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Tuberculosis treatment success among rural and urban Ugandans living with HIV: a retrospective study

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Setting: Government health centres and hospitals (six urban and 20 rural) providing tuberculosis (TB) treatment for people living with the human immunodeficiency virus (PLHIV) in central and western Uganda.

Objective: To identify and quantify modifiable factors that limit TB treatment success among PLHIV in rural Uganda.

Design: A retrospective cross-sectional review of routine Uganda National Tuberculosis and Leprosy Programme clinic registers and patient files of HIV-positive patients who received anti-tuberculosis treatment in 2014.

Results: Of 191 rural patients, 66.7% achieved treatment success compared to 81.1% of 213 urban patients. Adjusted analysis revealed higher average treatment success in urban patients than in rural patients (OR 3.95, 95%CI 2.70–5.78, $P < 0.01$, generalised estimating equation model). Loss to follow-up was higher and follow-up sputum smear results were less frequently recorded in TB clinic registers among rural patients. Patients receiving treatment at higher-level facilities in rural settings had greater odds of treatment success, while patients receiving treatment at facilities where drug stock-outs had occurred had lower odds of treatment success.

Conclusion: Lower reported treatment success in rural settings is mainly attributed to clinic-centred factors such as treatment monitoring procedures. We recommend strengthening treatment monitoring and delivery.

A sub-Saharan African country with both high tuberculosis (TB) incidence and human immunodeficiency virus (HIV) prevalence, Uganda is among the 20 countries with the highest TB-HIV burden worldwide.[1] TB incidence in Uganda in 2014–2015 was estimated to be 174 smear-positive cases per 100 000 population per year;[1] HIV prevalence in 15–49 year olds was 7.4% in 2012–2013.[2] TB treatment success rates have greatly improved in Uganda, from 44% in 1995 to 75% in 2014, approaching the 2015 World Health Organization (WHO) target of 85%.[1]

However, treatment success among TB patients living with HIV (PLHIV) are marginally lower than in their HIV-negative counterparts, both in Uganda (73% vs. 77%)[1] and globally (73% vs. 88% in 2014).[1] Low TB treatment success among PLHIV has been documented in various studies conducted in Africa.[3,4] Rural health care settings report lower treatment success than national rates,[3–6] although the introduction of the DOTS strategy may have improved rates.[7]

A qualitative evaluation identified health system barriers to TB treatment outcomes such as stock-outs of drugs and laboratory supplies, low motivation and poor co-ordination of services, as well as contextual barriers such as the cost of seeking treatment.[8] Previous studies in Uganda showed that late presentation, patients lost to follow-up from treatment and inadequate treatment monitoring were associated with negative outcomes.[9,10]

In the present study, we aimed to use data from routinely collected government facilities to identify factors that limit treatment success in Ugandan urban and rural settings among the vulnerable population of PLHIV.

METHODS

Study design, setting and population

A retrospective cross-sectional study of Uganda National Tuberculosis and Leprosy Programme (NTLP) routine data was conducted in 26 government health facilities in Kampala and western Uganda. The Ugandan health system is structured into five health facility levels, ranging from village health team (HC-I) to specialised services at the national referral hospital. TB treatment and diagnosis is available from HC-III facilities upwards, and most TB-HIV integrated care is available from HC-IV facilities upwards. Facilities (HC-III and upwards) were randomly sampled from rural and urban sites supported by the Infectious Diseases Institute (IDI), Kampala, Uganda. Six of eight urban Kampala City Council Authority (KCCA) clinics were selected. Twenty rural facilities from Western Uganda were selected from 44 available (Appendix Tables A.1 and A.2). Eligible participants were new pulmonary TB cases, PLHIV, aged ⩾14 years, who initiated anti-tuberculosis treatment in 2014. Participants were ineligible if they had multidrug-resistant TB (MDR-TB) or extensively drug-resistant TB (XDR-TB), or if their records were missing date of birth, age, TB diagnosis, TB regimen or date of treatment initiation. During the target period, the Uganda guidelines criteria for antiretroviral therapy (ART) were PLHIV with a CD4 count of <350 cells/μl regardless of WHO stage, or all PLHIV diagnosed with TB.[11,12] A rural setting was defined as an area outside a city or big commercial town, while an urban setting was defined as a city or big commercial town.

Anti-tuberculosis treatment

All clinics enrolled in the study followed the Uganda NTLP guidelines[13] for TB diagnosis and treatment.

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Conflicts of interest: none declared.

