

## RESEARCH ARTICLE

# Surveillance and Detection Applications: Health Information Systems in Japan during the COVID-19 Pandemic

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## ABSTRACT

The COVID-19 pandemic presented an immense challenge for Japan's health information systems (HIS). This paper examines national HIS adaptations to meet the increased epidemiological data demands of a pandemic. A literature review was conducted, and literature was collected from PubMed and was restricted to articles that contained the following three search terms: "Japan", "COVID-19", and "Health Information System". Fourteen papers were ultimately selected, including six supplemental resources. Studies revealed Japan's utilization of digital resources accelerated surveillance detection methods and addressed public health concerns, which allowed for the effective monitoring of COVID-19 infection cases. However, the utility of these surveillance and detection methods were limited by low adoption rates by the general population. Recommendations to strengthen Japan's HIS response to a future pandemic include increasing the horizontal scalability of contact tracing mobile applications, as well as improving electronic security.

## INTRODUCTION

According to the United Nations Development Programme, health information systems (HIS) perform data collection, processing, reporting, and uses functions to support the delivery of quality and equitable healthcare services [1].

Following the H1N1 pandemic in 2009, Japan modified its national policy for reporting illness, advising that during a pandemic, individuals should first contact a public health professional before visiting a primary care clinic as part of creating a triage system and to accommodate hospital capacity [2]. In line with the modified national policy, at the beginning of the COVID-19 pandemic contact and disease severity information were reported through phone calls, emails, and interviews—a time-consuming and labour-intensive process [3].

Japan employed two strategies to counter this strain: one involved the digitalization of relevant data using mobile applications; and another that utilized a hotline to improve access to relevant information.

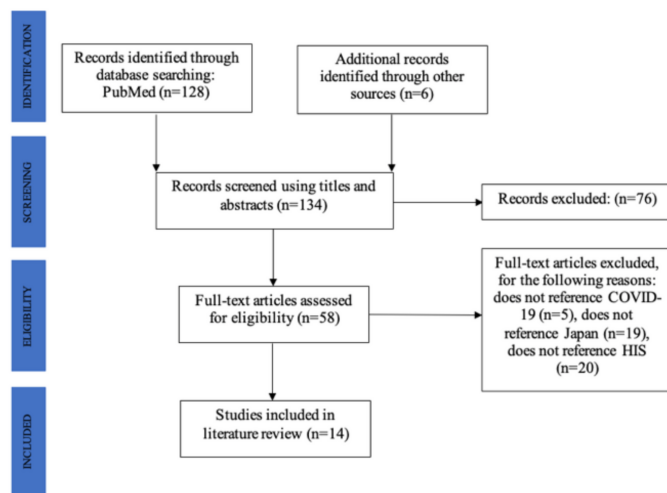
This paper presents how Japan's HIS prioritized mobile applications and online services to meet the demands of surveillance and contact tracing during the COVID-19 pandemic. Prioritizing horizontal scalability and electronic security for digital applications are key lessons in the development of public health strategies to detect and monitor future infectious diseases.

## METHODOLOGY

Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) strategy suggested by Moher et al, a literature review was

conducted using the following search terms in the PubMed database: “Japan”, “COVID-19”, “Health Information System,” and associated medical subject heading terms [4].

The search was limited to articles written in English and published between 2019 and 2021. Papers were reviewed and considered based on the following exclusion criteria: not specific to COVID-19, Japan, or HIS. Full-text reviews were completed resulting in the inclusion of eight research papers in the final literature review. Supplemental information on HIS from six grey literature was incorporated in this review (Figure 1).



**Figure 1.** PRISMA Flow Diagram.

## DISCUSSION

### *Digitalization of COVID-19 Data Management*

Japan’s HIS strategy focused on adapting digital methods to track infection rates in the general population [5]. A primary means of epidemiological mapping identified in the reviewed studies was the use of mobile applications to monitor potential and confirmed COVID-19 cases [6]. An example is an application developed by the LINE corporation, the largest provider of mobile applications and internet services in Japan, called the “COVID-19: Operation for Personalized Empowerment to Render smart

prevention And care seeking” (COOPERA) [5]. LINE’s launch of COOPERA, in collaboration with the Kanagawa prefectural government, expanded data collection to provide better insights into COVID-19’s spread in the country using LINE’s existing networks.

