

# Digital technology to end TB: *current state, evidence and solutions*

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«Wolfheze Workshops»

# Objectives of the presentation

- How digital technologies can support the End TB Strategy
- The evidence underpinning the rationale for digital technologies in TB care
- Solutions for present and future

# Digital health & the End TB Strategy

## PILLARS AND 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

Electronic tools to help stock management and procurement

SMS communication

Electronic notification of TB cases

Mobile phone credit as enabler

Automated laboratory results

VOT

eLearning for staff

eLearning for patients

Digital unique identifier

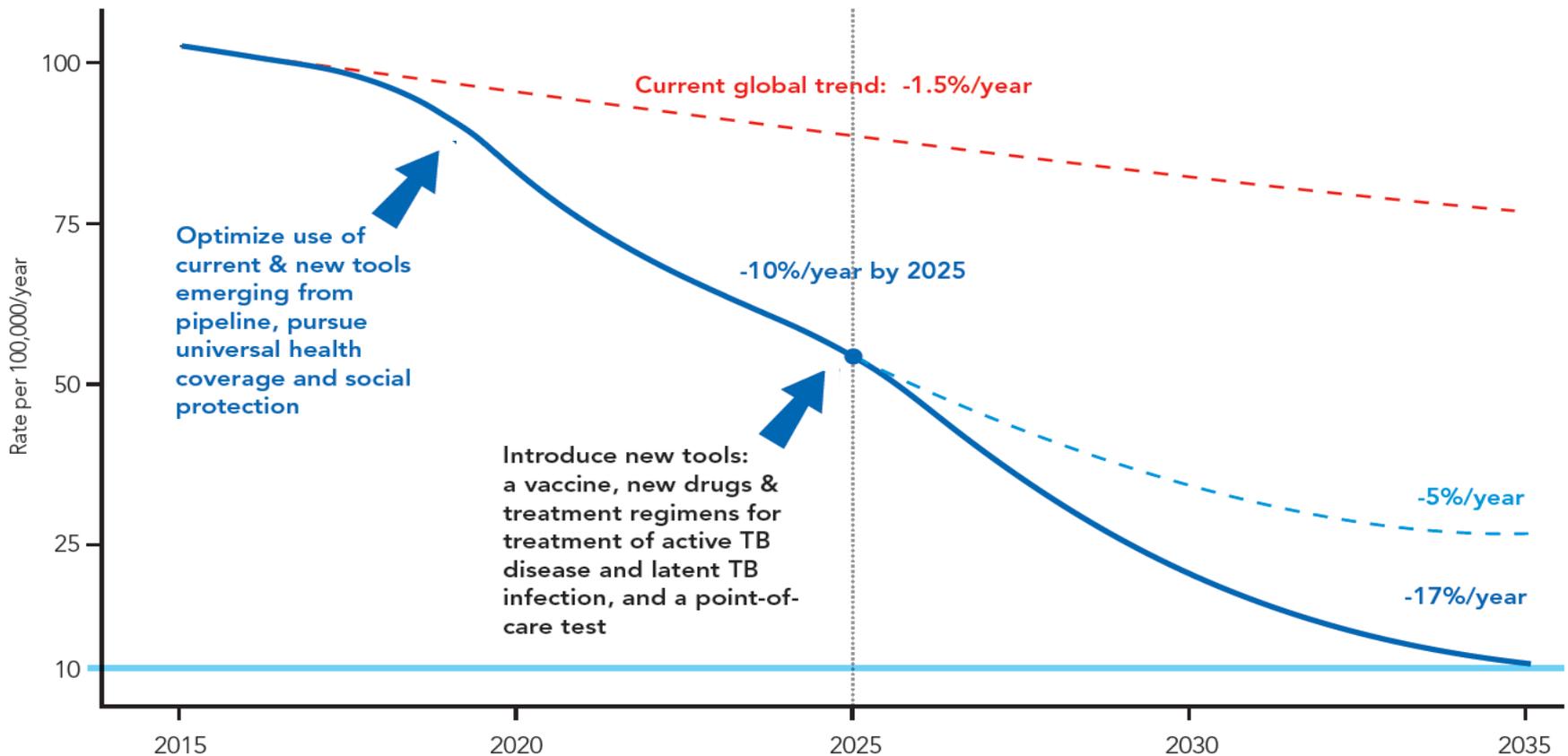
Add-on hardware to smartphones to permit clinical measurement

