의료기관 종사자에서 잠복결핵 감염의 진단과 치료

2015.11.13

2015 대한결핵 및 호흡기학회 추계학술대회
부산대학교병원 호흡기내과 목정하

Prevalence of LTBI among HCWs

	By TST	By IGRA
Jo, et al.[1] (existing employees)	**36.7%**	**17.2%**
Lee, et al.[2] (existing employees)	**37.8%**	**23.2%**
Park, et al.[3] (newly hired)	**25.8%**	**10.2%**

- **Annual risk of TB infection among newly employed nurse**[4] (both TST and IGRA) : at least **3%**
- **Annual IGRA conversion rate of newly hired HCWs**[3] : **3.3%**

1. Kyung-Wook Jo, et al. Tuberc Respir Dis. 2013;75:18-24.
2. Kyung Jong Lee, et al. Scand J Infect Dis. 2010;42:672-8.
3. Hye Yun Park, et al. Scand J Infect Dis. 2010;42:943-5.
4. Kwangha Lee, et al. Infect Control Hosp Epidemiol. 2009;30:1288-20.

Occupational infectious disease

Table 3. Distribution of occupational infectious disease by pathogen or mode of infection

Characteristics	Number (%) of cases	2000	2001	2002	2003	2004	2005	2006	2007
Bacterial infection	306 (37.4)	25	40	17	15	49	44	49	67
Tuberculosis	280 (34.2)	23	36	15	11	48	42	43	62
Spirochetal infection (i.e. Leptospirosis)	21 (2.6)	2	4	2	3		2	3	5
Other bacterial infection	1 (0.1)				1				
Viral infection	4 (0.5)					1		3	
Arthropod-borne viral infection	319 (39.0)	27	36	43	43	36	39	42	53
(i.e. Hemorrhagic fever, Dengue fever)	283 (34.6)	23	33	41	38	27	38	35	48
Viral hepatitis	3 (0.4)				1	1			1
Human immunodeficiency viral infection	33 (4.0)	4	3	2	4	8	1	7	4

Table 5. Distribution of industrial classification of compensated occupational infectious disease in Korea

Industrial classification	Number of workers								
	No. (%)	1999	2000	2001	2002	2003	2004	2005	2006	2007
Agriculture and forestry	82 (9.6)	5	2	18	4	1	15	12	10	15
Mining & quarrying	0 (0.0)	0	0	0	0	0	0	0	0	0
Manufacturing	42 (4.9)	2	2	6	2	4	8	7	7	4
Construction	29 (3.4)	2	3	5	1	1	3	1	6	7
Transport & post & telecommunication & electricity, gas & water supply	14 (1.6)	3	2	2	2	0	0	2	2	1
Whole sales & retail, hotel & restaurant	19 (2.2)	4	3	1	1	1	3	2	4	0
Financial institutions & insurance	6 (0.7)	1	1	2	2	0	0	0	0	0
Real estate & leasing Business	81 (9.5)	5	7	6	8	6	9	13	6	21
Public health & education	520 (61.1)	41	47	54	61	59	41	49	59	109
Recreational, cultural & sporting activities	58 (6.8)	3	3	2	1	4	12	12	19	2
Total	851 (100)	66	70	96	82	76	91	98	113	159

Yun Kyung Chung, et al. J Korean Med Sci. 2010;25:S53-61.

Tuberculosis among HCWs

Table 5. The distribution of workers by the kinds of infectious diseases and jobs

Kinds of infection	No. of workers (%)	Kinds of jobs
Tuberculosis	219 (71.3)	Nurses (168), Doctors (15), Aid nurses (11), Clinical pathology technician (11), Administrative staffs (5), Emergency aid workers (3), Institution-based nursing aids (1), Others (5) —Researcher (1), Laundry worker (1), Facility maintenance worker (1), Pharmacist (1), Technician for coronary angiography (1)
Hepatitis	42 (13.7)	Nurses (19), Doctors (10), Clinical pathology technician (6), Aid nurses (4), Physical therapist (1), Radiology technician (1), Others (1) –Facility maintenance worker (1)
Chickenpox	11 (3.6)	Nurses (6), Doctors (3), Aid nurses (2)
AIDS*	8 (2.6)	Nurses (6), Doctors (2)
Scabies	7 (2.3)	Institution-based nursing aids (7)
Measles	5 (1.6)	Nurses (2), Doctors (1), Clinical pathology technician (1), Physical therapist (1)
Pneumonia	4 (1.3)	Nurses (3), Doctors (1)
Others**	11 (3.6)	Doctors (5), Nurses (1), Aid nurses (1), Physical therapist (1), Others (3) —Nutritionist (1), Experimental animal breeder (1), Dental technician (1)
Total	307 (100.0)	Nurses (205), Doctors (37), Aid nurse (18), Clinical pathology technician (18), Institution-based nursing aids (8), Administrative staff (5), Physical therapist (3), Emergency aid workers (3), Others (10)

*Including simple needle stick injury.
**Epidemic keratoconjunctivitis (2), Cellulitis (2), Meningitis (1), Encephalitis (1), Purulent otitis media (1), Epidemic hemorrhagic fever (1), Septicemia with pseudomonas (1), Poststreptococcal glomerulonephritis (1), Choroiditis (1).

