The Association of Spirometric Impairment and History of Tuberculosis: a Population based Study in Uganda

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BACKGROUND

- Pulmonary tuberculosis (TB) is the leading infectious cause of death globally with an estimated 1.7 billion people currently infected with Mycobacterium tuberculosis and at risk of developing TB[1,2]

- While the treatment of drug-susceptible pulmonary TB is highly effective, up to 50% of TB survivors have varying degrees of residual pathological and functional conditions potentially leading to chronic sequelae[3]

- Post-TB patients have reported respiratory symptoms, reduced quality of life, and increased risk of mortality[4]

Objective: To describe the prevalence of post-TB exposure and lung function in individuals with post-TB exposure status in Uganda

Global TB incidence (per 100,000 population)[5]
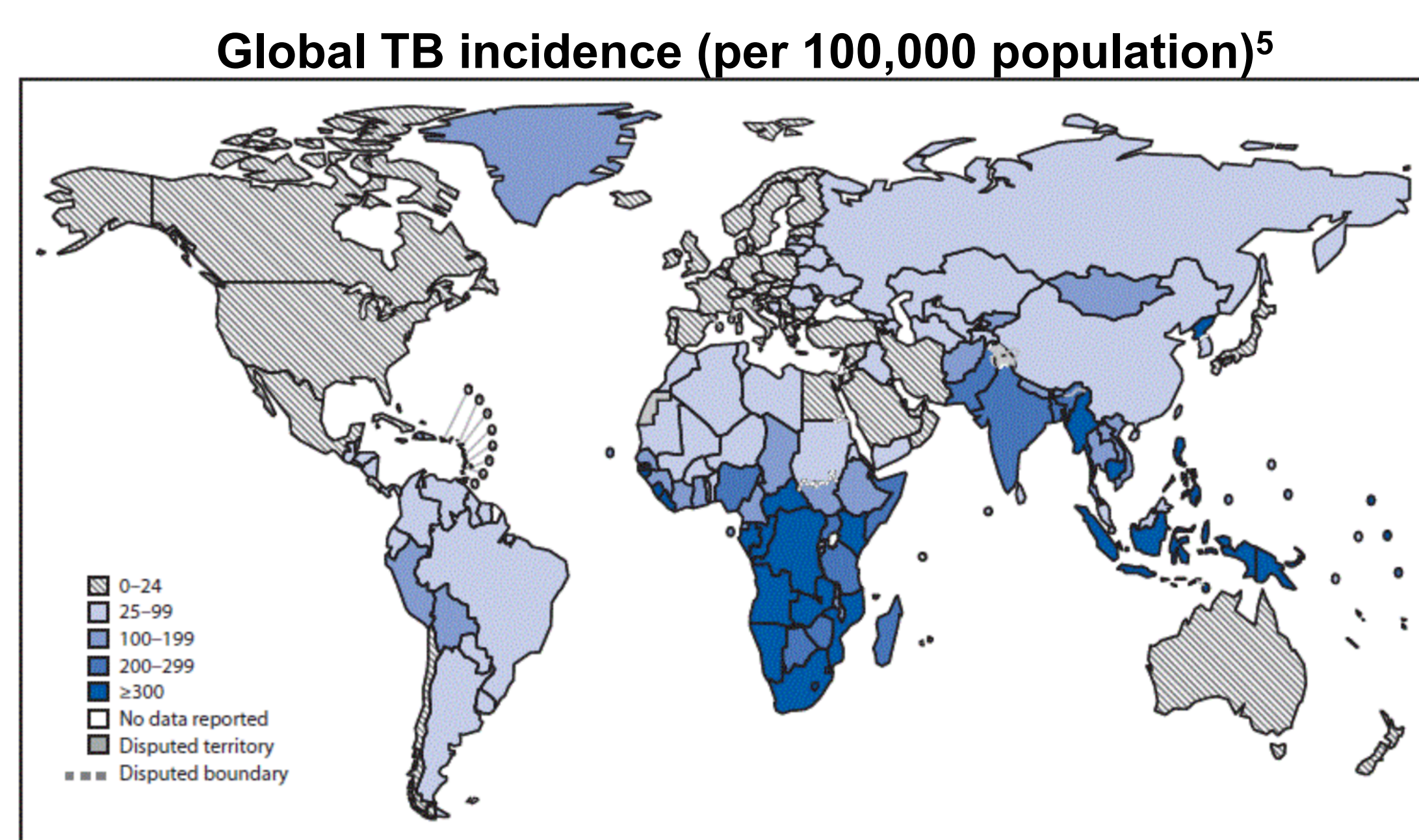
METHODS

- Secondary data analysis of the Lung Function in Nakaseke and Kampala (LiNK) study, which is a population-based cohort in urban and rural settings in Uganda.

