Call for increased patient support focus: Review and evaluation of mobile apps for tuberculosis prevention and treatment

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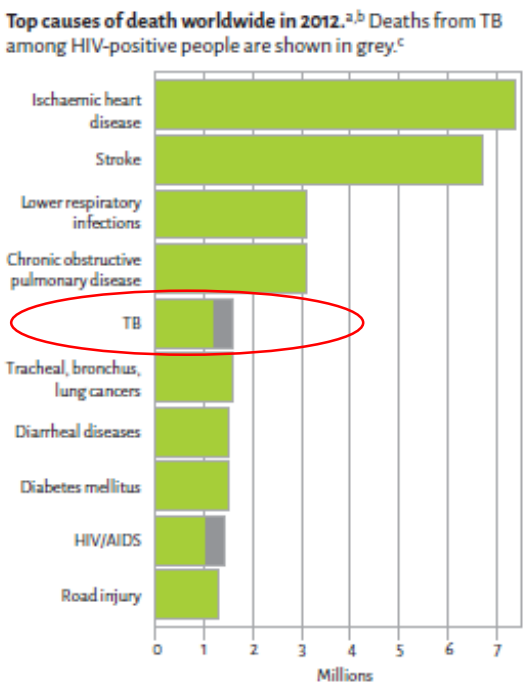
Conflict of Interest

The presenter has no conflict of interest to declare

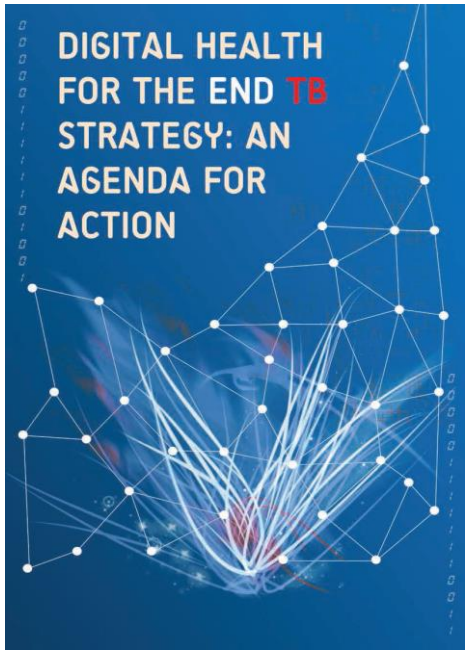
TB remains an global health threat

- Leading killer and cause of disability
  - 1.5 million deaths, >14 million active cases, large potential burden
- Death toll is recognized as unacceptably high (World Health Organization)
- Poor treatment outcomes → poor individual and societal outcomes



mHealth Potential

- Technology recognized as key
- 7 billion mobile phone subscribers, global penetration rate of 97% (2015)
- By 2017, more mobile phones than people
- Mobile applications (apps) have the potential to support TB prevention and treatment



Research Aims

1. Identify TB-related apps available in the main app stores
2. Describe their characteristics
3. Evaluate their range of functionalities
4. Describe any rigorous testing of the available apps
5. Scan the gray literature to identify if other TB-related apps are being developed

Iribarren, SJ, Schnall, R, Stone, P, Carballo-Diéguez A. Review of mobile applications to support tuberculosis prevention and treatment. *JMIR mHealth uHealth* 2016 (May 13); 4(2):e25.doi:10.2196/mhealth.5022

Method

- Quality and Risk of Bias Checklist for Studies that Review Smartphone Applications[1]
  - Checklist comprises 8 criteria for evaluating and reporting (eg, data collection time frame, description of app appraisal methods
- Institute for Healthcare Informatics[2] app functionality categories
- Adapted appraisal method

1. BinDhim et al. A systematic review of quality assessment methods for smartphone health apps. Telemed J E Health, 2015, Feb; 21(2):97-104
2 IMS Institute for Healthcare Informatics. Patient apps for improved healthcare: from novelty to mainstream. 2013

