

Preventing TB transmission in PHCs, and implications for COVID

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MHSC 5th Occupational Health Dialogue

“Reprioritising and reimagining occupational health to promote the health of mine employees in the era of COVID-19”



MHSC

Mine Health and Safety Council



TB transmission in health facilities remains a problem

Risk of active TB 3x higher in HCWs vs general population

“The overall risk of both LTBI and TB to HCWs continues to be significantly higher than that of the general population.....

This study highlights the continuing need for improvements in infection control and HCW screening programs.”

Uden 2017 Open Forum Infect Dis 2017;4:ofx137

TUBERCULOSIS AMONG HEALTH CARE WORKERS

DICK MENZIES, M.D., ANNE FANNING, M.D., LILIAN YUAN, M.D., AND MARK FITZGERALD, M.B.

1995

↓

2006

Tuberculosis among Health-Care Workers in Low- and Middle-Income Countries: A Systematic Review

Rajnish Joshi^{1,2}, Arthur L. Reingold¹, Dick Menzies³, Madhukar Pai^{3*}

↓

2007

Risk of tuberculosis infection and disease associated with work in health care settings

D. Menzies,* R. Joshi,† M. Pai*

↓

2011

Tuberculosis among Health Care Workers

Iacopo Baussano[✉], Paul Nunn, Brian Williams, Emanuele Pivetta, Massimiliano Bugiani, and Fabio Scano

RESEARCH ARTICLE Open Access

↓

2016

The epidemiology of tuberculosis in health care workers in South Africa: a systematic review

Liesl Grobler^{1*}, Shaheen Mehtar², Keertan Dheda³, Shahieda Adams⁴, Sanni Babatunde⁵, Martie van der Walt⁶ and Muhammad Osman⁷

↓

2017

Risk of Tuberculosis Infection and Disease for Health Care Workers: An Updated Meta-Analysis

Lydia Uden,¹ Ella Barber,^{1,2} Nathan Ford,³ and Graham S. Cooke¹

SARS-CoV-2 can be transmitted in health facilities



Report into a nosocomial outbreak of coronavirus disease 2019 (COVID-19) at Netcare St. Augustine's Hospital

15 May 2020

Dr Richard Lessells

Prof Yunus Moosa

Prof Tulio de Oliveira

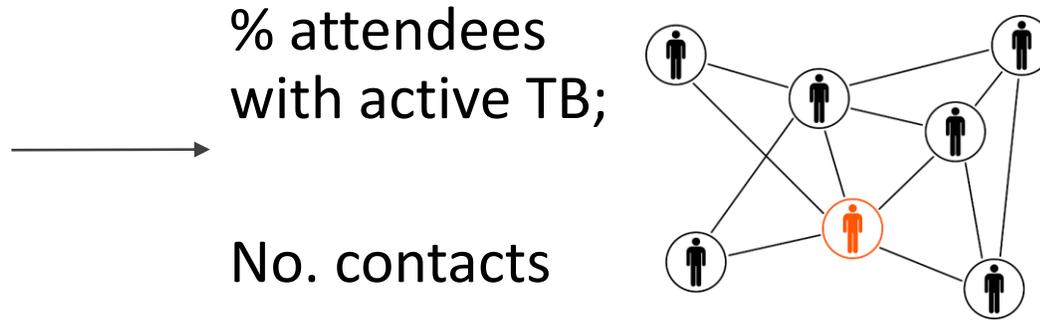
Nosocomial Transmission of Coronavirus Disease 2019: A Retrospective Study of 66 Hospital-acquired Cases in a London Teaching Hospital

Hannah M. Rickman,^{1,5} Tommy Rampling,¹ Karen Shaw,² Gema Martinez-Garcia,² Leila Hail,² Pietro Coen,^{1,2} Maryam Shahmanesh,^{1,3,4} Gee Yen Shin,¹ Eleni Nastouli,^{1,5} and Catherine F. Houlihan^{1,5}

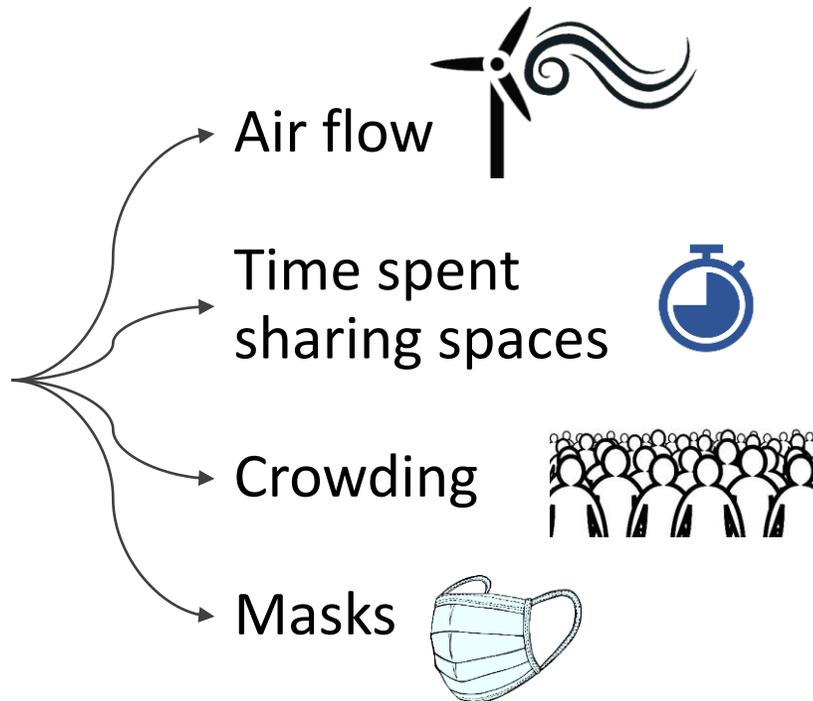
¹Department of Virology, University College London Hospitals NHS Trust, London, United Kingdom, ²Department of Infection Prevention and Control, University College London Hospitals NHS Trust, London, United Kingdom, ³Institute for Global Health, University College London, London, United Kingdom, ⁴Africa Health Research Institute, Durban, South Africa, and ⁵Department of Infection and Immunity, University College London, London, United Kingdom

What influences TB transmission risk in health facilities?

