糖尿病在結核病防治上之重要性

李品慧 醫師
疾病管制署 慢性傳染病組
107年結核病與系統性共病之臨床處置
2018.7.17

44 y/o M...

- Chief complaints: cough for at least one month
- History of smoking and alcoholic consumption
- Occupation: 機械工
- 2003/9
  - AFB smear +ve, TB culture +ve, Chest X-ray: multiple patches in L’ t lung
- newly diagnosed diabetes in 2003, with OHA control
- 2003/10
  - initiating anit-TB Tx with 1st line drugs;
  - BW: 62.2 Kg, BMI: 22.8
- Drug susceptibility testing (DST): resistant to H, R, E, SM

MDR-TB!

Course of MDR-TB treatment

- 2004/1-3: 離開原先治療TB的醫院轉到另一醫學中心就診
- 2004/4: initiating 2nd line drugs(SLD) for MDR-TB treatment
- Sputum TB culture conversion: 10th month after SLDs treatment
- 2005/12: completion of anti-TB treatment; 完治體重：78 Kg, BMI 23.6
- 2008/4: Relapse, and chest X-ray showed multiple patches in RUL, LUL and LLL (DST: MDR-TB)

Double troubles of DM-TB management

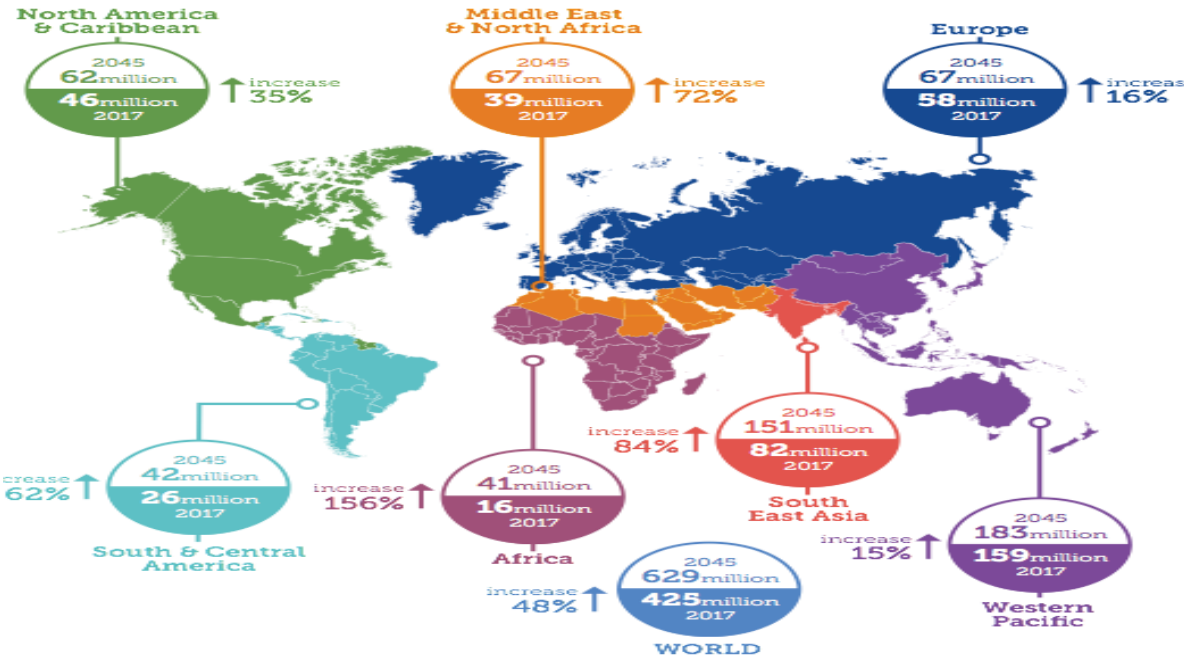
Glycemic control

MDR-TB

Date	OHA regimen	HbA1c	plasma glucose (mg/dL)
2003/10/7	Metformin	10.2	AC: 138 PC: 487
2004/2/27	Amaryl + Metformin		one touch: >300
2005/11/23	Amaryl + Metformin		AC: 137
2006/6/1	Metformin + Acarbose + Repaglinide	14.2	
2006/10/31	Metformin + Acarbose + Gliclazide	7.9	

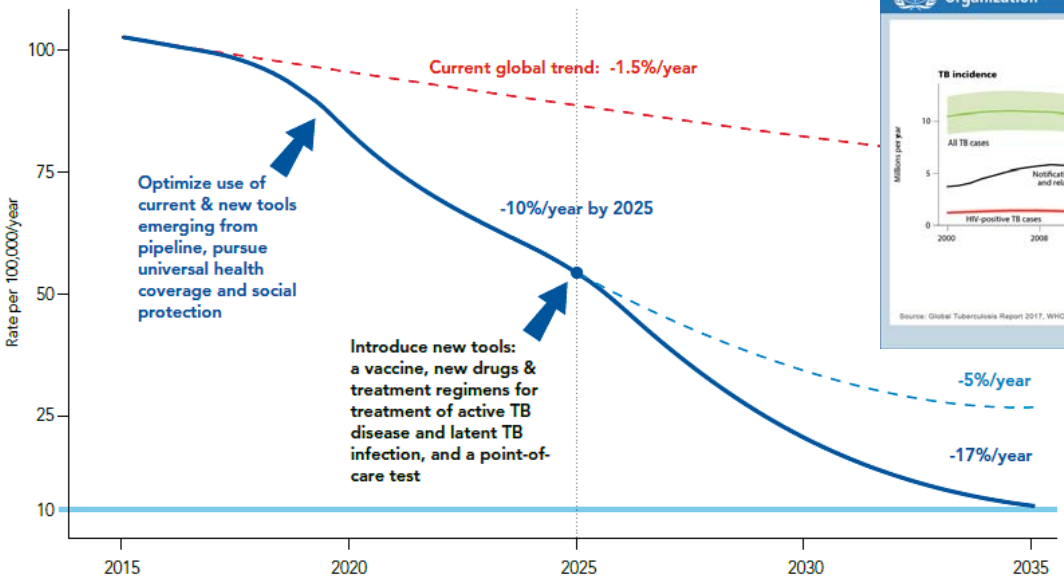
DM-TB: colliding epidemic

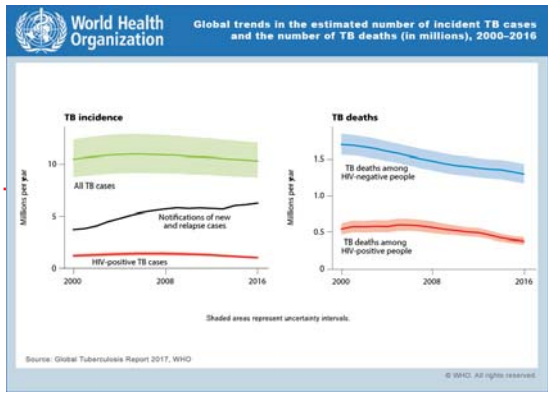
Number of people with diabetes in 2017 and 2045 (aged 20-79 years)