Mobile devices as resources for data collection



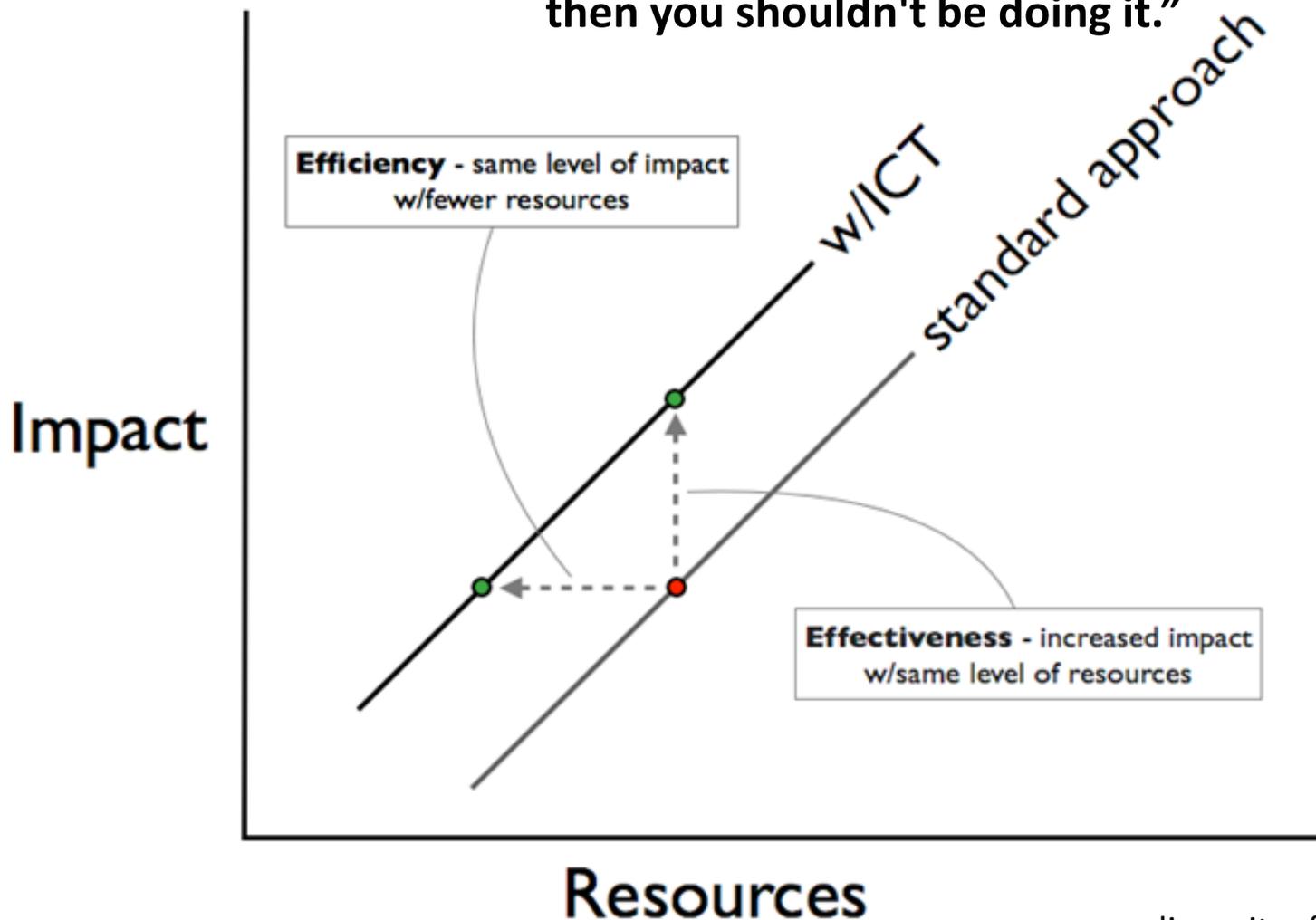
# How scalable?

*the ability to handle a growing amount of work in a capable manner or its ability to be enlarged to accommodate that growth*



# What evidence of effect?

“... if your initiative isn't increasing effectiveness or efficiency (or both) then you shouldn't be doing it.”