Risk of contact with a person with infectious TB



Risk of transmission given contact with infectious TB



SARS-CoV-2 is transmitted by aerosol, so the same principles apply

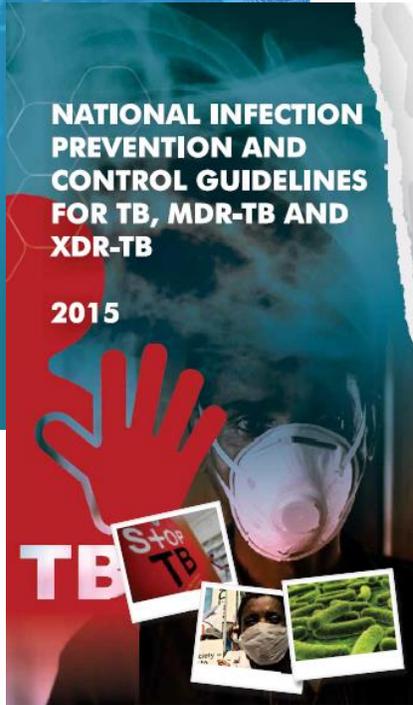
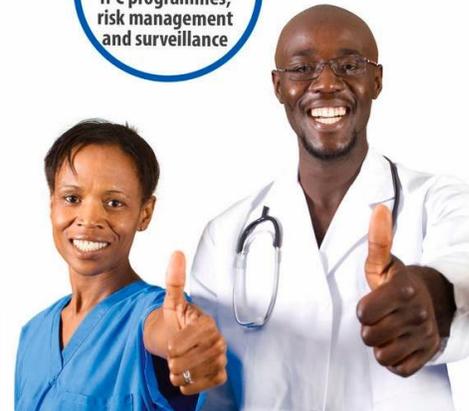
No shortage of policy or guidelines for TB IPC

WHO guidelines on tuberculosis infection prevention and control
2019 update

Infection Prevention and Control

A guide for healthcare workers in low-resource settings

2020 edition
IPC programmes, risk management and surveillance

A poster titled 'Triage for TB infection control' from the South African Department of Health and USAID. It lists several key actions:

- Screen all people for TB symptoms immediately upon arrival. (Symptoms: Coughing, Weight loss, Night sweats and fever)
- Educate people to cover their mouth and nose with a tissue or elbow when coughing.
- Provide masks to anyone who is coughing. Keep all windows open to improve airflow.
- Give people with TB symptoms priority for rapid diagnosis.

A poster titled 'WE BEAT TB' with the following components:

- W**ear your N95 respirator and encourage patients to wear a surgical mask.
- E**nsure good ventilation in the facility.
- E**ncourage proper cough hygiene.
- T**horoughly wash your hands with soap and water after each patient, after going to the toilet and before eating.
- A**ctively live a healthy lifestyle and encourage patients to do so too.
- B**e aware of the occupational health guidelines, the TB treatment guidelines and available treatment support.



Failure of TB IPC: a problem of HCW compliance?

Tuberculosis infection control practices in a high-burden metro in South Africa: A perpetual bane for efficient primary health care service delivery



Journal of Infection and Public Health (2012) 5, 67–81



ELSEVIER

Tuberculosis infection control in a high drug-resistance setting in rural South Africa: Information, motivation, and behavioral skills

RESEARCH ARTICLE

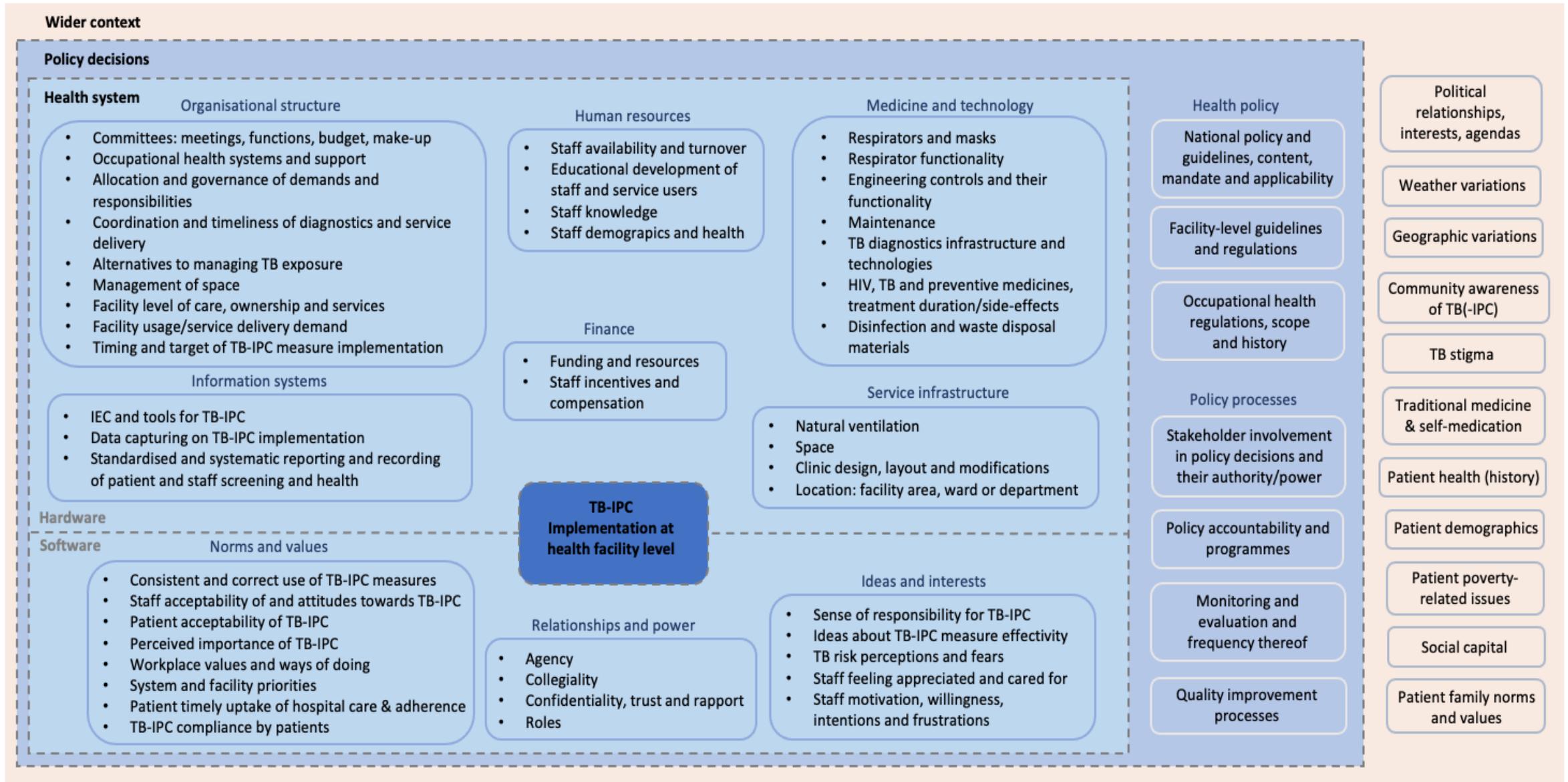
Open Access

Evaluation of tuberculosis infection control
measures implemented at primary health care
facilities in Kwazulu-Natal province of South
Africa