IDF DIABETES ATLAS, 8th edition 2017

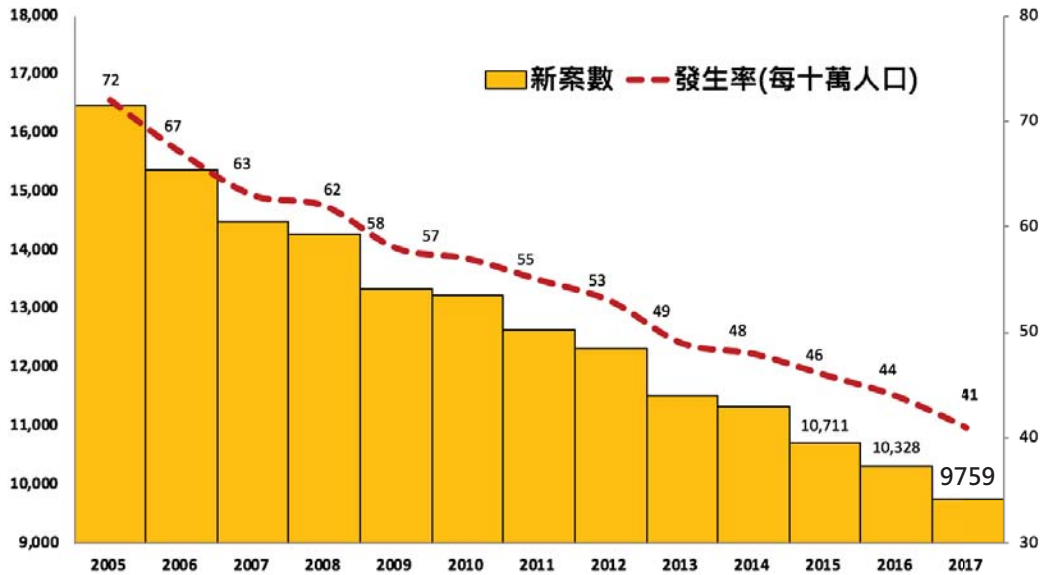
Projected decline of global TB incidence with optimizing current tools combined with progress towards universal health coverage and social protection





WHO: the end TB strategy
http://www.who.int/tb/strategy/end-tb/en/

台灣結核病發生率(本國籍新案)



Taiwan

Taiwan is one of the 22 countries and territories of the IDF WP region. 425 million people have diabetes in the world and 159 million people in the WP Region; by 2045 this will rise to 183 million. There were over 1,9 million cases of diabetes in Taiwan in 2017.

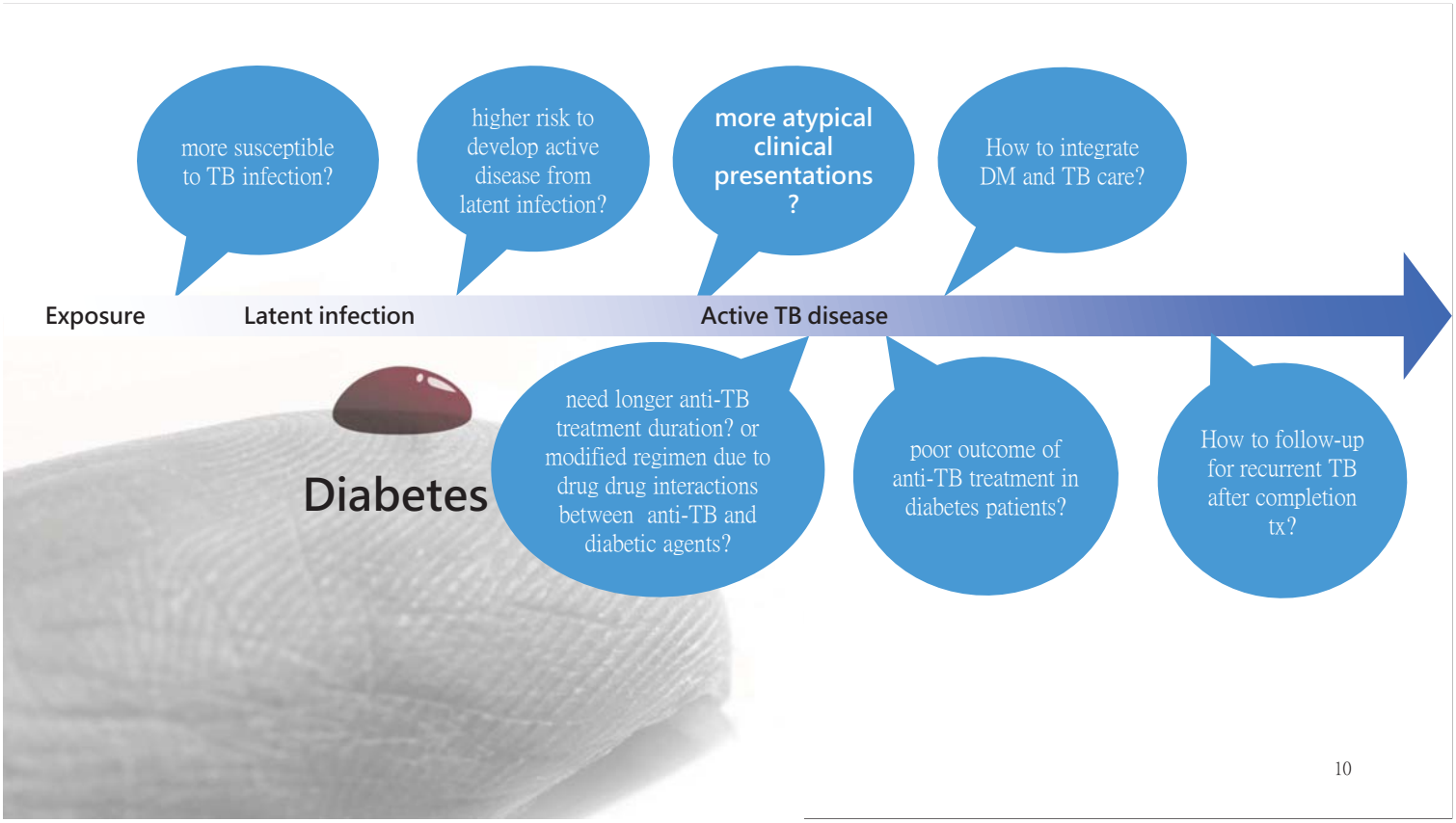
Total adult population : 18,017
Prevalence of diabetes in adults : 10.9
Total cases of diabetes in adults : 1,958.0

