International Journal of Scientific Multidisciplinary Research (IJSMR)
Vol.3, No.2, 2025: 191-202

# Use of Early Detection Digital Application: Changes in Family Perception of Tuberculosis Suspects

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A R T I C L E I N F O
*Keywords:* Perception, Tuberculosis, Early Detection, Digital Application

*Received: 28 December*
*Revised: 25 January*
*Accepted: 15 February*



A B S T R A C T
Tuberculosis (TB) cases continue to rise, along with a high mortality rate, necessitating innovations in TB management. This study aims to analyze the effect of a mobile-based health application on changes in family perceptions of TB. A quasi-experimental design was used with pretest-posttest and two groups: an intervention group using the JORIA Tuberculosis Early Detection Application, and a control group using contact investigation sheets. The Wilcoxon test was applied to assess perception changes. Results showed a significant increase in family perception post-intervention (p = 0.019). The study concludes that the application effectively improves the perception of TB among families, highlighting the potential role of digital tools in enhancing TB prevention efforts

DOI: https://doi.org/10.55927/ijsmr.v3i2.53
ISSN-E: 2986-5042
https://journal.formosapublisher.org/index.php/ijsmr

## INTRODUCTION

Tuberculosis (TB) is a contagious illness that results from the bacterium Mycobacterium tuberculosis. This disease can be transmitted through the air, particularly when individuals infected with tuberculosis cough, sneeze, or spit. (Pramono, Sudding, et al., 2023). At this time, Mycobacterium tuberculosis bacteria come out through sputum splashes and are released into the air, a person can easily get infected by inhaling Mycobacterium tuberculosis bacteria, this usually happens due to close and long contact/interaction (Long et al., 2022; WHO, 2022)

Families who have tuberculosis (TB) patients should be vigilant because they have a greater risk of contracting TB (Lung et al., 2019; Velen et al., 2021; Yuen et al., 2020) A previous study found that family members who lived with TB had a three-fold greater risk of contracting TB infection compared to family members who did not (Mariani et al., 2022). Every family member living with a person with tuberculosis should pay attention to the early symptoms of infection because the likelihood of tuberculosis transmission increases with longer contact duration and closer contact intensity (Fox et al., 2021; Izumi et al., 2019)East Kalimantan Province will be ranked 17th in Indonesia with 397,377 cases of tuberculosis in 2021, up from 351,936 cases in the previous year (Ministry of Health of the Republic of Indonesia, 2022). Based on data from the Central Statistics Agency in Samarinda, there were 1762 cases in 2019 and in Sungai Kunjang sub-district there were 238 cases of tuberculosis in 2019 (Central Statistics Agency 2021). In 2022, 124 cases of tuberculosis index were recorded (East Kalimantan Provincial Health Office, 2022). Based on a preliminary study conducted by the number of TB patients in the Karang Asam Health Center area as many as 30 patients, in the Loa Bakung Health Center area as many as 31 patients, and 24 patients in the Wonorejo Health Center area within 6 months from May to October 2023.

The mobile-based health app (mHealth) offers an innovative and practical solution to support TB control programs. With mHealth, family members can easily get information about the early symptoms of TB, how to prevent transmission, and health protocols that must be followed if any family members are infected (Htet et al., 2022b). In addition, this application also facilitates communication with healthcare professionals for consultation, monitoring patient conditions, and tracking treatment in real-time (Early et al., 2019; Pramono, Hendriani, et al., 2023)

The use of these technologies helps to overcome geographical and social barriers that often hinder access to health services, especially in remote areas or with limited health facilities (Tumuhimbise, 2021) (Lee et al., 2020). mHealth also allows for tighter surveillance of TB patients, so treatment adherence can be improved, which in turn reduces the risk of drug resistance (Chebet et al., 2022; Kumar et al., 2019; Maraba et al., 2018)Many innovations were made due to the ever-increasing cases of tuberculosis and the rising death rate. One of the benefits of technology for healthcare is the ability to detect potential tuberculosis early (Htet et al., 2022a). People at risk of contracting TB can use mHealth well, as it

can speed up TB case identification, treatment, and control of treatment adherence (Osei & Mashamba-Thompson, 2021).