- Trained research assistants randomly selected homes and administered standard questionnaires to adults 35 years or older that were full-time residents of each setting

- Prior TB diagnosis and treatment was self-reported by participants.

- The research team collected pre-bronchodilator forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), and the percentage of FVC exhaled in the first second (FEV_1/FVC) according to American Thoracic Society guidelines
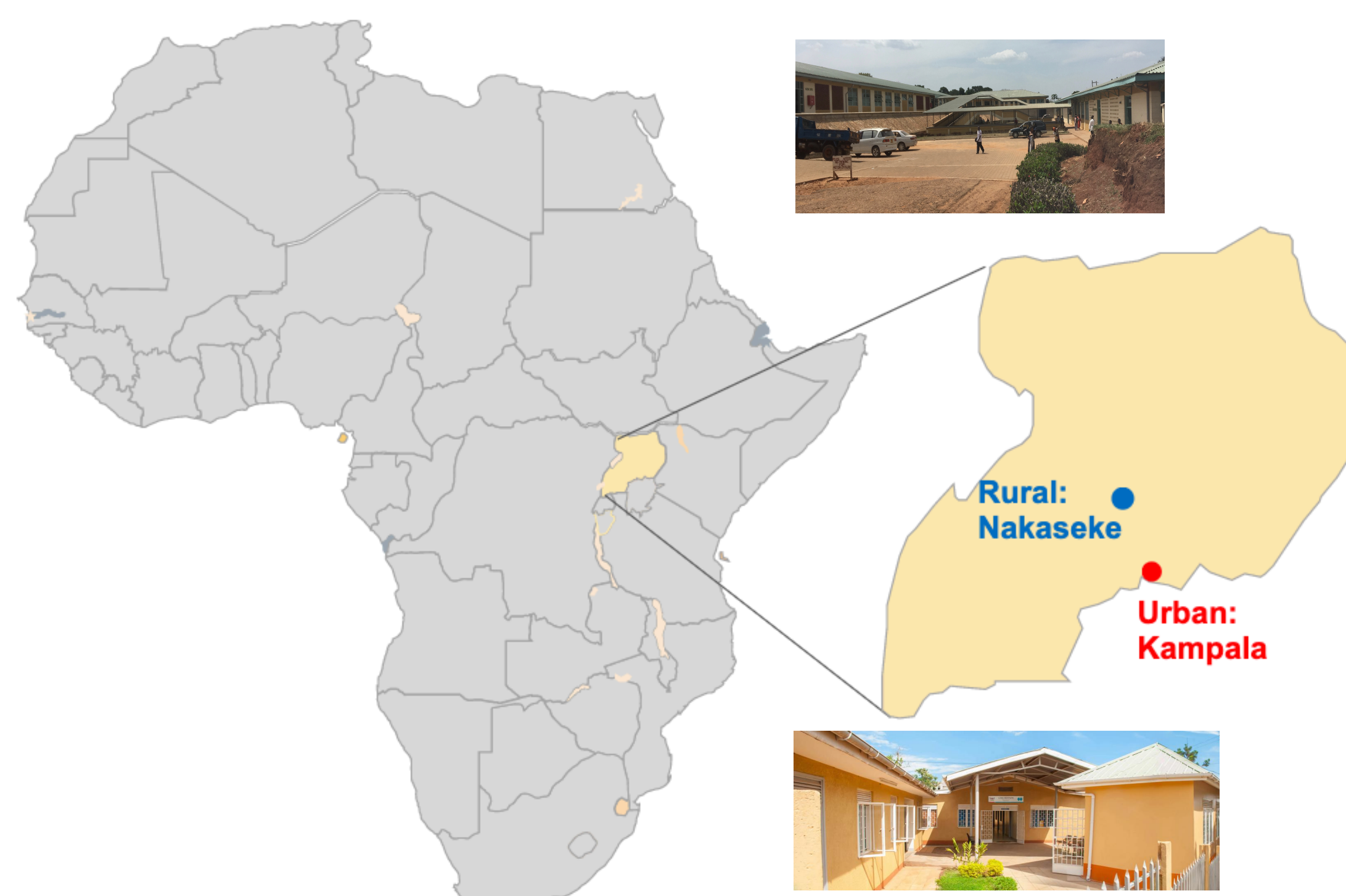
RESULTS

