Clinical Standards on management of post-TB lung Disease (PTLD)

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Learning Objectives

- Have we finished our work when the patient is cured from TB (and from COVID-19?)
- Evidence on PTLD (and on post-COVID-19 disease) and on the need to manage it
- The history: the JBP Review and the Stellenbosh Symposium
- Rationale for Clinical Standards on PTLD
- Description of the Standards
- Research priorities
- Acknowledgements & Conclusions

This presentation is a guide to read the original article, IJTLD, October 2021

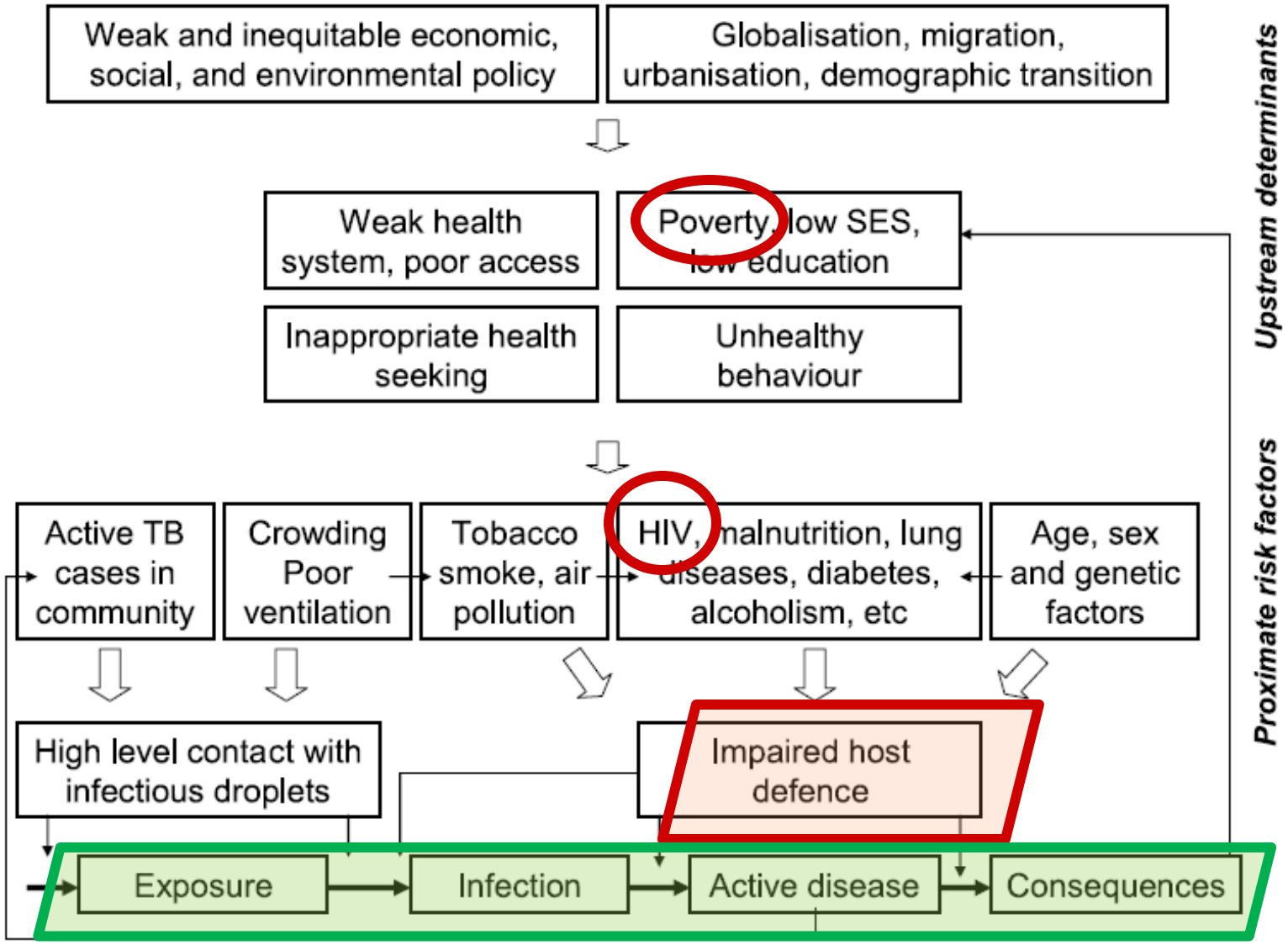


Fig. 4. Framework for proximate risk factors and upstream determinants of TB.