Innovation through this digital technology can help in changing the initial perception, Perception is the process of giving meaning to sensations so that humans have new knowledge. In other words, perception transforms sensations into information (Dos Santos et al., 2019). In the context of the family, the mHealth application can act as an empowerment tool, where families become more proactive in maintaining health, taking preventive measures, and raising awareness about the dangers of TB (McCreesh et al., 2022). This has the potential to significantly reduce the rate of TB transmission in the community, as well as strengthen the community-based health system (Mahmood et al., 2020; Turimumahoro et al., 2022)

Based on the above background, the researcher will see if there is an Effect of Using the Early Detection Application of Tuberculosis Suspects on the Perception of Families of Tuberculosis Patients in Sungai Kunjang District, Samarinda City.

## LITERATURE REVIEW

### Early Detection of Tuberculosis

Tuberculosis (TB) is a contagious illness caused by the Mycobacterium tuberculosis bacterium, primarily affecting the lungs. (Cavalhiero et al., 2020). Although TB can be cured with proper treatment, the disease is still a serious global health problem, especially in developing countries. Early detection of TB is an important key in controlling the spread and impact of this disease. Through early detection, treatment can be started immediately, preventing more severe complications and breaking the chain of transmission in the community (Bloom et al., 2017)

One of the methods that is widely used in the early detection of TB is active screening in high-risk groups, namely close contact with TB patients, in family members. Standard clinical examination includes anamnesis of classic symptoms such as cough for more than two weeks, fever, weight loss, and night sweats (Beyanga et al., 2018).

### Digital Application for Early Detection of Tuberculosis

The use of digital technology, especially the mHealth (mobile health) application, is increasingly growing in the world of health, including in efforts to detect tuberculosis (TB) early. The mHealth app offers innovative solutions to improve access, monitoring, and handling of TB cases, especially in areas with limited resources. Through applications based on mobile devices, early detection of TB can be carried out more quickly, effectively, and widely.

The mHealth application allows health workers and the public to screen for TB symptoms by filling out a digital questionnaire that covers the main symptoms such as chronic cough, fever, night sweats, and weight loss (Astha Triyono et al., 2023). In addition, the mHealth app provides benefits in terms of case tracking and surveillance. For example, the app can be used to trace close contacts of confirmed TB patients, allowing for more proactive screening and preventing further spread. The use of digital notifications and reminders also

helps patients adhere to long and complex TB treatment schedules, which are often a challenge in controlling the disease (Osei & Mashamba-Thompson, 2021).

**Perception and Health Behavior Model**

Perception is a cognitive process in which individuals interpret and understand information received through the five senses. Perception is not only dependent on the physical stimuli received but is also influenced by experience, prior knowledge, and social and cultural context (American Psychological Association, 2022). In healthcare, perception plays an important role in determining an individual's attitudes and behaviors toward disease risk, treatment options, and adherence to medical interventions. A person's perception of health risks is often related to whether they will take precautions or treatment. For example, the perception of a high risk of a disease tends to motivate individuals to undergo screening or vaccination. Therefore, understanding public perception is essential in designing effective health interventions (Matakanye et al., 2021).

The Health Belief Model (HBM) is a psychosocial theory developed in the 1950s to understand the factors that influence an individual's decision to take health precautions. This model identifies several main constructs, namely the perception of susceptibility, the perception of severity, the perception of benefits, and the perception of barriers (barriers). According to HBM, a person will take precautions if they feel vulnerable to a disease, understand that the disease is serious, believe that the action taken will be beneficial, and the resistance to such action is minimal (Anuar et al., 2020)

In addition, HBM also recognizes the role of *cues to action* (external stimuli that trigger action) and *self-efficacy* ( (Sari et al., 2017) In the context of public health, HBM is often used to design interventions aimed at increasing awareness and preventive behaviors, such as vaccinations, health screenings, and lifestyle changes. This model is effective in predicting individual health behaviors in various settings and interventions.