Functionality Evaluation Criteria

Functionality	Definition
Inform	Provide information; can be in a variety of formats such as text, photo, or video
Instruct	Provide instructions to the user (eg, specific steps to take for TB test or diagnosis)
Record	Capture user-entered data and record functional subcategories • Collect: enter and store health data on individual phone • Share: transmit health data (eg, upload, transfer, email) • Evaluate: evaluate the entered data • Intervene: send alerts based on the data collected or propose behavioral interventions or changes (eg, alert to treatment provider regarding treatment adherence, alert user for TB dosage due)
Display	Display user-entered data graphically and provide an output (eg, report, medication log, contact screening results, search results)
Guide	Provide guidance based on user-entered information (eg, patient TB risk factor screening and recommendations for testing, medication dosage based on entered data - weight/age). Having the function to enter search terms to obtain information or diagnostic criteria was not considered a guide functionality
Remind/alert	Provide reminders to the user (eg, medication, follow-up appointments)
Communicate	Facilitate communication between providers, patients, consumers, caregivers, and medication administrators or provide links to social networks (eg, Facebook, email)

Screening Process

- 1332 potentially relevant apps were identified
- 24 apps included
- Assessed by title and descriptions
- Most search results non TB related

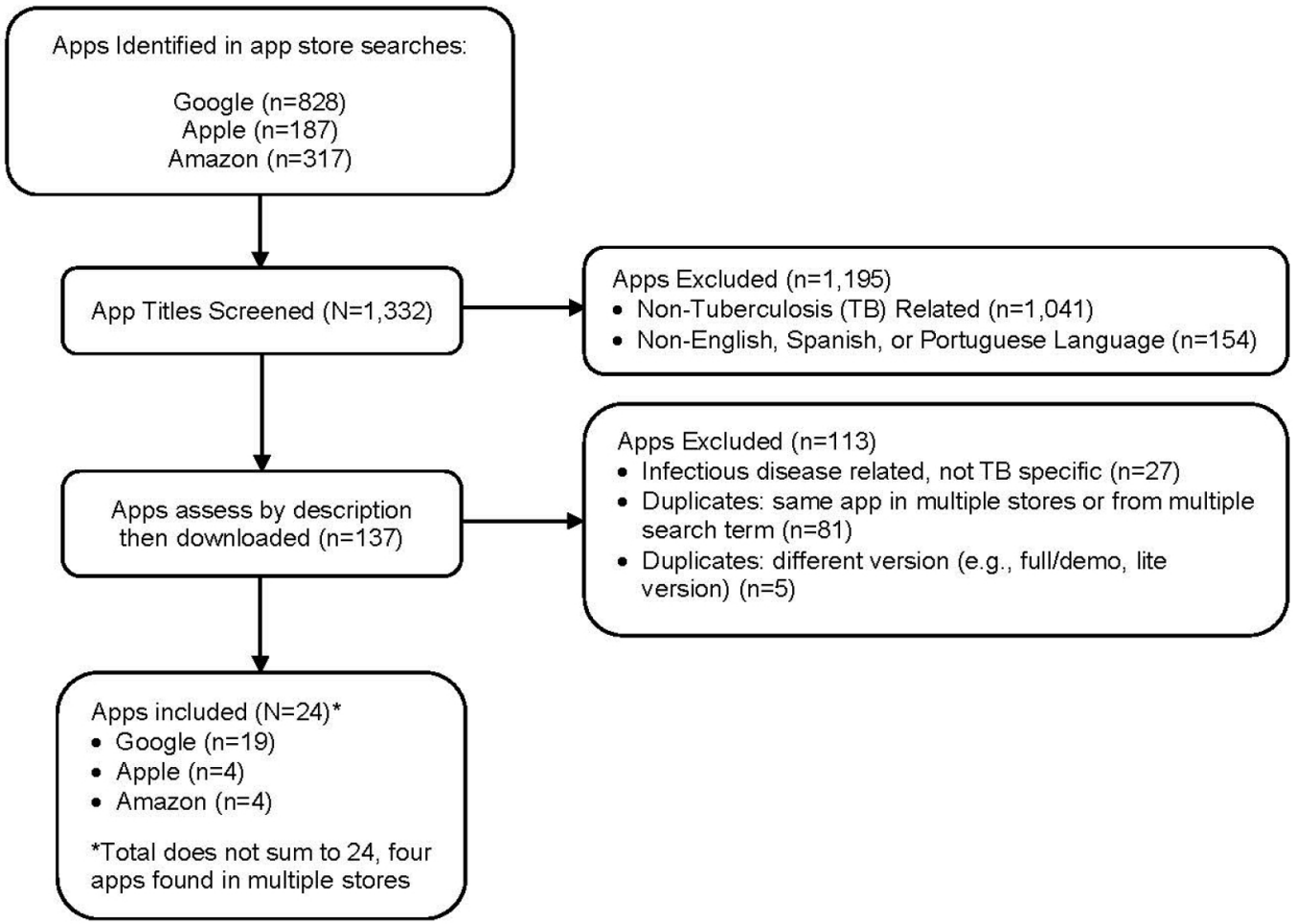


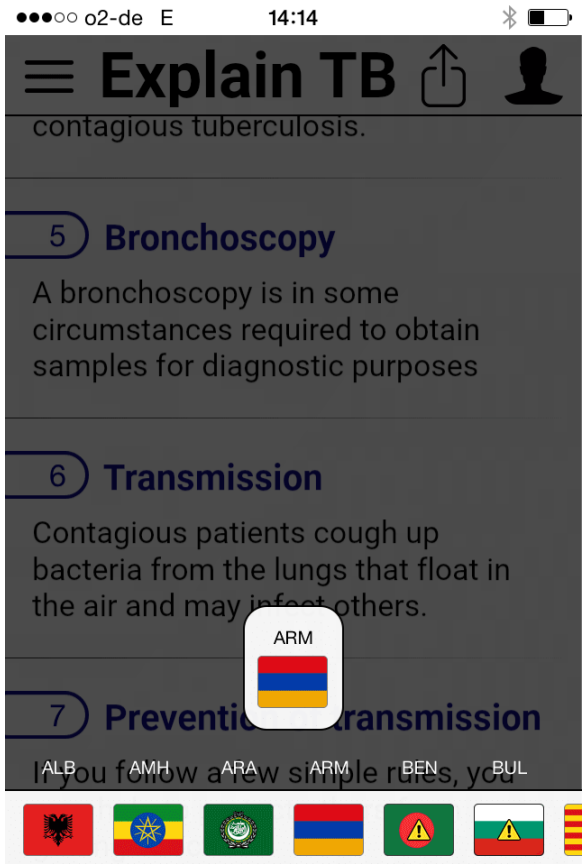
Figure 1. Screening process flowchart

Results

- All apps were free to download
  - 7 require login/password
- Most targeted health care professionals (n=17)
- Few were patient-focused (n=4)
- Most (n=17) had 4 or fewer functions out of 11 (range 1-6)
- Inform and Record most common functions (n=15)

Function to Inform

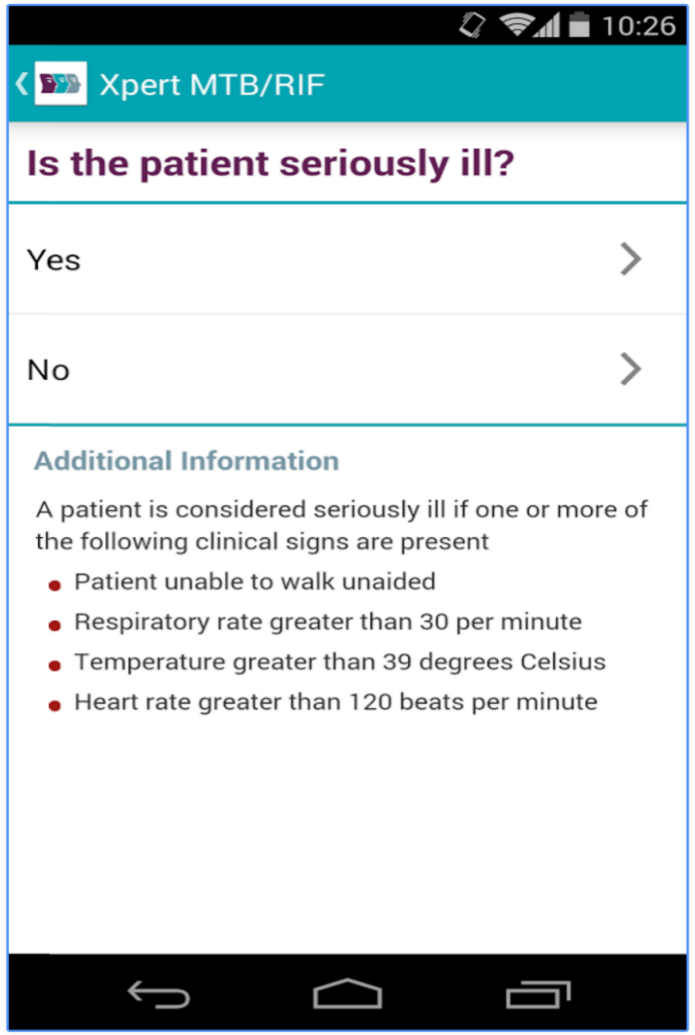
- Provided general information on TB, diagnosis, treatment and transmission
- Dose calculator
- One provided information in audio form and in multiple languages