**Demographic Characteristics of Participants**

- In the LiNK study, 11.6% (177/1526) participants were excluded due to lack of acceptable and reproducible spirometry data and/or missing prior history of TB status. 1349 participants were ultimately included in our analysis.

- 42 participants (3.1%) self-reported successfully treated TB. The mean (± SD) number of years since TB diagnosis was 9.2 ± 8.1 years.

- Participants with no TB history had 2.7 kg/m^2 higher BMI, on average, relative to post-TB participants (p=0.001). Among the remaining demographic characteristics, there were no statistically significant differences between participants with and without prior TB history.

Descriptive Characteristics of Participants

Demographic Characteristics	LiNK Cohort (N=1349)	Participants with Post-TB exposure status (n=42)
Age, years (mean [SD])	47.0 (10.4)	49.0 (17.9)
BMI, kg/cm^2 (mean [SD])	23.4 (5.6)	19.0 (1.1)
Standing height, cm (mean [SD])	161.9 (8.7)	169.5 (14.8)
Setting % (n)		
Urban	48.6 (656)	54.8 (23)
Rural	51.4 (693)	45.2 (19)
HIV status % (n)		
Positive	8.9 (120)	45.2 (19)
Negative	75.6 (1020)	54.8 (23)
Unknown	15.5 (209)	0 (0)
Prior COPD diagnosis % (n)	0.1 (1)	0 (0)
Currently Employed % (n)	87.4 (1179)	81.0 (34)
Tobacco Use		
Ever Smoker % (n)	8.1 (109)	19.0 (8)
Ever Daily Smoker % (n)	7.6 (103)	14.3 (6)
Current Smoker % (n)	7.9 (106)	4.8 (2)
Current Daily Smoker % (n)	5.0 (67)	4.8 (2)
Cigarettes smoked daily (mean [SD])	1.7 (2.1)	0 (0)
Biomass Exposure		
Any Biomass Use (wood, charcoal, dung) % (n)	51.0 (688)	59.5 (25)
Cooking Location % (n)		
Inside house	53.2 (718)	52.4 (22)
Outside house	9.9 (133)	14.3 (6)
Both inside and outside house	36.2 (488)	33.3 (6)
Unknown	0.7 (10)	0 (0)