## METHODOLOGY

This research falls under the category of quantitative studies and employs a quasi-experimental design aimed at examining causal relationships through the inclusion of a control group. The study utilizes a pretest-posttest framework with two group configurations. It was carried out in the Sungai Kunjang District of Samarinda City, specifically within the service areas of three health centers: Loa Bakung Health Center, Wonorejo Health Center, and Karang Asam Health Center. The research took place from March to April.

The JORIA android-based early detection application for TB suspects is used as an intervention medium, where respondents fill in an application that includes general data, contact history with TB patients, and symptoms of tuberculosis felt. Next, the app will conclude whether the user is a suspected of tuberculosis or in good health. In the end, users are required to read follow-up recommendations and health education materials on preventing tuberculosis transmission.

The population in this study is the family of Tuberculosis patients, as an illustration of the number of tuberculosis index cases from 3 health centers in Sungai Kunjang District as many as 85 patients. The sample in this study is part of the family of tuberculosis patients with a total of 32 samples, sampling in this study uses purposive sampling techniques. The inclusion criteria in this study are families of TB patients who live in the same house, are over 15 years old, are willing to become journalists, can read and write, and can use android applications. Exclusion criteria were sick, people with active tuberculosis, and not at home when the study was conducted.

The instrument that will be used during the research is a questionnaire, as a measure of the perception of Tuberculosis. The questionnaire used to measure perception is a Likert scale that presents positive or negative statements and respondents are asked to indicate their level of agreement with the statement. It usually uses 5 levels of answers: strongly agree, agree, neutral, disagree, and strongly disagree. The highest score is given to the most positive answer, and vice versa. Intervention by filling in the early detection of tuberculosis symptoms coupled with education on the application. Meanwhile, the control group used a tuberculosis contact investigation sheet and the education used a leaflet sheet.

Data analysis in the pretest-posttest research design with two group design, using the Wilcoxon Test. The Wilcoxon Signed-Rank test is a non-parametric statistical test used to compare two paired or related data sets. In the experimental group, an early detestation application will be given and the control group will be given an independent screening sheet, after and before the treatment will be given a pretest and posttest questionnaire as a measuring tool in the research.

**RESULT**

Table 1. Characteristics of Respondents (N=32)

| Characteristic | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 10 | 31.2 % |
| Female | 22 | 68.8% |
| **Age (Years)** | | |
| 21-30 | 8 | 25.0% |
| 31-40 | 5 | 15.6% |
| 41-50 | 9 | 28.1% |
| 51-60 | 4 | 12.5% |
| 61-70 | 6 | 18.8% |

Based on table 1. above, it is known that the number of respondents who are male is 10 respondents (31.2%), and respondents with female gender are 22 respondents (68.8%). At the same time, there were 8 respondents aged 21 to 30 years, comprising 25.0% of the total. Meanwhile, 5 respondents were between the ages of 31 and 40, representing 15.6%. Additionally, 9 respondents fell into the 41 to 50 age bracket, accounting for 28.1%. There were 4 respondents aged 51 to 60 years, making up 12.5%, and finally, 6 respondents were in the 61 to 70 age range, which constituted 18.8%.

Table 2. Respondent Distribution

| **Intervention** | **Before** | | **After** | |
|---|---|---|---|---|
| | **N** | **%** | **N** | **%** |
| Good | 6 | 37.5 | 11 | 68.8 |
| Quite good | 10 | 62.5 | 5 | 31.2 |
| Less | 0 | 0 | 0 | 0 |
| **Total** | **16** | **100** | **16** | **100** |
| **Control** | | | | |
| Good | 7 | 43.8 | 11 | 68.8 |
| Quite good | 9 | 56.3 | 5 | 31.2 |
| Less | 0 | 0 | 0 | 0 |
| **Total** | **16** | **100** | **16** | **100** |

Based on Table 2. above, the results were obtained that the distribution of respondents based on perception before being given the Tuberculosis Early Detection Application, with a good category of 6 people (37.5%), with a fairly good category of 10 people (68.8%), and a poor category of 0%. After being given the Tuberculosis Early Detection Application, it showed the perception of respondents, with a good category of 11 people (68.8%), with a fairly good category of 5 people (31.2%), and a poor category of 0%. Based on the table, the results were also obtained that the distribution of respondents was based on perception before being given an independent screening sheet, with a good category of 7 people (43.8%), with a fairly good category of 9 people (56.3%), and a poor category of 0%. After being given an independent screening sheet, it showed the perception of respondents, with a good category of 11 people (68.8%), a fairly good category of 5 people (31.3%), and a poor category of 0%.

