committee (ESRC), Kenya (Ref number AMREF-ESRC P611/2019).

Informed consent

This study was based on secondary data from the TB register in the refugee camps. Hence, written informed consents from the participants were not required due to the anonymous nature of the data.

Availability of data and materials

All data generated or analysed during this study are included in this Manuscript. However, patient level data which are analysed are available from the authors upon reasonable request and with permission of National TB, Leprosy and Lung Disease Programme (NTLD-P), Ministry of Health (MOH), Kenya.

References

1. Van Soolingen D. Molecular epidemiology of tuberculosis and other mycobacterium infections: main methodologies and achievements. J Intern Med. 2001; 249 (1):1–26.
2. Global tuberculosis report 2020. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.
3. World Health Organization (WHO). The End TB Strategy. Geneva: World Health Organization; 2015. Available at https://www.who.int/tb/strategy/end-tb/en/.
4. Njuki, C. and Abera, W. Forced displacement and mixed migration challenges in the IGAD region. GREAT insights Magazine- volume 7, Issue 1. Winter 2018
5. Kimbrough W, Saliba V, Dahab M, Haskew C, Checchi F. The burden of tuberculosis in crisis-affected populations: a systematic review. Lancet Infect Dis. 2012; 12:950–65
6. World Health Organization (WHO). Interregional workshop for tuberculosis control and care among refugees and migrant populations, 10-11 May 2016, Catania, Italy.
7. Acosta CD. Conflict and drug-resistant tuberculosis in Ukraine. Lancet. 2014; 384:1500–1.
8. Ejeta E, Beyene G, Balay G, Bonsa Z, Abebe G. Factors associated with unsuccessful treatment outcome in tuberculosis patients among refugees and their surrounding communities in Gambella Regional State, Ethiopia. PLoS ONE. 2018; 13(10): e0205468
9. United Nations High Commissioner for Refugees (UNHCR). Global Trends: Forced Displacement in 2018. Geneva: UNHCR; 2019. Available at https://www. unhcr.org/5d08d7ee7.pdf
10. World Health Organization (WHO). Tuberculosis control in refugee situations: An Inter-agency field manual. (WHO/TB/97.221)
11. Proença R, Souza FM, Bastos ML, Caetano R, Braga JU, Faerstein E, et al. Active and latent tuberculosis in refugees and asylum seekers: a systematic review and meta-analysis. BMC Public Health. 2020; 20: 838.
12. Kruijshaar ME, Abubakar I. Increase in extrapulmonary tuberculosis in England and Wales 1999–2006. Thorax. 2009; 64:1090-1095
13. World Health Organization (WHO), International Organization for Migration, Ministry of Health of Lebanon. Joint review of the national tuberculosis programme of Lebanon. 2015.
14. United Nations High Commissioner for Refugees (UNHCR). Public Health Strategy for Tuberculosis among Syrian Refugees in Jordan, July 2013.
15. World Health Organization. Stop TB strategy. Geneva: World Health Organization; 2006. WHO/HTM/TB/2006.368
16. United Nations High Commissioner for Refugees (UNHCR). Refugees and Asylum-Seekers in Kenya, Statistical summary as of November 2019, available at: https://www.unhcr.org/ke/wp-content/uploads/sites/2/2019/09/Kenya-Statistics-Package-31-August-2019.pdf.
17. World Health Organization (WHO). Definitions and reporting framework for tuberculosis-2013 revision. Geneva: WHO; 2013. WHO/HTM/TB/2013.2
18. World Health Organization (WHO), Compendium of WHO guidelines and associated standards: ensuring optimum delivery of the cascade of care for patients with tuberculosis, second edition. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO.
19. Ministry of Health, republic of Kenya. Guideline for integrated Tuberculosis, leprosy and lung disease in Kenya, September 2017 edition
20. Legesse T, Admenur G, Gebregzabher S, Woldegebriel E, Fantahun B, Tsegay Y, et al. Tuberculosis (TB) in the refugee camps in Ethiopia: trends of case notification, profile, and treatment outcomes, 2014 to 2017. BMC Infectious Diseases. 2021; 21:139

21. Center for diseases control and prevention (CDC): Epi Info 7.0.8.3. CDC/ WHO; 2011

22. WHO. Systematic Screening for Active Tuberculosis: Principles and Recommendations. Geneva: World Health Organization; 2013.

