The Evidence behind WHO Recommendations on TB Infection Prevention and Control

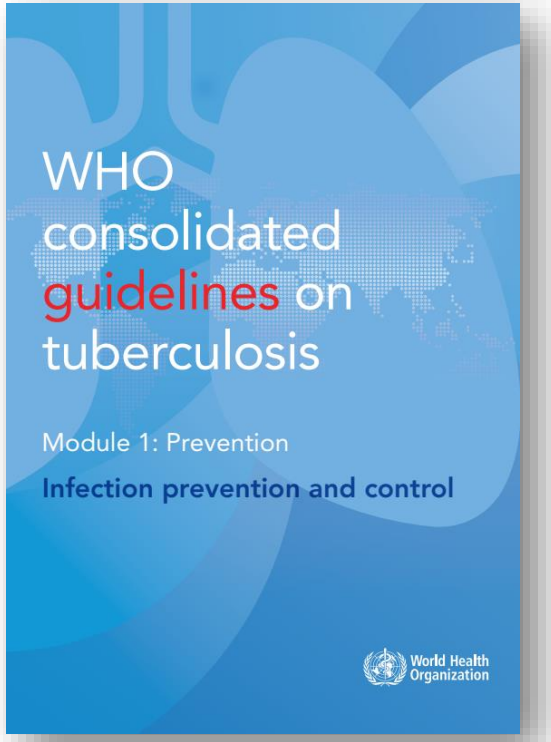
Dr. Grigory Volchenkov

WHO Expert

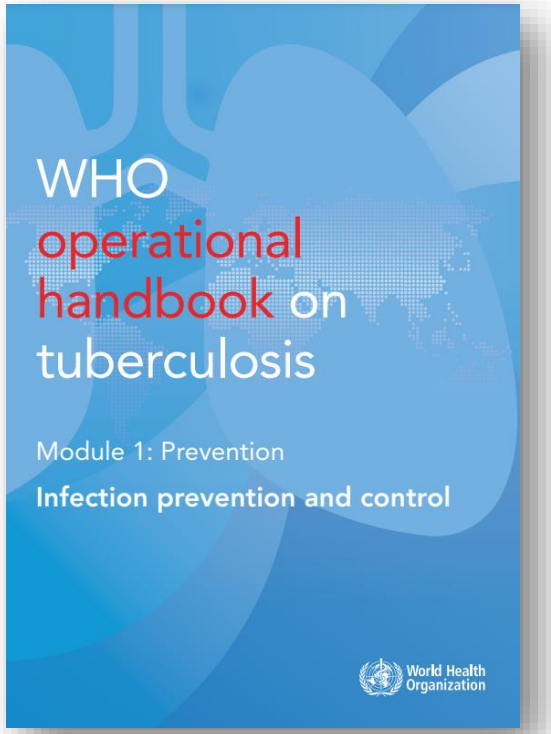
Vladimir, Russia

WHO Guidance on TB Transmission Risk Reduction

Updated in 2019 evidence-informed recommendations outlining a public health approach to prevent M. tuberculosis transmission within the clinical and programmatic TB management.



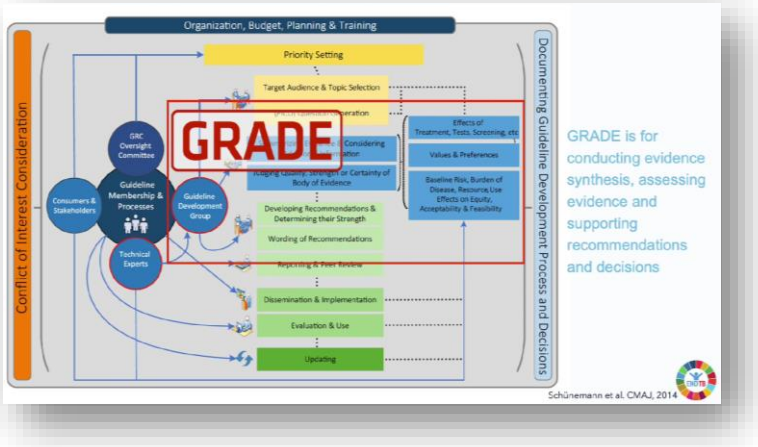
The GL version reformatted in 2022 in line with the WHO consolidated guidelines on TB series. No other changes have been made.



Practical advice on how to implement the WHO recommendations on TB IPC with best practices and experiences, checklists and job aids.

