HIV, Tuberculosis, and Chronic Lung Disease Among Kenyan Adults

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BACKGROUND

- PLWH are living longer with anti-retroviral therapy
- With aging, risk for non-communicable diseases such as chronic lung disease (CLD) is increased
- Much of the data linking HIV to CLD is from high-income countries
- Less is known in low and middle-income countries where mechanisms linking CLD and HIV may differ given varied factors such as tuberculosis (TB)

Research Questions

1) Does prior active TB increase risk for CLD, and which type of CLD?
2) Does HIV modify the relationship between TB and CLD?

METHODS

- Cross-sectional analysis of PLWH on ART in care >6 months and uninfected adults in Kisumu, Kenya from 12/2018 through 12/2019
- All participants underwent standardized spirometry and a validated respiratory specific questionnaire
- Prior active TB and pneumonia were self-reported

Spirometry (per ATS/ERS standards) used to define CLD:

- FEV1 - forced expiratory volume in 1 second, FVC - forced vital capacity, LLN - lower limit of normal (predicted normal per Global Lung Initiative 2012)
- Obstruction: FEV1/FVC < LLN
- Restriction: FEV1/FVC ratio normal, FVC <80% predicted
- Impaired: obstruction and/or restriction

Statistical analysis:

- Compared medians using Wilcoxon rank sum test and Chi-square for proportions. Multivariable logistic regression to evaluate factors associated with CLD (obstructive, restrictive, and impaired)

RESULTS

- Enrolled 483 participants, 254 PLWH and 229 HIV-uninfected; 466 have acceptable spirometry
- In unadjusted analyses, HIV associated with impaired lung function (OR 1.7, p=0.04)
- 28% of PLWH as compared to 3% of uninfected reported prior active TB (p<0.0001)
- With prior active TB, 37% of PLWH and 33% of uninfected had impaired lung function (p>0.05)
- Interaction between HIV and TB was not significant (p>0.05) in multivariable models for CLD

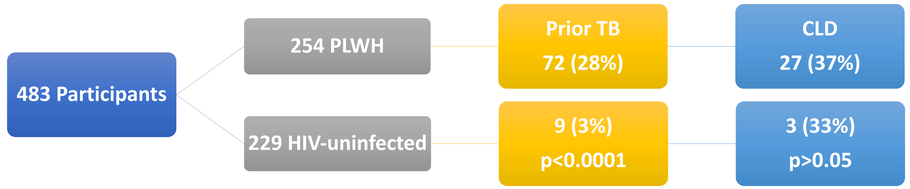

Table 1. Baseline Characteristics by HIV status

	PLWH N=254	Uninfected N=229	P-value
Age	47 (41-55)	44 (33-57)	0.004
Female sex	121 (48)	125 (55)	0.18
Prior			
Asthma	14 (6)	14 (6)	0.93
COPD	2 (1)	4 (2)	0.12
History of smoking	19 (7)	15 (7)	0.83
Prior active TB	72 (28)	9 (3)	<0.0001
Prior pneumonia	74 (29)	41 (18)	0.004
Any abnormal lung function	51 (21)	30 (14)	0.045
Obstructive pattern	28 (12)	21 (9)	0.57
Restrictive pattern	18 (7)	6 (3)	0.04

Table 2. Characteristics by impaired lung function [a]

	Normal lung function N=386	Impaired lung function N=80	p-value
Age	46 (37-56)	48 (41-58)	0.04
Female sex	193 (50)	42 (53)	0.70
BMI≥25	160 (42)	27 (34)	0.24
PLWH (n=242)	192 (50)	50 (62)	0.04
Detectable VL [b]	31 (21)	4 (10)	0.17
Prior active TB	**50 (13)**	**29 (36)**	**<0.0001**
Prior pneumonia	83 (22)	29 (36)	0.005
Smoking	26 (7)	7 (8)	0.52
Kerosene use	146 (38)	30 (38)	0.96
Wood use	191 (49)	44 (55)	0.53
Respiratory symptoms [d]	134 (35)	44 (55)	0.0007

Number (%) or median (interquartile range). Limited to 466 with acceptable spirometry. Abbreviations: BMI body mass index, MRC Medical Research Council, SD standard deviation, VL viral load.
[a] Obstruction, Restriction, or both [b] Detectable is >50 copies/mL. Data available for 186 participants. [d] Composite outcome of self-reported MRC dyspnea scale≥2 and/or cough or phlegm production

Table 3. Multivariable [a] analyses of cofactors of impaired lung function [b], and of either obstruction or restriction

	Impaired lung Function aOR (95% CI)	p-value	Obstruction aOR (95% CI)	p-value	Restriction aOR (95% CI)	p-value
HIV	1.1 (0.60-1.9)	0.84	0.81 (0.40-1.6)	0.55	2.4 (0.85-7.3)	0.11
Prior TB	**3.4 (1.9-6.2)**	**<0.0001**	**2.5 (1.2-5.3)**	**0.01**	**3.1 (1.2-7.9)**	**0.02**
Prior pneumonia	1.6 (0.94-2.8)	0.07	1.4 (0.70-2.7)	0.33	**2.4 (1.0-5.9)**	**0.049**
Smoking [c]	1.3 (0.44-3.2)	0.65	1.8 (0.58-4.9)	0.28	0.54 (0.03-3.3)	0.58
Female sex	1.3 (0.75-2.3)	0.33	1.4 (0.70-2.8)	0.35	1.1 (0.43-2.9)	0.85
Age	1.0 (0.99-1.0)	0.21	1.0 (0.97-1.0)	0.91	1.0 (1.0-1.1)	0.05
BMI	1.0 (0.95-1.0)	0.88	0.96 (0.90-1.0)	0.28	1.0 (0.97-1.1)	0.18
Kerosene use [d]	0.95 (0.54-1.6)	0.85	1.3 (0.69-2.5)	0.40	0.42 (0.13-1.2)	0.13
Wood use [d]	1.1 (0.60-1.9)	0.84	0.97 (0.49-1.9)	0.93	0.72 (0.27-2.0)	0.51

Abbreviations: CI, confidence interval; FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; LLN, lower limit of normal (predicted per Global Lung initiative 2012); aOR, adjusted odds ratio
[a] Adjusted for HIV status, prior TB, prior pneumonia, smoking (current or former), sex, age, BMI, kerosene use, and wood use. [b] Impaired lung function is a composite of obstruction, restriction, or both [c] Current or prior smoking [d] Use for heating or cooking at least once a week

Key Findings

- Prior active **TB** is common in PLWH and **strongly associated** with **impaired lung function,** both obstructive and restrictive patterns .
- Association of TB with CLD is **similar** in PLWH and uninfected.

CONCLUSIONS

- Prior active TB strongly associated with impaired lung function, both obstructive and restrictive patterns in the entire cohort
- Prior active TB more common in PLWH, placing them at higher risk for impaired lung function
- Those with impaired lung function were symptomatic with cough, phlegm production, and dyspnea
- Future work should investigate mechanisms and potential management strategies that could mitigate the risk of impaired lung function in those with prior TB

Limitations

- This cross-sectional study cannot establish causality
- Spirometry results are from a single visit and would be more reliable with serial measures
- TB is stigmatized thus prior TB may be underreported in this population

ADDITIONAL INFORMATION

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