# Estimating TB transmission in primary care clinics in TB/HIV high burden settings

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## BACKGROUND

- Tuberculosis (TB), an airborne transmitted disease, caused by *Mycobacterium tuberculosis (Mtb),* is a major public health problem in Africa (1).
- TB transmission is difficult to measure and its drivers are not well understood (2).
- Primary care clinics where HIV and TB patients have regular visits are at particularly high risk for transmission and important locations for infection control interventions (3-4).

## AIM

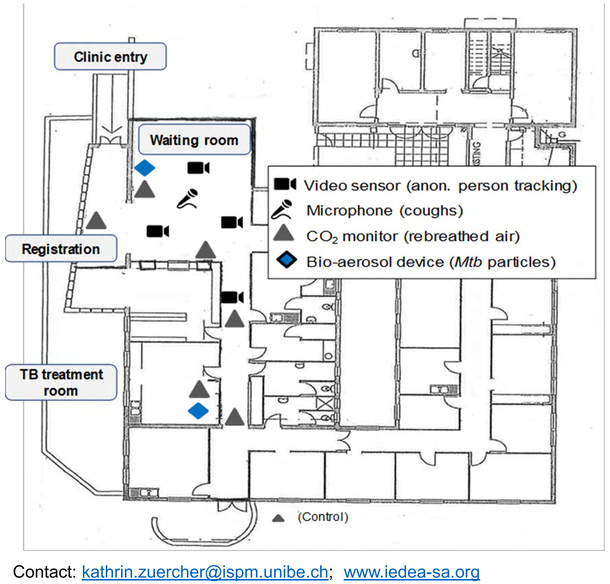
We piloted a novel approach to study TB transmission in a primary care clinic in Cape Town, South Africa, combining clinical, environmental and position-tracking data.

## METHODS

### *Study design*

- Longitudinal study with collection of patient- and environment-associated TB transmission factors.
- Data collected over 4 weeks in August 2019 (workdays only) at a primary care clinic in Cape Town, South Africa.

**Figure 1. Floor plan of the clinic indicating the measurements on patient movement, $CO_2$, coughing and *Mtb* paticiles .**




# *Feasibility of a novel approach to study tuberculosis transmission risk in high burden settings*

**Patient factors (Figure 1)**

- Patient characteristics from the electronic patient record system.
- Number of people present at the clinic, and their time spent in the waiting room from video sensors.

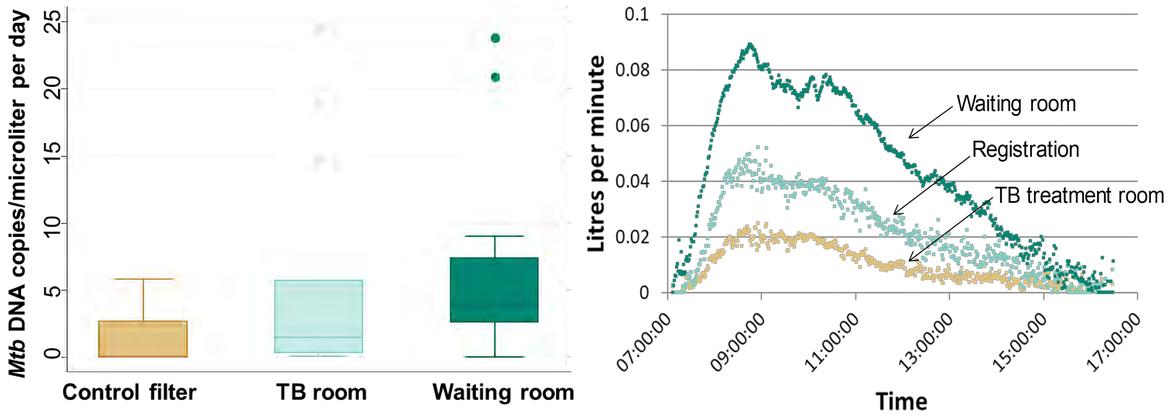
**Environmental factors**

- Indoor carbon dioxide levels ($CO_2$ in parts per million [ppm]) from $CO_2$ monitor.
- Frequency and duration of patients' coughs were extracted from acustic recordings.
- Number of *Mtb* particles in the air from a bio-aerosol sampling device, followed by PCR of filters.

### *Statistics*

- We used descriptive statistics to calculate median and interquartile range (IQR).
- We calculated rebreathed air volume (RAV) based on people density and $CO_2$ levels.
- We defined three areas in the clinic: Registration, Waiting room, and TB treatment room (Figure1).

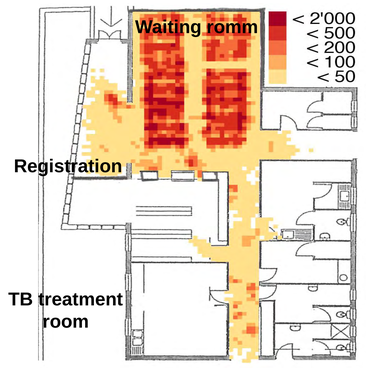
**Figure 2. *Mtb* DNA copies/microliter per day (left) and shared rebreathed air volume (RAV, in liters per minute) during workdays in the different clinic areas (right).**




## RESULTS

- 10,317 people visited the clinic. Median number of people per day was 523 (IQR 464-654) and the median time spent in waiting room 24min (IQR 23-27).
- 3,535 registered patients visited the clinic during the study period; median number of registered patient per day 154 (IQR 139-203); among them 19 had current TB.
- The highest density of people was found in the waiting room (Figure 3).
- Median *Mtb* DNA copies/microliter per day: TB room 1.5 (IQR 0.3-5.7); waiting room 4.0 (IQR 2.6-7.4, Figure 2).
  - Median RAV was 40 L/day (IQR 18-77) compatible with airborne TB transmission. Exchanged air was high with 11.2 L/h per person (Figure 2).
  - Median number of coughs per day was 325 (IQR 193-360).

**Figure 3. Heat map of density of visitors in the primary care clinic over the study period; data from video sensor tracking system.**




## CONCLUSIONS

This study demonstrates the feasibility of a novel approach to study TB transmission in high-risk settings. Mathematical modelling will allow identifying factors driving the risk of TB transmission and evaluating interventions such as separating patient flows or improving air ventilation.

## REFERENCE

1. World Health Organization. Global tuberculosis report 2018; 2. The Lancet. Lancet Respir Med (2019); 3.Wood R, et al. PloS one (2014); 4. Hella J, et al. J Infect (2017)

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