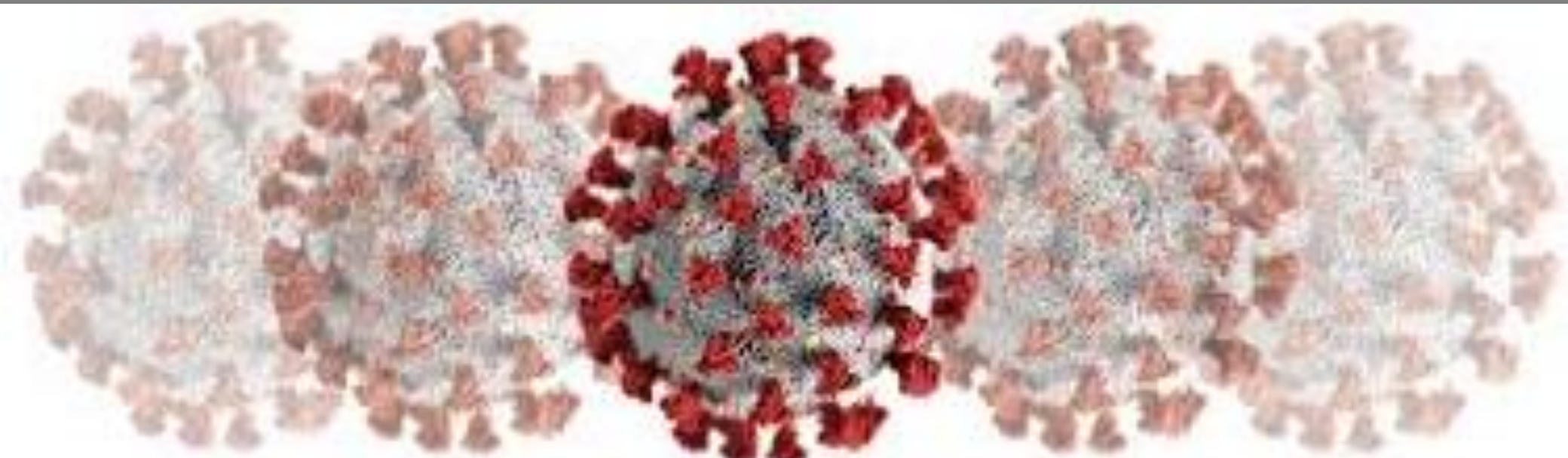
TONY BLAIR INSTITUTE FOR GLOBAL CHANGE

# COVID-19: Testing, Screening and Tracing

31 March 2020



# Screening

# Screening has four basic purposes

Screening and triage protocols and methods, from ad hoc passive screening to mass, indiscriminate testing, vary widely.

Regardless, the purpose of screening remains the same: (i) support risk communications to individuals; (ii) generate real-time data; (iii) enable acuity-based triage; and (iv) support proactive case finding and contact tracing early on.

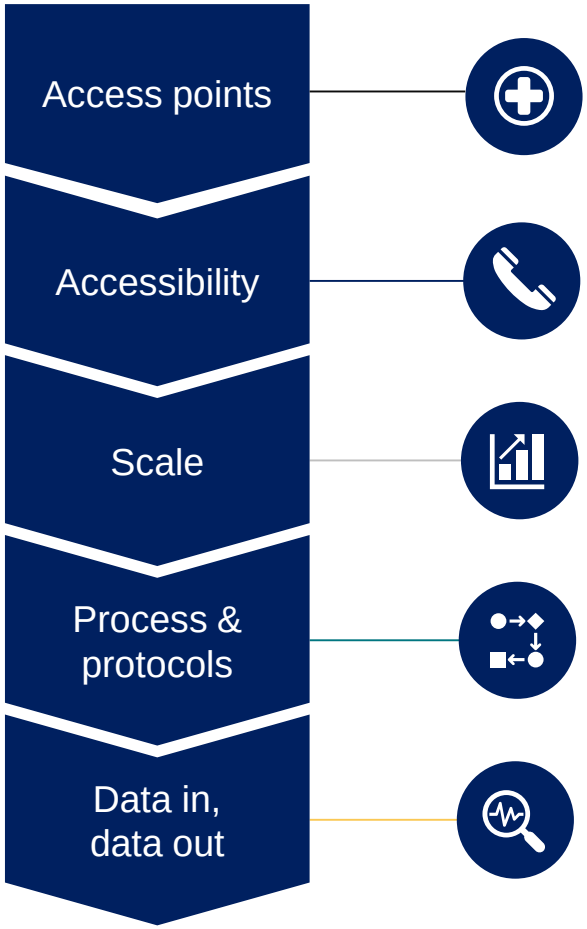
| | |
|---|---|
| **Risk Comms** | • Regardless of the method, the point of screening is an opportunity to provide risk communications.<br>• All points of access to the health system should provide risk comms to all patients.<br>• Part of wider crisis communications strategy. |
| **Real-Time Data** | • Generate real-time data from the health system, aggregating this across sites and organisations to give a comprehensive national picture. |
| **Acuity-Based Triage** | • In the early stages, allows health system to refer patients to the appropriate locations for clinical assessment and testing.<br>• In the later stages, can support referral for all suspected and confirmed Covid-19 patients, according to disease severity and acute care needs. |
| **Support Tracing** | • In the early stages of an outbreak, proactive screening facilitates active case finding, as well as contact tracing and quarantining. |