依據結核病通報與健保資料庫勾稽，
22.6%的結核病人有符合糖尿病診斷之ICD-9-CM

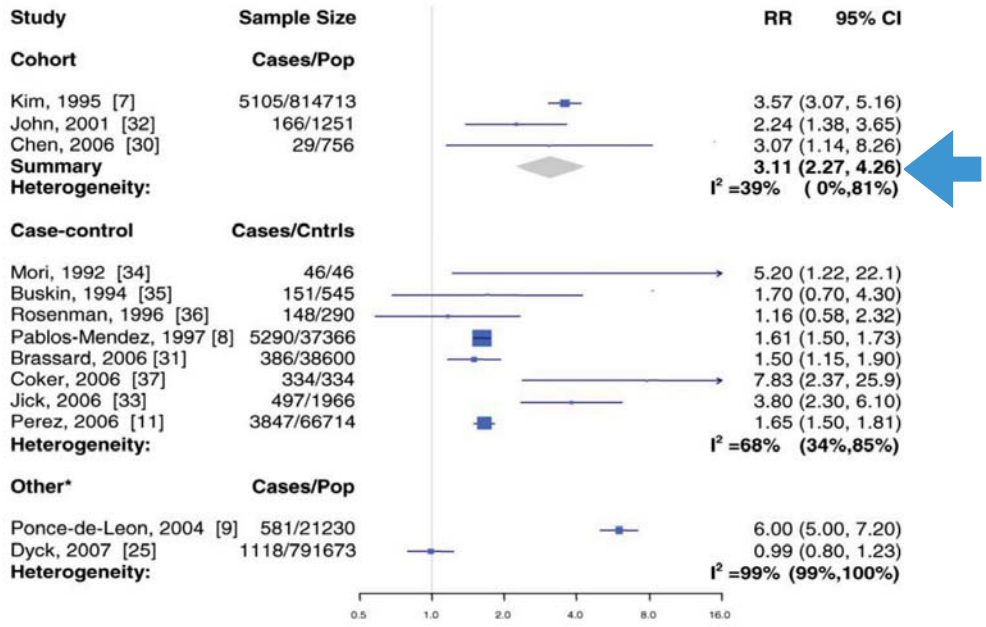
Table 3. Cases Comorbidities Distribution (N = 33 851)

Variable	Total	Percentage	<65 Years (n = 16 832) n	%	≥65 Years (n = 17 019) n	%	All Causes of Death (n = 5584) n	%	P
Total (any one of comorbid diseases[a])									<.001
No	14 225	42.0	9715	57.7	4510	26.5	970	17.4	
Yes	19 626	58.0	7117	42.3	12 509	73.5	4614	82.6	
COPD									<.001
No	25 877	76.4	14 511	86.2	11 366	66.8	3894	69.7	
Yes	7974	23.6	2321	13.8	5653	33.2	1690	30.3	
DM									<.001
No	26 214	77.4	13 792	81.9	12 422	73.0	3939	70.5	
Yes	7637	22.6	3040	18.1	4597	27.0	1645	29.5	
Cancer									<.001
No	29 312	86.6	15 368	91.3	13 944	81.9	4133	74.0	
Yes	4539	13.4	1464	8.7	3075	18.1	1451	26.0	
Stroke									<.001
No	29 593	87.4	16 227	96.4	13 366	78.5	3972	71.1	
Yes	4258	12.6	605	3.6	3653	21.5	1612	28.9	
Chronic liver disease and cirrhosis									<.001
No	31 117	91.9	15 385	91.4	15 732	92.4	4938	88.4	
Yes	2734	8.1	1447	8.6	1287	7.6	646	11.6	
Chronic kidney disease									<.001
No	32 089	94.8	16 104	95.7	14 983	88.0	4863	87.1	
Yes	1762	5.2	728	4.3	2036	12.0	721	12.9	
HIV									.84
No	33 687	99.5	16 674	99.1	17 013	99.96	5556	99.5	
Yes	164	0.5	158	0.9	6	0.04	28	0.5	

Lo et al, Asia Pac J Public Health. 2011 Dec 23
https://www.idf.org/our-network/regions-members/western-pacific/members/114-taiwan.html



Diabetes and Risk of Active TB Disease



Jeon et al, PLoS Med 2008

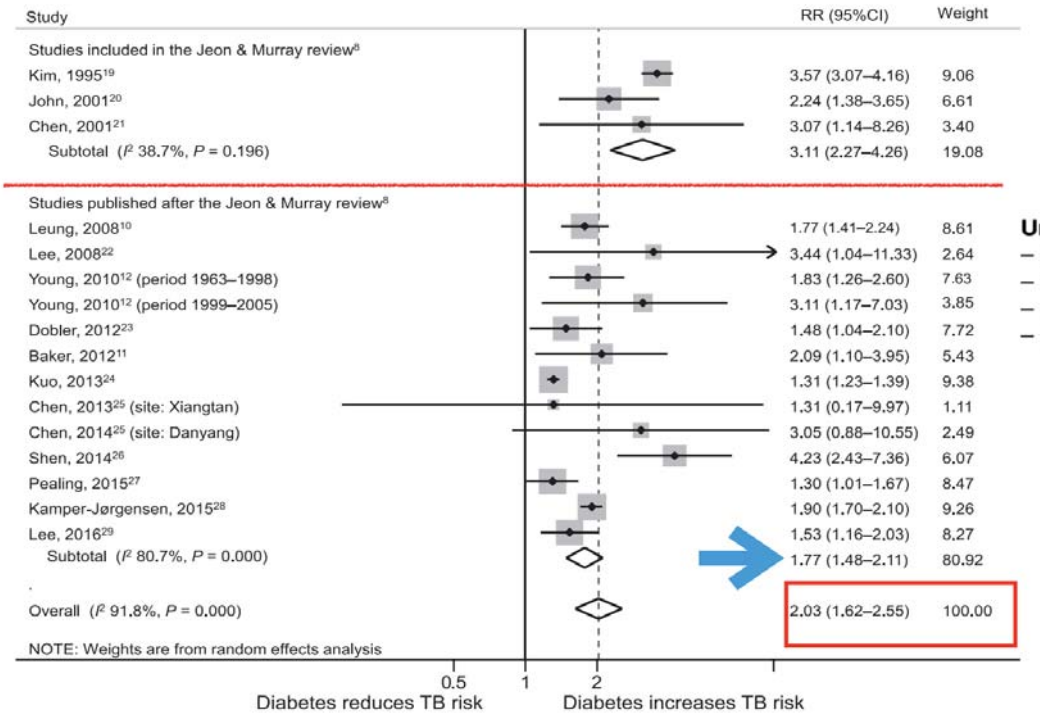
Table Summary of the cohort studies published since 2008 on the association between DM and TB

Study	Country	Population	Background TB incidence*	Study period	Definition of DM
Kim, 1995[19]	Korea	Civil servants health examination cohort	>100	1988–1990	Fasting blood sugar ⩾150 mg/dl, and post-prandial sugar ⩾180 mg/dl
John, 2001[20]	India	Renal transplant recipient cohort	>100	1986–1999	Fasting blood sugar >120 mg/dl, and 2-h post-prandial sugar >200 mg/dl
Chen, 2006[21]	Taiwan	Renal transplant recipient cohort	10–100	1983–2003	Record of DM
Leung, 2008[10]	Hong Kong	Community-based for those aged ⩾65 years	10–100	2000–2005	Fasting plasma glucose ⩾7.0 mmol/l
Lee, 2008[22]	Hong Kong	Close contacts	10–100	2000–2005	Self-report
Young, 2010[12]	UK	Oxford Record Linkage Study data sets	10–100	1963–2005	Record of DM
Dobler, 2012[23]	Australia	National general population historical cohort	<10	2001–2006	National Diabetes Services Scheme: DM care including glucose testing, or using anti-DM drugs
Baker, 2012[11]	Taiwan	Population-based cohort sampling from national health interview survey	10–100	2001–2004	Self-report or diagnostic code or pharmacy code for DM treatment
Kuo, 2013[24]	Taiwan	Type 2 DM cohort from the National Health Insurance claims database	10–100	2000–2011	Diagnostic code of ICD-9-CM
Chen, 2013[25†]	China	Community-based cohort in Xiangtan	>100	2009–2011	Self-report
Chen, 2013[25†]	China	Community-based cohort in Danyang	10–100	2009–2011	Self-report
Shen, 2014[26]	Taiwan	Type 1 DM cohort from the National Health Insurance claims database	10–100	2002–2011	Diagnostic code of ICD-9-CM
Pealing, 2015[27]	UK	Clinical Practice Research Datalink	10–100	1990–2013	Diagnostic read codes
Kamper-Jørgensen, 2015[28]	Denmark	National population	<10	1995–2009	National Diabetes Register based on blood glucose testing, foot treatment or purchase of anti-DM drugs
Lee, 2016[29]	Taiwan	Community-based for those aged ⩾30 years	10–100	2005–2012	Fasting plasma glucose ⩾126 mg/dl or using hypoglycemic agents