GL development approach

- The quality of evidence and strength of the recommendations were assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach
- This approach rates the certainty of evidence for all the critical outcomes identified in the PICO question as “high”, “moderate”, “low” or “very low”, based on a set of criteria:
  - study design limitations (risk of bias),
  - inconsistency,
  - imprecision,
  - indirectness
  - and publication bias.
- The direction (whether in favour of or against an intervention) and strength (whether conditional or strong) of the recommendations reflects the panel’s degree of confidence as to whether the desirable effects of the recommendations outweigh the undesirable effects.
- The guideline development process considered resource use and cost implications of implementing the recommendations from a public health perspective.



Understanding and using WHO guidelines on tuberculosis
OpenWHO.org
https://openwho.org/courses/who-gtb-guidelines

GL development approach

The process included

- identifying priority questions and outcomes,
- retrieving the evidence,
- assessing and synthesizing the evidence,
- formulating the recommendations,
- planning for dissemination and implementation.

PICO question

Breaking the question into four components to facilitate the identification of relevant evidence-based information

Population – Intervention - Control (Comparator) – Outcome

Example:

In health workers and persons in health care or other settings with a high risk of TB transmission, do the following interventions – use of particulate respirators and implementation of a respiratory protection programme – when compared with no intervention, reduce risk of TB transmission?

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Example:

In health workers and persons in health care or other settings with a high risk of TB transmission, do the following interventions – use of particulate respirators and implementation of a respiratory protection programme – when compared with no intervention, reduce risk of TB transmission?

Administrative controls

Recommendation 1. Triage

- Triage of people with TB signs and symptoms, or with TB disease, is recommended to reduce M. tuberculosis transmission to health workers, persons attending health care facilities or other persons in settings with a high risk of transmission.

(Conditional recommendation based on very low certainty in the estimates of effects)

Recommendation 1. Triage – to reduce risk for HCWs

Absolute risk reduction of 6% for LTBI incidence among health workers in all resource settings

1. Roth VR, Garrett DO,Laserson KF,Starling CE,Kritski AL,Medeiros EAS,Binkin N,Jarvis WR. A multicenter evaluation of tuberculin skin test positivity and conversion among health care workers in Brazilian hospitals.. Int J Tuberc Lung Dis; 2005.

2. Wenger PN, Otten J,Breeden A,Orfas D,Beck-Sague CM,Jarvis WR. Control of nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis among healthcare workers and HIV-infected patients. Lancet; 1995.

3. Welbel SF, French AL,Bush P,DeGuzman D,Weinstein RA. Protecting health care workers from tuberculosis: a 10-year experience. Am J Infect Control; 2009.

4. Blumberg HM, Watkins DL,Berschling JD,Antle A,Moore P,White N,Hunter M,Green B,Ray SM,McGowan Jr. J E. Preventing the nosocomial transmission of tuberculosis. Ann Intern Med; 1995.

5. Bangsberg DR, Crowley K,Moss A,Dobkin JF,McGregor C,Neu HC. Reduction in tuberculin skin-test conversions among medical house staff associated with improved tuberculosis infection control practices. Infect Control Hosp Epidemiol; 1997.

6. Holzman, RS. A comprehensive control program reduces transmission of tuberculosis to hospital staff. Clin Infect Dis; 1995.

7. Yanai H, Limpakarnjanarat K,Uthaivoravit W,Mastro TD,Mori T,Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.

8. Harries AD, Hargreaves NJ,Gausi F,Kwanjana JH,Salaniponi FM. Preventing tuberculosis among health workers in Malawi. Bull WHO; 2002.

9. Jacobson G, Hoyt DD,Bogen E. Tuberculosis in hospital employees as affected by an admission chest X-ray screening program. Dis Chest; 1957.

Recommendation 1. Triage – on prevention of TB transmission among non-health care staff

12.6% absolute risk reduction in the number of active TB disease cases in persons attending health care settings with the use of triage compared with similar populations in settings where triage was not implemented.

1. Stroud LA, Tokars JI Grieco MH Crawford JT Culver DH Edlin BR Sordillo EM Woodley CL Gilligan ME Schnieder N Williams J Jarvis WR. Evaluation of infection control measures in preventing the nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis in a New York city hospital. Infect Control Hosp Epidemiol; 1995.

2. Moro ML, Errante I Infuso A Sodano L Gori A Orcese CA Salamina G D'Amico C Besozii G Caggese L. Effectiveness of infection control measures in controlling a nosocomial outbreak of multidrug-resistant tuberculosis among HIV patients in Italy.. Int J Tuberc Lung Dis; 2000.

Administrative controls

Recommendation 2. Respiratory separation / isolation

- Respiratory separation / isolation of people with presumed or demonstrated infectious TB is recommended to reduce M. tuberculosis transmission to health workers or other persons attending health care facilities.

