

The background of the cover is a light blue gradient with a faint image of a person wearing a white lab coat and a surgical mask. Overlaid on this are two large circles: a dark blue one on the left and a white one on the right. Thin blue lines with small circles at the end, resembling circuit traces, are positioned in the top right and bottom left corners.

**USE OF**

# **DIGITAL & DATA SCIENCE**

**TO STRENGTHEN  
COVID-19 MANAGEMENT**

**INDIA  
CASE STUDY**

**APRIL 2021**

## TABLE OF CONTENTS

04

INTRODUCTION

04

STRUCTURE AND DATA FLOW  
OF INDIA'S DIGITAL BACKBONE  
FOR COVID-19

04

DEMONSTRATED BENEFITS  
FROM USE OF DIGITAL TOOLS  
FOR COVID-19 MANAGEMENT

04

PRACTICAL STEPS TO SCALE UP

04

KEY LEARNINGS  
FOR OTHER COUNTRIES

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# INTRODUCTION

The first confirmed case of COVID-19 in India was registered on January 28, 2020, and...

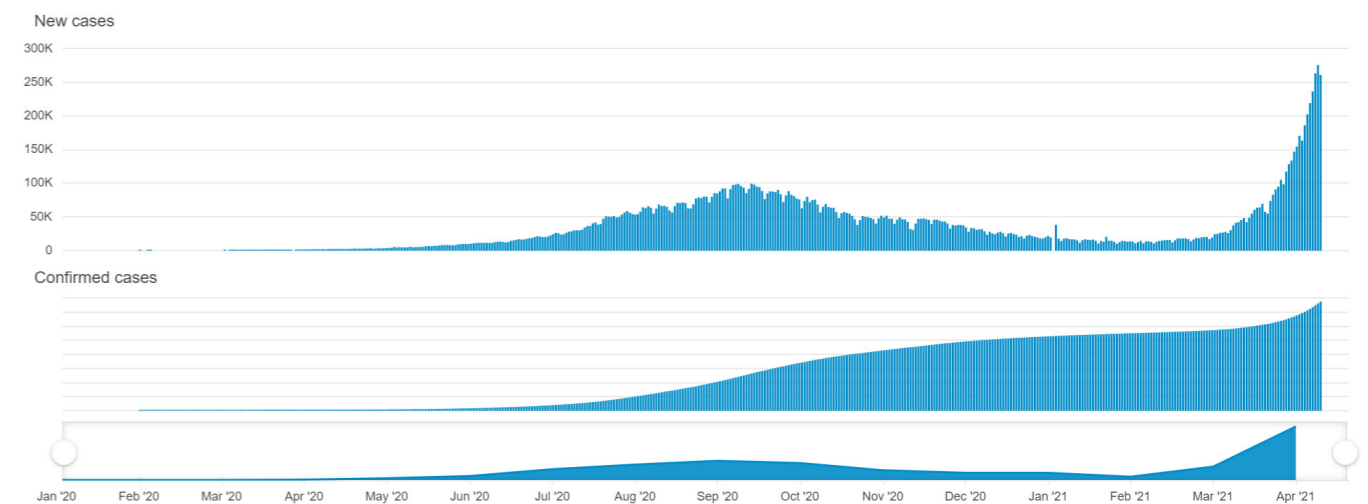
JANUARY 28, 2020

... by March 1, 2021, a total of **1.1 lakh (~11 million)** cases cumulatively had been detected from ~227 million tests

MARCH 1, 2021

As of March 15, 2021, India had **2,19,262 active cases** of COVID-19, with a cumulative **recovery rate of 96.7 percent** and a **death rate of 1.4 percent**


MARCH 15, 2021



**Figure 1:** India COVID-19 Epidemic Curve (source: <https://www.who.int/countries/ind/>)

In March 2020, software engineers, epidemiologists, statisticians, social scientists and legal experts from across India worked with the Government of India, to **develop a digital backbone for the country's COVID-19 response.**

The resulting systems, which entailed introduction of new digital tools as well as adaptation of existing ones, were designed to facilitate test-trace-isolate (TTI) programme activities, predict emerging hotspots and identify high-risk individuals in need of targeted testing. This case study outlines the structure, functionalities and impact of the key digital solutions that India is using on a national scale to support COVID-19 surveillance and management, highlighting key learnings and operational considerations that may be relevant to other countries.



## STRUCTURE AND DATA FLOW OF INDIA'S DIGITAL BACKBONE FOR COVID-19

India's digital ecosystem for COVID-19 management is centred around **Aarogya Setu** (Sanskrit for “Bridge to Health”), a public-facing mobile application designed specifically in response to the pandemic.

India's response also leveraged the pre-existing electronic infrastructure of Ayushman Bharat, the scheme from the National Health Authority (NHA) for provision of free healthcare to 500 million citizens. As illustrated in Figure 1, these two platforms support multiple case management functions across the TTI cascade.