studies after 2008

* Per 100 000 population per year.
† This study was conducted at two study sites with different background TB incidence.
DM = diabetes mellitus; TB = tuberculosis; ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification.

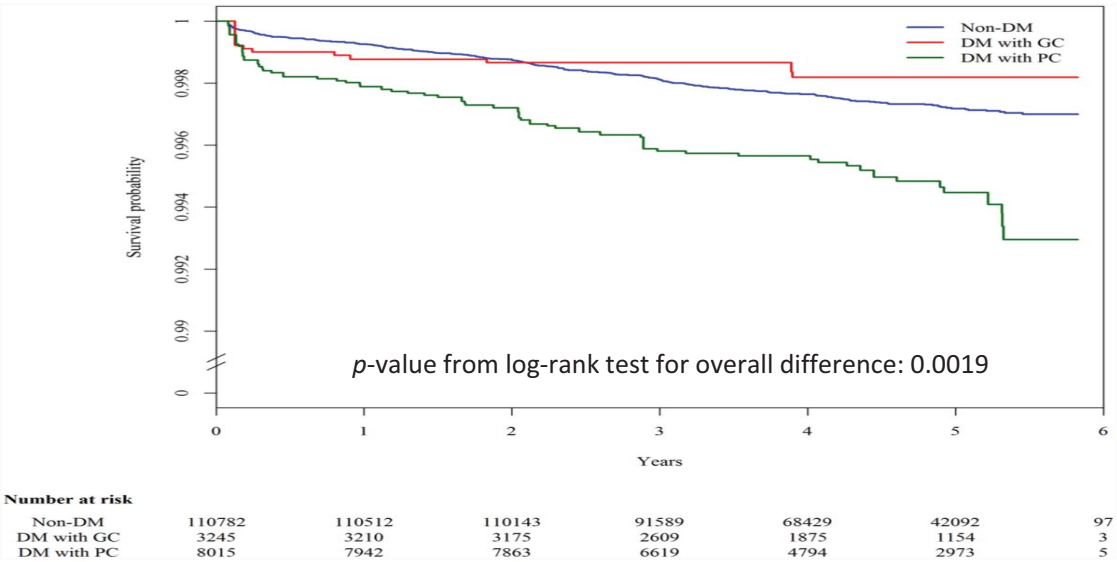
Lee et al, IJTLD 2018



Unmeasured confounders
- **Age**
- **BMI**
- **anti-diabetic agents**
- **glycemic control**

Lee et al, IJTLD 2018

Kaplan-Meier plot of tuberculosis-free survival by diabetes mellitus and glycemic control status, adjusted for age



poor glycemic control (FPG>130 mg/dL)

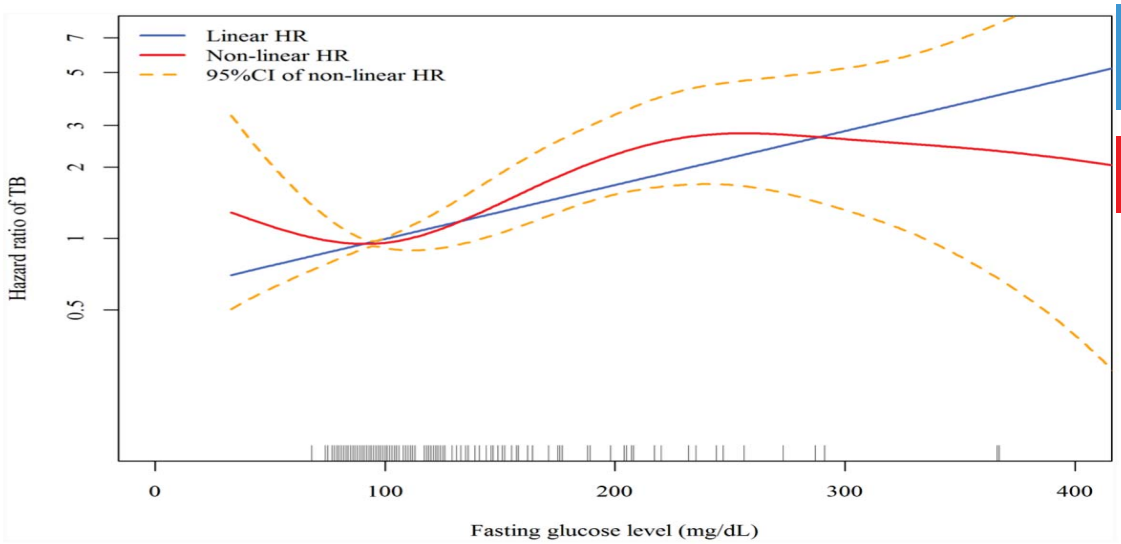
Lee et al, PLoS Med. 2016

Results from Cox proportional hazards regression model for association between diabetes status, glycemic control, and risk of TB

	No. of cases	Person-year	Age-adjusted model		Multivariable-adjusted model	
			aHR (95% CI)	*p*-value	aHR (95% CI)	*p*-value
I. Main analysis						
Non-diabetes	264	490839	Ref		Ref	
Diabetes	63	49281	1.53 (1.16, 2.03)	0.003	**1.70 (1.27, 2.27)**	**<.001**
Good glycemic control	9	13960	0.70 (0.36, 1.37)	0.296	**0.69 (0.35, 1.36)**	**0.281**
Poor glycemic control	54	35321	1.90 (1.41, 2.56)	<.001	**2.21 (1.63, 2.99)**	**<.001**
II. Subgroup analysis among those without diabetes-related complications						
Non-diabetes	264	490839	Ref		Ref	
Diabetes	47	40499	1.46 (1.06, 1.99)	0.019	**1.66 (1.20, 2.28)**	**0.002**
Good glycemic control	8	11124	0.82 (0.40, 1.66)	0.583	**0.87 (0.43, 1.77)**	**0.697**
Poor glycemic control	39	29375	1.73 (1.23, 2.43)	0.002	**2.02 (1.44, 2.86)**	**<.001**

