



終結結核：我們能做什麼？

台大公衛學院流行病學與預防醫學研究所

林先和

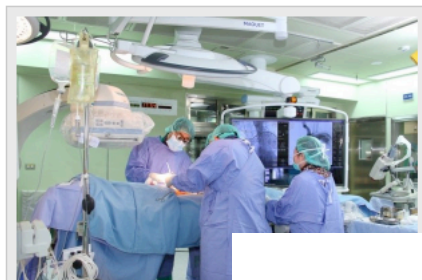
2017-Sep-07



2017-05-20 10:52



〔即時新聞 / 綜合報導〕知名醫學期刊《刺絡針》（The Lancet）當地時間18日發布最新全球醫療照護品質排行，195個國家中，西歐內陸小國安道爾（Principality of Andorra）奪冠，台灣位居第45名。



根據知名醫學期刊《刺絡針》（The Lancet）最新發布的「全球醫療照護品質排行」，台灣位居第45名。

Country	Access	Quality	Safety	Equity	Efficiency
USA	74	74	74	74	74
Andorra	85	85	85	85	85
Switzerland	78	78	78	78	78
Denmark	77	77	77	77	77
Norway	76	76	76	76	76
Sweden	75	75	75	75	75
Finland	74	74	74	74	74
Netherlands	73	73	73	73	73
Germany	72	72	72	72	72
France	71	71	71	71	71
UK	70	70	70	70	70
Spain	69	69	69	69	69
Italy	68	68	68	68	68
Japan	67	67	67	67	67
South Korea	66	66	66	66	66
Taiwan	64	64	64	64	64
China	63	63	63	63	63
India	62	62	62	62	62
Brazil	61	61	61	61	61
Mexico	60	60	60	60	60
South Africa	59	59	59	59	59
Argentina	58	58	58	58	58
Colombia	57	57	57	57	57
Venezuela	56	56	56	56	56
Peru	55	55	55	55	55
Chile	54	54	54	54	54
Costa Rica	53	53	53	53	53
Uruguay	52	52	52	52	52
Ecuador	51	51	51	51	51
Paraguay	50	50	50	50	50
Bolivia	49	49	49	49	49
Brazil	48	48	48	48	48
France	47	47	47	47	47
Germany	46	46	46	46	46
UK	45	45	45	45	45
Spain	44	44	44	44	44
Italy	43	43	43	43	43
Japan	42	42	42	42	42
South Korea	41	41	41	41	41
Taiwan	40	40	40	40	40
China	39	39	39	39	39
India	38	38	38	38	38
Brazil	37	37	37	37	37
Mexico	36	36	36	36	36
South Africa	35	35	35	35	35
Argentina	34	34	34	34	34
Colombia	33	33	33	33	33
Venezuela	32	32	32	32	32
Peru	31	31	31	31	31
Chile	30	30	30	30	30
Costa Rica	29	29	29	29	29
Uruguay	28	28	28	28	28
Ecuador	27	27	27	27	27
Paraguay	26	26	26	26	26
Bolivia	25	25	25	25	25
Brazil	24	24	24	24	24
France	23	23	23	23	23
Germany	22	22	22	22	22
UK	21	21	21	21	21
Spain	20	20	20	20	20
Italy	19	19	19	19	19
Japan	18	18	18	18	18
South Korea	17	17	17	17	17
Taiwan	16	16	16	16	16
China	15	15	15	15	15
India	14	14	14	14	14
Brazil	13	13	13	13	13
Mexico	12	12	12	12	12
South Africa	11	11	11	11	11
Argentina	10	10	10	10	10
Colombia	9	9	9	9	9
Venezuela	8	8	8	8	8
Peru	7	7	7	7	7
Chile	6	6	6	6	6
Costa Rica	5	5	5	5	5
Uruguay	4	4	4	4	4
Ecuador	3	3	3	3	3
Paraguay	2	2	2	2	2
Bolivia	1	1	1	1	1

美國第35名、台灣第45名（根據《刺絡針》）

《刺絡針》根據全球195個國家、32種疾病的死亡率，包括肺結核、呼吸道感染、乳癌、高血壓心臟病等，以及非致命外傷的醫療照顧、引起或提高事故發生機會與擴大損失的風險因素，比較1990年至2015年的醫療照顧情形，排出「醫療照護可及性與品質指數」（The Healthcare Access and Quality

台灣醫療品質全球45名？健保署不認同



2017-05-21 23:42 聯合報 記者鄧桂芬／即時報導

讚 836

分享

傳送

一篇針對全球的健康保健品質指標評比研究，台灣排名第45名，其中糖尿病與慢性腎臟病的預防死亡率被評為不及格。有醫師認為，大數據研究結果值得政府參考改進，但衛福部健保署官員反駁，台灣非世界衛生組織（WHO）會員，據以往經驗，被誤用資料比率高，不能因此判斷台灣的健康保健品質不好。

宜蘭縣愛胰協會理事長游能俊表示，糖尿病部分，該研究是分析50歲以下糖尿病之死亡率，台灣雖屬健康保健品質A段班，但和其他A段班國家相比，於1990年到2015年的死亡率相對降低不多。

Lancet 全球醫療可近性與品質指標評比 – 傳染病類

分類	HAQ整體分數	結核病	腹瀉疾病	下呼吸道感染	上呼吸道感染	白喉	百日咳	破傷風	麻疹	
A組	台灣	78	78	95	64	98	100	94	98	80
	美國	81	97	89	90	98	100	99	100	100
	日本	89	89	94	61	99	100	100	100	99
	韓國	86	67	97	79	98	100	99	99	98
	新加坡	86	79	96	39	99	100	100	100	100
	馬來西亞	67	58	86	25	96	100	96	95	83
B組	中國大陸	74	67	85	76	94	100	91	92	90
	泰國	71	54	89	38	94	100	94	89	89
	菲律賓	52	32	56	34	88	99	97	73	72
	印尼	49	27	52	56	90	98	81	54	60

*分數越高越佳，分數範圍0-100

終結結核策略 (End TB Strategy)

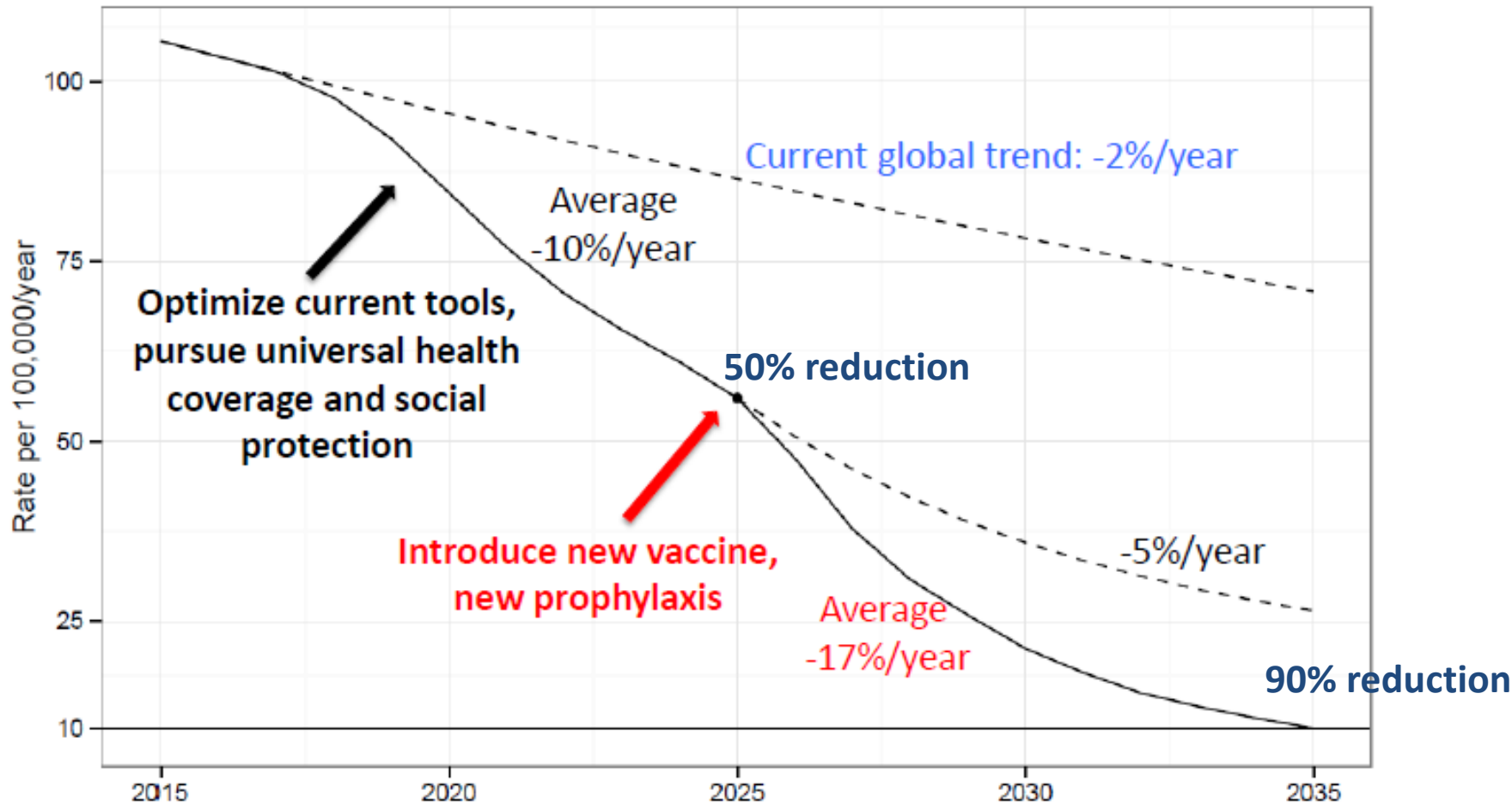
- 願景：A world free of TB
- 標的：在2015到2035年間
 - 結核病發生率下降90%
 - 結核病死亡人數減少95%
 - 沒有家庭會因為結核病的影響，而面臨災難性的花費 (catastrophic costs)
- 根除結核(TB elimination)
 - 在2050年：發生率小於百萬分之一



The End TB Strategy

VISION	A WORLD FREE OF TB — zero deaths, disease and suffering due to TB	
GOAL	END THE GLOBAL TB EPIDEMIC	
INDICATORS	MILESTONES	TARGETS
	2025	End TB 2035
Reduction in number of TB deaths compared with 2015 (%)	75%	95%
Reduction In TB incidence rate compared with 2015 (%)	50% (<55/100000)	90% (<10/100000)
TB-affected families facing catastrophic costs due to TB (%)	0	0

