The Effectiveness of TB Infection Control Strategies in High HIV/TB Burden Settings
Eltony Mugomery, Africa University, Zimbabwe
A Webber Training Teleclass

National University of Lesotho, Southern Africa

Central University of Technology, Free State

The effectiveness of TB infection control strategies in high HIV/TB burden settings: The case of isoniazid preventive therapy in Lesotho

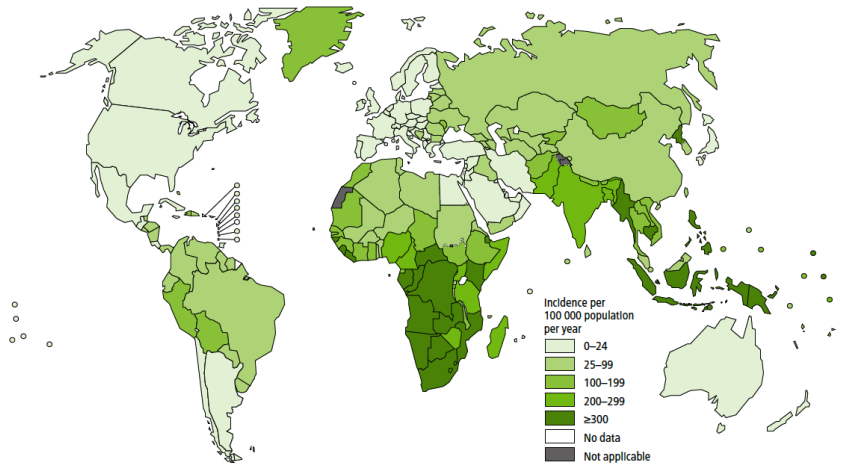
Eltony Mugomeri, DHSc
Department of Health Sciences, Africa University, Zimbabwe

AFRICA UNIVERSITY
A United Methodist-Related Institution

Hosted by Joseph Kaunda
Alberta Health Services, Canada

www.webbertraining.com February 7, 2019

Global TB Hot Spots, 2016



Global Tuberculosis Report (2017)

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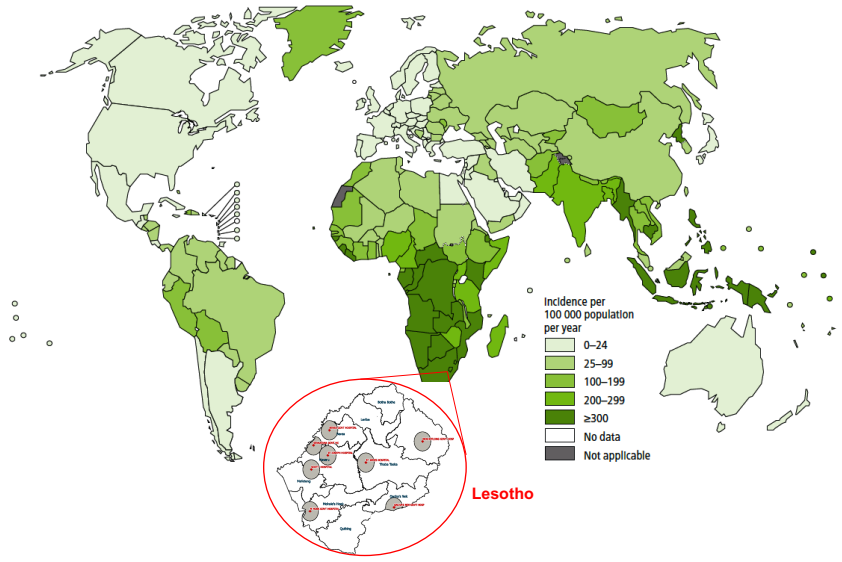

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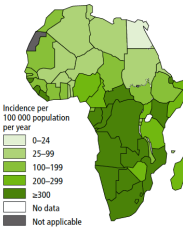
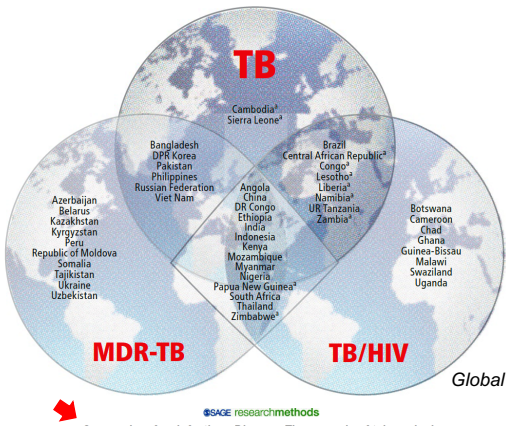
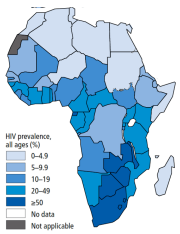
HIV/TB syndemic in sub-Saharan Africa



TB incidence, 2016





HIV rates in TB cases, 2016

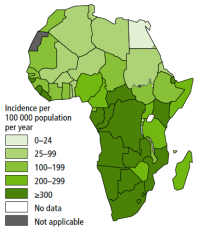
Global Tuberculosis Report (2017)

SAGE researchmethods
Geography of an Infectious Disease: The example of tuberculosis
In: Health and Inequality

- PLHIV in SSA largest reservoir of TB globally (74% of all annual infections). (Hermans et al, 2016).
- How effective is universal IPT (all HIV+) in high HIV/TB burden settings?

4

HIV/TB syndemic in sub-Saharan Africa



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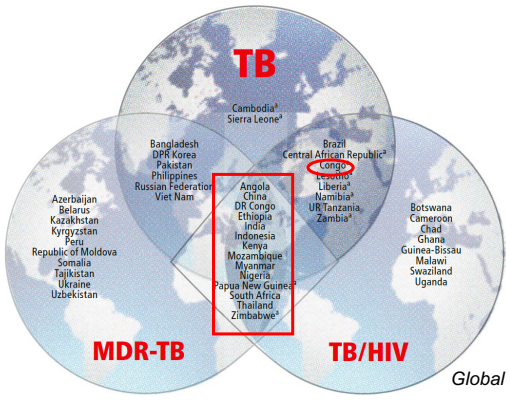

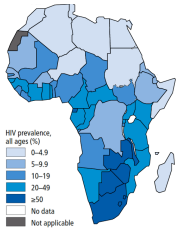

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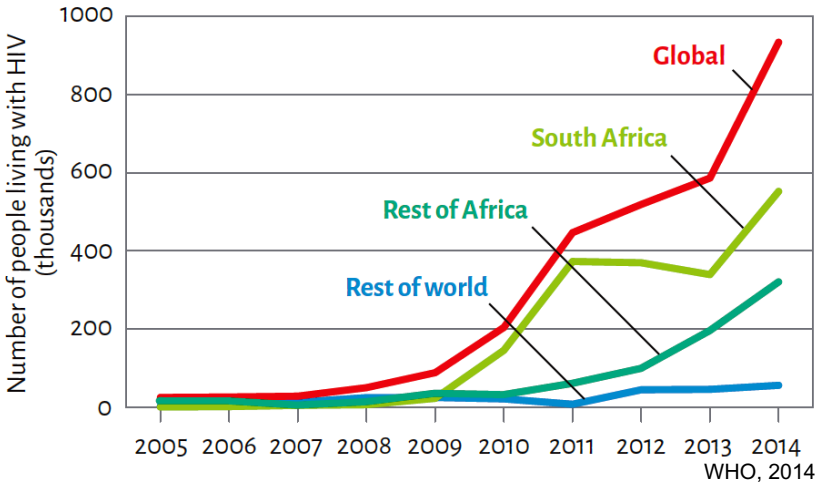
Provision of IPT to PLHIV, 2005-2014