Lee et al, PLoS Med. 2016

Dose-response curves for fasting plasma glucose and risk of incident tuberculosis in the Cox proportional hazards model



aHR 1.06 per 10-mg/dl increase in FPG

Test for nonlinearity *p*=0.081

Lee et al, PLoS Med. 2016

Subgroup Analysis or Diabetes Status and Risk of TB

Covariates	Diabetes status	No. of cases	aHR (95% CI)	*p*-value	Subgroup *p*-value
Age					0.053
< 65 y/o	No diabetes	148	Ref		
	DM, Good control	2	0.63 (0.16, 2.54)	0.513	
	DM, Poor control	29	3.38 (2.25, 5.09)	<0.001	
≥ 65 y/o	No diabetes	116	Ref		
	DM, Good control	7	0.69 (0.32, 1.49)	0.345	
	DM, Poor control	25	1.63 (1.05, 2.53)	0.028	

BMI and gender: not statistically significant effect modifiers

Lee et al, PLoS Med. 2016

Clinical manifestation of active TB disease in diabetes

	Year	Study location	Participants (n)		Lower lung more commonly involved?	More cavitary lesions?	More diffuse involvement?
			With diabetes	Without diabetes			
Weaver[49]	1974	USA	20	182	Yes	..	..
Marais[50]	1980	South Africa	9	427	Yes	..	..
Ikezoe et al[54]	1992	Japan	31†	71	No	Yes	Yes
Morris et al[55]	1992	Texas, USA	20	20	No	No	No
Umut et al[56]	1994	Turkey	37	37	No	Yes	Yes
Kuaban et al[57]	1996	Cameroon	..	273‡	Yes	..	..
al-Wabel et al[58]	1997	Saudi Arabia	28	38	No	..	..
Bacakoglu et al[59]	2001	Turkey	92	92	No§	No§	No
Perez-Guzman et al[60,61]	2000–01	Mexico	192	130	Yes	Yes	Yes
Shaikh et al[62]	2003	Saudi Arabia	187	505	Yes	..	..
Wang et al[63]	2005	Taiwan	99	362	No	Yes	..
Wang et al[64]	2008	Taiwan	74	143	Yes	Yes	..
Al-Tawfiq et al[51]	2009	Saudi Arabia	57	78	..	No	..

*Apart from the study by Ikezoe et al,[54] in which computed tomography was used. †Patients with diabetes mellitus or who were immunocompromised. ‡Patients with tuberculosis, of whom 28 had lower-lung disease. §Insulin-dependent diabetes mellitus had more cavitary disease than non-insulin-dependent diabetes mellitus; in subgroup analysis, diabetes mellitus was a risk factor for lower-lung disease in patients aged >40 years. ..=not reported.

Table 2: Studies assessing chest radiographic findings* in patients with tuberculosis, comparing diabetic to non-diabetic patients

Lancet Infect Dis. 2009 December ; 9(12): 737–746.

Outcomes of TB treatment in DM

- Systematic review in 2011:
  - increased risk ratio (RR) for TB treatment failure and death of 1.69 (95% CI, 1.36 to 2.12).
  - RR of death during TB treatment among the 23 unadjusted studies is 1.89 (95% CI, 1.52 to 2.36), and this increased to an effect estimate of 4.95 (95% CI, 2.69 to 9.10) after adjusting for age.
  - Diabetes is also associated with an increased risk of relapse (RR, 3.89; 95% CI, 2.43 to 6.23).
- Taiwan: The presence of DM during previous anti-TB treatment was independently associated with subsequent TB recurrence in Taiwan (aOR =1.96, 95% CI: 1.22-3.15)

Baker et al, BMC Medicine 2011, 9:81

Lee et al, Plos one 2014

Collaborative framework for care and control of TB and DM

- 基於過去HIV/TB的共同照護經驗，來建立DM/TB的共同照護架構
- 整合照護資源
- Operational studies conducted in China and India

WHO: Collaborative framework for care and control of TB and DM

Detection And Management of TB in Diabetes patients

- 對於糖尿病病人，建議在結核病的背景盛行率達到100/100,000 以上時，應進行結核病的篩檢
- 當糖尿病病人規則回診追蹤時，若詢問病人出現兩週以上的慢性咳嗽，要懷疑可能是結核病
- 懷疑糖尿病病人可能為結核病的疑似個案，應盡快轉介病人進行結核病的診斷與治療
  - 台灣糖尿病臨床照護指引2018:
    - 當糖尿病人咳嗽超過2週時，建議轉診至胸腔科或感染科，進一步篩檢結核菌感染
- 糖尿病的門診或醫療照護機構，應有院內感染控制計畫，包含如何早期診斷結核病以及環境控制，以減少一旦出現傳染性病人所造成院內傳播的風險

WHO: Collaborative framework for care and control of TB and DM

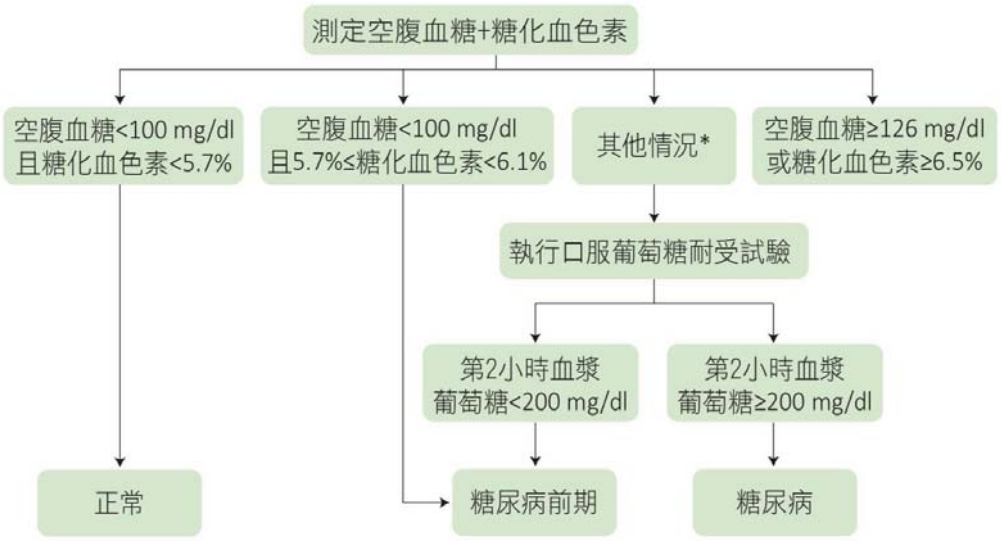
Detection and Management of Diabetes in TB patients

- 台灣結核病診治指引第6版建議:
  - 結核病人在開始抗結核藥物治療前篩檢糖尿病
  - 篩檢工具可包含：飯前血糖或糖化血色素
- 在開始結核病治療的初期(如: 開始治療的四週)，對於一開始血糖偏高的病人進行反覆的血糖檢測，會有助於確定糖尿病診斷，並及早開始控制血糖
- 第一線照護結核病的機構和工作人員，需要有血糖機並熟悉如何使用