John BONTEMPO  
[linearityofexpectation.blogspot.ch](http://linearityofexpectation.blogspot.ch)



# Eligibility

- Scalable digital technologies designed to improve TB treatment adherence
- Studies with success as an outcome
- Control groups

# Three scalable interventions

1. Use of Short Message Service (SMS)
2. Video-observed therapy (VOT)
3. Electronic medication monitors

# Use of SMS in TB care

*Three RCTs; control=SoC*

<b>Setting, years</b> (N in intervention)	<b>Outcome</b>	<b>Risk</b>
China, 2011-2012 (966)	<b>No</b> treatment success	aMR 0.44 (0.17-1.13)
Pakistan, 2011-2014 (1110)	Treatment success	OR 1.01 (0.81-1.28)
Cameroon, 2013 (137)	6 month cure	OR 1.06 (0.65-1.73)

# Use of SMS in TB care

Nglazi et al. *BMC Infectious Diseases* 2013, **13**:566  
<http://www.biomedcentral.com/1471-2334/13/566>



RESEARCH ARTICLE

Open Access

## Mobile phone text messaging for promoting adherence to anti-tuberculosis treatment: a systematic review

Mweete D Nglazi<sup>1,2\*</sup>, Linda-Gail Bekker<sup>1</sup>, Robin Wood<sup>1</sup>, Gregory D Hussey<sup>3</sup> and Charles S Wiysonge<sup>3,4,5</sup>

### Abstract

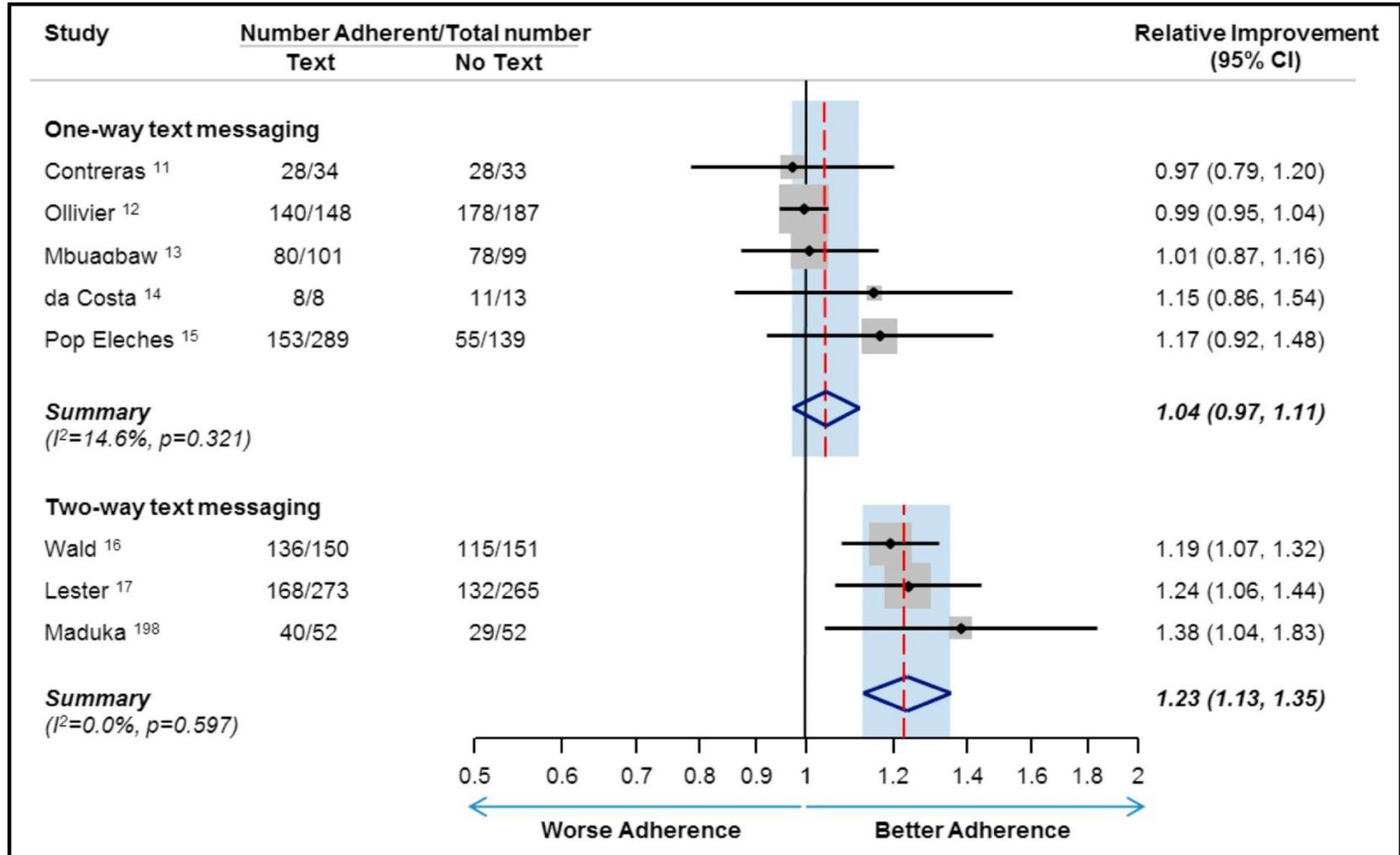
**Background:** Mobile phone text messaging (SMS) has the potential to promote adherence to tuberculosis treatment. This systematic review aims to synthesize current evidence on the effectiveness of SMS interventions in improving patients' adherence to tuberculosis treatment.