(Conditional recommendation based on very low certainty in the estimates of effects)

Recommendation 2. Respiratory separation / isolation

Absolute risk reduction of 2% in HCW when persons with presumed TB and confirmed TB patients underwent respiratory separation or isolation

1. Jones, SG. Evaluation of a human immunodeficiency virus rule out tuberculosis critical pathway as an intervention to decrease nosocomial transmission of tuberculosis in the inpatient setting. AIDS Patient Care Stds; 2002.
2. Jarvis, WR. Nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis. Am J Infect Control; 1995.
3. Roth VR, Garrett DO,Laserson KF,Starling CE,Kritski AL,Medeiros EAS,Binkin N,Jarvis WR. A multicenter evaluation of tuberculin skin test positivity and conversion among health care workers in Brazilian hospitals.. Int J Tuberc Lung Dis; 2005.
4. Wenger PN, Otten J,Breeden A,Orfas D,Beck-Sague CM,Jarvis WR. Control of nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis among healthcare workers and HIV-infected patients. Lancet; 1995.
5. Welbel SF, French AL,Bush P,DeGuzman D,Weinstein RA. Protecting health care workers from tuberculosis: a 10-year experience. Am J Infect Control; 2009.
6. Uyamadu N, Ahkee S,Carrico R,Tolentino A,Wojda B,Ramirez J. Reduction in tuberculin skin-test conversion rate after improved adherence to tuberculosis isolation. Infect Control Hosp Epidemiol; 1997.
7. Maloney SA, Pearson ML,Gordon MT,Del Castillo R,Boyle JF,Jarvis WR. Efficacy of control measures in preventing nosocomial transmission of multidrug-resistant tuberculosis to patients and health care workers. Ann Intern Med; 1995.
8. Fridkin SK, Manangan L,Bolyard E,Jarvis WR. SHEA-CDC TB survey, Part II: Efficacy of TB infection control programs at member hospitals, 1992. Society for Healthcare Epidemiology of America. Infect Control Hosp Epidemiol; 1995.
9. Blumberg HM, Watkins DL,Berschling JD,Antle A,Moore P,White N,Hunter M,Green B,Ray SM,McGowan Jr. J E. Preventing the nosocomial transmission of tuberculosis. Ann Intern Med; 1995.
10. Behrman AJ, Shofer FS. Tuberculosis exposure and control in an urban emergency department. Ann Emerg Med; 1998.
11. Bangsberg DR, Crowley K,Moss A,Dobkin JF,McGregor C,Neu HC. Reduction in tuberculin skin-test conversions among medical house staff associated with improved tuberculosis infection control practices. Infect Control Hosp Epidemiol; 1997.
12. Holzman, RS. A comprehensive control program reduces transmission of tuberculosis to hospital staff. Clin Infect Dis; 1995.
13. Yanai H, Limpakarnjanarat K,Uthaivoravit W,Mastro TD,Mori T,Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.
14. Harries AD, Hargreaves NJ,Gausi F,Kwanjana JH,Salaniponi FM. Preventing tuberculosis among health workers in Malawi. Bull WHO; 2002.
15. Claassens M, van Schalkwyk C,du Toit E,Roest E,Lombard CJ,Enarson DA,Beyers N,Borgdorff MW. Tuberculosis in Healthcare Workers and Infection Control Measures at Primary Healthcare Facilities in South Africa. PLoS One; 2013.

Administrative controls

Recommendation 3. Prompt initiation of effective treatment

- Prompt initiation of effective treatment of people with TB disease is recommended to reduce *M. tuberculosis* transmission to health workers, persons attending health care settings or other persons in settings with a high risk of transmission.

(Strong recommendation based on very low certainty in the estimates of effects)

Recommendation 3. Prompt effective treatment

Retrospective cohort (1) study suggested a reduction of 6.2% in incidence in active TB disease among HIV-positive individuals admitted to the ward, from 19/216 (8.8%) in the period before the intervention to 5/193 (2.6%) after implementation (P = 0.01).

1. Stroud LA, Tokars JI, Grieco MH, Crawford JT, Culver DH, Edlin BR et al. Evaluation of infection control measures in preventing the nosocomial transmission of multidrug-resistant *M. tuberculosis* in a New York City hospital. Infect Cont Hosp Epidemiol. 1995;16(3):141–7 https://www.ncbi.nlm.nih.gov/pubmed/7608500

2. Jarvis, WR. Nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis. Am J Infect Control; 1995.

3. Wenger PN, Otten J,Breeden A,Orfas D,Beck-Sague CM,Jarvis WR. Control of nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis among healthcare workers and HIV-infected patients. Lancet; 1995.