結核病診治指引(第六版): 第五章治療期間之監測與不良反應之處理及處方調整

WHO: Collaborative framework for care and control of TB and DM

利用空腹血糖與糖化血色素診斷糖尿病的參考流程



* 包括空腹血糖 <100 mg/dl 且 6.1%≤ 糖化血色素 <6.5%，以及 100≤ 空腹血糖 <126 mg/dl 且糖化血色素 <6.5%

2018年糖尿病臨床照護指引

Rifamycins and Anti-Diabetic Agents: Drug-Drug Interactions

	Generic	Rifampin (RIF) Drug-drug interactions	Recommendations
BIGUANIDE	Metformin	None noted	No contraindications
SULFONYLUREA (SU)	Glimepiride	↓Glimepiride levels 30%	– Consider glipizide as first choice of sulfonylurea – Increase monitoring – Consider dose adjustment of antidiabetic agents or alternative glucose control therapy
	Glipizide	↓Glipizide levels 22%	
	Gliclazide	↓Gliclazide levels 70%	
	Glibenclamide	↓Glibenclamide levels 39%	
Non-SU	Repaglinide	↓Repaglinide levels 31-57%	– Increase monitoring – Consider dose adjustment of antidiabetic agents or alternative glucose control therapy.
	Nateglinide	↓Nateglinide levels 24%	
TZD	Pioglitazone	↓Pioglitazone levels 54%	– Increase monitoring – Consider dose adjustment of antidiabetic agents or alternative glucose control therapy.
	Rosiglitazone	↓Rosiglitazone levels 54-65%	
alpha-GLUCOSIDASE INHIBITOR	Acarbose	None noted	
DPP4 inhibitor	Sitagliptin	May ↓sitagliptin levels	Increase monitoring; interaction may be minimal and require no adjustments
GLP-1 RECEPTOR AGONIST	Exenatide	None noted	
SGLT-2 inhibitor	Dapagliflozin	May ↓ 22% but no clinically meaningful effect on urinary glucose excretion	Interaction may be minimal
	Empagliflozin	NA	

Ruslami et al, Trop Med & Int Health 2010
Kasichayanula et al, Diabetes Obes Metab 2013
Scheen, Clin Pharmacokinet 2013
https://www.heartlandntbc.org/assets/products/Rifamycins%20and%20Anti-Diabetic%20Agents_

糖尿病合併結核病: 藥物交互作用及血糖監測

- 結核病治療期間血糖監測
  - 可考慮TB治療前四週每週監測，當血糖控制穩定可減少監測頻率，但仍建議每月監測血糖
  - TB個案管理定期訪視和都治關懷員協助病人自我監測血糖
- 轉介糖尿病照護網尋求專業協助

USAPI Standards for the Management of Tuberculosis and Diabetes
http://www.currytbcenter.ucsf.edu/international/tbdm_poster_pressquality.pdf

表一：成年人糖尿病的治療目標

空腹（餐前）血糖 (mg/dl)	餐後 2 小時血糖 (mg/dl)	HbA1c (%)
80-130	80-160	<7.0 （需個別化考量）

表二：老年糖尿病人 (≥65 歲) 的治療目標

健康狀態	糖化血色素	空腹（餐前）血糖	睡前血糖	血壓
健康狀態正常（少共病症，認知及身體機能正常）	<7.5%	90–130 mg/dl	90–150 mg/dl	<140/90 mmHg
健康狀態中等（多共病症，認知及身體機能輕微至中等異常）	<8.0%	90–150 mg/dl	100–180 mg/dl	<140/90 mmHg
健康狀態差（末期慢性病，認知及身體機能中等至嚴重異常）	<8.5%	100–180 mg/dl	110–200 mg/dl	<150/90 mmHg

2018年糖尿病臨床照護指引

合併糖尿病之抗結核藥物治療

- WHO:
  - 目前對於合併糖尿病的結核病治療建議，和對一般TB病人並無差異
- 美國:
  - 建議對於合併糖尿病的結核病人，當合併有開洞病灶，或治療二個月仍培養陽性，建議延長continuation phase, 治療為九個月
- 尚無定論:
  - monitoring of drug levels and dose adjustment and/or a longer regimen (i.e., longer intensive or continuation phase)?

WHO: Guidelines for treatment of tuberculosis, fourth edition
ATS guideline 2016: Treatment of Drug-Susceptible Tuberculosis

初次治療時程的延長
結核病診治指引(第6版)

- 初次治療的病人如果在治療滿2個月時痰培養仍然陽性，要特別加強查痰，密切注意是否已在治療中變成抗藥。發現這類病情改善不如預期的情形，除了排除抗藥、或服藥順從性不佳的問題外，可考慮延長4.1 (INH + RMP + PZA + EMB 2個月+ INH + RMP + EMB 4個月)的建議處方3到6個月
- 治療免疫力不好（如糖尿病、腎功能不全、接受抑制免疫力藥物治療等等）、胸部X光病灶嚴重、或痰陰轉較慢的病人，主治醫師可依據病人的臨床狀況，考慮延長治療的時間

結核病診治指引(第6版): 第四章結核病的治療

DM-TB的照護

- 給予pyridoxine (50 mg/day)預防INH引起的周邊神經病變
- 需要依照腎功能(Ccr<30)調整Pyrazinamide及Ethambutol的頻率
- 確定合併糖尿病的TB病人，對於TB的治療反應監測
  - 是否治療失敗/抗藥性/確定病人可達”治癒”
  - 由於DM-TB病人有較高的TB復發風險，完治後仍應衛教TB相關症狀/回診追蹤
  - TB完治後，仍要注意血糖控制!!

USAPI Standards for the Management of Tuberculosis and Diabetes
http://www.currytbcenter.ucsf.edu/international/tbdm_poster_pressquality.pdf

都治(Direct observation therapy, DOT)對於DM-TB病人的角色

- 都治確保服藥順從性 (包含結核病用藥與降血糖藥物)
  - 對於血糖控制不佳且順從性不佳的病人，可考慮由都治合併DM&TB藥物給藥
- 協助病人self monitoring of glucose control, 特別是使用胰島素控制血糖的病人
  - HbA1c在血糖控制尚未達到目標，應三個月監測一次;若血糖控制穩定，則一年至少檢測兩次
  - 協助副作用的觀察: 特別是低血糖
- Patient support/Diabetes self management education/life style change

糖尿病人臨床監測建議

測試項目	建議頻率
糖化血色素及靜脈血漿糖 (註 1)	3 個月
糖尿病衛教	3 個月
血脂肪：低密度、高密度與總膽固醇 / 三酸甘油酯 若血脂異常或使用降血脂藥物	1 年 3-6 個月
腎臟：肌酸酐 /eGFR/ 尿液常規 / 白蛋白尿 (註 2) 若上述檢查異常需追蹤者	1 年 3-6 個月
眼睛：視力、眼底檢查 (註 3)	1 年
足部：脈搏、踝臂動脈收縮壓比值 (註 4)	1 年
神經病變：單股纖維壓覺、頻率 128 Hz 音叉 震動感、肌腱反射	1 年
口腔檢查	1 年
癌症篩檢	配合國健署癌篩政策
糖尿病人自我管理：體重、血壓、血糖、足部	經常
焦慮與憂鬱之評估	高風險病患或有臨床症狀時