Sources: WHO, TBI TPP

# What types of screening are being used globally

| | | |
|---|---|---|
| **Telemedicine/ call-entre screening** | • Individuals call in to a helpline, with initial AI/chatbot screening before speaking to an advisor<br>**Examples:** China, UK, US | ***Pros:*** **Early-warning mechanism in a low-testing environment.** Combines tech with live advice; important source of information; potential to support acuity-based triage; can be integrated into existing points of access. Not smartphone dependent.<br>***Cons:*** AI/chatbot screening can be blunt; constrained by availability of trained call-centre staff. **Weak and/or capacity-constrained health systems will need clear case definition and referral systems.** |
| **Web/app-based screening** | • Individuals use website/app for screening<br>**Examples:** USA CDC, Iran, California, Verily | ***Pros:*** Quick to roll-out and refine; can be integrated into existing points of access; supports resource constrained environments.<br>***Cons:*** Depends on access to internet, reliable mobile networks and smartphones.CDC, Iranian & Verily services do not provide location-specific advice, and unlikely to support useful micro or macro insights. |
| **Drive-through testing** | • Individuals drive to remote testing facility, receive results within 24 hours<br>**Examples:** South Korea, Germany, UK, US | ***Pros:*** Encourages testing and triaging away from traditional health system; provides additional risk-comms opportunity; avoids close-contact queuing; supports acuity-based triage.<br>***Cons:*** Requires reliable road infrastructure, access to vehicles and sufficient testing capacity. |
| **Entry/exit screening** | • Entry and exit testing at all points of international transit<br>**Countries:** China, many others | ***Pros:*** Supports tracing in early stages; enforced quarantining overcomes limitations of testing; can help delay shift to clustering/ community transmission.<br>***Cons:*** Screening on entry/exit will miss asymptomatic cases/ individuals in incubation period. Needs to be backed by enforced quarantining. |

# Key issues in delivering a telemedicine/call-centre facility




## What are the traditional access points for your health system?

- How would a telemedicine/call-centre complement those access points?
- Do you need a centralised system, or a hub-and-spoke model?
- What comms channels are available to advertise the hotline?

## What % of population will be able to use a call centre?

- What is mobile penetration? What type and quality of mobile service is available?
- How does this overlay with demographics/location of Covid-19-vulnerable groups?
- What options are available to overcome language or literacy barriers?
- Can local agents with tablets/smartphones complement a call-centre?

## What resources are needed to scale telemedicine/call-centre services?

- What systems, protocols, equipment, people and training do you need to deliver a service at scale? How quickly can you access and deploy those resources?

## How will the service process individuals?

Weak or capacity-constrained health systems will need clear case definition, referral systems.

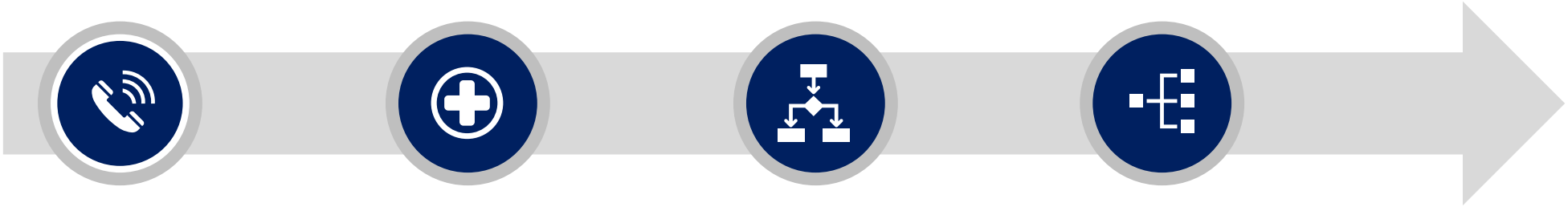
- Will the service be live (synchronous) or asynchronous (a doctor follows up later)?
- Can tech (e.g. AI/chatbots or geolocation) enhance data gathering/speed up screening?
- How quickly will individual calls be handled? How will follow-up advice and monitoring be managed?

## How prepared is the service to manage information?

- Can it sufficiently distinguish between Covid-19 and other respiratory illnesses?
- Can it capture and aggregate individual specific data (e.g. age, location, underlying health issues, Covid-19 related symptoms) to support reporting and decision-making?
- Can it refer individuals for specific treatment or actions based on their location and need?
- Can it provide individuals and/or communities with real-time information on potential infection hotspots?

# Sierra Leone: 117 Ebola Hotline (now in use for Covid-19)

*TBI directly supported the development of the 117 call centre in 2014*



**117 Call Centre Operations**

**Response Operations**

## Engage[1]

Individual calls 117 Hotline and operator logs information received.