Decline in FEV1/FVC and Diagnosis of COPD by Spirometry

- Multivariate linear regression (FEV1/FVC) and multivariate logistic regression (COPD based on FEV1/FVC <0.7) identified age, BMI, HIV status, a rural home, having ever smoked, currently working and prior TB diagnosis as associated with obstructive lung pathology. (* statistically significant change)
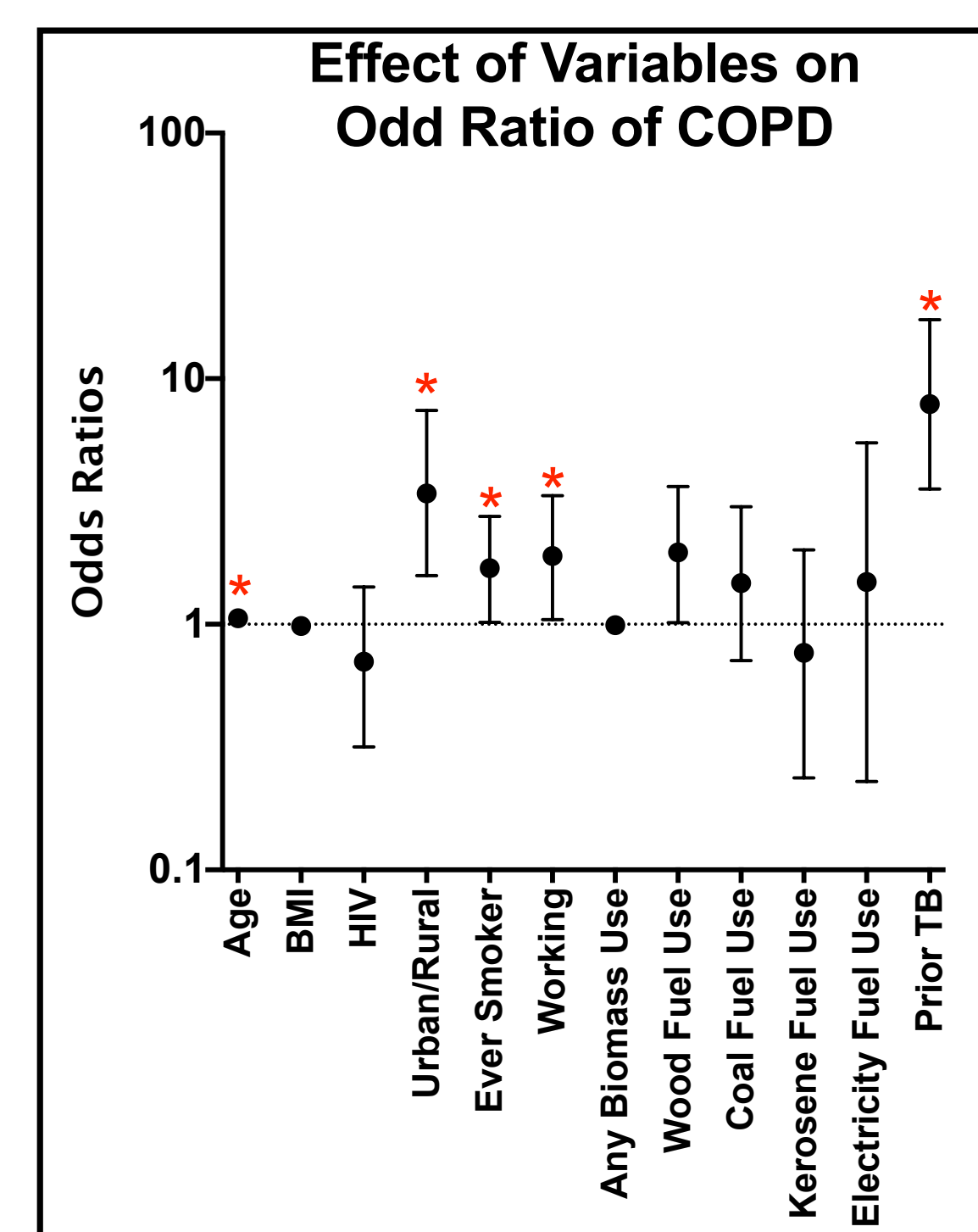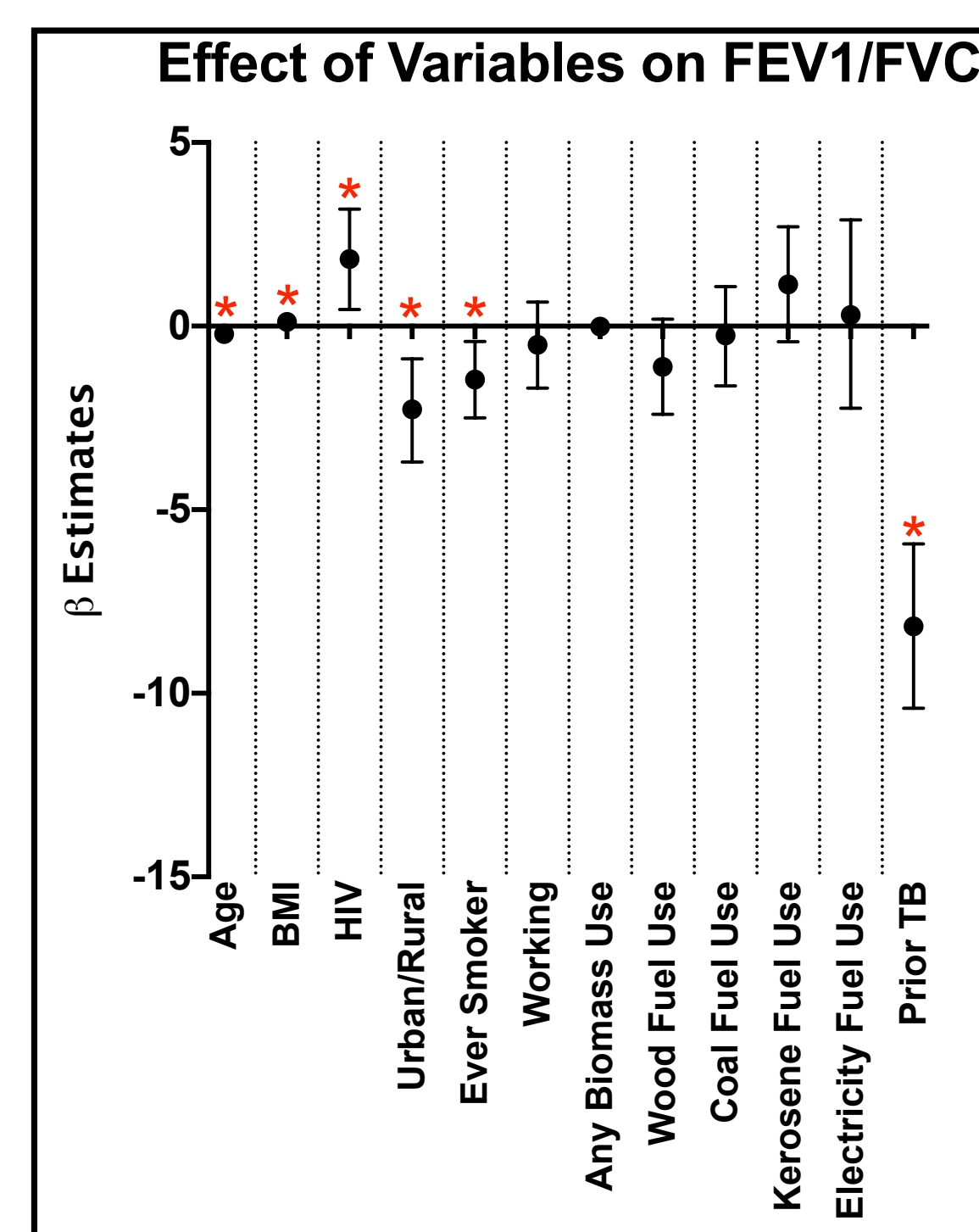