KEY WORDS
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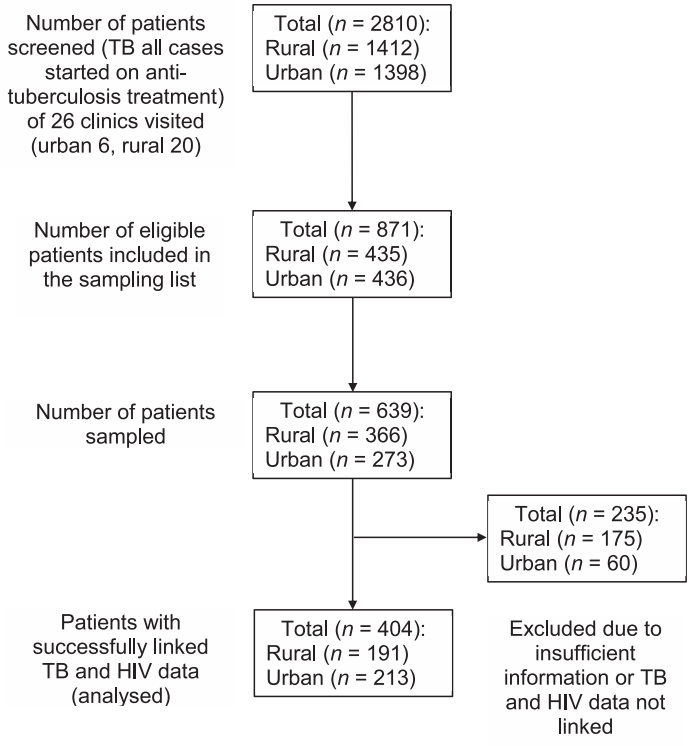

FIGURE 1 Numbers screened and analysed. TB = tuberculosis; HIV = human immunodeficiency virus.

New pulmonary TB patients were given first-line anti-tuberculosis treatment comprising a 2-month intensive phase of rifampicin (R), isoniazid (H), pyrazinamide (Z) and ethambutol (E) (2RHZE) and either a 6-month continuation phase comprising ethambutol (E) and isoniazid (H) (as combination: 6EH), or 4 months of rifampicin (R) and isoniazid (H) (4RH). The 4RH regimen was standard care for people aged ⩽15 years, and was used during drug stock-outs in some clinics.

Participants and data collection

Records were extracted between December 2015 and January 2016. To attain a targeted sample size of 396 cases (198 cases each from rural and urban areas), we required at least 33 cases per clinic. To allow for missing data, we targeted 40 cases and therefore included all eligible cases in facilities with ⩽40 cases, while in those with >40 cases, systematic sampling with probability proportional to size was used.

Participants' TB and HIV data were obtained from registers, HIV care cards in patient files and ART registers. Patients' HIV care identification clinic numbers (IDCNO) were used to match TB and HIV data, but when these were missing from TB registers, demographic characteristics were used for matching. If a patient's file could not be traced, the next eligible patient in the register was considered. Clinic-level data on drug stock-outs, staffing, geographic location, possession of microscopy and other clinic activities such as patient tracing were obtained from review of annual reports and from staff at the TB clinic.

Data were double-entered into Epi Info™ 7 statistical software (Centers for Disease Control and Prevention, Atlanta, GA, USA), verified for consistency, and transferred to Stata 13.1 software (Stata LP, College Station, TX, USA) for analysis.

Statistical analysis and outcomes

With 80% power, a significance of 5% and a sampling ratio of 1:1 in urban:rural clinics, 322 patients were required to detect a difference in treatment success, from 71%[14] in urban clinics to 56% in rural clinics, based on an estimated difference of 15% between success rates. To allow for clustering effects, the sample size was inflated by 20%, making a target sample size of 396.

The primary outcome was the proportion of participants with treatment success (defined as cure or treatment completed) comparing rural and urban participants. Secondary outcomes were standard end of treatment measures, defined according to the Uganda NTLP and the WHO[1,13] (Appendix Table A.3). Logistic generalised estimating equations (GEE) models with clinics as clusters, odds ratios (ORs) and 95% confidence intervals (CIs) were used to examine measured potential predictors of TB treatment success. Factors examined in the analysis included patient characteristics at TB treatment start (age, sex, CD4 cell count, body mass index [BMI], ART treatment history, living in a different subcounty from the clinic, and nature of TB diagnosis: bacteriologically confirmed or clinically diagnosed), status during TB treatment (timing of ART initiation among the ART-naïve, comorbidities that interfere with patient adherence, such as stomach ulcer and malaria, missed TB doses, missed clinic appointments, received 4 weeks' supply of anti-tuberculosis drugs for the intensive phase) and clinic factors (health facility level, TB drug stock-outs, number of staff at TB clinic by qualification, patient load at TB clinic). All analyses used inverse probability weighting to account for unequal sampling probability of participants at each clinic. Sex, age and being on ART at the start of anti-tuberculosis treatment were a priori factors included in the adjusted model. All variables with P values <0.3 were then added to the adjusted model and removed if $P > 0.3$ in the adjusted model. All remaining variables were tested again one by one, and included if $P < 0.3$ in the adjusted model.