Yeon-Soon Ahn, et al. Industrial Health. 2008;46:448-54.

Tuberculosis among HCWs

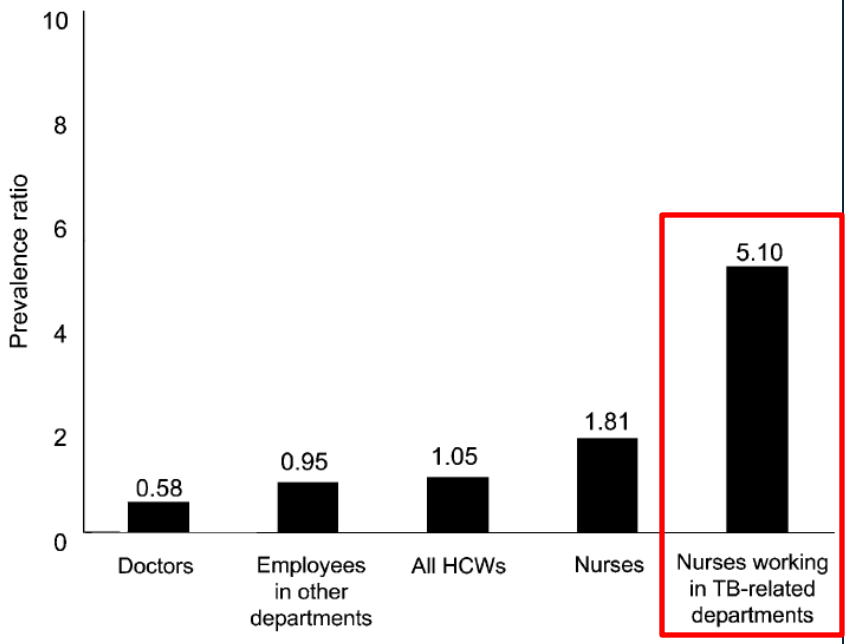


Figure The PR of tuberculosis according to occupational subgroups. The PR of the general population is 1. TB = tuberculosis; PR = prevalence ratio.

Table 2 Rate ratios of laboratory technicians' risk of contracting tuberculosis according to specific laboratory procedures

Type of work	Rate ratio	95%CI
Microscopy vs. non-laboratory workers	1.4	0.2–10.0
Culture vs. non-laboratory workers	2.0	0.2–13.3
Culture vs. microscopy	1.3	0.2–9.5
DST vs. non-laboratory workers	21.5	4.5–102.5
DST vs. microscopy	15.9	3.2–72.9
DST vs. culture	11.4	2.4–54.2

CI = confidence interval; DST = drug susceptibility testing.

Kyung-Wook Jo, et al. Int J Tuberc Lung Dis. 2008;12:436-40.
S.J.Kim, et al. Int J Tuberc Lung Dis. 2007;11:138-42.

Newly hired HCWs – Baseline screening

Routine follow-up of TB screening

Contact investigation

Newly hired HCWs – Baseline screening

Routine follow-up of TB screening

Contact investigation

Recommendation

Baseline testing for *M. tuberculosis* infection is recommended for all newly hired HCWs, regardless of the risk classification of the setting

Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings.
MMWR. 2005;54:RR17.

Employees new to the NHS who will be working with patients or clinical specimens should not start work until they have completed a TB screen or health check.

Clinical diagnosis and management of tuberculosis,
and measures for its prevention and control, NICE CG117, 2011.

Purpose of baseline screening

Scenario

- 37세 간호사
- 내과계 중환자실, 폐렴으로 입원한 환자의 간호
- 입원 3일 후 객담 AFB smear 3+, TB PCR +

무증상, 특이 과거력 없음
CXR : 정상
TST 1차 : 6mm → 2차 (8주 뒤) : 15mm
이전의 TST 검사결과 없음

최근 감염? Booster effect ?
치료를 권고해야 하나?

Purpose of baseline screening

- **Provide a basis for comparison** in the event of a potential or known exposure to *M. tuberculosis*

- Facilitate the **detection and treatment of LTBI** or TB disease in an HCW before employment begins and **reduces the risk to patients and other HCWs**

Screening methods

	By TST	By IGRA
Jo, et al.[1] (existing employees)	**36.7%**	**17.2%**
Lee, et al.[2] (existing employees)	**37.8%**	**23.2%**
Park, et al.[3] (newly hired)	**25.8%**	**10.2%**

Discordance

TST	IGRA
• Rich data and evidences • Cheap	• Specific • Single visit • No booster effect
• False positive (eg, BCG, NTM) • Subjective measure • Need return visit • Booster effect	• Expensive • Operator error (complex laboratory test)

1. Kyung-Wook Jo, et al. Tuberc Respir Dis. 2013;75:18-24.
2. Kyung Jong Lee, et al. Scand J Infect Dis. 2010;42:672-8.
3. Hye Yun Park, et al. Scand J Infect Dis. 2010;42:943-5.