WHO, 2014

- WHO recommended 6 month IPT course for PLHIV in 2004.
- Slow uptake of IPT common in SSA where needed most

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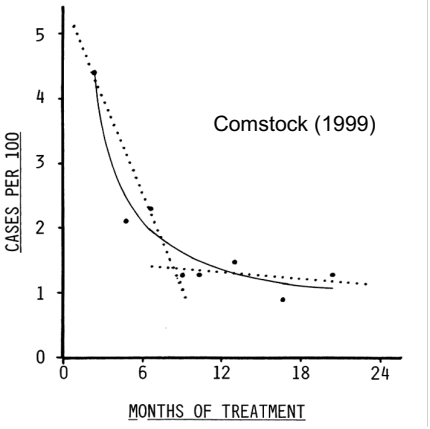
Efficacy of IPT in clinical trials



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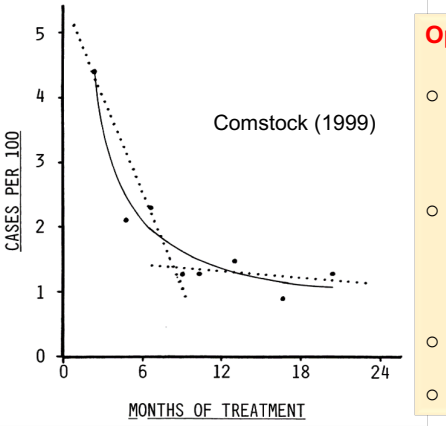
Efficacy of IPT in clinical trials



Optimum course IPT (Clinical Trials)

- 36 months IPT = 3 yrs protection (Martinson et al, 2009 [S.Africa]; Samandari et al, 2011 [Botswana]).
- 6 months IPT = 6 months protection (Rangaka et al, 2014) in S. Africa where IPT reduced TB incidence by 60% in HIV+ adults with no history of TB.
- Rifampicin & pyrazinamide?
- How effective is universal IPT?

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Universal IPT for latent TB

Shayo *et al. BMC Public Health* (2018) 18:35
DOI 10.1186/s12889-017-4597-9

BMC Public Health

RESEARCH ARTICLE Open Access

Cost-Effectiveness of isoniazid preventive therapy among HIV-infected patients clinicaly screened for latent tuberculosis infection in Dar es Salaam, Tanzania: A prospective Cohort study

Grace A. Shayo[1*], Dereck Chitama[2], Candida Moshiro[3], Said Aboud[4], Muhammad Bakari[1,5] and Ferdinand Mugusi[1]

Abstract

Background: One of the reasons why Isoniazid preventive therapy (IPT) for Tuberculosis (TB) is not widely used in low income countries is concerns on cost of excluding active TB. We analyzed the cost-effectiveness of IPT provision in Tanzania having ruled out active TB by a symptom-based screening tool.

Conclusion: IPT should be given to HIV-infected patients who screen negative to symptom-based TB screening questionnaire. Its cost-effectiveness supports government policy to integrate IPT to HIV/AIDS care and treatment in the country, given the availability of budget and the capacity of health facilities.

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Reactivation of persistent latent infection is a challenge

Hermans *et al. BMC Medicine* (2016) 14:45
DOI 10.1186/s12916-016-0589-3

BMC Medicine

World TB Day

RESEARCH ARTICLE Open Access

The timing of tuberculosis after isoniazid preventive therapy among gold miners in South Africa: a prospective cohort study

Sabine M. Hermans[1,2,3,4*], Alison D. Grant[1,5,6], Violet Chihota[5,7], James J. Lewis[1], Emilia Vynnycky[1,8], Gavin J. Churchyard[1,5,7,9] and Katherine L. Fielding[1,5]

- The durability of protection by IPT was lost within 6–12 months in this setting with a high HIV prevalence and a high annual risk of M. tuberculosis infection.
- The observed rate of reinfection was higher than the modelled rate [1.3/100 pyrs, vs 2.2/100 pyrs (95 % CI, 1.8–2.7)], suggesting that reactivation of persistent latent infection plays a role in the rapid return to baseline TB incidence.

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Poor contact investigations remains a barrier to TB infection control

RESEARCH Open Access

Identifying barriers to and facilitators of tuberculosis contact investigation in Kampala, Uganda: a behavioral approach

Irene Ayakaka[1], Sara Ackerman[2], Joseph M. Ggita[1], Phoebe Kajubi[3], David Dowdy[4], Jessica E. Haberer[5], Elizabeth Fair[6], Philip Hopewell[6], Margaret A. Handley[7,8], Adithya Cattamanchi[6], Achilles Katamba[9] and J. Lucian Davis[10*]

- Barriers included stigma, limited knowledge about TB among contacts, insufficient time and space in clinics for counselling, mistrust of health center staff among index patients and contacts, and high travel costs for lay health workers and contacts.
- The most important facilitators identified were the personalized and enabling services.
- The use of a behavioral theory and a validated implementation framework provided a comprehensive approach for systematically identifying barriers to and facilitators of TB contact investigation.

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TB infection control in healthcare facilities remains a concern

Kuyinu et al. BMC Infectious Diseases (2016) 16:126
DOI 10.1186/s12879-016-1453-y

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Tuberculosis infection control measures in health care facilities offering tb services in Ikeja local government area, Lagos, South West, Nigeria

Y. A. Kuyinu[1*], A. S. Mohammed[1], O. O. Adeyeye[2], B. A. Odugbemi[1], O. O. Goodman[1] and O. O. Odusanya[1]

Abstract

Background: Tuberculosis infection among health care workers is capable of worsening the existing health human resource problems of low - and middle-income countries. Tuberculosis infection control is often weakly implemented in these parts of the world therefore, understanding the reasons for poor implementation of tuberculosis infection control guidelines are important. This study was aimed at assessing tuberculosis infection control practices and barriers to its implementation in Ikeja, Nigeria.

Methods: A cross-sectional study in 20 tuberculosis care facilities (16 public and 4 private) in Ikeja, Lagos was conducted. The study included a facility survey to assess the availability of tuberculosis infection control guidelines, the adequacy of facilities to prevent transmission of tuberculosis and observations of practices to assess the implementation of tuberculosis infection control guidelines. Four focus group discussions were carried out to highlight HCWs' perceptions on tuberculosis infection control guidelines and barriers to its implementation.

Results: The observational study showed that none of the clinics had a tuberculosis infection control plan. No clinic was consistently screening patients for cough. Twelve facilities (60 %) consistently provided masks to patients who were coughing. Ventilation in the waiting areas was assessed to be adequate in 60 % of the clinics while four clinics (20 %) possessed N-95 respirators. Findings from the focus group discussions showed weak managerial support, poor funding, under-staffing, lack of space and not wanting to be seen as stigmatizing against tuberculosis patients as barriers that hindered the implementation of TB infection control measures.

