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The Use of Surveillance Technologies to Combat the Spread of COVID-19

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The Use of Surveillance Technologies to Combat the Spread of COVID-19

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1. INTRODUCTION

Tracking and tracing technologies have proven to be effective in containing COVID-19 throughout various stages of the pandemic. Recent successful examples from Asia help illustrate their importance in living with COVID-19 and preparing for a sustainable return to pre-COVID-19 life routines with minimal social distancing. As such, surveillance technologies will become an integral part of day-to-day life for the foreseeable future.

Israel and other Western countries continue to look for ways, including public health surveillance tools, to contain the spread of COVID-19 and enable a gradual return to normalcy. They should cooperate with Asian states like Singapore, South Korea, Taiwan, and Hong Kong and learn from their successful use of similar measures. These countries, all with close ties to mainland China, had internalized the lessons of the SARS outbreak in 2003 and MERS in 2015 and already had pandemic response plans in place, including mechanisms for multi-ministry systematic coordination.

A critical lesson from the experience of these Asian nations is that governments must deploy epidemiological tracking technologies in tandem with other measures such as extensive medical testing, data analysis, and enforcement in order to manage infection rates. Another is that the public needs to be relatively confident that the government will deploy these technologies sensibly. These countries have relayed a clear and unified message to their citizens regarding the role of civilian cooperation in fighting community transmission of COVID-19 and have made significant efforts to prevent misinformation in the press and on social media.

The epidemiological application of cellular surveillance and artificial intelligence raises an array of dilemmas and tensions vis-a-vis civil liberties. The debate on how to balance security and civil liberties is not a new one. Mass surveillance programs by the U.S government following the passage of the PATRIOT Act in 2001 as part of the war against terror led to much controversy, especially after leaks by former CIA sub-contractor, Edward Snowden exposed the scope of these programs (Edgar 2017: 5). The use of mass surveillance in response to COVID-19 raises a new set of challenges to personal freedoms and civil liberties. Technological advancements since 2001 mean that governments (and corporations) have far greater ability to collect and store copious amounts of data, and under the auspices of the COVID-19 crisis, might use these powers without due process and little oversight at best. Moreover, implementing these measures as an emergency response raises concerns that their prevalence and use will slowly be normalized and become routine, even after the crises subsides (Ram and Gray 2020: 2). Israel's use of the Israel Security Agency (ISA), the only democratic country to use its internal intelligence agency for this task, appears to have mixed results.[1] [2]

This paper is an action-focused policy paper, analysing the best practices and lessons from four democratically-oriented Asian governments. These governments dealt remarkably well

[1] See Shwartz-Altshuler, A. & Aridor-Hershkowitz, R., 2020. How Israel's COVID-19 mass surveillance operation works. https://www.brookings.edu/techstream/how-israels-covid-19-mass-surveillance-operation-works/

[2] See https://www.haaretz.co.il/captain/net/.premium-1.9088727?utm_source=App_Share&utm_medium=iOS_Native

with the COVID-19 pandemic, and we will draw upon their experiences to create a toolbox for Israeli policymakers.

The paper will review different surveillance methods employed in Asia and Israel and make recommendations for policymakers. The second paper in this project will consider the optimal legal framework for contact tracing technologies. The third and final paper will consolidate critical insights and recommendations from a roundtable of experts and relevant officials from both Israel and Asia, focusing more broadly on best practices of the COVID-19 pandemic management.

The paper begins with an overview of the technological surveillance methods implemented in Taiwan, South Korea, Singapore, and Hong Kong. Next, it reviews the Israeli COVID-19 response to date, followed by an examination of its tensions and challenges. The paper then discusses the best and most relevant practices from Asia, followed by a recommendations section, and finally, a brief concluding section.

2. ASIA OVERVIEW

For this comparative section, we chose to focus on Asian countries that appear to be most relevant for Israel in terms of government systems and size. Singapore, Taiwan, South Korea, and Hong Kong have all used some form of digital surveillance for contact tracing purposes. Although all methods described hereinafter were digital, they varied in their mandate (compulsory vs voluntary), method of data collection (geospatial vs Bluetooth), openness (open source vs closed source), and other properties. It is worth noting again that none of the aforementioned countries used their intelligence agencies as a central instrument in their tracing efforts. The following section will review the technological surveillance methods these nations used.

2.1 SINGAPORE

In January 2020, Singapore rapidly assembled a Multi-Ministry Taskforce. Its purpose was to streamline interagency coordination and direct the national pandemic response. This unified approach allowed for a clear and direct public awareness campaign, including daily press briefings and cartoons, and the campaign has been remarkably effective in abating public confusion and encouraging civilian cooperation with government efforts. Furthermore, the task force agreed to utilize the Singaporean in-house tech agency, GovTech, to develop the relevant mobile applications like TraceTogether and SafeEntry, as well as a COVID-19 specific chatbot and a live situation report room to make public health data available to both civilians and international audiences. Additionally, the Multi-Ministry Taskforce includes nearly 3,000 enforcement officers and ambassadors from over 30 agencies who are deployed to public spaces in public housing estates across the island to ensure compliance with safe distancing measures.

Lauded by the World Health Organization (WHO) for its emergency preparedness, Singapore has been quite successful in tracing potential virus transmission. Per John Hopkins University's global COVID-19 tracker, as of November 9, 2020, Singapore had 58,064 confirmed cases and only 28 deaths.[3] Its population is 5.69 million (residents and non-residents).[4]

As of March 25, the Singapore Government made the TraceTogether app freely available to developers around the world. Additionally, it released its open-source code, called OpenTrace, to be maintained by a group of open-source advocates. This effort will also allow users of OpenTrace to advance the codebase and tailor it to their communities.

Supported by the Personal Data Protection Act (PDPA)[5] passed in 2012, the Singapore Personal Data Protection Commission, comprised of several officials from the government, private sector, and university faculty to help navigate the COVID-19 crisis, issued a special advisory. The advisory states that all relevant personal data can be collected and disclosed without consent during this period as part of contact tracing efforts and other response measures.

[3] Numbers were retrieved from John Hopkins University https://coronavirus.jhu.edu/map.html on November 9, 2020

[4] Per Singapore's Department of Statistics, 2020. See https://www.singstat.gov.sg/modules/infographics/population

[5] See https://www.pdpc.gov.sg/Overview-of-PDPA/The-Legislation/Personal-Data-Protection-Act

All Singaporean surveillance methods detailed hereinafter follow transparency and privacy safeguards called the BlueTrace protocol. The protocol protects app users and allows for global interoperability.[6] The following government-implemented technologies have been successful in helping curb virus transmission in Singapore and allow for a gradual return to normalcy.

TraceTogether Mobile Application

The Singaporean Ministry of Health launched the app on March 20, 2020. Individuals download the app voluntarily. The app exchanges short-distance Bluetooth signals between phones to detect other participating TraceTogether users in proximity. The app pairs a person's phone number with a random anonymized ID, which it is the only data exchanged between phones. Data is stored locally on each user's phone. The app does not collect or use location data of any kind and does not access a user's phone contact list or address book.