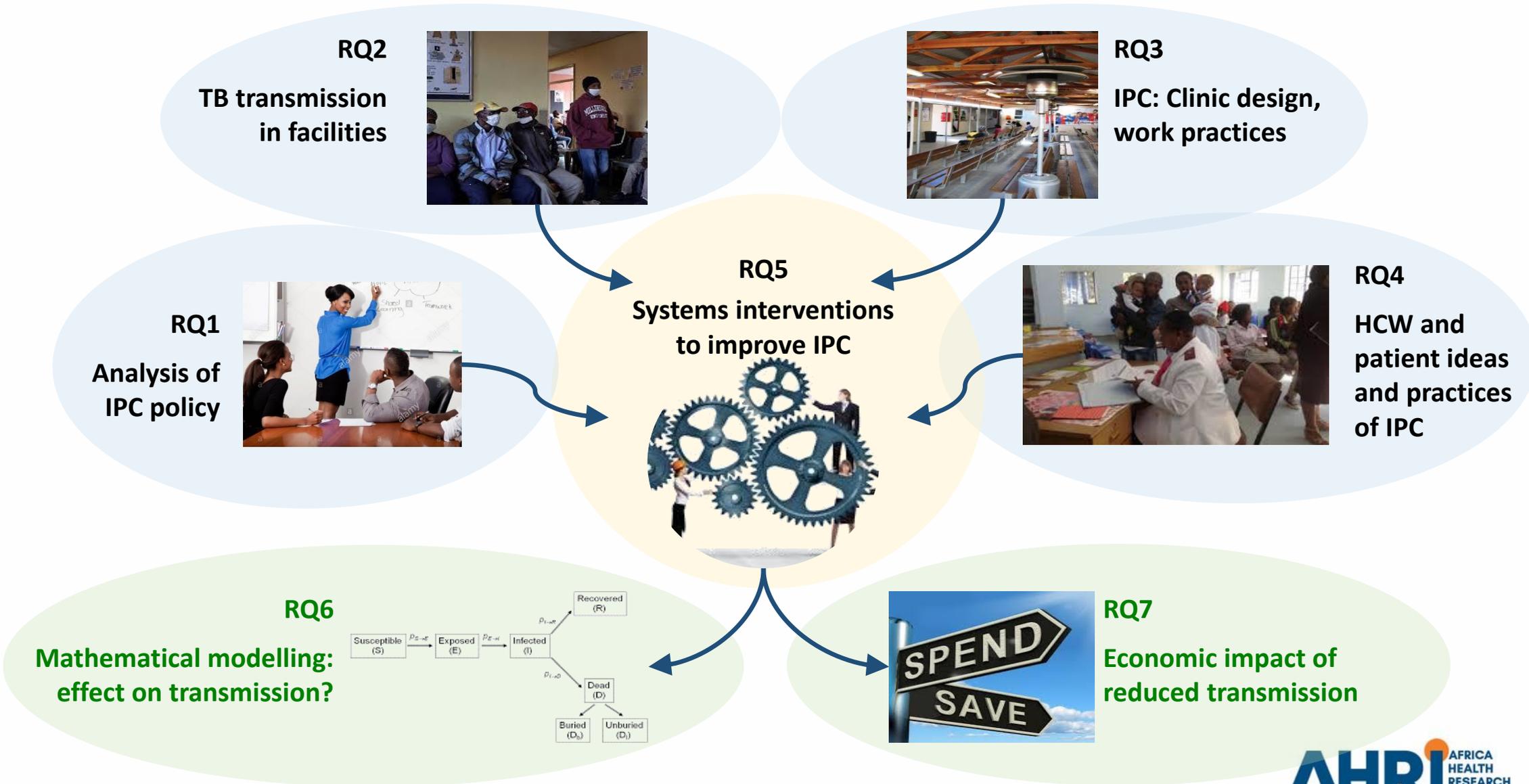


<http://www.elsevier.com/locate/jiph>

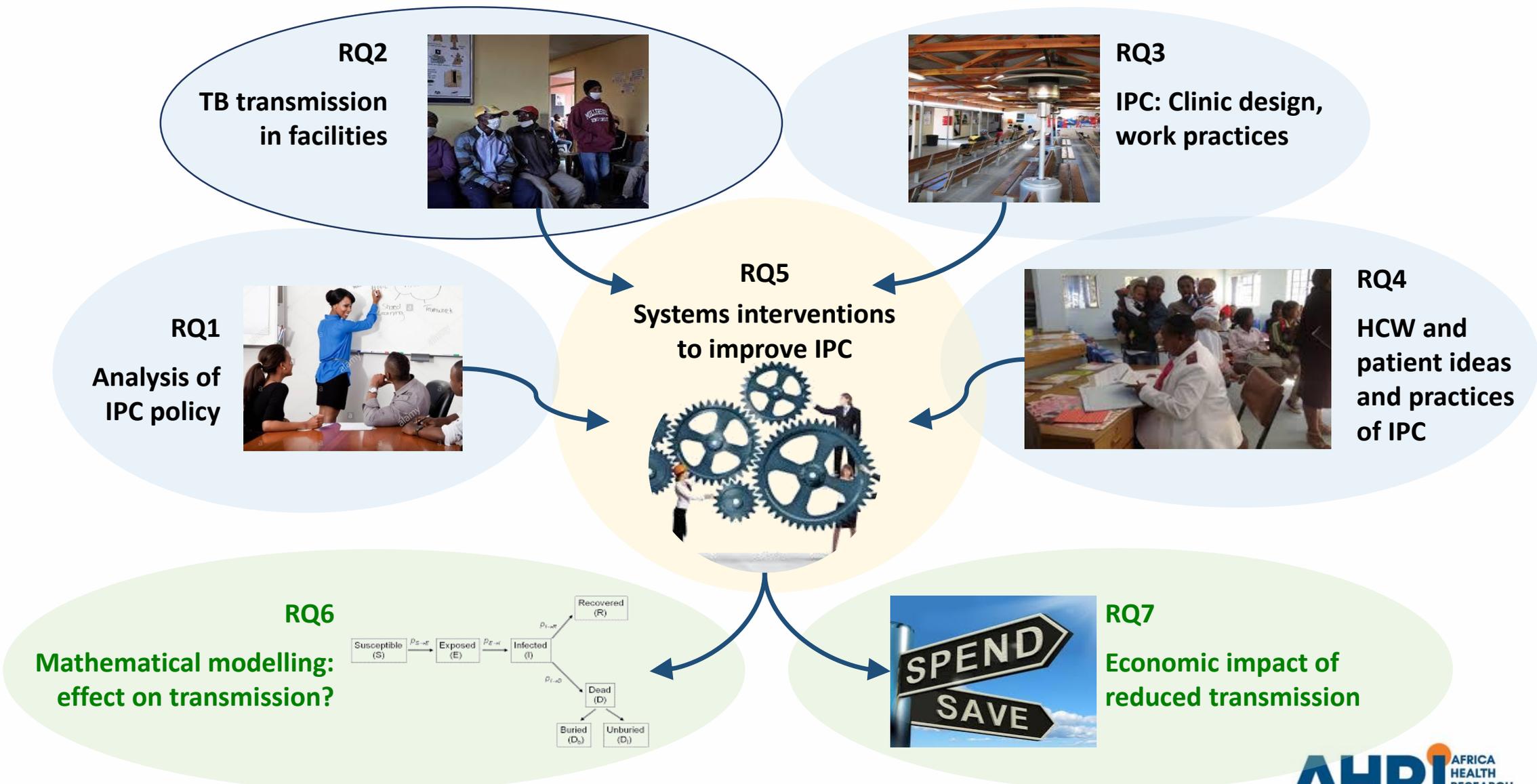
Many health system factors influence TB IPC implementation