Function to Record

- Frontline health workers data collection
  - Replace paper-based notification or tracking
  - Screening tools

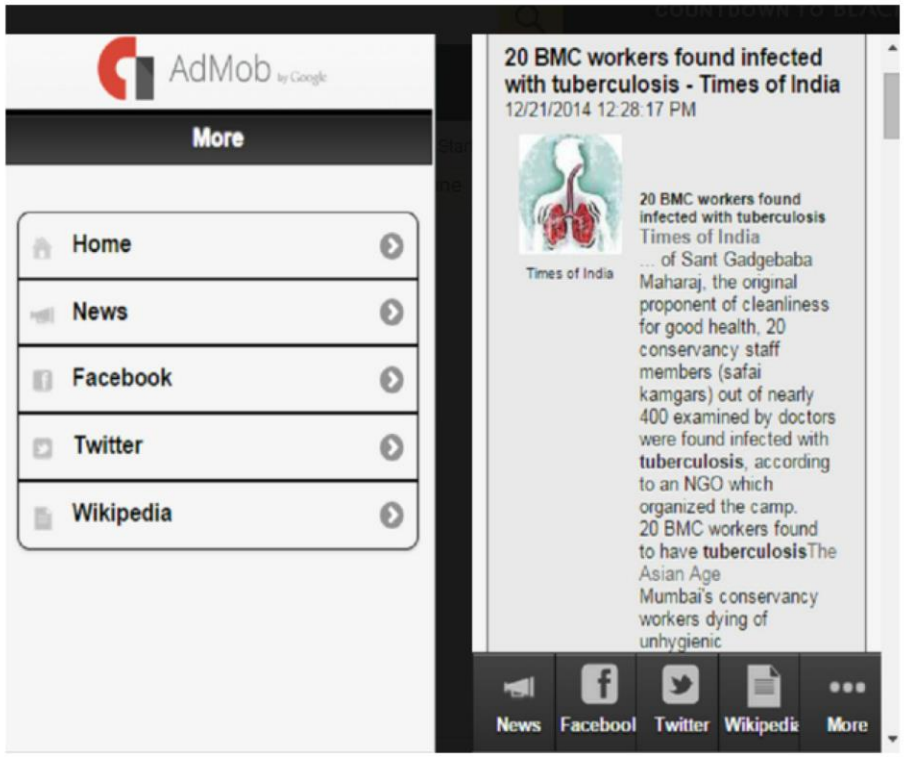
FindTB (Google)



Function to Communicate

- Limited to access to social media links (eg, Facebook, Twitter)
- Email

Tuberculosis News, TB Proof



Issues

- Inconsistent responses to data entry
- Incorrect spelling and grammar
- Crashed or links to features that had no data
- One-third of the apps (8/24) not been updated for more than a year and may no longer be supported

Screening tool issues and misspelled words

Screening form

> “Is the patient age 12 years?; Is the patient HIV infected?; Has the patient is in close contact with TB patients in home or at work?; and Does the patient has any **systomps** ?”

Same recommendation for all responses

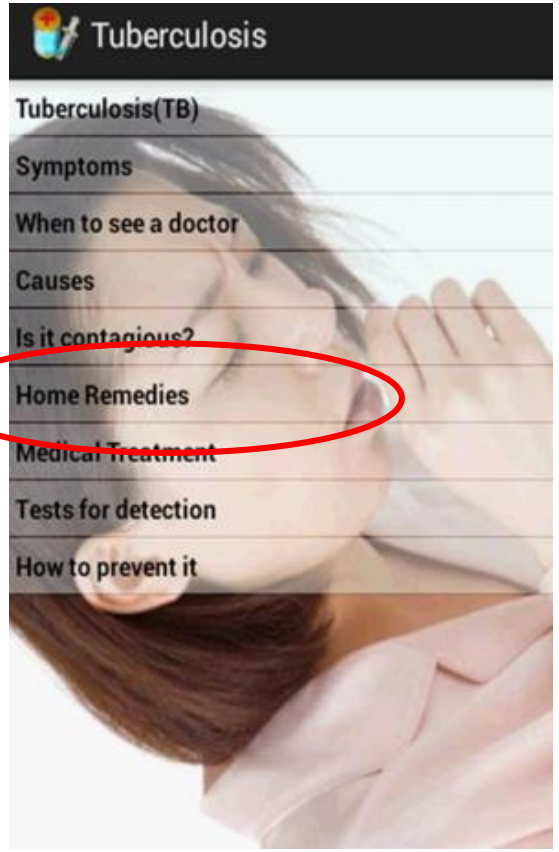
> “The patient has **systomps** of TB he/she must be tested as soon as possible by a **helth** care professional to determine the TB. If he/she is detected TB then the family members should also be checked for TB”