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Effective IPC governance is needed in some countries

American Journal of Infection Control 46 (2018) e13-e17

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

Major Article

The efficacy of infection prevention and control committees in Lesotho: A qualitative study

Eltony Mugomeri MTech *

Department of Pharmacy, Faculty of Health Sciences, National University of Lesotho, Maseru, Lesotho

Key Words:
Barriers to infection control practice
Infection prevention and control committees
Infection prevention and control governance

Background: The implementation of the core components of infection prevention and control (IPC) recommended by the World Health Organization faces severe challenges, particularly in developing countries. Given that hospital IPC committees in these countries are the key implementers of IPC, there is a need to evaluate their effectiveness. This study qualitatively evaluated the effectiveness of IPC committees in the southern African country of Lesotho with the aim of identifying themes for policy discourse on improving IPC practice in the country.
Methods: Data gathering was conducted through open interviews with purposefully selected key informant IPC committee members and relevant officials at the Ministry of Health, whereas data analysis was based on grounded theory.
Results: Despite their commitment, IPC committees were largely ineffective because of 5 major barriers, namely poor sense of competence, administrative constraints, inadequate financial support, role uncertainty, and negative staff attitudes. Poor IPC governance was found to be a central barrier to the effectiveness of IPC committees in Lesotho.
Conclusions: The import of this study is that effective IPC governance is key to improving the IPC program in Lesotho. Effective leadership with the necessary competencies is needed to steer the IPC program in the country.

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Lesotho's HIV/TB situation

- HIV+ = 23.5% (adults) & TB incidence = 852 per 100,000 (WHO, 2016);
- > 700 per 100,000 alongside S. Africa & Swaziland
- 74% of TB+ co-infected with HIV (WHO, 2014).
- TB incidence & notification rates, Lesotho?

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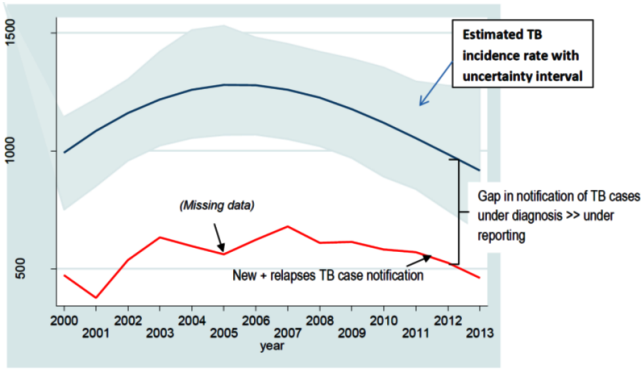

TB incidence & notification rates, Lesotho? (2000-2013)

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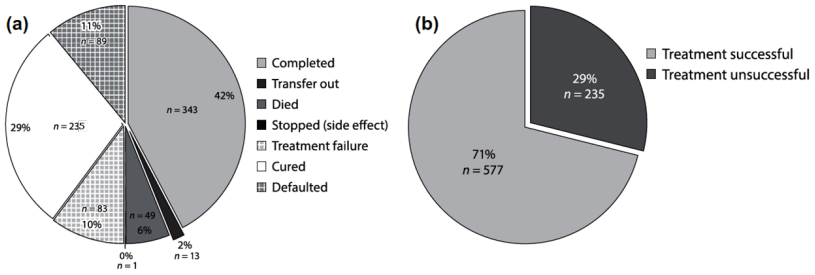
Lesotho's HIV/TB situation

Poor TB treatment outcomes persist



TB treatment outcomes (2016) by category (a) and overall (b) (*n* = 812).

Taylor & Francis

Trends in diagnostic techniques and factors associated with tuberculosis treatment outcomes in Lesotho, 2010–2015

Eltony Mugomeri[a*], Bisrat S Bekele[a], Charles Maibvise[b] and Clemence Tarirai[c]

Southern African Journal of Infectious Diseases, 33:1, 18-23,

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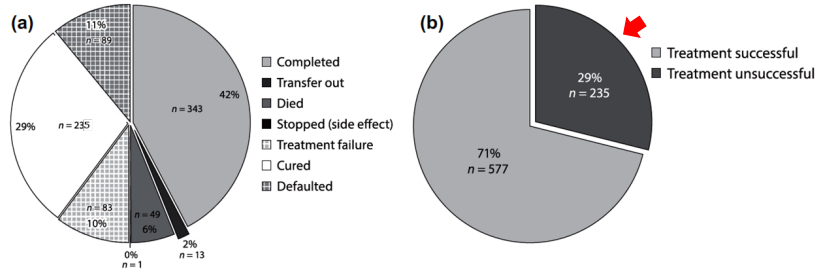
Lesotho's HIV/TB situation

Poor TB treatment outcomes persist



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Lesotho's HIV/TB situation

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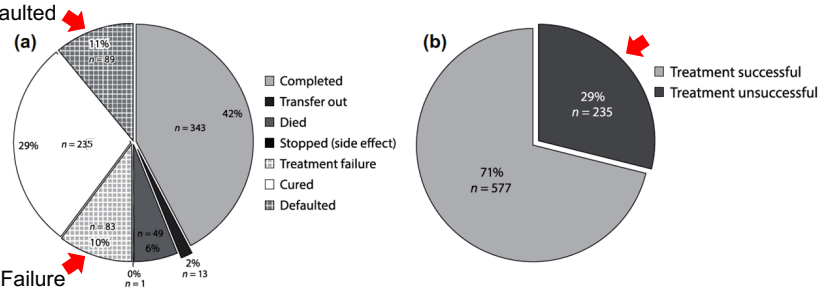

Rx Failure

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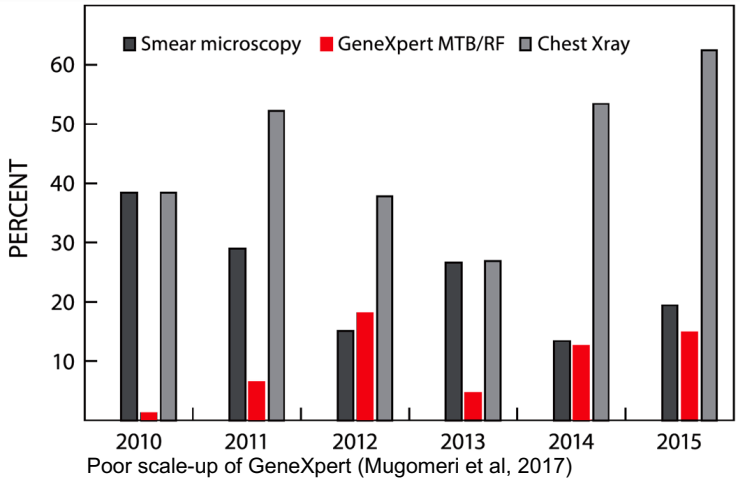
Diagnostic techniques for TB in Lesotho



Poor scale-up of GeneXpert (Mugomeri et al, 2017)

