Epidemiological profile, treatment outcomes and factors associated with unfavorable treatment outcomes among patients co-infected with Tuberculosis and Human Immunodeficiency Virus in the Centrale Health Region in Togo, 2008 – 2017

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ABSTRACT

Introduction: Co-infection with Tuberculosis and Human Immunodeficiency Virus (TB/HIV) is highly lethal and Africa hosts 74% of cases. In Togo, the prevalence of TB/HIV co-infection was 22% in 2016 with a 42% mortality among the TB/HIV co-infected cases. There is limited data on TB/HIV co-infection in Centrale health region to inform control and commitment efforts towards end TB by 2030. We aimed to describe epidemiological characteristics, treatment outcomes and identify factors associated with unfavorable outcomes among TB/HIV co-infected cases. **Methods:** We conducted a descriptive analysis of secondary data on TB cases recorded in the four Centers of Diagnosis and Treatment (CDTs) of the Togolese Centrale health region from 2008 to 2017. Socio-demographical, clinical and treatment data were collected on a designed questionnaire by reviewing all TB management tools of the four CDTs. We subsequently entered data in Epi-Info-7 and calculated means, ratio and proportions for descriptive analysis. In multivariate analysis, logistic regression was performed to obtain Adjusted Odd Ratio (AOR), 95% Confidence Interval (CI) and p-value to identify factors associated with unfavorable outcomes. **Results:** Over the period, 1,448 patients were screened for HIV among 1,825 TB patients recorded. Overall, TB/HIV prevalence was 30.87% (447/1448) range 43.8% in 2008 to 27.6% in 2017 (p=0.01). The mean age of TB/HIV patients varied from 28.80±7.70 years in 2008 to 33.48±8.11 years in 2017. Female to Male sex ratio varied from 9.7 in 2008 to 2.5 in 2017. Pulmonary TB form cases accounted for 94.41% (422/447) of which 74.41% (314/422) were smear positive (SPT+) and 25.59% (108/422) were smear negative, while extra-pulmonary form cases represented 5.59% (25/447). The proportion of TB/HIV patients on Antiretroviral Treatment (ART) varied from 5.25% (2/32) in 2008 to 94.29% (33/35) in 2017. Lost to follow up patients represented 1.57% (7/447) while treatment success rate varied from 62.29% in 2008 to 82.00% in 2017. Case fatality rate decreased from 34.48% in 2008 to 23.53% in 2017. Smear-positive TB (AOR=2.11, 95% CI (1.21-3.60)), TB treatment initiation in the second quarters of the year (AOR=1.71, 95% CI (1.03-2.85)) and having been taken care of between 2015 and 2017 (AOR=1.90, 95% CI (1.14 – 3.12)) were independently associated with unfavorable outcome. When stratified by type of outcome, the absence of ART (AOR=2.62, 95% CI (1.46 – 4.69) were associated with deaths. **Conclusion:** TB/HIV co-infection affected young people particularly women with high mortality. The TB form, period of treatment initiation and lack of HIV care influenced treatment outcomes. Systematic HIV screening and ART earlier initiation, practice of DOTS whether based on family or based on caregivers for each patient and caregivers training on TB/HIV co-infection management are necessary to improve patients' survival.

Introduction

Tuberculosis and Human Immunodeficiency Virus (TB/HIV) co-infection is the existence of both active TB and HIV infection in the same person. The immune suppression induced by HIV infection increases the risk of developing the active form of TB. TB is the leading cause of death among HIV patients [1-3] and TB/HIV co-infection increases the risk of poor outcome of either disease [4].

The burden of TB/HIV co-infection is high worldwide and Africa is one of the most affected regions [3, 5]. In 2008, TB/HIV co-infection accounted for 15% of the estimated 9.4 million new TB cases worldwide, with 78% of the TB/HIV cases in the African region [6,7]. Seven years later, in 2015, TB/HIV accounted for 11% of the estimated 10.4 million TB cases and 22% of deaths were related to TB infection [8]. In 2017, TB/HIV co-infection represented 9% of TB cases worldwide of which 72% were in Africa with mortality estimated at 18.8% [9].

Nevertheless, effective response strategies and interventions exist and are accessible in low- and middle-income countries. Early detection of TB/HIV co-infection and treatment combining antiretroviral therapy (ART) and anti-TB drugs are the main documented strategies. The proportion of TB/HIV co-infection cases on anti TB therapy increased from 33% in 2008, to 78% in 2015 and 84% in 2017 [9,10]. Despite this progress treatment TB/HIV co-infection, remains a very deadly co-morbidity [11-13].

In Togo, the National Tuberculosis Control Program (PNLT) strategic actions are based on the "Stop TB" and "End TB" strategic objectives [14, 15]. By the actions of PNLT, the proportions of TB/HIV co-infections declined from 28% in 2008 to 22% in 2016 [16]. Despite the high TB/HIV co-infection burden in Togo, there is paucity of data on the dual burden. [17,18]. Moreover, the annual national TB control reports do not provide specific regional characteristics of TB/HIV co-infection to guide tailored control interventions.