Table 3. The Effect of Intervention Using Early Detection Applications and Self-Screening Sheets

| Groups | Before | | | After | | | p-value |
|---|---|---|---|---|---|---|---|
| | n | Mean | Std. Deviation | n | Mean | Std. Deviation | |
| **Experiment** | 16 | 1.62 | 0.500 | 16 | 1.31 | 0.479 | 0.019 |
| **Control** | 16 | 1.56 | 0.512 | 16 | 1.31 | 0.79 | 0.018 |

Based on Table 3. above, it is known that the respondents' perception prior to the introduction of the early detection application showed a mean score of 1.62 with a standard deviation of 0.500. In contrast, after utilizing the tuberculosis early detection application, the mean score decreased to 1.31, accompanied by a standard deviation of 0.929.From the results of the data test with *the Wilcoxon* test, a perception value with *p-value* = 0.019 was obtained, because the value was 0.019 < 0.05, it was concluded that Ha was accepted, which means that there is an influence of using the tuberculosis early detection application on family perception in Sungai Kunjang sub-district, Samarinda City.

The table above illustrates the respondents' perceptions prior to receiving the self-screening sheet, where the mean score was 1.56 and the standard deviation was 0.512. In contrast, after they received the self-screening sheet, the mean score dropped to 1.31, and the standard deviation decreased to 0.479. From the results of the data test with *the Wilcoxon* test, a perception value with *p-value* = 0.018 was obtained, because the value was 0.018 < 0.05, it was concluded that he was accepted, which means that there is an effect of using an independent screening sheet on family perception in Sungai Kunjang sub-district, Samarinda City.

After conducting follow-up tests to find the difference between the two methods, the result of *p-value* = 0.288 was obtained, because the value was 0.288 > 0.05, it was concluded that there was no significant difference in perception in using the tuberculosis early detection application or using the self-screening sheet.

**DISCUSSION**

The results of the study showed that the distribution of respondents based on perception before being given the Tuberculosis Early Detection Application, respondents who were included in the good category were 6 people (37.5%), respondents with a fairly good category as many as 10 people (62.5%), and with a less than 0% category. This result is the initial perception of the respondents where the initial session is a constructive process influenced by sensory information, memory, and attention, in which the individual actively interprets and understands his or her environment (Smith, E. E., & Kosslyn, S. M. 2021).

The results obtained, from the respondents whose initial perception was quite good were 10 people (62.5%) out of 16 respondents, which means that the initial perception was positive. This is in line with previous research conducted by Maciel et al. (2021) that positive perceptions and good knowledge about tuberculosis among Brazilian patients increase involvement in tuberculosis treatment and control programs. Positive initial perceptions can help increase community participation in TB control programs, including vaccination and health education. Conversely, misperception or initial information can hinder these efforts. According to the theory *Health Belief Model* A person's initial behavior toward tuberculosis is influenced by their perception of their susceptibility to tuberculosis, how severe the disease is, the benefits they see from seeking treatment, and the obstacles they face when seeking treatment (Sazali et al., 2023)(Monk et al., 2018)

The results of the study found that after being given the Early Detection Application for tuberculosis, the respondents' perception showed that 11 people (68.8%) were in the good category, with 5 people (31.3%) in the fairly good category, and the category was less than 0%. A study found that community-based education programs in Africa have successfully increased knowledge about TB and turned negative perceptions into positive ones (Mahmood et al., 2020) (Kidanemariam et al., 2023). Meanwhile, education campaigns and intervention programs in many developing countries have increased awareness about TB around the world (Eang et al., 2012) (Singh et al., 2019).