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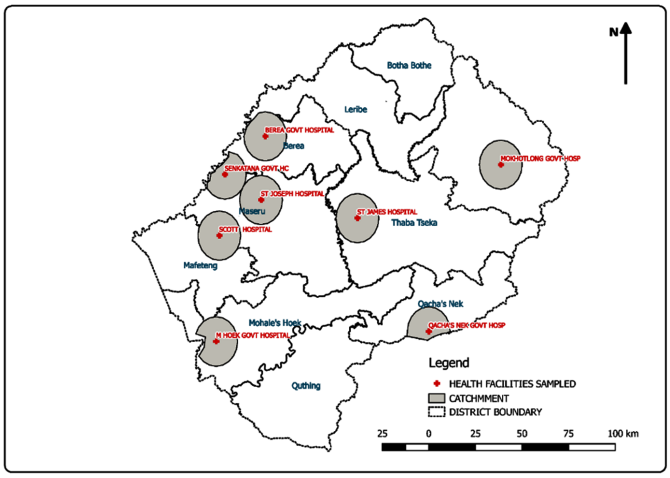
Study sampling criteria

- Stratified systematic random sampling
- PLHIV (2004 – 2016) from eight district hospitals (three in sparse & five in densely inhabited districts).



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Data Collection

- HIV-positive children, adolescents, adults, geriatric & pregnant in 2 cohorts (Before & after IPT launch.) NB. Lesotho launched IPT in 2011.
- Discrete-time survival data (6-month intervals).

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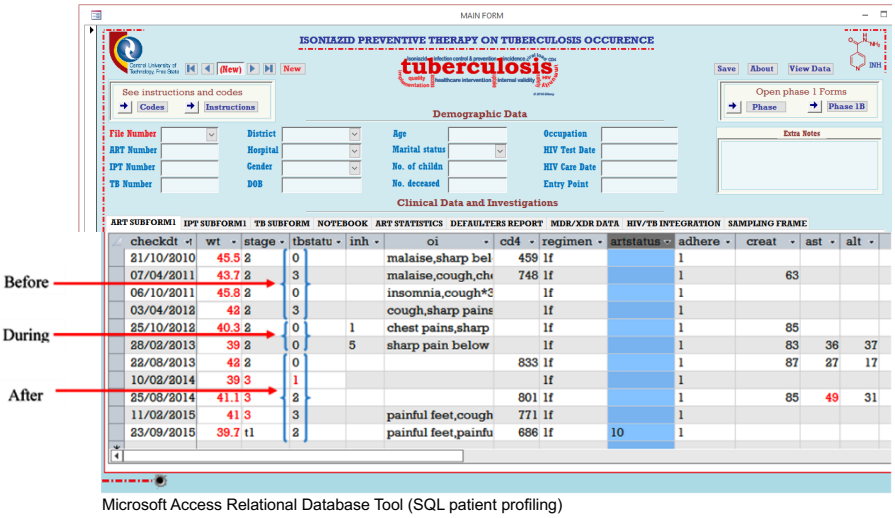
Data Abstraction Tool



checkdt	wt	stage	tbstatu	inh	oi	cd4	regimen	artstatus	adhere	creat	ast	alt
21/10/2010	45.5	2	0		malaise,sharp bel	459	1f		1			
07/04/2011	43.7	2	3		malaise,cough,ch	748	1f		1	63		
06/10/2011	45.8	2	0		insomnia,cough*3		1f		1			
03/04/2012	43	2	3		cough,sharp pains		1f		1			
25/10/2012	40.3	2	0	1	chest pains,sharp		1f		1	85		
28/03/2013	39	2	0	5	sharp pain below		1f		1	83	36	37
22/08/2013	42	2	0			833	1f		1	87	27	17
10/02/2014	39	3	1				1f		1			
25/08/2014	41.1	3	2			801	1f		1	85	49	31
11/02/2015	41	3	3		painful feet,cough	771	1f		1			
23/09/2015	39.7	t1	2		painful feet,painfu	686	1f	10	1			

Microsoft Access Relational Database Tool (SQL patient profiling)

TB Status Key	INH Key	Regimen Key
0 | No TB signs 1 | Active TB 2 | Past TB 3 | TB signs	1 | Begin IPT 5 | Completed	1f | tenofovir

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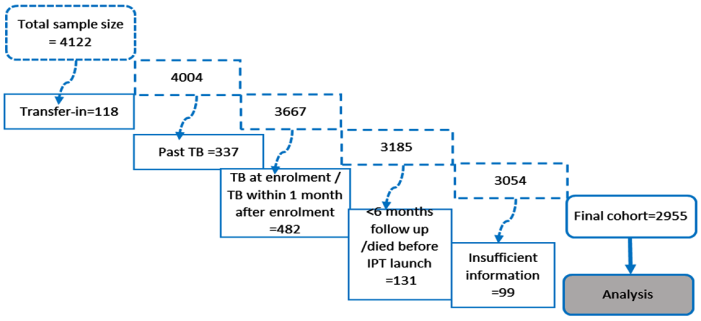
Sample size



Analysis?

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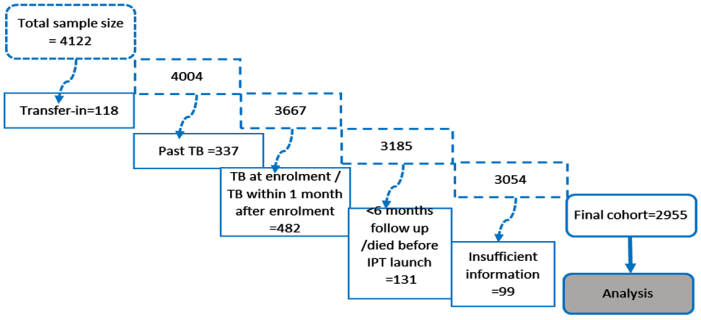
Sample size



Analysis

- Cox's proportional hazard regression model for TB occurrence in Stata®

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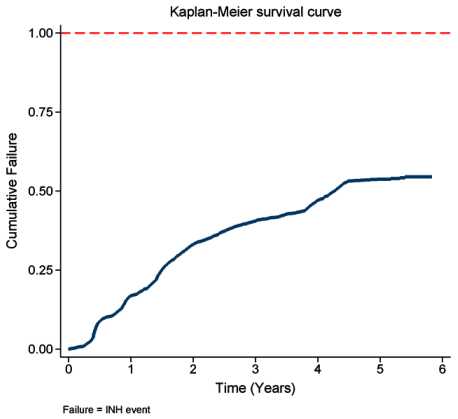
Rate of initiation on IPT

- 68.8% of 2,955 sample had received IPT by study exit time (Dec 2016).
- IPT initiation was 20.6 per 100 person-years, with 135 (6.6%) defaults.
- Slow IPT initiation?