## Review

Call-centre software reviews case, alerts Dispatch Team

## Refer

Dispatch Team sends cases to districts:

Alerts relating to Freetown automatically show at Freetown Command Centre; those for the provinces sent to the Alert Centre in the reported location.

## Response

Command Centre/Alert Centre filter responses as follows:

1. Reported suspect/prospective quarantine calls to the surveillance team.
2. Reported security threats to Office of National Security.
3. Reported death calls to Burial Team.

117 Call Centre conducts randomised call-backs to confirm effectiveness of the response.

[1] **Note:** Current technology should enable geolocation of each and every caller, developing a heat map to direct limited surveillance and testing capabilities.

# China: Telemedicine website

| Engage | Review | Refer | Test | Results | Triage |
|---|---|---|---|---|---|
| Patient describes their symptoms on a website or app. | Nurse decides if a test is needed.<br><br>Individual data is aggregated. | Patient is referred to one of dozens of “fever clinics” set up far from other patients and health-care systems. | Medical personnel in full-body PPE check patient, administer rapid testing. | Results of Covid-19 test delivered within four hours. | Patients are triaged based on severity of illness/need of the patient. |

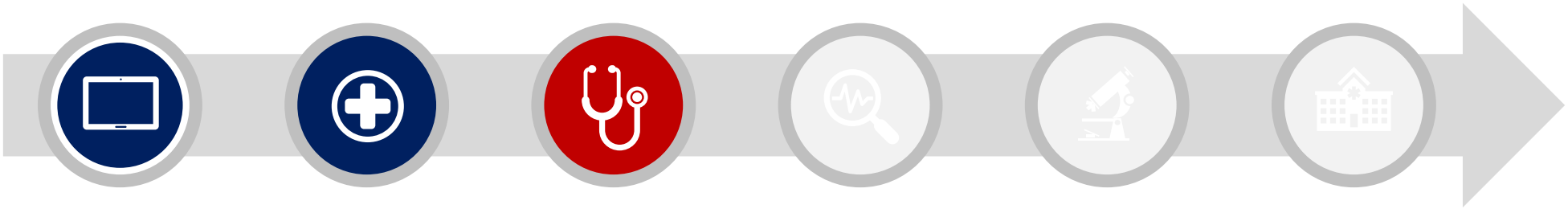
# UK: NHS 111

| Engage | Review | Refer | Test | Results | Triage |
|---|---|---|---|---|---|
| Patient calls NHS111 to report potential symptoms.<br><br>(NHS111 is a pre-existing, non-emergency telemedicine service.) | Nurse decides if a follow-up call is needed. | Patients are rarely referred on for testing, even if they are returning from high-risk areas or in vulnerable groups. | Testing is only done on very rare occasions, primarily on those presenting at hospitals. | Results of Covid-19 test delivered ASAP. | Patients are triaged based on severity of illness/need of the patient. |

# US: 98point6 and Bright.MD

| Engage | Review | Refer | Test | Results | Triage |
|---|---|---|---|---|---|
| Individual calls 117 Hotline and operator logs information received. | Call-centre software | Patient is referred to their hospital or is scheduled for a follow-up call with a doctor. | Testingis administered at hospital or remote facility, depending on patient's location. | Results of Covid-19 test delivered within 24 hours. | Patients are triaged based on severity of illness, need of the patient. |

# US & Iran: CDC “CV Self-Checker” & Iran “CV Screening”



**Engage**

New web-based services ask individuals to input information on age, symptoms and, for the CDC, US state.

**Review**

AI/chatbot reviews information.

**Refer**

Vulnerable individuals referred to local A&E.

**Notes**

These new government-designed services have low take-up as they are not adequately advertised.

In addition, they are not linked to local health-system protocols on testing and triaging patients.

Referring high-risk, vulnerable patients to the A&E (like the CDC chatbot does), will strain local services, putting the individual and others at greater risk.

# Testing

# **Importance of testing:** Testing enables containment and informs broader policy decisions

## Benefits of testing

**Enables prevention**

- Triggers tracing and other measures
- Provides early warning to health system

**Lets people work**

- Lets key workers stay in work (if they test negative)
- Lets others go back to work (if they previously had the virus)

**Limits disruption**

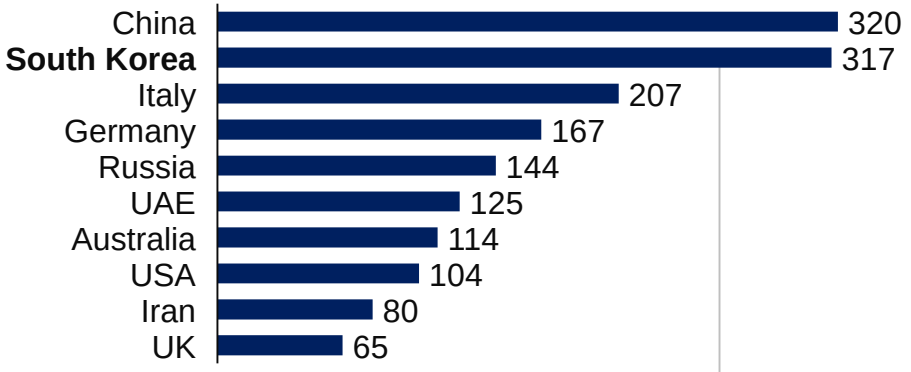
- Informs large-scale policies such as curfews and school closures