Decline in FEV1/FVC and Diagnosis of COPD by Spirometry (Tabulated Data)

	Effect on FEV1/FVC			Effect on COPD Diagnosis (based on FEV1/FVC)		
	Beta Estimates	95% CI	Significant?	Odds Ratio	95% CI	Significant?
Age	-0.217	-0.254	-0.181	*	1.058	1.041	1.075	*
BMI	0.113	0.036	0.189	*	0.985	0.942	1.027	
HIV	1.824	0.453	3.187	*	0.705	0.317	1.420	
Urban/Rural	-2.268	-3.698	-0.893	*	3.411	1.577	7.419	*
Ever Smoker	-1.458	-2.498	-0.417	*	1.693	1.018	2.748	*
Working	-0.512	-1.690	0.652		1.896	1.044	3.340	*
Any Biomass Use	-0.012	-0.037	0.013		0.991	0.971	1.006	
Wood Fuel Use	-1.106	-2.401	0.187		1.964	1.015	3.640	
Coal Fuel Use	-0.255	-1.627	1.078		1.473	0.712	3.010	
Kerosene Fuel Use	1.133	-0.429	2.708		0.764	0.237	2.006	
Electricity Fuel Use	0.305	-2.235	2.890		1.486	0.229	5.474	
Prior TB	-8.176	-10.410	-5.932	*	7.885	3.550	17.392	*

(Note: in the table above, the three values after "Beta Estimates" span Beta Estimate and 95% CI columns; the three values after "Odds Ratio" span Odds Ratio and 95% CI columns.)