23. Ministry of Health, Republic of Kenya. National Tuberculosis, Leprosy and Lung disease program (MOH/ NTLD-P, 2017). Annual report, 2017

24. Global Fund IGAD TB/HIV regional grant performance evaluation: October 201-Decebber 2017, February 2018

25. Global tuberculosis report 2018. Geneva: World Health Organization; 2018. Licence: CC BY-NC-SA 3.0 IGO

26. Dangisso MH, Datiko DG, Lindtjørn B. Trends of Tuberculosis Case Notification and Treatment Outcomes in the Sidama Zone, Southern Ethiopia: Ten-Year Retrospective Trend Analysis in Urban-Rural Settings. PLoS ONE. 2015; 10(4): e0125135.

27. Gebreegziabher, S.B., Yimer, S.A. and Bjune, G.A. Tuberculosis Case Notification and Treatment Outcomes in West Gojjam Zone, Northwest Ethiopia: A Five-Year Retrospective Study. Journal of Tuberculosis Research. 2016; 4, 23-33.

28. Dogar OF, Shah SK, Chughtai AA, Qadeer E. Gender disparity in tuberculosis cases in eastern and western provinces of Pakistan. BMC Infect Dis. 2012; 12: 244.

29. Borgdorff MW, Nagelkerke NJ, Dye C, Nunn P. Gender and tuberculosis: a comparison of prevalence surveys with notification data to explore sex differences in case detection. Int J Tuberc Lung Dis. 2000; 4: 123–132.

30. Thorson A, Diwan VK. Gender inequalities in tuberculosis: aspects of infection, notification rates, and compliance. Curr Opin Pulm Med. 2001; 7: 165–169.

31. Shingadia D, Novelli V. Diagnosis and treatment of tuberculosis in children. Lancet Infect Dis. 2003; 3(10):624–32.

32. Dogru S, Doner P. Frequency and outcomes of new patients with pulmonary tuberculosis in Hatay province after Syrian civil war. Indian J Tuberc. 2017; 64: 83-88.

33. Vo LNQ, Codlin AJ, Forse RJ, Nguyen HT, Vu TN, Truong VV et al. Tuberculosis among economic migrants: across-sectional study of the risk of poor treatment outcomes and impact of a treatment adherence intervention among temporary residents in an urban district in Ho Chi Minh City, Viet Nam. BMC Infect Dis. 2020; 20(1):134.

34. Sukrakanchana-Trikham P, Pue´chal X, Rigal J, Rieder HL.10-year assessment of treatment outcome among Cambodian refugees with sputum smear-positive tuberculosis in Khao-l-Dang, Thailand. Tuber Lung Dis. 1992; 73(6):384–7.

35. Minetti A, Camelique O, Hsa Thaw K, Thi S, Swaddiwudhipong W, Hewison C. et al. Tuberculosis treatment in a refugee and migrant population: 20 years of experience on the Thai-Burmese border. Int J Tuberc Lung Dis. 2010 Dec; 14(12):1589–95.

36. Rutta E, Kipingili R, Lukonge H, Assefa S, Mitsilale E, Rwechungura S. Treatment outcome among Rwandan and Burundian refugees with sputum smear-positivetuberculosis in Ngara, Tanzania. Int J Tuberc Lung Dis. 2001; 5(7):628–32.

37. Feng JY, Huang SF, Ting WY, Chen YC, Lin YY, Huang RM, et al. Gender differences in treatment outcomes of tuberculosis patients in Taiwan: a prospective observational study. Clin Microbiol Infect. 2012; 18 (9):E331–7.

38. Allotey P, Gyapong M. Gender in tuberculosis research. Int J Tuberc Lung Dis. 2008; 12 (7):831–6.

39. Murphy ME, Wills GH, Murthy S, Louw C, Bateson ALC, Hunt RD, et al. Gender differences in tuberculosis treatment outcomes: a post hoc analysis of the REMoxTB study. BMC Med. 16, 189 (2018).

40. Sisay S, Mengistu B, Erku W, Woldeyohannes D. Directly Observed Treatment Short-course (DOTS) for tuberculosis control program in Gambella Regional State, Ethiopia: ten years' experience. BMC Research Notes. 2014; 7:44. https://doi.org/10.1186/1756-0500-7-44

41. Masjedi MR, Hosseini M, Aryanpur M, Mortaz E, Tabarsi P, Soori H, et al. The effects of smoking on treatment outcome in patients newly diagnosed with pulmonary tuberculosis. Int J Tuberc Lung Dis. 2017;21(3):351-6. https://doi.org/10.5588/ ijtld.16.0513 PMID: 28225348

42. Jiménez-Corona ME, Cruz-Hervert LP, García-García L, Ferreyra-Reyes L, Delgado-Sánchez G, Bobadilla-Del-Valle M, et al. Association of diabetes and tuberculosis: impact on treatment and post-treatment outcomes. Thorax. 2013;68(3):214- 20. https://doi.org/10.1136/ thoraxjnl-2012-201756 PMID: 23250998