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Per a September 9, 2020, virtual media conference, the app had 2.4 million downloads, accounting for more than 40% of Singapore's population.[7] However, officials noted that not all users have the app running throughout the day. This insufficient participation level partially explains the inability to monitor every confirmed COVID-19 case, a requisite for contact tracing to be most effective. To address this issue, Singapore will supplement the app by distributing TraceTogether Tokens – small devices that can be carried on a keychain, and have a battery life of 6 months.[8] Their widespread distribution will begin September 14. The government initially gave the tokens in late June to seniors, a population more vulnerable to COVID-19 and less digitally connected.[9] By the end of December, it will be mandatory to either check-in with the Token or the app in all public places.[10]

SafeEntry/SingPass Mobile Applications

The Singaporean Ministry of Health launched the app on April 23, 2020. It is mandatory for individuals visiting high traffic hotspots and for permitted businesses to operate during the partial lockdown period. Businesses wishing to opt-out must be capable of logging entry/exit information in the proper format (.csv) to be submitted to the Ministry of Health database.

[6] For more info, see https://bluetrace.io/
[7] https://sg.news.yahoo.com/covid-19-singapore-to-begin-distributing-trace-together-tokens-next-monday-105506858.html
[8] For more information of TraceTogether tokens see https://support.tracetogether.gov.sg/hc/en-sg/categories/360004357834-TraceTogether-Token
[9] For the press release, see https://www.sgpc.gov.sg/media_releases/sndgo/press_release/P-20200628-2
[10] https://www.straitstimes.com/singapore/what-do-i-need-to-know-about-compulsory-tracetogether-check-in-from-end-december

SafeEntry is a free-for-use, cloud-based visitor registration system that logs the mobile number, name, and national identity or passport number of individuals visiting hotspots and venues providing essential services. Verification takes place through (1) scanning of QR codes, (2) scanning of national identity numbers at hotspots and high traffic locations, or (3) checking in with the SingPass Mobile App registered with SafeEntry.

According to a May 2 Ministry of Health press release, all data collected by SafeEntry is used by authorized personnel for contact tracing purposes only, and stringent measures are in place to safeguard it, per the government's data security standards.

In September, the Singaporean Ministry of Health stated that the Trace Together (TT) program, comprising of the app and token, reduced the time taken to identify and quarantine individuals from 4 days to less than 48 hours.[11]

2.2 SOUTH KOREA

With a population of just over 50 million people, the South Korean government has been able to accurately report its number of confirmed COVID-19 cases due to innovative and widespread testing efforts. Initially believed as a potential hot spot, by early November 2020, South Korea has managed to stabilize virus infection rates with 27,553 total cases and 480 deaths.[12]

In cooperation with the South Korean Ministry of Health and Korean Central Disease Control (KCDC), civilian software developers have also implemented voluntary apps, such as Corona 100m and CoronaMap. They use publicly available information to post the date of a confirmed COVID-19 patient along with the person's nationality, age, gender, and whereabouts of possible virus transmission. The KCDC incorporates the data in its investigations, including patient interviews, CCTV Footage, credit card records, mobile GPS, and medical records. All recorded information is then shared with local governments of proper jurisdiction and directly connects the user to the Korea Centers for Disease Control and Prevention Call Center. A list of incoming travellers is also provided to each local government (city or province) to strengthen its inspection network, supported by local police enforcement.

The success of the South Korean model is the result of a high level of interagency coordination, paired with innovative and widespread testing processes. Led by the KCDC, government officials were quick to assemble the Central Disaster and Safety Countermeasure Headquarters, headed by the Prime Minister, to bolster the government-wide responses to COVID-19. The response system establishes an information flow from the pan-government agency to local government disaster control task-forces in charge of local disease control.

A noteworthy outcome of such efficacious levels of information sharing and coordination is the Epidemic Investigation Support System launched by the South Korean government on March 26. This automated data-analysis platform allows investigators to get clearance and pull up patient trajectories in under a minute, leading to more efficient and complete contact tracing. The COVID-19 data platform assists epidemiological surveyors to quickly identify places that

[11] For Singapore MoH News Release, see https://www.moh.gov.sg/news-highlights/details/tracetogether-and-safeentry-to-be-enhanced-in-preparation-for-further-opening-of-the-economy
[12] Data retrieved from South Korea's ministry of health at http://ncov.mohw.go.kr/en/

infected individuals have visited by conducting a spatial-temporal analysis of data such as GPS, mobile information, and credit card transaction history. The platform helps health officials corroborate contact and location information from patient interviews.

The Infectious Disease Control and Prevention Act (2015) article 76-2 is the legal basis for Korean quarantine enforcement agencies to gather not only patient statements but also personal data through location tracking, card transactions, and CCTV recordings for contact and infection tracing purposes. A recent amendment, carried out on March 3, 2020, outlines a provision for deleting all personal data collected once no longer necessary, a procedure overseen by The Ministry of Health. In July, Media outlets reported significant security breaches in the app that exposed details of quarantined individuals. The Korean government said that it has since fixed those defects.[13]

Self-Quarantine Safety Protection Mobile Application

The Korean Central Disease Control / Ministry of Interior and Safety launched the app on March 7, 2020. It is Voluntary for those living in South Korea and, as of April 1, 2020, mandatory for all inbound travellers.

The application has three main functions: (1) self-diagnosis for the users to conduct and submit the results with the assigned government officers; (2) GPS-based location tracking to prevent possible violation of self-quarantine orders; and (3) providing necessary information including self-quarantine guidelines and the contact info of the assigned government case officers. There are two versions of the application: one for the users under self-quarantine and one for the assigned government case officers. Additionally, there is a communication protocol between users and officials in place. Users are required to check-in and report their current symptoms twice-a-day. The app automatically sends all the self-diagnostic data to an assigned case officer for monitoring. If the data is no longer shared or if the subject breaks their quarantine, the case officer is notified and will take appropriate measures to have the subject return to the quarantine area. After the 14-day mandatory quarantine, an automatic message notifies the user to delete the application to avoid confusion.

According to the South Korean government, the application has been useful in monitoring those under self-quarantine. As of June 2020, the government reported more than 162,000 downloads.[14] There are alternative phone call arrangements in case a user has trouble using the application or does not own a smartphone. Additionally, the application's alarm function has been deemed effective in encouraging quarantined people to stay within their designated location.

Self-diagnosis Mobile Application (for inbound travelers)

The Korean Central Disease Control / Ministry of Interior and Safety launched the app on February 12, 2020. It is mandatory for all inbound travellers as of April 1, 2020. URL and QR codes to download the app are made available upon arrival at the airport. They are posted on immigration gates as well as printed on unique arrival cards. Travellers must install the application and submit passport information, nationality, name, address, and other necessary

[13] https://www.nytimes.com/2020/07/21/technology/korea-coronavirus-app-security.html
[14] https://www.nytimes.com/2020/07/21/technology/korea-coronavirus-app-security.html

information for the mandatory 14-day quarantine. All inbound travellers must report several health indicators such as body temperature, cough, and sore throat through the application once a day during their 14 days of quarantine. The submitted data entries are collected on the self-diagnosis mobile system and checked against immigration records before being sent to the relevant public health clinics.

The self-diagnosis mobile system receives immigration and visa information from the Korean government. If an inbound traveller fails to install the app or does not report their daily health conditions, the authorities will track them through it. If, after receiving warnings via text messages and calls, the traveller still does not use the application as instructed, the police pursue the case.