Screening methods

Table 5. Multivariate lo … nong 493 HCWs

		tive QFT-GIT	
		CI)	p-value
Age range, yr			
30-39*		-4.37)	0.001
>40*		-11.90)	<0.001
Gender, female†		-3.11)	0.321
Profession, nurse‡		-2.03)	0.895
Experience of working in		-5.34)	0.029
Degree of contact with T			
Mild§		-5.14)	0.273
Moderate§		-4.32)	0.739
Severe§		-5.74)	0.367

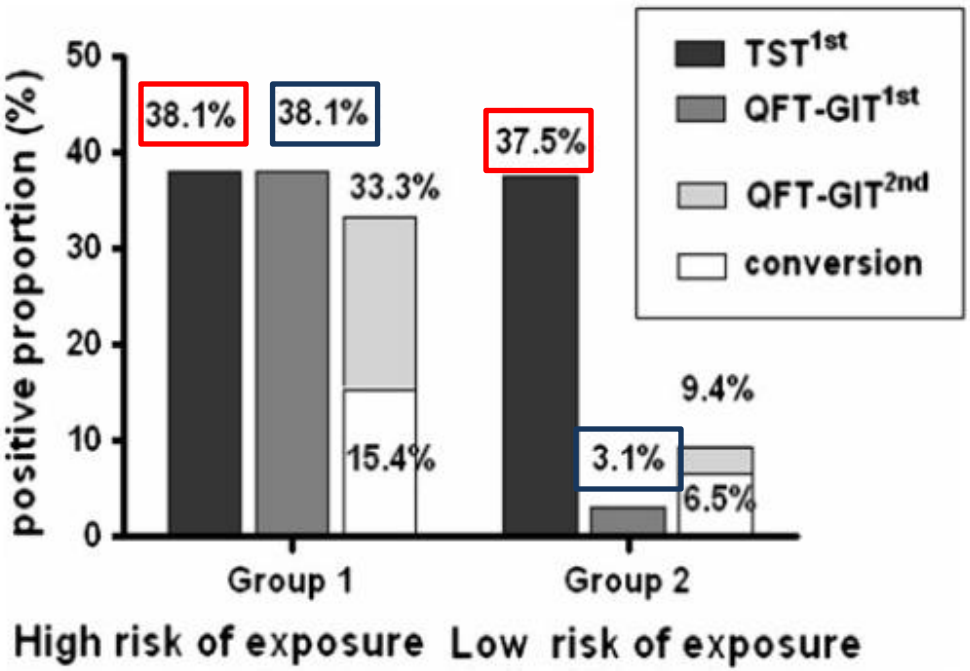


Fig. 2 Serial testing of healthcare workers (HCWs) for latent tuberculosis infection according to exposure risk. *TST* tuberculin skin test, *QFT-GIT* QuantiFERON-TB Gold In-Tube

Clinical diagnosis and management of tuberculosis and measures for its prevention and control, NICE CG117, 2011.
Kyung-Wook Jo, et al. Tuberc Respir Dis. 2013;75:18-24.
SY Kim, et al. Infection. 2013;41:511-6.

Screening methods

- **IGRA may be a better test** of LTBI than a TST **for baseline TB screening** in HCWs in intermediate TB-burden countries where BCG vaccination is common among HCWs.

Limitation of IGRA for HCWs

1. High cost

Utilization of the QuantiFERON-TB Gold Test in a Two-Step Process with the Tuberculin Skin Test To Evaluate Health Care Workers for Latent Tuberculosis[▽]

Baha Abdalhamid,[1] Steven H. Hinrichs,[1] Jodi L. Garrett,[2] Jean M. O'Neill,[3] Kristine M. Hansen-Cain,[3] Amy A. Armbrust,[2] and Peter C. Iwen[1]*

J Clin Microbiol. 2010;48:2955-6.

Study subject n = 242

TST only	IGRA only	TST → IGRA
87,186 USD	44,650 USD	38,776 USD

Limitation of IGRA for HCWs

2. Limitation in serial testing (routine F/U testing)

- Highly dynamic, fluctuation
- Poor repeatability, reproducibility
- No acceptable definition exists for ‘Conversion’ and ‘Reversion’
- False positive conversion