Based on the results of the research with the *Wilcoxon* Obtained perception value by *p-value* = 0.019, because the value of 0.019 < 0.05 is in, it is concluded that Ha is accepted, which means that there is an influence of using the tuberculosis early detection application on family perception in Sungai Kunjang sub-district, Samarinda City. Mobile apps that provide community support and educational information can help reduce the stigma of tuberculosis and improve the quality of life of people with tuberculosis (Mulyana & Nursasi, 2019)(Loh et al., 2023). Mobile applications that provide interactive and easy-to-understand tuberculosis information have increased positive perceptions of tuberculosis and community involvement in tuberculosis prevention (Ayu Andini Saleha et al., 2024; Osei & Mashamba-thompson, 2021).

This study also showed that there was no difference in perception from the use of early detection applications or self-screening sheets. This is because the level of literacy or individual skills in understanding the application of early detection of tuberculosis and self-screening sheets is still lacking. However, there

is a slight comparison where the mean value and standard deviation are higher when using an early detection application compared to using a self-screening sheet.

In this study, changes in perception about tuberculosis are very important for better preventive behavior changes, but changes in perception and behavior must also have the support of facilities both from health services directly and through developing technology. The Tuberculosis Early Detection Application as a tuberculosis early detection application can also help to more easily recognize the early signs of tuberculosis.

## CONCLUSIONS AND SUGGESTIONS

There is an effect of using tuberculosis early detection applications on family perceptions of suspected tuberculosis. It is recommended that all tuberculosis contacts who are at risk of contracting it, especially in the family, carry out early detection using the JORIA application. This application can also be used as a monitoring and control base for tuberculosis transmission among contacts of TB patients.

## REFERENCES

American Psychological Association. (2022). Types of perception Perception-in-Action. https://www.apa.org/about

Anuar, H., Shah, S. A., Gafor, H., Mahmood, M. I., & Ghazi, H. F. (2020). Usage of Health Belief Model (HBM) in health behavior: A systematic review. Malaysian Journal of Medicine and Health Sciences, 16(6), 201–209.

Astha Triyono, E., Mahanani, M., Anggraini, S. D., Maulana, H., Pratiwi, W. D., Yochanan, C., Tan, F., & Masyfufah, L. (2023). Early Detection of Tuberculosis Application (E-Tibi): a New Paradigm To Detect New Case of Tuberculosis. Jurnal Berkala Epidemiologi, 11(3), 267–276. https://doi.org/10.20473/jbe.v11i32023.267-276

Ayu Andini Saleha, Joko Pramono, & Tini. (2024). Correlation of Knowledge Level with Prevention Practice of Tuberculosis Transmission among Household Contacts in Sungai Kunjang Sub-District, Samarinda City. International Journal of Scientific Multidisciplinary Research, 2(3), 195–206. https://doi.org/10.55927/ijsmr.v2i3.8453

Beyanga, M., Kidenya, B. R., Gerwing-Adima, L., Ochodo, E., Mshana, S. E., & Kasang, C. (2018). Investigation of household contacts of pulmonary tuberculosis patients increases case detection in Mwanza City, Tanzania. BMC Infectious Diseases, 18(1), 1–8. https://doi.org/10.1186/s12879-018-3036-6

Bloom, B. R., Atun, R., Cohen, T., Dye, C., Fraser, H., Gomez, G. B., Knight, G., Murray, M., Nardell, E., Rubin, E., Salomon, J., Vassall, A., Volchenkov, G., White, R., Wilson, D., & Yadav, P. (2017). Tuberculosis. In Disease

Control Priorities, Third Edition (Volume 6): Major Infectious Diseases (pp. 233–313). The World Bank. https://doi.org/10.1596/978-1-4648-0524-0_ch11

Cavalhiero, A. P., Shin, S. S., Seung, K. J., & Furin, J. J. (2020). Tuberculosis. In Hunter's Tropical Medicine and Emerging Infectious Diseases (pp. 454–471). https://doi.org/10.1016/b978-0-323-55512-8.00043-0

