의료기관내 결핵감염관리
– administrative control

울산대학교 의과대학
서울아산병원 호흡기내과
조경욱

1. Risk of TB among HCW

2. Preventive strategy – Administrative control

3. Screening for LTBI by TST for HCW

4. Screening for LTBI by IGRA for HCW

1. Risk of TB among HCW

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3. Screening for LTBI by TST for HCW

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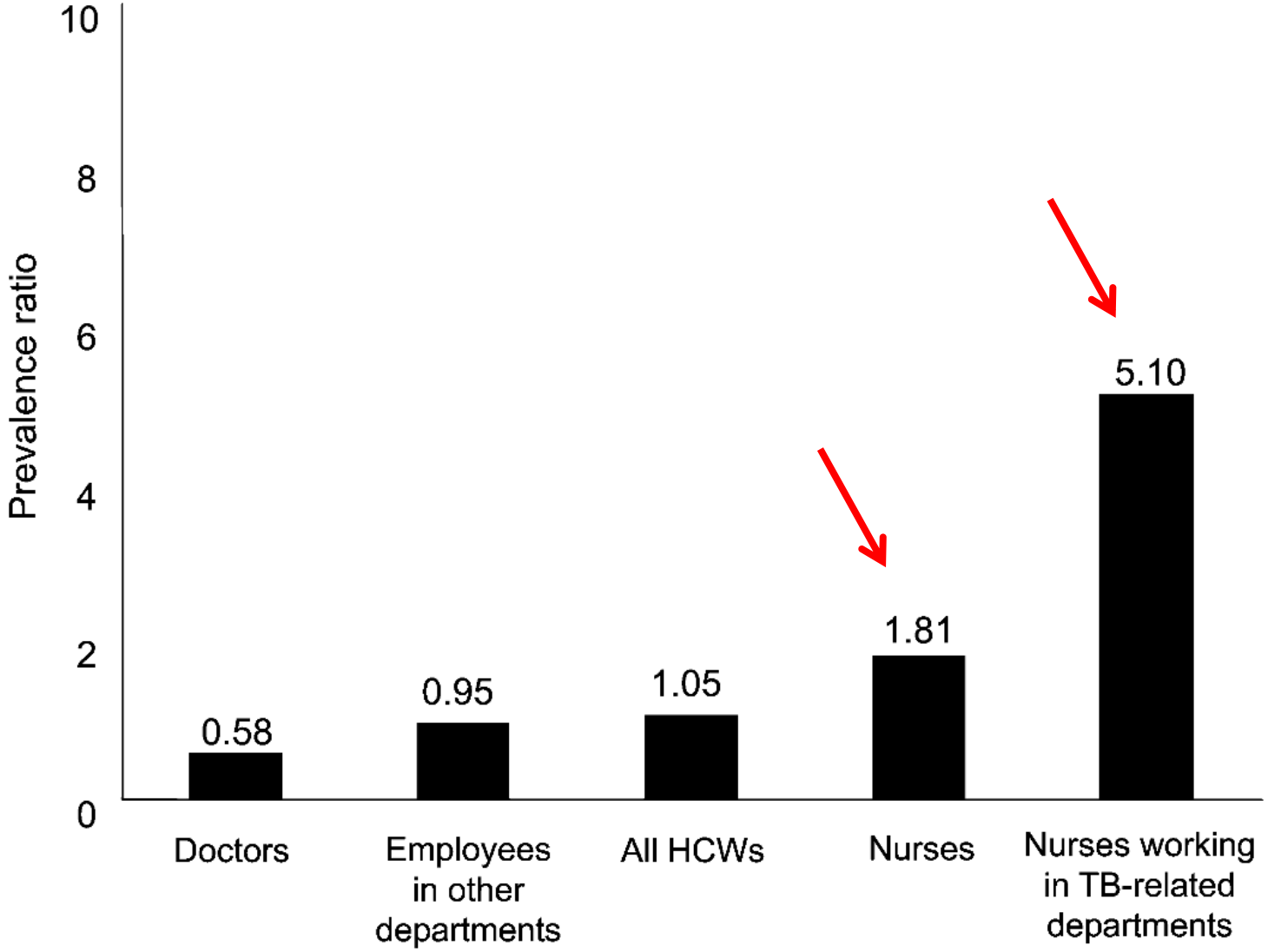
우리나라 결핵환자 및 신(新)환자 현황 (단위: 명)

연도	2007년	2008년	2009년	2010년	2011년	2012년	2013년
결핵환자	45,597	44,174	47,302	48,101	50,491	49,532	45,292
결핵 신환자	34,710	34,157	35,845	36,305	39,557	39,545	36,089



*** HCW : HealthCare Worker**

Int J Tuberc Lung Dis 2008:12:436-440

ORIGINAL ARTICLE

Annual Incidence of Latent Tuberculosis Infection among Newly Employed Nurses at a Tertiary Care University Hospital

Kwangha Lee, MD; Min Kyoung Han, RN; Hye Ran Choi, RN; Chang-Min Choi, MD; Yeon-Mok Oh, MD; Sang Do Lee, MD; Woo Sung Kim, MD; Dong Soon Kim, MD; Jun Hee Woo, MD; Tae Sun Shim, MD