Ethical considerations

The ethics committees of the London School of Hygiene & Tropical Medicine, London, UK (LSHTM reference 9761), The AIDS Support Organization (TASO), Kampala, Uganda (number: TASO-REC/062/15-UG-REC-009) and the Uganda National Council for Science and Technology, Kampala, Uganda (UNCST number: HS 1965) granted ethical approval for the study. Due to the retrospective study design and strict anonymity of participants, the need for patient consent was waived. However, written consent was obtained from TB clinic staff who provided clinic-level data.

RESULTS

Of 2810 individuals initiated on anti-tuberculosis treatment during the study period in 26 clinics studied, 871 met the inclusion criteria: TB and HIV data were obtained for 191 rural and 213 urban participants (Figure 1). The majority were male (61.1%), and had been prescribed 2RHZE/6EH (92.0%); the mean age was 35 years (standard deviation 10) and 40.7% were on ART at the start of anti-tuberculosis treatment (Table 1). At 2 months, 235 (51.2%) participants had follow-up sputum smear results, 183 (42.4%) at 5 months and 174 (40.9%) at 8 months (Figure 2). Treatment was successful for 81.1% of 213 participants in urban facilities and 66.7% of 191 participants in rural facilities (Table 2). Urban patients were more likely to have achieved treatment success than rural patients (adjusted OR [aOR] 3.95, 95%CI 2.70–5.78, $P < 0.01$; Table 3). There was no evidence of an independent

TABLE 1 Sociodemographic, clinical and facility characteristics by urban or rural location*

	All (*n* = 404) %	Rural (*n* = 191, 47%) %	Urban (*n* = 213, 53%) %	*P* value†
Characteristics at start of anti-tuberculosis treatment				
Male sex	61.1	60.9	61.4	0.929
Age, years, mean ± SD	34.5 ± 10	34.8 ± 13	34.3 ± 6	0.607
14–34	54.7	53.1	56.3	0.413
⩾35	45.3	46.9	43.7	
On ART‡	40.7	49.3	32.2	0.007
CD4 count, cells/μl, median [IQR]§	188 [62–422]	140 [58–367]	256 [75–487]	0.844
<200	51.3	57.1	42.5	0.345
⩾200	48.7	42.9	57.5	
BMI < 18.5 kg/m²§	41.7	38.4	46.1	0.412
Lived in subcounty different from that of clinic§	56.4	61.5	51.6	0.380
TB bacteriologically confirmed	72.9	67.2	78.7	0.243
Health facility level				
HC-III	33.6	17.0	50.2	0.469
HC-IV	36.5	43.7	29.4	
Hospital	29.9	39.3	20.4	
Characteristics of anti-tuberculosis treatment				
TB regimen				
2RHZE/6EH	92.0	90.4	93.5	0.623
2RHZE/4RH	8.0	9.6	6.5	
TB prescription pattern				
Prescribed 4 weeks' supply for the intensive phase	18.0	27.5	8.6	0.074
Prescribed 8 weeks' supply for the continuation phase§	13.9	6.3	20.9	0.280
Was not prescribed enough medications at least once	5.0	3.7	6.2	0.533
Appointment attendance				
Number attended, median [IQR]	9 [6–10]	8 [4–10]	9 [7–10]	<0.001
Attended at least 7 days late (in the intensive phase) or 14 days late (in the continuation phase)	43.8	53.3	34.4	0.027
Missed a dose (scheduled appointments)	31.4	39.1	23.7	0.062
Time of ART initiation among ART-naïve patients at start of TB treatment§				
<2 weeks	23.9	15.5	29.6	0.010
2–8 weeks	54.5	48.6	58.5	
>8 weeks	21.6	36.0	11.9	
Experienced comorbidity¶	15.8	15.8	15.8	0.992
Characteristics of clinics	(*n* = 26)	(*n* = 20)	(*n* = 6)	
Health facility level				
HC-III	46.2	40.0	66.7	0.479
HC-IV	38.5	45.0	16.7	
Hospital	15.4	15.0	16.7	
Stock-out of anti-tuberculosis drugs in 2014	57.7	50.0	83.3	0.197
TB clinic had a counsellor	50.0	50.0	50.0	1.000

* All estimates and *P* values are adjusted for sampling weights.
† *P* values compare rural and urban estimates.
‡ Of patients on ART, 96% were on an efavirenz-based regimen; 5% switched ART regimens during the course of anti-tuberculosis treatment.
§ Missing values for CD4 cell count: overall (*n* = 296, 73%), urban (*n* = 171, 80%), rural (*n* = 125, 65%); for BMI: overall (*n* = 289, 72%), urban (*n* = 152, 71%), rural (*n* = 137, 72%); lived in different subcounty to clinic: overall (*n* = 7, 2%), urban (*n* = 0, 0%), rural (*n* = 7, 4%); prescribed 8 weeks' supply during the continuation phase: overall (*n* = 55, 14%), urban, (*n* = 18, 8%), rural (*n* = 37, 19%).
¶ Any of the following recorded on TB or HIV clinic cards during TB treatment period: gastroenteritis, diarrhoea, anaemia, vomiting, malaria, peripheral neuropathy, hypertension documented on record, gastrointestinal disease, Kaposi's sarcoma, cryptococcal meningitis, stomach ulcer.
SD = standard deviation; ART = antiretroviral therapy; IQR = interquartile range; BMI = body mass index; TB = tuberculosis; HC = health centre; R = rifampicin; H = isoniazid; Z = pyrazinamide; E = ethambutol; HIV = human immunodeficiency virus.