Lönnroth et al. Soc Science Med 2009

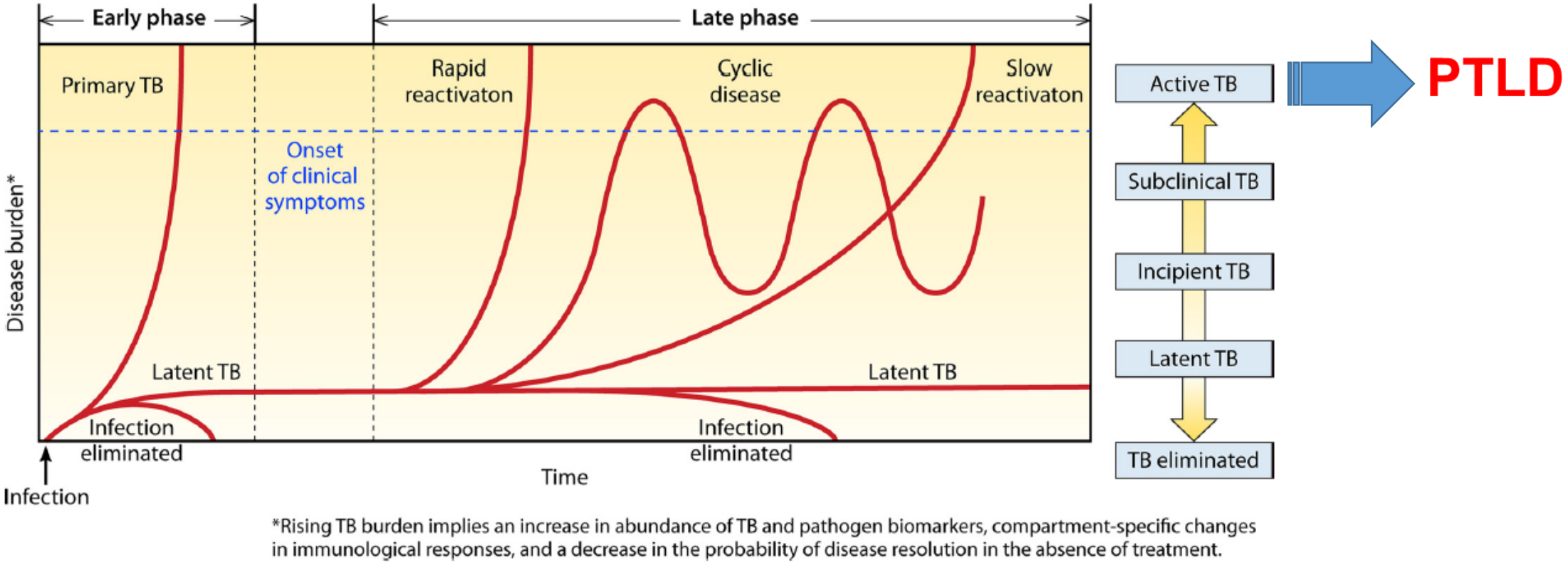


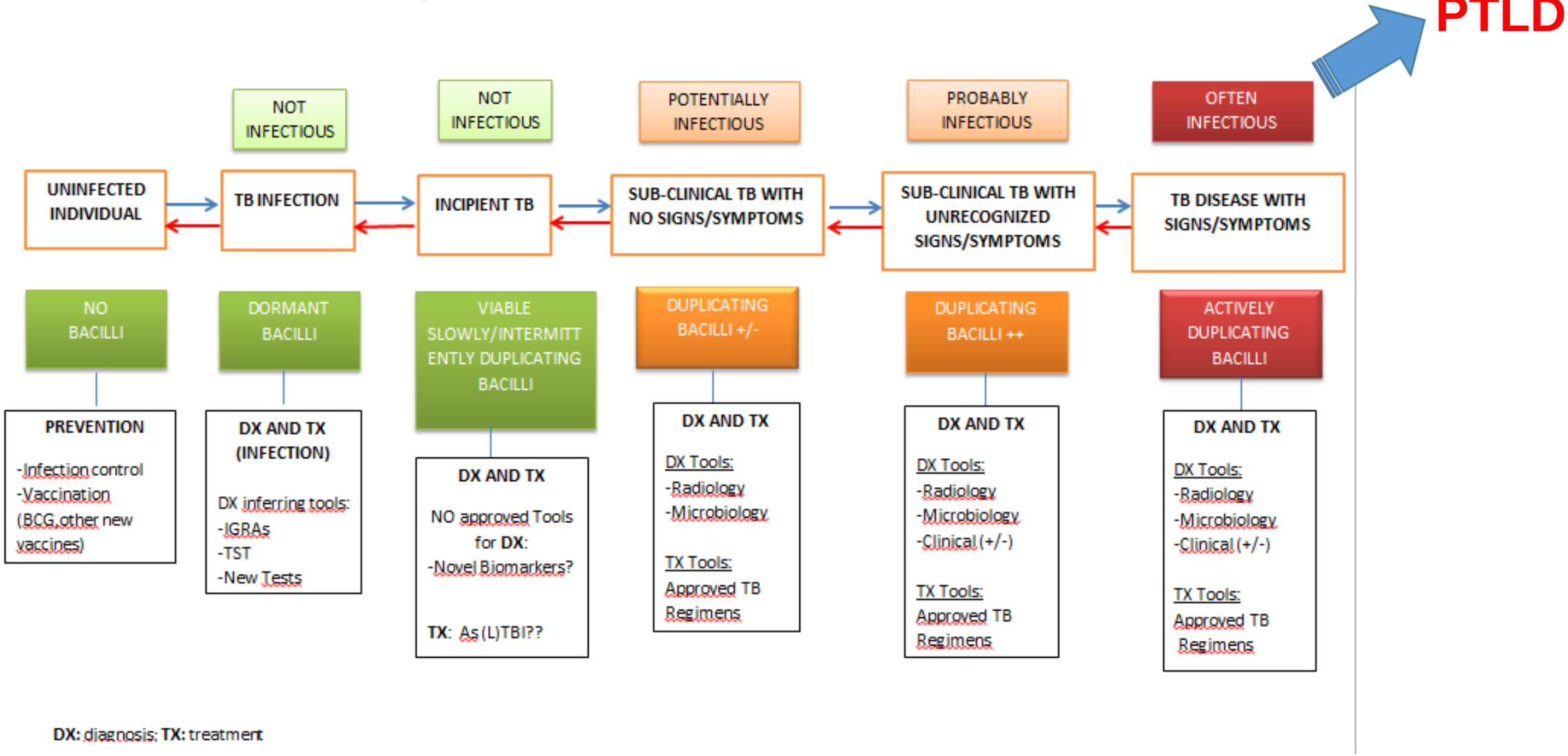
FIG 1 Pathways of tuberculosis disease progression. After initial exposure, *M. tuberculosis* may be eliminated by the host immune response, persist as a latent infection, or progress to primary active disease. Following the establishment of latent infection, disease may persist in a latent form, naturally progress in a slow or rapid fashion to active tuberculosis, or cycle through incipient and subclinical states before developing into symptomatic disease or eventual disease resolution. Although not all possibilities for regression of disease burden are depicted, spontaneous recovery may occur in any of these clinical trajectories.

From a 2 stage (L)TBI----TB disease) to a 5 stage descritpion of a continuous process

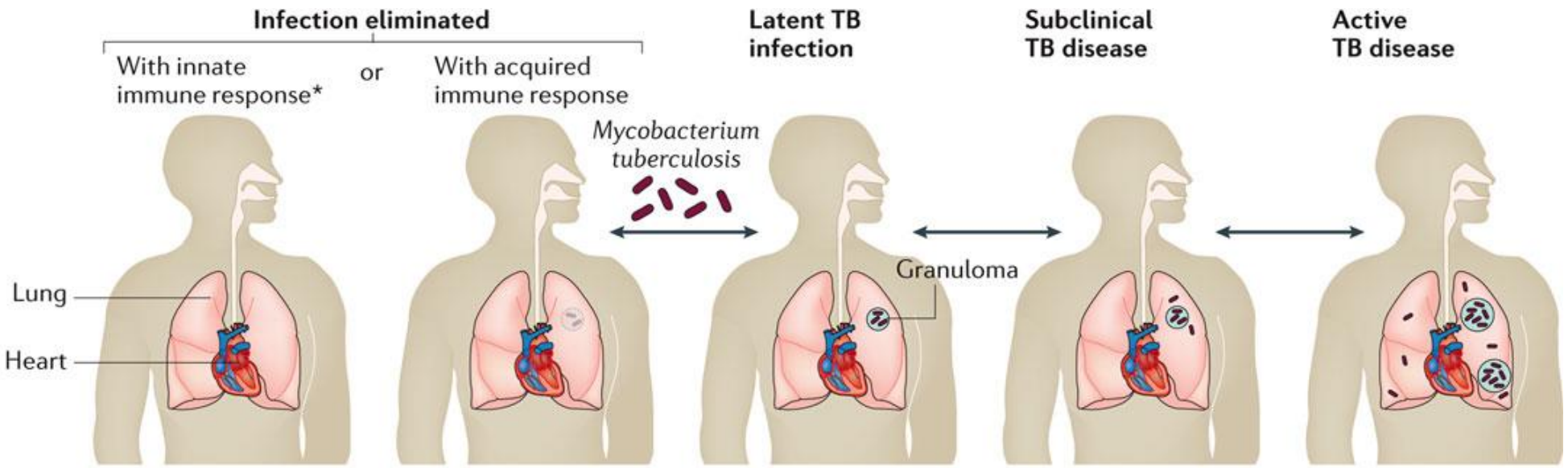
Drain, Clinical Microbiology Review 2018