Umoya omuhle: a whole systems approach to TB IPC in PHCs



Umoya omuhle: clinic TB prevalence survey

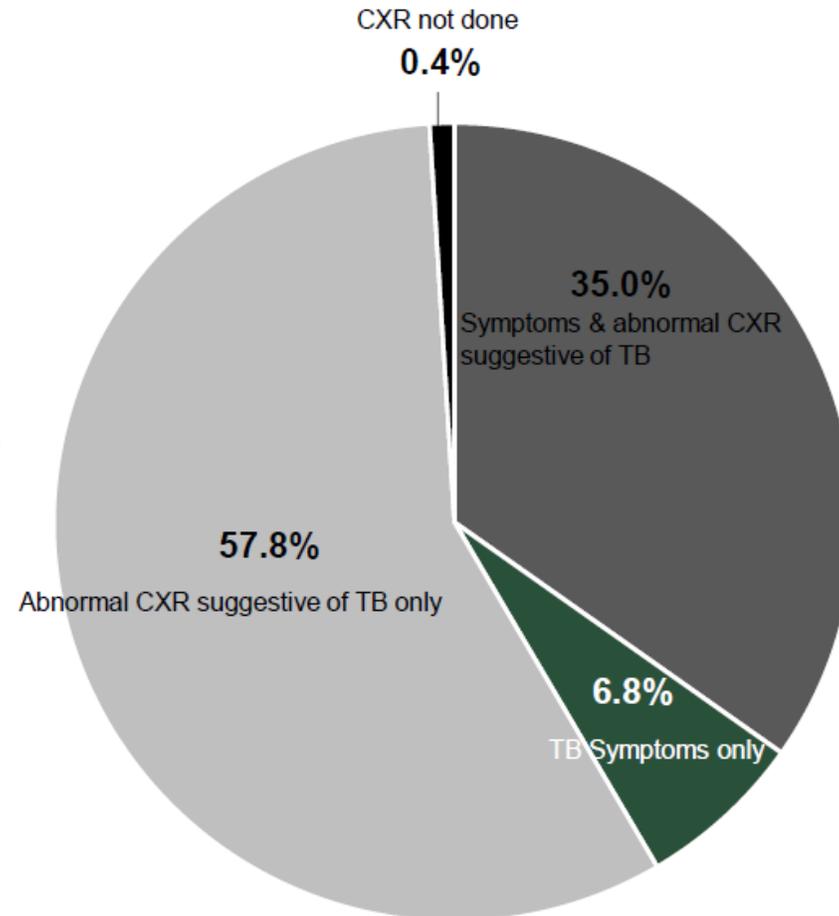


Most clinic attendees with Mtb in sputum don't report TB symptoms

- *Umoya omuhle* survey of randomly-selected adults registering in two primary healthcare clinics in KZN
- All asked to give a sputum specimen, regardless of symptoms
- Among 2055 participants
 - 131 (6.4%) reported ≥ 1 TB symptom (cough, weight loss, fever, night sweats)
 - 20 (1.0%) had Mtb cultured from sputum
- Among 20 with Mtb in sputum
 - **14/20 (70%) reported no TB symptoms**

