An Artificial Intelligence (AI)-based disruptive innovation in cataract screening.

The case of e-PAARVAI

INTRODUCTION

- e-Paarvai is an AI-based smartphone application launched in 2021 that screens for cataracts.
- Developed through a collaboration between the Tamil Nadu e-Governance Agency and the Tamil Nadu State Blindness Control Society, it aims to address the high prevalence of untreated cataracts leading to blindness, especially in rural areas.
- e-Paarvai allows easy and affordable cataract screening at the patient's doorstep.

CONTEXT OF THE CASE

- The case highlights the prevalence of cataract blindness in Tamil Nadu and the efforts of the Tamil Nadu State Blindness Control Society (TNSBCS).
- The high incidence of untreated cataracts in rural areas and the lack of accessibility and affordability of quality eye care screenings led to the need for innovative solutions.
- The case highlights the success of Kanmani, who was the first to undergo cataract surgery after e-Paarvai detection, and Govindarajan, who also tested positive and regained eyesight.

TRANSFORMATION AND MAJOR ACTORS

The TNSBCS partners with the Tamil Nadu e-Governance Agency (TNeGA) to develop an AI-powered mobile app called e-Paarvai to provide door-to-door cataract screening by minimally trained volunteers.

After an initial failure, the app improved to 94% accuracy, screening 25,000 cataract patients in over 30 rural districts within 10 months. It has won the NASSCOM AI Gamechangers award for its social impact.

There are plans to scale it beyond Tamil Nadu to help 20 million aged 50+ at risk. Beneficiaries like Govindarajan spread awareness in his community about e-Paarvai.

Kanmani and he wonders about the social impact if e-Paarvai is scaled across India, providing accessible and affordable cataract screening to rural populations. This could help eradicate preventable blindness for millions.

The Story:
Cataract-The Global Picture

The statistics

As of 2020

- Blindness due to cataract-**17 million**
- Vision impairment and sight restoration- **83 million**

The concerning projection

- Aging population-Estimated to triple (140 million in 2019 to 420 million in 2050)

Cataract in India (Tamil Nadu)

The statistics:

India (2020)

- Blindness attributable to cataract-**66.2%(50% globally)**

India (2021)

- Ophthalmologist-to-population ratio in rural areas - **1:250,000 (WHO standard of 1:50,000)**

Tamil Nadu (2021)

- Cataract patients-**0.19 Million**
- Rural population in Tamil Nadu-**51.5% (significantly high blindness)**

Fight against blindness-The History

Conflict as Catalyst for change:

- Vision impairment led to ***social separation, difficulty in walking, a greater risk of falls and fractures, and the likelihood of an early entry into nursing or care homes.***
- Cataract(a leading cause of visual impairment)- ***frequently avoidable & needless.***
- If not detected and treated within the stipulated period, ***cataract leads to blindness.***.

Fight against blindness-The Role of TNSBCS

Initial Action against Blindness and Cataract:

- The TNSBCS was established in April 1996. ***(Tamil Nadu State Blindness Control Society).***
- ***Monitoring*** chronic eye disorders and ***address*** them at the district level.
- World-Bank-assisted cataract blindness control project implemented in 1996-***INR 0.64 billion.***
- Establishment of ***district community hospitals.***
- Financial assistance ***to encourage voluntary organizations*** to perform cataract surgeries.

The climax (The middle)

Results of initial action:

- The state met a target of about ***0.35 million surgeries a year until 2001.***
- However, the growing population, inadequate health infrastructure, and sharp urban rural divide was an issue.
- In 2019, the TNSBCS had performed about ***0.2 million cataract surgeries against a target of 0.4 million.***

Monitoring & Feedback:

- High incidence of untreated cataract cases in rural area of Tamil Nadu despite of sufficient infrastructure.
- Lack of accessibility and affordability in rural area.
- Lack of awareness of eye health and lower literacy in rural area.
- TNSBCS was forced to explore the use of TECH to scale its operations and solve the conflict.

The Falling Action

Use of technology as a final action:

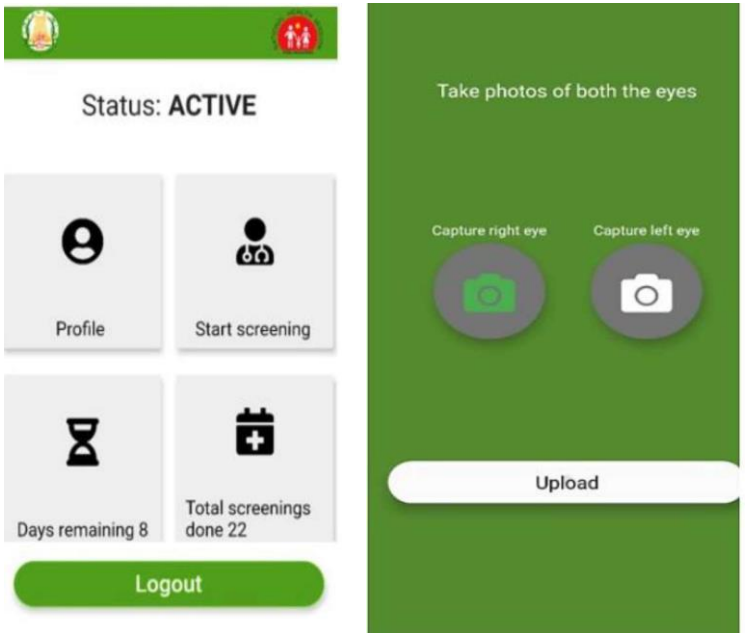
- TNSBCS approached the TNeGA (technology and innovation organization of the Government of Tamil Nadu) in December 2020 ***to use emerging technology to solve the issue.***