Limitation of IGRA for HCWs

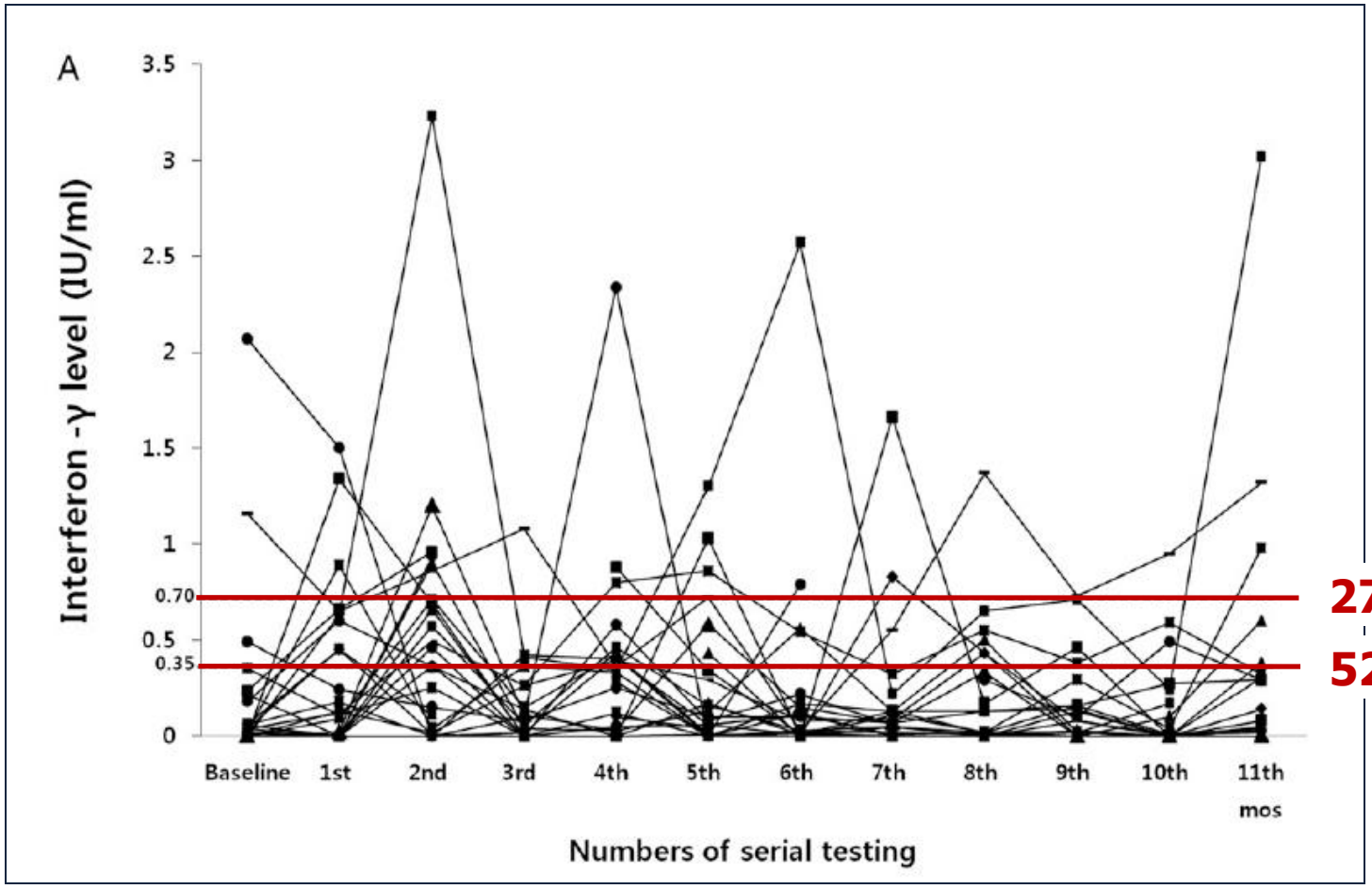
Table 3: Distribution of IFN-γ Release Assay Quantitative Results at Baseline, and Conversions Stratified by Baseline Quantitative Result

Baseline TB-nil (*IU/ml for QFT-GIT; spots for T-SPOT*)	Participants with Result [*n* (% of *Total*)]	Participants with Reversion among Those with at Least One Follow-up Result after Baseline [*n*/*Subtotal* (%)]	Participants with Conversion among Those with at Least One Follow-up Result after Baseline [*n*/*Subtotal* (%)]	Percentage of All Conversions [*n*/*Subtotal* (%)]	Participants Whose Conversion Was "Transient," among Those with at Least One Follow-up Visit after Conversion [*n*/*Subtotal* (%)]
QFT-GIT (n = 2,418)					
<0.01	1,176 (48.6)	—	52/1,129 (4.6)*	52/138 (37.7)	35/43 (81.4)†
0.01–0.19	1,024 (42.3)		65/972 (6.7)*	65/138 (47.1)	35/46 (76.1)†
0.20–0.35	63 (2.6)	—	21/62 (33.9)*	21/138 (15.2)	11/17 (64.7)†
0.36–0.49	29 (1.2)	28/29 (96.6)*	N/A	N/A	N/A
0.50–0.69	23 (1.0)	16/23 (69.6)*	N/A	N/A	N/A
0.70–0.99	13 (0.5)	7/13 (53.8)*	N/A	N/A	N/A
1.00–2.99	23 (1.0)	12/23 (52.2)*	N/A	N/A	N/A
3.00+	30 (1.2)	4/30 (13.3)*	N/A	N/A	N/A
Indeterminate	37 (1.5)		N/A	N/A	N/A
T–SPOT (n = 2,418)					
<1	1,309 (54.1)	—	54/1,241 (4.4)*	54/177 (30.5)	31/34 (91.2)*
1–4	754 (31.2)		92/727 (12.7)*	92/177 (52.0)	46/57 (80.7)*
5–7	74 (3.1)	—	31/70 (44.3)*	31/177 (17.5)	14/27 (51.9)*
8	17 (0.7)	13/17 (76.5)*	N/A	N/A	N/A
9	19 (0.8)	16/19 (84.2)*	N/A	N/A	N/A
10	8 (0.3)	6/8 (75.0)*	N/A	N/A	N/A
>10	100 (4.1)	56/100 (56.0)*	N/A	N/A	N/A
Invalid or failed	137 (5.7)		N/A	N/A	N/A

Definition of abbreviations: N/A = not applicable; QFT-GIT = QuantiFERON-TB Gold In-Tube test; TB = tuberculosis; T-SPOT = T-SPOT.*TB* test.
*$P < 0.001$ for trend; all trends assessed by logistic regression.
†$P = 0.19$ for trend; all trends assessed by logistic regression.