This study is a secondary data analysis of TB cases focused on TB/HIV co-infection cases that aims to describe socio-demographic and clinical characteristics, treatment outcomes and factors associated with unfavorable outcomes among TB/HIV co-infected patients in the Centrale health region of Togo from 2008 to 2017.

Methods

Study setting and study area

The Centrale health region of Togo comprises four health districts including Blitta, Sotouboua, Tchamba and Tchaoudjo with a total population of 502,000 inhabitants in 2008 and 717,040 inhabitants in 2017 [19]. Each district, has a Diagnosis and Treatment of Tuberculosis Center (CDT), supervised by the Health District Manager. These four CDTs are directly led by a focal person, who is trained in TB case management.

Each CDT had an accredited medical laboratory that can conduct TB Acid-Fast Bacilli microscopy but does not have capacity for bacteriological culture and testing of TB drug resistance. Each health district also has a standard x-ray testing facility for TB diagnosis.

From 2008 to 2011, the TB treatment protocol comprised a fixed combination of Rifampicin (R), Isoniazid (H), Pyrazinamide (Z), Ethambutol (E) for two months and Rifampicin (R) and Isoniazid (H) for six months: 2RHZE/6RH for a total of duration of eight months. From 2012 onwards, the duration of the treatment regimen was reduced to six months: 2RHZE/4RH. Patients undergoing TB retreatment (for treatment failure and TB relapse) would receive additional daily Streptomycin (S) injection for two months making the treatment regimen last nine months: (2RHZES/4RHZE/3RH). Directly Observed Treatment Short-course (DOTS) as WHO´s guideline for TB treatment was the recommended treatment strategy [14], but in practice, the treatment of the majority of patients is not directly supervised by a relative or a health worker.

For HIV/AIDS case management, the National HIV/AIDS Program applied the WHO and UNAIDS guidelines for ART to develop treatment protocols [20,21].

Study design and population

In a cross sectional study, we reviewed health data on TB cases recorded in the Centrale health region

of Togo from 1st January 2008 to 31st December 2017. The study population included all TB/HIV co-infected cases recorded in all TB registers during the study period in the four CDTs.

Concepts definitions

Smear-positive pulmonary tuberculosis (SPT+)

Any case of pulmonary TB with a positive sputum smear and a positive HIV test.

Smear negative pulmonary tuberculosis (SNT-)

Any case with bronchopulmonary signs, whose microscopic examination of the sputum is negative with a chest X-ray suggestive of an active TB and whose HIV test was positive.

Extra pulmonary tuberculosis (EPT)

Any case bacteriologically confirmed or clinically diagnosed TB in organs other than the lungs are affected and whose HIV test was positive.

Cured of tuberculosis

A patient cured of TB was any person with TB/HIV with a negative smear during the last month of TB treatment and at least once before during the course of TB treatment.

Treatment completed for tuberculosis

A TB/HIV patient who has completed TB treatment without evidence of failure, but there is no data available indicating that the results of the smear examination were negative during the last month of treatment and at least once before, either because the tests were not performed or because the results were not available.

Tuberculosis treatment failure

Was defined as a patient with TB/HIV with a positive smear after five months or more of treatment.

Death

TB/HIV patient died for any reason during or before end of treatment.

Lost to follow-up

Concerned TB/HIV patient who had started TB treatment and had not been seen for two or more consecutive months.

Favorable outcome or treatment success

Any TB/HIV patient under TB treatment who was cured of TB or who had completed his treatment.

Unfavorable outcome

Any TB/HIV patient under TB treatment who died, or was been lost to follow up or with TB treatment failure.

Study variables

Socio-demographic characteristics studied were: age, sex, socio-professional category, area of residence, and the period of TB/HIV detection. Clinical and therapeutic characteristics were: form of TB, density of Acid-Fast Bacilli (AFB), type of TB, TB form, treatment outcome, time of TB treatment initiation, period of the first reassessment of the sputum after treatment initiation, result of microscopic sputum examination at the first follow-up assessment of the sputum, Cotrimoxazole prophylaxis and ART.

Data collection

All the TB management tools (including TB treatment registers, laboratory registers and TB control management quarter reports) of the four CDTs were reviewed, to extract available data of TB/HIV co-infection onto a designed study checklist on which were transcribed all the socio-demographic, clinical and therapeutic variables recorded in the TB treatment register.

Laboratory information

The Ziehl Nelson coloration technique was used to identify AFB and diagnose smear-positive pulmonary tuberculosis (SPT+). Smear-negative pulmonary (SNT-) or EPT was diagnosed by considering medical history, clinics and results of chest, hips, knees, or spine X-rays.

The Determine rapid test supplemented by the "First Response" test were used to screen patients for HIV infection.

Data processing and analysis

The TB/HIV co-infection database was examined to identify missing data, outliers and inconsistencies which were corrected by reviewing TB registers and reports. Those that could not be corrected were removed. Epi Info software, version 7.2.1.0. was used for the analysis. Univariate analysis was performed first, using Student´s t test to compare two means. When there were more than two means to compare, ANOVA test was used when p-value of Bartlet test were greater than or equal to 0.05 and Kruskall Walis test when p-value of Bartlet test was less than 0.05.