Post-2015 TB control targets



Post-2015 Global TB Strategy- **Components**

1. INTEGRATED, PATIENT-CENTRED CARE AND PREVENTION

- A. Early diagnosis of tuberculosis including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups
- B. Treatment of all people with tuberculosis including drug-resistant tuberculosis, and patient support
- C. Collaborative tuberculosis/HIV activities, and management of co-morbidities
- D. Preventive treatment of persons at high risk, and vaccination against tuberculosis

2. BOLD POLICIES AND SUPPORTIVE SYSTEMS

- A. Political commitment with adequate resources for tuberculosis care and prevention
- B. Engagement of communities, civil society organizations, and public and private care providers
- C. Universal health coverage policy, and regulatory frameworks for case notification, vital registration, quality and rational use of medicines, and infection control
- D. Social protection, poverty alleviation and actions on other determinants of tuberculosis

3. INTENSIFIED RESEARCH AND INNOVATION

- A. Discovery, development and rapid uptake of new tools, interventions and strategies
- B. Research to optimize implementation and impact, and promote innovations

Mass treatment to eliminate tuberculosis from an island population



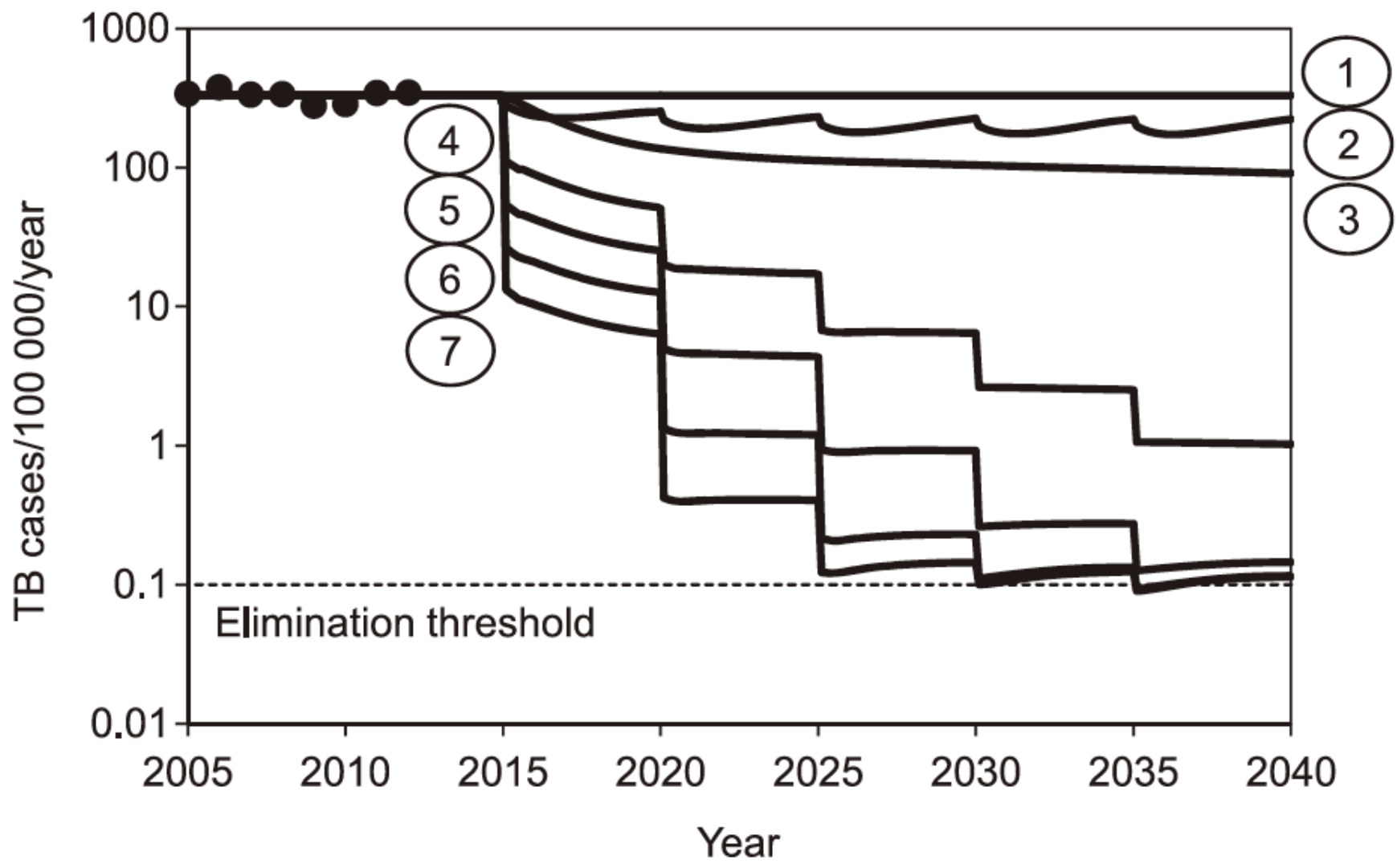
Authors: Hill, P. C.¹; Dye, C.²; Viney, K.³; Tabutoa, K.⁴; Kienene, T.⁴; Bissell, K.⁵; Williams, B. G.⁶; Zachariah, R.⁷; Marais, B. J.⁸; Harries, A. D.⁵

Source: [The International Journal of Tuberculosis and Lung Disease](#), Volume 18, Number 8, 1 August 2014, pp. 899-904(6)

Publisher: [International Union Against Tuberculosis and Lung Disease](#)



Mass treatment to eliminate tuberculosis from an island population



Mass treatment to eliminate tuberculosis from an island population



Authors: Hill, P. C.¹; Dye, C.²; Viney, K.³; Tabutoa, K.⁴; Kienene, T.⁴; Bissell, K.⁵; Williams, B. G.⁶; Zachariah, R.⁷; Marais, B. J.⁸; Harries, A. D.⁵

Source: [The International Journal of Tuberculosis and Lung Disease](#), Volume 18, Number 8, 1 August 2014, pp. 899-904(6)

Publisher: [International Union Against Tuberculosis and Lung Disease](#)



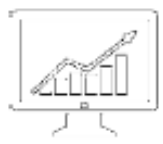
INT J TUBERC LUNG DIS 18(8):883

© 2014 The Union

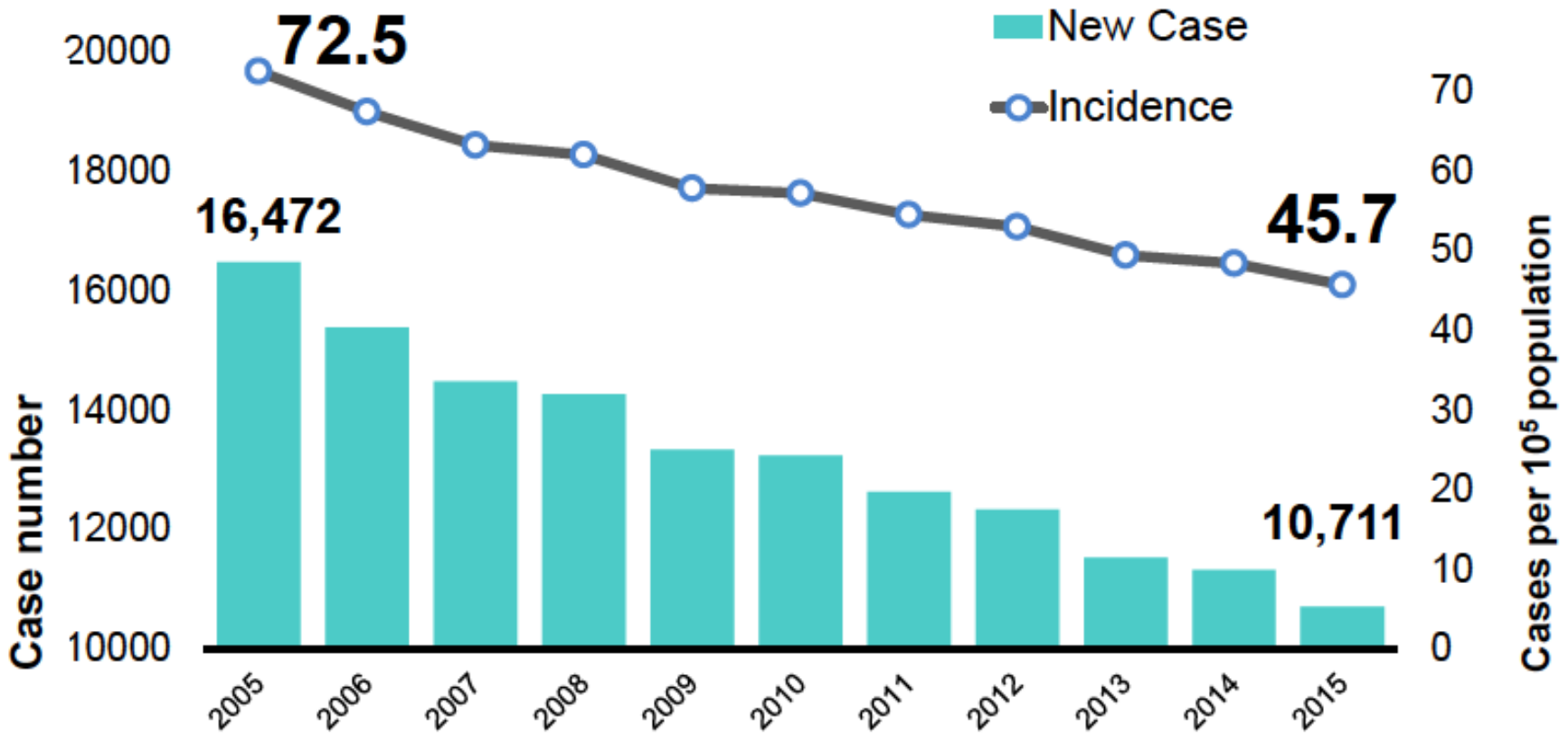
<http://dx.doi.org/10.5588/ijtld.14.0386>