SE Dorman, et al. AJRCCM. 2014;189:77-87.

Limitation of IGRA for HCWs



Jong Sun Park, et al. CHEST. 2012;142:1461-8.

Limitation of IGRA for HCWs

- The QFT-IT conversion rate was **not affected** by the employing department, exposure history to tuberculosis patients, or job category (doctor or nurse).

Hye Yun Park, et al. Scand J Infect Dis. 2010;42:943-5.

- **No difference** in the QFT-GIT conversion rate between HCWs at high and low risk of TB exposure during the almost 2-year study period.

SY Kim, et al. Infection. 2013;41:511-6.

Screening methods

- **IGRA may be a better test** of LTBI than a TST **for baseline TB screening in HCWs** in intermediate TB-burden countries where BCG vaccination is common among HCWs.

- The use of **IGRAs for serial testing for HCWs** is complicated by **lack of data** on optimum cut-offs for serial testing and unclear interpretation and prognosis of conversions and reversions.

Screening methods

- **Korean guideline** [1] (no specific reference for HCWs)
  : **TST only** (or) **IGRA only** (or) **TST → IGRA**

- **Baseline 2-step TST**
  - To avoid booster effect (reported rate in Korea[2] : 14.2%)
  - Repeat TST for person with negative initial results (1-4wk later)
  - Who have documented TST result within the previous 12 months
    : 2-step TST is not needed
  - Cut value ≥ 10mm (1st or 2nd TST)

- **Timing of IGRA** (dual screening strategy)
  : On the day of return for TST

1. Korean guidelines for tuberculosis, 2nd edition, 2014.
2. Song Yee Kim, et al. PLoS One. 2013;8:e64563.

Treatment

Indication (should be considered)

1. High risk population
- HIV infection
- Organ transplantation - immunosuppressive
- Recent TST conversion (within 2yr)
- TNF-α antagonist
- Silicosis
- Systemic corticosteroid
- DM
- CKD
- Head and neck cancer
- Hematologic malignancy
- Gastrectomy or jejunoileal bypass
- TB scar on CXR without history of treatment

2. Recent contact of active TB patients

3. HCWs who serve patients who are at high risk

Regimens

- **9H**
- **4R**
- **3HR**

Korean guidelines for tuberculosis, 2nd edition, 2014.

Newly hired HCWs – Baseline screening

Routine follow-up of TB screening

Contact investigation

Routine F/U of TB screening

- 의료기관의 장은 결핵을 조기발견하기 위하여 결핵환자를 검진, 치료하는 의료인 등 의료기관 종사자에 대하여 정기적으로 결핵검진 및 **잠복결핵 감염검진**을 실시하여야 한다.
  결핵검진등의 실시 주기는 **연 1회 이상**으로 한다.

  결핵예방법, 결핵예방법 시행규칙

- 실시 대상은 다음과 같다.
  - 결핵환자를 검진, 치료하는 의료인
  - 결핵환자를 진단하는 의료기사
  - 그 밖에 호흡기를 통하여 감염이 우려되는 의료기관의 종사자

  결핵예방법 시행규칙 제 4조

Risk classification

	Low risk	Medium risk	Potential ongoing transmission
Baseline	**Yes**	**Yes**	**Yes**
Routine testing	**No**	**Every 12 months**	**Every 8-10 weeks**
After exposure	**Contact investigation**		

Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings. MMWR. 2005;54:RR17.

Risk classification

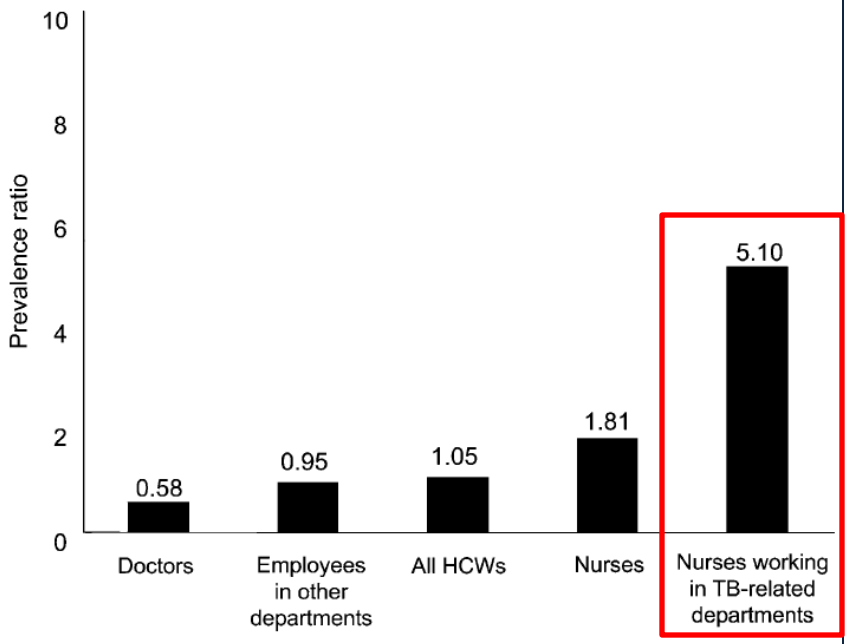


Figure The PR of tuberculosis according to occupational subgroups. The PR of the general population is 1. TB = tuberculosis; PR = prevalence ratio.