4. Welbel SF, French AL,Bush P,DeGuzman D,Weinstein RA. Protecting health care workers from tuberculosis: a 10-year experience. Am J Infect Control; 2009.

5. Maloney SA, Pearson ML,Gordon MT,Del Castillo R,Boyle JF,Jarvis WR. Efficacy of control measures in preventing nosocomial transmission of multidrug-resistant tuberculosis to patients and health care workers. Ann Intern Med; 1995.

Rouillon A, Perdrizet S, Parrot R. Transmission of tubercle bacilli: The effects of chemotherapy. Tubercle 1976; 57:279-299

Annik Rouillon. MD MPH
1929 - 2015

- Evidence that smear and culture positive TB patients on therapy do not infect close contacts.
- Sputum smear and culture positivity correlate with transmission before but not on therapy

"These facts seem to indicate very rapid and powerful action by the drugs on infectivity…"

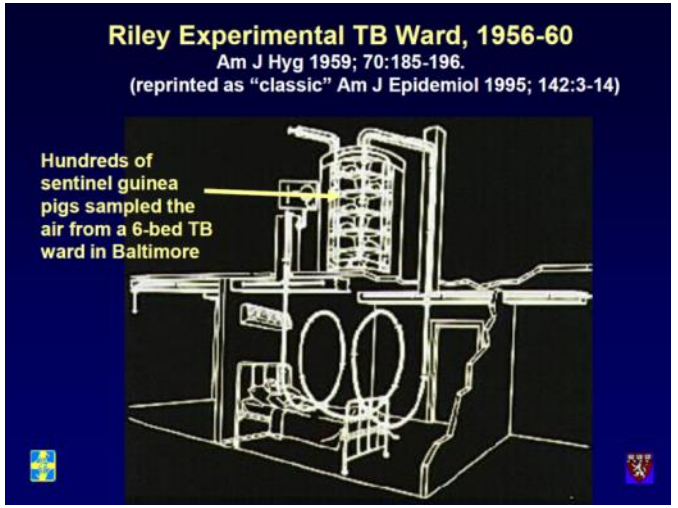
"There is an ever-increasing amount of evidence in support of the idea that abolition of the patient's infectiousness – a different matter from 'cure,' which takes months and from negative results of bacteriological examinations, direct and culture, which may take weeks – is very probably obtained after less than 2 weeks of treatment".

"The future reduction of transmission will essentially depend on the maintenance of an adequate system ensuring the early diagnosis and correct treatment of cases, which will inevitably continue to appear among the already infected portion of the population. "

Riley RL, Mills CC, Nyka W, Weinstock N, Storey PB, Sultan LU, Riley MC, Wells WF. 1995.

Aerial dissemination of pulmonary tuberculosis: A two-year study of contagion in a tuberculosis ward: 1959. Am J Epidemiol 142: 3–14.

"The treated patients were admitted to the ward at the time treatment was initiated and were generally removed before the sputum became completely negative. Hence the decrease in infectiousness preceded the elimination of the organisms from the sputum, indicating that the effect was prompt as well as striking."



Courtesy of Edward Nardell

Dharmadhikari AS, Mphahlele M, Venter K, Stoltz A, Mathebula R, Masotla T, van der Walt M, Pagano M, Jensen P, Nardell E. 2014.
Rapid impact of effective treatment on transmission of multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 18: 1019–1025

Guinea Pig Transmission: South Africa

109 patients: smear +, cavitary, coughing, recently started on therapy

	# Patients/ Exp. Duration	% guinea pigs infected (# exposed)	Patients # XDR (MGIT)
Pilot	26* / 4 mos	74% (360)	3/11
Exp 1	24 / 3 mos	10% (90)	5/10
Exp 2	15 / 2 mos	53% (90)	2/11
Exp 3	27 / 3 mos	1% (90)	0/21 *0/27 (LPA)*
Exp 4	17/ 3 mos	77% (90)	2/10

* 8 different spoligotypes, but only 2 transmitted to GPs – both XDR-associated

The AIR Facility in Witbank, Mpumalanga province , South Africa

Courtesy of Edward Nardell

Administrative controls

Recommendation 4. Respiratory hygiene (including cough etiquette)

- Respiratory hygiene (including cough etiquette) in people with presumed or confirmed TB is recommended to reduce *M. tuberculosis* transmission to health workers, persons attending health care facilities or other persons in settings with a high risk of transmission.