Overall cumulative IPT uptake, 2011-2016

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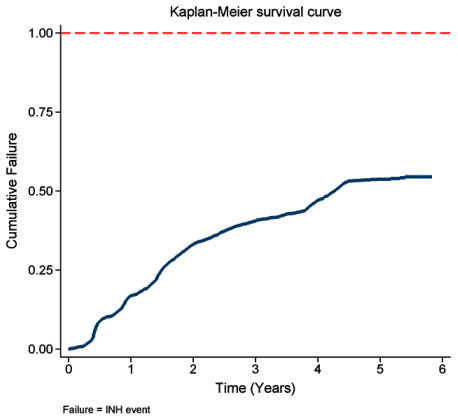
Rate of initiation on IPT

- 68.8% of 2,955 sample had received IPT by study exit time (Dec 2016).
- IPT rate of initiation was only 20.6 per 100 person-years, with 135 (6.6%) defaults.
- Slow IPT initiation: Children/adolescents, higher population density and longer duration of ART>=5 years
- Overall TB incidence rate was 2.0 per 100 person-years in 12 208 person-years. (No previous TB)



Overall cumulative IPT uptake, 2011-2016

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Rate of initiation on IPT

- The rate of IPT implementation remains slow.
- Using national coverage statistics, as is the current practice globally, may be misleading.
- More bioinformatics tools and skills are needed to improve this.
- Currently, data on rate IPT initiation is scarce, with only Brazil reporting such data – the rate of initiation in that country was 20.0 per 100 person-years in 2014 (Dowdy et al., 2014)

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IPT uptake: sub Saharan Africa overview

- National coverage for IPT in 15 of the 30 high HIV/TB burden countries ranged from 1% in Swaziland to 53% in South Africa (WHO, 2018).
- Other countries in sub Saharan Africa with IPT coverage higher than 30% include Ethiopia (45%) and Nigeria (39%).
- Sierra Leone (22%), Zambia (18%), Namibia (15%) and Angola (13%). Notably, IPT coverage in many sub Saharan countries, including Botswana, Malawi, Ghana and Uganda, was unknown in 2017 (WHO, 2018)

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Data table: Cox proportional hazards model for initiation of IPT by patient characteristics in Lesotho

Predictor	Total (N)	Outcome: Initiation rate per 100 PY	Unstratified model 2004-2016: Unadjusted HR (95% CI)	p-value	Unstratified model 2004-2016: Adjusted HR (95% CI)	p-value	Model stratified by period of enrolment: 2004-2010 Adjusted HR (95% CI)	2011-2016 Adjusted HR (95% CI)
Enrolment period								
2011-2016	1745	27.0	1 (base)		1 (base)			
2004-2010	1210	15.8	0.60 [0.54-0.68]	0.000	0.63 [0.55-0.72]	0.000		
Duration of pre-ART								
<1	2127	20.7	1 (base)		1 (base)			
1-2	269	21.1	1.02 [0.86-1.20]	0.851	1.01 [0.85-1.20]	0.909		
3-5	344	19.2	1.06 [0.91-1.23]	0.491	0.99 [0.85-1.16]	0.905		
>5	215	21.6	0.96 [0.76-1.20]	0.706	0.84 [0.66-1.06]	0.137		
Baseline WHO stage								
I	1049	24.4	1 (base)		1 (base)			
II	1219	18.7	0.81 [0.72-0.91]	0.000	0.87 [0.77-0.98]	0.023		
III	516	19.6	0.83 [0.72-0.96]	0.011	0.92 [0.79-1.06]	0.255		
IV	171	19.1	0.88 [0.68-1.13]	0.333	0.92 [0.72-1.19]	0.538		
Adherence								
Good	2219	21.7	1 (base)		1 (base)			
Poor	615	17.5	0.96 [0.85-1.07]	0.432	0.96 [0.85-1.07]	0.462		
District category								
Sparse	1042	16.9	1 (base)		1 (base)		1 (base)	1 (base)
Dense	1913	15.4	0.77 [0.69-0.86]	0.000	0.58 [0.42-0.78]	0.000	1.03 (0.46-2.30)	0.59 [0.38-0.94]
Duration on ART*								
0-4	1454	16.0	1 (base)		1 (base)		1 (base)	
>=5	1501	15.8	0.76 [0.67-0.86]	0.000	1.40 [1.16-1.70]	0.001	3.34 [2.08-5.43]	1.33 [1.00-1.76]

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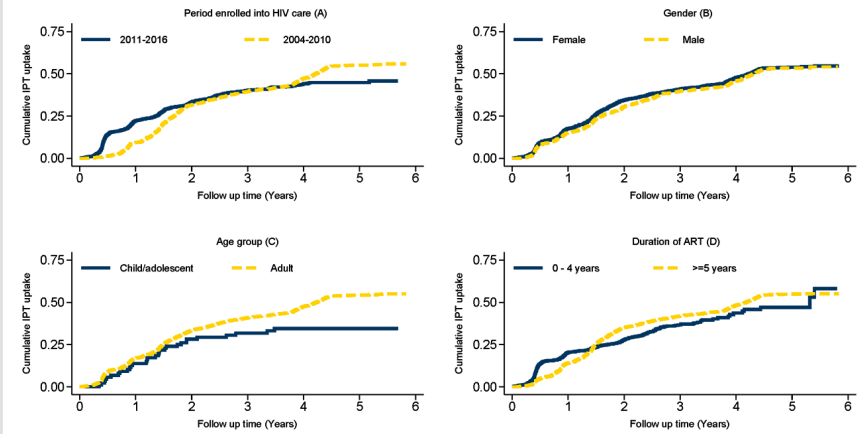
Data table (Cont.)

Geographic location # Duration of ART					1 (base)		1 (base)	
Sparse	1042	16.9			0.81 [0.83-0.95]	0.000	0.86 [0.77-0.96]	0.95 [0.85-1.06]
Dense	1913	15.4			0.86 [0.79-0.89]	0.000	0.86 [0.81-0.90]	1.01 [0.89-1.14]
Gender*								
Female	1942	16.1	1 (base)		1 (base)			
Male	1013	15.4	0.97 [0.87-1.08]	0.568	0.97 [0.88-1.07]	0.579		
Age*								
Child/ Adolescent	107	9.7	1 (base)		1 (base)		1 (base)	1 (base)
Adult	2848	16.1	1.63 [1.13-2.33]	0.008	1.71 [1.20-2.47]	0.003	1.64 [1.02-2.61]	1.78 [1.00-3.15]
Baseline CD4 count*								
1-100	639	15.9	1 (base)		1 (base)			
101-350	1714	15.9	1.10 [0.98-1.25]	0.116	1.08 [0.95-1.22]	0.231		
351-500	357	17.3	1.25 [1.03-1.52]	0.024	1.11 [0.91-1.35]	0.316		
501-1572	245	14.6	1.07 [0.85-1.36]	0.553	1.02 [0.81-1.30]	0.841		
Fate*								
Loss	265	14.6	1 (base)		1 (base)			
Dead	121	14.2	0.83 [0.54-129]	0.416	0.79 [0.51-1.22]	0.288		
Transfer out	76	15.1	1.19 [0.83-1.70]	0.355	1.16 [0.81-1.67]	0.417		
Art cont.	2493	16.1	1.28 [1.06-1.55]	0.012	1.27 [1.05-1.55]	0.014		
Treatment failure*								
No	2909	18.2	1 (base)		1 (base)			
Yes	46	15.9	0.74 [0.53-1.04]	0.083	0.79 [0.56-1.11]	0.176		

*Predictors insignificant when controlled for baseline WHO clinical Stage, duration of ART, district category and adherence to ART; WHO=World Health Organization, ART= Antiretroviral therapy; Fate=patient status at study exit time; N=number of patients; PLHIV=People living with HIV; # denotes interaction of term