A model to describe TB pathogenesis

Migliori GB et. al, Breathe 2021



DX: diagnosis; **TX:** treatment

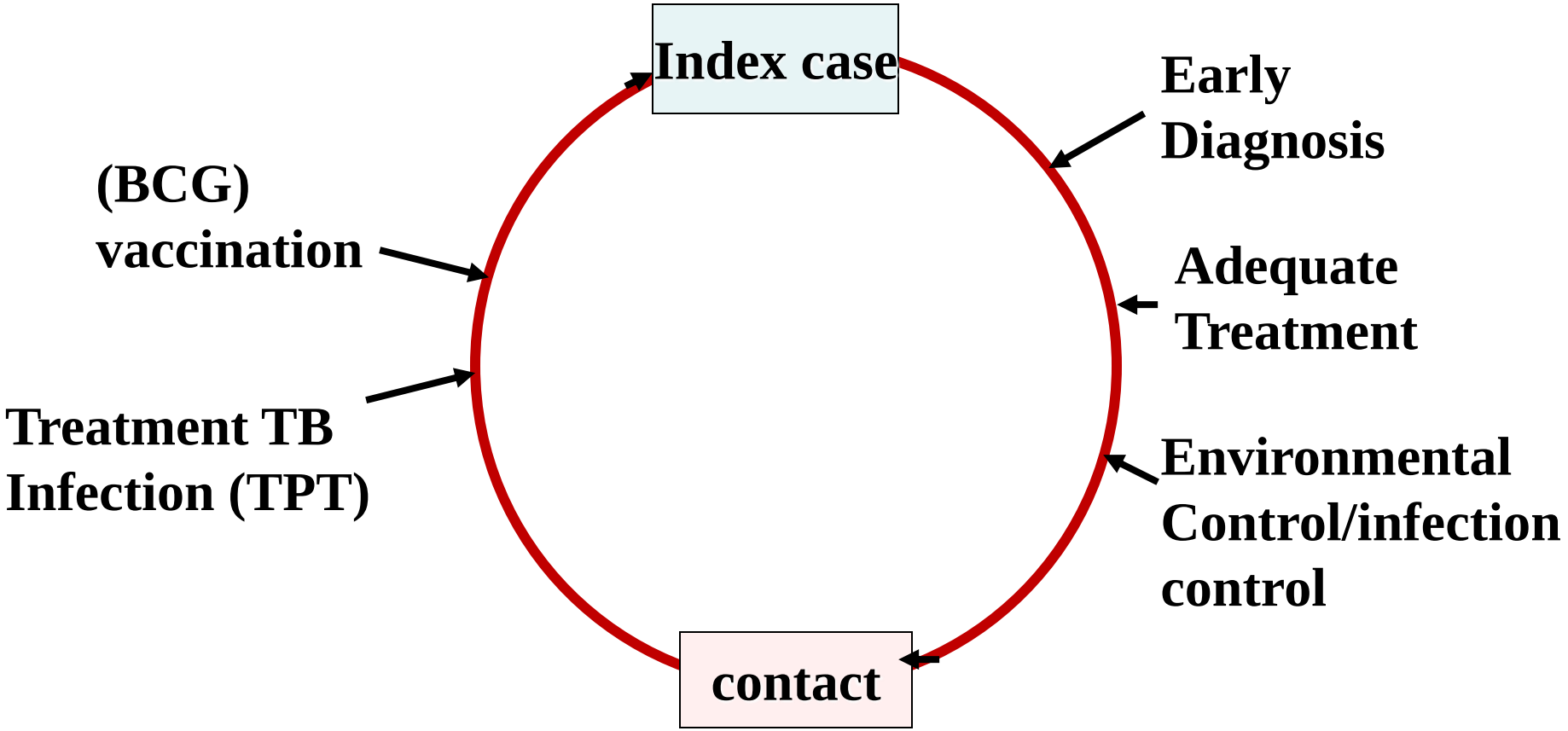


Sequelae

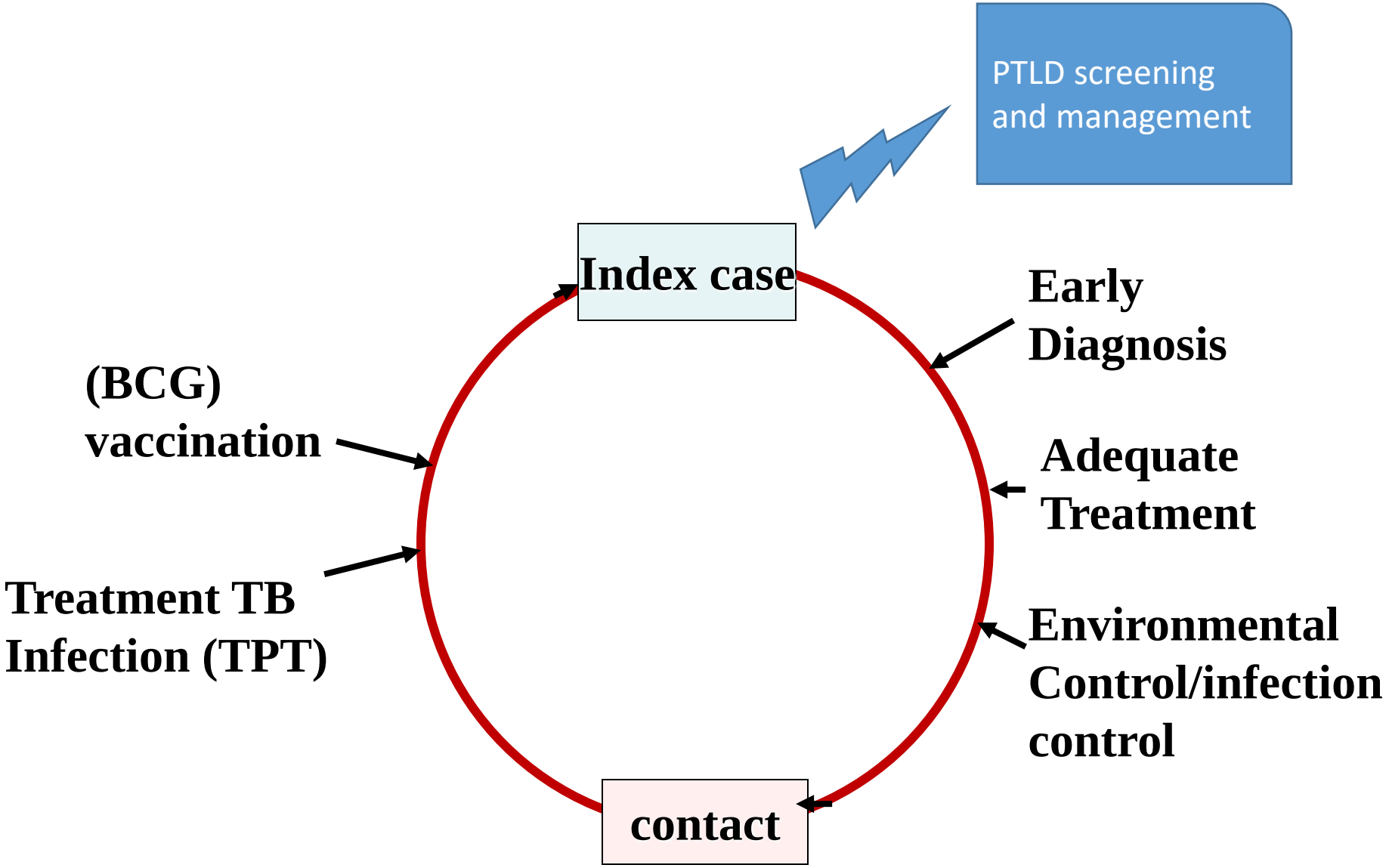
PTLD

TST	Negative	Positive	Positive	Positive	Usually positive	+
IGRA	Negative	Positive	Positive	Positive	Usually positive	+
Culture	Negative	Negative	Negative	Intermittently positive	Positive	-
Sputum smear	Negative	Negative	Negative	Usually negative	Positive or negative	-
Infectious	No	No	No	Sporadically	Yes	No
Symptoms	None	None	None	Mild or none	Mild to severe	Yes
Preferred treatment	None	None	Preventive therapy	Multidrug therapy	Multidrug therapy	Rehab

Nature Reviews | Disease Primers



Programmatic approach to TB



Programmatic approach to TB

The Union
The Official Journal of The International Union Against Tuberculosis and Lung Disease

The International Journal of Tuberculosis and Lung Disease (IJTLD)

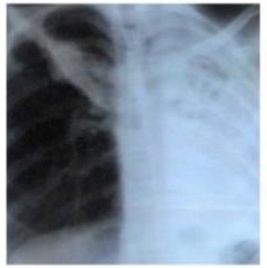
The IJTLD Clinical Standards for Lung Health

With support from the Oskar-Helene-Heim Foundation and the Günther Labes Foundation, we have published the first four IJTLD Clinical Standards for Lung Health.

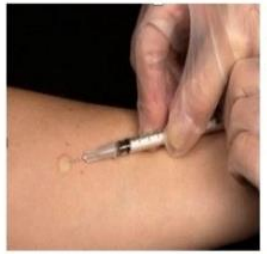