Chebet, N. A., Kirui, J., Otieno, G., Sanga, D., & ... (2022). Tuberculosis treatment adherence among patients taking anti-TB drugs in Kilifi County, Kenya. African Journal of Health Sciences, 35(2), 210–223. https://www.ajol.info/index.php/ajhs/article/view/227098

Dinas Kesehatan Provinsi Kaltim. (2022). Satu Data Kalimantan Timur 2019-2022. Satu Data Kalimantan Timur 2019-2022. https://data.kaltimprov.go.id/organization/dinas-kesehatan

Dos Santos, L. R. A., Bernardi, F. A., Silva Prado, G. C., Lima, V. C., Crepaldi, N. Y., Marçal, M. A., Lopes Rijo, R. P. C., Galliez, R. M., Ruffino-Netto, A., & Alves, D. (2019). The perception of health providers about an artificial intelligence applied to Tuberculosis video-based treatment in Brazil: A protocol proposal. Procedia Computer Science, 164, 595–601. https://doi.org/10.1016/j.procs.2019.12.225

Eang, M. T., Satha, P., Yadav, R. P., Morishita, F., Nishikiori, N., Van-Maaren, P., & Weezenbeek, C. L. Van. (2012). Early detection of tuberculosis through community-based active case finding in Cambodia. BMC Public Health, 12(1). https://doi.org/10.1186/1471-2458-12-469

Early, J., Gonzalez, C., Gordon-Dseagu, V., & Robles-Calderon, L. (2019). Use of Mobile Health (mHealth) Technologies and Interventions Among Community Health Workers Globally: A Scoping Review. Health Promotion Practice, 20(6), 805–817. https://doi.org/10.1177/1524839919855391

Fox, G. J., Johnston, J. C., Nguyen, T. A., Majumdar, S. S., Denholm, J. T., Asldurf, H., Nguyen, C. B., Marks, G. B., & Velen, K. (2021). Active case-finding in contacts of people with TB. International Journal of Tuberculosis and Lung Disease, 25(2), 95–105. https://doi.org/10.5588/ijtld.20.0658

Htet, K. K. K., Phyu, A. N., Thwin, T., & Chongsuvivatwong, V. (2022a). Mobile Health app for tuberculosis screening and compliance to undergo chest X-ray examination among presumptive cases detected by the app in Myanmar: usability study. JMIR Formative Research, 6(6), 1–14. https://doi.org/10.2196/37779

Htet, K. K. K., Phyu, A. N., Thwin, T., & Chongsuvivatwong, V. (2022b). Mobile Health App for Tuberculosis Screening and Compliance to Undergo Chest X-ray Examination Among Presumptive Cases Detected by the App in Myanmar: Usability Study. JMIR Formative Research, 6(6), 1–14. https://doi.org/10.2196/37779

Izumi, K., Murase, Y., Uchimura, K., Kaebeta, A., Ishihara, K., Kaguraoka, S., Takii, T., & Ohkado, A. (2019). Transmission of tuberculosis and predictors of large clusters within three years in an urban setting in Tokyo, Japan: a population-based molecular epidemiological study. BMJ Open, 9(5), e029295. https://doi.org/10.1136/bmjopen-2019-029295

Kemenkes RI. (2022). Profil Kesehatan Indonesia 2021. In Profil Kesehatan Indonesia 2021. Ministry of Health of Republic Indonesia. https://ebooks.gramedia.com/id/buku/profil-kesehatan-indonesia-2021

Kidanemariam, A. Y., Kidanemariam, B. Y., H. Tesfamariam, E., & Gulbetu., M. E. (2023). Community Knowledge, Attitude and Practice towards Tuberculosis in Nakfa Subzone: Cross-Sectional Study, 2021. Journal of Environmental Science and Public Health, 07(02), 44–56. https://doi.org/10.26502/jesph.96120186

Kumar, A. A., De Costa, A., Das, A., Srinivasa, G. A., D'souza, G., & Rodrigues, R. (2019). Mobile health for tuberculosis management in South India: Is video-based directly observed treatment an acceptable alternative? JMIR MHealth and UHealth, 7(4), 1–16. https://doi.org/10.2196/11687