**Methods:** We searched electronic databases (PubMed, EMBASE, Science Citation Index), reference lists of relevant

"...a paucity of high-quality data on the effectiveness of SMS interventions for improving patients' adherence to tuberculosis treatment. The low quality of the current evidence implies that further studies (in particular randomized trials) ... are needed."

# One-way versus two-way SMS

Wald DS, et al. *Am J Med.* 2015 Oct;128(10):1139.e1-5.



# VOT for TB care (1)

## *modalities*

- Synchronous Video DOT
  - Real-time/live streaming
  - Videoconferencing



- Asynchronous Video DOT
  - Recorded videos
  - Store-and-forward



*Source: R Garfein*

# VOT for TB care (2)

*Chuck C et al. Int J TB L Dis. 2016 May 1;20(5):588-93*

61 TB patients using VOT vs 329 on in-person DOT; New York City, 2013-2014

Adherence to scheduled VOT sessions was 95% vs. 91% with in-person DOT ( $P < 0.01$ )

RR for treatment completion (VOT vs in-person DOT) = 1.02 (0.89-1.16)

# VOT for TB care (3)

*Wade VA et al. PLoS ONE. 2012 Nov 30;7(11):e50155.*

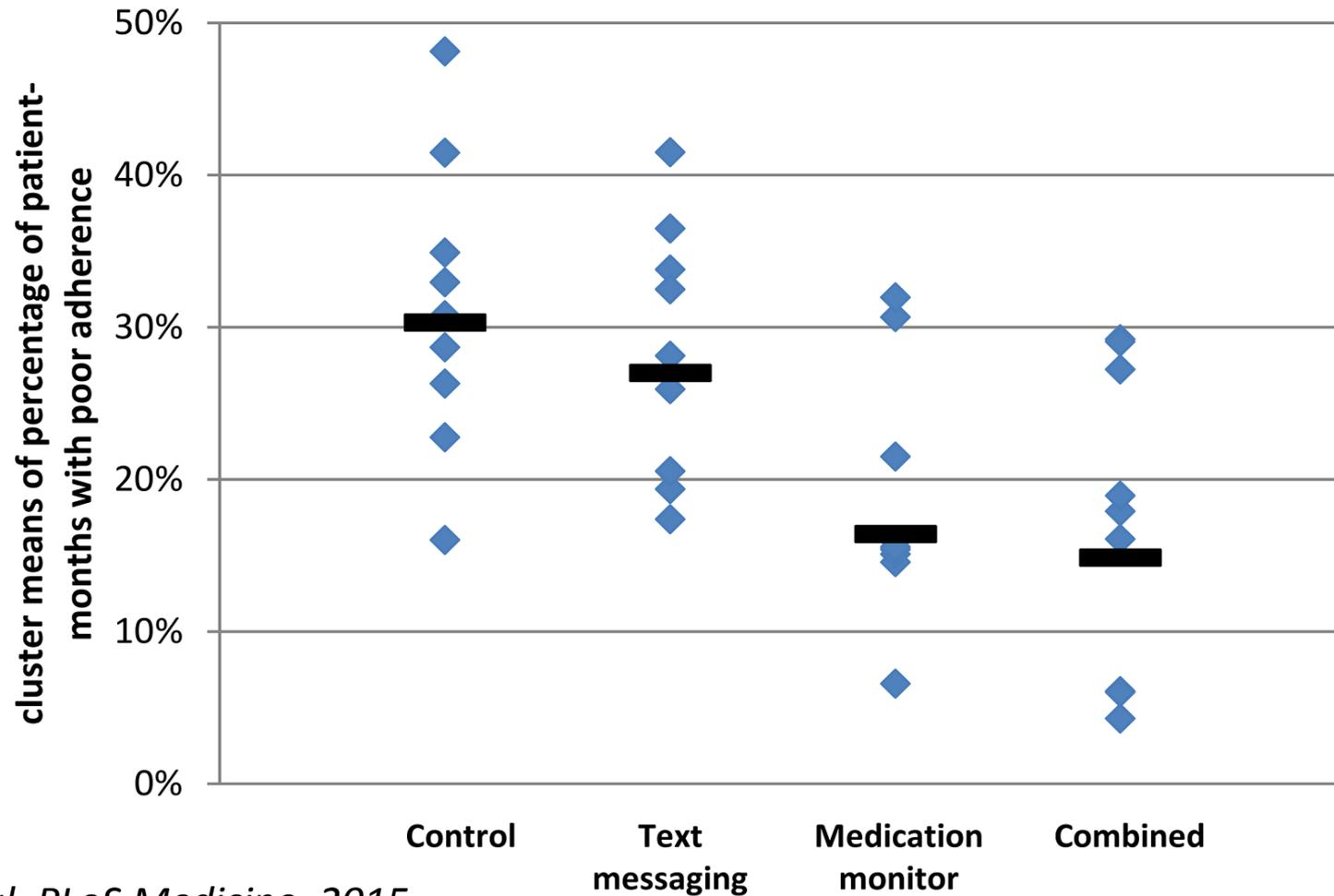
58 TB patients using VOT via desktop videophone  
vs 70 on in-person DOT; Australia, 2009-2010  
(2003+ for comparator group)