In bivariate analysis, factors associated with unfavorable outcomes and deaths were assessed by calculating the crude Odds Ratio (OR), its 95% confidence interval (CI) and the p-value (p). In multivariate analysis, logistic regression was performed to identify the independent factors associated with unfavorable outcome or deaths. For each of these factors, the association was assessed by calculating the Adjusted Odds Ratio (AOR) with $p<0.05$.

Ethical considerations

Togo's National Tuberculosis Control Program provided authorization before we conducted this study. Data collection was carried out confidentially and anonymously and the access to database was protected by a password.

Results

From January 2008 to December 2017, 1,825 patients were diagnosed with TB in the four CDTs. Among them, 79.34% (1448/1825) were screened for HIV infection of whom 30.87% (447/1448) patients were TB/HIV co-infected.

Socio demographic characteristics of TB/HIV coinfection cases

The mean age of TB/HIV co-infected cases in the Centrale health region was 31.09 ±10.20 years, range from 28.80 ±7.70 years in 2008, 31 ±10.57 years in 2012 and 33.48 ±8.11 years in 2017 (p=0.008). The mean age in women was 29.53± 9.15 years and was 36.25 ± 11.74 years in men (p<0,001). The female to male sex ratio was 3.30 (343/104) and varied from 9.7 in 2008 to 2.5 in 2017 (p=0.133).

Of the 447 cases recorded, 40 (8.95%) were from Blitta, 64 (14.32%) from Sotouboua, 55 (12.30%) from Tchamba and 288 (64.43) from Tchaoudjo. Up to 53.69% (240/447) of patients came from rural areas. When classified by CDTs and those coming from rural areas, there was 80% (32/40) in the CDT of Blitta; 40.62% (26/64) in the CDT of Sotouboua; 30.73% (18/55) in the CDT of Tchamba and 56.94% (164/288) in the CDT of Tchaoudjo (p<0.001) **Table 1**

By occupations, 69.16% (305/441) were housewives, 19.95% (88/441) were famers, 8.16% (36/441) pupils and 2.72% were other occupations. Farmers range 2 (6.25%) in 2008 and 7 (20%) in 2017. The number of housewives varied from 27 (84.38%) in 2008 to 36 (72.00%) in 2012 and 23 (65.71%) in 2017.

Clinical features and treatment outcomes of TB/HIV co-infection cases

Newly diagnosed TB cases were 428 (95.75%) among 447 TB/HIV cases recorded. Pulmonary TB forms accounted for 94.41% (422/447) of which 74.41% (314/422) were smear positive (SPT+) and 25.59% (108/422) were smear negative, while EPT forms represented 5.59% (25/447). In 2008, proportions of SPT+ and SNT- forms were respectively 81.25% (26/32), 18.75% (6/32) with no EPT cases. From 2012 to 2017, SPT+ varied respectively from 58.00% (29/50) to 82.86% (29/35), SNT- varied from 32.00% (16/50) to 0% (0/35) and EPT varied from 10.00% (5/50) to 17.14% (6/35). Among the SPT+ cases, 55.64% were diagnosed with 1-10 AFB density per microscopic field. This proportion varied from 57.69% in 2008 to 50.00% in 2012 and 64.29% in 2017 (p = 0.569).

Overall, the proportion of TB cases screened for HIV was 79.69% (1448/1817) and ranged from 34.27% (73/213) in 2008 to 93.14% (163/ 175) in 2012 and 93.38% (127/136) in 2017 (p<0.001) **Figure 1**.

All TB/HIV cases had received anti-TB drugs and 81.43% (364/447) were taking Cotrimoxazole prophylaxis. Over the ten years, the proportion of cases taking Cotrimoxazole varied from 31.25% (10/32) in 2008, to 85.71% (42/49) in 2012 and to 94.29% (33/35) in 2017 (p<0.001). Proportion of patients on ART was 64.11% (284/443) and varied from 6.25% (2/32) in 2008 to 67.35% (33/49) in 2012, and 94.29% (33/35) in 2017 (p<0.001)**Figure 1**.

For microscopic sputum monitoring at two months in SPT+ cases, 83.44% were performed on time and 9.16% (24/262) were positive.

Treatment success rate (Figure 2) was 76.92% in general, and varied from 61.29% (19/31) in 2008 to 82.00% (41/50) in 2012 and 70.59% (24/34) in 2017 (p = 0.115). From one CDT to another, treatment success rate was 89.74% (35/39) in Blitta, 68.25% (43/63) in Sotouboua, 67.27% (37/55) in Tchamba and 78.95% (225/285) in Tchaoudjo (p=002). Among SPT+ cases, the cure rate was 72.23% (227/310) and ranged from 57.69% (15/26) in 2008 to 68.97% (20/29) in 2012 and 75% (21/28) in 2017 (p=0.389) **Table 2**.

Fatality rate (Figure 2) decreased from 34.48% (10/29) in 2008 to 14.00% (7/50) in 2012 before rising to 23.53% (8/34) in 2017 (p=0.104). Among CDTs, fatality rate varied from 10.25% (4/39) in Blitta, to 28.57% (45/63) in Sotouboua, 28.30% (38/53) in Tchamba and 16.07% (45/235) in Tchaoudjo (p=0.016).