According to data provided by the South Korean Government as of April 9, the application had been installed by approximately 170,000 travellers, with further action taken for nearly 9,000 of them with possible symptoms.[15]

Smart Wristbands

The Korean Central Disease Control / Ministry of Interior and Safety announced the Smart Wristband on April 7, 2020. They are mandatory for all individuals caught violating self-quarantine regulations. The wristband pairs with the self-check app ("Self-Quarantine Safety Protection") via Bluetooth and alerts officials if the person leaves home or tries to destroy the band. Data gathered from the app is uploaded to the Korea Center for Disease Control database. Police and local administrative officials ensure individuals wearing wristbands remain in quarantine. Pairing the wristband with the app allows officials to know if a quarantined individual is away from their phone or damages the wristband.

Legal grounds for forcing subjects to wear the wristbands are "insufficient" and police, and local officials must offer consent forms for the devices while investigating those caught breaking quarantine.[16] Personal Information Protection Act (2011) imposes strict compliance requirements on entities that collect any information that could identify a specific person. Individuals also have the right to abstain from sharing information, among other data ownership rights.

2.3 TAIWAN

Taiwan has been granting the National Health Insurance Administration (NHIA) access to immigration and customs databases to identify possible cases in both overseas arrivals and within the community. As of September 15, eight months after the first reported case, the Taiwan Center for Disease Control (CDC) reports 499 confirmed COVID-19 cases with only seven deaths.[17] The government streamlined surveillance information flow by establishing the

[15] See *Flattening the curve on COVID-19, How Korea responded to a pandemic using ICT*. The Government of the Republic of Korea, p. 31 http://overseas.mofa.go.kr/viewer/skin/doc.html?fn=20200424050534524.pdf&rs=/viewer/result/202009

[16] In September 2020, the ROK government announced that people who are found to be defying quarantine will be forced to wear a wristband following a spike of cases in which quarantined people tried to overcome the current surveillance methods. See more: https://asia.nikkei.com/Spotlight/Coronavirus/South-Korea-to-adopt-wristbands-for-quarantine-violators2

[17] Data retrieved from the Taiwanese CDC, https://www.cdc.gov.tw/En

National Health Command Center (NHCC) with the Taiwanese CDC as its base. In general, the NHCC addresses public health emergencies and provides disaster information to decision-makers. It is a unified central command system that includes the Central Epidemic Command Center, the Biological Pathogen Disaster Command Center, the Counter-Bioterrorism Command Center, and the Central Medical Emergency Operations Center.

Furthermore, the NHCC set up an information-exchange platform to collect and integrate real-time information. This platform collects data from multiple databases, such as the National Health Insurance (NHI), stockpile systems, Taiwan National Infectious Disease Statistics System, and media surveillance; allowing the NHCC to analyse global epidemic issues as soon as possible and exchange information with other countries through the World Health Organization's International Health Regulation (IHR) Focal Point. The information is then made available at any time and location with mobile devices.

Another mechanism that proved successful in the Taiwanese model of surveillance and coordination is the Entry Quarantine System for border control. In addition to early border closures that began at the end of January, the entry system requires all incoming travellers to undergo a mandatory COVID-19 test upon arrival.[18] Additionally, they must scan a QR code and fill out an online form detailing travel information to determine their risk status. On February 18, the government announced that all hospitals, clinics, and pharmacies in Taiwan would have access to patients' travel records.

JY interpretation No. 690 (2011) allows the government to deprive those at risk of infection from personal freedoms when necessary to prevent the spread of contagious diseases. It also upheld the constitutionality of all necessary measures or administrative dispositions which have been broadly delegated by the Communicable Disease Control Act (Amended 2019).[19] Per the Personal Data Protection Act (2015), health officials are liable for privacy violations unless deemed necessary in a state of emergency.[20] As of September 15, 2020, the Taiwanese government has not declared a state of emergency.

Electronic Geo-Fence

The Taiwanese Central Epidemics Command Centre launched the Electronic Geo-Fence on January 29, 2020. It is mandatory for all person placed in compulsory quarantine. The Geo-Fence combines government immigration and health databases with real-time GPS cell phone tracking to create an "electronic fence" intended to monitor phone signals of individuals in quarantine. Based on the information collected, Taiwanese police makes twice-daily phone calls to ensure quarantine orders are followed and contact or visit those who trigger an alert within 15 minutes. Officials assure that they are tracking individuals only during the period of mandatory quarantine.

The Taiwanese Central Epidemics Command Centre partnered with the National Communications Commission to implement a system that only records the location of the person placed in mandatory quarantine and does not obtain their private records.

[18] For the Taiwanese MFA notice, see https://www.boca.gov.tw/cp-220-5081-c06dc-2.html
[19] https://cons.judicial.gov.tw/jcc/en-us/jep03/show?expno=690
[20] https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=I0050021

The system has been very accurate to date, with only about 1% of alerts being false, most of those had been inaccurate due to connectivity problems in rural areas.[21] Additionally, Taiwanese police deployed the M-Police system, which gives officers cloud-based access to numerous databases, including a database of individuals under quarantine orders. The police can then visit popular gathering places, check the identities of patrons, and compare it with the list of quarantined individuals.

2.4 HONG KONG

As of November 9, Hong Kong has reported 5,381 total cases (HK reports confirmed/ probable) and 107 deaths, nine months after the first reported case.[22] Rather than relying on more innovative technological contact tracing methods, Hong Kong's strategy focuses more heavily on enforcing mandatory quarantine for potential imported cases of COVID-19, while trusting residents to self-isolate and regulate individual movement.

Although the Hong Kong government initially struggled to implement functional location tracking wristbands, their relatively successful management of COVID-19 is primarily due to significant citizen cooperation. One such civilian method of aiding the Hong Kong government has been the collaborative effort by researchers from the University of Hong Kong and the e-payment service provider Octopus. While also used as a public transportation card, Octopus helps researchers track COVID-19's transmission by only sharing data of aggregate value. It does not reveal the identity of users or the use of any individual card.

The Personal Data (Privacy) Ordinance is one of Asia's longest-standing comprehensive data protection laws. It obliges government officials to take all practicable steps to ensure the openness of their personal data policies and practices.

Honk Kong experienced a second surge of infections in early July that was bigger than the initial outbreak in March but was able to contain it within a month. Additionally, the daily record number of new cases reached 149, in a territory of about 7.5 million.[23] In comparison, Israel's second surge began in early June, and the country shattered its record for daily new cases – 9,078 on September 30 (Israel's population is approximately 8.9 million).[24]

Combined with the live situation dashboard launched by the Hong Kong government, which maps buildings with cases in the past 14 days and buildings with cases beyond 14 days, the following technological surveillance mechanisms operate together in monitoring potentially imported cases of COVID-19.