association of sex, age and ART status with treatment success (Table 3). Analysis of secondary outcomes revealed that 41.4% were cured (17.0% in rural, 65.7% in urban areas), 32.5% completed treatment (49.7% in rural, 15.4% in urban areas), 1% had failed and 8.1% had died, whereas 6.9% of patient outcomes could not be evaluated and 10.1% of the participants had become lost to follow-up (LTFU), with rural clinics having a higher proportion of cases LTFU than urban clinics (16.6% vs. 3.5%; Table 2).

The median number of participants per clinic was nine (interquartile range [IQR] 4–13) in rural and 34 (IQR 32–39) in urban

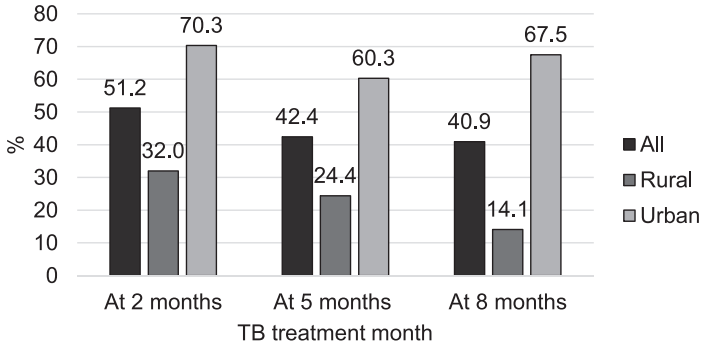

FIGURE 2 Percentage of patients with sputum smear results recorded in TB registers: all patients (n = 404), rural patients, (n = 191), urban patients (n = 213). Comparison of urban and rural percentage at 2 months P value = 0.003, at 5 months $P < 0.001$ and at 8 months $P < 0.001$. TB = tuberculosis.

facilities. Sputum smear results in TB registers were significantly more likely to be recorded in urban than in rural facilities at all times ($P < 0.001$), and did not depend on the level of health facility ($P = 0.480$). Clinic-level treatment success ranged from 72% to 91% in urban and 0% to 100% in rural facilities. The two clinics with 0% success had less than five patients; one had no counsellor and one reported TB drug stock-outs during the period studied. Having a TB drug stock-out was associated with lower treatment success (aOR 0.38, 95%CI 0.24–0.60, $P < 0.01$), while having a counsellor in the clinic was associated with on average 55% higher odds of treatment success (aOR 1.55, 95%CI 1.05–2.28, P = 0.03; Table 3). Treatment success increased with health facility level in rural areas: 49.1% at HC-III, 64.8% at HC-IV and 76.4% at hospital level (P value for interaction <0.01: Appendix Table A.4). For urban clinics, treatment success was highest in hospitals (90.9%) and lowest in HC-IV facilities (72.4%). TB-HIV integrated services were being implemented in five of the six urban health facilities and nine of the 20 rural health facilities during the study period.

DISCUSSION

TB treatment success rates among PLHIV vary widely among sub-Saharan African countries,[15–21] and our study findings fit within this range. Studies that reported better treatment success rates than our study had more well-organised community-based DOTS programmes and better patient tracing[7,17,22–24] than most rural clinics in our study. The higher proportion of patients reported as LTFU by rural clinics was likely related to patient characteristics: such patients lived further from health facilities, presented later for treatment, were more likely to be malnourished, and had lower CD4 cell counts at diagnosis than their urban counterparts and received less treatment monitoring than urban patients, consistent with other studies in Uganda and elsewhere in sub-Saharan Africa.[3,5,8,21,25]

Treatment monitoring was key to the improved treatment success in urban clinics. The availability of follow-up sputum smear results was less common for rural patients, despite the presence of microscopes in all facilities. Facilities reported lack of laboratory supplies such as reagents, which limited the performance of sputum testing. In addition, data management was poor in most rural clinics, resulting in missing sputum results and treatment outcomes in TB registers even when the tests were performed. Efforts were made to obtain missing outcome data, but we were limited by what was recorded in the TB registers. A comparable rural Ugandan study found that of 264 511 patient encounters, 1.8% had sputum smear microscopy prescribed, of which 60% underwent a complete evaluation.[26] Fewer rural health facilities had TB-HIV integrated care than urban facilities. Rural clinics may have tailored TB appointments to coincide with HIV clinic appointments for HIV patients on anti-tuberculosis treatment, specifically due to the longer distances to the health facility. This could have contributed to poor adherence to anti-tuberculosis treatment among rural patients due to a lack of adequate monitoring.