196 newly employed nurses

TST + IGRA

→ Annual risk of TB infection: at least 3%

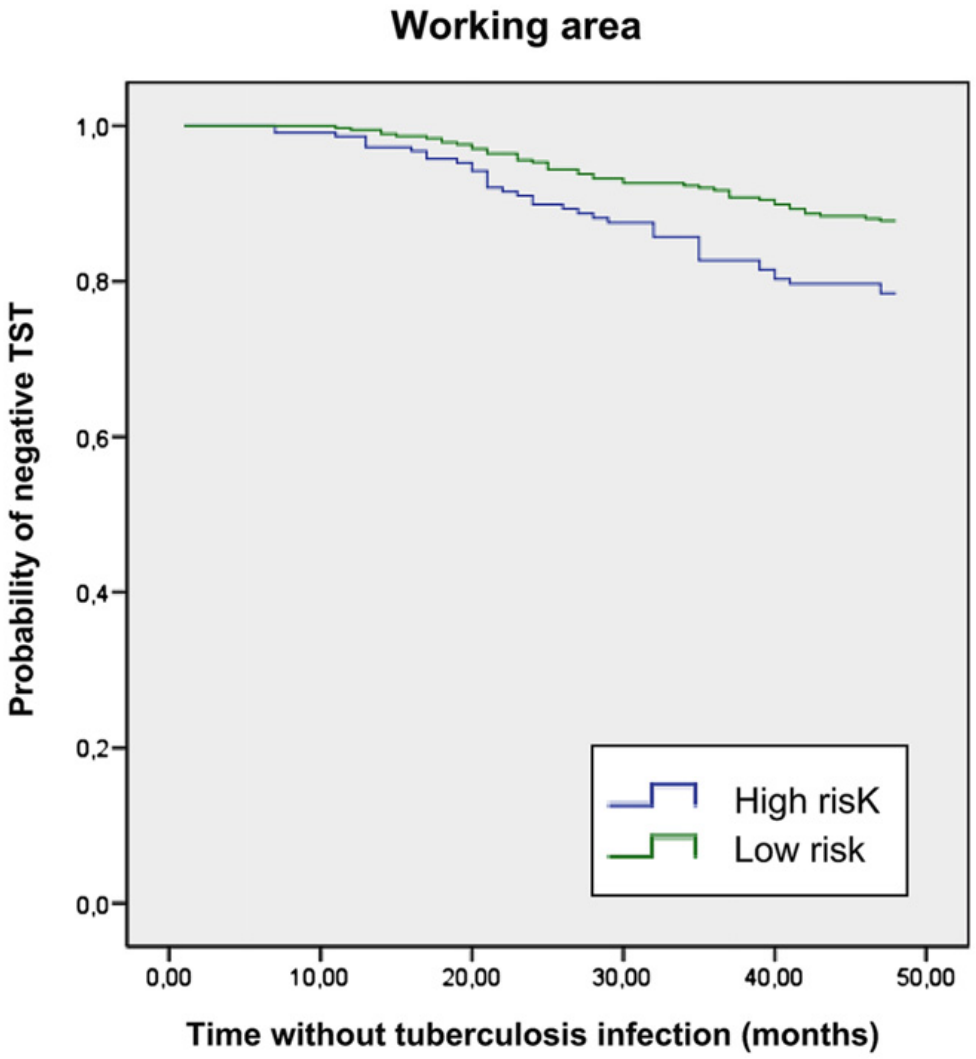
***vs*. 0.2% in general population**

Infect Control Hosp Epidemiol 2009:30:1218-1222

Table 2 Incidence and risk of tuberculosis among healthcare workers and matched cohort.

	No. of events	Person-years	Incidence rate[b]	Crude		Adjusted[a]	
				Hazard ratio (95% CI)	*p*	Hazard ratio (95% CI)	*p*
Matched cohort	38	100,493	37.81	Reference		Reference	
Healthcare workers	62	101,505	61.08	1.62 (1.08–2.42)	0.020	1.62 (1.08–2.43)	0.019

J Infection 2014;69:525-532



Respir Med 2013;107:601-607

Preventive strategies for HCWs

First level: administrative control

Second level: environmental control

Third level: personal protection

1. Risk of TB among HCW

2. Preventive strategy – Administrative control

3. Screening for LTBI by TST for HCW

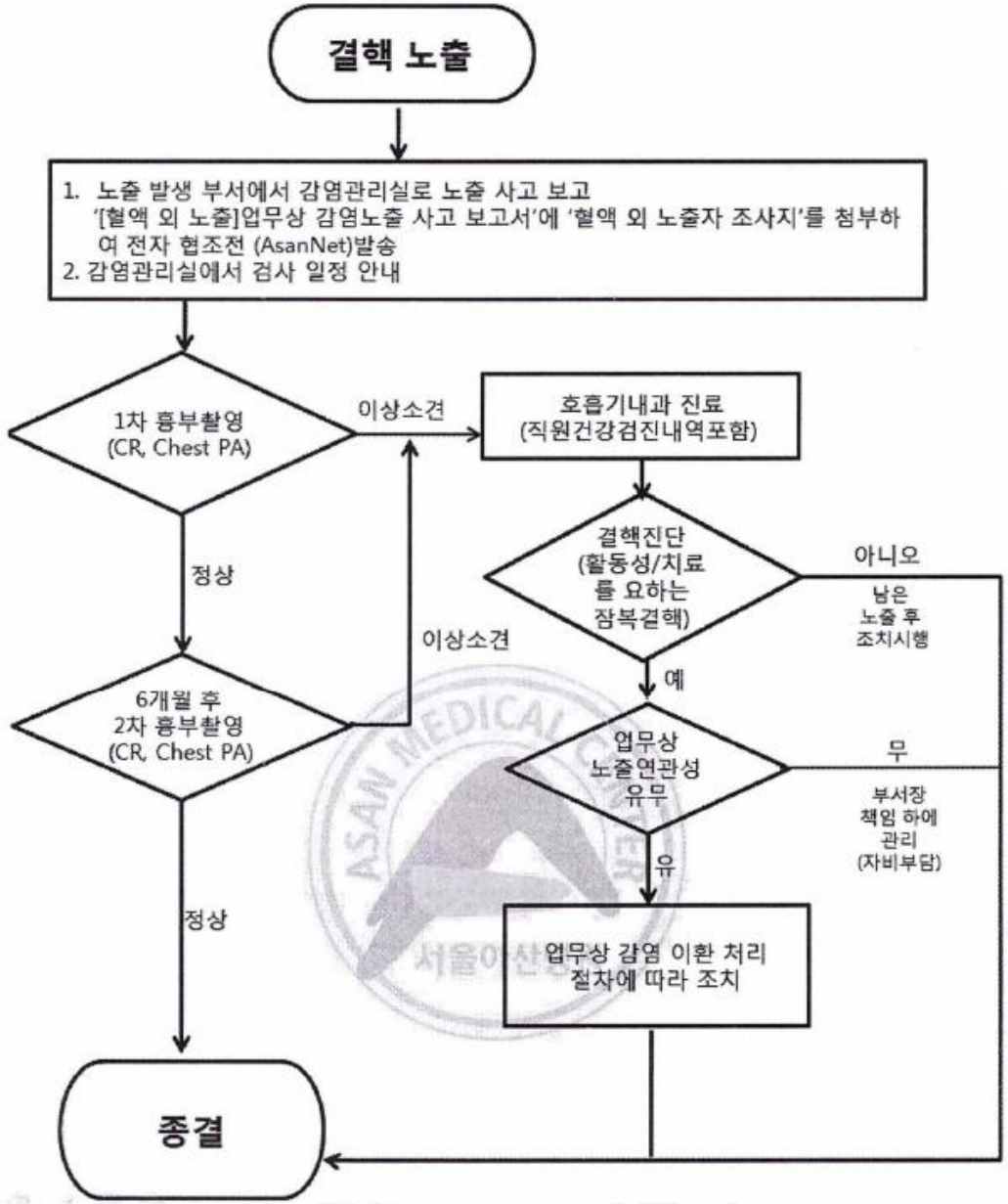
4. Screening for LTBI by IGRA for HCW

Administrative control

1. **Assigning responsibility for TB infection control**

2. **Written TB infection control plan**

CDC 2005 guideline



<그림 1. 결핵 노출 시 처리 절차>

Administrative control

1. Assigning responsibility for TB infection control

2. Written TB infection control plan

3. TB risk assessment

CDC 2005 guideline

Setting	Risk classification		
	Low risk	Medium risk	Potential ongoing transmission
Inpatient <200 beds	<3 TB patients/year	≥3 TB patients/year	Evidence of ongoing TB transmission, regardless of setting
Inpatient ≥200 beds	<6 TB patients/year	≥6 TB patients/year	

CDC 2005 guideline

Administrative control

1. Assigning responsibility for TB infection control
2. Written TB infection control plan
3. TB risk assessment
4. **Proper cleaning and sterilization of disinfection of potentially contaminated equipment**

CDC 2005 guideline


WARNING
WARNING

Administrative control

1. Assigning responsibility for TB infection control
2. Written TB infection control plan
3. TB risk assessment
4. Proper cleaning and sterilization of disinfection of potentially contaminated equipment
5. **Posters to remind patients of proper cough etiquette**

CDC 2005 guideline

올바른 기침예절을 지켜주세요!