Factors associated with unfavorable outcome

In bivariate analysis **Table 3**, having been diagnosed before 2009 was not associated with unfavorable outcome, but when stratified by CDT, having TB/HIV patients diagnosed before 2009 in the CDT of Tchaoudjo, had 10.66 times the odds of having unfavorable outcome of treatment than having been diagnosed after 2009 (OR=10.66, 95% CI=(1.08-105.28)). In the CDT of Sotouboua, having been diagnosed before 2011 was associated with unfavorable outcome (OR=3.84, 95% CI=(1.80-8.20)). Having been diagnosed SPT+ was associated with unfavorable outcome than combination of other forms (OR=2.17, 95% CI=(1.25-3.75)). Not being on ART contributed 2 times to the occurrence of unfavorable outcome of TB treatment (AOR=2.14, 95% CI=(1.23-3.71)). Being treated for TB before 2010 had 61 times the odds of being cured than in 2010 and after (OR=61; 95% CI=(2.02-1835)). Cases who did not receive ART had 2 times the odds of dying compare to those on ART(OR=1.80, 95% CI=(1.10-2.94)). SPT+ cases who were not re-assessed after two months of treatment had up to 83 times the odds of dying than those assessed (OR=83.31, 95% CI=(29.79-233.02)).

In multivariate analysis **Table 4**, independent factors found associated with unfavorable outcome among TB/HIV co-infection cases were smear-positive TB (AOR=2.11, 95% CI=(1.21-3.60)), belonging to cohorts from 2008 to 2014 (AOR=0.6, 95% CI=(0.36-0.98)) and having started TB treatment during the period from April to June (second quarter) (AOR=1.71, 95% CI=(1.03-2.85)). Not being on ART (AOR=2.62, 95% CI=(1.46-4.69)) and belonging to cohorts from 2008 to 2014 (AOR=0.40, 95% CI=(0.21-0.76) were independently associated with mortality.

Discussion

In Togo, data available concerning TB/HIV co-infection are facility-based study conducted in local hospitals and this study is the first multi-center one in the country that assesses the epidemiological characteristics of TB/HIV co-infection.

Over the study period, the prevalence of TB/HIV co-infection in the Centrale health region was very high, indicating that nearly one-third of TB patients are also infected with HIV. This prevalence is explained by the fact that HIV infection increases the risk of developing *Mycobacterium Tuberculosis* infection [22]. In 2007, a study on pulmonary TB in Togo found a TB/HIV prevalence of 23.70% which is less than the findings of this study. The difference can be explained by the fact that before 2010, HIV screening among TB patients was not systematic [16]. The TB/HIV prevalence in this study was higher than findings in other studies in Ghana, Nigeria and Democratic Republic of Congo [23-25] though lower than that found in Senegal at 55.69% in Cameroon 59.00% and in South Africa at 61% [26-28]. The variations in the TB/HIV co-infection prevalence among studies can be explained by differences in HIV prevalence and the epidemiology from one region to another [29-33]. Most of the co-

infected cases were young and were coming from rural areas. This result is in line with findings in other studies [34-37]. The HIV infection increases the reactivation of latent TB. [22]. Similar to other previous studies, most of the TB /HIV co-infected cases were women [34,35]. Women have been shown to be affected by HIV/AIDS; infection which favours the re-activation of TB [37].

The proportion of SPT+ cases in our study represented approximatively two thirds of TB/HIV cases and were higher than those reported in other studies [22,23,27,28]. These differences in proportions can be explained by the peculiarities of diagnostic methods used to detect TB cases from one study to another. The proportion of more than one third of patients without ART and one fifth without cotrimoxazole prophylaxis represented a high risk of profound deterioration of the immune system and the occurrence of other opportunistic infections with an increased risk of death. However, it has been shown that initiating ART and anti TB treatment during the same period in TB/HIV co-infected patients coupled with cotrimoxazole prophylaxis improve treatment outcome [38,39]. Based on this evidence, the Togolese national TB control program adopted the new recommendations for treatment TB/HIV co-infection resulting into increased registered number on both ART and cotrimoxazole prophylaxis [40].

Over the study period, TB treatment success and cure rates did not meet the 85% target of the STOP TB strategy and the 90% target of the "END TB" initiative recommended by WHO [41,42]. Actually, by that time, there was a lack of collaboration between TB and HIV/AIDS services delivery at operational level of healthcare system, due to some weakness of different protocols that were not connected. The result was a poor performance and a high fatality rate. Low treatment success rate among people living with TB/HIV co-infection have been also reported in other studies [17, 43, 44]. Yet, this result is statistically higher than the 60.83% ($p<0.001$) reported in Cameroon [27], 65.86% ($p<0.001$) in Nigeria [24] but similar to that reported in South Africa [28] at 75.5% ($p=0.79$) and in Ghana [23]at 77% ($p=0.74$).

Despite a high proportion of TB/HIV co-infected cases on ART from 2014 onwards, the fatality rate remained high. This could be explained by advanced HIV disease at treatment initiation coupled with poor compliance to the TB treatment regimen resulting from insufficient implementation of family-based or caregiver-based DOTS [45].