Most people in community surveys with Mtb in sputum don't report TB symptoms

58% people with TB reported no TB symptoms



More half of the cases had an abnormal CXR only

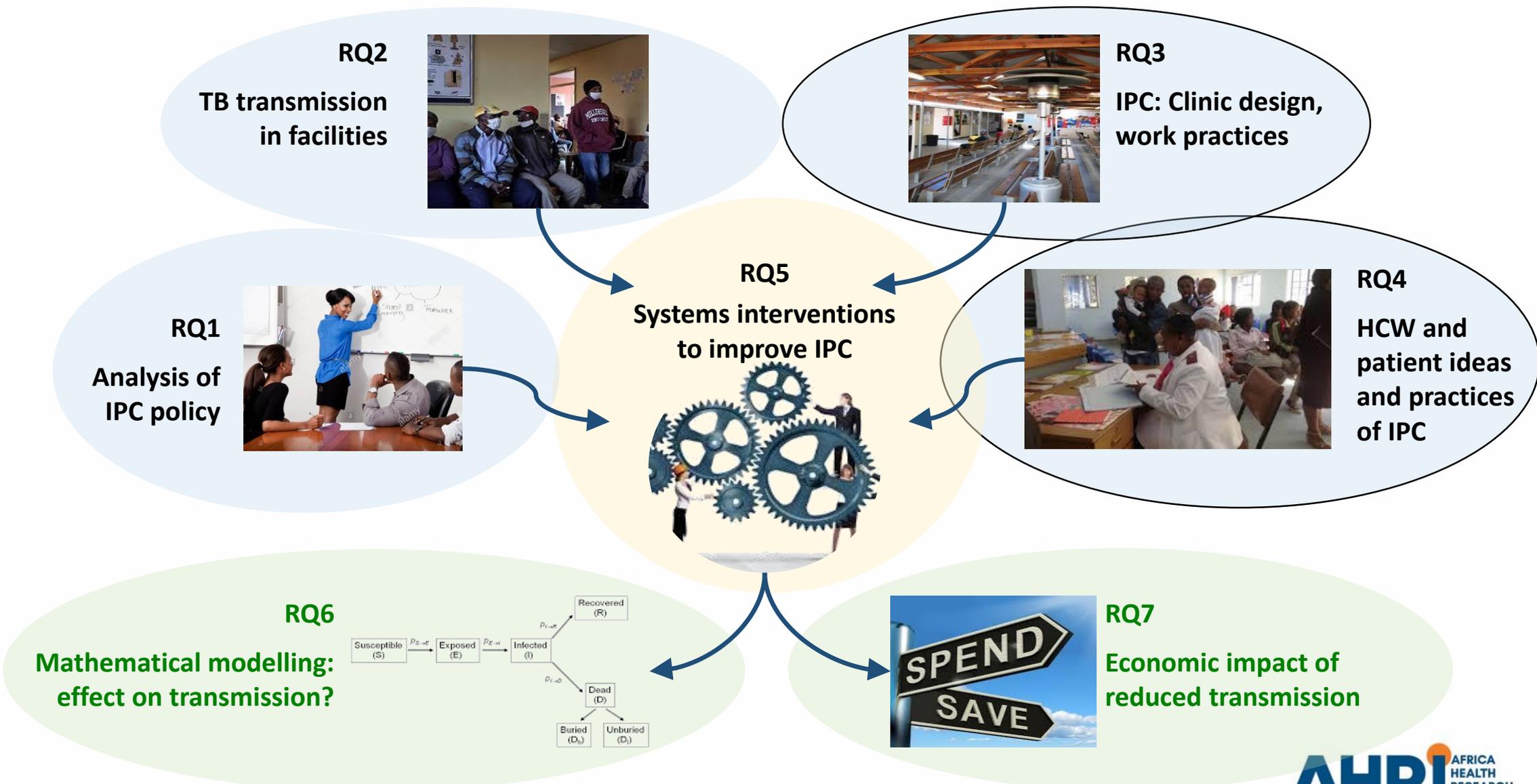
6.8% had TB symptoms only

Most people in community with SARS-CoV-2 on PCR report no symptoms

- PHIRST-C study: community-based cohorts in Mpumalanga (rural) and North West (urban)
- 222 households, 1189 individuals (including children)
- Symptom screen and nasal swab for SARS-CoV-2 PCR twice weekly July 2020 – March 2021
- Among 259 PCR+ episodes, **217 (84%) reported no symptoms**

IPC strategies which depend on identifying symptoms will likely miss a lot of people with TB and COVID

Umoya omuhle: contextual influences on TB IPC in PHCs



Contextual barriers to TB IPC implementation

PPE:

Absence of perceived risk

My personal perception [of the N95] is probably very warped. I'll (only) wear a mask when I specifically see a patient. I don't deal a lot with the TB patients. But if I do see somebody that's very sick, then I will be a little bit strict with wearing the mask" (WC, Facility 5, [Doctor](#)).

Perceived stigma:

They [patients] do not wear them because they think we are stigmatizing them. Sometimes they might wear it for the first 10-20 minutes. After that they pull it off. You will find they will have it on but below their chins or on top of their heads, forgotten (KZN, Facility 3, [TB Nurse](#)).

Ventilation:

Air flow requirements are perceived to be at odds with climatic and infrastructural conditions

"Sometimes it's very cold. We can't open these doors because there are old people who are sitting here" (WC, Facility 4, TB nurse).

Patient flow/crowding:

e.g. Bottlenecks in corridors not designed or intended for waiting

Fieldnote observations, WC: Facility with a high patient load given in-migration to the area and the reputation of the clinics for good care. A large, well ventilated central atrium for waiting. However, patients crowded in a corridor outside the first point of care for vital signs and were too afraid to move away in case they did not hear the nurse calling their name and thus went to the back of the very long queue.

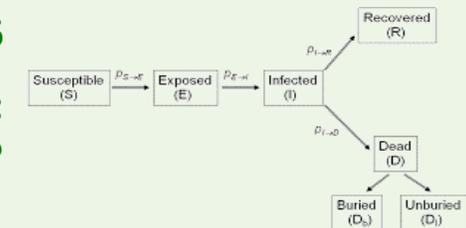
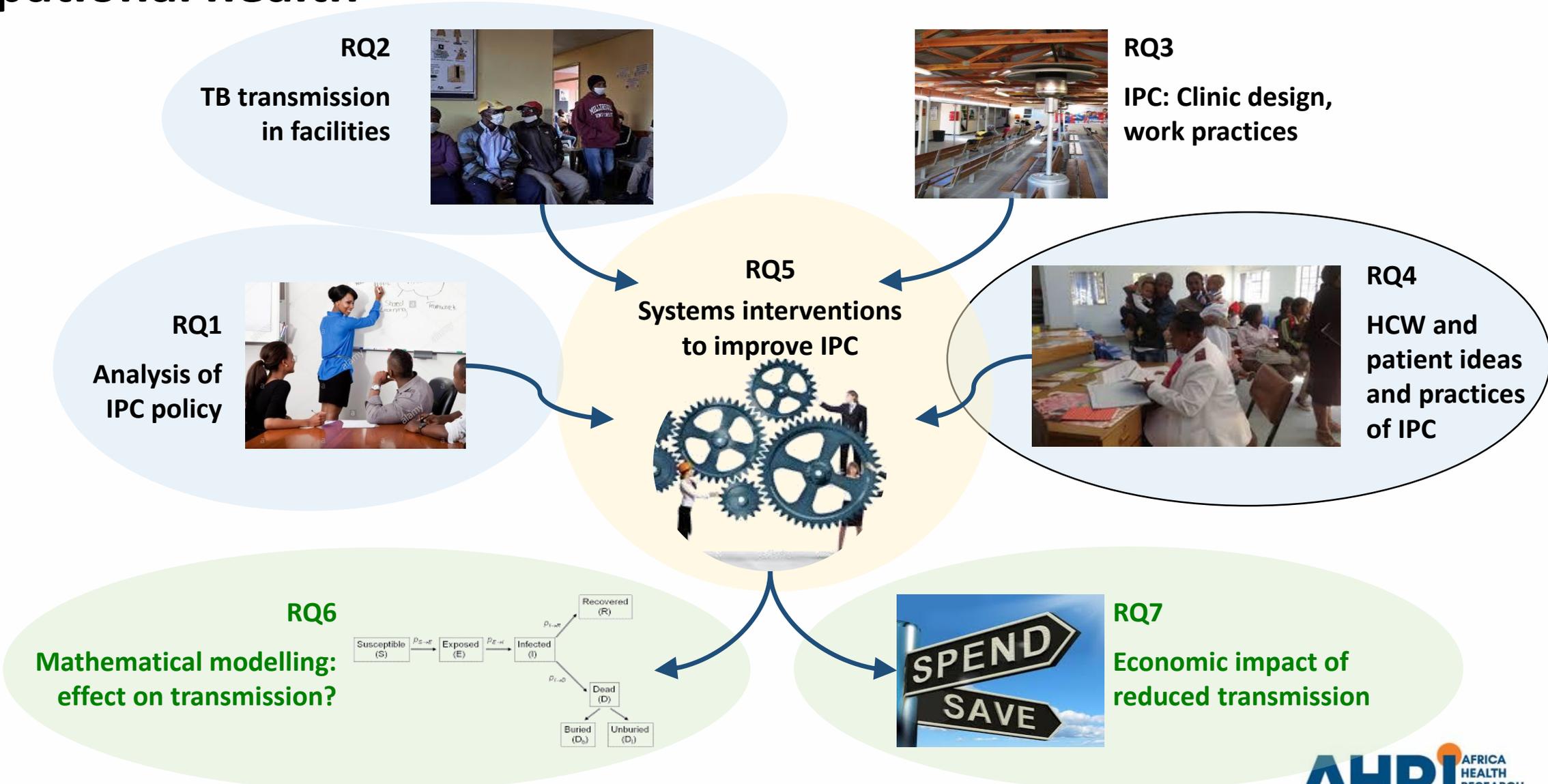
Barriers to HCW adherence with IPC guidelines for respiratory infectious diseases

Main findings:

- HCW unsure how to adhere to guidelines
- HCW not trained on IPC or how to use PPE
- Insufficient space to isolate patients
- Lack of PPE
- Workplace culture

TB IPC interventions need to move from a focus on compliance to a systems focus

Umoya omuhle: HCW perceptions of TB IPC relevant to occupational health



PHC HCW perceptions of occupational health

PPE:

Absence of perceived risk:

“Patients do not spend a lot of time here. If you are asking about masks, I do not wear a mask personally. It’s uncomfortable even. I don’t wear the mask, even though I have them. And the patients I see normally do not have mask on. I would appreciate it if the sisters asked the TB patients they send here to wear masks.”