Smart Wristbands

The wristbands were launched by the Department of Health / The Innovation and Technology Bureau in mid-March 2020 and are mandatory for all incoming travellers placed in quarantine. The wristband displays a QR code and pairs with the StayHomeSafe app. Once paired, the

[21] https://qz.com/1825997/taiwan-phone-tracking-system-monitors-55000-under-coronavirus-quarantine/
[22] Data retrieved from the HK government dashboard, https://www.coronavirus.gov.hk/eng/index.html#Updates_on_COVID-19_Situation
[23] The record number of new cases was on July 30, 2020, per data from https://www.bing.com/covid/local/hongkong?vert=graph
[24] Retrieved from the Israeli MoH COVID-19 dashboard, https://datadashboard.health.gov.il/COVID-19/general?utm_source=go.gov.il&utm_medium=referral

wristband and app use geofencing technology (such as Bluetooth, Wi-Fi, and GPS signals) to determine when a target individual enters a boundary. It then identifies unique sets of communications signals to deduce whether someone is inside or outside their home. If an individual breaches quarantine by leaving their home, the app triggers a warning and alerts the government. Health officials and police have partnered to implement surprise phone/video calls to aid in quarantine enforcement.

The wristband tracks changes in the location of subjects, rather than targeting specific locations. Hong Kong authorities have been actively working with the Privacy Commissioner for Personal Data - an independent statutory body established to help enforce Hong Kong's rules on privacy.

There have been four versions of the tracking wristbands thus far, ranging from paper to electronic. Among the first versions distributed, one third or more of the 60,000 wristbands appeared to have been inactive or developed software glitches.

As of May, Hong Kong authorities began distributing larger Bluetooth wristbands to incoming travellers at the airport. These smart wristbands are capable of reporting the locations of quarantined people independent of cellphones. By June 1, 9,800 persons under home quarantine have used reusable electronic wristbands; 87,000 individuals under home quarantine have used disposable electronic wristbands, and 41,000 individuals have used disposable monitoring wristbands with a QR code.[25] The government plans to use the reusable electronic wristbands for other purposes, such as elderly care after the pandemic subsides.

StayHomeSafe mobile application

The Office of the Government Chief Information Officer / Department of Health operate the app. It was launched on March 14, 2020, and is mandatory for all incoming travellers placed in compulsory quarantine. Incoming travellers are issued a wristband displaying a QR code for pairing with the app. Once paired, the wristband and app use geofencing technology (such as Bluetooth, Wi-Fi, and GPS signals) to determine when a target individual enters a boundary. It then identifies unique sets of communication signals to deduce whether someone is inside or outside their home.

Once a traveller arrives at the airport, government officials assist them in installing the application. Officials make test calls to ensure that the phone number provided is correct and that both the wristband and app are registered. Upon arrival at the quarantine facility (hotel or home), the wearers receive a prompt to walk around the perimeter of their quarantine destination to complete the activation process. If an individual breaches quarantine by leaving their room or home, the app triggers a warning and alerts the government. Several times throughout the quarantine period, the app prompts users to scan the QR code located on the wristband to confirm presence at the chosen place of quarantine. Health officials and police have partnered to implement surprise phone/video calls to aid in quarantine enforcement.

[25] For the full record from the HK legislative council, see https://www.itb.gov.hk/en/legislative_council_business/questions/2020/pr_20200603b.html

Hong Kong authorities have been actively working with the Privacy Commissioner for Personal Data, an independent statutory body established to help enforce Hong Kong's rules on privacy while partnering with local startup Compathnion Technology Limited to develop the app. All information collected is stored on a government-private cloud platform. At the same time, the detection and analysis of environmental signals do not involve the collection of personal data aside from telephone numbers. It will not read any information on smartphones. Users uninstall the app once they complete the mandatory 14-day quarantine. However, the Office of the Government Chief Information Officer has stated that it stores the information for up to three months.

According to a March 16, 2020 press release from the Government's Innovation & Technology Bureau, the addition of a mobile application to complement the existing wristband method has been very potent in monitoring compulsory quarantines.[26] [27] Additionally, a review by Asian Development Bank published in July found HK's digital tracing operations, including StayHomeSafe, to be successful, and instrumental to its impressive efforts to contain COVID-19.[28]

[26] For the press release, see https://www.itb.gov.hk/en/speeches/2020/pr_20200316.html
[27] https://asia.nikkei.com/Spotlight/Comment/Hong-Kong-startup-s-tracing-app-keeps-coronavirus-in-check
[28] For the full review, see https://development.asia/case-study/digital-solutions-covid-19-control-case-hong-kong-china

3. ISRAEL'S COVID-19 TECHNOLOGICAL MEASURES

Powered by different technologies and different government agencies, Israel has been utilizing the three primary surveillance schemes to curb the spread of COVID-19. Israel surveillance efforts operated within the framework of emergency regulations.

3.1 THE MAGEN (SHIELD) MOBILE APPLICATION REPLACED BY MAGEN 2.0

The Ministry of Health launched the Magen app on March 22, 2020, and the Magen 2.0 on July 27, 2020. Use of both apps is voluntary. The app gauges a user's infection probability by cross-referencing users' location data and identifying interactions between infected and uninfected people. If it finds a possible match, the user can dispute it or report the suspected infection to the Ministry of Health for further action. The original version of the app, launched at the start of the pandemic, was based on GPS-based geolocation only. In the second version, The system combines GPS and Bluetooth based technology, identifying proximity points between mobile phones where the app is running. The app also features an option to share routes of a verified COVID-19 patient to support the epidemiological investigation process.

The information collected by the app is stored on the device only, and it does not transmit data to the server. The app complies with stringent information security standards and passed tests by information security experts.

While 1.5 million users downloaded the first version of the application (approximately 1/8 of the Israeli population), 400K have since removed it. In August 2020, two weeks after the launch of Magen 2.0, it appears that about 40% of the users, who then installed the app on their mobile device, uninstalled it shortly after. Only 44,098 users installed the app, but 17,079 of them removed it. The Israeli government decided in July that after 1.68 million downloads of Magen 2.0 (third of the total number of smartphones in Israel) it will become the only government tool to locate contacts.[29] Later, an official briefed that the government did not set a target number of downloads to measure the effectiveness of the app.[30] On November 17, 2020, news outlets reported that PM Netanyahu instructed Ze'ev Elkin and Izhar Shay, the Ministers of Higher Education and Science and Technology, respectively, to examine ways of increasing usership of the Magen 2.0, including making them mandatory to entering public spaces.[31]

3.2 QUARANTINE ENFORCEMENT VIA CELLULAR SURVEILLANCE

The Israeli police began enforcing mandatory quarantines on March 16, 2020. The government tasked the police with enforcing sanctioned quarantine orders by using GPS to track cellular phones. The police department randomly samples GPS tracking information of infected individuals and compares it to their known place of residence. Should the subject be found violating their quarantine, the authorities could penalize and if needed, prosecute them.

[29] https://www.ynet.co.il/digital/technews/article/rklLkX7xv
[30] For the press release, see https://main.knesset.gov.il/Activity/committees/ForeignAffairs/News/Pages/pr190720.aspx
[31] https://www.ynet.co.il/news/article/rJICQrZ5D?utm_source=ynet.app.android&utm_term=58475320&utm_campaign=general&utm_medium=social

Data is stored for 14 days and then deleted. However, if data shows the individual violated quarantine orders, the data will then be stored for up to 90 days for criminal proceedings purposes.

The Foreign Affairs and Defense Committee (parliamentary committee) provides oversight on this program. On April 22, 2020, the Minister of Justice adjourned a hearing on a law meant to codify the emergency regulations.