The aim of these Clinical Standards is to guide clinicians and programme managers in implementing appropriate measures for optimal person-centred care. All four articles are Open Access and free to read – see below:

The IJTLD Clinical Standards for Lung Health

Clinical standards for drug-susceptible pulmonary TB



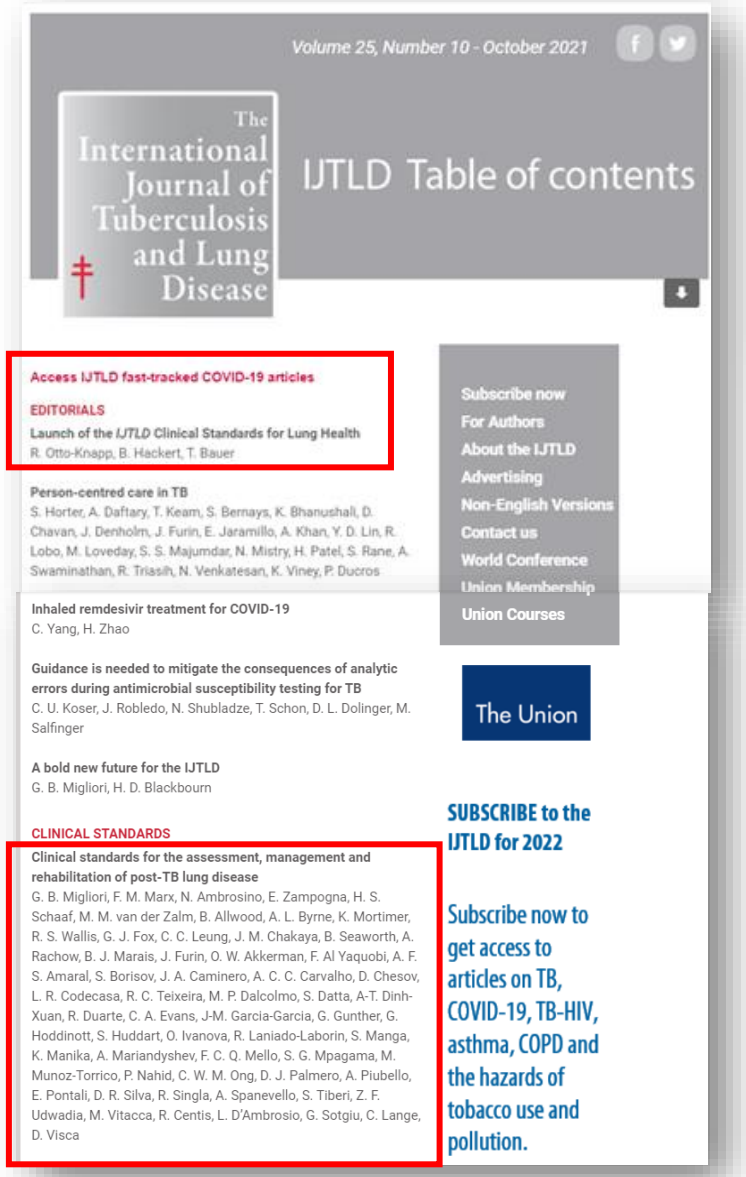
Clinical standards for the assessment, management and rehabilitation of post-TB lung disease



Clinical standards for the diagnosis, treatment and prevention of TB infection

Clinical standards for the dosing and management of TB drugs

PTLD, clinical standards



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CLINICAL STANDARDS

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CLINICAL STANDARDS FOR LUNG HEALTH

Clinical standards for the assessment, management and rehabilitation of post-TB lung disease

6 Standards on:

- evaluation of patients
- identification of patients for rehabilitation
- design and evaluation of rehabilitation
- health education & councelling

IJTLD October 2021

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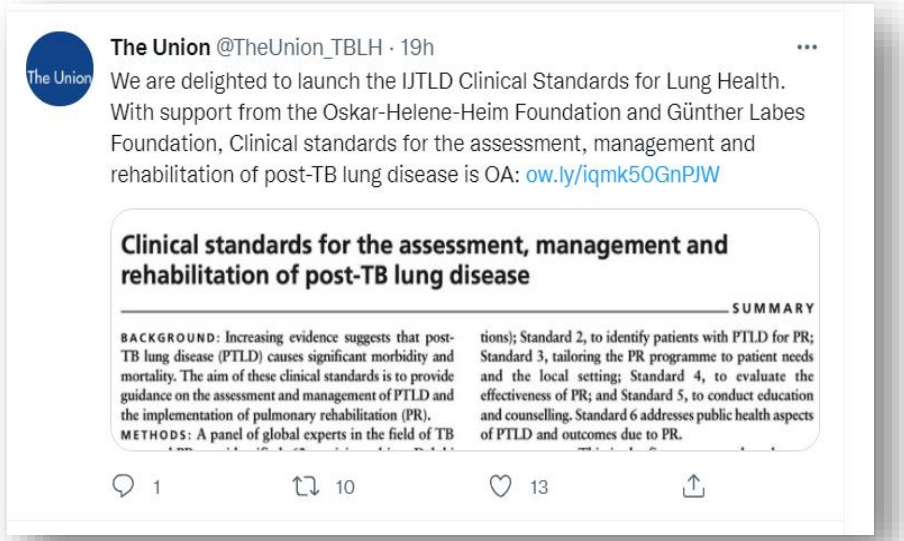
* GBM, FMM, NA, EZ and HSS contributed equally to this Clinical Standard.