(Strong recommendation based on low certainty in the estimates of effects)

Respiratory hygiene is defined as the practice of covering the mouth and nose during breathing, coughing or sneezing (e.g. wearing a surgical mask or cloth mask, or covering the mouth with tissues, a sleeve, or a flexed elbow or hand, followed by hand hygiene)

Recommendation 4. Respiratory hygiene

The prospective cohort study (1) quantified the effect of surgical masks worn by MDR-TB patients on incident infection among pathogen-free guinea-pigs exposed to ward air.

The study found that 76.6% of animals exposed to air from patients not wearing surgical masks (the control group) became infected with *M. tuberculosis*. In contrast, only 40% of animals exposed to exhaust air from patients wearing masks (the intervention group) acquired infection.

This represents a relative risk reduction of 47.8%. The retrospective outbreak investigation found that no patients developed MDR-TB after IPC measures were fully implemented.

https://www.ncbi.nlm.nih.gov/pubmed/22323300

1. A. Dharmadhikari, M. Mphahlele, A. Stoltz, K. Venter, R. Mathebula, T. Masotla, W. Lubbe, M. Pagano, M. First, P. A Jensen, M. van der Walt, E. Nardell. Surgical Face Masks Worn by Patients with Multidrug-Resistant Tuberculosis. Am J Respir Crit Care Med; 2012.

2. Moro ML, Errante I Infuso A Sodano L Gori A Orcese CA Salamina G D'Amico C Besozii G Caggese L. Effectiveness of infection control measures in controlling a nosocomial outbreak of multidrug-resistant tuberculosis among HIV patients in Italy.. Int J Tuberc Lung Dis; 2000.

3. Roth VR, Garrett DO, Laserson KF, Starling CE, Kritski AL, Medeiros EAS, Binkin N, Jarvis WR. A multicenter evaluation of tuberculin skin test positivity and conversion among health care workers in Brazilian hospitals.. Int J Tuberc Lung Dis; 2005.

4. Yanai H, Limpakarnjanarat K, Uthaivoravit W, Mastro TD, Mori T, Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.

5. Harries AD, Hargreaves NJ, Gausi F,Kwanjana JH, Salaniponi FM. Preventing tuberculosis among health workers in Malawi. Bull WHO; 2002.

Environmental controls

Recommendation 5. Upper-room germicidal ultraviolet systems

- Upper-room germicidal ultraviolet (GUV) systems are recommended to reduce *M. tuberculosis* transmission to health workers, persons attending health care facilities or other persons in settings with a high risk of transmission.

(Conditional recommendation based on moderate certainty in the estimates of effects)

Recommendation 5. Upper-room GUV

Crude TST Conversion Rate for Animals under Control and Ultraviolet Intervention Conditions by Month of Exposure for the Two Sequential Experiments (Combined in the Analysis)

TST (>6 mm)	Experiment 1		Experiment 2	
	Intervention	Control	Intervention	Control
Month 1	0	1	4	17
Month 2	0	3	12	31
Month 3	0	5	0	1
Month 4	0	0	—	—
Total	0	9	16	49

The model evaluated in South Africa (1) demonstrated that 64.4% of the guinea-pigs in the control group compared with 17.7% of animals in the intervention group developed LTBI. This represents a relative risk reduction of 72.4%.

1. Mphaphlele M, Dharmadhikari AS, Jensen PA, Rudnick SN,van Reenen TH, Pagano MA, Leuschner W, Sears TA, Milonova SP, van der Walt M, Stoltz AC, Weyer K, Nardell EA. Institutional Tuberculosis Transmission Controlled Trial of Upper Room Ultraviolet Air Disinfection: A Basis for New Dosing Guidelines. Am J Respir Crit Care Med; 2015.

2. Escombe AR, Moore DAJ, Gilman RH, Navicopa M, Ticona E, Mitchell B, Noakes C, Martinez C, Sheen P, Ramirez R, Quino W, Gonzalez A, Friedland JS, Evans CA. Upper-Room Ultraviolet Light and Negative Air Ionization to Prevent Tuberculosis Transmission. Plos Medicine; 2009.

3. Fella P, Rivera P, Hale M, Squires K, Sepkowitz K. Dramatic increase in tuberculin skin test conversion rate among employees at a hospital in New York City. Am J Infect Control; 1995.

4. Yanai H, Limpakarnjanarat K, Uthaivoravit W, Mastro TD, Mori T, Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.

5. Welbel SF, French AL, Bush P, DeGuzman D, Weinstein RA. Protecting health care workers from tuberculosis: a 10-year experience. Am J Infect Control; 2009.