감염병 예방과 타인을 배려하는 첫 걸음

기침, 재채기를 할 때 손으로 가리지 않기

휴지나 손수건으로 입과 코를 가리고 하고,
사용한 휴지는 휴지통에 버리기

휴지나 손수건이 없을 때는
옷소매 위쪽으로 입과 코를 가리고 하기

기침 후에는 흐르는 물에 비누로 손 씻기

보건복지부 질병관리본부

Administrative control

1. Assigning responsibility for TB infection control
2. Written TB infection control plan
3. TB risk assessment
4. Proper cleaning and sterilization of disinfection of potentially contaminated equipment
5. Posters to remind patients of proper cough etiquette
6. **TB screening program for HCWs**

CDC 2005 guideline

Risk Classification	Need for Testing	Frequency of Testing
Low risk	Should be used for settings in which persons with TB disease are **not** expected to be encountered.	Exposure to *M. tuberculosis* in these settings is unlikely, and further testing is **not** needed unless exposure has occurred.
Medium risk	Should be used for facilities in which the risk assessment has determined that HCWs will possibly be exposed to persons with TB disease.	Repeat testing should be done annually.
Potential ongoing transmission	Should be temporarily assigned to any setting where there is evidence of person-to-person transmission of *M. tuberculosis* in the past year.	Testing should be repeated every 8 to 10 weeks until there is **no** evidence of ongoing transmission.

CDC 2013 core curriculum on TB

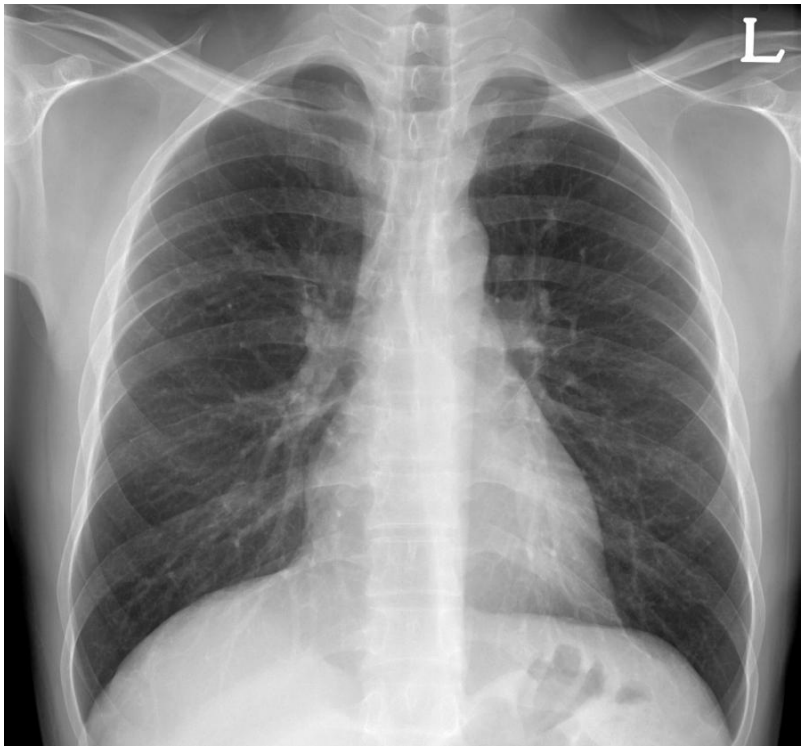
의료기관에 근무하는 직원들에 대한 결핵 감염 예방 대책

권고 요약

- 결핵환자에 노출될 가능성이 높거나 결핵환자를 직접 진료하거나 간호하는 부서의 직원은 정기적인 결핵검진을 받아야 한다(IIIA).
- 결핵균에 노출될 위험이 높은 검사를 시행하는 직원은 정기적인 결핵검진을 받아야 한다(IIIA).

2014 결핵진료지침, 2nd edition

Active TB



Latent TB Infection

TST

IGRA

1. Risk of TB among HCW

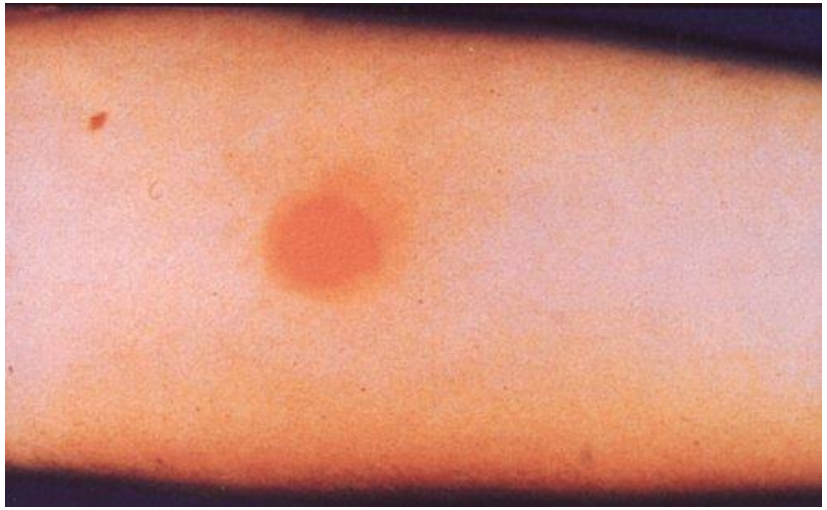
2. Preventive strategy – Administrative control

3. Screening for LTBI by TST for HCW

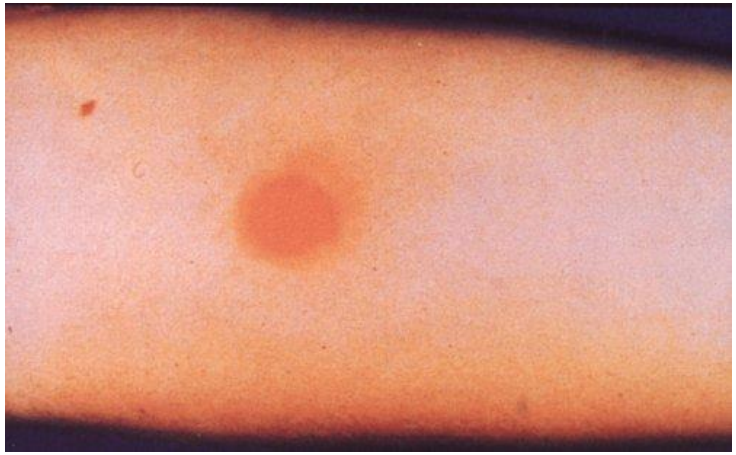
4. Screening for LTBI by IGRA for HCW

Tuberculin skin test (TST)

Serial TST



Latent TB infection



- LTBI로 판명된 아래의 경우에는 LTBI 치료를 시행한다(결핵발병 고위험군).
  - HIV 감염인(IA)
  - 장기 이식으로 면역억제제를 복용 중이거나 복용 예정자(IIB)
  - 모든 연령에서 최근 2년 내 감염이 확인된 경우(TST 양전이 확인된 경우)
  - TNF 길항제 사용자 혹은 사용예정자