Patients who were diagnosed and started TB treatment in the second quarter of the year were nearly twice unlikely to be successful than patients diagnosed in other quarters of the year. In this study, most of the co-infected cases are housewives or farmers coming from rural areas where the main occupation is farming and also housewives happen to be farmers [19]. The second quarter of the year is the prolific period of intensive farming activities, where farmers are likely to focus on farming activities than having time for their treatment because, either they forget to take drugs or they are afraid of drug side effects.

Limitations

As for any secondary data analysis, this study could be affected by missing and inconsistent data. The regular quarterly supervisions conducted, during which the completeness of TB registers and other tools are checked had minimized the proportion of missing, outliers and inconsistent data. In addition, the identified outliers and inconsistencies data that were not corrected were removed from the database to ensure the data quality.

Conclusion

The current study, the first one conducted at regional level in Togo, has established the epidemiological characteristics and the treatment outcome of TB/HIV coinfection. The prevalence of TB/HIV co-infection was high among TB patients and affected mostly young housewives living in rural areas. The proportion of patients on anti-TB and ART treatment increased significantly between 2008 and 2017 and contributed to a significant reduction in case fatality with the persistence of a non-negligible proportion of patients who did not receive both treatments. It has shown the impact of combined ART and anti-TB treatment in improving treatment outcome in TB/HIV co-infected patients since treatment of both ailments became free of charge. The smear positive form of TB, the initiation of TB treatment in the second quarter and the absence of ART were independently associated with

unfavorable outcome in TB/HIV co-infected patients.

A systematic review of TB/HIV co-infection control coordination in the Centrale region during 2008 to 2014 could lead to the identification of best practices and lessons learned, whose scaling up in Togo will contribute to improving patients´ survival. The systematic practice of DOTS whether family-based or based on caregivers for each patient, early detection of TB/HIV co-infection and treatment by concomitant anti-TB drugs and ART, intensification of TB screening among HIV infected need to be strengthened. There is also a need to develop specific action plans including outreach communication and the establishment of youth- and adolescent-friendly HIV/AIDS care services to limit the magnitude of TB/HIV co-infection among youngs and adolescents. Training of health care providers on TB/HIV co-infection management and strengthening of community-based interventions on TB/HIV co-infection to improve patient outcomes must be taken into account in TB and HIV/AIDS control plans.

What is known about this topic

- HIV infection increases the incidence of TB and both are a real threat to patient survival
- Early ART combined with TB treatment increases patient survival
- As women are more affected by HIV, they are also the most affected by TB/HIV co-infection

What this study adds

- This study is the first study on TB/HIV co-infection conducted at regional and district level in Togo
- It shows the particularities of the epidemiology of TB/HIV co-infection and the specific actions that should be implemented in the Centrale region to strengthen TB and HIV/AIDS control

Competing interests

The authors declare no competing interests

Authors' contributions

Tchalla Abalo Agballa Mébiny – Essoh developed the protocol of the study, did data collection, data processing and analysis, manuscript development and review. Akara Essona Matatom participated in data processing and analysis, manuscript development and review. Haienga Bokoulmé, N'tapi Kassouta, Assane Hamadi, Hilim Péléké Mawaba, Aboudramane Lambonkale, N'djao Akawulu, Tchéou Dadou Pikédinam, Sawadogo Bernard participated in data collection and review of the manuscript. All authors read and approved the final manuscript.

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Tables and figures

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Figure 2: Evolution of Tuberculosis treatment success rate, antiretroviral treatment proportion and case fatality rate in TB/HIV co-infection cases, Centrale region - Togo, 2008 - 2017

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Table 1: Socio demographic characteristics of TB/HIV co-infected cases by Center of Diagnosis and Treatment in Centrale health region-Togo, 2008 to 2017