EDITORIAL

Bold thinking for bold results: modeling the elimination of tuberculosis



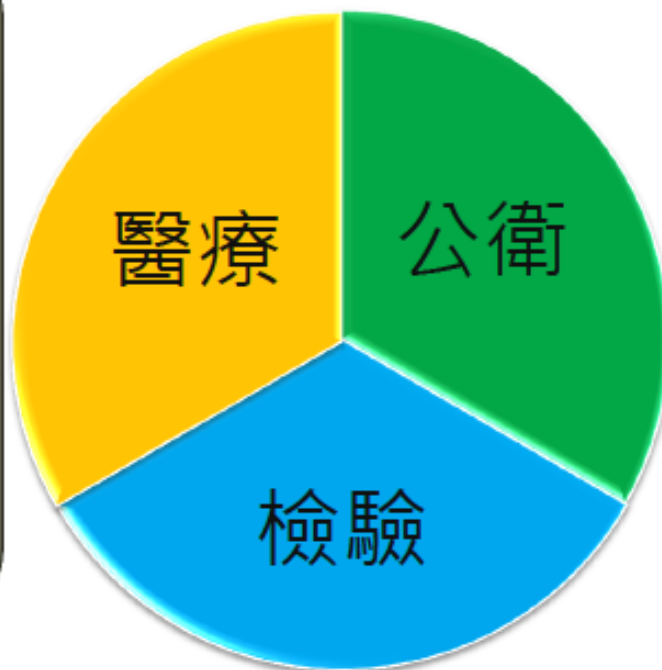
TB Incidence (2005-2015)



Year 2016: 10177 with 43/100000 incidence

台灣結核病防治未來展望

- 引進短程抗結核治療、短程LTBI治療方案
- 針對臨床高風險之共病(DM, HIV, ESRD, smoking, RA ...)之結核病患，進行早期發現及醫療介入



- 因應預算緊縮
- 主動篩檢高風險族群(DM, HIV, aboriginal, homeless, low SES...)
- 研發新疫苗以取代BCG

- 提高檢驗品質，縮短結果turn-around time
- 分析可行檢體減量措施，提高檢驗品質

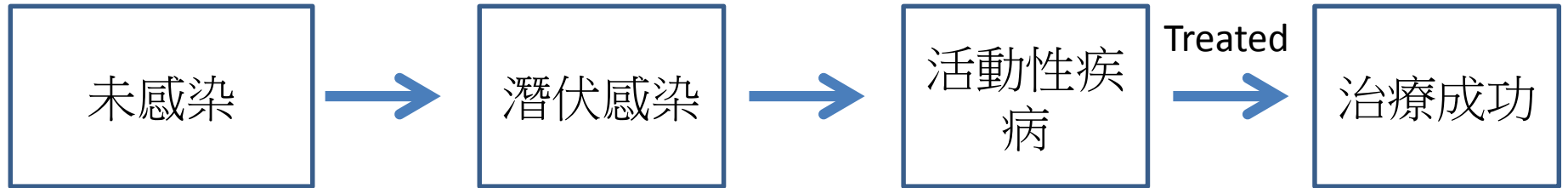
大哉問

- 2035終結結核，目標是否能達成？

下列何者對於台灣結核病發生率的下降最有影響？

- 1. 接觸者檢查與預防性投藥
- 2. 將非接觸者之高風險對象納入預防性投藥
- 3. 高風險族群之主動個案發現(山地鄉, HIV, DM, ESRD, ...)
- 4. 精進結核病患者之診療服務
- 5. 控制結核發病之危險因子，例如糖尿病
- 6. 其他

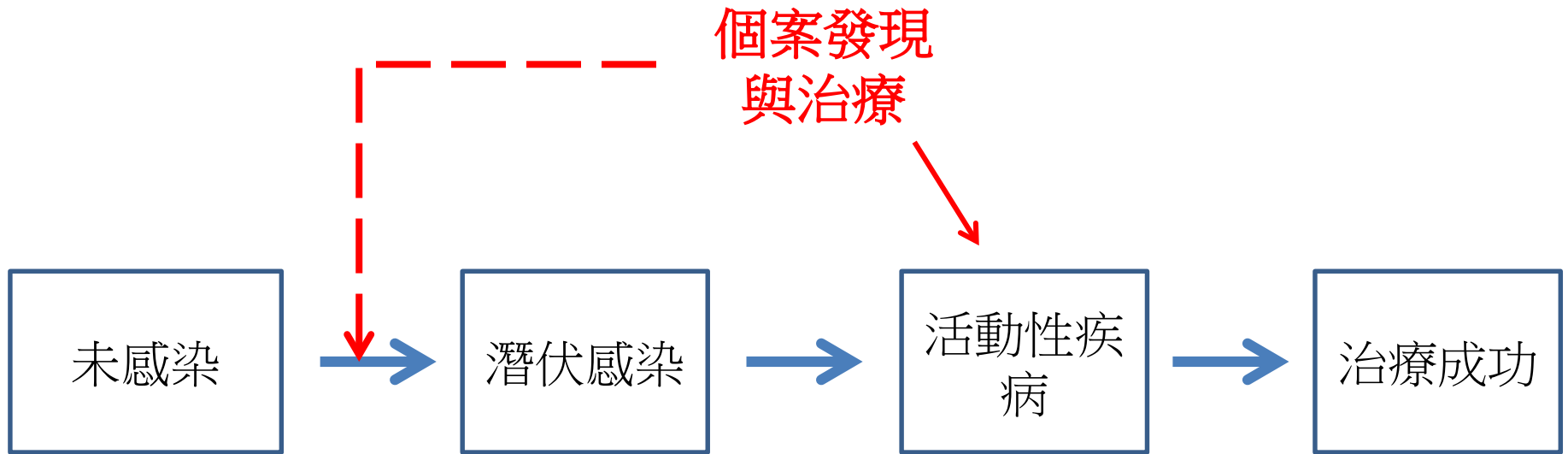
結核病的自然史



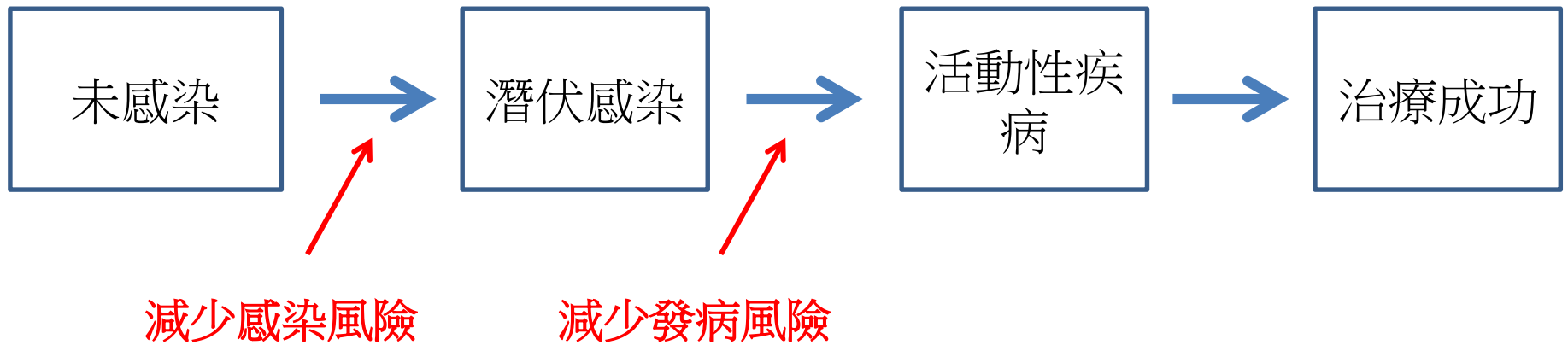
Untreated: ~50% mortality



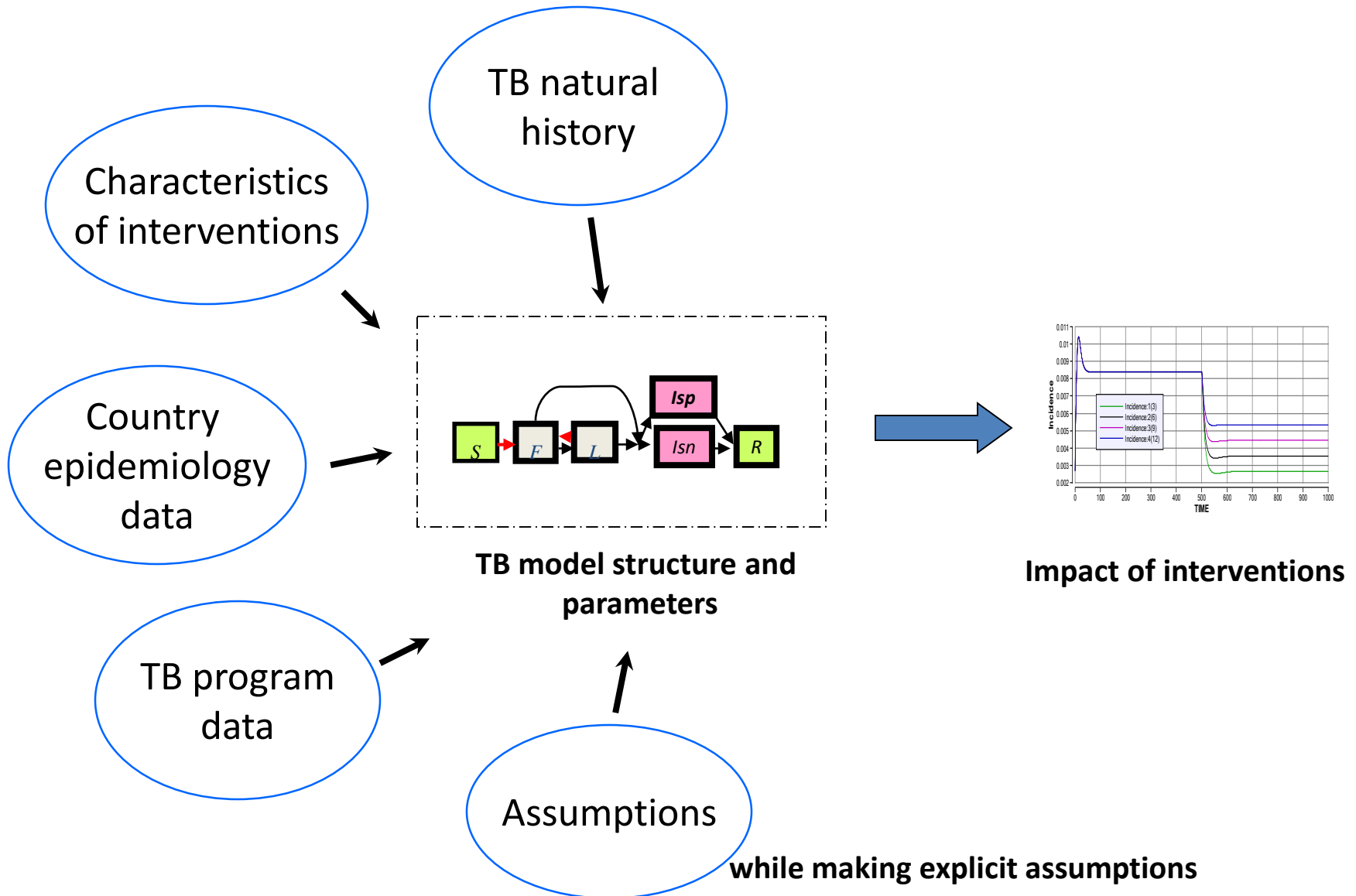
結核病的控制與預防



結核病的控制與預防



利用數理模型來預測與評估結核病防治成效



Karel Styblo, MD (1921-1998)