2014 결핵진료지침, 2nd edition

Limitation of TST

Prior BCG

Adverse reaction

Require 48 to 72 h for a valid result

Need to establish a program

Tuberculin Skin Test and Boosted Reactions among Newly Employed Healthcare Workers: An Observational Study

Song Yee Kim[1], Moo Suk Park[1], Young Sam Kim[1], Se Kyu Kim[1], Joon Chang[1], Dongeun Yong[2], Hyun Sook Kim[2], Kyungwon Lee[2], Young Ae Kang[1]*

Negative → 1~4 weeks

Two step TST

→14.2% (79/556) HCWs

Plos One 2013:8:e64563

Setting	Risk classification		
	Low risk	Medium risk	Potential ongoing transmission
Recommendations for screening frequency			
Baseline two-step TST	Yes, for all HCWs	Yes, for all HCWs	Yes, for all HCWs
Serial TST	No	At least every 12 months	As needed

CDC 2005 guideline

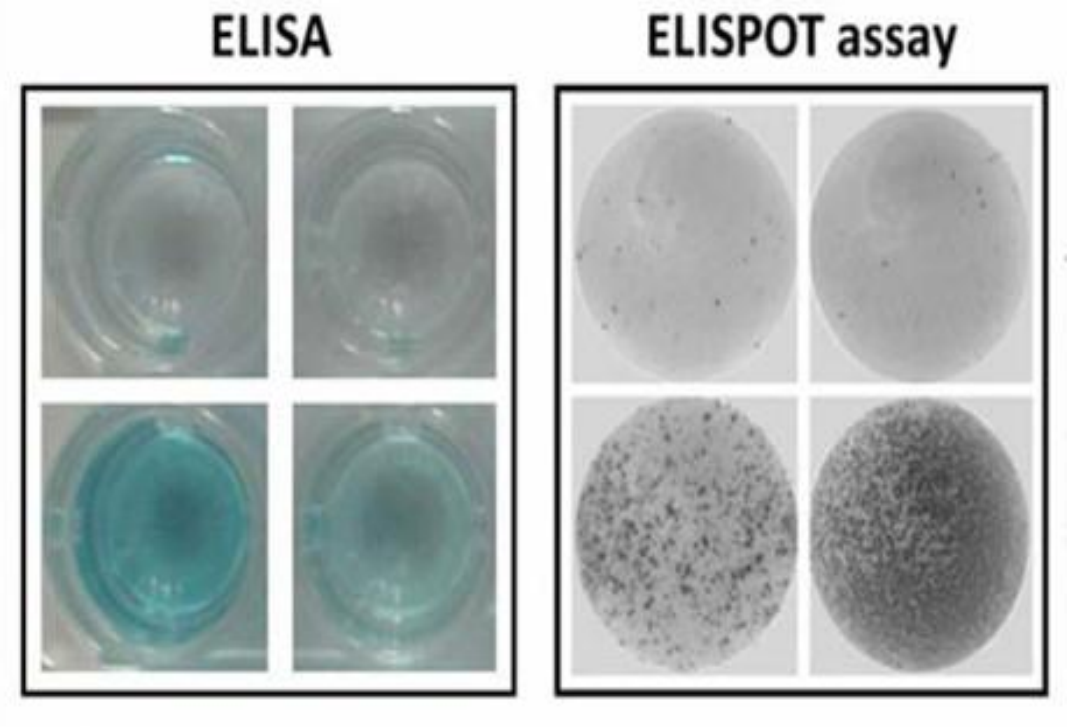
1. Risk of TB among HCW

2. Preventive strategy – Administrative control

3. Screening for LTBI by TST for HCW

4. Screening for LTBI by IGRA for HCW

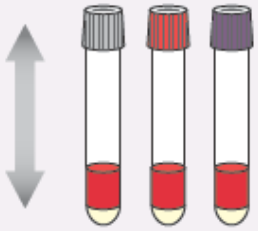
Interferon gamma release assay



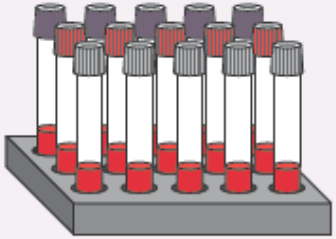
T-SPOT®

QuantiFERON-GOLD-IN-TUBE (QFT-GIT)

Part 1. Blood Incubation

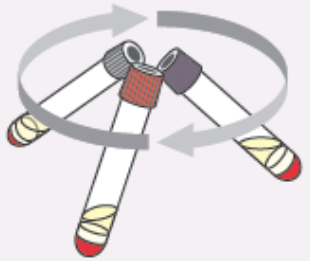


After blood collection, mix QFT tubes thoroughly, by shaking vigorously for 5 seconds.



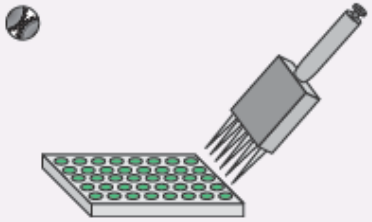
As soon as possible, and within 16 hours of collection, incubate tubes upright at 37°C for 16–24 hours.

Incubated tubes are stable for up to 3 days at room temperature, enabling shipment to laboratory.

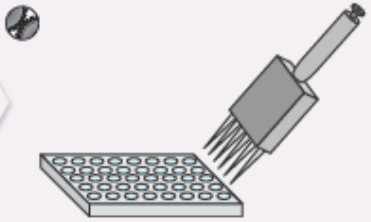


Centrifuge tubes at 2000–3000g (RCF) for 15 minutes.

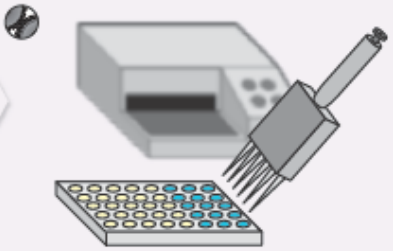
Part 2. IFN-gamma ELISA



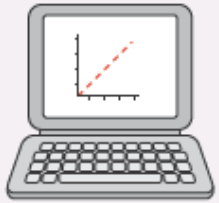
Add 50µL of working conjugate to each well. Add 50µL of plasma or standard. Incubate for 120 minutes at room temperature.



Wash plate ≥6 times. Add 100µL of substrate. Incubate 30 minutes at room temperature.



Add 50µL of stop solution. Read absorbance at 450nm (620–650nm ref).



Calculate results using QuantiFERON-TB Gold In-Tube Analysis Software, or similar.