Effectiveness: During a Foreign Affairs and Security Committee hearing on April 22, 2020, the police presented sampling data for 3,000 citizens from over two days of examination. According to data pulled from cellular GPS activity, 200 citizens violated their mandatory quarantine. Physical police checks only found three civilians in violation. As cases were rising and tracking systems seemed to be widely ineffective in the following months, police lost their ability to monitor quarantined individuals effectively. Officers were reportedly able to visit barely 1% of all quarantined individuals as of mid-September, 2020.[32]

3.3 ADVANCED EPIDEMIOLOGICAL INVESTIGATIONS VIA CELLULAR SURVEILLANCE

The Israel Security Agency (ISA, "Shin Bet") began using its capabilities for epidemiological investigations on March 17, 2020, under the auspices of emergency regulations and the General Security Service Law (2002).

The ISA's task is to assist the Ministry of Health in conducting epidemiological research of infected and likely infected individuals. Individuals testing positive for COVID-19 receive a text message alert, and the Ministry of Health transfers their information to the Shin Bet (ISA). The Shin Bet retrieves the individual's mobile location meta-data records from the previous two weeks. It then cross-references it with mobile location meta-data of other users to find possible connections. Based on this data, any potentially infected individual receives a notification from the Ministry of Health and is requested to immediately self-quarantine.

Shin Bet has access to the meta-data of all cellular users in Israel. Once it makes a query on a specific user, they store the information for up to 30 days. Subsequently, the information gathered from the query is automatically erased.

Due to the involvement of intelligence agencies, oversight occurs behind closed doors and is scarce. Relevant legislation and procedures on data protection and civil rights are unknown or vague. On April 26, the Supreme Court decided the Shin Bet would not be able to further assist the Ministry of Health in the fight against COVID-19 effective April 30, unless new legislation explicitly authorizes it. However, the Court stipulated it would allow some flexibility should there be a legislative procedure in motion.

Effectiveness: During a hearing in the Supreme Court on April 16, 2020, government officials presented information demonstrating how the discovery of 4,600 previously unknown

[32] https://www.haaretz.co.il/health/corona/.premium.highlight-1.9158057?utm_source=App_Share&utm_medium=iOS_Native

infections became possible using Shin Bet's cellular surveillance.[33] In a May 5, 2020 hearing of the Knesset Intelligence Subcommittee, officials reported that the ISA's tool discovered about one-third of all infected citizens in Israel at the time of the hearing.[34] However, Israel's second wave, reaching its peak (so far) in September 2020, has overburdened the system. A call centre set up by the MoH to answer calls of potential cases (people who have been in close contact with a confirmed COVID-19 case per ISA surveillance) has been overwhelmed.[35] Additionally, there were doubts over the accuracy of geospatial tracking in determining potential exposure of individuals to confirmed COVID-19 cases.[36] In July 2020, The Knesset Foreign Affairs and Defense Committee approved, by a majority vote, the General Security Service Accreditation Bill to assist in the national effort to reduce the spread of COVID-19 (Temporary Order) (Amendment), 2020, Which will be valid until January 2021.[37]

[33] https://www.haaretz.com/israel-news/.premium-israel-s-shin-bet-could-monitor-anyone-crossing-paths-with-coronavirus-patient-1.8775649
[34] For the Intelligence Subcommittee's notes, see https://main.knesset.gov.il/Activity/committees/ForeignAffairs/News/Pages/pr_050520.aspx
[35] https://www.themarker.com/coronavirus/.premium-1.9152490
[36] https://privacyinternational.org/long-read/3747/israels-coronavirus-surveillance-example-others-what-not-do
[37] https://main.knesset.gov.il/Activity/committees/ForeignAffairs/News/Pages/pr190720.aspx

4. TENSIONS AND CHALLENGES WITHIN THE ISRAELI MODEL

Following the enaction of emergency regulations that allowed for mass surveillance by the ISA, and implementation of a strict nation-wide lockdown, the pandemic appeared to be under control and winding down; new cases were virtually non-existent on some days in May.[38]

In the weeks that followed, Israel began experiencing a surge in cases. At the end of September, it reached its record number of new cases at 9,078. What started as a slight trickle of new cases, turned gradually into a downpour and eventually, a flood. On September 13, the Israeli government announced a three-week lockdown which began on the eve of the Jewish new year, occurring on September 18 this year.[39] [40]

Many localities and nations have experienced a second surge of cases at some stage after containing the initial outbreak – Hong Kong, South Korea, and Singapore included.[41] [42] [43]

The failure of the Israeli response is due to several reasons. Following years of political polarization that culminated in 3 consecutive elections in just one year, public trust in institutions was already alarmingly low; the government's perceived shambolic response to the second wave of infections has led to a further lack of trust. The government demonstrated extreme ineptitude and inability to coordinate between its agencies effectively. Conflicting messages delivered to the public also further politicized the crisis. Additionally, a high level of government indecisiveness left the public feeling helpless, confused, and angry, at a time when Israel entered the usually uplifting and family-focused period of the high holidays.[44]

Moreover, using law enforcement agencies proved to be only partially effective. It also potentially contributed to the increasing erosion of the public's trust and its willingness to take voluntary measures to contain the pandemic. In the first months, Israelis appeared to follow the government orders, despite the negative impact on their freedom of movement, lives and livelihoods. Shortly after an initial phase, public trust decreased, and distrust in the system seemed to increase as appeal cases against quarantine orders numbered and notices about incorrect messages spread. In the first week of operation, between July 1 and July 8, 2020, the organization identified 70,051 contacts, 22,000 of those appealed, and about 60% of the appealers eventually won.[45] 18% incorrect quarantine orders seems high, but it is difficult to compare it to other nations, as there is scarce data on appeal cases elsewhere.

Furthermore, social distancing guidelines recommend that individuals stay 2 meters (6 feet) from one another, so individuals who were within 6 feet of an infected person are potentially infected. However, GPS data is only usually accurate to within 16 feet, and less so in crowded areas, casting doubts over the efficiency of geospatial contact tracing (Ram & Gray 2020: 13).

[38] https://www.bloomberg.com/news/articles/2020-07-07/forged-to-tackle-virus-israel-s-alliance-of-rivals-falls-short
[39] https://datadashboard.health.gov.il/COVID-19/general
[40] See graphs in 8. Appendix for visual representation and comparisons
[41] Data retrieved from https://www.bing.com/covid/local/hongkong
[42] Data retrieved from the World Health Organization, https://covid19.who.int/region/wpro/country/kr
[43] Data retrieved from the World Health Organization, https://covid19.who.int/region/wpro/country/sg
[44] https://www.nytimes.com/2020/09/08/world/middleeast/israel-coronavirus-ronni-gamzu-netanyahu.html
[45] https://www.calcalist.co.il/internet/articles/0,7340,L-3839575,00.html

The use of ISA and other non-civilian resources also comes at a dangerous price. Reallocating resources from counterterrorism to epidemiological investigations could hinder the ISA from performing its essential role of protecting Israelis. Additionally, it constitutes an unprecedented, ominous turn in the role of the ISA, essentially using it to spy on Israeli citizens en masse. Nadav Argaman, head of the ISA, himself urged policymakers against these steps.[46]

While it was arguably necessary to utilize the ISA's capabilities and divert them for contact tracing purposes in the immediate start of the pandemic, Israel failed to develop an ongoing solution. Instead, it extended its emergency protocols.