- “Father of modern TB epidemiology” (Migliori et al, ERJ 2011)
- The “Styblo coefficient”: an incidence of 50/100,000 smear(+) cases will generate 1% annual risk of infection
- The DOTS (Directly Observed Therapy, Short course) strategy
 - 70% detection rate and 85% cure rate



Prospects for worldwide tuberculosis control under the WHO DOTS strategy

Christopher Dye, Geoffrey P Garnett, Karen Sleeman, Brian G Williams

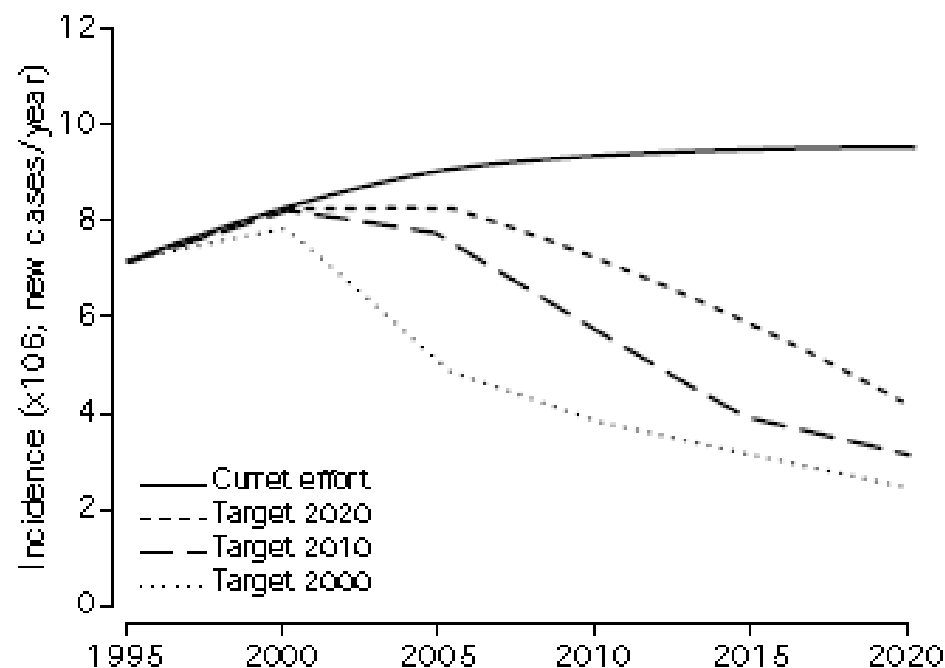


Figure 5: **Projected annual worldwide incidence of tuberculosis under assumption that WHO targets for case finding and cure are met in 2000, 2010, and 2020, compared with maintenance of current control effort**

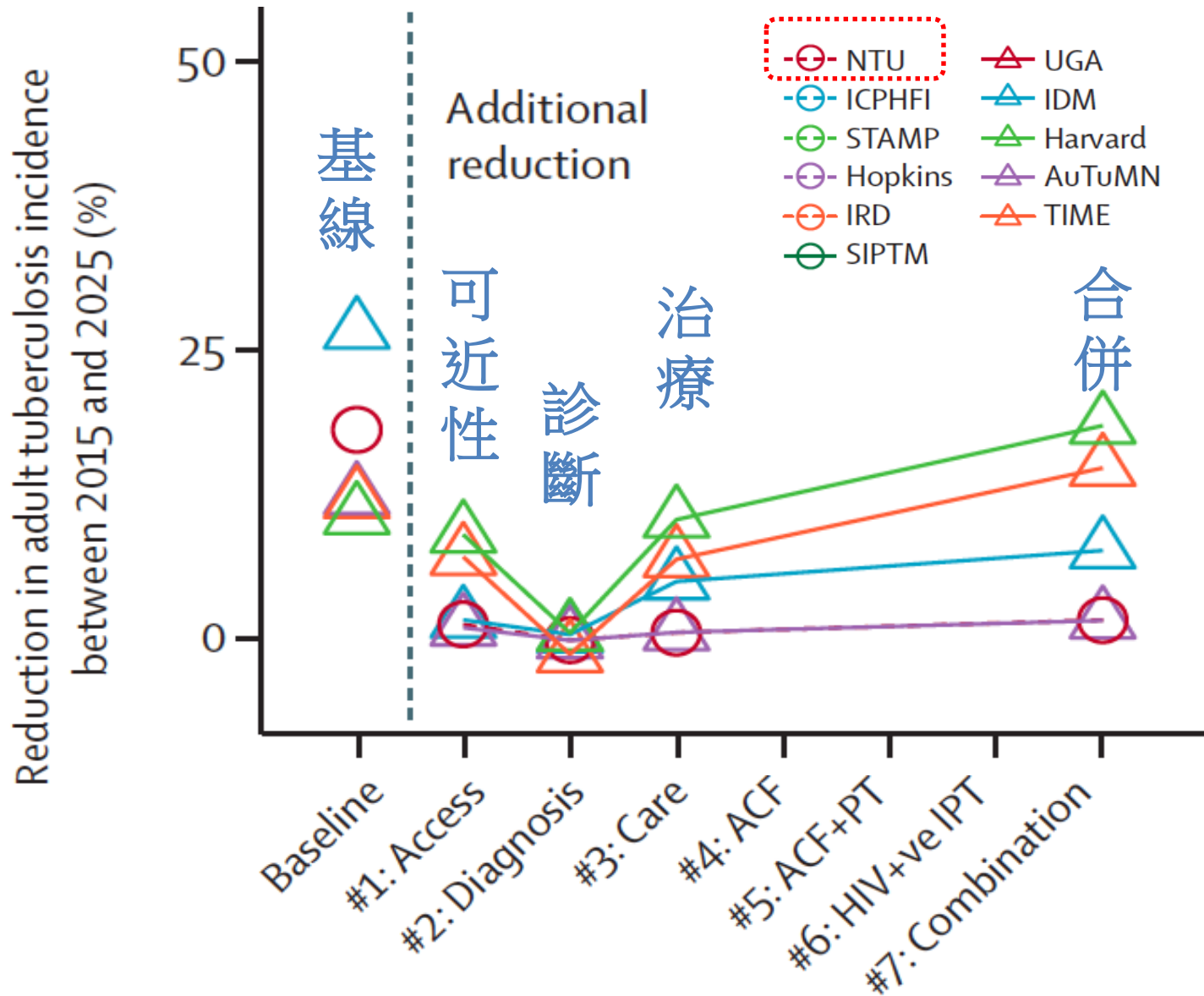
Feasibility of achieving the 2025 WHO global tuberculosis targets in South Africa, China, and India: a combined analysis of 11 mathematical models

Rein M G J Houben, Nicolas A Menzies, Tom Sumner, Grace H Huynh, Nimalan Arinaminpathy, Jeremy D Goldhaber-Fiebert, Hsien-Ho Lin, Chieh-Yin Wu, Sandip Mandal, Surabhi Pandey, Sze-chuan Suen, Eran Bendavid, Andrew S Azman, David W Dowdy, Nicolas Bacaër, Allison S Rhines, Marcus W Feldman, Andreas Handel, Christopher C Whalen, Stewart T Chang, Bradley G Wagner, Philip A Eckhoff, James M Trauer, Justin T Denholm, Emma S McBryde, Ted Cohen, Joshua A Salomon, Carel Pretorius, Marek Lalli, Jeffrey W Eaton, Delia Boccia, Mehran Hosseini, Gabriela B Gomez, Suvanand Sahu, Colleen Daniels, Lucica Ditiu, Daniel P Chin, Lixia Wang, Vineet K Chadha, Kiran Rade, Puneet Dewan, Piotr Hippner, Salome Charalambous, Alison D Grant, Gavin Churchyard, Yogan Pillay, L David Mametja, Michael E Kimerling, Anna Vassall, Richard G White

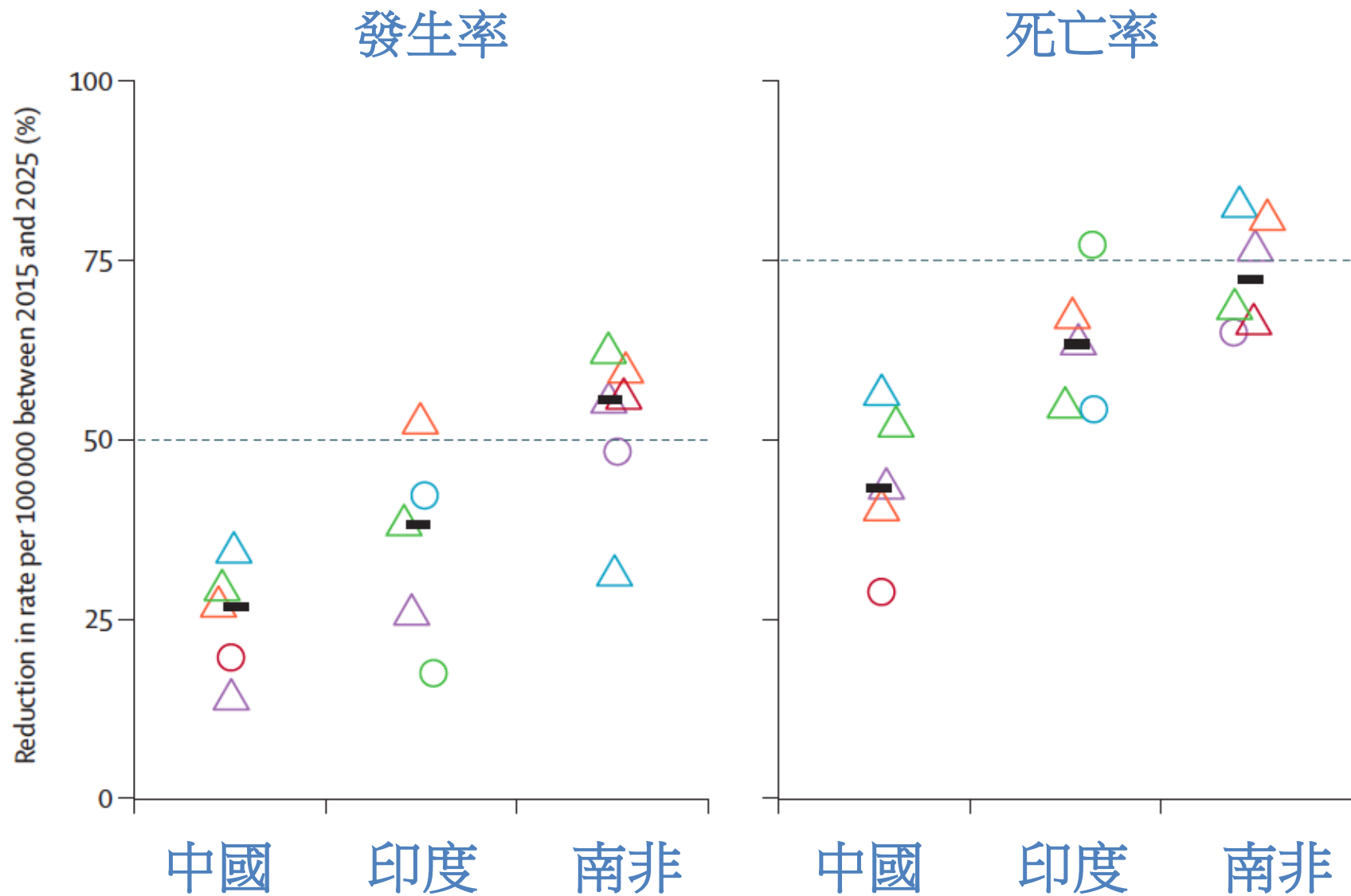
Funding Bill & Melinda Gates Foundation.