Interferon gamma release assay

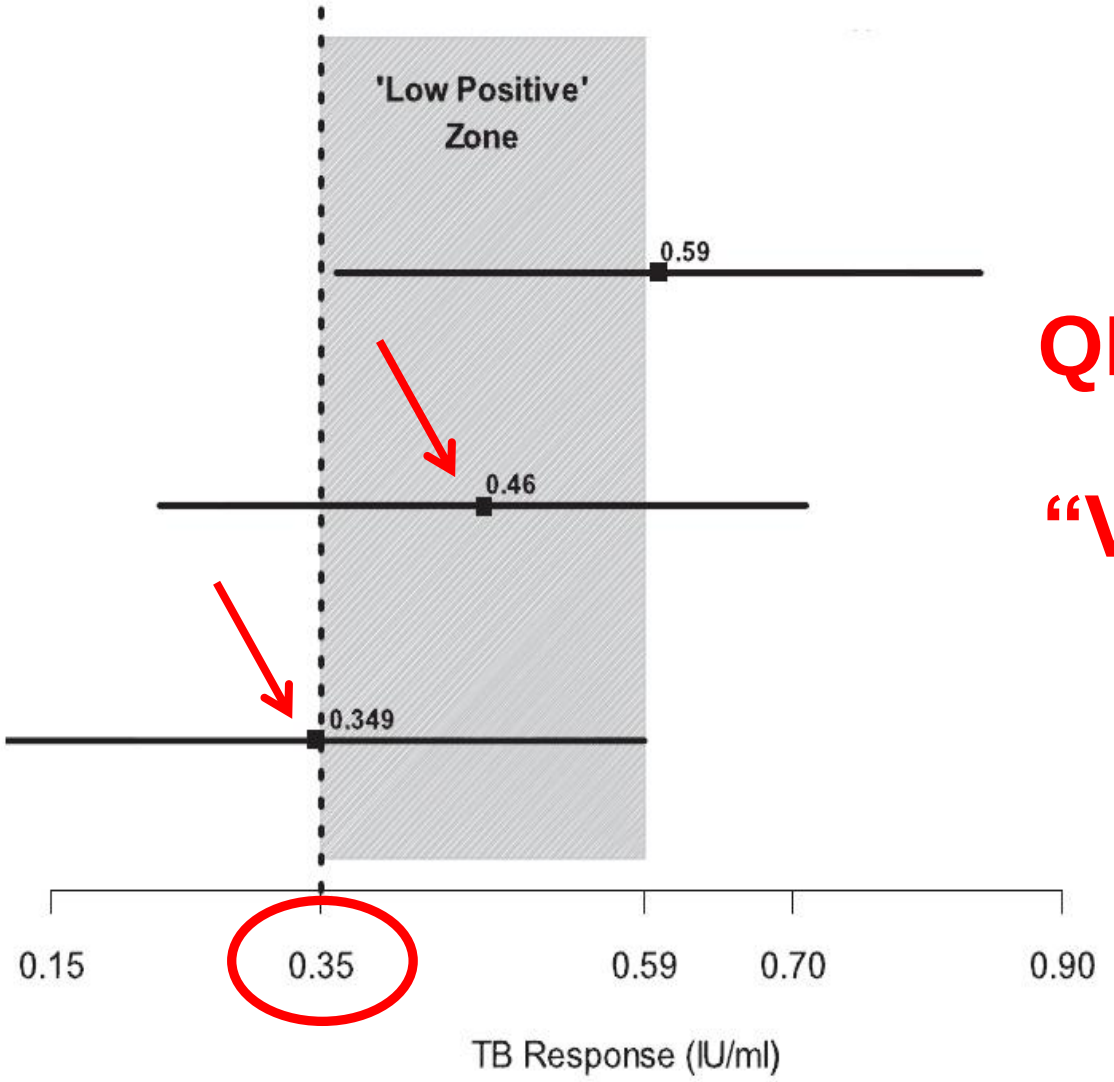
Does not have cross-reactivity with BCG

Risk of adverse events can be reduced

Require few visits

Need to establish a program

→ Serial testing with IGRA in HCW?



QFT-GIT: 0.35 IU/ml

"Variability"

Am J Respir Crit Care Med 2013;187:206-211

Challenges with QuantiFERON-TB Gold Assay for Large-Scale, Routine Screening of U.S. Healthcare Workers

Madeline L. Slater[1], Gary Welland[2], Madhukar Pai[3], Julie Parsonnet[1], and Niaz Banaei[1,4,5]