Missed observations = 12.1% in VOT group vs.  
31.1% in-person DOT group (Risk diff: 18.9% (95%  
CI: 12.2 – 25.4))

RR for treatment completion (VOT vs in-person  
DOT) = 1.47 (0.96-2.25)

# Electronic medication monitors

*RCT (36 clusters, N=4,173), China, 2011-2012*



*Liu et al, PLoS Medicine, 2015*

# Electronic medication monitors

*RCT (36 clusters, N=4,173), China, 2011-2012*

Table 3. Effectiveness of interventions on tuberculosis treatment adherence and treatment outcomes endpoints.

Endpoint and Study Arm	Number of Patients	Geometric Mean of Cluster-Level Endpoint	Unadjusted Analysis		Adjusted Analysis <sup>1</sup>	
			MR (95% CI)	p-Value	MR (95% CI)	p-Value
Major treatment outcome (treatment failure, death, or patient loss to follow-up) <sup>5</sup>						
Control	1,066	8.6%	1		1	
Text messaging	966	3.9%	0.45 (0.18, 1.16)	0.092	0.44 (0.17, 1.13)	0.084
Medication monitor	955	6.1%	0.70 (0.32, 1.53)	0.264	0.71 (0.33, 1.51)	0.346
Combined	992	8.8%	1.01 (0.46, 2.22)	0.973	1.00 (0.45, 2.20)	0.991