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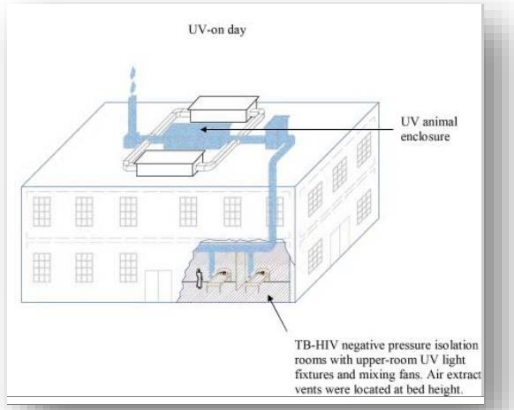

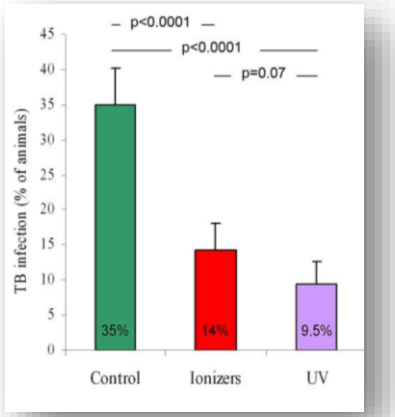

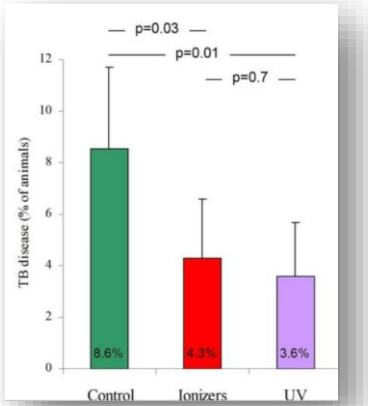

In the experimental model conducted in Peru (2), 34.8% of animals in the control group converted TST compared with 9.4% of animals in the intervention group breathing ward air when the upper room UVGI was turned on in the the patient ward, representing a relative risk reduction for TB infection of 72.9%.

1. Mphaphlele M, Dharmadhikari AS, Jensen PA, Rudnick SN,van Reenen TH, Pagano MA, Leuschner W, Sears TA, Milonova SP, van der Walt M, Stoltz AC, Weyer K, Nardell EA. Institutional Tuberculosis Transmission Controlled Trial of Upper Room Ultraviolet Air Disinfection: A Basis for New Dosing Guidelines. Am J Respir Crit Care Med; 2015.

2. Escombe AR, Moore DAJ, Gilman RH, Navicopa M, Ticona E, Mitchell B, Noakes C, Martinez C, Sheen P, Ramirez R, Quino W, Gonzalez A, Friedland JS, Evans CA. Upper-Room Ultraviolet Light and Negative Air Ionization to Prevent Tuberculosis Transmission. Plos Medicine; 2009.

3. Fella P, Rivera P, Hale M, Squires K, Sepkowitz K. Dramatic increase in tuberculin skin test conversion rate among employees at a hospital in New York City. Am J Infect Control; 1995.

4. Yanai H, Limpakarnjanarat K, Uthaivoravit W, Mastro TD, Mori T, Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.

5. Welbel SF, French AL, Bush P, DeGuzman D, Weinstein RA. Protecting health care workers from tuberculosis: a 10-year experience. Am J Infect Control; 2009.

Environmental controls

Recommendation 6. Ventilation systems

- Ventilation systems (including natural, mixed-mode, mechanical ventilation, and recirculated air through HEPA filters) are recommended to reduce *M. tuberculosis* transmission to health workers, persons attending health care facilities or other persons in settings with a high risk of transmission.

(Conditional recommendation based on very low certainty in the estimates of effects)

Remarks

- *The use of portable room-air cleaner appliances is not advised as a system to reduce M. tuberculosis transmission to health workers, persons attending health care facilities or other persons in settings with a high risk of transmission.*

Recommendation 6. Ventilation systems

The longitudinal cohort study (6) assessed the effect of negative pressure isolation rooms with HEPA filtration and 20 ACH in two hospitals in Brazil, comparing TST conversion rates among HCW with those in two other hospitals where environmental controls were not implemented. The incidence of TST conversions was 7.4 per 1000 person-years and 8.1 per 1000 person-years in the two facilities where the measures were applied, compared with 12.2 per 1000 person-years and 19.8 per 1000 person-years in the two hospitals where the measures were not applied. This represents a relative risk reduction of 51,5%.

1. Fella P, Rivera P, Hale M, Squires K, Sepkowitz K. Dramatic increase in tuberculin skin test conversion rate among employees at a hospital in New York City. Am J Infect Control; 1995.