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Günther Labes Stiftung

Stiftung Oskar Helene Heim

The methodology

METHODS: A panel of global experts in the field of TB care and PR was identified; 62 participated in a Delphi process. A 5-point Likert scale was used to score the initial ideas for standards and after several rounds of revision the document was approved (with 100% agreement).

TB clinicians ($n = 34$), TB public health ($n = 18$), TB paediatricians ($n = 3$), PR experts ($n = 6$), PFT/lung diseases experts ($n = 3$), methodologists ($n = 2$) and psychologist ($n = 1$). Out of the 67 experts invited, 3 declined and 2 did not respond. The 62 respondents

1. Identification of the panel and of the core group
2. Invitation
3. Delphi process
4. Preliminary formulation of the Standards (reduction from 7 to 6)
5. Draft development (7)
6. Approval by consensus

AIM OF THE CLINICAL STANDARDS

This consensus-based document aims to describe the following activities:

1) Assessing patients at the end of TB treatment for sequelae and PTLD (Standard 1). A universal standard was defined, with special considerations for children and possible adaptation in different settings and situations (for organisational, legal or economic reasons).
2) Identifying patients with PTLD for pulmonary rehabilitation (PR) (Standard 2).
3) Adapting the PR programme for specific patient needs and different settings (Standard 3).
4) Evaluating the effectiveness of PR and follow-up (Standard 4).
5) Education and counselling for a patient (Standard 5) to help manage their condition.
6) A public health standard highlighting the need to record changes in patient outcome resulting from PR (Standard 6).
7) Priorities for future research into PTLD.

5 clinical standards

+

1 public health standard

Priorities for future research

Standard 1

STANDARD 1

Every patient completing TB treatment should be clinically evaluated for PTLD. The assessment should be conducted as soon as possible at the end of treatment and organised by the TB programme. In special settings and situations, post-TB treatment evaluation can be simplified and/or modified to include a set of basic examinations with the aim to identify patients with sequelae at risk of deterioration (or even death) and those likely to benefit from PR. The following set of basic examinations is considered essential upon clinical suspicion of either the presence of, or risk factors for, PTLD: clinical examination/history, CXR, PFT, six-minute walking test (6MWT), complemented by symptom score and QoL questionnaire evaluation. Other examinations are considered conditional.

- Clinical evaluation, end of Tx
- Special settings and situations
- Set of essential examinations:
  - Clinical/history
  - CXR
  - PFT
  - 6MWT
  - Symptom score
  - QoL questionnaire

Table 1 Standard 1: Recommended examinations to be conducted at the end of treatment and in special settings and situations because of legal, organisational or economic reasons

Essential and conditional examinations/investigations		Adaption for special settings and situations
Clinical assessment	• Clinical history, symptom assessment and clinical examination	• Clinical history, symptom assessment and clinical examination
Imaging	• Chest radiography (digital) • Computed tomography	• Chest radiography
Functional evaluation	• Spirometry, including pre- and post-bronchodilator test • Plethysmography • Diffusion capacity assessment (DLCO, KCO) • Tidal breathing techniques (oscillometry/MBW) • Arterial blood gas analysis, and pulse oximetry (SpO_2) • 6MWT • CPET	• Spirometry • SpO_2 • 6MWT
Subjective evaluation	• QoL questionnaire • Frequent symptoms score	• QoL questionnaire • Frequent symptoms score

DLCO = diffusing capacity of the lungs for carbon monoxide; KCO = carbon monoxide transfer coefficient; MBW = multiple breath washout; SpO_2 = peripheral capillary oxygen saturation; 6MWT = six-minute walking test; CPET = cardiopulmonary exercise testing; QoL = quality of life.

Standard 2

STANDARD 2

Evaluation for PR. Former TB patients with clinical and radiological signs and symptoms consistent with post-TB treatment sequelae, evidence of obstruction and/or restriction, desaturations and/or low oxygen levels, reduced exercise tolerance and related impairment in quality of life should be evaluated for PR.

This is a newly conceptualized Standard which aligns PTLD with other chronic respiratory diseases (COPD, Asthma)

Table 2 Standard 2: Indications for pulmonary rehabilitation[69–84]

Indications	Essential and conditional examinations/investigations	Adaption to special settings and situations
Pulmonary rehabilitation should be evaluated in all cases of TB cured (smear- or culture-negative in the last month) and TB treatment completed with:		
Impaired exercise capacity[32,56,69,70]	• Cardiopulmonary exercise test and/or • Six-minute walking test and/or • Five repetition sit to stand test and/or • Maximal voluntary contraction	• Six-minute walking test and/or • Five repetition sit to stand test
Reported respiratory symptoms (dyspnoea, cough, sputum, wheeze, chest pain, fatigue)[71–74]	• Modified Medical Research Council • Modified Borg Scale • Visual Analogue Scale	• Modified Medical Research Council • Modified Borg Scale • Visual Analogue Scale
Presence of comorbid conditions, including chronic obstructive pulmonary disease, asthma, bronchiectasis, pulmonary fibrosis, pulmonary hypertension, and/or need for surgery[12,13,75]	• Clinical history • Diagnostic test or examinations	• Clinical history • Diagnostic test or examinations
At least 1 hospitalisation or 2 exacerbations in the last 12 months[11,32,76,77]	• Clinical history	• Clinical history
Impaired pulmonary function showing airflow obstruction or restriction or mixed abnormalities and bronchodilator response and/or impaired diffusing capacity for carbon monoxide[78]	• Spirometry with plethysmography, if available • Diffusing capacity for carbon monoxide	• Spirometry
Abnormal blood gas PaO_2 <80 mmHg/10.6 kPa and/or $PaCO_2$ >45 mmHg/6.0 kPa and/or nocturnal and exercise-induced desaturation[79]	• Blood gas analysis and/or • Pulse oximetry	• Pulse oximetry
Ineffective cough and/or difficult to clear bronchial secretions[80,81]	• Clinical examination and/or • Lung function tests (reduction of vital capacity <1.5 L and/or reduction of peak cough flow <160–200 L/min and/or reduction of maximal inspiratory pressure and/or reduction of maximal expiratory pressure)	• Clinical examination
Impaired quality of life[82–84]	• TB-specific questionnaire: EUROHIS-QOL 8 ≤16 • Disease specific questionnaire: SGRQ >25 • Generic questionnaire WHOQOL-BREF <60 (subjects aged ≥60)	• TB-specific questionnaire: EUROHIS-QOL 8 ≤16 • Disease-specific questionnaire: SGRQ >25 • Generic questionnaire WHOQOL-BREF <60 (subjects aged ≥60 years)

EUROHIS-QOL = European Health Interview Survey-Quality of Life; SGRQ = St George's Respiratory Questionnaire; WHOQOL-BREF = abbreviated World Health Organization Quality of Life.