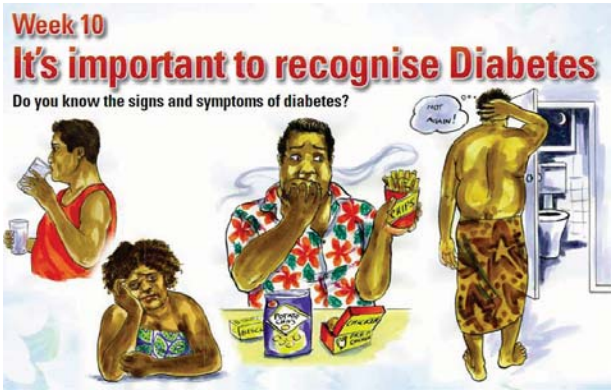
2018年糖尿病臨床照護指引

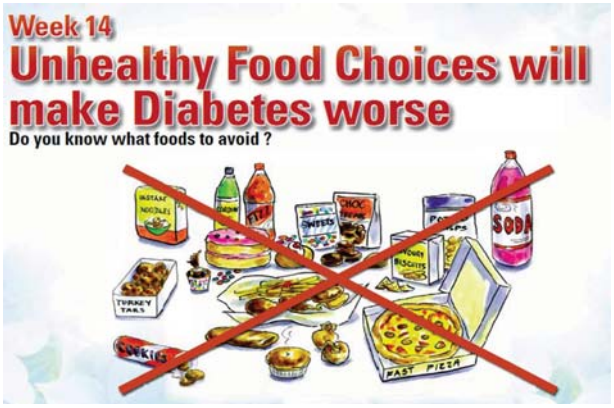
Index - Key Messages for TB & Diabetes

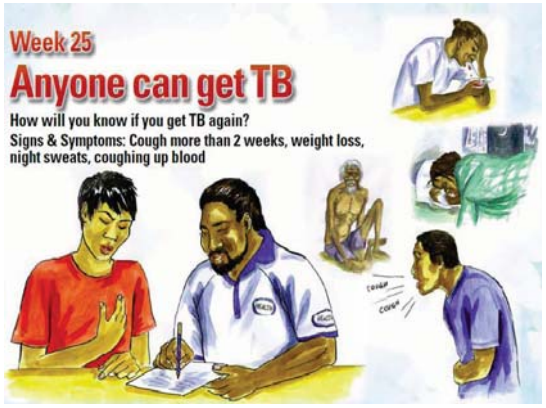
來自澳洲的衛教手冊

Week 1	Day 1	Help Stop the spread of TB
	Day 2	Help Stop the spread of TB continued
	Day 3	Taking your TB treatment will kill the TB germs
Week 2	Day 1	DOT helps cure TB !
	Day 2	Report if you feel unwell on treatment
Week 3	Day 1	Being healthy is important
	Day 2	It can take a little time before you start feeling better
Week 4		Your relatives and friends are important too
Week 5	Day 1	You have also been diagnosed with diabetes
	Day 2	Diabetes can affect anyone
Week 6	Day 1	TB Myths prevent people from getting the help they need
		What things do other people say about TB
	Day 2	TB Myths prevent people from getting the help they need
		How did being told you have TB make you feel ?
Week 7		Regular check ups are important
Week 8		The end of the first stage of TB treatment
Week 9		Diabetes can be controlled through healthy lifestyle
Week 10		It is important to recognise Diabetes
Week 11	Day 1	You can control Diabetes
	Day 2	Medication helps control Diabetes
Week 12		Healthy Eating helps Control Diabetes
Week 13		Healthy Food Choices helps Control Diabetes
Week 14		Unhealthy Food Choices will make Diabetes worse
Week 15		There are better ways to cook food
Week 16	Day 1	Too much food will make Diabetes worse
	Day 2	Drink lots of water
Week 17	Day 1	Being Active helps Control Diabetes
	Day 2	Be Active every day
Week 18		It is important to care for your feet
Week 19		Diabetes and your heart: take charge
Week 20		Diabetes and your eyes: take charge
Week 21		Diabetes and your kidneys: take charge
Week 22	Day 1	Monitor your Diabetes
Week 22	Day 2	Low blood sugar levels can be dangerous (Hypoglycaemia) change numbering in chart
Week 23		Keep a Healthy attitude
Week 24		Staying well helps control Diabetes
Week 25		Anyone can get TB
Week 26		Live Healthy, Stop TB and Control Diabetes

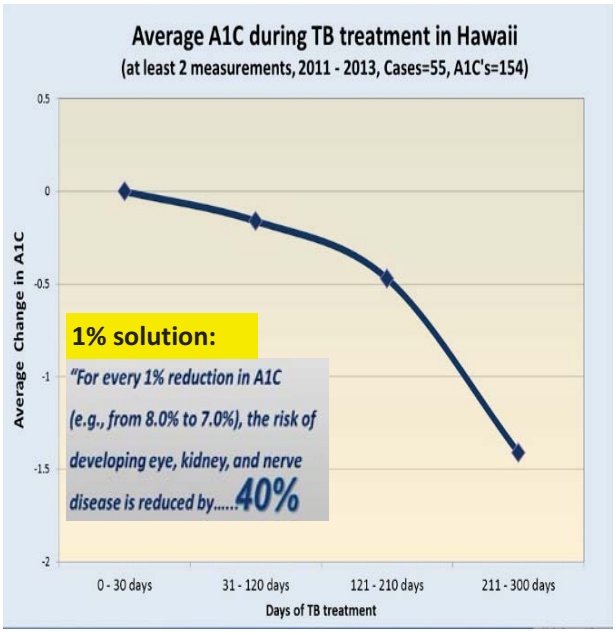
PDF: http://www.thearc.org.au/Resources/Uploaded/Resources/21812%20-%20ARC%20TB%20Diabetes%20Flipchart%20-%20WEB.pdf







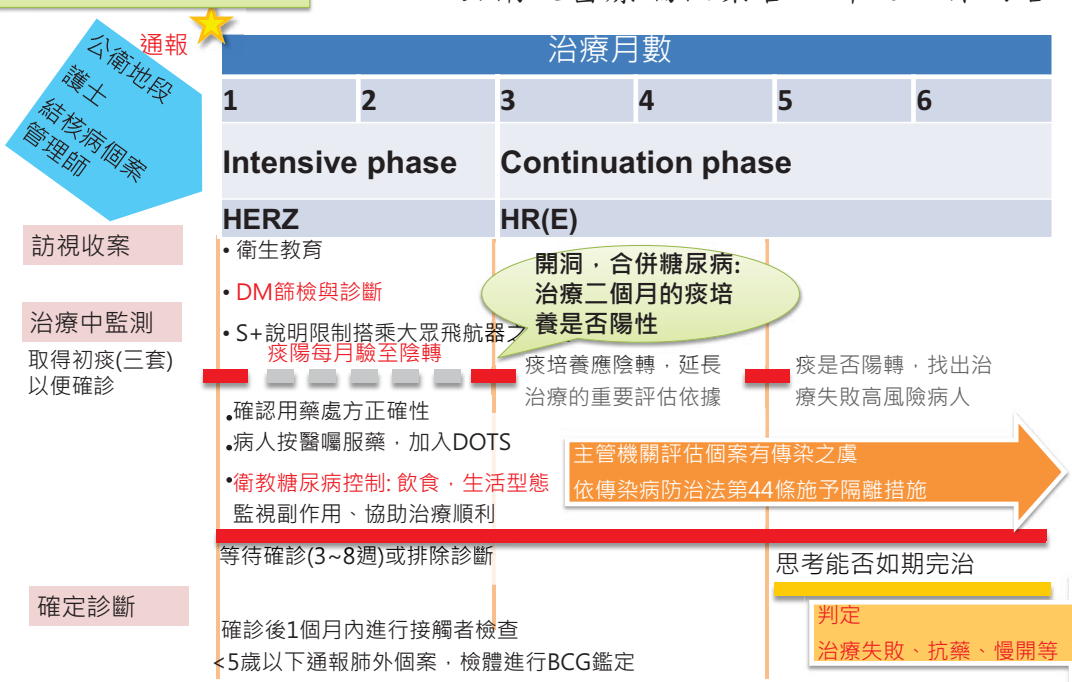
DM-TB co-management: from evidence to action…