Lee, Y., Raviglione, M. C., & Flahault, A. (2020). Use of digital technology to enhance tuberculosis control: Scoping review. Journal of Medical Internet Research, 22(2), 1–15. https://doi.org/10.2196/15727

Loh, S. Y., Zakaria, R., & Mohamad, N. (2023). Knowledge, Attitude, and Stigma on Tuberculosis and the Associated Factors for Attitude Among Tuberculosis Contacts in Malaysia. Medeniyet Medical Journal, 38(1), 45–53. https://doi.org/10.4274/MMJ.galenos.2023.14478

Long, R., Divangahi, M., & Schwartzman, K. (2022). Chapter 2: Transmission and pathogenesis of tuberculosis. Canadian Journal of Respiratory, Critical Care, and Sleep Medicine, 6(S1), 22–32. https://doi.org/10.1080/24745332.2022.2035540

Lung, T., Marks, G. B., Nhung, N. V., Anh, N. T., Hoa, N. L. P., Anh, L. T. N., Hoa, N. B., Britton, W. J., Bestrashniy, J., Jan, S., & Fox, G. J. (2019). Household contact investigation for the detection of tuberculosis in Vietnam: economic evaluation of a cluster-randomised trial. The Lancet

Global Health, 7(3), e376–e384. https://doi.org/10.1016/S2214-109X(18)30520-5

Mahmood, H., Mckinstry, B., Saturnino, L., Fairhurst, K., Nasim, S., Hazir, T., & Collaboration, R. (2020). Community Health Worker-Based Mobile Health (mHealth) Approaches for Improving Management and Caregiver Knowledge of Common Childhood Infections: A Systematic Review. Journal of Global Health, 10(2), 1–21. https://doi.org/10.7189/jogh.10.020438

Maraba, N., Hoffmann, C. J., Chihota, V. N., Chang, L. W., Ismail, N., Candy, S., Madibogo, E., Katzwinkel, M., & Churchyard, G. J. (2018). Using mHealth to improve tuberculosis case identification and treatment initiation in South Africa : Results from a pilot study. PLoS ONE, 13(7), 1–12. https://doi.org/https://doi.org/10.1371/journal.pone.0199687 July

Mariani, H., Afriandi, I., Setiawati, E. P., Gondodiputro, S., Wiwaha, G., Nataprawira, H. M., Arisanti, N., & Sumantri, S. (2022). Tuberculosis Family Support Training's (TB FaST) Influence on Encouraging TB Treatment Compliance. The Open Public Health Journal, 15(1), 1–9. https://doi.org/10.2174/18749445-v15-e2208041

Matakanye, H., Tshitangano, T. G., Mabunda, J. T., & Maluleke, T. X. (2021). Knowledge, beliefs, and perceptions of tb and its treatment amongst tb patients in the limpopo province, South Africa. International Journal of Environmental Research and Public Health, 18(19). https://doi.org/10.3390/ijerph181910404

McCreesh, N., Mohlamonyane, M., Edwards, A., Olivier, S., Dikgale, K., Dayi, N., Gareta, D., Wood, R., Grant, A. D., White, R. G., & Middelkoop, K. (2022). Improving Estimates of Social Contact Patterns for Airborne Transmission of Respiratory Pathogens. Emerging Infectious Diseases, 28(10), 2016–2026. https://doi.org/10.3201/eid2810.212567

Monk, E. J. M., Kumwenda, M., Nliwasa, M., Mpunga, J., & Corbett, E. L. (2018). Factors affecting tuberculosis health message recall 2 years after active case finding in Blantyre, Malawi. International Journal of Tuberculosis and Lung Disease, 22(9), 1007–1015. https://doi.org/10.5588/ijtld.18.0006

Mulyana, R., & Nursasi, A. Y. (2019). The Intervention Strategies To Reduce Tuberculosis Stigma Based On Community: A Systematic Review. Jurnal Pendidikan Keperawatan Indonesia, 5(1), 15–24. https://doi.org/10.17509/jpki.v5i1.16371