Table 2 Rate ratios of laboratory technicians' risk of contracting tuberculosis according to specific laboratory procedures

Type of work	Rate ratio	95%CI
Microscopy vs. non-laboratory workers	1.4	0.2–10.0
Culture vs. non-laboratory workers	2.0	0.2–13.3
Culture vs. microscopy	1.3	0.2–9.5
DST vs. non-laboratory workers	21.5	4.5–102.5
DST vs. microscopy	15.9	3.2–72.9
DST vs. culture	11.4	2.4–54.2

CI = confidence interval; DST = drug susceptibility testing.

Kyung-Wook Jo, et al. Int J Tuberc Lung Dis. 2008;12:436-40.
S.J.Kim, et al. Int J Tuberc Lung Dis. 2007;11:138-42.

Risk classification

Predicted risk of future occupational exposure

High risk	Medium risk	Low risk
Staff with regular contact with patients with possible TB infection e.g. staff working in: – TB clinics, – Respiratory wards or emergency departments, – Microbiology laboratories dealing with TB specimens, – Bronchoscopy or sputum induction, – Post-mortem examinations, – Lung function testing.	Staff with regular contact with patients, none of whom are considered to be high risk.	Staff who do not have contact with patients (e.g. clerical, administrative, non-microbiological laboratory staff)

Tuberculosis and health care workers, Government of Wesrtern Australia, Department of Health, 2011.

Risk classification

High risk	Medium risk	Low risk
• 외래 (호흡기내과, 감염내과) • 결핵/호흡기내과 병동 • 응급실 • 내과계 중환자실 • 기관지내시경실 • 유도객담 검사실, 폐기능 검사실 • 결핵균 검사실 • 흡입 치료실 • PPM 간호사, 상담간호사 • 면역저하자를 진료하는 의료인	그 이외 대부분의 직원	-
1년에 2회 이상	1년에 1회	

Screening methods

- **HCWs with previously negative results**
  : symptom screening, CXR, TST or IGRA (whichever was used for the first test)

- **HCWs with previously positive results / TB or LTBI Tx Hx**
  : symptom screening, CXR

1. TST (single); definition of conversion

Previous results		Routine Screening
< 10mm	→	**≥ 10mm + increase of ≥ 6mm**

2. IGRA

lack of data on optimum cut-offs for conversion (eg, ≥ 0.7 IU/L)

Treatment

- **Indication**
  - All HCWs with newly positive conversion on routine F/U testing, regardless of the age

- **Treatment regimens** – 9H / 4R / 3HR

- **Uncertainty**
  HCWs with positive results on routine follow-up testing who do not have baseline (previous) results

Newly hired HCWs – Baseline screening

Routine follow-up of TB screening

Contact investigation

Indication of investigations

1. Conversions in test results in HCWs for *M. tuberculosis* infection

2. Diagnosis of TB disease in HCWs

3. Suspected person-to-person transmission of *M. tuberculosis*

4. Expose to TB patients

5. Possible TB outbreaks

Indication of investigations

1. Conversions in test results in HCWs for *M. tuberculosis* infection

2. Diagnosis of TB disease in HCWs

3. Suspected person-to-person transmission of *M. tuberculosis*

4. Expose to TB patients

5. Possible TB outbreaks

Selection of index patient

CDC

- Sputum AFB smear + / cavity
- Sputum AFB culture +, PCR + / abnormal CXR consistent with TB
- Bronchoalveolar lavage, gastric aspirate only → infectious

NHS

- Sputum AFB smear +

  (except: MDR TB, aerosol-producing procedure, immunocompromised host)
- Bronchial washing only → non-infectious

Guidelines for the investigation of contacts of persons with infectious tuberculosis. MMWR. 2005;54:RR-15.
Guidelines for the prevention and control of tuberculosis in hospital/Version 7. NHS. 2013.

Selection of index patient

KOREA

- 신고된 환자가 전염성 결핵 **(객담 또는 기관지세척액 도말 및 배양 양성)** 으로 진단된 경우, 접촉자 조사를 지체 없이 시행한다.

의료기관 결핵관리 안내, 보건복지부/질병관리본부, 2014.

- 접촉자 검진의 대상이 되는 환자는,
  - **객담검사 등에서 (도말 또는 배양검사) 양성**이 나온 결핵
  - **영상의학검사 (CXR or CT) 상 활동성 병변**이 관찰된 결핵
  - **TB PCR 양성**이 나온 결핵

국가결핵관리지침, 보건복지부/질병관리본부, 2015.