The main challenges Israel has faced in its COVID-19 response:

- *Decentralization*: Despite there being many initiatives led by different agencies, including the Ministry of Health, the Prime Minister's office, and the Ministry of Defense, it is necessary to implement a more unified planning and execution process. As we move to lift restrictions again, coordinated and swift action between relevant agencies will be crucial.
- *Privacy/oversight*: The use of intelligence agencies for epidemiological investigations (Shin Bet) has been presumably effective in the Israeli experience in the short term but much less so over several months. Moreover, this practice, especially over a prolonged period, raises significant concerns and limits the agencies operational capacity. Utilizing the agency for non-core uses hampers its ability to carry out its counterterrorism responsibilities effectively.
- *Detection*: The ability to precisely detect newly infected citizens is necessary for reopening and rehabilitating the market economy. That said, and in line with Israeli practice thus far, achieving this goal includes expanding the number of privacy-intrusive queries and further infringing upon the rights of its citizens.
- *Arrivals*: The return of international travellers to Israel will likely continue to be a source of transmission and demands effective monitoring. Current measures in place to monitor imported cases are costly and not fully implemented.
- *Return to the public sphere*: As Israel moves out of its second lockdown and businesses reopen, there is a need for effective monitoring and quick detection of new infection hotspots. Several of the solutions that have been proposed thus far, including one calling for shopping malls to design apps of their own, appear to lack effectiveness and coordination. Furthermore, they can potentially compromise users' privacy.
- *Low levels of public participation and engagement*: International experience shows that when governments are more transparent and communicative of their measures, their efforts to contain COVID-19 are also increasingly fruitful. Transparency and communication also positively impact voluntary public participation, including the use of voluntary apps and adherence to regulations and guidelines.

[46] https://www.npr.org/sections/coronavirus-live-updates/2020/06/24/882741912/israels-government-wants-spy-agency-to-resume-covid-19-tracing-spy-chief-objects

5. BEST PRACTICES FROM ASIA

5.1 PRIVACY:

Singapore's TraceTogether app logs Bluetooth encounters between participating devices to facilitate contact tracing. The BlueTrace Protocol (link) ensures that user data and privacy are protected. Only the health authority can decrypt shared encounter history and obtain identifying information to uncover and subsequently contact potentially infected users. BlueTrace supplements manual contact tracing by addressing its crucial limitation: an infected person can only report contacts they are acquainted with and remember having met.

South Korea retains personal information within its KCDC database. However, current legislation requires relevant authorities to delete such data once it is no longer needed. Ministry of Health officials operate as an oversight committee.

In tandem with the Privacy Commission for Personal Data, the Hong Kong government implemented smart wristbands that pair with the StayHomeSafe mobile application. While the app allows for the detection and analysis of environmental signals, the software does not involve the collection of personal data and does not read any information on smartphones.

5.2 COORDINATION:

The Taiwanese model promotes a centralized disaster response centre. It acts more as a national surveillance agency and has less influence on policy implementation and information flow among non-health-related agencies. With the Taiwanese Center for Disease Control as its base, the government streamlined surveillance information flow by establishing the National Health Command Center (NHCC). The NHCC set up an information-exchange platform to process real-time data into COVID-19 related intelligence. This platform collects data from multiple databases such as the National Health Insurance (NHI), medical supply stockpile systems, Taiwan National Infectious Disease Statistics System, and media surveillance. The platform allows the NHCC to analyse global epidemic issues as soon as possible and exchange information within the relevant government agencies. The NHCC partnered with the National Communications Commission to implement the "electronic fence" system, allowing it to identify and record the location of individuals placed in mandatory quarantine.

Another fundamental difference between the Taiwanese and Israeli models in handling virus transmission is the authorities' frequent acts of transparency and the widespread use of civic technology. Aptly named as "hacktivists", developers and citizens collaborated with the government on the brainstorming site, vTaiwan, which serves as an online town hall platform. Some civilians developed apps to help their fellow residents face the pandemic. For example, some apps made sure individuals were never short of masks by mapping locations of stocked medical supplies, and assisting in their allocation to where they were most needed. Rather than utilising a top-down, opaque method of surveillance, the Taiwanese success is primarily due to a two-way information flow based on a clear and coordinated effort, boosted by civilian participation and open-source technology.

5.3 EFFECTIVELY MONITORING TRANSMISSION WHILE REOPENING THE ECONOMY:

- South Korea's *Smart Quarantine System* for international arrivals. Korea's app-based self-diagnosis and quarantine system for all inbound travellers, both national and non-national, offers an effective model to monitor travellers.
    - *Mandatory screening.* Health report compiled at the port of arrival with on-site testing. A mandatory download of apps for daily self-diagnosis.
    - *Cross-referencing* between the Health and Immigration Ministry.
    - *User-friendly services.* Simple yes-or-no, self-diagnostic questions for the app user to update once a day. After the 14-day quarantine, an automatic message notifies the user to delete the application to avoid confusion.
    - *Non-app based component.* A call centre contacts those that are without a smartphone or are unable to use the app. Call centre operatives also notify the police in case a user fails to use the app appropriately.
- Hong Kong implemented the Compulsory Quarantine of Persons Arriving at Hong Kong from Foreign Places Regulation, in place until December 31, 2020. The mandatory quarantine and evaluation protocols require incoming travellers to download the *StayHomeSafe mobile application* and pairing it with their location tracking *smart wristband*. Authorities provide paper instruction manuals, fact sheets, symptom tracking information, and transportation records for incoming travellers to fill out after leaving the airport.
    - *Mandatory screening.* Incoming travellers must complete a health declaration form at the port of arrival, and undergo testing at the airport. They either await their results for 10 hours at the airport or at a designated facility overnight. The arrival packet includes Compulsory Quarantine order forms. Travellers are also mandated to download the app and receive a wristband. They must also quarantine regardless of the test result.
    - *COVID-19 testing kit.* The arrival packet distributed at the port of arrival includes a testing kit. Incoming travellers must test themselves on the 10th day of quarantine and send it to a nearby testing facility.
    - *User-friendly services.* Upon arrival at the airport, health officials assist incoming travellers with the app and wristband. Health authorities test the reported phone number at the airport and assist with instructions and following procedures. After the 14-day quarantine, an automatic message notifies the user that quarantine has ended and that they can dispose of the wristband.
    - *Non-app based component.* Incoming travellers receive sim card activated Bluetooth wristbands at the port of arrival. These smart wristbands are capable of reporting the locations of quarantined people independent of cellphones.
- While Singapore continues to trace and monitor the community spread of the virus, the use of the SafeEntry app allows businesses to reopen while simultaneously boosting contact tracing efforts. This mobile application protects business operations, employers/employees, and individuals travelling to high traffic zones by logging entry/exit information. Should an individual test positive for the virus, there is an efficient mechanism for notifying relevant parties and health officials simultaneously.