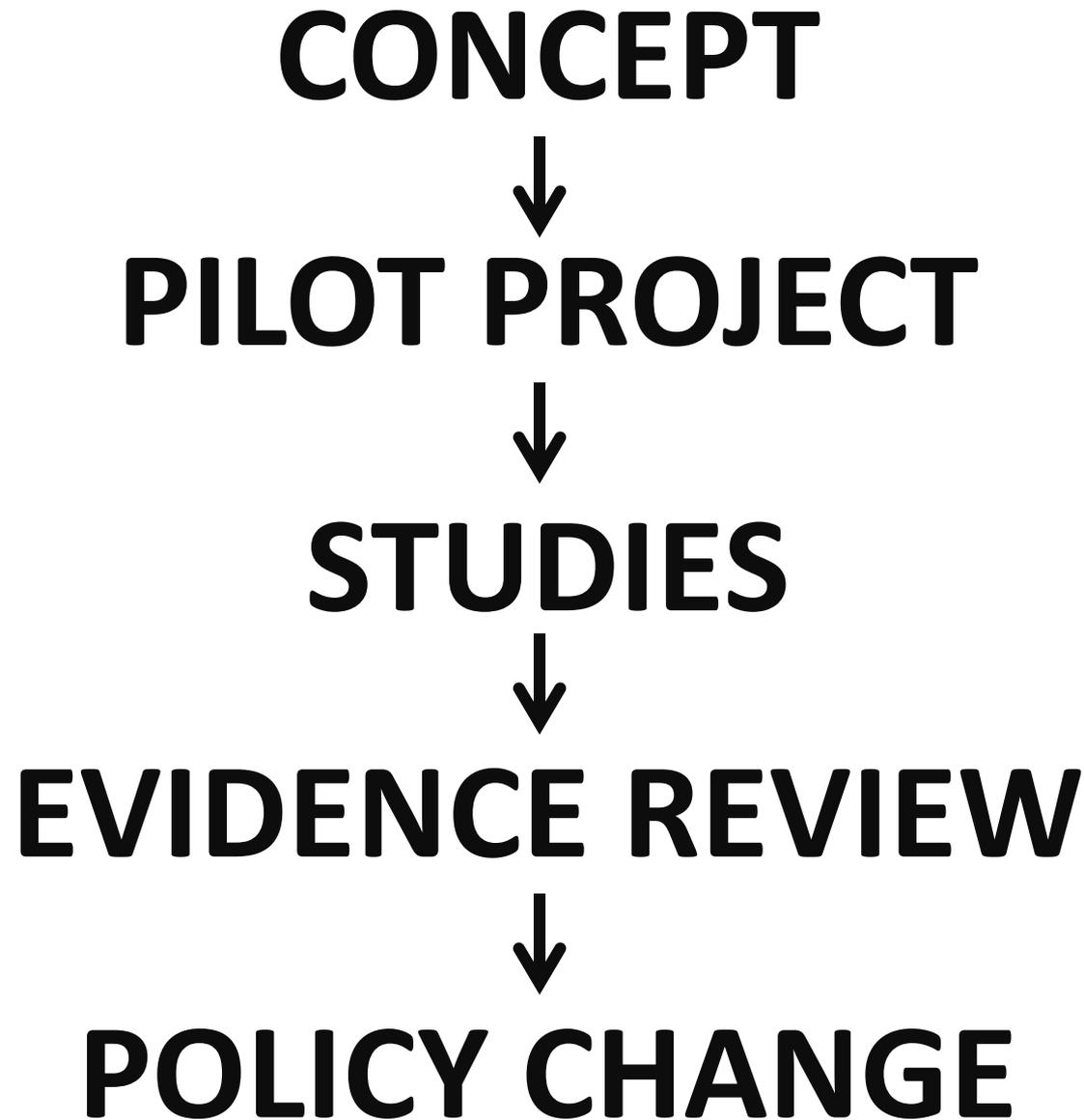
*Liu et al, PLoS Medicine, 2015*

# Evidence (1)

- Evidence-base underpinning certain digital interventions rely on **experience from outside TB care** (e.g. ART), but TB studies now becoming available. Determinants of behaviour change may be common across disease programmes even if the analogy may be imperfect.
- Several digital health concepts still need **testing under broader contexts**: geographical settings, decentralization, different patient subgroups
- Certain digital health interventions **more amenable to a traditional study design** and RCT than those for which impact is less straightforward to measure

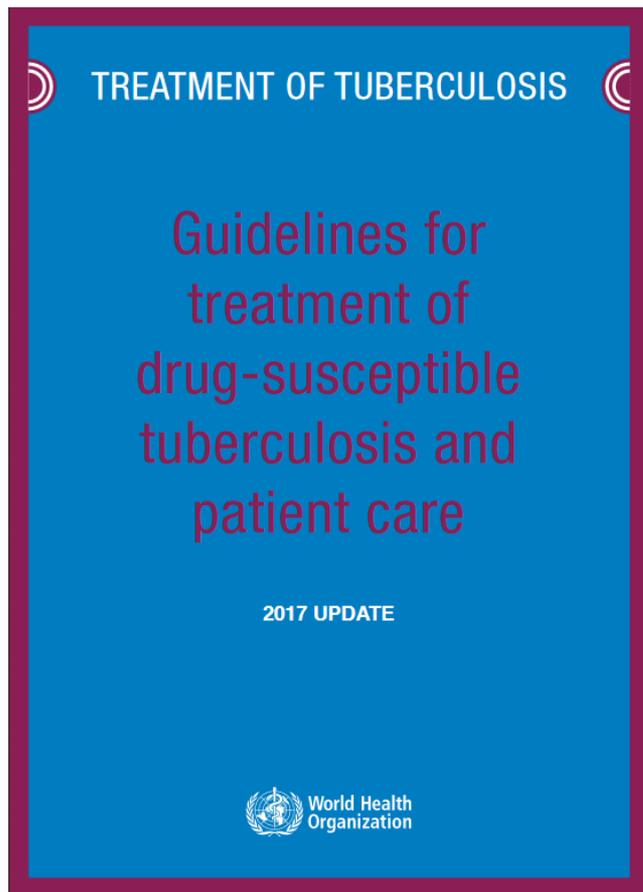
# Evidence (2)

- **Even if evidence is weak** there is a need to invest, explore and to collect data because programmes are bound to continue using digital tools and will keep asking “what works?”
- Looking **beyond the «reminder»** attributes of SMS and exploring its contribution to adherence within a package of different measures (e.g. comorbidity, patient enablers) and behaviour change models
- **Better quality evidence** (for impact or efficiency) needed, directly relevant to TB programme implementation (better rigour, RCT design)