Infectious period

TABLE 2. Guidelines for estimating the beginning of the period of infectiousness of persons with tuberculosis (TB), by index case characteristic

Characteristic			
TB symptoms	AFB* sputum smear positive	Cavitary chest radiograph	Recommended minimum beginning of likely period of infectiousness
Yes	No	No	3 months before symptom onset or first positive finding (e.g., abnormal chest radiograph) consistent with TB disease, whichever is longer
Yes	Yes	Yes	3 months before symptom onset or first positive finding consistent with TB disease, whichever is longer
No	No	No	4 weeks before date of suspected diagnosis
No	Yes	Yes	3 months before first positive finding consistent with TB

SOURCE: California Department of Health Services Tuberculosis Control Branch; California Tuberculosis Controllers Association. Contact investigation guidelines. Berkeley, CA: California Department of Health Services; 1998.
* Acid-fast bacilli.

- **Sputum AFB culture (+) only → 4 weeks**
- **Except above → 3 months**

Guidelines for the investigation of contacts of persons with infectious tuberculosis. MMWR. 2005;54:RR-15.

Priority for screening

High-priority

(Regardless of the age)

- Close contact
- Exposure during medical procedure (bronchoscopy, sputum induction..)
- Non-close contact with medical risk factor

Evidence of new infection in high-priority

Medium-priority

- Non-close contact

Close contact

A person who has **shared the same air space** in a household or other enclosed environment for a prolonged period (**days or weeks**, not minutes or a couple hours) with a person with suspected or confirmed TB disease

Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings. MMWR. 2005;54:RR17.

Descriptive studies from the UK which were considered by the GDG **do not give a clear definition of close contacts** and it is therefore difficult to give guidance on whom to trace. It would be useful to give TB nurses an objective definition of close contacts, but there is insufficient evidence to make a recommendation on factors such as length of time spent in the same room without ventilation before 'close contact' is deemed to have occurred.

Clinical diagnosis and management of tuberculosis, and measures for its prevention and control, NICE CG117, 2011.

Close contact

Patients should be regarded as at risk of infection if they spent more than **eight hours** in the same bay as an inpatient with sputum smear-positive TB who had a cough.

Clinical diagnosis and management of tuberculosis,
and measures for its prevention and control, NICE CG117, 2011.

'Significant' exposure should be assessed on a **case by case basis**, but can be defined as: Contact with an inpatient with sputum that is smear positive for pulmonary TB who has not been isolated or where a breach of TB isolation precautions has occurred

: contact on a single occasion or cumulatively, for **≥2 hours if close contact (direct care)** or **≥5 hours if casual contact**

Tuberculosis and health care workers, Government of Wesrtern Australia, Department of Health, 2011.

Priority for screening

Infectious risk assessment

- Intensity of the exposure based on proximity
- Overlap with the infectious period of the index case
- Duration of exposure
- Presence or absence of infection-control measures
- Infectiousness of the index case
- Performance of procedures that could increase the risk for transmission during contact
  (e.g., sputum induction, bronchoscopy, airway suction)
- Exposed cohort of contacts for TB screening

Priority for screening

- 조사대상은 전염성 결핵환자의 **밀접접촉자**이며, 구체적인 조사 범위는 의료기관 관할 보건소, 시도, 질병관리본부 중앙결핵 역학조사팀이 **논의하여 결정**, 현장조사 결과에 따라 **변경 가능함**

의료기관 결핵관리 안내, 보건복지부/질병관리본부, 2014

Screening methods

- **Contacts with previously negative results, no previous results**
  : symptom screening, CXR, TST or IGRA

- **Contacts with previously positive results / TB or LTBI Tx Hx**
  : symptom screening, CXR

1. TST

2. IGRA

3. TST → IGRA

Repeat exam 8–10 weeks after the end of exposure, if the initial exam result is negative

- **Uncertainty**
  'cut value' vs. 'conversion' ?