5.4 LEGAL PROTECTIONS:

Without proper legislation, only voluntary participation protects democratic values, encourages transparency, and develops public trust in the government. Legislation implemented after the SARS outbreak in 2003 and MERS in 2015 laid almost all the groundwork for the effective coordination and swift responses of the Asian nations reviewed in this paper. In every Asian model, regulations allow relevant health authorities to access personal data while acknowledging individual privacy protections, and a designated statutory body receives the responsibility for privacy protection oversight. Indeed, these regulations fall under the pandemic response plan of each Asian model examined, or were introduced by policymakers after the implementation of new technological mechanisms for quarantine surveillance.

6. RECOMMENDATIONS

Israel has adopted the Asian model in terms of an early, relatively extreme implementation of quarantine measures, but not in terms of coordination, legislation, and the employment of a range of civilian technologies alongside enforcement measures. Following the failure to adopt effective policies and practices to contain the spread of COVID-19[47], policymakers must take the time to learn from Asian experience and that of other countries. Israel must formulate policies that will allow it to lift the second lockdown successfully.

Recommended Overarching Principles:

- *Implement a sustainable, long term approach.* The government should pool resources and management into a synchronized and effective response. Using a combination of technologies will allow the government to map, restrict, and enforce social distancing as well as enable citizens to effectively self-govern their well-being.

- *Increase public participation and engagement.* The government must allocate funding to public awareness campaigns that encourage public participation, including the widespread use of the Magen application. A centralized, unified, coherent, and (to the most considerable extent possible) transparent voice was instrumental to Asian nations' ability to achieve public buy-in and participation.

- *Integrate privacy considerations cross-board.* Privacy considerations, guaranteed by law, should be applied by appropriate privacy officers as an integral part of any research, development, retention, or use of personal information (to include meta-data). In general, the state should limit the breadth of information it receives, whether voluntarily shared or otherwise retained, to the necessary minimum. If collected, authorities should affirmatively erase any personal information as soon as possible; its use should be strictly limited to the intended use, and; an independent statutory entity should be in place to conduct effective oversight over its collection and use. E.g., Singapore's Personal Data Protection Commission, comprised of several officials from the government, private sector, and university faculty and created to help navigate the COVID-19 crisis. Furthermore, the entire data cycle, from retention to deletion, should be publicly disseminated, explained, and transparent before its utilisation. As a general rule of thumb, the technology that is least infringing upon civil rights should be preferable, as long as it is effective in achieving its goals.

- *End any further reliance on ISA for surveillance purposes.* The ISA was an efficient first responder given the emergency circumstances. However, its intrusive methods are disproportional in a democratic society when other similarly effective methods are available. Furthermore, requiring the ISA to persist in this mission long term will be counterproductive to its counterterrorism responsibilities and dangerous to the security of Israel.

[47] Several countries have seen returns to partial lockdown notably in the state of Victoria, Australia and several cities in China.

Recommended Actions:

Drawing on the previously described Asian experiences and existing Israeli infrastructure, we recommend the following measures:

- Centralization and delegation:

    - *We recommend creating a dedicated and competent aggregating COVID-19 command centre.* As a permanent body charged with technological preparedness for future pandemics, this command centre should include members of the relevant legislature, government offices, and organisations under the Ministry of Health, as well as representatives from the private sector. The command centre will integrate and coordinate data gathering and relevant technical solutions, ensure transparency and legal compliance with privacy regulations, and promote technological innovation. Taiwan's model has been very successful in achieving these goals with its implementation of a central command centre.

- Detection and lifting the lockdown:

    - *We recommend developing an all-in-one mobile application.* The Magen app should incorporate technologies such as those used in Singapore (SafeEntry mobile application) and Hong Kong (StayHomeSafe mobile application) to enable effective home quarantine and safely monitor businesses and high traffic zones. The use of such applications should be a prerequisite for accessing designated public spaces.

    - *We recommend expanding the use of 'Tav Sagol'.* Tav Sagol guidelines should include the scanning of a QR by the Magen app (or another solution for non-phone users) in stores. Customers that do not have smartphones can use alternative measures, from scannable wristbands to manual information logged by shop owners.

    - *We recommend incorporating culturally appropriate solutions.* Bluetooth based technologies can also run on "kosher" phones. Bracelets or tokens can be used independently of phones.

7. CONCLUSION

Nearly every pandemic documented has been characterized by a resurgence of infections in either two or three waves following the initial outbreak. Most countries around the world are experiencing an ongoing battle to reduce the spread of the virus for the foreseeable future. Technological surveillance measures are only partially effective; thus, every solution needs to include a strategic communications program for engaging the public in the battle against COVID-19, while also adhering to behavioural guidelines.

Multiple waves of infection are probably unavoidable, and therefore we must now prepare a long-term strategy utilizing medical resources as well as implementing innovative, effective, and existing surveillance technologies to reduce transmission and conduct contact tracing.

In this action-focused policy paper, we analyzed the best practices and lessons from four democratically-oriented Asian governments. We drew upon their experiences to create a toolbox for Israeli policymakers. The paper introduced an overview of the technological surveillance methods implemented in Taiwan, South Korea, Singapore, and Hong Kong. We then reviewed the Israeli COVID-19 response to date, followed by an examination of its tensions and challenges. The paper then discussed the best and most relevant practices from Asia, followed by our recommended principles and actions to Israeli decision-makers. Our main recommendations included:

Principles:

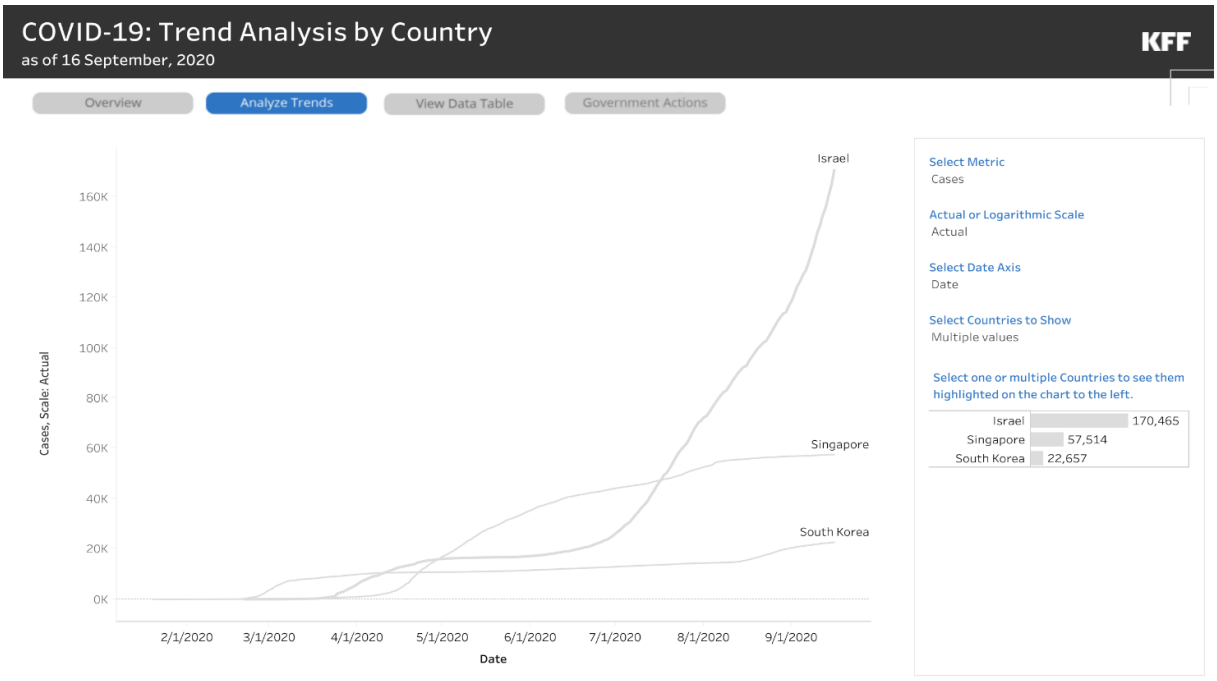
1. Implement a sustainable, long term approach to COVID-19 management
2. Increase public participation, engagement and trust
3. Integrate privacy considerations cross-board
4. End any further reliance on ISA for surveillance purposes