Standard 3

STANDARD 3

The PR programme should be organised according to feasibility, effectiveness and cost-effectiveness criteria, based on the local organisation of health services and tailored to the individual patient's needs.

- Evidence PR is effective
- Simplified programmes with no need of major capital outlay exist

Table 3 Standard 3: Summary of the core components of a rehabilitation programme[100–109]

Components	Indication	Methods: Interventions	Methods: Adaption to special setting and situations
Aerobic exercise: endurance training	Impaired exercise capacity, limited by dyspnoea and or other respiratory symptoms Restriction in daily life activities.[11,32]	• Treadmill and/or cycle-ergometer • 30 min 2–5 times/week for 4–8 weeks • Intensity set according to maximal oxygen consumption or the equation of Luxton or 80% of heart rate max adjusted on dyspnoea • In or out-patients or tele-monitoring • Suggest maintenance programme	• Free walking • 30 min 2–5 times/week for 4–8 weeks • Intensity set according to perceived dyspnoea • Outpatients or home setting • Suggest maintenance programme
Strength training: upper and lower extremities (limited evidence on TB)	Reduced muscle mass and strength of peripheral muscles. Lower muscle weakness with risk for falls. Impaired activities of daily living involving the upper extremities (including dressing, bathing, and household tasks)[11]	• Free weights (dumbbells and ankle-brace) • 20–30 min 2–5 times/week for 4–8 weeks • 2–3 set of 6–12 repetitions • Intensity set to 80% of maximal voluntary contraction and/or adjusted on muscles fatigue • In or out-patients or tele-monitoring • Suggest maintenance programme	• Free weights (dumbbells and ankle-brace) • 20–30 min 2–5 times/week for 4–8 weeks • 2–3 set of 6–12 repetitions • Intensity set according to perceived muscles fatigue • Out-patients or home setting • Suggest maintenance programme
Inspiratory muscle training (limited evidence on TB)	Impaired respiratory muscle function, altered respiratory mechanics, decreased chest wall compliance or pulmonary hyperinflation[100]	• Load threshold devices, seated and using a nose clip • Interval training: 10 exercises followed by 10 seconds break between each. • 15–20 min 2–5 times/week for 4–8 weeks • Loads from 30% to 80% of maximal inspiratory pressure	Not applicable
Airway clearance techniques	Difficult to remove secretions or mucous plugs Frequent bronchial exacerbations (≥2/year) Concomitant diagnosis of bronchiectasis[101]	• Choose the technique suitable for the subject among those available, based on respiratory capacity, mucus rheology, collaboration and patient preferences • 15–30 min one or more times/day • Choose the duration of treatment based on chronic (long term) or acute problem (short term) • Suggest maintenance programme when needed	• Choose the technique suitable for the subject among those available, based on respiratory capacity, mucus rheology, collaboration and patient preferences • 15–30 min one or more times/day choose the duration of treatment based on chronic (long term) or acute problem (short term) • Suggest maintenance programme when needed
Long-term oxygen therapy (limited evidence on TB)	Resting hypoxaemia despite stable condition and optimal medical therapy (partial pressure of oxygen <7.3 kPa (<55 mmHg) or ≤8 kPa (≤60 mmHg) with evidence of peripheral oedema, polycythaemia (haematocrit ≥55%) or pulmonary hypertension)[102,103]	• Titrate oxygen flow that maintain oxygen saturation >92–93% • Long-term oxygen therapy should be initiated on a flow rate of 1 L/min and titrated up in 1 L/min increments until oxygen saturation >90%. An arterial blood gas analysis should then be performed to confirm that a target partial pressure of oxygen ≥8 kPa (60 mm Hg) at rest has been achieved • Ambulatory and nocturnal oximetry may be performed to allow more accurate flow rates to be ordered for exercise and sleep, respectively during rest, sleep and exertion • Provide formal education to patients referred to home • Schedule periodic re-assessment at 3 months	• Titrate oxygen flow that maintain oxygen saturation >92–93% • Long term oxygen therapy should be initiated on a flow rate of 1 L/min and titrated up in 1 L/min increments until oxygen saturation >90% at rest has been achieved • Non-hypercapnic patients initiated on long term oxygen therapy should increase their flow rate by 1 L/min during sleep in the absence of any contraindications • Ambulatory oximetry may be performed to allow more accurate flow rates to be ordered for exercise • Provide formal education to patients referred to home • Schedule periodic re-assessment at 3 months

Part 1

- Aerobic exercise, endurance training
- Strength training upper and lower extremities
- Inspiratory muscle training
- Airway clearance techniques
- LTOT

Table 3 *(continued)*

Components	Indication	Methods: Interventions	Methods: Adaption to special setting and situations
Long-term nocturnal non-invasive mechanical ventilation (limited evidence on TB)	Chronic stable hypercapnia (partial pressure of carbon dioxide >6–8 kPa (45–60 mmHg)), despite optimal medical therapy Non-invasive ventilation could be applied during aerobic training in case of severe breathlessness or reduced exercise resistance[91,104]	• Not initiating long-term non-invasive ventilation during admission for acute on-chronic hypercapnic respiratory failure, favouring reassessment at 2–4 weeks after resolution • Titrate non-invasive ventilation setting • Titrate mask • Plan education • Consider non-invasive ventilation during exercise • Schedule an educational meeting and verifies the ability of the subject and/or a caregiver to manage the non-invasive ventilation at home	Probably not applicable
Nutritional support	Malnutrition (body mass index <16 kg/m^2 or body mass index <17 kg/m^2 in patients with TB-HIV, MDR-TB, or pregnant and lactating mothers)[105–107]	• Nutritional assessment • Tailored treatment from foods and medical supplements • Need for financial incentives, and transportation access should be evaluated	• Nutritional assessment • Tailored treatment from foods and medical supplements • Need for financial incentives, and transportation access should be evaluated
Psychological support	Social isolation, depression and anxiety. Impaired health status and/or quality of life despite optimal pharmacological treatment. Low adherence to medical treatment[108,109]	• Psychological assessment • Psychological support • Consider self-help group	• Psychological assessment • Psychological support • Consider self-help group

MDR-TB = multidrug-resistant TB.