**Limitations**

- Current tests are costly – may have to be initially limited to economic hubs – but cost/complexity is likely to reduce over next 8-16 weeks

## Global success in testing

*Tests carried out (thousands) as of 20 March 2020*




- **South Korea's aggressive testing programme has been credited with containing the disease**
- It can test 140,000 samples a week
- "Drive-through" tests, in which patients give samples without leaving their cars, are convenient and clean
- The number of new cases per day has declined from a peak of 900 to just 76

**WHO Director General Tedros Adhanom Ghebreyesus said:**
**"We have a simple message for all countries: test, test, test."**

# **How testing works:** The most commonly used test is accurate but cumbersome; a new test is faster

**There are currently two types of test;** a new antibodies test is less cumbersome than the widely used PCR test.

| | PCR (polymerase chain reaction) test | Antibodies test |
|---|---|---|
| **Aim** | Detect (current) presence of the virus | Detect if patient has had virus and may be immune |
| **Method** | Searches for the DNA of the virus through ribonucleic acid (RNA) from nose or throat swabs | Searches for antibodies (defensive agents produced by the body) in blood samples, which are inserted into a simple “cassette” for testing |
| **Facilities** | Administered by a medical practitioner and analysed in a lab | Administered by a medical practitioner with results given instantly |
| **Availability** | Now – widely available via major companies such as Thermofisher | Within weeks – some are already commercially available but have not yet been approved by health bodies |
| **Pros** | Accurate (if sample taken correctly) | Fast (10 mins) |
| **Cons** | Slow (theoretically within 5 hours but most health systems take c. 24 hours) | Inaccurate in early stages of infection (before the body has produced antibodies) |

# **Recent developments:** innovative solutions are being developed, but are not yet ready and may be hard to scale

### UK-Senegal partnership trial 10-minute coronavirus test

- $1 cost is a potential life-saver
- Partnership between diaTropix and UK firm; earliest test will be available is likely June 2020
- If successful, over 500k kits could be produced a month

### UK Laboratory claims its finger-prick test works in 15 minutes

- Device will cost £125 ($150) and can be done at home in just 15 minutes. No external trials have taken place yet
- Targeted at large Fortune 500 companies who want to screen their employees

### US testing hampered by poor planning

- US started to develop its own test, rather than using the WHO test
- South Korea for example commissioned four factories to produce kits and have tested nearly 400k people

# Case study on testing: India

## Current situation

**Current state in India**

- India has reported close to 700 cases (as of March 27th) with a death toll of 16 thus far.
- However as of March 22nd, **only 17,000 people had been tested** (equivalent to the number of tests South Korea can run in one day).

**Why they have such low testing capacity**

- **Until last week, testing was conducted only by government laboratories.**
- India is home to companies (e.g. Trivitron Healthcare) that have cumulatively produced over 100k test kits – **but have been shipping them to China** over past few months since local use was not approved.

**What is happening now**

- **Government gave approval last-week for private laboratories** to test for COVID
- Country has moved quickly to fast-track approval of kits – **18 kits (both locally manufactured and imported) are currently approved for use.**

## Important to note

- The regulatory environment is critical, ranging from which labs are allowed to conduct tests to import and (at times) export restrictions.
- Building alliances with other countries' regulatory bodies to understand what they have certified vs. not (and potentially adopting their standards) could save time/money.
- Given global shortage of kits, large-scale manufacturing powerhouses (e.g. India) aren't likely to be able to export kits until their domestic demand is fulfilled.

# **Testing:** Identifying who to test first will depend on availability of resources relative to degree of potential spread

## Constraints to testing

**Availability of test kits**

**Government (and private-sector) lab capacity and reagents availability**

**Technical personnel (skills and numbers)**

**Transport links to/from point of testing to labs**

## Who to test

**Availability of financial and health-system resources**

**Degree of spread relative to testing-related resources**

- Large segments of the population
- Specific groups that have high macro risk factors (e.g. travellers)
- High-risk contacts linked to people who likely have the virus
- Heavily-symptomatic cases or those in close contact with confirmed cases
- Severely symptomatic cases

## Approximate examples

- **UK:** Government actively moving towards testing large segments of population; health workers will be prioritised
- **Ghana:** Tested 1,030 travellers who came from planes and into quarantine (and 78 tested positive)
- **Rwanda:** Conducted large-scale testing (over 500 tests before identifying first case)
- **Vietnam:** Aggressive and early testing (30,000 tests – less than 200 cases confirmed) due to robust government response early on to test travellers and anyone they came into contact with
- **Malaysia:** Relative availability of test kits allowed for slightly expanded test-basis beyond those with only severe symptoms
- **US:** Used to be situation there until testing availability started to ramp up