Lancet Glob Health 2016;
4: e806–15

不同介入措施對於結核疫情的影響：中國



合併介入措施對於終結結核2025里程碑達成之影響

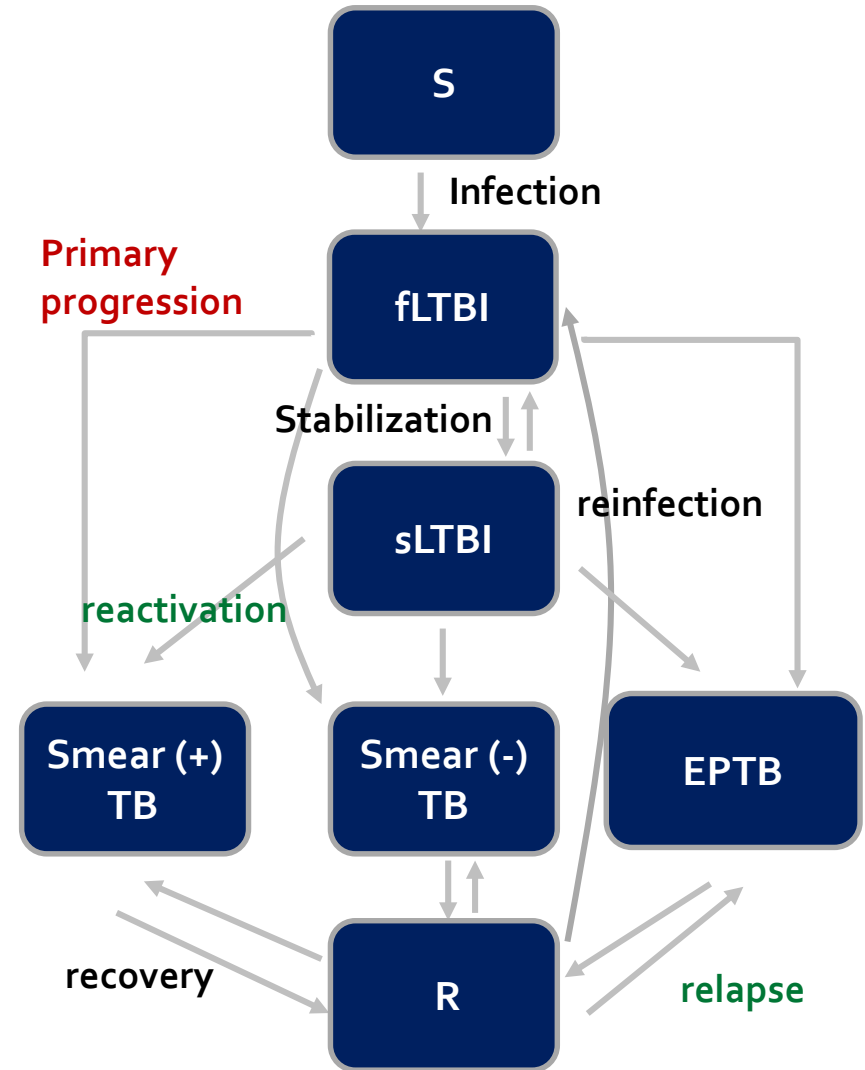


台灣結核疫情防治的數理模式研究

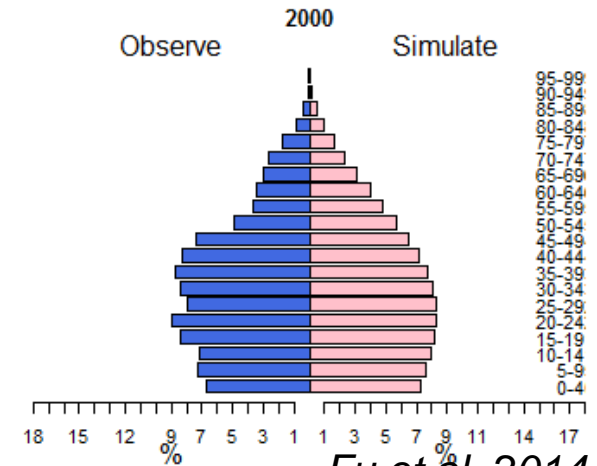
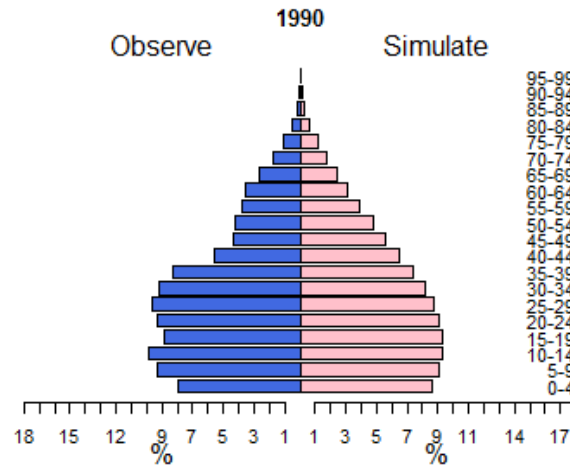
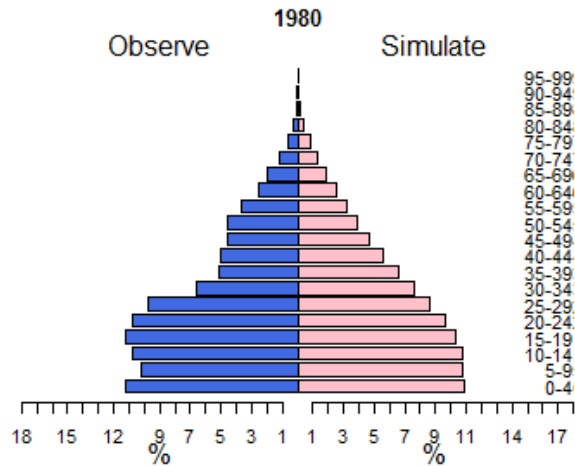
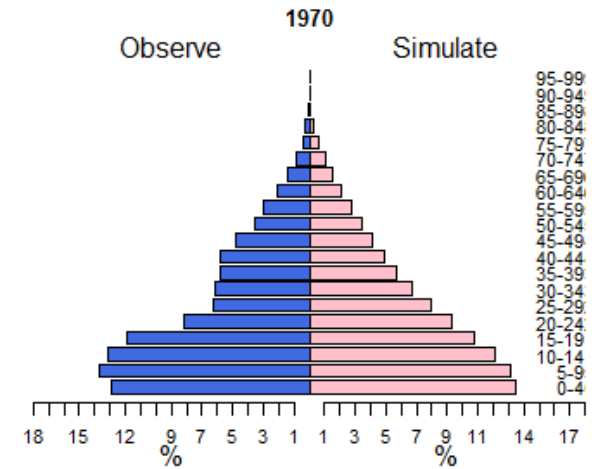
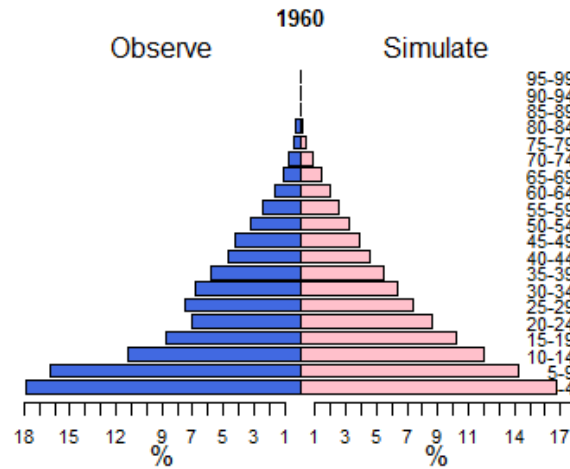
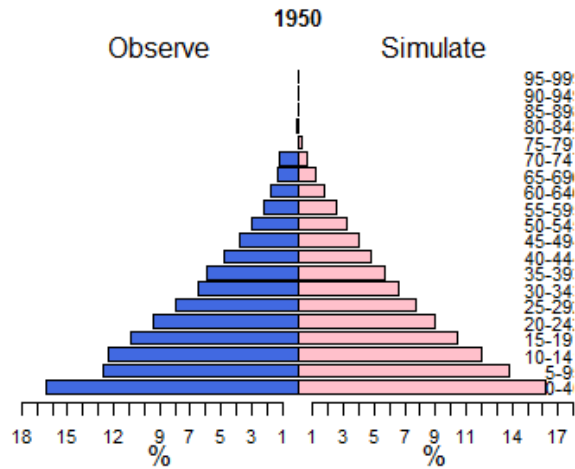
- Funding
 - NHRI-EX103-10228PC
- 台大公衛學院
 - 林先和
 - 傅涵
 - 辜鉅璋
- 疾病管制署
 - 楊靖慧
 - 陳昶勳
 - 王貴鳳
 - 許建邦
 - 詹珮君
 - 李品慧
 - 盧珉如