courtesy of Dr. R. Brostrom' s presentation

合併糖尿病的結核病人

公衛及醫療端個案管理師之工作內容



*失敗：治療滿四個月及以後依然S(+)或C(+)，或者治療前痰陰性、治療二個月後變成S(+)或C(+)的病人

從公衛防治的角度看DM-TB

Relative Risk, Prevalence and Population Attributable Risk of Selected Risk Factors for TB, in 22 High TB Burden Countries

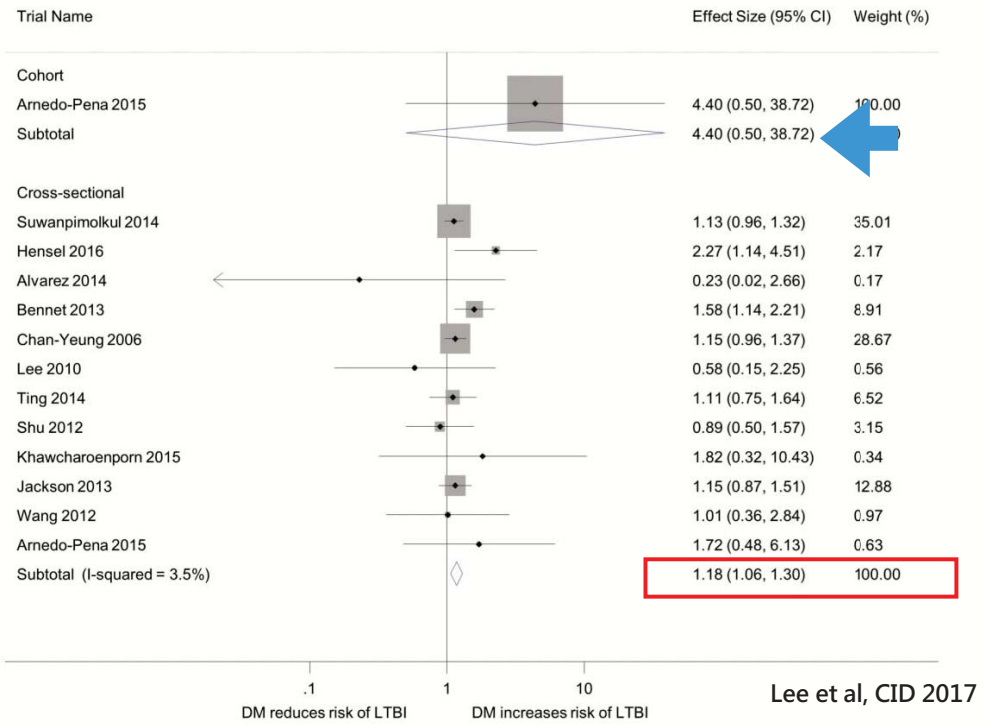
Risk Factor (reference for relative risk and prevalence estimates, respectively)	Relative Risk for Active TB Disease (Range)[a]	Weighted Prevalence, Total Population, 22 TB High Burden Countries[b]	Population Attributable Fraction (Range)[c]
HIV infection[53,54]	8.3 (6.1–10.8)	1.1%	7.3% (5.2–9.6)
Malnutrition[46,55,d]	4.0 (2.0–6.0)	17.2%	34.1% (14.7–46.3)
Diabetes[51,56,e]	3.0 (1.5–7.8)	3.4%	6.3% (1.6–18.6)
Alcohol use >40g/day[50,f]	2.9 (1.9–4.6)	7.9%	13.1% (6.7–22.2)
Active smoking[48,57,g]	2.6 (1.6–4.3)	18.2%	22.7% (9.9–37.4)
Indoor pollution[47,49,h]	1.5 (1.2–3.2)	71.1%	26.2% (12.4–61.0)

Lonnroth et al, SEMINARS IN RESPIRATORY AND CRITICAL CARE MEDICINE/VOLUME 29, NUMBER 5 2008

Public health implication

- An estimated 7.5% (95% CI: 4.1%–11.5%) of incident TB could be attributed to poor glycemic control in Taiwan
- It was estimated that 15% of adult TB cases worldwide could be attributed to DM in 2013.
- In the 22 high TB burden countries where the average TB incidence was reported at 159 per 100000 population, the DM-associated PAF was 15%.
- However, in the WHO Americas Region, where TB incidence was as low as 29/100000, the PAF was estimated to be 17%.

DM and latent TB infection (LTBI)

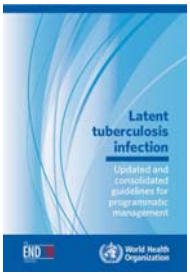


Lee et al, CID 2017

Identification of populations for testing and treatment of LTBI

強烈建議	條件式建議	不建議
•使用 anti-TNF生物製劑 •洗腎透析族群 •準備進行器官或骨髓移植患者 •矽肺病患者	低結核病發生率國家可考慮: •監獄收容者 •醫療照護者 •來自結核病高負擔國家移民 •遊民 •使用非法藥物者	•糖尿病 •酒癮 •吸菸 •體重過輕者

A decision to test for and treat LTBI systematically in these population groups should be made in accordance with the local TB epidemiology and context, health system structure, availability of resources and overall health priorities.



台灣2018年擴大LTBI診斷及治療服務對象

- 縣市衛生局選擇高風險族群，進行主動發現與潛伏結核感染診斷治療服務
- 可選定對象：
- 糖尿病患者且HbA1c >9%、HIV、IDU、山地鄉、洗腎、器官移植、TNF-α-blocker使用者、密集機構老年族群
- 與醫療院所或衛生所糖尿病照護服務網合作
- 提供ＩＧＲＡ檢驗，排除活動性結核病後進行潛伏感染治療

Take home message

- DM is associated with a two-fold increase in the risk of active TB disease and a slightly increased risk for LTBI
- Good glycemic control could potentially modify the risk of TB among diabetic patients and may contribute to the control of TB in settings where diabetes and TB are prevalent
- The increasing prevalence of DM and the magnitude of the DM-TB association imply that the burden of TB attributable to DM is high
- Need collaborative work for DM-TB co-management

Thanks for your attention!

leepinhui@cdc.gov.tw

UNITE TO END TB