Performance of the World Health Organization Algorithm for Tuberculosis Screening in Kenya

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BACKGROUND

- The World Health Organization (WHO) recommends TB screening for all people living with HIV (PLHIV) using an evidence-based symptom screening algorithm
  - PLHIV screening positive should be evaluated for TB
  - PLHIV screening negative should receive isoniazid preventive therapy (IPT)
- Implementation of WHO recommendations began in 2010 in Nyanza Province, which has highest TB/HIV burden in Kenya

METHODS

- Prospective recruitment of PLHIV from 15 randomly-selected HIV clinics using probability proportionate to size sampling in 4 districts of Nyanza Province
- Phased enrollment between May 2011 – June 2012
- Patient inclusion criteria
  - Age 7 years or older
  - Documented HIV infection
  - No HIV care or treatment in the preceding 2 years
  - No TB diagnosis or treatment in preceding 1 year
- All PLHIV received TB assessment at enrollment:
  - WHO-recommended symptom screening
  - Chest radiograph (regardless of symptoms)
  - Collection of 3 sputum specimens (regardless of symptoms) for smear microscopy, liquid culture, and Xpert MTB/Rif testing (Xpert)
- Patients who did not have at least 2 sputum specimens with valid results (i.e. no culture contamination and no error on Xpert) were excluded
- Remaining patients were classified as follows:
  - Pulmonary TB: *Mycobacterium tuberculosis* complex (MTBC) confirmed by at least one Xpert or culture
  - No TB: No MTBC on any Xpert or culture

PRELIMINARY RESULTS

- 83 (11.2%) of 738 PLHIV were diagnosed with pulmonary TB at enrollment into HIV care services
- Median age of all PLHIV: 30 years; interquartile range (IQR), 24–39 years
- Median CD4+ cell count at enrollment: 344 cells/µL; IQR, 168 to 518 cells/µL
  - Significantly lower in PLHIV with pulmonary TB than those with no TB (166 versus 360 cells/µL; p <0.0001)
- 371 (50.3%) of all PLHIV reported at least one TB symptom at enrollment
  - Weight loss was most commonly reported (65.8% of symptomatic PLHIV)
  - Cough was least commonly reported (46.7% of symptomatic PLHIV)
- WHO screening algorithm more sensitive in patients with lower CD4 count at enrollment
  - Sensitivity among PLHIV with CD4 < 100 versus ≥ 100: 92.6% versus 60.9%; p <0.0001

Figure 1. Study Enrollment

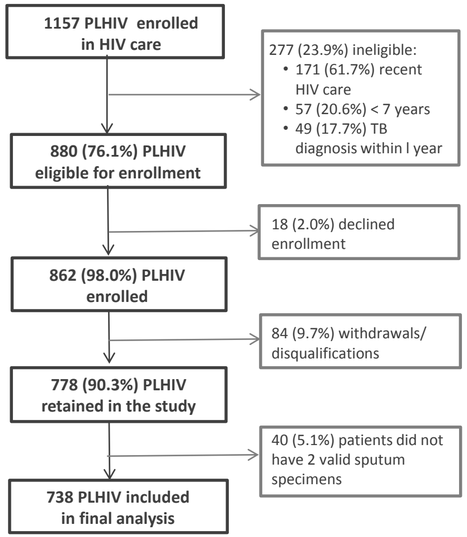


Table 1. Performance of Clinical Screening for TB

Screening Tool	Sensitivity	Specificity	Negative Predictive Value	Positive Predictive Value	Negative Likelihood Ratio*	Positive Likelihood Ratio**
WHO Algorithm	**74.4%**	**49.4%**	**93.9%**	**15.6%**	**0.52**	**1.47**
Any cough	42.7%	76.4%	91.4%	18.5%	0.75	1.81
Fever	55.8%	68.0%	92.5%	17.9%	0.65	1.74
Night sweats	47.4%	75.7%	92.1%	19.5%	0.70	1.95
Weight loss	59.2%	67.6%	93.1%	18.4%	0.60	1.83
WHO Algorithm & Chest Radiograph	**90.9%**	**31.9%**	**96.2%**	**15.7%**	**0.29**	**1.33**
Chest Radiograph	77.3%	60.0%	95.0%	21.3%	0.38	1.29

* Negative likelihood ratio is calculated as (1 − sensitivity) ÷ specificity.
**Positive likelihood ratio is calculated as sensitivity ÷ (1 − specificity).

CONCLUSIONS

- Half of all PLHIV newly enrolling in HIV care services in this setting reported at least one TB symptom
  - Only 15% of symptomatic PLHIV were diagnosed with pulmonary TB
- If TB diagnostic testing were limited to PLHIV reporting symptoms in the WHO algorithm, 25% of PLHIV with laboratory-confirmed pulmonary TB would have been missed
- Adding a chest radiograph to the WHO symptom screening algorithm improved case finding and more reliably identified PLHIV who should receive IPT
- Symptom screening alone performed best in patients with low CD4 counts at enrollment
- HIV programs should consider the feasibility of alternate TB screening algorithms, such as screening all PLHIV using Xpert at enrollment in HIV care and adding chest radiography to the screening algorithm
- Additional analyses are needed to determine the performance of WHO screening at follow-up visits and the optimal intervals for screening

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