Tuberculosis Symptoms Guide

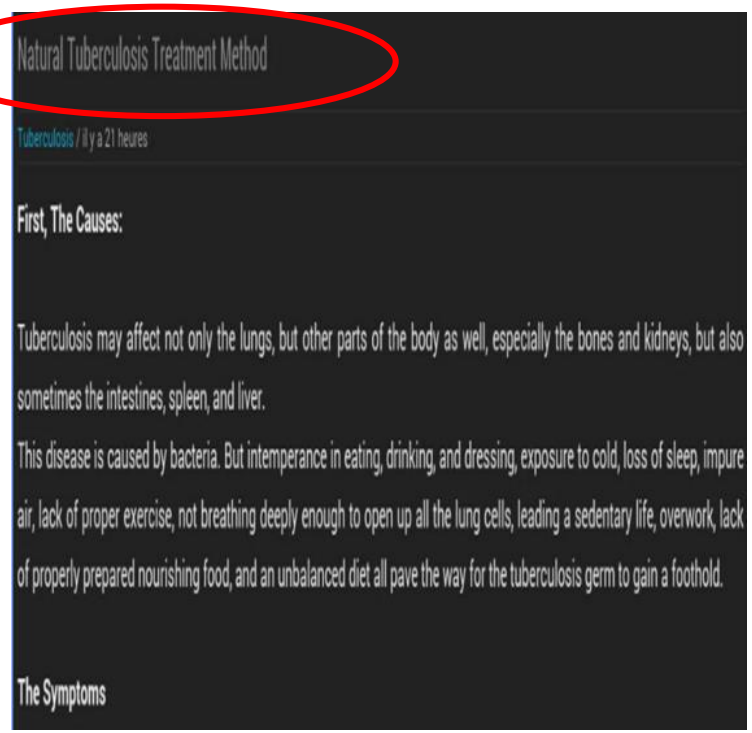
Messages incongruent with guidelines and could cause harm

- Home remedy options
- Link to medicinal herbs
  - “It seems like a cure all because it kills and neutralizes poisons”
- Links to natural healers

Tuberculosis (Amazon)



Tuberculosis (Google)



Formal research published on TB app

2 had peer reviewed publications

- CAD4TB
  - Cohort study to assess the app's sensitivity and specificity
  - Distinguish between the chest radiographs of culture-positive TB cases and controls
- TB Mobile app
  - Curated and prioritized data on molecules available in the Collaborative Drug Discovery database

Gray literature results

3 identified as in progress, being launched, or tested

- DOTsync
  - For community health workers
  - Replace paper-based system, document DOT, monitor infection control and drug complications, track nutritional support, and conduct TB contact tracing
- Nikshay
  - For clinicians
  - Case notifications in India
- Unnamed
  - Digitize and automate contact tracing

Conclusion

- TB apps had minimal functionalities, primarily targeted frontline health care workers, and focused on TB information or data collection
- Few for use by patients
- None supported patient involvement or management in their own care (eg, reminders/alerts for follow-ups) or to improve communication with healthcare team
- More refined work needed to directly support patients with TB

Next steps

- Develop patient-centered app
- Trial in setting where patients receive treatment by self-administration

Recommendations for app review

- Checklist for quality and risk of bias
- Mobile App Rating Scale (MARS) (Stoyanov et al. 2015)
  - 19 items and 4 scales: engagement, functionality, aesthetics, information quality
- Tailored functionalities (Institute for Healthcare Informatics)
- Disease guidelines (eg, self-behavior recommendations)

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Columbia University School of Nursing

IECS Instituto de Efectividad Clinica y Sanitaria

The University of Utah

NIH National Institute of Nursing Research
Building the Scientific Foundation for Clinical Practice

NIH Fogarty International Center
Advancing Science for Global Health

University of Utah College of Nursing