Aarogya Setu additionally captures location data via Bluetooth, which is used for risk scoring of users based on their exposure (proximity and duration) to confirmed cases, in order to determine who is at high risk of infection and should be prioritized for testing.

Targeted testing strategies are further informed by the IT-enabled **Integrated Hotspot Analysis System (ITIHAS)** that uses syndromic data submitted by Aarogya Setu users to map future hotspots.

ITIHAS also generates hotspot predictions using the historic location data (based on cell phone tower signals) of confirmed positives diagnosed in the Indian Council of Medical Research (ICMR)'s network of approved labs. The recent fusion of these two surveillance methods (syndromic mapping and historical location data) has deepened the precision of hotspot predictions.

# AAROGYA SETU

Aarogya Setu, the centre of India's digital backbone for COVID-19 management, is a mobile application that was launched for public use on 2 April 2020.

Users download the app free of charge and register using their mobile number, following which a de-identified identification (DID) is generated to enable anonymized transfer of their data in the system. The Setu app then captures two key sets of data:

**As of November 2020, it had 170 million registered users: 13% of the country's population.**

## 01 SELF-REPORTED SYMPTOMS – FOR CASE MANAGEMENT AND HOTSPOT MAPPING

**The app includes a questionnaire on key symptoms relevant to COVID-19: cough, fever, loss of smell/taste and difficulty in breathing.**

Of Aarogya Setu's users, 70% have provided symptom data at least once, with more than half reporting symptoms more than once.

These symptom data are used to identify high-risk individuals in need of testing, whose contact information is transferred to the Ayushman Bharat/NHA call centre for follow-up to ensure that they are linked to care (see section 2.2). This data transfer takes place through a two-way application programming interface (API) integration with Ayushman Bharat.

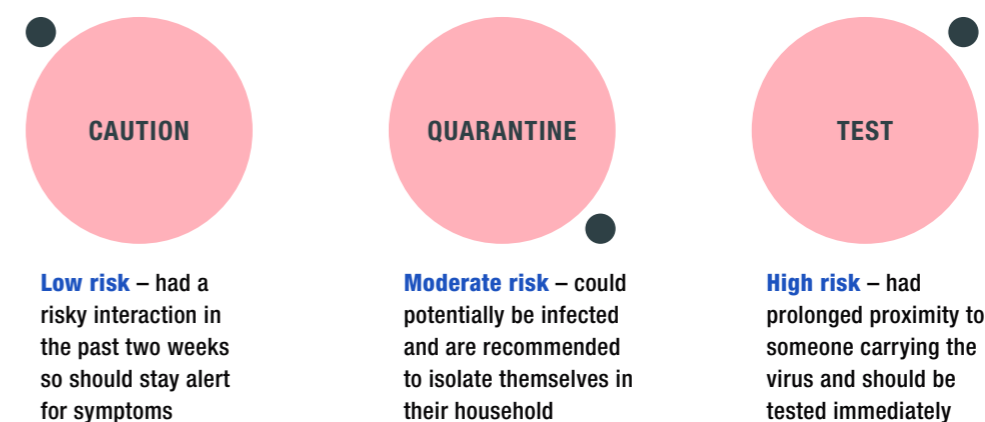
The GPS coordinates at which the symptom screen was completed are also captured, and fed into the syndromic mapping exercise conducted with ITIHAS to predict hotspots in need of targeted testing, as demonstrated in section 3.2.

## 02 LOCATION (BLUETOOTH) – FOR CONTACT ALERTS

Aarogya Setu requests user permission to enable regular recording of location data through Bluetooth signals and periodic latitude-longitude measurements. These data are not immediately transmitted to the app's servers but are instead stored in encrypted form on the device for 15 days, after which they are automatically deleted, unless the individual has been diagnosed with COVID-19, or come in contact with a confirmed case who also had location tracking enabled in their app.

Once a user is diagnosed by an ICMR-affiliated lab, their location data are downloaded to the Aarogya Setu server from the cloud. This includes data from any app users with whom the diagnosed cases have been in contact with over the prior 15 days, as captured through Bluetooth signal interactions. A risk-scoring algorithm uses these data to assign users to one of three risk levels, which are continuously updated as new contact data becomes available. Data on individuals who may have been infected are kept for 24 days after they have been identified as possible infectors, so they can remain included in simulations throughout the potential window of infectivity.

**Based on a user's risk level, follow-up actions are recommended:**



These risk scores and recommended measures – including information on nearby testing facilities if needed – are communicated to the user via a text message, and also inform early identification of hotspots.

**Within the first eight weeks of the app's introduction, more than 900 000 users identified through the algorithm had been contacted with such information.**

Information on high-risk individuals is also transmitted to the Ayushman Bharat call centre, which follows up with them by phone to support linkage to testing and care.