結核病數理模型

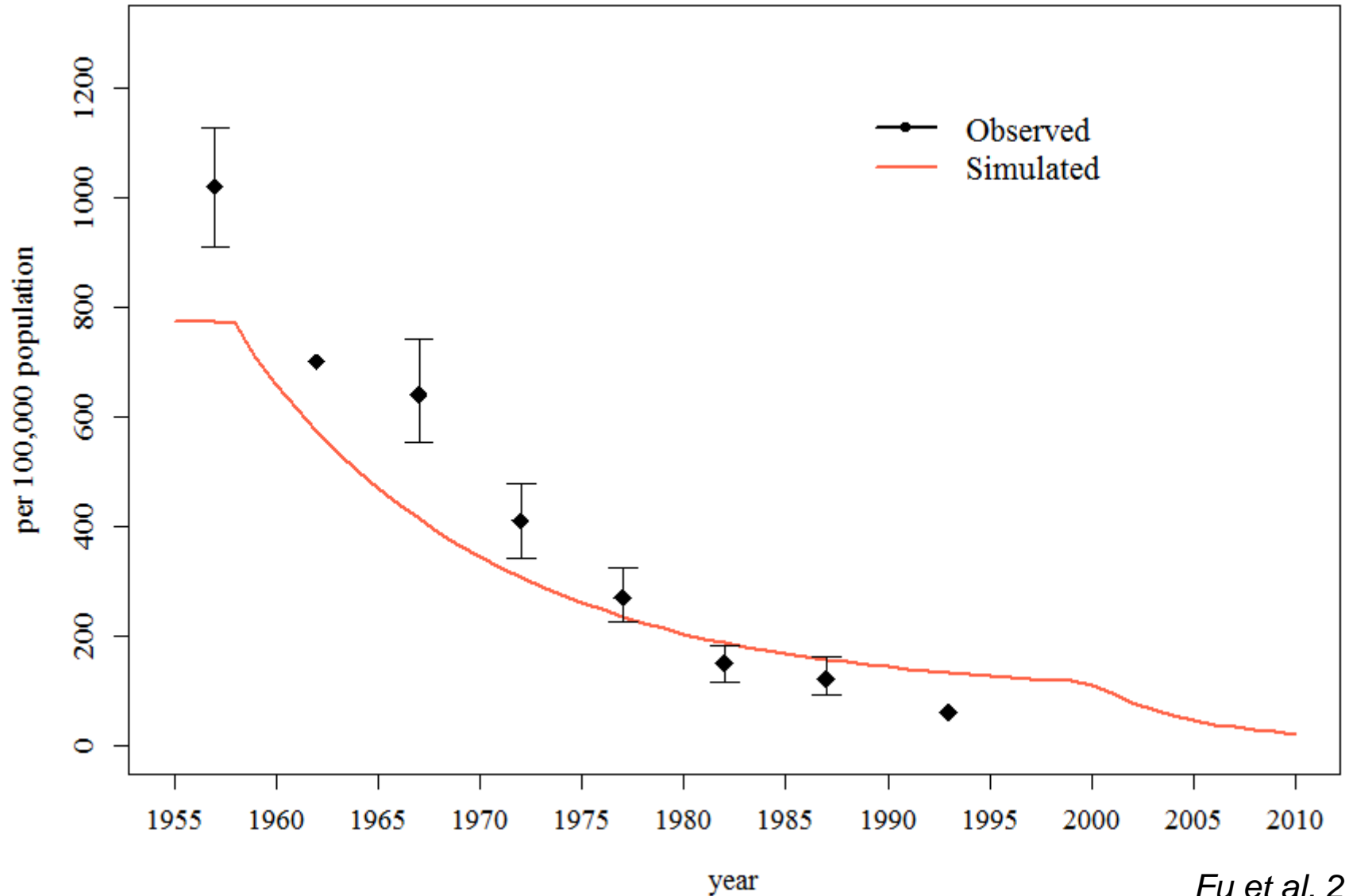
- Disease status
 - Susceptible
 - Latent
 - fast, slow
 - Active TB
 - s(+), s(-), EPTB
 - Recovered
- Consider age structure



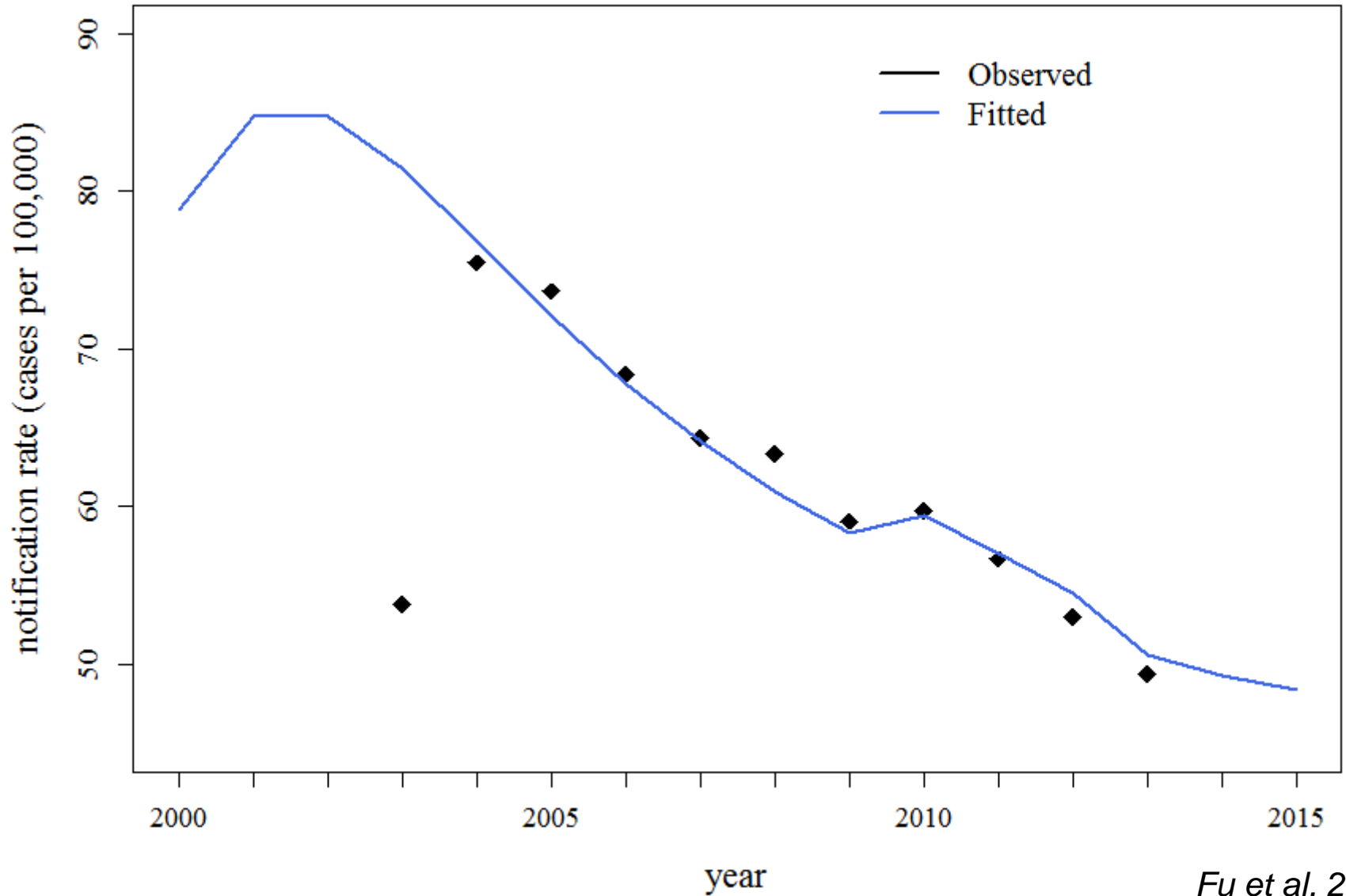
Age pattern in total population



Model calibration: TB prevalence



Model calibration: TB notification



考慮的防治措施

- A. 接觸者預防性投藥
- B. 縮短診斷與治療的延遲
- C. 糖尿病患者血糖控制

A. 接觸者預防性投藥

Scenario	Description
A0. Baseline	No coverage to contacts > 30 y/o
A1. Aggressive control	Expansion to contacts at all ages with 80% coverage
A2. Moderate control	Expansion to contacts at all ages with 40% coverage