Part 2

- Ventilation (non-invasive)
- Nutritional support
- Psychological support

Standard 4

STANDARD 4

Evaluating the effectiveness of PR for former TB patients. The standard includes a short description on how to evaluate the effectiveness of PR by comparing the core variables before and after rehabilitation. The standard also suggests how to organise follow-up for the patient.

- Evaluation of PR effectiveness
- Core variables to use for the post-vs. pre- PR comparison
- Follow-up to mantain the results achieved

Table 4 Standard 4: Evaluation of pulmonary rehabilitation effectiveness

		Type of measure	
	Outcomes	Essential and conditional examinations/investigations	Adaption to special setting and situations
Functional	Lung function	• Spirometry (FEV_1, FVC, FEV_1/FVC) • Plethysmography	• Spirometry (FEV_1, FVC, FEV_1/FVC)
	Gas transfer	• PaO_2, • $PaCO_2$ • Pulse oximetry (SpO_2, % desaturation) • DLCO, KCO	• Pulse oximetry (SpO_2, % desaturation)
	Exercise capacity	• 6MWT • VO_{2max} • ISWT • 5STS	• 6MWT • 5STS
TB-specific	Health-related quality of life	• EUROHIS-QOL 8 • SGRQ • WHOQOL-BREF • Paediatric: EQ-5D-Y and TANDI	• EUROHIS-QOL 8 • SGRQ • WHOQOL-BREF • paediatric: EQ-5D-Y and TANDI
	Self-reported symptoms	• mMRC • VAS • Modified Borg	• mMRC • VAS • Modified Borg
Generic	Acute infectious exacerbations (e.g., in bronchiectasis) requiring antibiotic and/or steroid treatment	Number of episodes	Number of episodes
	Hospitalisation	Number of episodes/hospital days	Number of episodes/hospital days
	Mortality (see Standard 6)	Number of deaths	Number of deaths

FEV_1 = forced expiratory volume in the first second; FVC = forced vital capacity; PaO_2 = partial pressure of arterial oxygen; $PaCO_2$ = partial pressure of arterial carbon dioxide; SpO_2 = peripheral capillary oxygen saturation; DLCO = diffusing capacity of the lungs for carbon monoxide; KCO = carbon monoxide transfer coefficient; 6MWT =six-minute walking test; ISWT = incremental shuttle walk test; 5STS = 5 repetitions of sit to stand test; VO_{2max} = maximal oxygen consumption; EUROHIS-QOL = EUROHIS-QOL = European Health Interview Survey-Quality of Life; SGRQ = St George's Respiratory Questionnaire; WHOQOL-BREF = abbreviated World Health Organization Quality of Life; TANDI = Toddler and Infant; mMRC = modified Medical Research Council; VAS = Visual Analogue Scale.

Standard 5

STANDARD 5

Each patient completing PR should undergo counselling/health education, including a follow-up plan to maintain/improve the results achieved, organised according to feasibility and cost-effectiveness criteria, based on the local organisation of health services and tailored to the individual patient's needs.

- Central role of councelling/ health education..
- …to mantain the results achieved

Table 6 Standard 5: Summary of the components of the counselling/health education session

Components:

- Structured and comprehensive educational programmes are an integral and essential component of the management of PTLD and pulmonary rehabilitation
- Educational programmes should be age-specific, gender-sensitive, delivered in the local language and extended to families/households
- Education should be delivered by professionals who are competent in the relevant subject areas and trained to deliver educational sessions
- Educational materials and technological support used to deliver them needs to be evaluated in the setting-specific context

Recommended topics:

- Basic principles of TB: epidemiology, clinical aspects and transmission (reinforcing what is ideally provided at diagnosis)
- Importance of treatment (and treatment adherence/retention in care) to stop transmission, protect contacts and prevent relapses
- Simple concepts of infection control and safety procedures
- Advantages/importance of smoking cessation and risk of comorbidities (e.g., HIV co-infection, diabetes, etc.) in household/families
- Importance of physical activity and exercise to improve quality of life
- Maintaining results achieved with pulmonary rehabilitation (follow-up plan)
- Ensuring adequate nutrition
- Importance of adhering to medical prescriptions in terms of management of comorbidities and vaccinations
- Recognising deterioration of clinical conditions and what actions to undertake to prevent relapse
- Achieving an optimal healthy life style

PTLD = post-TB lung disease.

- Components
- Topics

Table 5 Recommended examinations during anti-TB treatment and post-treatment follow-up

Time point/ assessment	M0*	M2/3*†	EOT*	M3† after EOT	M6‡ after EOT	M12¶ after EOT	Rationale	Comments
Microbiological examination of sputum (culture, microscopy or Xpert/NAAT)	x	x	x	(x)	(x)	(x)	Microbiological status before treatment initiation Monitoring treatment response and recurrent TB Determination of (microbiological) TB treatment outcome	Integrated in WHO or NTP guidelines
Clinical examination, including BMI	x	(x)	x	x	x	x	Identification of (potential) permanent TB sequelae and adverse effects of TB treatment Establish status quo at EOT to observe trend over time	Suggested use of a checklist to monitor for adverse drug events
Respiratory history and status of comorbidities (HIV infection, diabetes mellitus, COPD, CVD, nutrition status, cigarette smoking)	x		x	(x)	x	x	Identification and evaluation of potential risk factors that may have an influence on the prognosis and the management of PTLD Planning for interventions and education program Observing trend over time	Depending on the setting this should also include history such as vaccination status, exposure to silica and biomass fuel, investigations such as serology for hepatitis B/C, Sars-CoV-2, aspergillosis, nutritional status associated conditions such as anaemia
Chest radiography	x		x		(x)		Establish dimension of (permanent) pulmonary destruction before and after TB treatment Status quo at EOT to compare with future chest X-rays, e.g., assessment of respiratory exacerbations or recurrent TB Presence of cavities may increase risk of TB relapse and more severe PTLD sequelae	If available, digital radiography should be performed due to advantages regarding expert analysis, remote reading, automated analysis and data storage
Spirometry/ (plethysmography)	pre-TB	(x)	x	x	x	x	Capture lung function results before TB treatment, where available Establish status quo at EOT to compare with future spirometry testing Identification of subjects for rehabilitation	ERS/ATS guidelines should be followed Adequate reference standards should be used for result interpretation Appropriate equipment, including maintenance of equipment needed Body-plethysmography, only for research purpose or in specific patients and settings
Computed tomography			(x)		(x)		Allows a more refined investigation of pulmonary structures and pathologies, e.g., bronchiectasis, fibrosis, aspergillosis of the lung Presence of cavities may increase risk of TB relapse and more severe PTLD sequelae	Recommended in symptomatic patients or in patients with TB-related abnormalities, which cannot be well investigated on chest radiography
6MWT	pre-TB		x	x	x	x	Establish physical exercise capacity (before –if available- and) after TB treatment Status quo at EOT to compare with future 6MWTs Identification of subjects, who may potentially benefit from rehabilitation	Very useful to observe trend over time May be additionally indicated after recovery of exacerbated patients Validated for other respiratory conditions including prognosis evaluation