Sociodemographic characteristics	Centers of Diagnosis and Treatment (CDTs)				Centrale Health Region n (%)
	Blitta n (%)	Sotouboua n (%)	Tchamba n (%)	Tchaoudjo n (%)	
Age range (Years)					
Mean ± Standard Deviation	34.62 ± 8.37	31.18 ± 9.36	33.00 ± 11.22	30.22 ± 10.27	31.09 ± 10.20
Under 15	0 (00.00)	3 (04.69)	1 (01.82)	15 (05.21)	19 (04.25)
15 - 29	10 (25.00)	28 (43.75)	21 (38.18)	133 (46.18)	192 (42.95)
30 - 44	23 (57.50)	27 (42.19)	26 (47.27)	110 (38.19)	186 (41.61)
45 - 59	7 (17.50)	6 (09.38)	4 (07.27)	29 (10.07)	46 (10.29)
60 and more	0 (00.00)	0 (00.00)	3 (05.45)	1 (00.35)	4 (00.89)
Sex					
Female	24 (60.00)	47(73.44)	46 (83.64)	226 (78.47)	343 (76.73)
Male	16 (40.00)	17 (26.56)	9 (16.36)	62 (21.53)	104 (23.27)
Area of residence					
Rural	32 (80.00)	26 (40.62)	18 (30.73)	164 (56.94)	240 (53.69)
Urban	8 (20.00)	38 (59.38)	37 (69.27)	124 (43.06)	207 (46.31)
Year of detection					
Between 2008 and 2012	16 (40.00)	34 (53.13)	41 (74.55)	157 (54.51)	248 (55.48)
Between 2013 and 2017	24 (60.00)	30 (46.87)	14 (25.45)	131 (45.49)	199 (44.52)
Quarter of detection					
Quarter 1	10 (25.00)	21 (32.81)	17 (30.91)	75 (26.04)	123 (27.52)
Quarter 2	10 (25.00)	10 (15.63)	7 (12.73)	70 (24.31)	97 (21.70)
Quarter 3	9 (22.50)	17 (26.56)	20 (36.36)	70 (24.31)	116 (25.95)
Quarter 4	11 (27.50)	16 (25.00)	11 (20.00)	73 (25.34)	111 (24.83)
Occupation					
Trader	1 (02.50)	0 (00.00)	0 (00.00)	0 (00.00)	1 (00.23)
Farmer	13 (32.50)	11 (17.19)	9 (16.36)	55 (19.50)	88 (19.95)
Private employee	4 (10.00)	5 (07.81)	0 (00.00)	0 (00.00)	9 (02.04)
Pupils	1 (02.50)	3 (04.69)	1 (01.82)	31 (10.99)	36 (08.16)
Civil servants	1 (02.50)	1 (01.56)	0 (00.00)	0 (00.00)	2 (00.45)
Housewives	20 (50.00)	44 (68.75)	45 (81.82)	196 (69.50)	305 (69.16)

Table 2: Clinical characteristics of TB/HIV co-infected cases, Centrale health region, 2008 – 2017

Clinical characteristics	Centers of Diagnosis and Treatment (CDTs)				Centrale Health Region n (%)
	Blitta n (%)	Sotouboua n (%)	Tchamba n (%)	Tchaoudjo n (%)	
Form of TB					
Smear-positive TB	35 (87.50)	44 (68.75)	48 (87.27)	187 (64.93)	314 (70.25)
Smear-negative TB	4 (10.00)	13 (20.31)	7 (12.73)	87 (29.17)	108 (24.16)
Extrapulmonary TB	1 (02.50)	7 (10.94)	0 (00.00)	17 (5.90)	25 (05.59)
Type of TB					
New cases	37 (60.00)	61 (95.31)	51 (92.73)	279 (96.88)	428 (95.75)
Relapse	1 (40.00)	2 (03.13)	0 (00.00)	3 (01.04)	6 (01.34)
Re-treatment	0 (00.00)	0 (00.00)	2 (03.64)	0 (00.00)	2 (00.45)
Failure	0 (00.00)	1 (01.56)	1 (01.82)	6 (02.08)	8 (01.79)
Transferred	2 (05.00)	0 (00.00)	1 (01.82)	0 (00.00)	3 (00.67)
Period of reassessment of sputum at 2nd month of treatment in SPT+					
Normal	27 (77.14)	36 (81.82)	37 (77.08)	162 (86.63)	262 (83.44)
Late	8 (22.86)	8 (18.18)	11 (22.92)	25 (13.37)	52 (16.56)
Result of microscopic sputum examination at 2nd month of treatment					
Positive	1 (03.33)	4 (11.11)	0 (00.00)	19 (12.03)	24 (09.16)
Negative	29 (96.67)	32 (39.53)	38 (100.00)	139 (87.97)	238 (89.84)
Density of Acid-Fast Bacilli at the moment of diagnosis					
1 – 10 AFB/Field	18 (51.43)	26 (60.47)	26 (54.17)	94 (55.62)	164 (55.59)
More than 10 AFB/Field	17 (48.57)	17 (46.87)	22 (45.83)	75 (44.38)	131 (44.41)
Result of treatment					
Cured	29 (72.50)	27 (42.19)	30 (54.55)	117 (40.63)	203 (45.41)
Treatment completed	6 (15.00)	16 (25.00)	7 (12.73)	108 (37.50)	137 (30.65)
Failure	0 (00.00)	2 (03.13)	1 (01.82)	10 (03.47)	13 (02.91)
Death	4 (10.00)	18 (28.13)	15 (27.27)	45 (15.53)	82 (18.34)
Lost to follow-up	0 (00.00)	0 (00.00)	2 (03.64)	5 (01.74)	7 (01.57)
Transferred	1 (02.50)	1 (01.56)	0 (00.00)	3 (01.04)	5 (01.12)
Cotrimoxazole prophylaxis					
Yes	31 (77.50)	43 (68.25)	51 (92.73)	239 (82.99)	364 (81.61)
No	9 (22.50)	20 (31.75)	4 (07.27)	49 (17.01)	82 (18.39)
Anti-Retroviral Treatment (ART)					
Yes	28 (70.00)	43 (69.35)	25 (45.45)	188 (65.73)	284 (64.11)
No	12 (30.00)	19 (30.65)	30 (54.55)	98 (34.27)	159 (35.89)

Table 3: Results of bivariate analysis between variables of interest and treatment outcome among TB/HIV coinfection cases, Centrale health region, 2008 – 2017