30

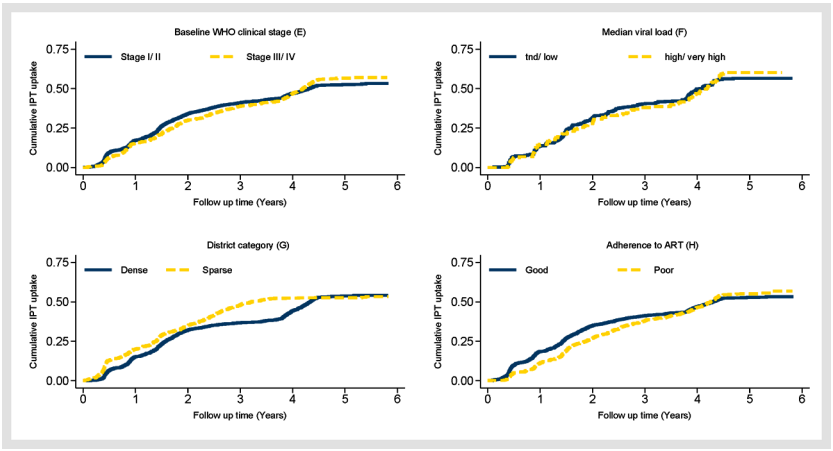


- Age group, district category and duration of ART emerged as the most significant predictors of IPT initiation.

Comments:

- Patients enrolled on ART after IPT was launched have a higher initiation rate in this setting. This disparity therefore needs to be addressed.

31



Patients in the sparsely populated districts [Odds ratio (OR)=1.6] and males [OR=2.1] had significantly ($p<0.005$) higher rates of defaulting IPT compared to those in the densely populated districts and females, respectively.

Comments:
The high rates of defaulting IPT in the sparsely inhabited districts is evidence to the need to improve the monitoring of this programme.

32

Implementation of IPT in Lesotho

Seven health system challenges to implementation of IPT in Lesotho:

- Decentralisation of HIV services;
- Monitoring and evaluation systems;
- Service delivery;
- Supply chains;
- Health workforce;
- Health information systems.

Gebreegziabher et al. BMC Infectious Diseases (2016) 16:673
DOI 10.1186/s12879-016-1995-z

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Patients' and health system's delays in the diagnosis and treatment of new pulmonary tuberculosis patients in West Gojjam Zone, Northwest Ethiopia: a cross-sectional study

Senedu Bekele Gebreegziabher[1,2*], Gunnar Aksel Bjune[3] and Solomon Abebe Yimer[1,2,3,4]

The median health system's delay was 22 days (IQR: 4–88 days).

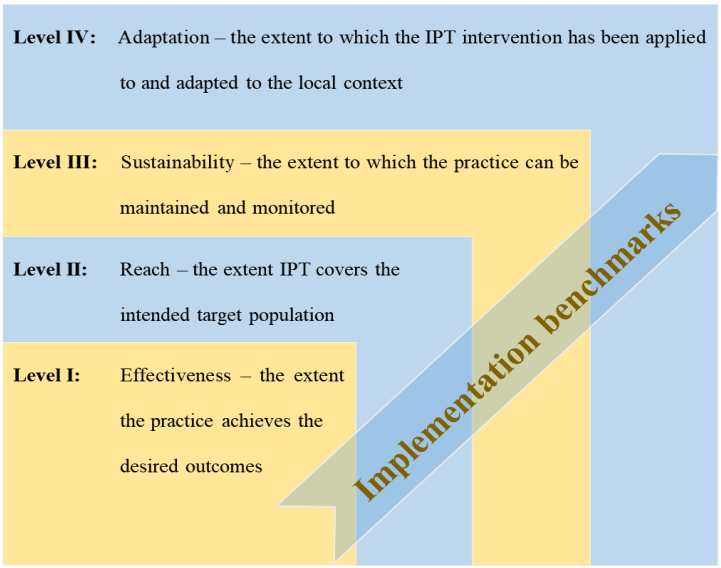
Predictors of patients' delay
Poor knowledge of TB
First visit to non-formal health provider
Self-treatment
Patients' age (≥45 years).

Predictors of health system's delay
Smear-negative TB
First visit to public health centers
Health posts

Observation: Implementation of complex health interventions need a 'health systems' approach

33

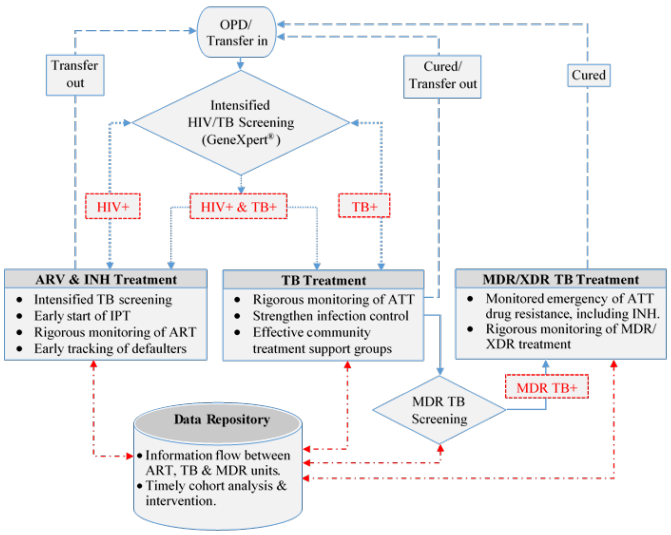
Benchmarks for evaluating the effectiveness of health interventions



Source: Author

34

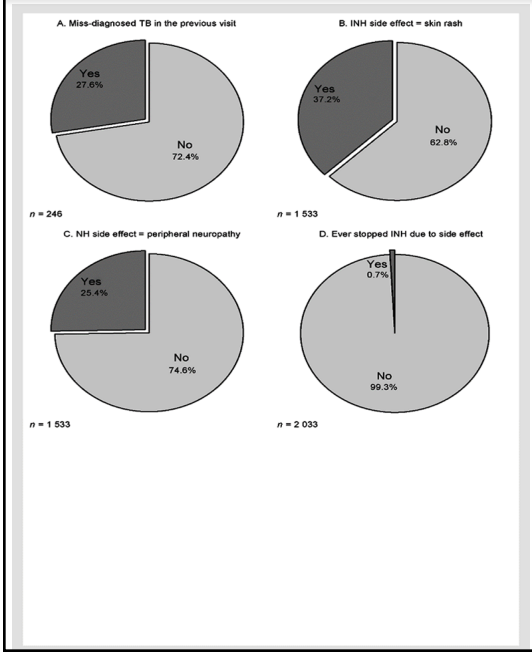
Better monitoring strategies needed to improve TB screening and IPT uptake



Source: Author

35

IPT side effects still a problem



Miss-diagnosis of TB persists

Side effects

IPT defaulting?