# **Cost of Covid-19 testing:** There is currently a large variance of cost, but price is likely to converge on lower end

## Current approximate cost benchmarks


**$1** — Unregulated rapid tests (antibody tests), not commercially available *

**$5** — Regulated rapid testing (e.g. prototype from Brunel University, London)

**$15** — Mylabs India test

**$40** — PCR lab-test cost in the United States

**$60** — What private clinics are charging in India currently to run test

Same price being charged by Health Minister in Egypt to run test

Note : All data provided here is meant to provide a **broad overview** of indicative prices, not to serve as a reference for any purchasing decisions or benchmarking. Prices and reliability of tests (as well as accuracy and other technical specifications) are highly subjective and fluctuating on an **hourly basis.**

## Likely cost implications

- **It is likely that the cost for testing will fall quickly.**
- The UK is already exploring providing up to 3.5 MM residents with at-home finger-prick testing kits (potentially government funded, shipping in early April) after the govt. recently made a bulk order
- The global cost will likely start to converge on the lower end of the scale (particularly for rapid-testing with lower accuracies) that can be deployed for large populations

* Does not include cost to admister test and send to lab for results – just cost of kit

# **Case study:** Procurement of critical medical products and test kits are increasingly challenging; Chinese authorities struggle to police supply

**China is a key player in medical manufacturing…**

**China is a leading manufacturer** across global supply chains **and key supplier for the medical industry** (e.g. China accounts for ~50% of protective mask production)

- **Demand for medical products has exponentially increased** given Covid-19 pandemic (e.g. China produces +200 Mn. face masks a day - 20x the amount it made in February)
- Chinese **companies have since reoriented production lines** to manufacture highly demanded medical products to fight Covid-19 (e.g. protective masks, testing kits, medical equipment)

**…facing capacity and regulatory challenges…**

**Balancing production flow versus quality assurance is a critical challenge** for Chinese authorities as the private sector scales production and new entrants emerge to meet demand; **three main approaches adopted**:

- **Enhance compliance to mitigate defective and uncertified products** reaching markets (e.g. joint efforts by regulators and police resulted in thousands of counterfeit operations being halted across the country)
- **Streamline certification policies** to minimise bottlenecks, clarify standards and increase capacity of market-ready devices and products
- **Prioritise and fast-track regulatory approvals** for companies producing prevention products (e.g. Chinese start-up "YouIbot" developed a robot that sanitises surfaces and scans people for symptoms)

**…leading to testing constraints and faulty roll-outs**

**Production crunches, surging demand and lack of robust quality assurance have led to failed roll-outs of population testing** by governments worldwide:

- **China-Spain dispute:** Chinese company Shenzhen Bioeasy Biotechnology exported 50k+ faulty test kits (~30% accuracy) to Spain leading to a dispute between parties; China since agreed to replace test kits however has come under enhanced international scrutiny due to their role as a major global supplier
- **Netherlands, Turkey recall:** Dutch Health Ministry recalled 600k masks shipped from China on March 21 after they were found to be defective; Turkey rejected shipments due to substandard test margins of error

Source: Financial Times, New York Times, TBI analysis

# Four-step process to think about approach to testing

## Organise

**Objective**: Make the interaction with testing providers as simple as possible;

- Create a single, central organising body and single interface for suppliers with government buyers and regulator
- If possible, underwrite and guarantee cashflow for companies involved in the testing supply-chain procurement within your country

## Regulate

**Objective**: Remove barriers and time constraints of regulation

- Speed up regulation
  - Create a new fast-track regulation specifically for antibody testing
  - Relax regulations and testing where necessary
- Relax/remove testing requirements
  - For example, explore using testing facilities at pharmaceutical companies

## Manufacture/Secure

**Objective**: Ensure production or import capacity for the number of test kits you might need:

- If relevant for your country, identify 3D-printing capability for protypes or urgent need (e,g. for medical suppliers)
- Identify “clean room” spaces for manufacturing, e.g. with plastic suppliers or other industries

## Distribute

**Objective**: Ensure that the right places in the country/city are getting the kits:

- Make information about which tests are available where accessible online, complemented by government communications
- Potentially look at WHO’s recommended FFX protocol to triage patients
- Ensure full traceability, including oversight by qualified persons on where the test-kits are

# FAQs

## How many test kits are available in Africa today?

- Aside from Jack Ma's 20k donation (per country) that have arrived in Addis and is making its way to each country, many countries have limited or no availability beyond this. Africa's Centre for Disease Control and Prevention is in the process of distributing 200k test kits across the continent.

## How many test kits do I need?

- Modelling is still underway in several countries (primarily based on Imperial College in UK's baseline model) to determine what is ideal number of test-kits required depending on scenario. Results will likely be available sometime in April and can help in demand-forecasting.

## When should we expect more test kits to become available/in greater numbers?

- Considering the global shortage of kits (majority are produced in South Asia, Europe and US), it is unlikely there will be a huge surge of kits available (regardless of financing) in the next few weeks weeks in Africa.
- It could very likely take months before there are sufficient kits being produced globally to cater for significant testing demand.