Am J Respir Crit Care Med 2013;188:1005-1010

9153 HCW

↓

Initial QFT-GIT negative (n = 7832), 85.6%

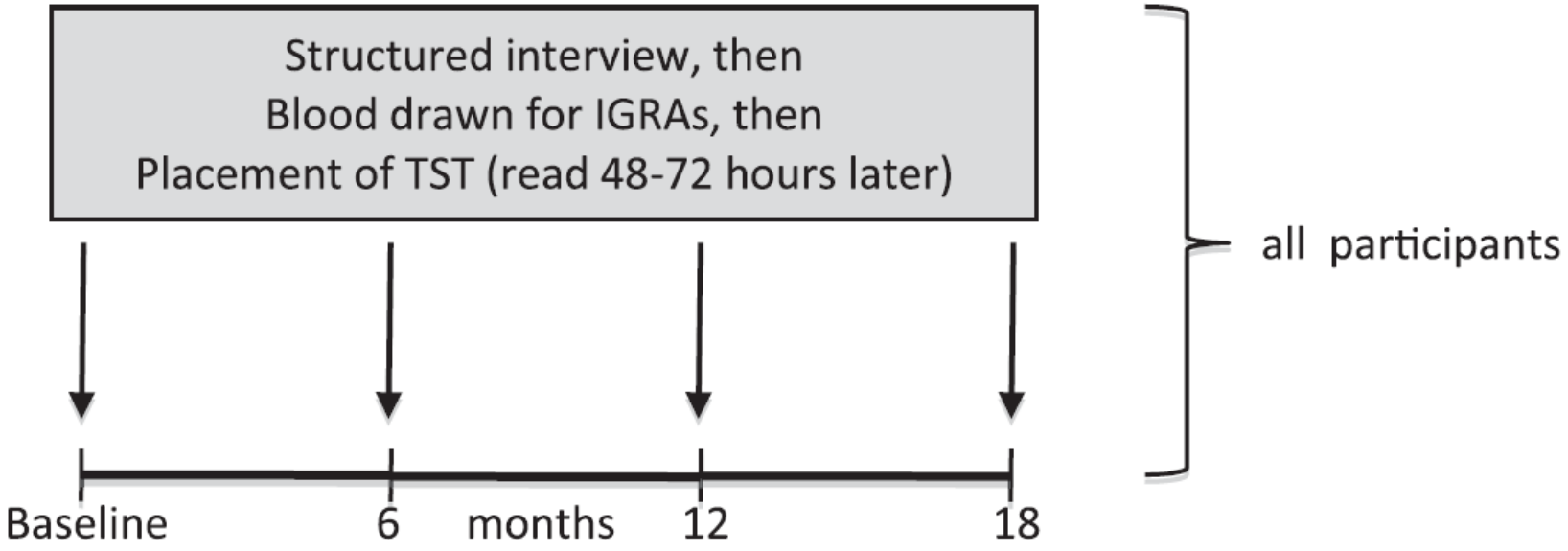
↓

Negative → positive (n = 335), 4.3%

↓

Negative → positive → negative (n = 218), 64.9%

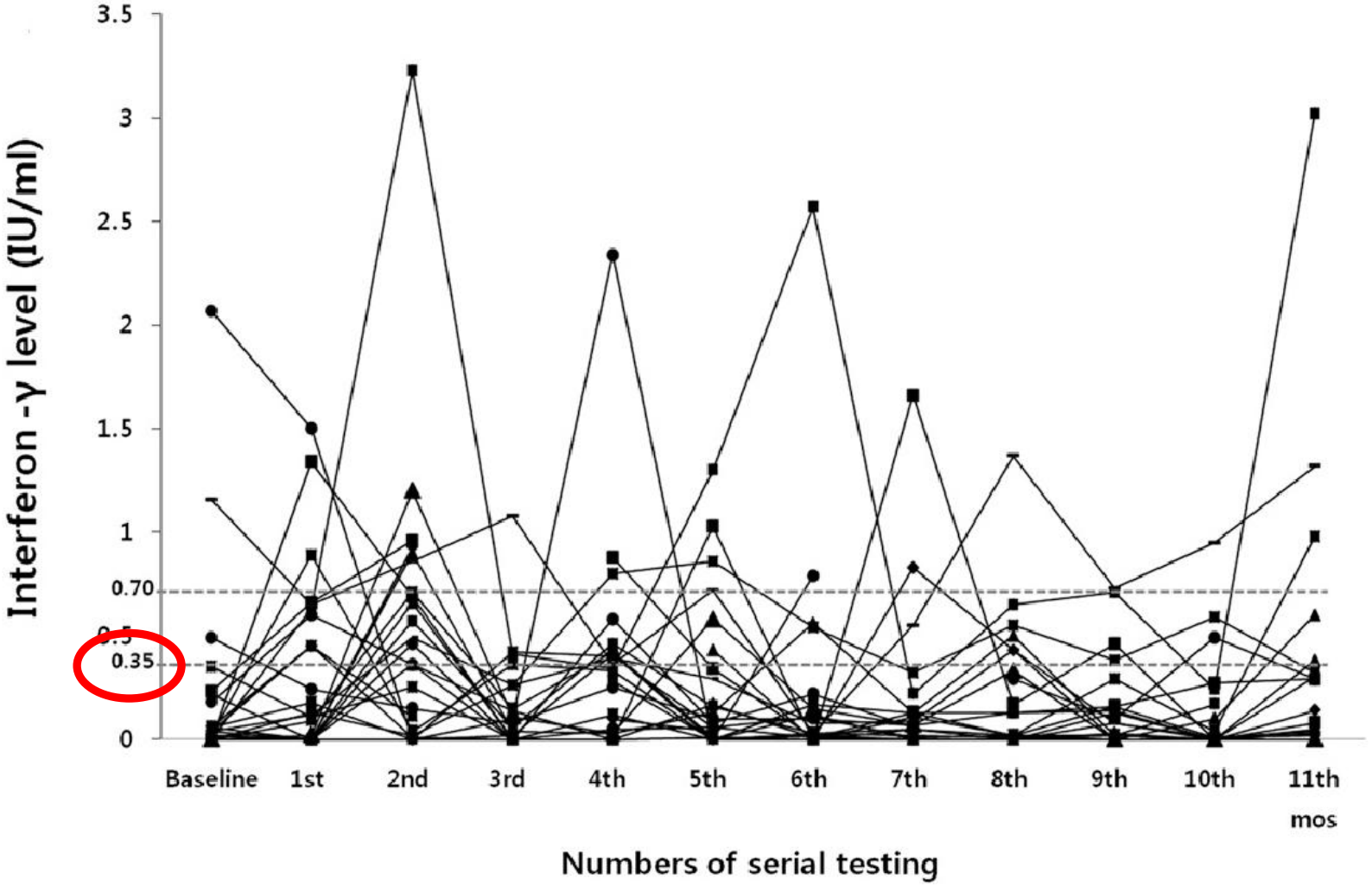
Am J Respir Crit Care Med 2013;188:1005-1010



Negative → Positive

→ TST: 1% *vs.* QFT-GIT: 6%

Am J Respir Crit Care Med 2014;189:77-87



CHEST 2012;142:1461-1468

CANADIAN
RESPIRATORY JOURNAL
REVUE CANADIENNE DE PNEUMOLOGIE
JULY/AUGUST 2013 • VOLUME 20 • SUPPLEMENT A

CANADIAN TUBERCULOSIS STANDARDS, 7TH EDITION

Discourage the use of serial IGRA testing in HCWs

Can Respir J 2013;20(Suppl A):23A-34A

Serial LTBI test for HCW

TST *vs.* IGRA

QFT-GIT *vs.* T-SPOT®?

TST: 18mm

QFT-GIT: 1.59 IU/ml

Administrative control

1. Assigning responsibility for TB infection control
2. Written TB infection control plan
3. TB risk assessment
4. Proper cleaning and sterilization of disinfection of potentially contaminated equipment
5. Posters to remind patients of proper cough etiquette
6. TB screening program for HCWs
7. **Training and educating HCWs regarding TB**