Factors	Unfavorable Outcome n (%)	Favorable Outcome n (%)	Crude Odds Ratio (COR)	Confidence Interval (95% CI)	p-value
Age <40	80 (78.43)	273 (80.29)	0.89	0.51 – 1.53	0.680
Age ≥ 40	22 (21.57)	67 (19.71)			
Sex					
Male	24 (23.53)	78 (22.94)	1.03	0.61 – 1.74	0.090
Female	78 (76.46)	262 (77.06)			
Area of residence					
Urban	50 (49.02)	156 (45.88)	1.13	0.72 – 1.76	0.310
Rural	52 (50.98)	184 (54.12)			
Being put under treatment in the 2nd quarter					
Yes	71 (69.61)	274 (80.59)	0.55	0.33 – 0.90	0.018
No	31 (30.39)	66 (19.41)			
Year of detection					
Between 2008 and 2014	68 (66.67)	265 (77.94)	0.56	0.34 – 0.91	0.020
Between 2015 and 2017	34 (33.33)	75 (22.06)			
Being taken care of in CDT of Blitta					
Yes	4 (03.92)	35 (10.29)	0.35	0.12 – 1.02	0.046
No	98 (96.08)	305 (89.71)			
Being taken care of in CDT of Sotouboua					
Yes	18 (17.65)	42 (12.35)	1.52	0.83 – 2.77	0.171
No	84 (82.35)	298 (87.65)			
Being taken care of in CDT of Tchamba					
Yes	18 (17.65)	37 (10.88)	1.75	0.95 – 3.23	0.069
No	84 (82.35)	303 (89.12)			
Being taken care of in CDT of Tchaoudjo					
Yes	60 (58.82)	225 (66.18)	0.73	0.46 – 1.14	0.173
No	42 (41.18)	115 (33.82)			
Form of tuberculosis					
SPT+	83 (81.37)	227 (66.76)	2.17	1.25 – 3.75	0.004
Other (SNT- & EPT)	19 (18.63)	113 (33.24)			
No medical therapy for the co-infection (Anti Tuberculosis Treatment and ART)					
Yes	43 (42.57)	112 (33.23)	1.48	0.94 – 2.34	0.085
No	58 (57.43)	225 (66.77)			

Table 4: Independent factors associated with unfavorable outcome in the Centrale health region –Togo, 2008-2017

Independents Factors	Unfavorable Outcome n (%)	Favorable Outcome n (%)	Crude Odd Ratio [95% CI]	Adjusted Odds Ratio [95% CI]	p-value
Smear Positive Tuberculosis					
Yes	83 (81.37)	227 (66.76)	2.17 [1.25 – 3.75]	2.11 [1.21 – 3.60]	0.0078
No	19 (18.63)	113 (33.24)			
Having been taken care between 2015 and 2017					
Yes	34 (33.33)	75 (22.06)	1.78 [1.06 – 2.95]	1.90 [1.14 – 3.12]	0.0427
No	68 (66.67)	265 (77.94)			
Being diagnosed in the 2nd quarter diagnosed in the 2nd quarter					
Yes	81 (79.41)	251 (73.82)	1.36 [0.79 – 2.34]	1.71 [1.03 – 2.85]	0.0381
No	21 (20.59)	89 (26.18)			