- Opted for smartphone application that used AI to ***screen and identify people with operable cataract (e-Paarvai)***

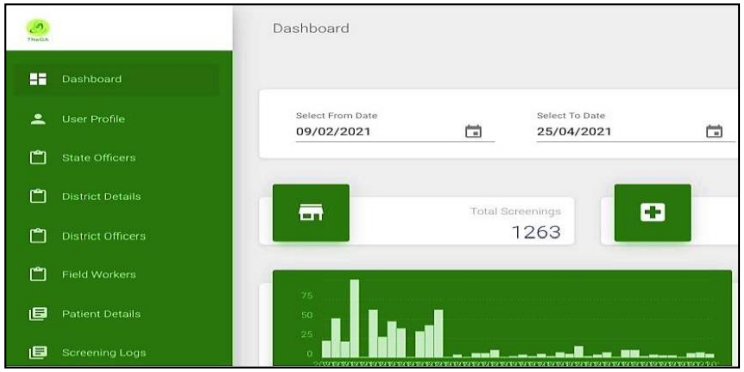
Healthcare Workers using E-Paarvai App for Cataract Screening

Resolution

Problems/Concerns	Solutions used
1. Drastically increased elderly cataract cases in ***the rural areas***.	• Affordable and easy to scale application ***e-Paarvai*** available on google play and easily downloadable by the TNSBCS volunteers. • ***Doorstep screening*** by volunteers with minimal technical training.
2. ***Travelling and Issue of affordability*** for rural population living on daily wages (in case cataract is detected)	• TNSBCS to ***cover the travel cost.*** • Volunteers to accompany patients to the hospital and facilitate the whole process until returning home after surgery.
3. Issue of full dependence on application with probable mis-diagnosis.	• Certified ophthalmologist to ***cross-verify*** the diagnosis through a manual eye checkup. • ***Mandatory step*** before the surgery. • The ***invalid the data was stored automatically*** and used to train the AI algorithm.



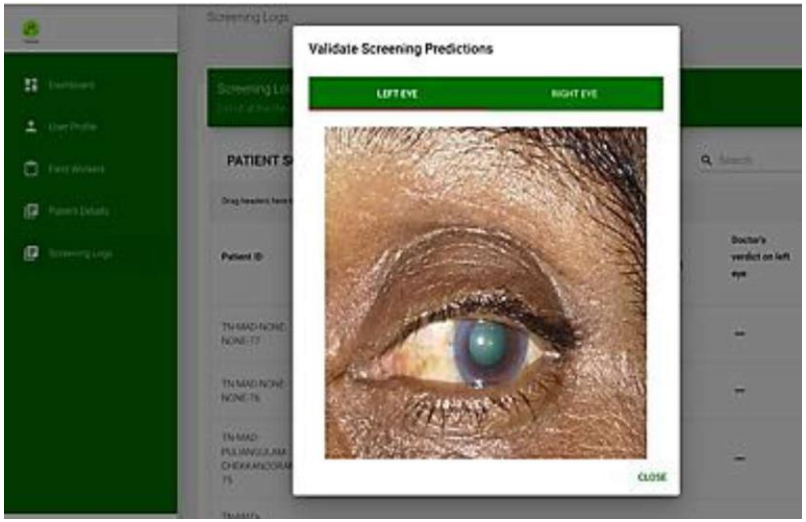
The application e-paarvai



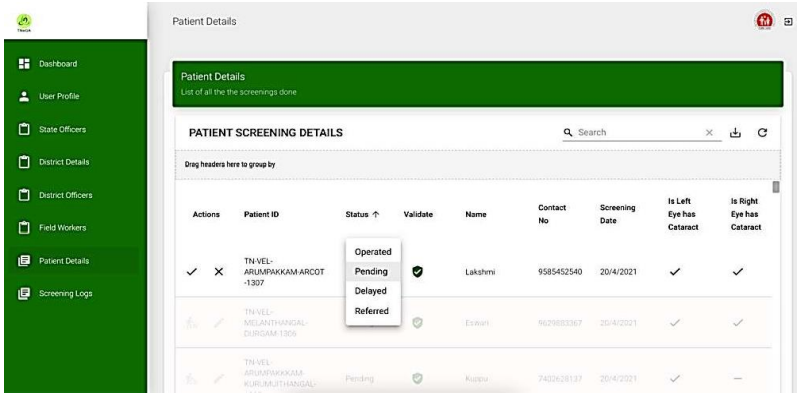
The admin dashboard

Resolution

Problems/Concerns	Solutions used
4. Overall Logistics (the process flow)	• ***Increased accessibility*** through mobile app and doorstep screening by volunteers. • ***Output to Dashboard*** accessible to a local community hospital. • Comprehensive assessment of each eye of the patient ***to approve the result*** and then perform the surgery. • ***Local hospital accountable for the surgery and updating the dashboard .***
5. Assurance over Reliance on AI	• First field trial of application for testing. • Rectification resulted in ***94% accuracy.*** • Use of technical training and manual to help use the app properly



e-Paarvai Dashboard: Data Validation by a doctor



e-Paarvai Dashboard: Patient Status Update

Findings

1. AI can be used in critical areas such as Healthcare to increase scalability and accessibility.

2. Constant test and trials are important for deploying any digital solutions. Not to forget-the constant monitoring and feedback.

3. The quintessential need of human touch- For quality control and output of over-reliance on AI and digital solution.

3. Recommendations for managers

1. Problem/Conflict first-Awareness of existing pain points on governance and individual level is important to force innovation.

2. AI for augmentation and not for automation-Human touch, testing, trials and monitoring.

3. Strategic partnerships & collaborations with external technology vendors keeping in mind the adaptability.

THANK YOU!!