Osei, E., & Mashamba-thompson, T. P. (2021). Mobile health applications for disease screening and treatment support in low-and middle-income

countries : A narrative review. Heliyon, 7(September 2020), e06639. https://doi.org/10.1016/j.heliyon.2021.e06639

Pramono, J. S., Hendriani, D., & Ardyanti, D. (2023). Implementasi Aplikasi Deteksi Dini Suspek Tuberkulosis Berbasis mHealth di antara Kontak Serumah : Tinjauan Sistematik. Jurnal Kesehatan Vokasional, 8(3), 163–173. https://doi.org/DOI https://doi.org/10.22146/jkesvo.83119 Implementasi

Pramono, J. S., Sudding, R., & Tini, T. (2023). Relationship between Side Effects of Anti-tuberculosis Drugs (ATDs) and Adherence to Medication in Elderly Patients with Tuberculosis. Poltekita : Jurnal Ilmu Kesehatan, 17(2), 326–333. https://doi.org/10.33860/jik.v17i2.2020

Sari, G. P., Samekto, M., & Adi, M. S. (2017). Self efficacy dan self motivation kader dalam melakukan active case finding untuk menurunkan epidemi tuberculosis dalam mewujudkan target SDGs 2030. Jurnal Kesehatan Masyarakat, 16(1), 30–37. http://publikasi.dinus.ac.id/index.php/visikes/article/view/1845/1269

Sazali, M. F., Rahim, S. S. S. A., Mohammad, A. H., Kadir, F., Payus, A. O., Avoi, R., Jeffree, M. S., Omar, A., Ibrahim, M. Y., Atil, A., Tuah, N. M., Dapari, R., Lansing, M. G., Rahim, A. A. A., & Azhar, Z. I. (2023). Improving Tuberculosis Medication Adherence: The Potential of Integrating Digital Technology and Health Belief Model. Tuberculosis and Respiratory Diseases, 86(2), 82–93. https://doi.org/10.4046/trd.2022.0148

Singh, H., Bhardwaj, A., Khan, Z. A., Mittal, A., Nazir, M., & Jain, P. (2019). A study of knowledge and awareness regarding pulmonary tuberculosis in patients under treatment for tuberculosis in tuberculosis unit Ambala city (Haryana). Indian Journal of Public Health Research and Development, 10(10), 455–459. https://doi.org/10.5958/0976-5506.2019.02849.3

Tumuhimbise, W. (2021). Mobile Health Technologies could enhance Public Private Mix for Tuberculosis care in Rural Southwestern Uganda : Qualitative Findings. Research Square, 1–18. https://doi.org/10.21203/rs.3.rs-1114770/v1

Turimumahoro, P., Tucker, A., Gupta, A. J., Tampi, R. P., Babirye, D., Ochom, E., Ggita, J. M., Ayakaka, I., Sohn, H., Katamba, A., Dowdy, D., & Davis, J. L. (2022). A cost analysis of implementing mobile health facilitated tuberculosis contact investigation in a low-income setting. PLoS ONE, 17(4 April), 1–14. https://doi.org/10.1371/journal.pone.0265033

Velen, K., Nhung, N. V., Anh, N. T., Cuong, P. D., Hoa, N. B., Cuong, N. K., Dung, N. H., Sy, D. N., Britton, W. J., Marks, G. B., & Fox, G. J. (2021). Risk Factors for Tuberculosis (TB) Among Household Contacts of Patients With Smear-Positive TB in 8 Provinces of Vietnam: A Nested Case-Control Study. Clinical Infectious Diseases, 73(9), e3358–e3364. https://doi.org/10.1093/cid/ciaa1742

WHO. (2022). Global TB Report 2022. World Health Organization (WHO). https://reliefweb.int/report/world/global-tuberculosis-report-2022?psafe_param

Yuen, C. M., Seddon, J. A., Keshavjee, S., & Dodd, P. J. (2020). Risk-benefit analysis of tuberculosis infection testing for household contact management in high-burden countries: a mathematical modelling study. The Lancet Global Health, 8(5), e672–e680. https://doi.org/10.1016/S2214-109X(20)30075-9