2. Wenger PN, Otten J, Breeden A,Orfas D, Beck-Sague CM, Jarvis WR. Control of nosocomial transmission of multidrug-resistant Mycobacterium tuberculosis among healthcare workers and HIV-infected patients. Lancet; 1995.

3. Welbel SF, French AL,Bush P, DeGuzman D, Weinstein RA. Protecting health care workers from tuberculosis: a 10-year experience. Am J Infect Control; 2009.

4. Maloney SA, Pearson ML, Gordon MT, Del Castillo R, Boyle JF, Jarvis WR. Efficacy of control measures in preventing nosocomial transmission of multidrug-resistant tuberculosis to patients and health care workers. Ann Intern Med; 1995.

5. Blumberg HM, Watkins DL, Berschling JD, Antle A,Moore P, White N, Hunter M, Green B, Ray SM ,McGowan Jr. J E. Preventing the nosocomial transmission of tuberculosis. Ann Intern Med; 1995.

6. Roth VR, Garrett DO, Laserson KF, Starling CE, Kritski AL, Medeiros EAS, Binkin N, Jarvis WR. A multicenter evaluation of tuberculin skin test positivity and conversion among health care workers in Brazilian hospitals. Int J Tuberc Lung Dis; 2005.

7. Menzies D, Fanning A, Yuan L, FitzGerald JM. Factors associated with tuberculin conversion in Canadian microbiology and pathology workers. Am J Respir Crit Care Med; 2003.

8. Muecke C, Isler M, Menzies D, Allard R, Tannenbaum TN, Brassard R. The use of environmental factors as adjuncts to traditional tuberculosis contact investigation. Int J Tuberc Lung Dis; 2006.

9. Yanai H, Limpakarnjanarat K,Uthaivoravit W,Mastro TD,Mori T,Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.

10. Behrman AJ, Shofer FS. Tuberculosis exposure and control in an urban emergency department. Ann Emerg Med; 1998.

Recommendation 6. Ventilation systems

Fig. 1. Comparative assessment for the use of ventilation systems[a]

	Natural ventilation	Mixed-mode ventilation	Mechanical ventilation	Recirculated air with filtration
Balance of effects	★★★★☆	★★★★☆	★★★★☆	★★★☆☆
Resources required	★★★★☆	★★★☆☆	★☆☆☆☆	★★☆☆☆
Cost effectiveness	★★★★★	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆☆
Equity	★★★★☆	★★★☆☆	★★☆☆☆	★★☆☆☆
Acceptability	★★★★★	★★★★☆	★★★★☆	★★★★☆
Feasibility	★★★★☆	★★★☆☆	★★☆☆☆	★☆☆☆☆

Personal respiratory protection

Recommendation 7. Respiratory protection

- Particulate respirators, within the framework of a respiratory protection programme, are recommended to reduce *M. tuberculosis* transmission to health workers, persons attending health care facilities or other persons in settings with a high risk of transmission.

(Conditional recommendation based on very low certainty in the estimates of effects)

Recommendation 7. Personal respiratory protection

Fella (2) showed that particulate respirators use was associated with a reduction in TST conversion from 41/303 (13.5%) to 21/446 (4.7%), a reduction of 8.8%. (RRR 65,2%)

Baussano (3) found that staff respiratory protection was associated in a reduction in TST conversion from 26.3/1000 to 9.4/1000 person years – a reduction of 16.9/ 1000 person years. (RRR 64,2%)

Blumberg (6) showed a composite intervention with a particulate respiratory was associated in a reduction of TST conversions from 18/3579 (3.3%) to 25/5153 (0.4%), a 2.9% reduction. (RRR 87,9%)

These studies represent an average relative risk reduction (RRR) of 72,4%.

1. Maloney SA, Pearson ML, Gordon MT,Del Castillo R, Boyle JF, Jarvis WR. Efficacy of control measures in preventing nosocomial transmission of multidrug-resistant tuberculosis to patients and health care workers. Ann Intern Med; 1995.

2. Fella P, Rivera P, Hale M, Squires K, Sepkowitz K. Dramatic increase in tuberculin skin test conversion rate among employees at a hospital in New York City. Am J Infect Control; 1995.

3. Baussano I, Bugiani M, Carosso A, Mairano D, Barocelli AP, Tagna M, Cascio V, Piccioni P, Arossa W. Risk of tuberculin conversion among healthcare workers and the adoption of preventive measures. Occup Environ Med; 2007.