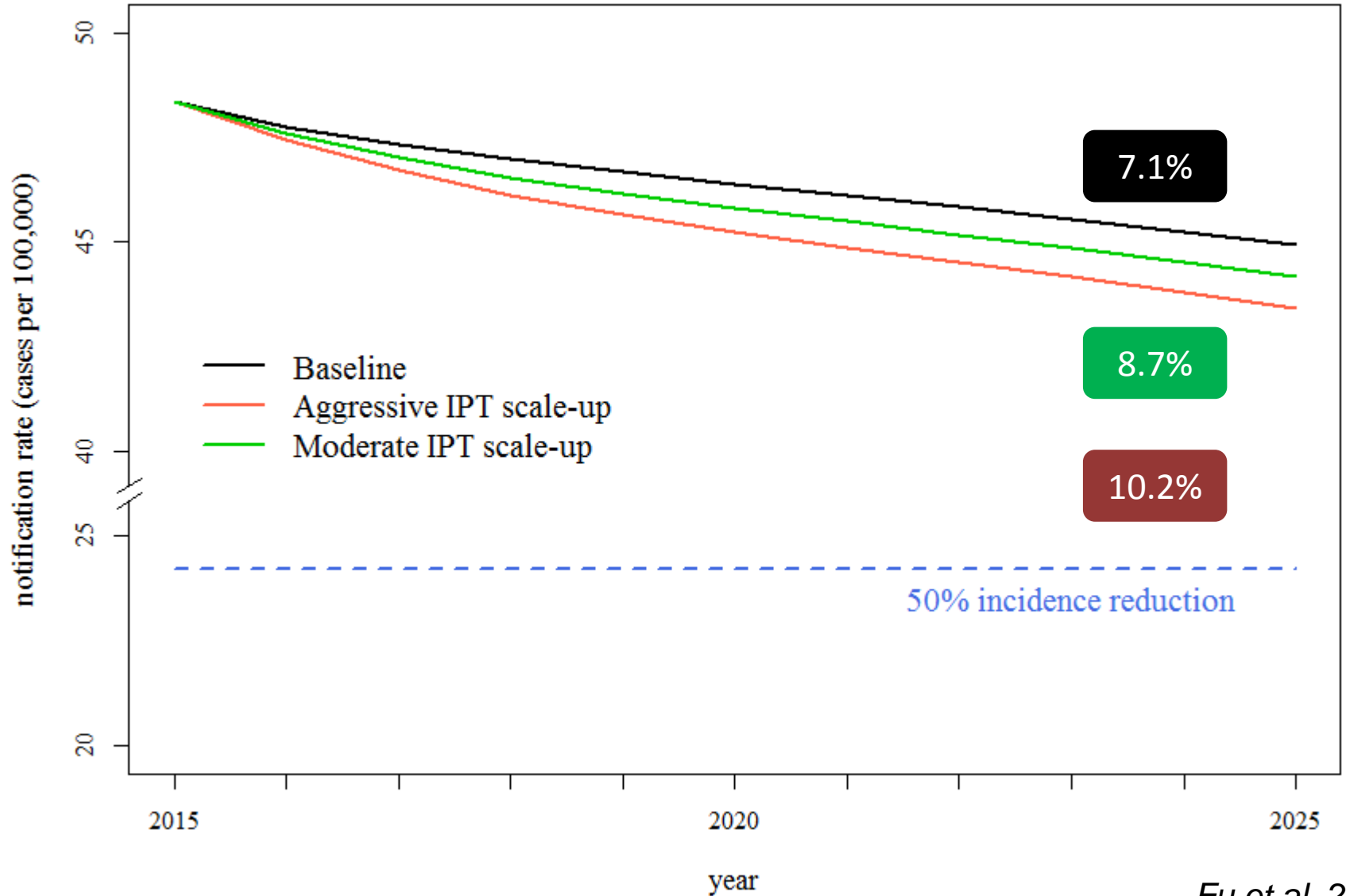
*Assumptions for IPT:

Scale-up period: first three years

DOPT rate: **90%** (treatment success)

Protection of isoniazid: **90%** (Hsu, 1984)

A. 接觸者預防性投藥



所有潛伏感染者進行預防性投藥？

Scenario	Description
Baseline	IPT in contacts < 30 y/o
Aggressive control	Targeting general latent TB population

- Annual screening rate
 - Each LTBI case is screened once within a year

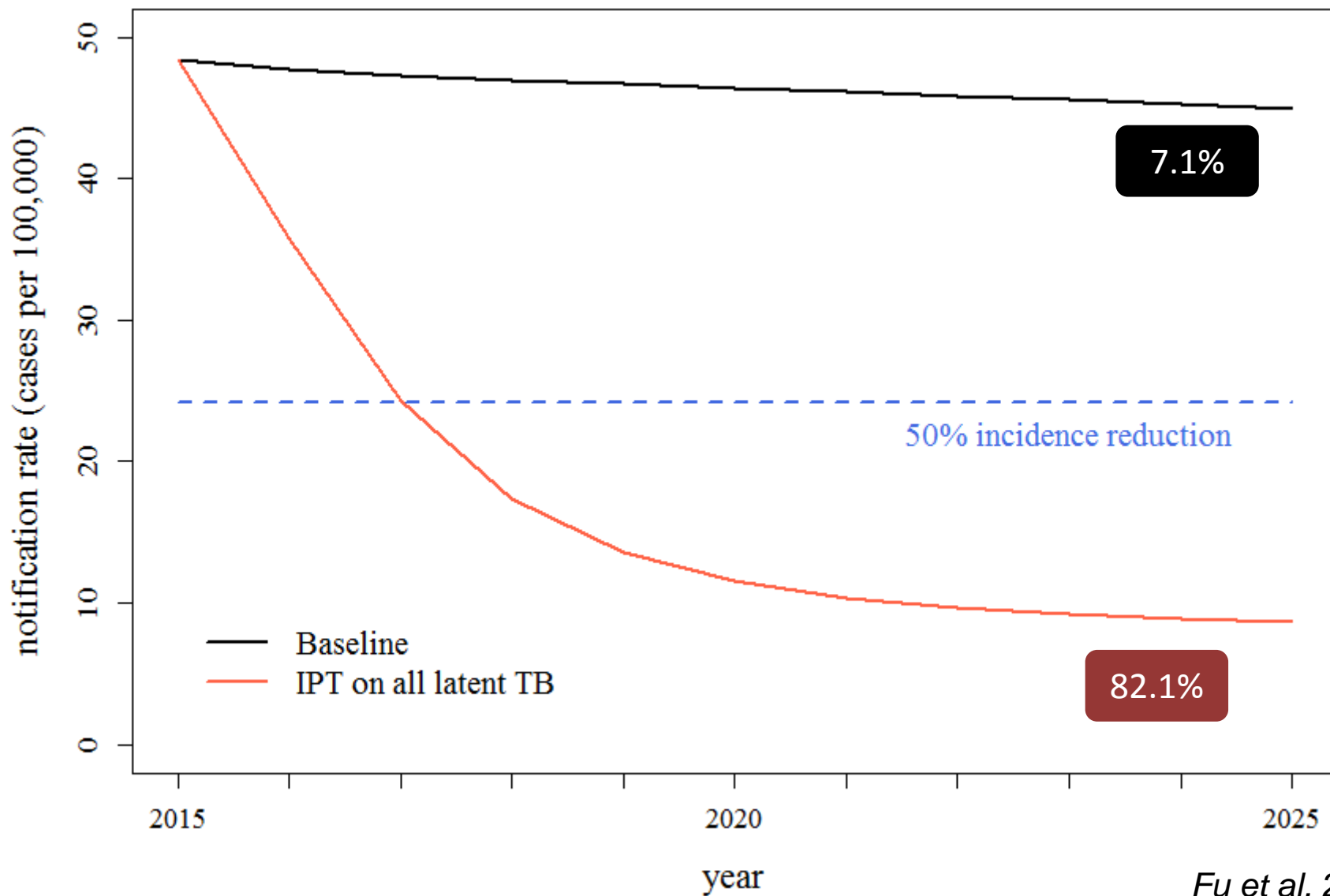
*Assumptions for IPT:

Scale-up period: first three years

DOPT rate: **90%** (treatment success)

Protection of isoniazid: **90%** (Hsu, 1984)

所有潛伏感染者進行預防性投藥

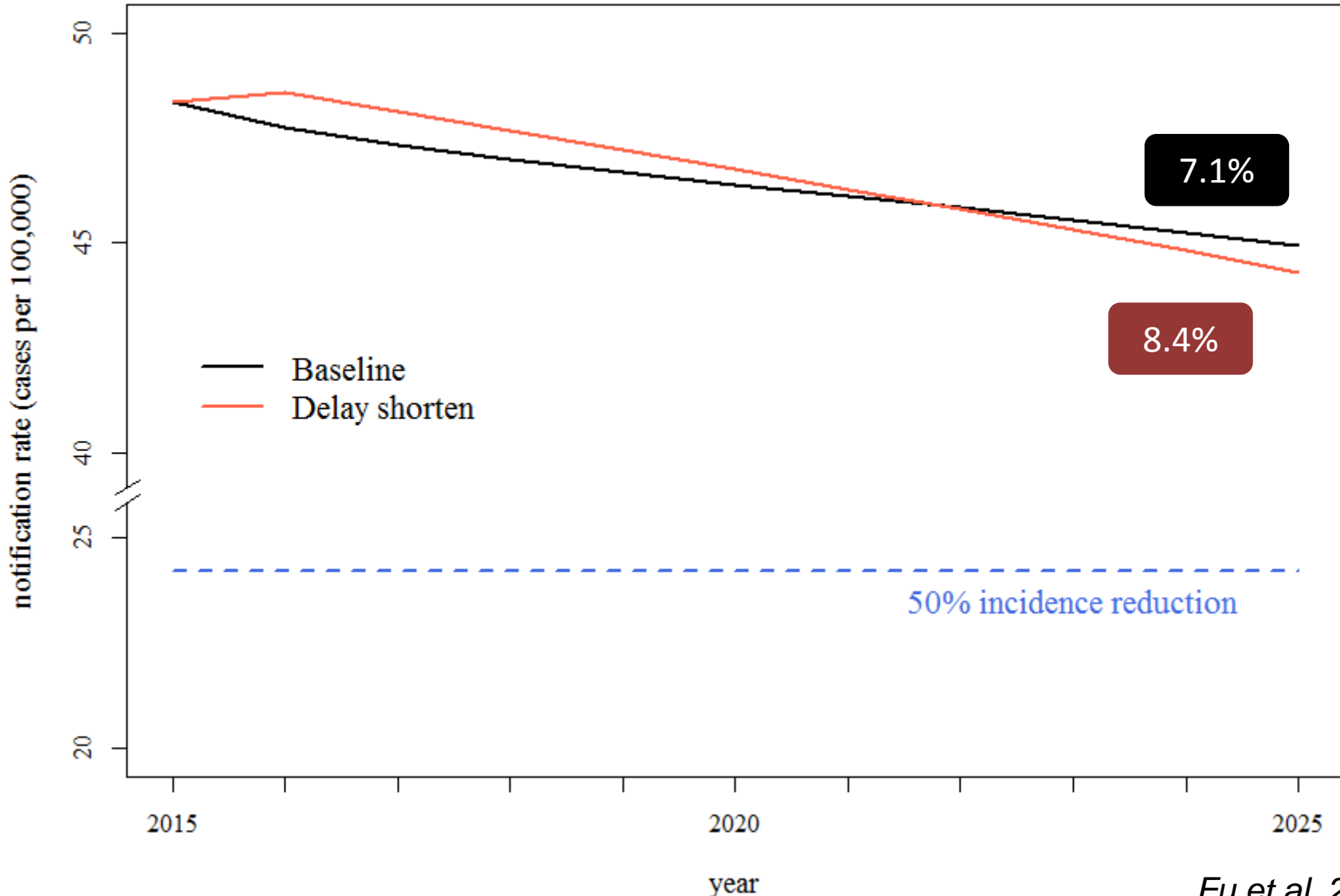


B. 縮短診斷與治療的延遲

Scenario	Description
B0. Baseline	Total delay: 3.4 months
B1. Aggressive control	Delay time shortened from 3.4 to 2.0 months