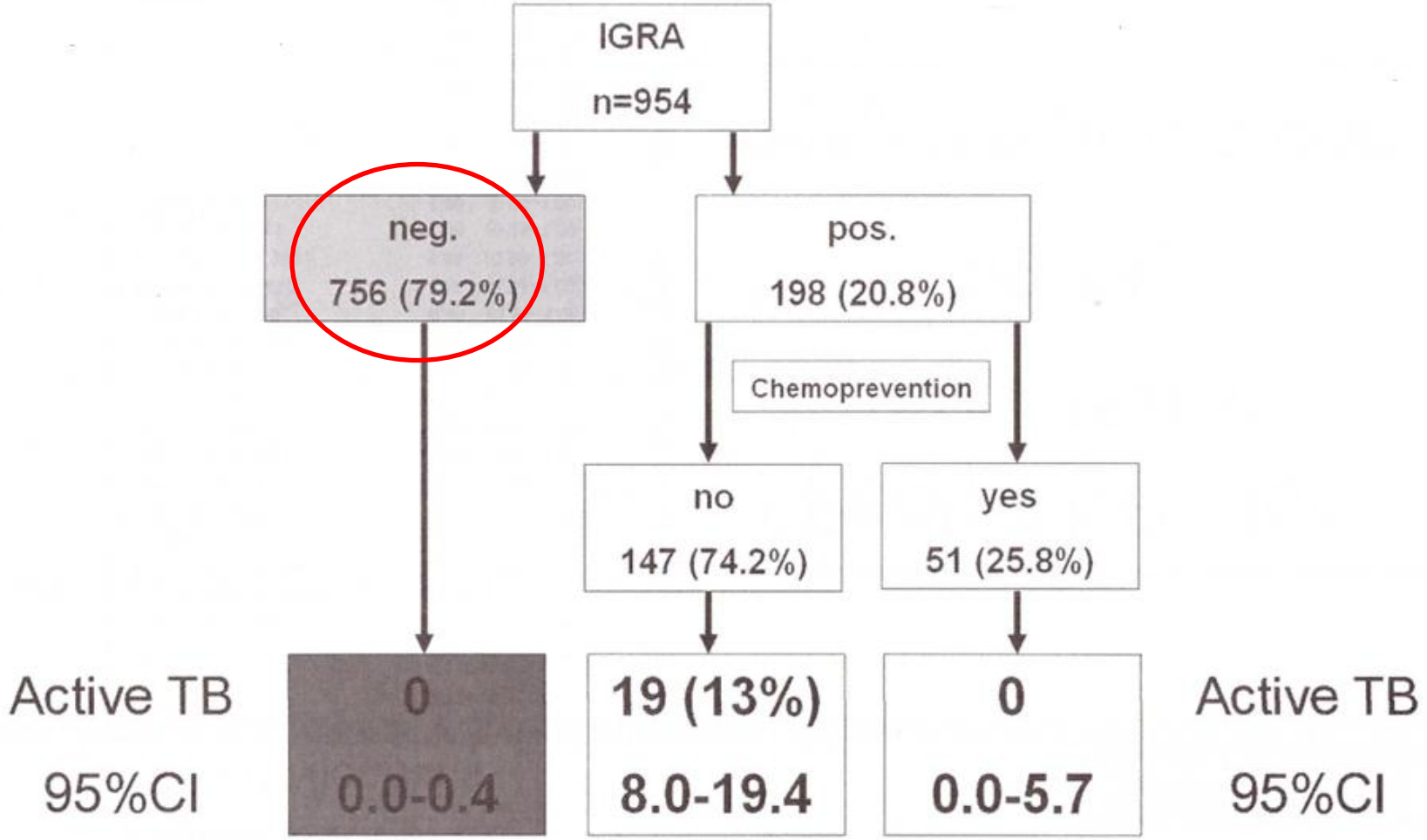
CDC 2005 guideline

1. Risk of TB among HCW

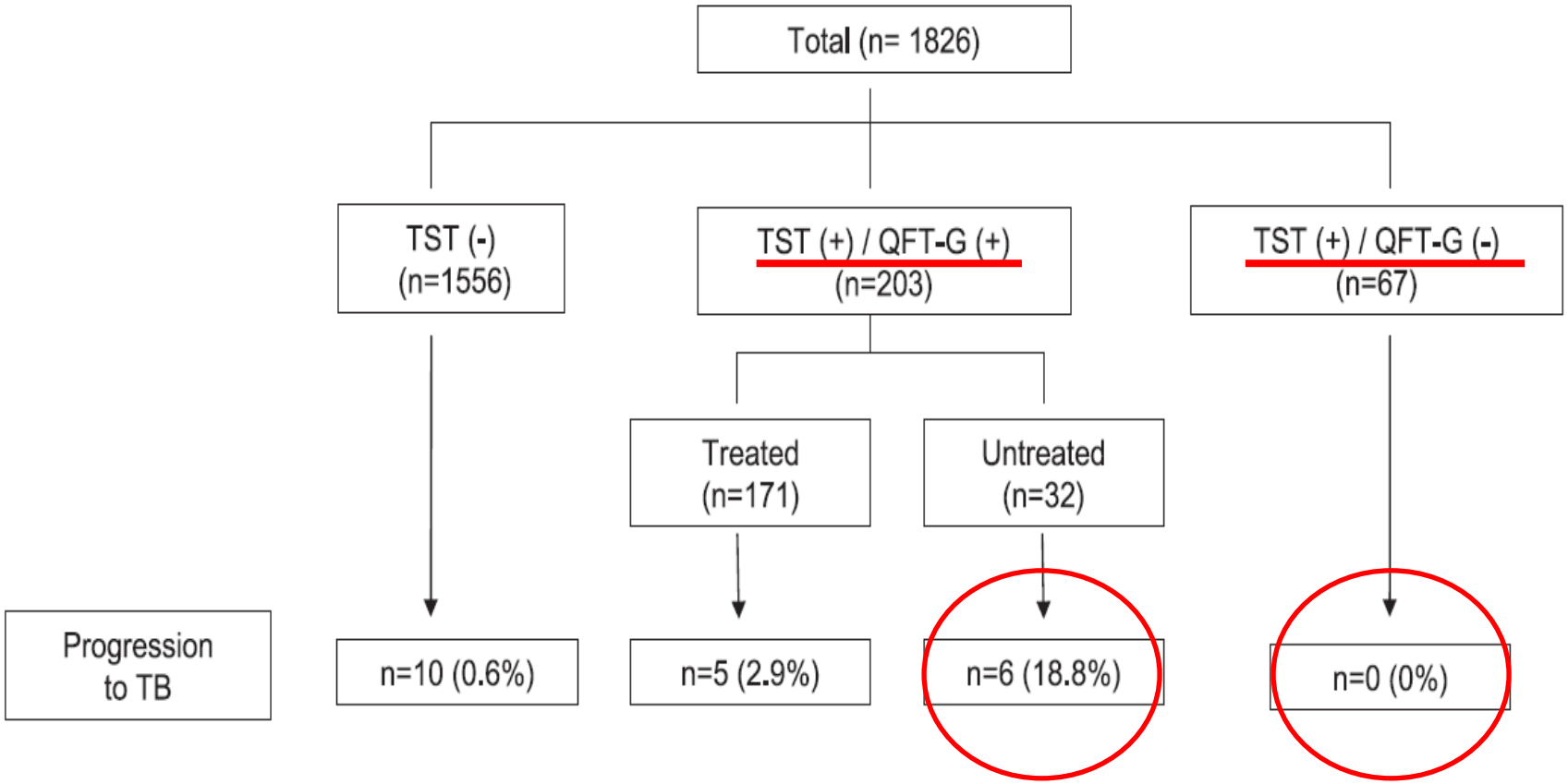
2. Preventive strategy – Administrative control