4. Yanai H, Limpakarnjanarat K, Uthaivoravit W, Mastro TD, Mori T, Tappero JW. Risk of Mycobacterium tuberculosis infection and disease among health care workers, Chiang Rai, Thailand. Int J Tuberc Lung Dis; 2003.

5. Roth VR, Garrett DO, Laserson KF, Starling CE, Kritski AL, Medeiros EAS, Binkin N, Jarvis WR. A multicenter evaluation of tuberculin skin test positivity and conversion among health care workers in Brazilian hospitals.. Int J Tuberc Lung Dis; 2005.

6. Blumberg HM, Sotir M, Erwin M, Bachman R, Shulman JA. Risk of house staff tuberculin skin test conversion in an area with a high incidence of tuberculosis. Clin Infect Dis; 1998.

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Quality of GRADE recommendations

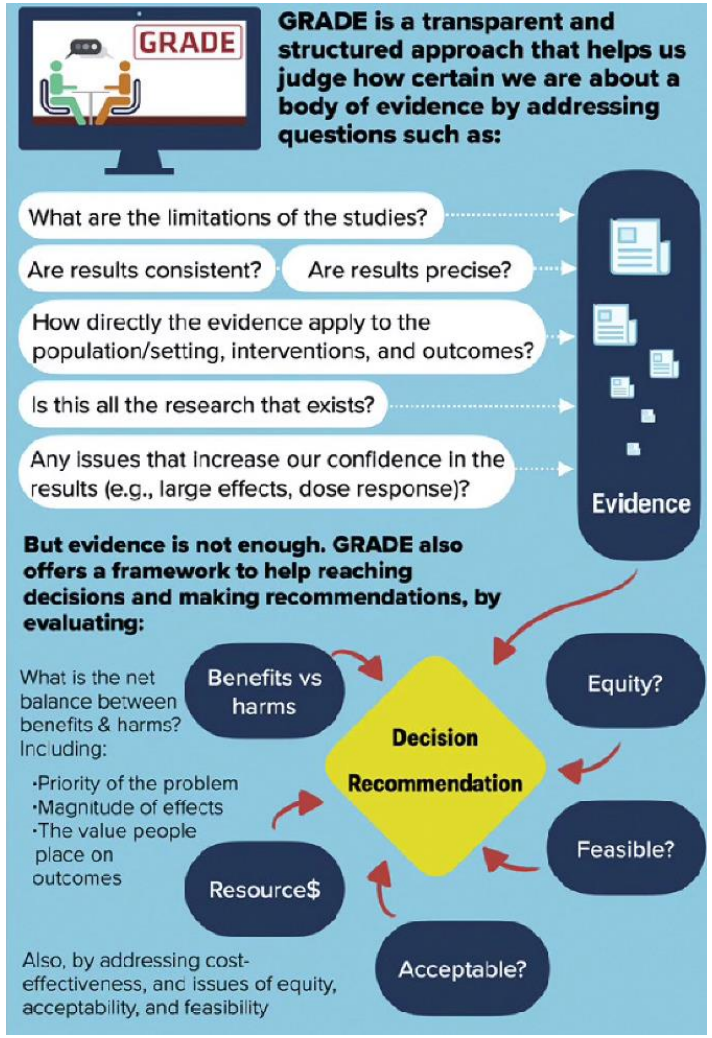
Recommendations	Strength	Certainty in the estimates of effects
Triage	Conditional	Very low
Respiratory separation / isolation	Conditional	Very low
Prompt initiation of effective TB treatment	Strong	Very low
Respiratory hygiene, incl. masking and cough etiquette	Strong	Low
Upper-room GUV	Conditional	Moderate
Ventilation	Conditional	Very low
Particulate respirators within the framework of a respiratory protection programme	Conditional	Very low

The direction (whether in favour of or against an intervention) and strength (whether conditional or strong) of the recommendations reflects the panel's degree of confidence as to whether the desirable effects of the recommendations outweigh the undesirable effects.

Certainty of evidence for the outcomes identified in the PICO question is rated as "High", "Moderate", "Low" or "Very low", based on a set of criteria: study design limitations (risk of bias), inconsistency, imprecision, indirectness and publication bias.

Limitations

- Scarcity of studies measuring the effect of TB-specific IPC interventions
- Composite nature of interventions on IPC, leading to a high level of indirectness; effects of individual measures could not be disaggregated
- Fundamental animal studies have been considered as indirect
- Meta-analyses for most of recommendations could not be performed because of the heterogeneity between the available studies



Understanding and using WHO guidelines on tuberculosis
OpenWHO.org
https://openwho.org/courses/who-gtb-guidelines

Thank you!

vlchnkv@yahoo.com