“I only wear one when patients are symptomatic.”

Lack of PPE:

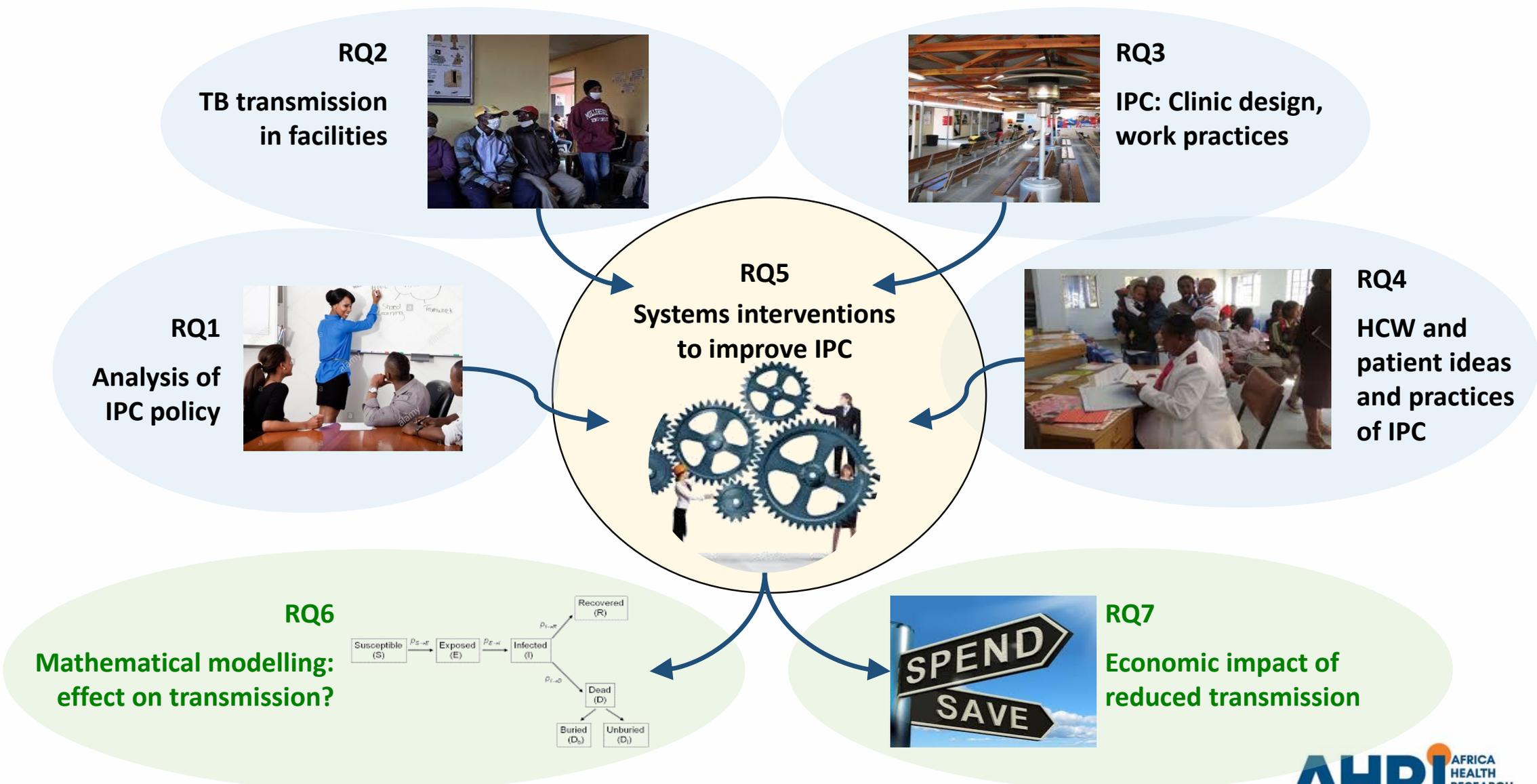
“...not sure if masks are available at the clinic, I never wear one”. Observation: *There is a N95 mask box on the cabinet in the TB room, behind boxes with condoms.*

Occupational health TB screening:

Staff aware it should be done, but often isn’t

- often not available on site at PHCs
- staff not called for screening
- staff too busy to attend “mother” hospital
- some staff reported sending their own sputum for testing
- several reports that screening should be organised at the clinic (and some clinics do this)

Umoya omuhle: developing systems interventions for TB IPC



Developing systems interventions for TB IPC

System dynamics modelling: a way for policy makers and practitioners to identify and prioritise interventions

Two workshops (Durban, 2019) with staff from national and provincial levels (Western Cape and KwaZulu-Natal)

- Policy makers (n = 9): policy-makers with expertise in TB, primary care, financing, information systems, medicine availability
- Practitioners (n = 15): patient advocates, health care staff and managers, program leadership, architecture and infrastructure specialists