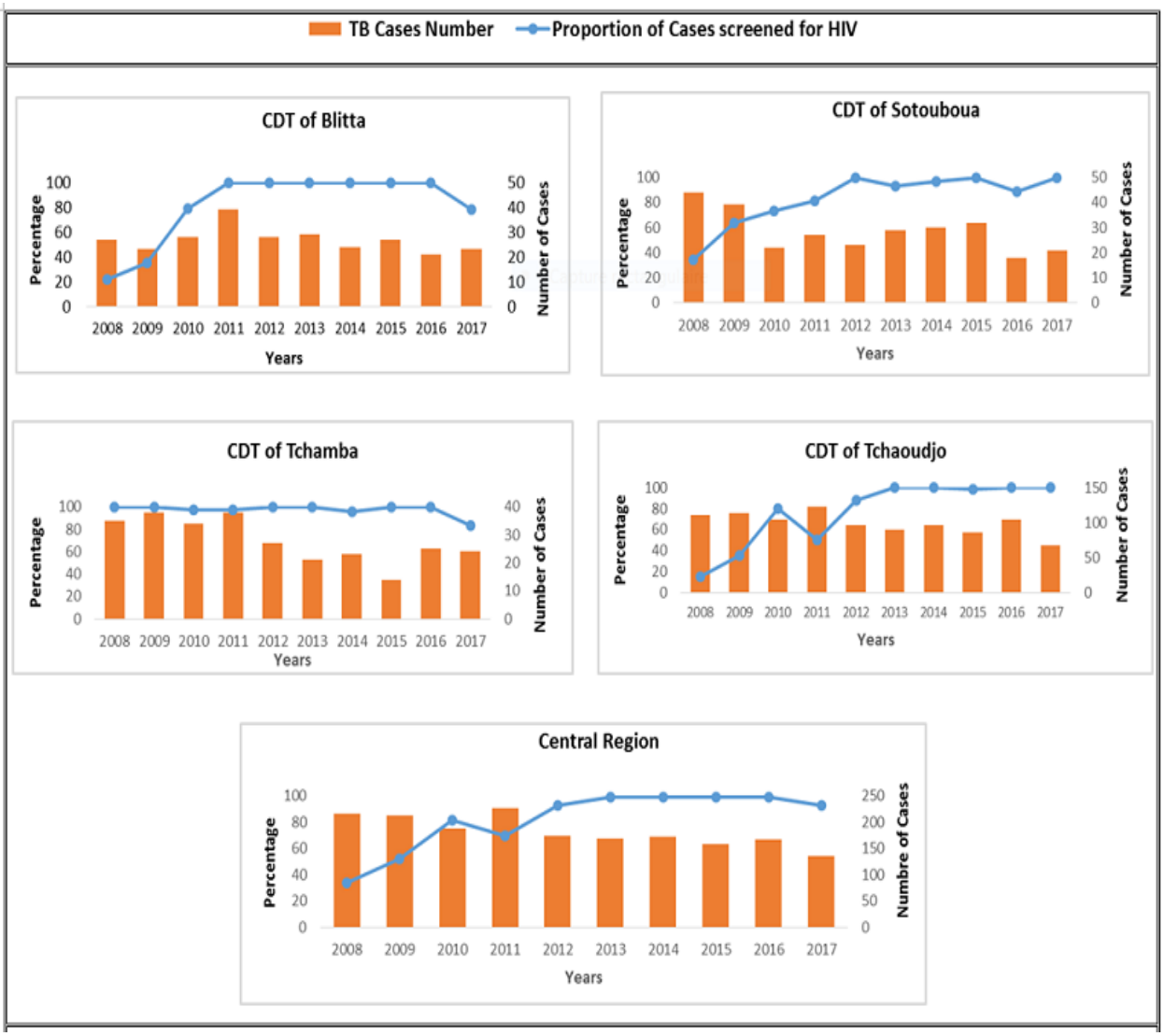

Figure 1: Evolution of Tuberculosis cases number and HIV screening proportion, districts and Centrale region – Togo, 2008 - 2017

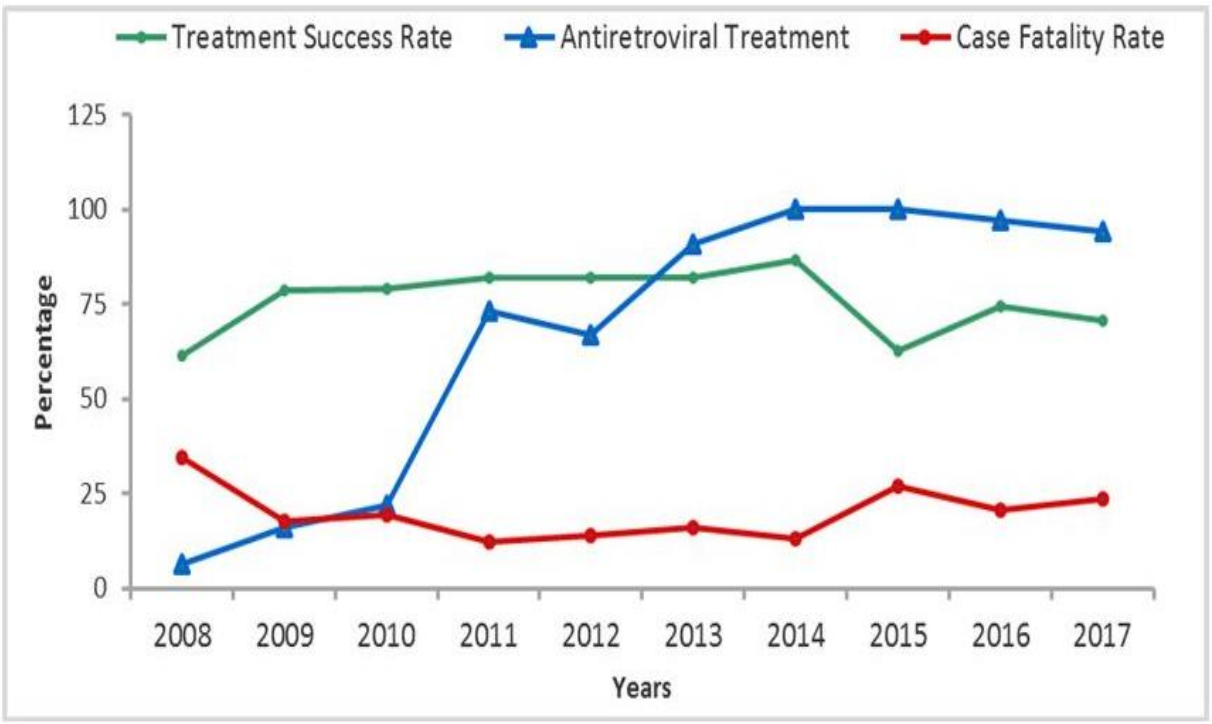

Figure 2: Evolution of Tuberculosis treatment success rate, antiretroviral treatment proportion and case fatality rate in TB/HIV co-infection cases, Centrale region – Togo, 2008 – 2017