# evidence -> WHO policy, 2016/2017

## administration option



[apps.who.int/iris/bitstream/10665/255052/1/9789241550000-eng.pdf](https://apps.who.int/iris/bitstream/10665/255052/1/9789241550000-eng.pdf)

“The following treatment administration options may be offered to patients on TB treatment:

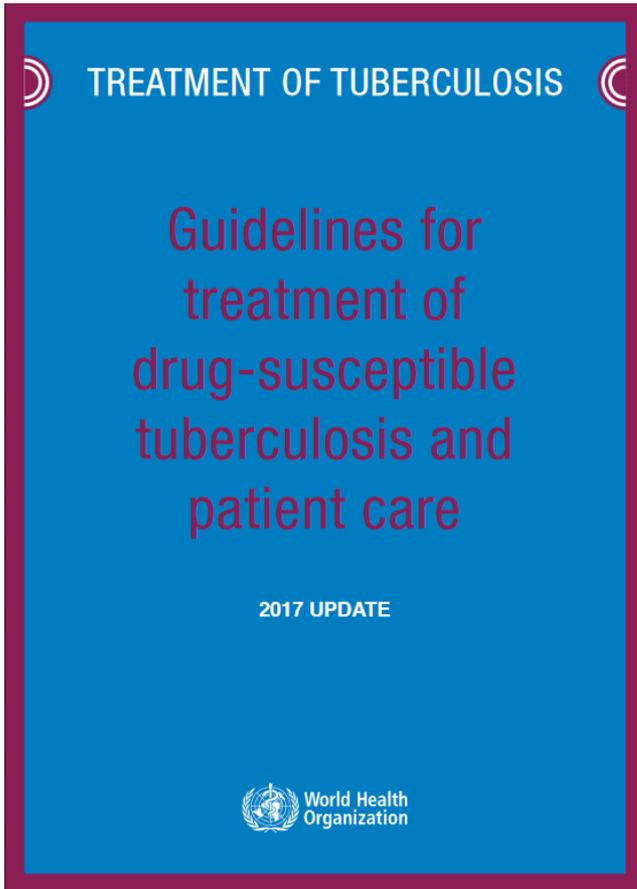
...

c) Video observed treatment (VOT) can replace DOT when the video communication technology is available and can be appropriately organized and operated by health-care providers and patients”