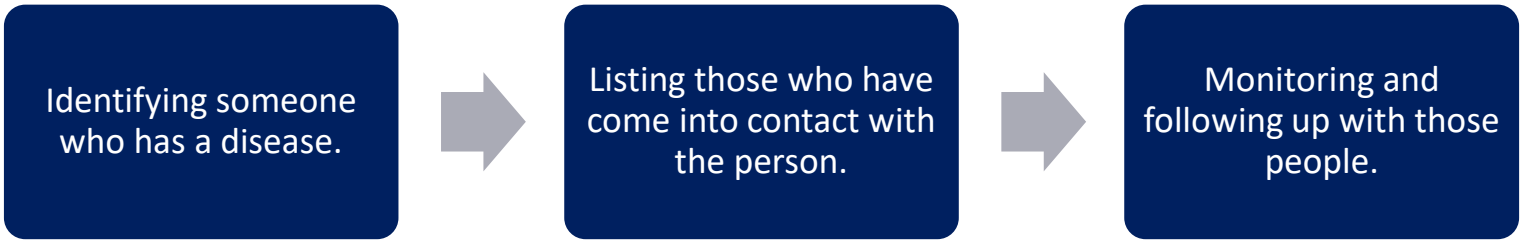
## As a government, how do I go about securing more test kits so the country is ready?

- There is a list of available kit manufacturers globally available here: https://www.finddx.org/covid-19/pipeline/
- However, as of now there is no comprehensive information available on global demand versus supply of kits given the scale and speed of innovation happening.
- Given the above, the focus should be on the rapid stand up of screening facilities (typically via call-centres) to help detect if there are clusters/communities where the virus might be spreading. Any testing that can be done should be targeted to these identified sub-groups/population.

# Tracing

# What is contact tracing?

- **Contact tracing** is a monitoring process that is central to fighting infectious disease outbreaks. The World Health Organisation breaks it down into three basic steps:

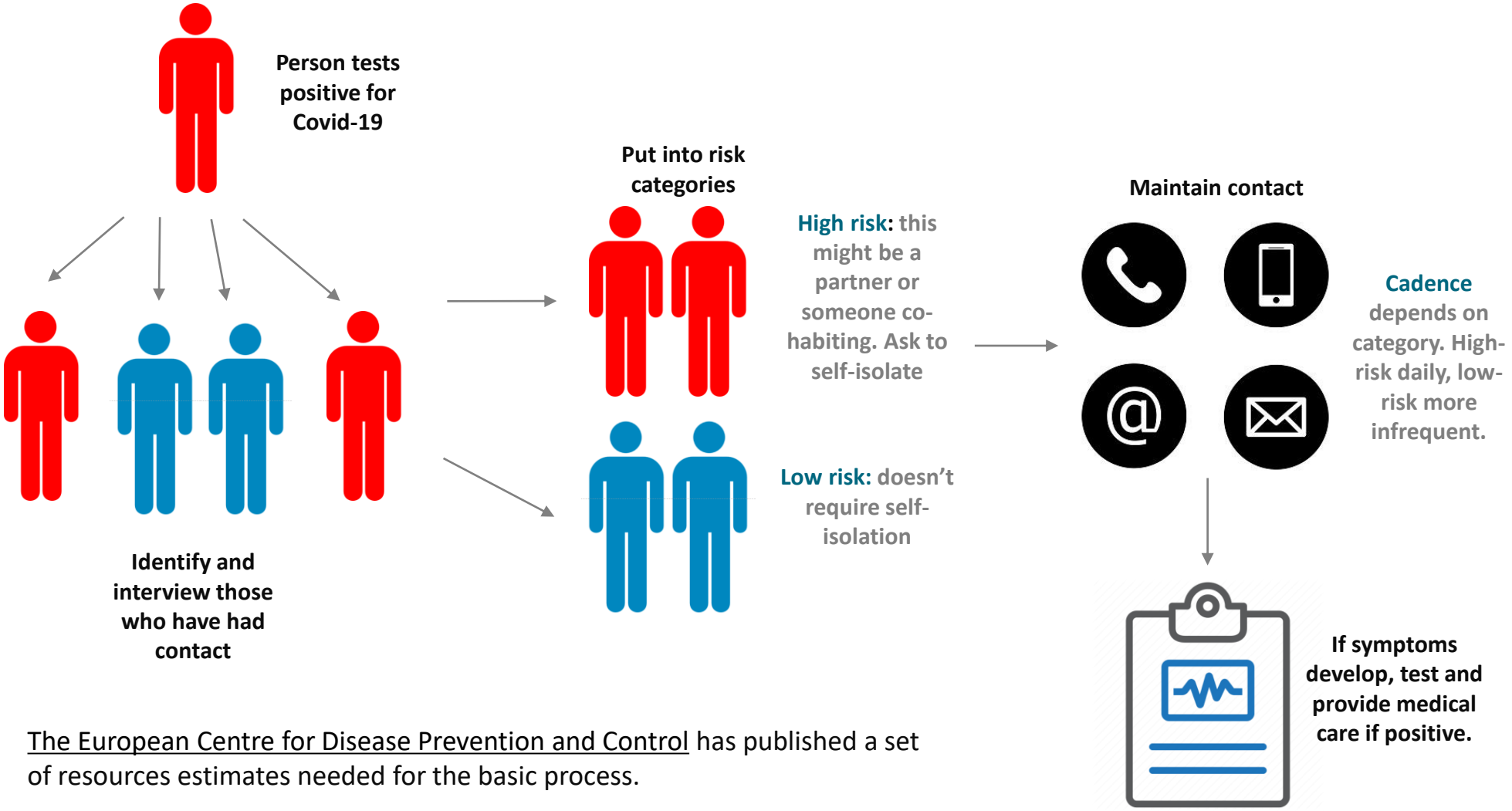



- Over the last couple of decades it has been used during the **SARS coronavirus (SARS-CoV), MERS coronavirus (MERS-CoV) and Ebola outbreaks.** The speed at which it is deployed is critical, as those who may have come into contact with initial cases can be quarantined to prevent further transmission. The asymptomatic early phase of Covid-19 makes this particularly important.

- A recent study from the London School of Hygiene & Tropical Medicine estimates that, along with case isolation measures, i.e. the separation of symptomatic contacts from other people, contact tracing should be "enough to control a new outbreak of Covid-19 within 3 months."

- To date, China has tested millions of people and traced more than 685,000 contacts.

# Contact-tracing process




The European Centre for Disease Prevention and Control has published a set of resources estimates needed for the basic process.

# **Contact tracing:** In the case of rapidly escalating community transmission, priorities need to be set

## Degree of community transmission relative to resources


**Phase 1 : Active contact tracing**

- Limited affected population and or very low infection rate
- Government can (and should) invest in active contact tracing and testing (depending on resource availability)

**Phase 2: Only for people under investigation**

- Shift focus of tracing to only people under investigation (e.g. see FFX protocol in Appendix)

**Phase 3: High-risk people under investigation**

- Focus only on high-risk patients who have increased likelihood of being severely affected by disease and/or higher risk of spreading to others

**Phase 4: Confirmed cases with high-risk factors for spread/negative outcome**

- In constrained environment where large numbers of people are affected (or limited resources), limit tracing to only confirmed cases that have high-risk factors

## Key takeaways

- The **resources (both testing kits and technology/capacity to trace) matter greatly in setting the strategy** of whom exactly to follow and trace.
- **Training for health-care workers needs to be comprehensive** and clear; **how they should adjust their definitions of whom to spend time/energy** on especially if community transmission is increasing at a rapid rate.

# Technological solutions exist and countries have taken extensive measures

**South Korea**

- Extensive tracing of infected individuals via GPS, credit-card transactions and apps.
- Corona 100m app uses government data and alerts users when they come within 100m of a location visited by an infected person.
- Coronamap site shows travel histories of confirmed patients.

**Taiwan**

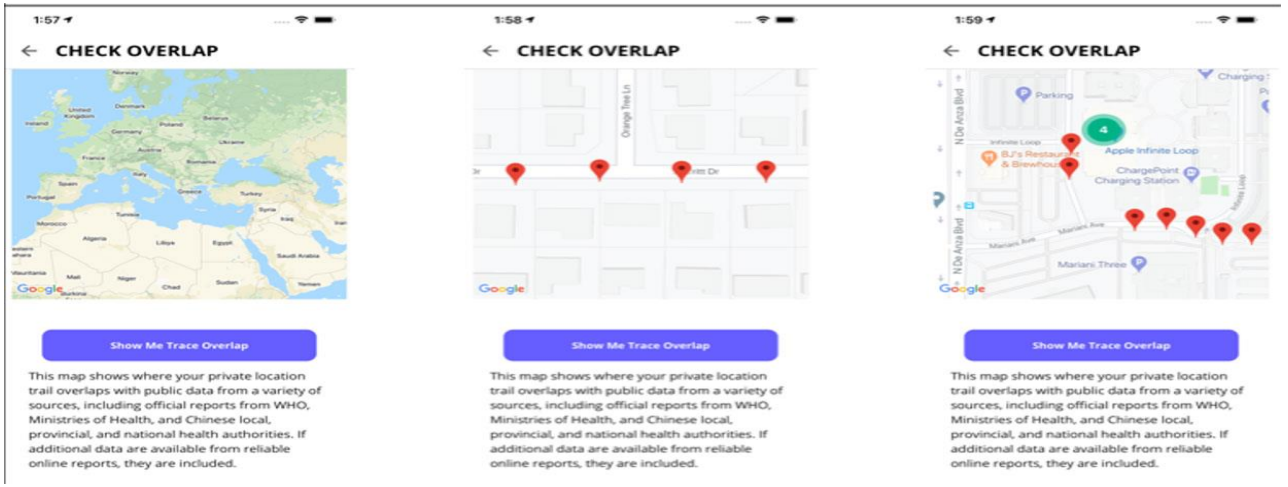
- Phone-tracking system known as the “electric fence” uses phone signals to identify locations.
- An alert is sent to the authorities if the handset is turned off for more than 15 minutes.
- More than 6,000 people under home quarantine are tracked this way.