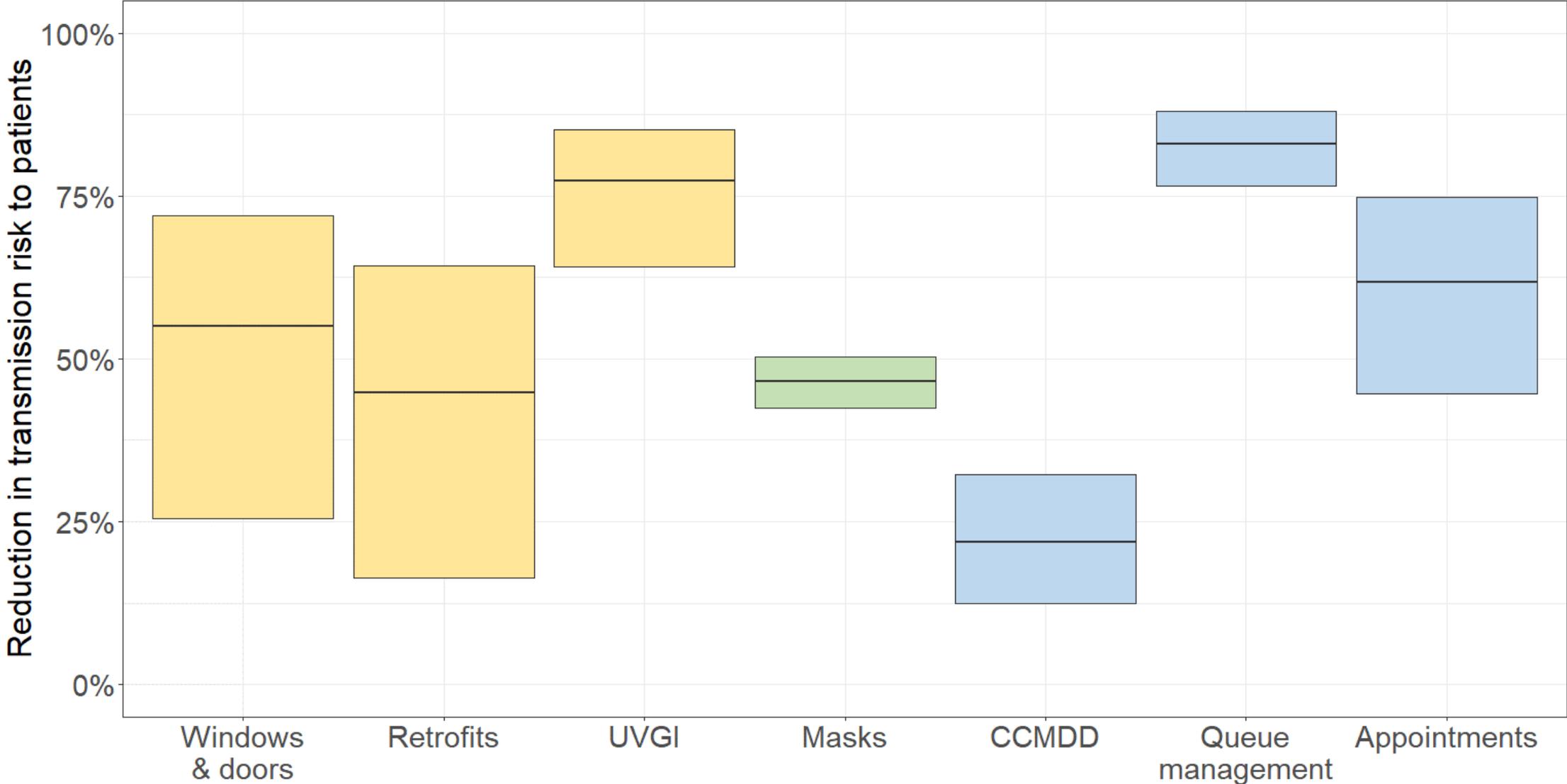
Interventions prioritised

Intervention mechanisms and elements	Intervention 1: Improving ventilation by opening doors and windows 	Intervention 2: Improving ventilation at clinics via simple retrofits 	Intervention 3: Installation of UVGI lights	Intervention 4: Surgical mask wearing for patients & N95 respirators wearing for staff 
Core shared elements	Surveys with patient to monitor satisfaction and potential issues Training by the Office of Health Standards Compliance, at facility level for all staff Training for IC peer-reviewers, operational managers at central level Supervision and monitoring by operational managers (with IPC lead support) Additional monitoring and communication to facility and policy via IC peer- and HAST reviews Communication campaigns with patients and staff			
Specific elements	Weekly staff and monthly community workshops in first 3 months to enable troubleshooting + intervention being embedded	One-off workshop to decide which retrofits	UVGI installation + new operational manager responsibilities	Weekly staff and monthly community workshops in first 3 months to enable troubleshooting + intervention being embedded

Interventions prioritised

Intervention mechanisms and elements	Intervention 5: Curbing high clinic utilization by strengthening medicine dispensing & distribution in the community (CCMDD) 	Intervention 6: Reducing crowding in waiting areas via introduction of a queue management system 	Interventions 7: Addressing high utilization at clinics via introduction of an appointment system 										
Core shared elements	Surveys with patient to monitor satisfaction and potential issues <table border="1" data-bbox="644 529 2474 1072"> <tr> <td data-bbox="644 529 1281 639"></td> <td data-bbox="1281 529 2474 639"> Workshops between facility staff and communities to decide on design of the new systems/regularly check in </td> </tr> <tr> <td data-bbox="644 639 1281 749"></td> <td data-bbox="1281 639 2474 749"> Training by the Office of Health Standards Compliance, at facility level for all staff on necessity of new systems </td> </tr> <tr> <td data-bbox="644 749 1281 859"></td> <td data-bbox="1281 749 2474 859"> Training for IC peer-reviewers, operational managers at central level </td> </tr> <tr> <td data-bbox="644 859 1281 969"></td> <td data-bbox="1281 859 2474 969"> Supervision and monitoring by operational managers </td> </tr> <tr> <td data-bbox="644 969 1281 1072"></td> <td data-bbox="1281 969 2474 1072"> Availability of covered areas to enable system to function </td> </tr> </table>				Workshops between facility staff and communities to decide on design of the new systems/regularly check in		Training by the Office of Health Standards Compliance, at facility level for all staff on necessity of new systems		Training for IC peer-reviewers, operational managers at central level		Supervision and monitoring by operational managers		Availability of covered areas to enable system to function
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	Supervision and monitoring by operational managers												
	Availability of covered areas to enable system to function												
Specific elements	Maximise use of existing pick-up points; revise guidelines to increase the number of patients potentially eligible; increase medicine dispensation time-frame	Specific process of queuing system	Specific process of appointment system										