Stock-outs in the facilities studied were most common for the drug combination administered during the intensive phase (RHZE), and lasted on average for 2 months (maximum 8 months). As in other studies,[27] causes of reported stock-outs were delayed supply of drugs from national medical stores and poor forecast of requirements of drugs by the clinics. Solutions reported were borrowing from nearby clinics or issuing alternative drugs. Drug stock-outs of antiretroviral or anti-tuberculosis drugs were also reported in 25% of 2454 South African health facilities studied in 2014.[27] Adequate funding and commitment among the stakeholders responsible for procurement, custody and issuing of drugs may reduce stock-outs of essential drugs in public health facilities in sub-Saharan Africa.[27]

Furthermore, the presence of counsellors in the team of TB clinic staff is undoubtedly related to better-resourced—and proba-

TABLE 2 Percentage of patients with anti-tuberculosis treatment outcomes by urban or rural location

Outcome	All %	Rural %	Urban %	P value*
Smear-negative at 2 months	88.5 (n = 208)	85.9 (n = 67)	89.8 (n = 141)	0.376
Smear-negative at 5 months	98.4 (n = 180)	96.0 (n = 48)	99.3 (n = 132)	0.123
Smear-negative at 8 months	98.3 (n = 171)	100.0 (n = 32)	97.9 (n = 139)	0.407
	All (n = 404)	Rural (n = 191)	Urban (n = 211)	
Cured	41.4	17.0	65.7	<0.001
Treatment completed	32.5	49.7	15.4	
Treatment failed	1.0	0.7	1.3	
Died	8.1	7.6	8.7	
Not evaluated†	6.9	8.4	5.3	
Lost to follow-up	10.1	16.6	3.5	
Treatment success	73.9	66.7	81.1	0.030

*χ^2 comparison of rural vs. urban locations adjusted for sampling weights.
†Includes results not documented and transferred out.

TABLE 3 Sociodemographic, clinical and facility characteristics associated with TB treatment success by urban or rural location

	n	Treatment success %*	OR (95%CI)*	*P* value*	aOR (95%CI)*	*P* value*
Characteristics at start of anti-tuberculosis treatment						
Clinic location						
Rural	191	66.7	1		1	
Urban	213	81.1	2.20 (1.15–4.21)	0.02	3.95 (2.70–5.78)	<0.01
Sex						
Male	255	70.6	1		1	
Female	149	79.1	1.53 (0.79–2.97)	0.20	1.58 (0.77–3.24)	0.21
Age, years						
14–34	218	71.5	1		1	
⩾35	186	76.8	1.28 (0.84–1.96)	0.24	1.28 (0.84–1.97)	0.25
On ART						
No	241	75.5	1		1	
Yes	163	71.6	0.91 (0.64–1.29)	0.59	0.99 (0.61–1.61)	0.98
Lived in subcounty different from that of clinic†						
No	189	72.3	1			
Yes	208	75.7	1.28 (0.86–1.91)	0.26	—	—
TB bacteriologically confirmed						
No	99	78.4	1		1	
Yes	305	72.2	0.70 (0.40–1.21)	0.20	0.64 (0.32–1.28)	0.20
Health facility level						
HC-III	191	73.9	1		1	
HC-IV	124	67.9	0.96 (0.41–2.24)	0.12	1.15 (0.74–1.79)	<0.01
Hospital	89	81.4	1.92 (0.86–4.29)		3.48 (2.20–5.52)	
Characteristics of anti-tuberculosis treatment						
TB regimen						
2RHZE/6EH	384	73.3	1			
2RHZE/4RH	20	80.7	1.52 (0.35,6.58)	0.56	—	—
TB prescription pattern						
Intensive phase						
Prescribed 2 weeks' supply	348	75.9	1			
Prescribed 4 weeks' supply	56	64.7	0.59 (0.28–1.23)	0.16	—	—
Continuation phase†						
Prescribed 4 weeks' supply	314	81.4	1			
Prescribed 8 weeks' supply	35	93.2	3.09 (1.70–5.64)	<0.01	—	—
Insufficient drugs prescribed at least once						
No	380	73.7	1			
Yes	24	78.0	1.22 (0.60–2.49)	0.59	—	—
Appointment attendance, prompt	233	73.6	1			
Late at least once	171	74.3	1.11 (0.69–1.79)	0.67	—	—
Missed a dose ever						
No	285	74.0	1			
Yes	119	73.8	1.08 (0.59–2.00)	0.80	—	—
Experienced comorbidity‡						
No	328	74.5	1			
Yes	76	70.6	0.79 (0.50–1.24)	0.31	—	—
Stock-out of anti-tuberculosis drugs during 2014						
No	106	76.4	1		1	
Yes	298	73.2	0.78 (0.31–1.98)	0.61	0.38 (0.24–0.60)	<0.01
TB clinic had a counsellor						
No	189	73.8	1		1	
Yes	215	74.0	1.02 (0.49–2.13)	0.96	1.55 (1.05–2.28)	0.03