3. Screening for LTBI by TST for HCW

4. Screening for LTBI by IGRA for HCW

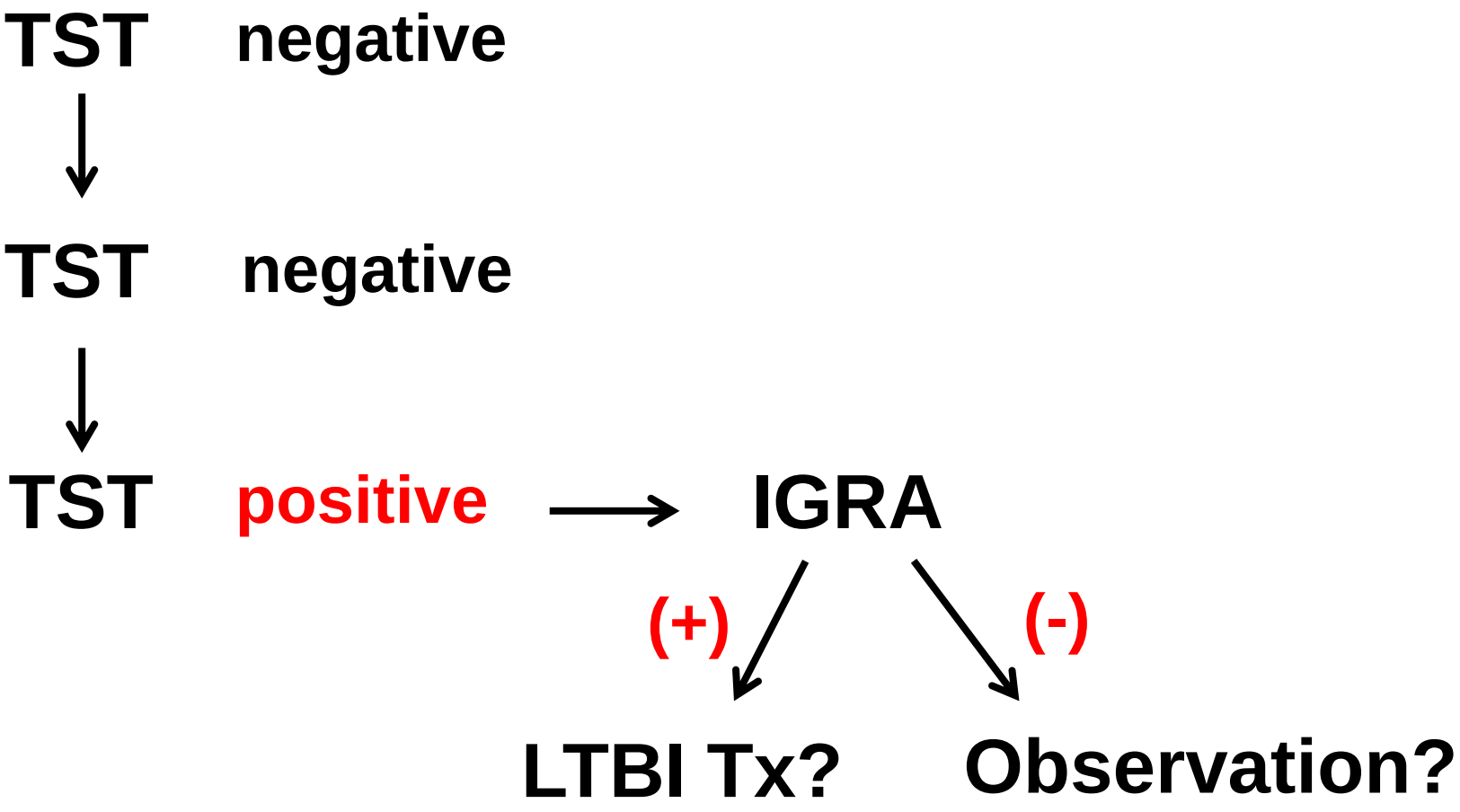


Am J Respir Crit Care Med 2011;183:88-95



CHEST 2012;141:983-988

Serial LTBI test for HCW



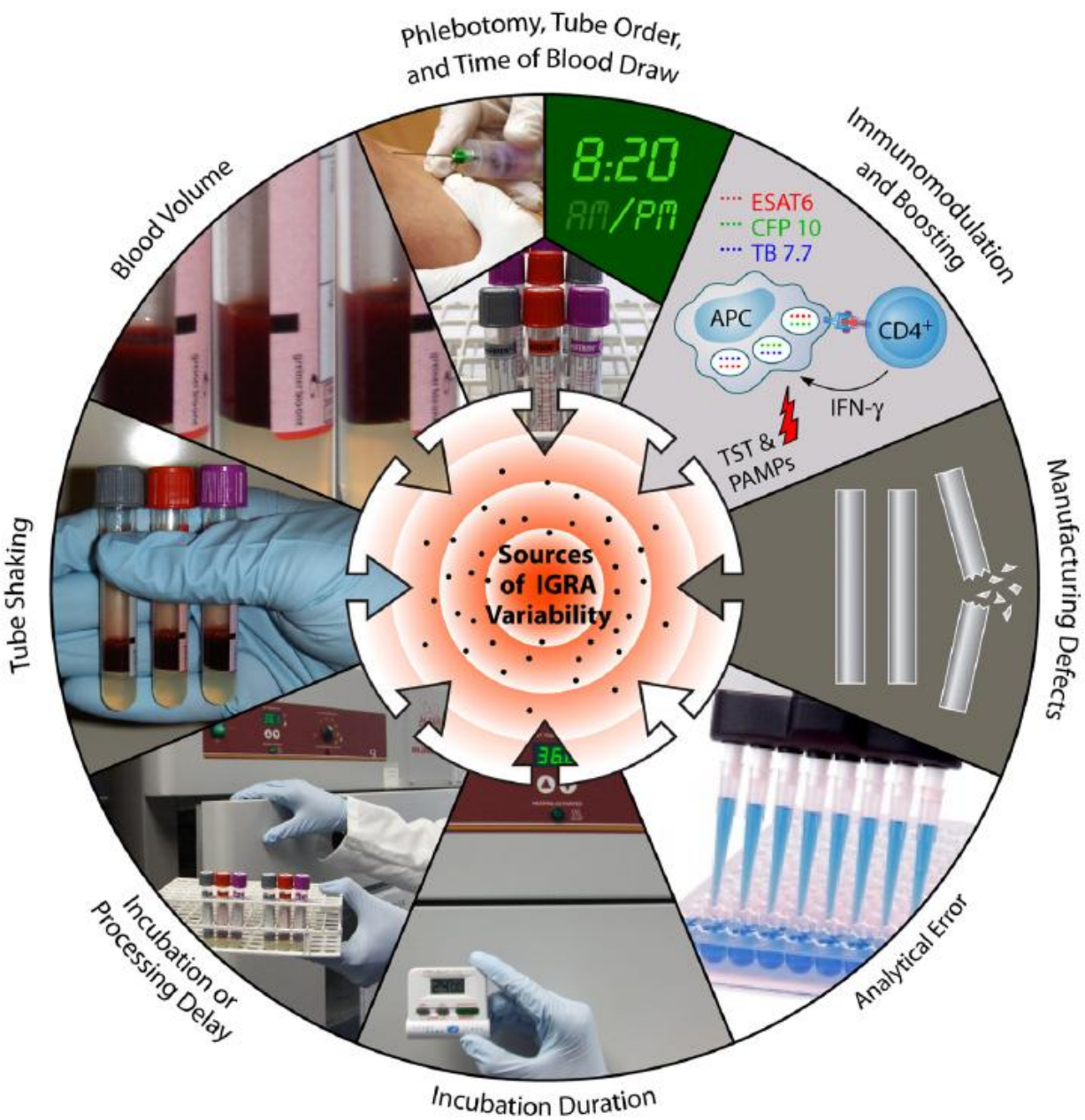


FIG 3 Sources of variability in the QuantiFERON-TB Gold In-Tube assay.

Clin Microbiol Rev 2014;27:3-20

Adequately Washed Bronchoscope Does Not Induce False-Positive Amplification Tests on Bronchial Aspirates in the Diagnosis of Pulmonary Tuberculosis*

Tae Sun Shim, MD; Hyun Sook Chi, MD; Sang Do Lee, MD; Younsuck Koh, MD; Woo Sung Kim, MD; Dong Soon Kim, MD; and Won Dong Kim, MD, FCCP

Adequately cleaned and disinfected bronchoscopes did not cause false-positive amplification test results for M.TB by cross-contamination

CHEST 2002;121:774-781

Table 4. Predictive factors for positive TST and QFT-GIT among 493 HCWs

	No.	Positive TST		Positive QFT-GIT	
		No. (%)	p-value	No. (%)	p-value
Age range, yr			<0.001		<0.001
20–29	264	72 (27.3)		26 (9.8)	
30–39	181	87 (48.1)		40 (22.1)	
>40	48	23 (47.9)		19 (39.6)	

Tuberc Respir Dis 2013:75:18-24

Challenges of Interferon-γ Release Assay Conversions in Serial Testing of Health-care Workers in a TB Control Program

Kimberlee S. Fong, DO; J. Walton Tomford, MD; Lucileia Teixeira, MD; Thomas G. Fraser, MD; David van Duin, MD, PhD; Belinda Yen-Lieberman, PhD; Steve M. Gordon, MD; and Cyndee Miranda, MD

The criteria for defining conversion and reversions

by establishing new cutoffs

CHEST 2012;142:55-62