*Scale-up period: ten years

B. 縮短延遲



C. 糖尿病患者血糖控制

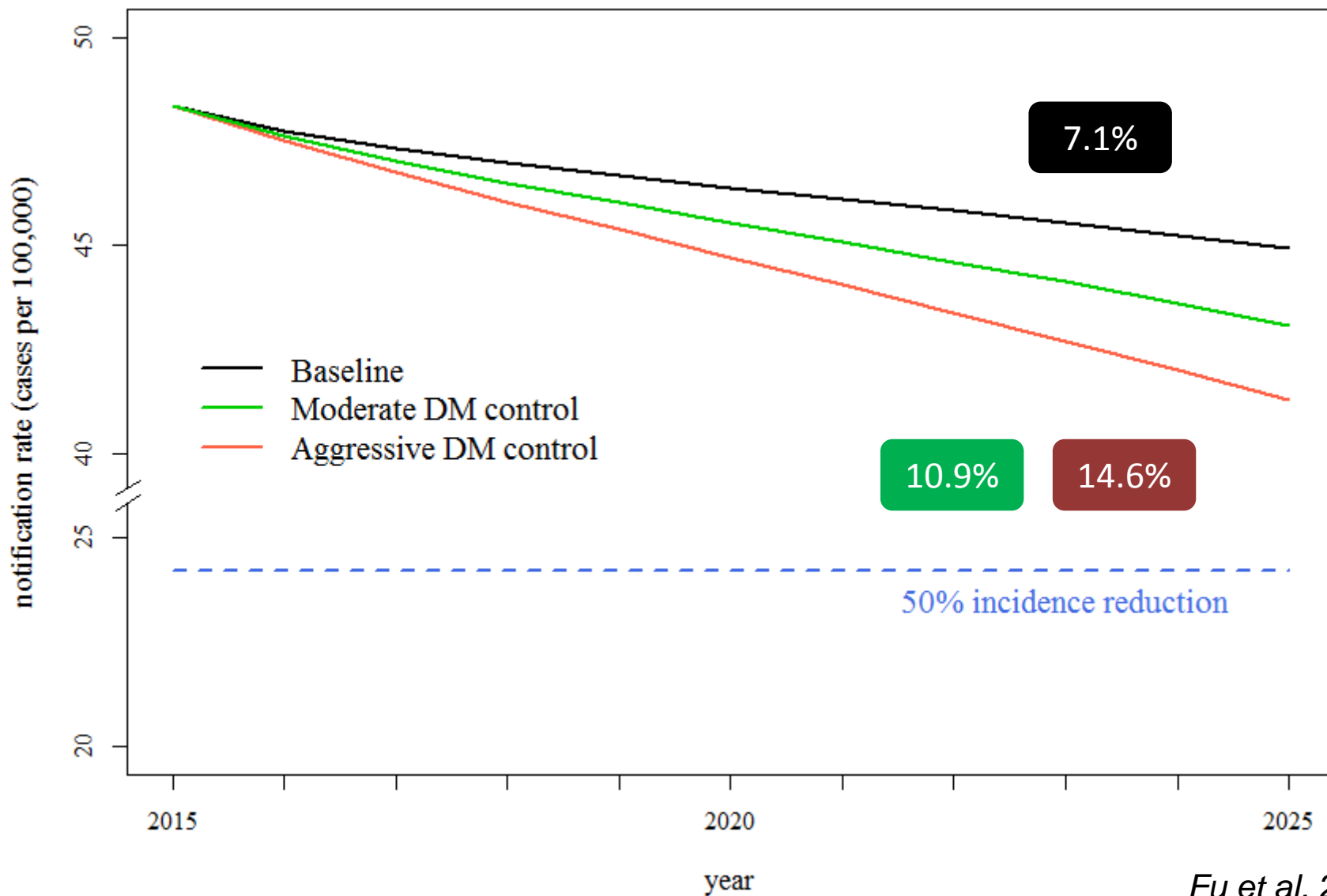
Scenario	Description
C0. Baseline	Current distribution of HbA1c (%) <7: 35% ; >7: 65% (Yu et al., 2013)
C1. Aggressive control	HbA1c <7%: 85%
C2. Moderate control	HbA1c <7%: 60%

*Assumptions for DM control:

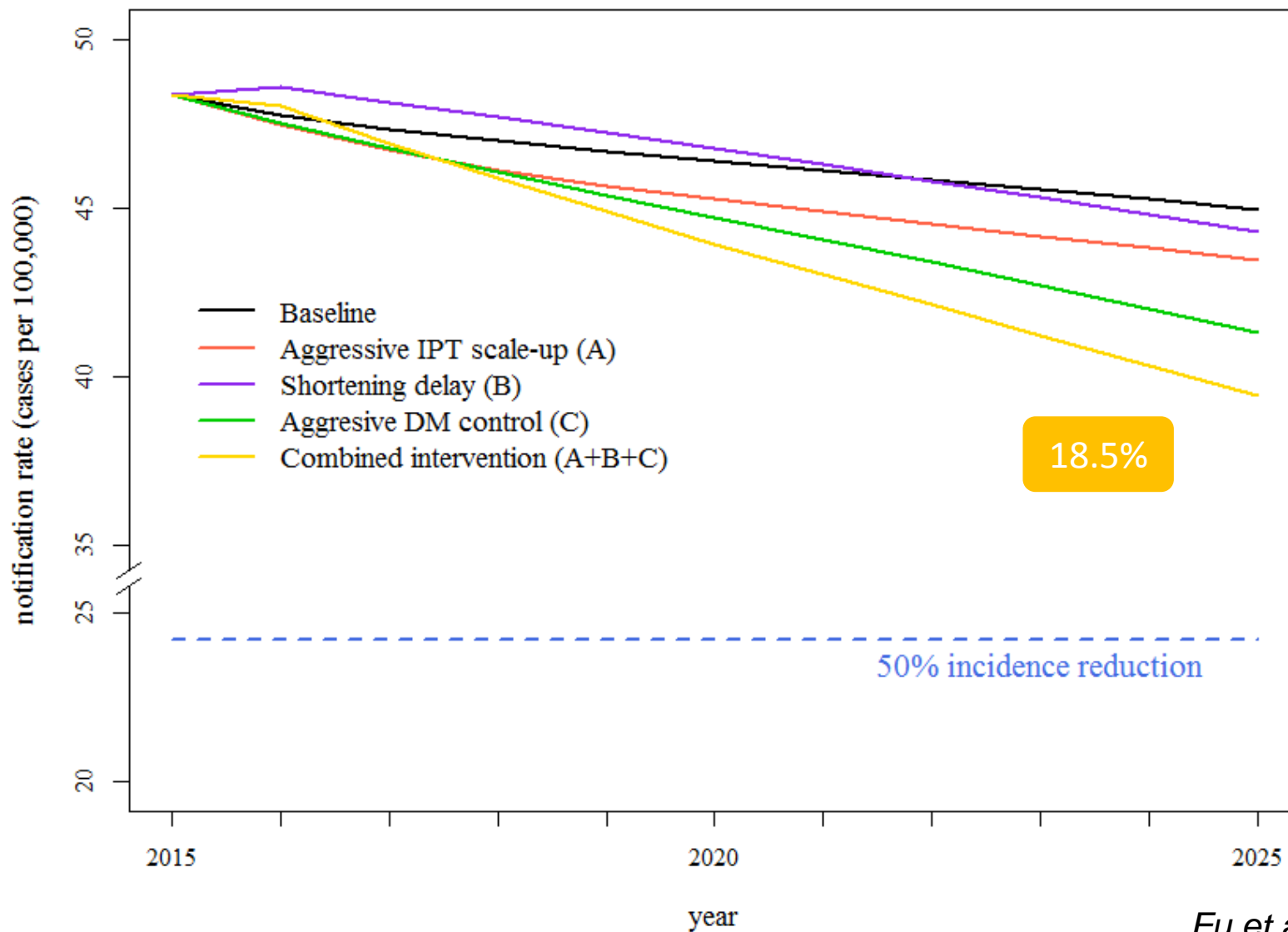
Scale-up period: ten years

Prevalence of DM unchanged

C. 糖尿病患者血糖控制



不同介入政策的比較

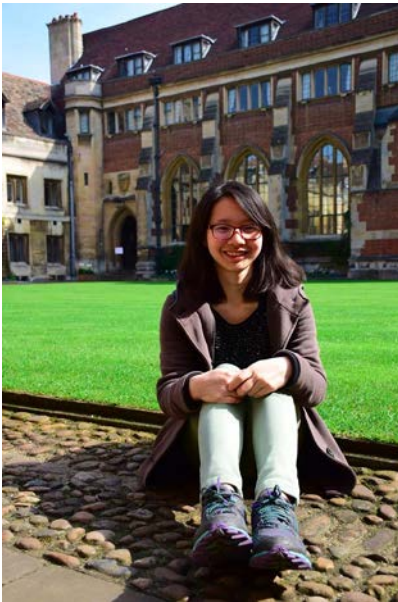


風險族群	估計族群人數	年齡層	估計潛伏感染比例	估計結核病發生率 (per 100,000)	資料來源
接觸者	>100,000/ 年	全年齡層	30%	967	contacts' first year of TB incidence, 2005,
山地鄉	178,047	全年齡層	55.1%	227	external review 報告、2011 年生策會報告
新移民	141,420	20-49 歲	---	40.3-176.2	INT J TUBERC LUNG DIS 18(8):931-938
經濟弱勢*	678,296	全年齡層	---	59.7	IUATLD 2014 abstract
矯正機關	65,000	全年齡層	25%	244	Thorax 2013;68:263-268、法務部 2013 統計資料
TNF- α -blocker users	5,383	50 歲以上	18.6%	293-530	TFDA RMP report、2012 年生策會報告
HIV	22,000	15-49 歲為主	6.8%-15%	390-500	external review 報告、生策會報告、PLoS ONE 8(8): e73069
糖尿病	1,200,000	40 歲以上	25.4%	99.9-150	生策會報告、: Clinical Infectious Diseases 2012;54(6):818,Au
洗腎	74,216	50 歲以上	26.6%	300	生策會報告、Clin Microbiol Infect 2011; 17: 1646-1652

故事還沒結束

Imperial College
London

傅涵



辜鉅璋



The
University
Of
Sheffield.

結論

- 隨著疫情的下降與趨緩，潛伏感染在結核病防治的角色將愈形重要
- 針對高風險族群(包括接觸者)的篩檢與預防性投藥是未來防疫政策之重點族群。但許多的發病個案可能將來自於中低度風險但人數眾多的族群
- “最後一哩路”

I want
ZERO
TB DEATHS



I want a
WORLD
FREE OF TB



WORLD TB DAY 24 MARCH 2012

謝謝聆聽，請多指教！

林先和

hsienho@gmail.com