*Estimates and *P* values adjust for clinic as a cluster and use sampling weights.
†Missing values for 'lived in different subcounty from that of clinic': overall (*n* = 7, 2%), urban (*n* = 0, 0%), rural (*n* = 7, 4%); prescribed 8 weeks' supply during the continuation phase: overall (*n* = 55, 14%), urban (*n* = 18, 8%), rural (*n* = 37, 19%).
‡Any of the following recorded on TB or HIV clinic cards during TB treatment period: gastroenteritis, diarrhoea, anaemia, vomiting, malaria, peripheral neuropathy, hypertension documented on record, gastrointestinal disease, Kaposi's sarcoma, cryptococcal meningitis, stomach ulcer.
TB = tuberculosis; OR = odds ratio; CI = confidence interval; aOR = adjusted OR; ART = antiretroviral therapy; HC = health centre; R = rifampicin; H = isoniazid; Z = pyrazinamide; E = ethambutol; HIV = human immunodeficiency virus.

bly higher level—clinics. Counselling services have been previously shown to improve treatment success.[9] The higher treatment success rates in urban sites may be attributable to programmes being implemented in KCCA clinics (TB Care 1[28] and TRACK-TB [project ongoing until 2017]), but not in rural clinics. These programmes aimed to improve the quality of TB treatment care, adherence, treatment outcomes, data quality/documentation and drug management. The reports from such programmes have shown significant improvements in documentation in patients' medical records as a result of TB staff training and support supervision.[28] Such programmes should be extended to rural settings to achieve nationwide improvements in treatment success. The interrelationship between patient-level and clinic-level factors highlights the obstacles to improving treatment success.[29,30]

Both a strength and a weakness of this study was that it used data routinely collected from public health facilities at primary health care level. The inclusion of public health facilities from outlying rural areas provided good representation of routine TB care in Uganda, although routine hospital data may suffer from incomplete recording, resulting in missing data, including outcome data. We correctly analysed the data using sampling weights to account for multiple site sampling. Because we restricted data collection to clinics supported by IDI and to patients with linked TB-HIV data, this may have limited the generalisability of our findings to clinics that were not providing these services. This may have led to an estimation of greater treatment success than would be expected in non-IDI clinics. However, this should not affect the urban-rural comparison, as this restriction was imposed in both areas. Furthermore, many proxy variables had to be used, for example distance to clinic (not collected in data sources used), which was approximated by residence in another subcounty. Linkage of TB and HIV health records was less likely in rural settings, among males and among LTFU patients, which may have overestimated treatment success due to the exclusion of high numbers of LTFU patients that would otherwise be categorised as unfavourable outcomes.

CONCLUSION

The lower reported treatment success rates in rural clinics are likely a combination of patient-centred factors, such as late presentation and distance to clinic, and clinic-centred factors, such as staff unavailability for treatment monitoring and follow-up. We recommend the reinforcement of community-based TB treatment, especially in rural settings, active tracing of patients who miss appointments and increased staff training on treatment monitoring and delivery, and good data management.

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APPENDIX

TABLE A.1 List of sampled health facilities

District	Name of health facility	Health facility level	Sample *n*	New PTB-HIV patients in 2014* *n*
Urban sites			213	436
Kampala City	Naguru Hospital	Hospital	33	89
	Kisenyi Health Center	IV	29	128
	Kiswa Health Center	III	44	56
	Komamboga Health Center	III	39	51
	Kisugu Health Center	III	35	49
	Kitebi Health Center	III	33	63
Rural sites			191	435
Kiboga District	Kiboga Hospital	Hospital	20	48
	Bukomero Health Center	IV	24	30
	Lwamata Health Center	III	6	9
Kyankwanzi District	Ntwetwe Health Center	IV	8	14
	Butemba Health Center	III	13	20
	Kyankwanzi Health Center	III	3	4
Kibaale District	Kagadi Hospital	Hospital	24	104
	Kakumiro Health Center	IV	13	38
	Kibaale Health Center	IV	6	14
Hoima District	Kikuube Health Center	IV	11	12
	Kigorobya Health Center	IV	14	25
	Kyangwali Health Center	III	2	12
Masindi District	Bwijanga Health Center	IV	11	17
Buliisa District	Buliisa Health Center	IV	6	15
	Biiso Health Center	III	4	8
Kiryandongo District	Kiryandongo Hospital	Hospital	12	19
	Mutunda Health Center	III	1	2
	Diima Health Center	III	2	4
	Panyandoli Health Center	III	9	15
	Kakindo Health Center	IV	2	25
Total			404	871

*Aged ⩾14 years.
PTB = pulmonary tuberculosis; HIV = human immunodeficiency virus.