**Singapore**

- Developed the TraceTogether app, which uses Bluetooth to track and notify people who have come into contact with those infected.
- More than 620,000 people have downloaded it; the only data stored is a mobile number and a random anonymised user ID.
- Government has made the software open source.

# Other countries exploring a variety of options

- UK: NHSX is developing a contact-tracing app.
- US: White House has been in conversation with Google, Facebook and others about sharing anonymised location data.
- Italy: Government is working with Facebook and telcos to use anonymous data sets aggregating users' movement to help with contact tracing. Belgium, Austria and Germany also doing similar.
- Sierra Leone: Country is working on a partnership with Dimagi on a contact-tracing app. Dimagi has developed a platform that enables tracing via SMS and possibly WhatsApp. This is also being explored in Rwanda.
- MIT developers have also developed Private Kit: Safe Paths, which stores up to 28 days of a user's GPS location data and if they test positive for the virus, allows them to share it with health officials.




https://www.washingtonpost.com/technology/2020/03/17/white-house-location-data-coronavirus/

# Considerations for government

- **Form of intervention**: There are both non-technical and technical solutions, and interventions are likely to require a combination. The traditional method, adopted during Ebola, was primarily person-based interviews, although phone, SMS and WhatsApp-based services can be deployed where technological capacity is low.

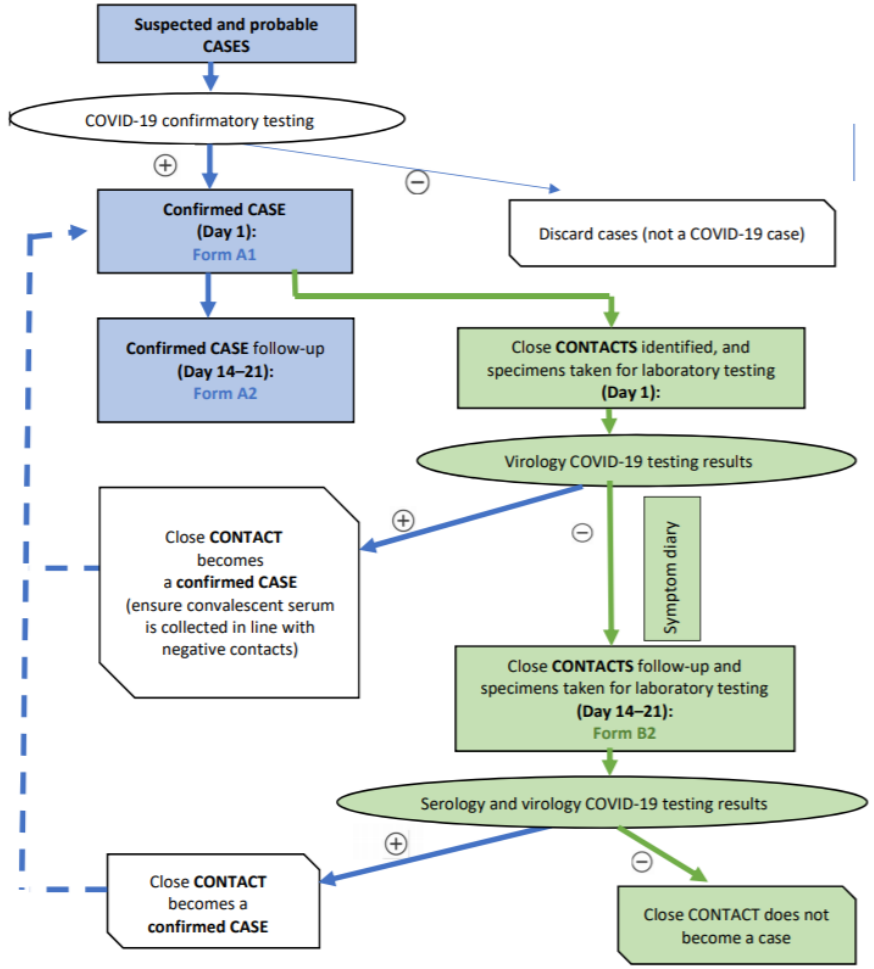
- **Resource requirements**: Traditional and technological solutions both have significant resource requirements. The former most predominantly in human capital, the latter more in digital infrastructure, although open source and market-based solutions exist.

- **Trade-offs and risks**: Privacy and consent have been primary questions within many countries, with highly intrusive interventions, which identify individuals, creating an atmosphere of fear. Access and inclusion, as well as security concerns around hacking, fraud and misinformation, have all been present on systems that have been rolled out to date.

# Appendix

# FFX Protocol for testing: WHO recommended

**Fig. 2. Case investigation algorithm and summary of data-collection tools**

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