Effect of Prior TB on Spirometry and diagnosis of COPD

- A significant difference was noted in FEV1, FVC, and FEV1/FVC measurements based on prior TB status (left). Similarly, a diagnosis of COPD by spirometry (FEV1/FVC <70%) was also different based on prior TB status (right, p<0.0001)
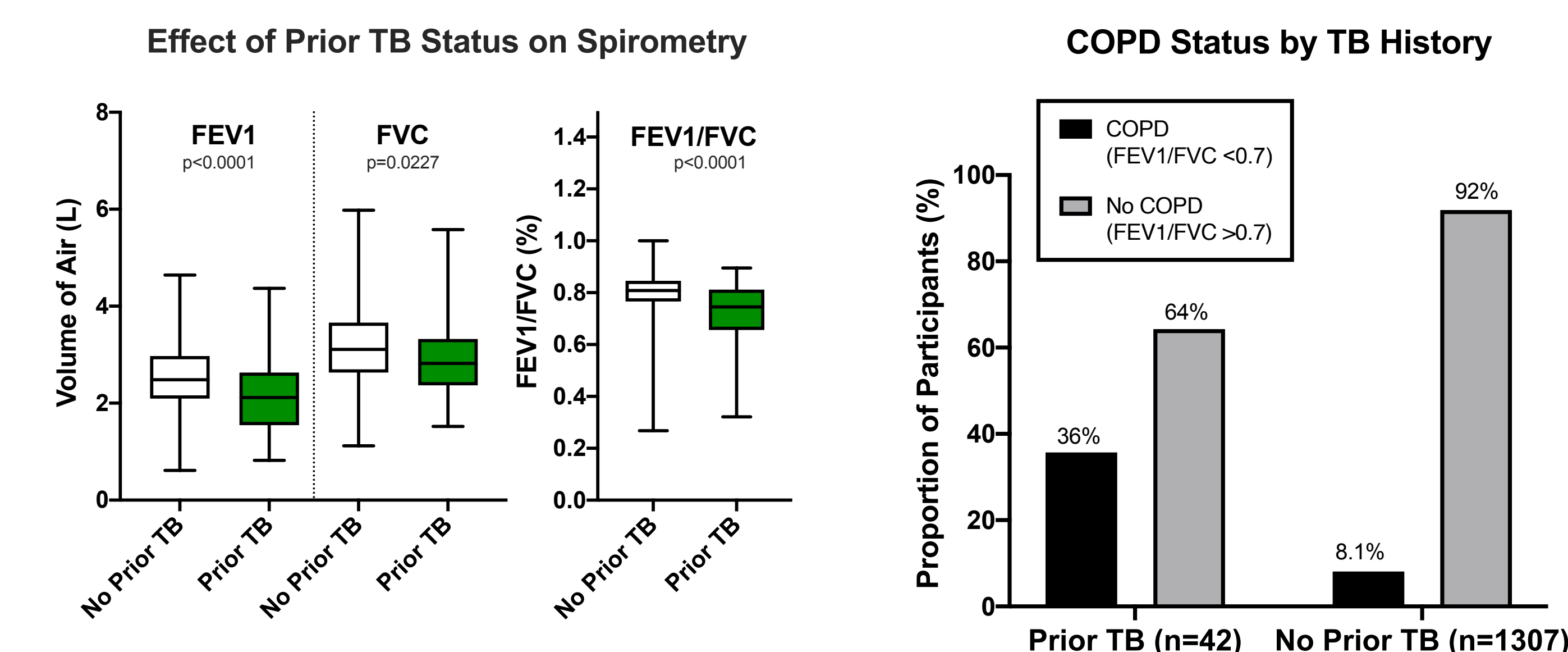
DISCUSSION

- Several factors in our study were associated with changes is spirometry and development of COPD in a statistically significant way: Age, BMI, HIV, rural home, ever having smoked, currently working, and pulmonary TB

- Of these factors, a rural home, having ever smoked and pulmonary TB had the largest effect on the outcomes. TB had a particularly strong effect

CONCLUSION

- Prior TB infection is significantly and strongly associated with development of COPD (OR 7.89, 95% CI 3.55 – 17.4)

- ~25% of the world's population has active TB infection

- Screening for chronic respiratory disease in patients identified with TB may be a crucial step in overall management of this patient population

FUNDING

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