Using a chatbot software application, COOPERA gathered participants’ relevant information, like their place of residence and symptoms exhibited, offering the prefectures a rapid epidemiological assessment of user data [5]. A significant positive correlation between the data generated by COOPERA and the reported cases of COVID-19 in the nine regions the study examined support the validity of this tool [7].

Contact tracing applications that were publicly available include COVID-19 Contact-Confirming Application (COCOA) and GitHub, which differed from COOPERA in their emphasis on privacy and security. For example, GitHub did not collect personal data but generated transmission graphs using participants’ contact points, preserving user anonymity [8]. COCOA is a peer-to-peer phone application for COVID-19 contact tracing that employs Bluetooth technology to instantly capture close contact on various smartphone devices [6]. A study that examined the design and implementation of COCOA found that these detection measures lowered instances of cross-transmission by accelerating detection and proximity measures through Bluetooth technology [6].

K-note is another health-promoting mobile application that predates the COVID-19 pandemic. The application was expanded to allow users to input COVID-specific data and track contacts of infected individuals [9]. Made accessible to the public, K-note quickly amassed over 20,000 users. A 2020 study suggested that K-note’s primary benefit was in alleviating the burden on epidemiologists by notifying them of all close contacts of a reported infection, drastically expediting this traditionally labour-intensive process [9]. This study affirmed K-

note's role as an effective counter-cluster measure to mitigate the spread of COVID-19.

#### *Use of hotlines to improve access to information*

Japan's Ministry of Health, Labour, and Welfare promoted the institution of hotlines with public health nurses as a COVID-19 response to address public concerns and refer infected individuals to the proper healthcare facilities for medical care [2]. A 2021 study analyzed the nature of 1017 calls placed to a special hotline in Tokyo and found that approximately 80% of callers were concerned civilians, while 20% represented larger organizations. A qualitative analysis of these calls identified that a high proportion of concerns were related to COVID-19 symptoms and the availability and location of PCR testing. More than 70% of consultations resulted in a referral to a primary care clinic for in-person care, indicating that there were limitations in the hotline's ability to alleviate the burden on health care professionals but, shows improvements in service coordination and system navigation [2].

## **RECOMMENDATIONS**

This paper's policy recommendations outline several ways in which high-income countries can adapt and improve their HIS in preparation for future infectious disease outbreaks based on lessons learned from Japan.

#### *Increase horizontal scalability of contact tracing*

It was found that individuals, managers, and civil servants employed by large companies in the service sector were most likely to download the contact tracing application, COCOA [10]. Horizontally scaling the application to reach a wider audience strengthens monitoring efforts through the continued expansion of pre-existing infrastructure [11]. COCOA could be adapted across various countries, albeit requiring consideration of local privacy concerns and legislation, population

technological literacy, and application cost [12]. In 2020, between 70-85% of the population of most high-income countries owned a smartphone, making scaling highly feasible [13].

The scaling process would ensure that the data improves policy and overall health service delivery. By focusing on equity and accessibility when designing tracing applications, epidemiologists will have comprehensive data that more accurately enable decision-makers to improve health policy, services, and systems during a pandemic [1]. Based on contact tracing data, policymakers can better evaluate and implement application mandates within these regions to address data gaps that lead to low case reporting and high rates of infection due to policy gaps. Overall, horizontal scaling would increase the pool of available applications and systems to draw on during future pandemics [1].

#### *Improve electronic security to leverage technology*

K-note's tracking system relieved the burdened health care system during the COVID-19 wave by providing timely, complete, quality and readily available personal health records and data [9,14]. However, security concerns about data management and privacy should be resolved for the complete uptake of any eHealth systems. For instance, strict compliance with data privacy measures, and the use of non-cloud-based data storage networks could protect against potential breaches of health data, thereby alleviating public distrust and increasing software uptake [15].

## **CONCLUSION**

Japan's HIS utilized mobile applications and online services to meet epidemiological demands and increased prefectures' capacity to carry out health observations and contact tracing during the COVID-19 pandemic. The application of mobile technology minimized the burden on epidemiologists by improving the monitoring of trends through real-time collection of location and infection data. Greater consideration of horizontal scalability and

electronic security, and their integration into public health policy, could enhance Japan's readiness—as well as other high-income countries with similar infrastructure and processes in place—for future infectious disease pandemics.

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