Treatment

- **Indication**
  - All contacts with

- **Previously posit**
  - consider a treatr
    intensity of expo

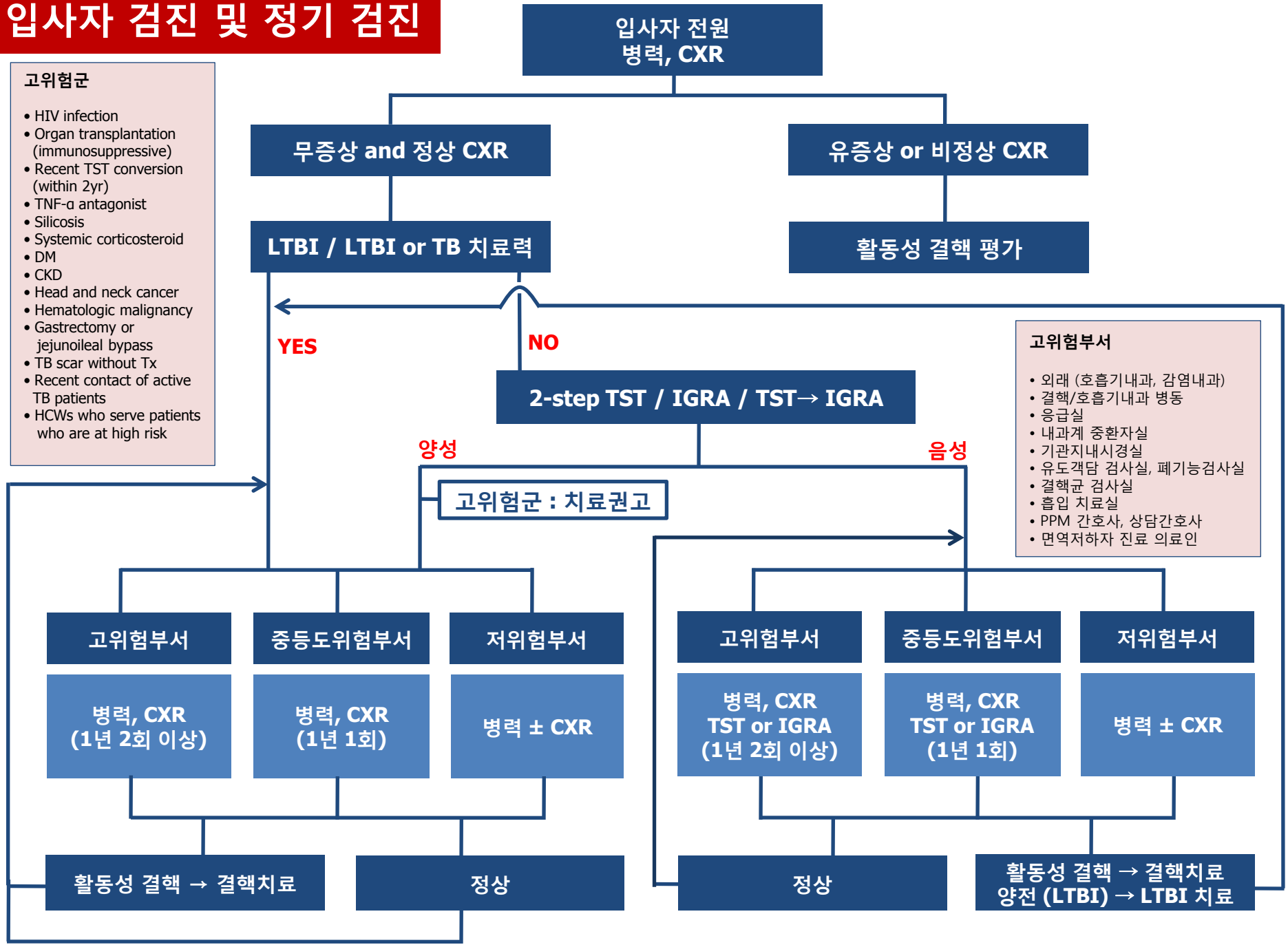
- **Treatment regin**

- **Uncertainty**
  Contacts with pos
  baseline (previou

권고요약

- LTBI 검사 결과와 무관하게 (접촉 상황을 고려하여) LTBI 치료를 시행한다.
  - HIV 감염인(IIA).
- 첫 TST 가 음성이어도 잠정적으로 LTBI 치료를 시행하며 접촉 종료 8주 후에 TST를 반복하여 LTBI 치료지속 여부를 결정한다.
  - 장기 이식으로 면역억제제를 복용 중이거나 복용 예정자
  - TNF 길항제 사용자 혹은 사용예정자
- LTBI 로 판명되면 치료를 시행한다.
  - 35세 이하
  - 학교, 군대, 요양시설, 교정 시설 등 집단 생활 시설에서 전염성 결핵 발병이 확인된 경우(IIB)
  - 장기간 스테로이드를 사용 중이거나 사용예정자 (15 mg/일 이상 prednisone, 1달 이상 사용하는 경우) (IIB)
  - 만성신부전(IIB)
  - 당뇨병(IIB)
  - 두경부암 및 혈액암
  - 위절제술 혹은 공회장우회술(jejunoileal bypass) 시행 혹은 시행예정자(IIB)
  - 규폐증(IB)

입사자 검진 및 정기 검진


입사자 전원
병력, CXR
무증상 and 정상 CXR
유증상 or 비정상 CXR
LTBI / LTBI or TB 치료력
활동성 결핵 평가
YES
NO
2-step TST / IGRA / TST→ IGRA
양성
음성
고위험군 : 치료권고
고위험군
• HIV infection
• Organ transplantation (immunosuppressive)
• Recent TST conversion (within 2yr)
• TNF-α antagonist
• Silicosis
• Systemic corticosteroid
• DM
• CKD
• Head and neck cancer
• Hematologic malignancy
• Gastrectomy or jejunoileal bypass
• TB scar without Tx
• Recent contact of active TB patients
• HCWs who serve patients who are at high risk
고위험부서
• 외래 (호흡기내과, 감염내과)
• 결핵/호흡기내과 병동
• 응급실
• 내과계 중환자실
• 기관지내시경실
• 유도객담 검사실, 폐기능검사실
• 결핵균 검사실
• 흡입 치료실
• PPM 간호사, 상담간호사
• 면역저하자 진료 의료인
고위험부서
중등도위험부서
저위험부서
병력, CXR (1년 2회 이상)
병력, CXR (1년 1회)
병력 ± CXR
고위험부서
중등도위험부서
저위험부서
병력, CXR TST or IGRA (1년 2회 이상)
병력, CXR TST or IGRA (1년 1회)
병력 ± CXR
활동성 결핵 → 결핵치료
정상
정상
활동성 결핵 → 결핵치료
양전 (LTBI) → LTBI 치료