Eltony Mugomeri emugomeri@yahoo.com

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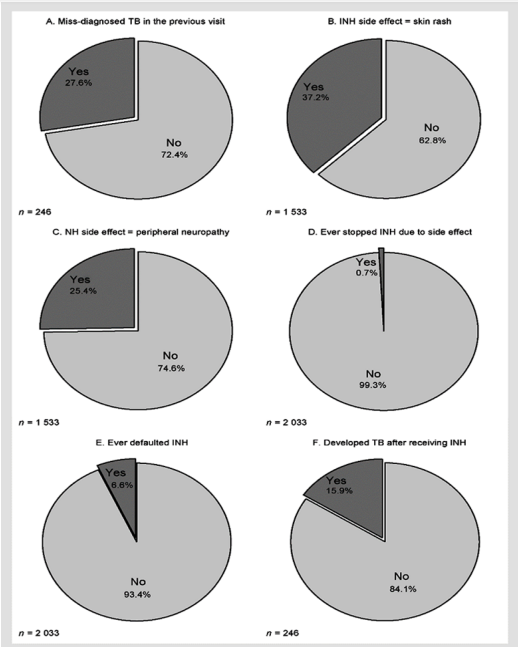
IPT treatment outcomes



Misdiagnosis of TB persists

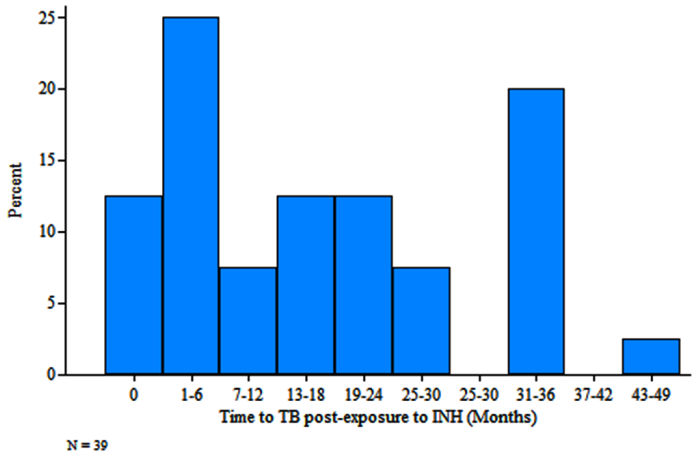
Side effects

IPT defaulting

- Patients in the sparsely populated districts (aOR)=1.6] and males [aOR=2.1] had significantly ($p<0.005$) higher rates of defaulting IPT compared to those in the densely populated districts and females, respectively.

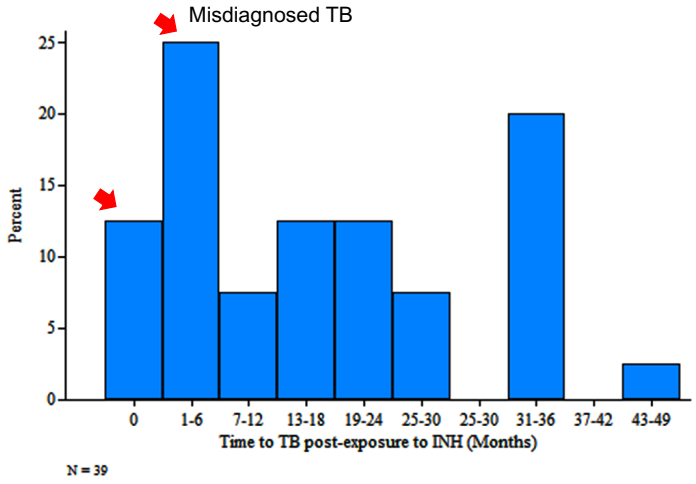
TB after IPT?

Time to TB event in IPT-exposed cohort



Thirty-nine (15.9%, *n* = 246) patients developed TB after IPT

Time to TB event in IPT-exposed cohort



Thirty-nine (15.9%, *n* = 246) patients developed TB after IPT

39

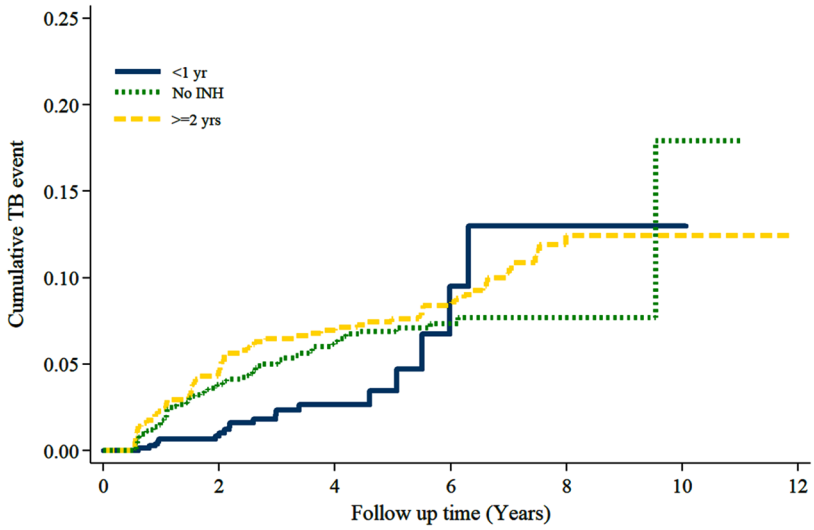
Effectiveness of IPT in Lesotho

TB incidences per 100 person-years by timing of IPT:

- IPT before ART (1.7),
- IPT after ART (1.8),
- no IPT (2.6),
- IPT within one year of ART commencement (1.3) &
- IPT 3-5 years after ART initiation (2.3).