Actions:

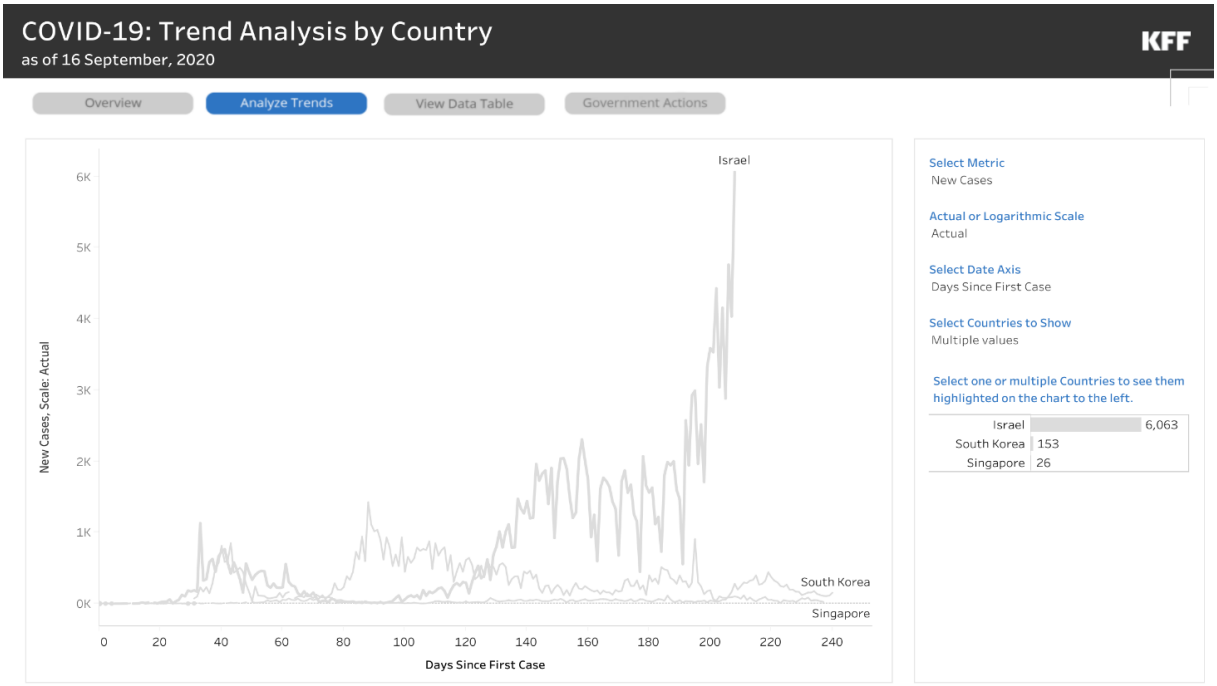
5. Create a permanent, dedicated, and competent aggregating COVID-19 command centre
6. Develop an all-in-one civilian mobile application to assist with the gradual return to everyday life
7. Incorporate culturally appropriate solutions for different groups in Israeli society

The next paper in this project will consider the optimal legal framework for contact tracing technologies. Our roundtable of experts and officials from both Israel and Asia will focus on optimal pandemic management practices.

8. APPENDIX



Source: Johns Hopkins University (JHU) Coronavirus Resource Center; last updated with data from 9/16/2020. Data prior to January 22, 2020 are from the World Health Organization's (WHO) Coronavirus disease (COVID-2019) situation reports. Notes: Cumulative case totals include both laboratory confirmed and clinically diagnosed cases; prior to February 14, 2020, totals include only laboratory confirmed cases. Japan's totals include cases that have been identified on the Diamond Princess cruise ship (except in cases that have been re-categorized by a reporting country). Totals for the United States do not include territories, which are reported separately.



Source: Johns Hopkins University (JHU) Coronavirus Resource Center; last updated with data from 9/16/2020. Data prior to January 22, 2020 are from the World Health Organization's (WHO) Coronavirus disease (COVID-2019) situation reports. Notes: Cumulative case totals include both laboratory confirmed and clinically diagnosed cases; prior to February 14, 2020, totals include only laboratory confirmed cases. Japan's totals include cases that have been identified on the Diamond Princess cruise ship (except in cases that have been re-categorized by a reporting country). Totals for the United States do not include territories, which are reported separately.

9. SOURCES

Edgar, T. H., 2017. Introduction: Making a Difference. In: *Beyond Snowden.* Washington, DC: Brookings Institution Press, pp. 4-5.

Government of the Hong Kong Special Administrative Region, 2020. *Coronavirus Disease (COVID-19) in HK.* [Online]
Available at: https://www.coronavirus.gov.hk/eng/index.html#Updates_on_COVID-19_Situation
[Accessed November 2020].

Government Technology Agency of Singapore, 2020. *BlueTrace Protocol.* [Online]
Available at: https://bluetrace.io/

Israeli Ministry of Health, 2020. *COVID-19 Database.* [Online]
Available at: https://data.gov.il/dataset/covid-19
[Accessed September 2020].

Israeli Ministry of Health, 2020. *COVID-19 In Israel: Dashboard.* [Online]
Available at: https://datadashboard.health.gov.il/COVID-19/general
[Accessed November 2020].

Israeli Ministry of Health, 2020. *HaMagen 2.0.* [Online]
Available at: https://govextra.gov.il/ministry-of-health/hamagen-app/download-en/
[Accessed September 2020].

Israeli Ministry of Health, 2020. *Privacy Policy and Information Security, HaMagen Application.* [Online]
Available at: https://govextra.gov.il/ministry-of-health/hamagen-app/magen-privacy-en/
[Accessed September 2020].

John's Hopkins University, 2020. *COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at JHU.* [Online]
Available at: https://coronavirus.jhu.edu/map.html
[Accessed November 2020].

Korean Ministry of Health and Welfare, 2020. *Coronavirus Disease-19, Republic of Korea.* [Online]
Available at: http://ncov.mohw.go.kr/en
[Accessed November 2020].

Ram, N. & Gray, D., 2020. Mass surveillance in the age of COVID-19. *Journal of Law and the Biosciences,* 7(1).

Singaporean Ministry of Health, 2020. *Updates on COVID-19.* [Online]
Available at: https://www.moh.gov.sg/covid-19
[Accessed November 2020].

Taiwan Centers for Disease Control, 2020. *Coronavirus disease 2019 (COVID-19).* [Online]
Available at: https://www.cdc.gov.tw/En
[Accessed October 2020].