Modelled % reduction in Mtb transmission to patients

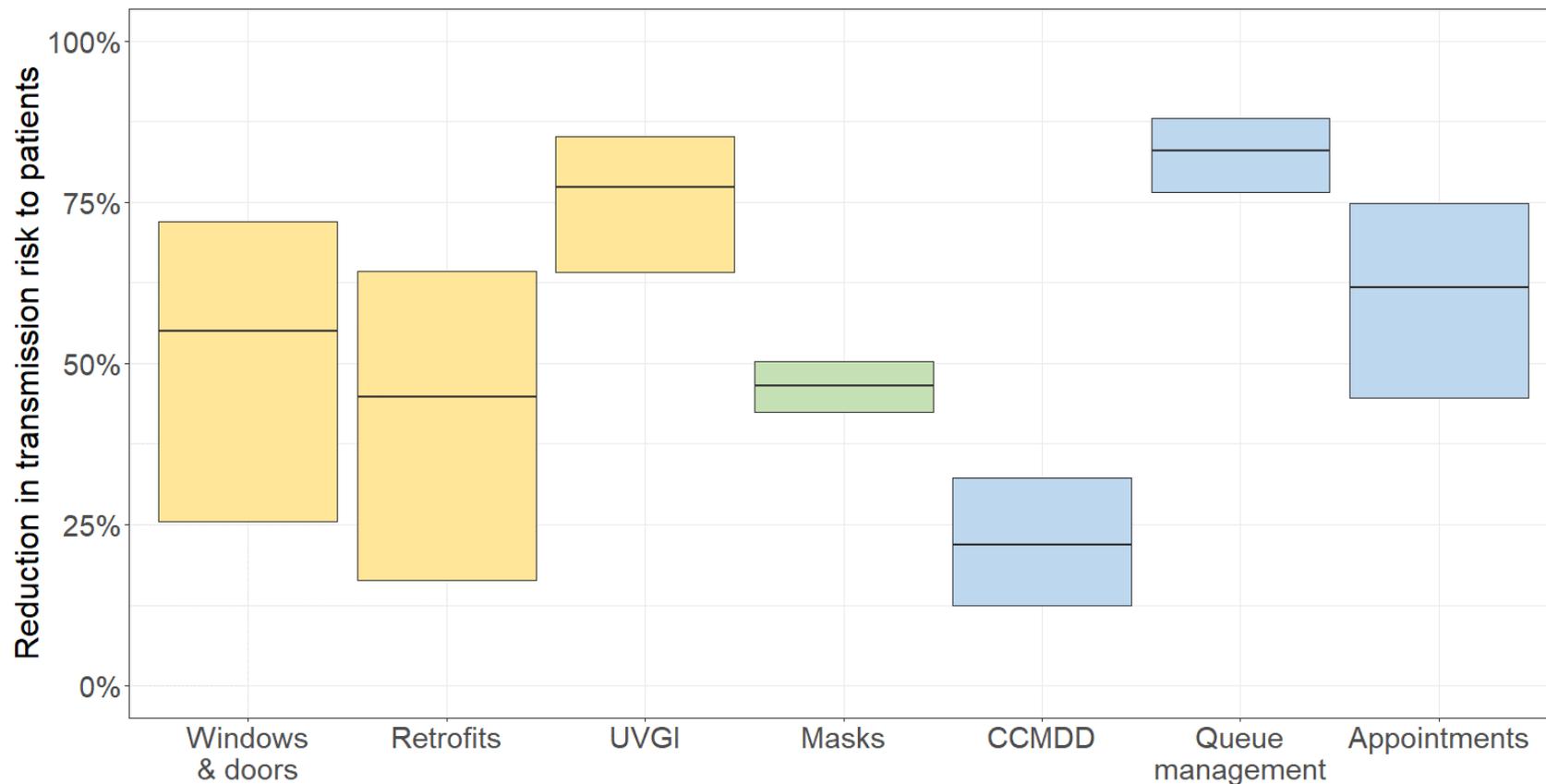


All interventions are highly cost-effective; some cost-saving

All interventions highly cost-effective: in South Africa, considered cost effective if ICER < US\$ 3,200 per DALY averted

Retrofits and expansion of CCMDD estimated to save money

Incremental cost-effectiveness ratio (ICER) = cost per disability-adjusted life year (DALY) averted



Intervention	W & D	Retrofits	UVGI	Masks	CCMDD	Q Mx	Appts
Total costs (2019 USD)	63.9M	63.7M	63.8M	63.97M	55.2M	63.7M	63.8M
Incremental DALYs averted	1,674	1,345	2,321	1,446	980	2,480	1,861
ICER vs. base case	126	cost-saving	57	151	cost-saving	28	72

“IPC” interventions compare favourably to other TB interventions

All interventions highly cost-effective: in South Africa, considered cost-effective if ICER < US\$ 3,200 per DALY averted
Our proposed interventions compare favourably in terms of cost-effectiveness to other accepted TB interventions:

Study	Intervention	ICER (cost/DALY averted, USD)
Our study	UVGI	57
	Optimised CCMDD	cost-saving
	Queue management	28
Menzies et al. (2016)	Optimise TB screening among HIV-infected patients and scale-up IPT	732
	Improve TB symptom screening in primary care and linkage to care	1,119
	Reduce initial loss to follow-up and improve staffing for MDR-TB treatment	599
Bozzani et al (2020)	Reach 100% Xpert coverage	1,121
	90% follow-up of Xpert negatives (microscopy)	847
	ICF - Cough triage in 90% of PHC patients	2,061
	ICF – WHO symptom screened in 90% PHC patients	4,190

Incremental cost-effectiveness ratio (ICER)
 = cost per disability-adjusted life year (DALY) averted

Summary

- IPC solutions which depend upon identifying symptomatic people will miss many people with TB (and COVID)
- IPC may be more usefully framed as a systems problem, not a compliance problem
- System interventions for TB IPC prioritised by policy makers and practitioners
 - predicted to be effective and cost-effective
 - do not rely on reported symptoms
 - less dependent on HCW adherence
 - (some) would have other benefits for patients (e.g. reduced waiting time)
- Most of these interventions would likely also be effective vs. COVID, therefore even more cost-effective

Thanks to everyone who made Umoya omuhle happen

Study participants: nearly 7,000 people: patients, HCWs, government staff, engineers, architects, activists; staff at the 12 participating clinics and DoHs

Investigators and LSHTM core team: Kathy Baisley, Peter Beckwith, Adrienne Burrough, Chris Colvin, Karin Diaconu, Indira Govender, Alison Grant, Idriss Kallon, Aaron Karat, Karina Kielmann, Hayley MacGregor, Nicky McCreesh, Janet Seeley, Naomi Stewart, Alison Swartz, Amy Thomas, Anna Vassall, Anna Voce, Richard White, Tom Yates, Gimenne Zwama

Africa Health Research Institute: Nkosingiphile Buthelezi, Njabulo Dayi, Siphephelo Dlamini, Yutu Dlamini, Anita Edwards, Dickman Gareta, Patrick Gabela, Emmerencia Gumede, Sashin Harilall, Kobus Herbst, Mandla Khoza, Nozi Khumalo, Zilethile Khumalo, Nondumiso Kumalo, Richard Lessells, Sithembiso Luthuli, Sinethemba Mabuyakhulu, Nonhlanhla Madlopha, Thabile Mkhize, Duduzile Mkhwanazi, Zinhle Mkhwanazi, Zodwa Mkhwanazi, Sashen Moodley, Sihle Mthethwa, Xolile Mpfana, Sphiwe Mthethwa, Nozipho Mthethwa, Silindile Mthembu, Sanele Mthiyane, Vanisha Munsamy, Tevania Naidoo, Nompilo Ndlela, Thandekile Nene, Sabelo Ntuli, Nompumulelo Nyawo, The PIP CRAs, Anand Ramnanan, Aruna Sevakram, Sizwe Sikhakane, Zizile Sikhosana, Theresa Smit, Marlise Venter, Precious Zulu

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Funders:



Siyabonga, thank you for your attention



Find out more about Umoya omuhle: <https://www.lshtm.ac.uk/research/centres-projects-groups/uo#welcome>