* x = all centres; (x) = research-oriented centres

† Optional evaluation during TB treatment

M = month; EOT = end of treatment for TB;

- Microbiological examinations
- Clinical examinations
- CXR/imaging
- 6MWT

Table 5 (*continued*)

Time point/ assessment	M0*	M2/3*†	EOT*	M3† after EOT	M6‡ after EOT	M12¶ after EOT	Rationale	Comments
SpO_2	(x)		x	x	x	x	Severity staging of respiratory failure Evaluation of nocturnal and/or exercise-associated oxygen desaturation Information for the indication of LTOT May be helpful for evaluation of patients with acute exacerbations	Integrated part of 6MWT Less accurate than BGA
BGA			(x)		(x)	(x)	Diagnosis and severity staging of respiratory failure Information for the indication of LTOT	Only for research purpose or in specific patients and settings More accurate and provides more information compared to SpO_2 Metabolic disturbance diagnosis Appropriate equipment, including maintenance of equipment needed
DLCO, KCO			(x)		(x)	(x)	To assess CO-diffusion capacity and identify the underlying cause of impaired lung gas-exchange	Only for research purpose or in specific patients and settings Useful for consideration of pulmonary hypertension and other causes of dyspnoea Appropriate equipment, including maintenance of equipment needed
Tidal breathing techniques (oscillometry/ MBW)	(x)	(x)	(x)	(x)	(x)	(x)	Assessment of small airways and of ventilation heterogeneity seen in complex structural lung disease	Only for research purpose or in specific patients and settings Oscillometry easy to perform in children and other patients, who cannot perform spirometry
QoL questionnaire (including dyspnoea score)	(x)	(x)	x	x	x	x	Establish the severity of respiratory symptoms and quality of life impairment after TB treatment Status quo to compare with future evaluations Identification of subjects with potential benefit from rehabilitation	Depending on the context and educational level, validated scales and questionnaires suitable for the patient should be chosen
ECG			(x)		(x)	(x)	Supports diagnosis of secondary cardiac damage due to chronic lung diseases, including PTLD Differential diagnosis between primary and secondary cardiac diseases	Only for research purpose or in specific patients and settings
Cardiac-ultrasound (echo)			(x)		(x)	(x)	Allows diagnosis of secondary conditions due to TB or PTLD such as constrictive pericarditis, pulmonary hypertension, right heart failure Differential diagnosis between primary and secondary cardiac disease	Only for research purpose or in specific patients and settings Could be complemented by measurement of NT-pro-BNP to rule out heart failure

- BGA, SpO_2
- Tidal breathing
- QoL questionnaires
- ECG
- Other cardiologic examinations

Standard 6

STANDARD 6 (PUBLIC HEALTH)

Each change in outcome for a patient (cured or treatment completed as per WHO guidelines) occurring during or after PR should be promptly notified to public health services and be included in the TB register. If the TB register/surveillance database allows, for research purposes the results of the PR programme should be recorded and updated over time. Patients with permanent sequelae and disability need to be supported by social protection schemes whenever possible, according to the legal framework in place.

- Notify change of status
- Need of social protection schemes for patients with PTLD

Research priorities

Table 7 Research priorities

	Research priority	Type of studies
1)	To describe the frequency and severity of PTLD in different populations and subgroups of TB patients over time since the completion of TB treatment, including in children and adolescents	Cross-sectional studies, cohort studies
2)	To establish risk factors for severe PTLD and associated poor health outcomes, including elevated mortality	Cohort studies (case-control studies)
3)	To quantify the health and economic impact of PTLD at the individual and population level, including the impact of managing PTLD on health systems	Health economic/mathematical modelling studies
4)	To identify feasible, accurate and cost-effective tools to evaluate patients at the end of TB treatment for their risk of PTLD and subsequent poor health outcomes (Standard 1)	Diagnostic accuracy studies, diagnostic randomised-controlled trials
5)	To develop optimal approaches and algorithms to diagnose and manage PTLD, and to discriminate between PTLD and recurrent TB (Standards 1, 2)	Diagnostic accuracy studies, diagnostic randomised-controlled trials
6)	To identify effective and cost-effective strategies to prevent PTLD during anti-TB treatment, including, for example, adjuvant therapies and interventions to reduce concomitant risk factors for poor lung health outcomes (e.g., smoking cessation programmes)	Randomised-controlled trials
7)	To identify effective and cost-effective strategies to deliver pulmonary rehabilitation in specific sub-groups (using standard measures of minimum clinically important difference), including individual patient follow-up in different settings and populations (Standards 2–5)	Randomised-controlled trials
8)	To investigate the role of patient education programmes in improving long-term health outcomes post-TB (Standard 5)	Randomised-controlled trials
9)	To investigate the role of social protection and support programmes in improving health outcomes and quality of life among former TB patients (Standard 6)	Randomised-controlled trials
10)	To identify a set of standard indicators for the surveillance of PTLD that are feasible to implement within national TB programmes (Standard 6)	Operational research studies

PTLD = post-TB lung disease.

Conclusions

- This document is a pioneer in defining how to approach clinically the patient with TB sequelae and follow him/her during the rehabilitation and the mantainance phase;
- Guidance is provided on how to conduct councelling and health education
- Evidence in several areas is still initial, and therefore quality studies are needed to shed light in some areas
- The document offer a perspective on future research priorities

We need your help!!

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The first four IJTLD Clinical Standards for Lung Health are available as Open Access articles.

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Conclusions: summary

- TB still public health priority, 7 years ‘lost’ because of COVID-19
- Large number of prevalent TB cases, large number of PTLD
- All main WHO guidelines revised in 2022, **not yet official recommendations on PTLD**
- Clinical Standards series available in the IJTLD (Clinical), the first on PTLD. High interest and highly cited.
- They will be updated every 2-years based on the evidence available

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CLINICAL STANDARDS FOR LUNG HEALTH

Clinical standards for diagnosis, treatment and prevention of post-COVID-19 lung disease

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RESULTS: Four clinical standards were agreed: Standard-1, assess patients with unexplained COVID-19 sequelae for post-COVID-19 disease (minimally including a set of core examinations) identifying those likely to benefit from pulmonary rehabilitation (PR); Standard-2, evaluate patients with clinically objective and/or subjective reduced quality-of-life (QoL) for treatment and PR; Standard-3, PR is organized according to feasibility, effectiveness and cost-effectiveness criteria, based on local health service organisation and tailored to the individual patient's needs and standard 4 evaluate the effectiveness of PR comparing core variables pre- and post-rehabilitation, also enable access to counselling/health education sessions.

CONCLUSION: This is the first consensus-based set of Clinical Standards for diagnosis, treatment and prevention of post-COVID-19 lung disease. Our aim is to improve patient care and QoL by guiding clinicians, programme managers and public health officers in planning and implementing adequate measures to assess and manage post-COVID-19 lung disease.

To be together is the beginning
To remain together is a progress
To work together is a result

Henry Ford

Thank you very much!!