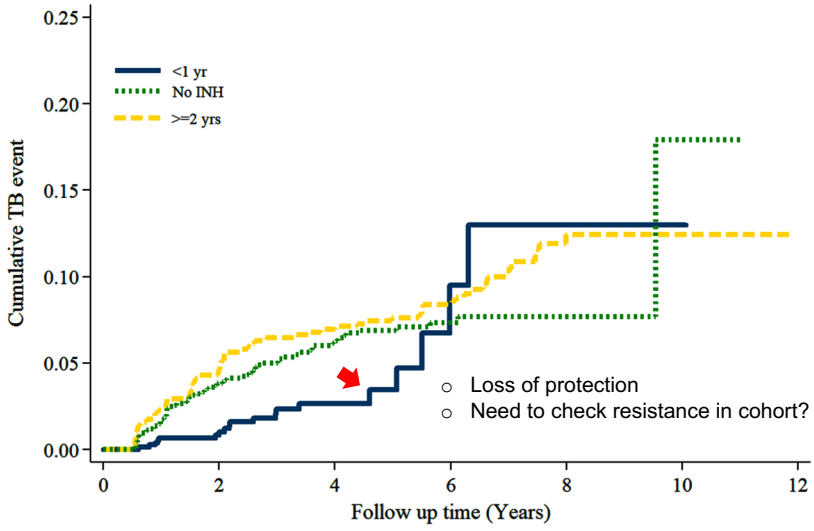
40

Effectiveness of IPT in Lesotho



41

Effectiveness of IPT in Lesotho



42

Predictor variables for TB event

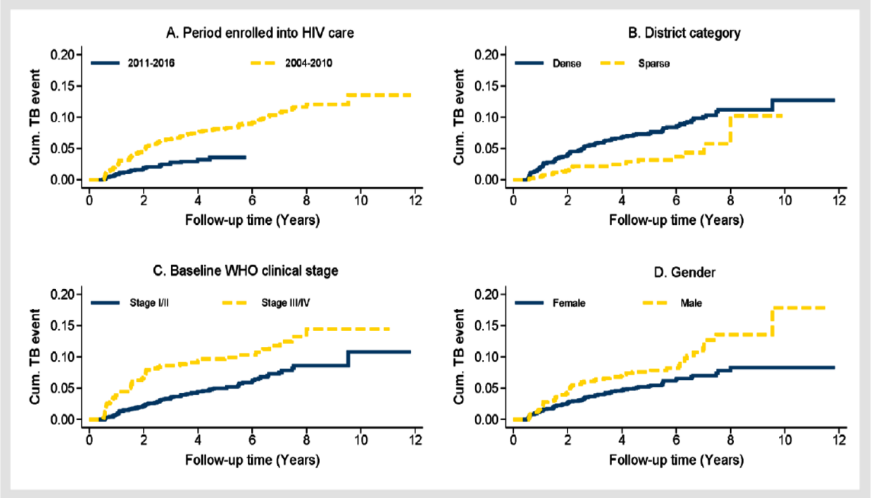
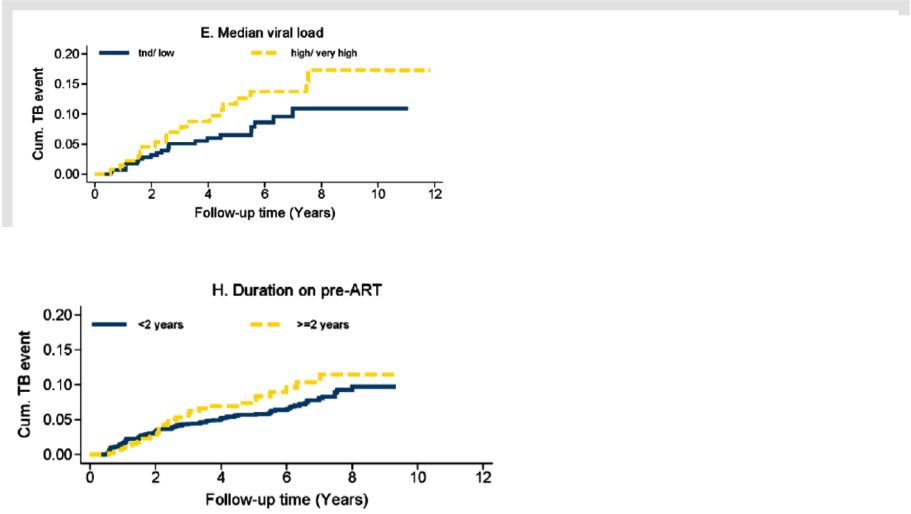


Figure 5.4 Cumulative occurrence of first TB event by predictor variable (A-D)

43

Predictor variables for TB event



44

Significant Predictor variables for TB event

Based on Wilcoxon's log-rank test & Kaplan-Meier survival plots (Categorical) and Cox regression analysis (Continuous)

- Gender,
- baseline WHO clinical stage,
- district category
- Time to IPT relative to ART commencement (Continuous variable)

45

Table 5.3 Cox's proportional hazards model of the effect of IPT on the occurrence of TB in PLHIV in Lesotho

Predictor	Outcome		Unstratified model 2004-2016				Model stratified by period of enrolment 2004-2016	2011-2016
	Total (*n*)	TB incidence per 100 PY	Unadjusted HR (95% CI)	*p*-value	Adjusted HR (95% CI)	*p*-value	Adjusted HR (95% CI)	Adjusted HR (95% CI)
Enrolment period								
2011-2016	1 745	1.6	1 (base)		1 (base)			
2004-2010	1 210	2.3	2.37 (1.77-3.17)	36.5; 0.000	1.53 (0.98-2.41)	0.064		
Time to IPT/ART	2 955	2.0	1.18 (1.08-1.27)	15.5; 0.000	1.20 (1.07-1.36)	0.024	1.06 (0.88-1.25)	1.59 (1.01-2.50)
Baseline WHO stage								
I	1 049	0.9	1 (base)		1 (base)		1 (base)	1 (base)
II	1 219	1.6	1.95 (1.31-2.90)	0.007	2.62 (1.53-4.46)	0.000	1.82 (0.73-4.54)	3.61 (1.67-7.80)
III	516	4.2	5.17 (3.50-7.64)	0.000	17.12 (10.75-27.28)	0.000	8.09 (3.57-18.30)	26.01 (13.27-51.02)
IV	171	2.1	2.21 (1.12-4.38)	0.851	9.50 (4.98-18.13)	0.000	6.05 (1.82-20.06)	9.72 (3.75-25.21)
Gender								
Female	1 942	1.6	1 (base)		1 (base)		1 (base)	1 (base)
Male	1 013	2.9	1.84 (1.43-2.36)	0.004	1.54 (1.34-1.79)	0.000	1.64 (1.35-1.98)	1.42 (1.14-1.77)
District population density								
Sparse	1 042	1.2	1 (base)		1 (base)		1 (base)	1 (base)
Dense	1 913	2.3	2.06 (1.49-2.86)	0.000	1.25 (1.04-1.52)	0.021	1.42 (1.06-1.92)	1.11 (0.86-1.44)

46

Table 5.3 Cox's proportional hazards model of the effect of IPT on the occurrence of TB in PLHIV in Lesotho

Predictor	Outcome		Unstratified model 2004-2016				Model stratified by period of enrolment	
							2004-2010	2011-2016
	Total (*n*)	TB incidence per 100 PY	Unadjusted HR (95% CI)	*p*-value	Adjusted HR (95% CI)	*p*-value	Adjusted HR (95% CI)	Adjusted HR (95% CI)
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Increasing time to IPT by one six-month interval increased the risk of contracting TB by between 6% and 59%, depending on the cohort.

CONCLUSION

*Time to IPT relative to ART commencement is an important determinant

Ethiopia study: IPT-before-ART (aHR = 0.18, 95% CI = 0.08–0.42) better than simultaneously with ART (aHR = 0.20, 95% CI = 0.10–0.42) (Yardaw et al, 2014)

*High risk of reinfection in certain settings

Compared to no IPT, combined IPT and ART reduces the risk of contracting TB by 37% (HR = 0.63, 95 % CI 0.41-0.94) (Rangaka *et al.* 2014) in S.A;

- 60 % (HR = 0.40; 95 % CI 0.18 - 0.87) (Ayele et al, 2015) in Ethiopia;
- Six months IPT = six months protection? (Rangaka et al, 2014) in S. Africa.

*Booster doses needed

Brazil: Six-month IPT course reduces the risk of contracting TB for at least seven years? Golub et al. (2015)

www.webbertraining.com/schedulep1.php	
February 13, 2019	*(South Pacific Teleclass)* THE INTRODUCTION OF RISK-BASED ASSESSMENT FOR THE MANAGEMENT OF ESBL-E PATIENTS IN ACUTE CARE Speaker: **Julianne Munro**, Clinical Nurse Specialist, Infection Prevention & Control, Canterbury District Health Board, New Zealand
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