TABLE A.2 Districts in Uganda and accredited government health facilities for HIV care where the Infectious Diseases Institute (Kampala, Uganda) offered support up to May 2015

Districts	Health facilities
Kampala	Naguru Hospital*
	Kisenyi HC-IV*
	Kiswa HC-III*
	Komamboga HC-III*
	Kisugu HC-III*
	Kitebi HC-III*
	Kawempe Hospital
	Kirudu Hospital
Kiboga	Kiboga Hospital*
	Bukomero HC-IV*
	Lwamata HC-III*
	Katwe HC-III
	Muwanga HC-III
Kyankwanzi	Ntwetwe HC-IV*
	Butemba HC-III*
	Kyankwanzi HC-III*
	Kikonda HC-III
	Kiyuni HC-III
	St Balikudembe HC-III
Kibaale	Kagadi Hospital*
	Kakindo HC-IV*
	Kibaale HC-IV*
	Kakumiro HC-IV*
	Kisiita HC-III
	Kyaterekera HC-III
	Nkooko HC-III
	Nyamarwa HC-III
	Kinyarugonjo HC-III
Kiryandongo	Kiryandongo Hospital*
	Kigumba HC-III
	Panyadoli HC-III*
	Mutunda HC-III*
	Diima HC-III*
	Masindi Port HC-III
Buliisa	Buliisa HC-IV*
	Biiso HC-III*
	Butiaba HC-II
	Avogera HC-II
Masindi	Bwijanga HC-IV*
	Pakanyi HC-III
	Nyakitibwa HC-III
	Kyatiri HC-III
Hoima	Kikuube HC-IV*
	Kigorobya HC-IV*
	Kyangwali HC-III*
	Kabwoya HC-III
	Dwooli HC-III
	Kabaale HC-III
	Butema HC-III
	Buseruka HC-III
	Rwenyawawa HC-III
	Buhanika HC-III
	Karongo HC-II
	Nsozi HC-III
	Buhimba HC-III
	Mparangasi HC-III
	Mukabara HC-III
Hoima	Buraru HC-III
	Bugambe HC-III
	Bujugu HC-III
	Bujumbura HC-III
	Muhwiju HC-III
	Bujalya HC-III
	Kaseeta HC-III

*Included in this study.
HIV = human immunodeficiency virus; HC = health centre.

TABLE A.3 Definition of key terms taken from WHO guidelines[1]

Term	Definition
Bacteriologically confirmed TB case	Defined as a patient with a biological specimen that is positive on smear microscopy, culture or WRD, such as Xpert® MTB/RIF
Clinically diagnosed TB case	Patient who does not fulfil the criteria for bacteriological confirmation but has been diagnosed with active TB by a clinician or any other medical practitioner who has prescribed the patient a full course of anti-tuberculosis treatment. This also includes X-ray abnormalities or suggestive histology and EPTB cases without laboratory confirmation
PTB	Refers to any bacteriologically confirmed or clinically diagnosed case of TB involving the lung parenchyma or the tracheobronchial tree. This also includes miliary TB. Patients with both PTB and EPTB are classified as PTB
EPTB	Refers to any bacteriologically confirmed or clinically diagnosed TB case involving organs other than the lungs, such as pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges
TB relapse	Patient who has previously been treated for TB, was declared cured or treatment completed at the end of their most recent course of treatment, and is now diagnosed with a recurrent episode of TB (either a true relapse or a new episode of TB caused by re-infection)
Treatment after failure	Patient who was previously treated for TB and whose treatment failed at the end of their most recent course of treatment
HIV-positive TB patient	Refers to a bacteriologically confirmed or clinically diagnosed TB case who is HIV-positive at the time of TB diagnosis or any other evidence of enrolment into HIV care, such as enrolment into pre-ART register or in ART register once ART has been started
Cure	A PTB patient with bacteriologically confirmed TB at the beginning of treatment, who is smear- or culture-negative in the last month of treatment and on at least one previous occasion
Treatment completed	A TB patient who completed treatment without evidence of failure BUT with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not performed or results were unavailable
Treatment failed	A patient whose sputum smear or culture is positive at month 5 or later during treatment
Died	A TB patient who dies for any reason before starting or during treatment
Lost to follow-up	A patient who did not start treatment or whose treatment was interrupted for ⩾2 consecutive months
Not evaluated	A TB patient for whom no treatment outcome is assigned. This includes cases transferred out to other treatment units as well as TB patients whose treatment outcome is unknown to the reporting unit
Treatment success	Sum of cured and treatment completed

WHO = World Health Organization; TB = tuberculosis; WRD = WHO-endorsed rapid diagnostic device; PTB = pulmonary TB; EPTB = extra-pulmonary TB; HIV = human immunodeficiency virus; ART = antiretroviral therapy.