*[Conditional recommendation, low certainty in the evidence]*

# evidence -> WHO policy, 2016/2017

## adherence interventions

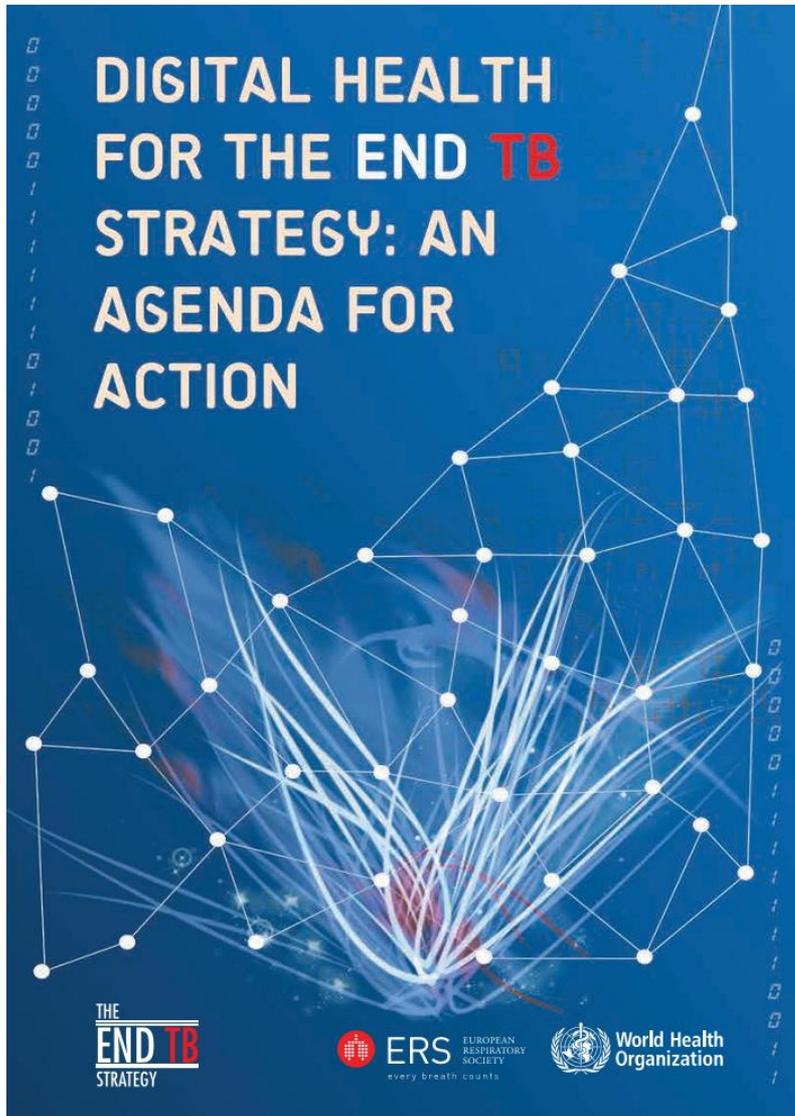


Treatment adherence interventions - including SMS, voice, and electronic medication monitors - may be offered to patients on TB treatment

*[Conditional recommendation, low certainty in the evidence]*

[apps.who.int/iris/bitstream/10665/255052/1/9789241550000-eng.pdf](https://apps.who.int/iris/bitstream/10665/255052/1/9789241550000-eng.pdf)

# “Agenda for action”



The strategic direction that WHO is mapping out to integrate digital health into preventive and care activities for the different components of the End TB strategy

Comments on the evidence and an outline of the target product profiles

*Sep 2015*

# Target product profiles (TPP) (1)

*for priority digital technologies for TB*

<b>Function</b>	<b>TPP : short description</b>
<b>Patient care</b>	1. Video treatment support (VOT) via mobiles
	2. eHealth portal
<b>Surveillance &amp; monitoring</b>	3. Graphic dashboards
	4. eNotify
	5. eReporting of adverse events of treatment
<b>Programme management</b>	6. Diagnostic device connectivity
<b>eLearning</b>	7. Patient information platform
	8. Web-based training for health care professionals
	9. Clinical decision support systems

# Target product profiles (TPP) (2)

*for priority digital technologies for TB*



TASK FORCE REPORT  
WHO/ERS STATEMENT



CrossMark

## Digital health for the End TB Strategy: developing priority products and making them work

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*ERJ; 2016*



World Health  
Organization

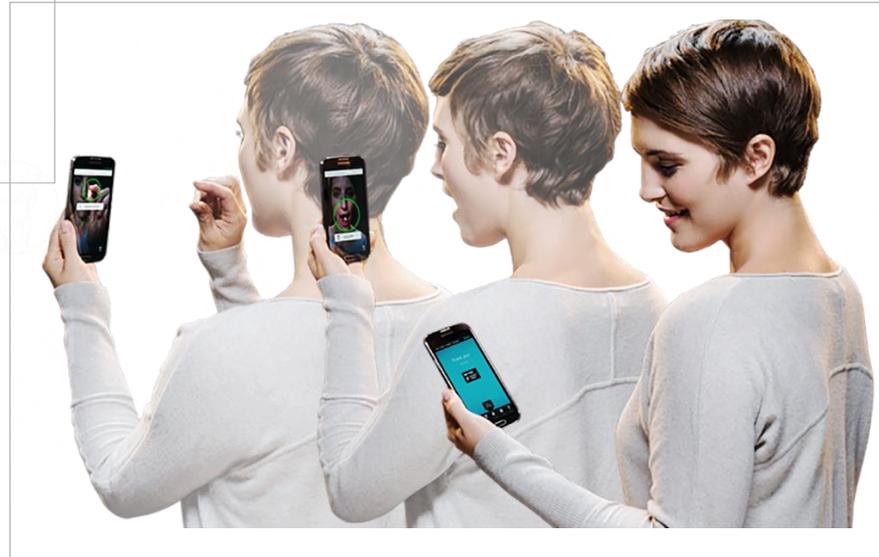


GLOBAL TB  
PROGRAMME

END TB

# WHO/ERS digital health consultation 2017

*novelties... ideas for the (near) future*



# Next steps ...

- Vast potential of digital health in action against major diseases like TB
- WHO started process of evidence-based policy on use of digital technologies
- Evidence base for role in TB efforts is emerging but challenged by resources, rapid evolution of technologies, study design, concepts like precision medicine ... in some areas the evidence will probably be limited to contextual narratives
- Nonetheless clinicians, managers, patients are bound to employ digital technologies and therefore the demand for assistance is likely to grow