TABLE A.4 TB treatment success across health facility level stratified by rural/urban

	Rural*		Urban‡	
Health facility level	Patients with treatment success *n* (%)	aOR (95%CI)†	Patients with treatment success *n* (%)	aOR (95%CI)†
HC-III	40 (49.1)	1	151 (82.2)	1
HC-IV	95 (64.8)	2.44 (0.95–6.27)	29 (72.4)	0.84 (0.62–1.13)
Hospital	56 (76.4)	6.45 (2.90–14.36)	33 (90.9)	2.50 (1.75–3.55)
Total	191 (66.7)		213 (81.1)	
P value	—	<0.001	—	0.109

*Includes 8 HC-IIIs, 9 HC-IVs and 3 hospitals.
†Adjusted for participants' baseline characteristics: sex, age, type of TB diagnosis, bacteriological or clinical.
‡Includes 4 HC-IIIs, 1 HC-IV, 1 hospital.
TB = tuberculosis; aOR = adjusted odds ratio; CI = confidence interval; HC = health centre.

Reference

1 World Health Organization. Definitions and reporting framework for tuberculosis: 2013 revision. WHO/HTM/TB/2013.2. Geneva, Switzerland: WHO, 2014.

Contexte : L'étude a été réalisée dans des centres de santé et des hôpitaux publics, six urbains et 20 ruraux, fournissant un traitement de la tuberculose (TB) aux personnes vivant avec le VIH (PVVIH) dans le centre et l'ouest de l'Ouganda.
Objectif : Identifier et quantifier les facteurs modifiables qui limitent le succès du traitement de la TB parmi les PVVIH dans l'Ouganda rural.
Schéma : Une revue rétrospective transversale des registres cliniques et des dossiers de patients du Programme national tuberculose et lèpre d'Ouganda pour les patients VIH positifs qui ont reçu un traitement de TB en 2014.
Résultats : Parmi 191 patients ruraux, 66,7% ont eu un bon résultat de leur traitement, tandis que parmi 213 patients urbains, 81,1% ont eu un bon résultat. Une analyse ajustée a révélé un succès thérapeutique moyen plus élevé chez les patients urbains comparés aux patients ruraux (OR 3,95 ; IC95% 2,70–5,78 ; $P < 0,01$; modèle d'équation d'estimation généralisée). Les pertes de vue ont été plus élevées et les résultats de frottis de crachats de suivi ont été moins souvent enregistrés dans les registres des centres TB pour les patients ruraux. Les patients recevant un traitement dans des structures de plus haut niveau, toujours en zone rurale, avaient plus de chances d'avoir un succès thérapeutique. Les patients recevant leur traitement dans des structures où étaient survenues des ruptures de stock de médicaments avaient moins de chances de succès thérapeutique.
Conclusion : Les taux plus faibles de succès du traitement rapportés en zone rurale sont en majorité attribués à des facteurs liés aux centres de santé, comme les procédures de suivi du traitement. Nous recommandons le renforcement de la fourniture et du suivi du traitement.

Marco de referencia: El estudio se llevó a cabo en centros de salud y hospitales del sector público, seis en entornos urbanos y 20 en medio rural y consistió en suministrar el tratamiento antituberculoso a las personas positivas frente al virus de la inmunodeficiencia humana (VIH) en la región central y occidental de Uganda.
Objetivo: Determinar y cuantificar los factores modificables que limitan la eficacia del tratamiento antituberculoso en las personas positivas frente al VIH en las zonas rurales de Uganda.
Método: Fue este un estudio transversal retrospectivo de análisis de los registros corrientes y las historias clínicas de los pacientes positivos frente al VIH, en los consultorios del Programa Nacional contra la Tuberculosis y la Lepra de Uganda en el 2014.
Resultados: De los 191 pacientes de entornos rurales, el 66,7% logró un tratamiento eficaz y en los 213 pacientes en medio urbano esta proporción fue 81,1%. Un análisis ajustado reveló un promedio de éxito terapéutico más alto en los pacientes urbanos en comparación con los pacientes rurales (OR 3,95; IC95% de 2,70 a 5,78; $P < 0,01$, según un modelo de ecuaciones de estimación generalizadas). En medio rural, se observó una mayor pérdida durante el seguimiento y se consignaban con menor frecuencia los resultados de las baciloscopias de seguimiento en los registros de tuberculosis de los consultorios. Los pacientes que recibían tratamiento en los establecimientos de nivel de atención más alto en medio rural tenían mayores posibilidades de éxito terapéutico. Los pacientes que recibían tratamiento en centros que presentaban desabastecimientos de medicamentos tuvieron menos probabilidades de lograr un tratamiento eficaz.
Conclusión: La menor proporción de éxito terapéutico notificada en los entornos rurales se debe en su mayor parte a factores que dependen del consultorio, como los procedimientos de supervisión del tratamiento. Se recomienda reforzar la supervisión y el suministro del tratamiento antituberculoso.

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