ONLINE GLOBAL CONSULTATION ON CONTACT TRACING FOR COVID-19

9-11 June 2020

World Health Organization

GOARN
Global Outbreak Alert and Response Network

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List of acronyms and abbreviations

AFENE	African Field Epidemiology Network
ECDC	European Centre for Disease Prevention and Control
FAQ	frequently asked questions
FETP	field epidemiology training programme
GOARN	Global Outbreak Alert and Response Network
GPS	global positioning system
IHR	International Health Regulations
MSF	Médecins Sans Frontières
PAHO	Pan American Health Organization
PCR	polymerase chain reaction
SaVES	Surveillance and Vaccination Electronic System
SORMAS	Surveillance, Outbreak Response Management and Analysis System
TCN	temporary contact number
WHO	World Health Organization

Note to the reader

This report condenses discussions according to the subjects addressed, rather than attempting to provide a chronological summary. Summaries of discussions and group work address the themes emerging from wide-ranging discussions among all speakers, and do not necessarily imply consensus.

Summaries of presentations and of points made in discussion are presented as the opinions expressed; no judgement is implied as to their veracity or otherwise.

Executive summary

Contact tracing is an essential part of the response to the COVID-19 pandemic, and should be a central component of all national COVID-19 control strategies. It slows transmission of the virus by breaking chains of human-to-human transmission, helping to get the number of new cases generated by each confirmed case to less than one and keeping it there.

Historically, however, contact tracing has suffered from a lack of a real "home" in public health. It relies on the work of professionals and citizens from diverse backgrounds, including public health and laboratory staff, digital experts, anthropologists, community leaders and community health workers. With its components dissipated across so many disciplines, in times outside crisis when teams are stood down it can be hard to give it the necessary importance in outbreak preparedness.

COVID-19 has heavily emphasized how contact tracing is crucial for managing outbreaks, and as part of the strategy for adjusting, and eventually lifting, lockdowns and other stringent public health and social measures. As the pandemic develops further, it will be a core measure to manage further waves of infection.

Expanding and improving capacity for contact tracing encompasses many elements, all of which must be appropriately adapted for COVID-19. These include, but are not limited to, planning for implementation, scale-up and sustainability at national and subnational levels; training; risk communication and community engagement; information management in real time; assessing and implementing new tools and approaches; extended analysis of contact tracing indicators (outcomes and processes) and chains of transmission; and monitoring and evaluation.

To address this, in early June 2020 the World Health Organization (WHO) convened an online global consultation on contact tracing in the context of COVID-19, looking at the lessons of the pandemic to date; known and emerging best practices; and the measures necessary for urgent implementation, scale-up, maintenance and enhancement of contact tracing activities. Its stated objectives were to identify practical opportunities for stakeholders and partners to build and improve capacity and capability; to provide support and advice for countries on strengthening contact tracing; to review the operational experiences of selected countries and partners, identifying successes, challenges, and needs; to review relevant recent developments in digital technology; and to strengthen and facilitate coordination, collaboration and networking between partners and stakeholders.

Some clear themes emerged.

Establishing definitions and guidelines is essential: not all of the central concepts of contact tracing are universally understood. There remains a need for cohesive definitions and categorizations of cases, contacts and risks across countries so that the science of effective tracing can be better understood and the lessons more readily shared. Historically, there has not been a great deal of evidence-based research in this area of work compared to other public health interventions. Authoritative, well maintained and regularly updated guidelines are needed, not least in order to clarify contact tracing in a way that helps ensure compliance among the public. The Global Outbreak Alert and Response Network (GOARN) knowledge hub was identified as a useful resource for sharing existing guidance and collaboration.

Because epidemics and pandemics are unpredictable in nature, scaling and training the contact tracing workforce can be challenging, particularly in places where resources are limited. A lack of prior knowledge of the scope of and requirements for contact tracing hampers preparation, but workforce calculations can be helped by contextualizing and applying the definitions and guidelines mentioned earlier to define

and clarify the required skills and competencies, and by using existing tools such as the Excel-based health workforce estimator currently available from WHO[1]. Workforces can be reorganized and adapted by training and redeploying students, volunteers, nurses, other public servants and even military personnel. Even during a pandemic that limits social contact, training can be carried out through online courses using technology, then made more robust in deployment by employing measures such as "buddy systems" to smooth the transition of new trainees into the field. Longer term capacity can be built through field epidemiology training programmes (FETPs) and certification. Given the nature and sensitivity of the job, psychological preparation and support and cultural competency are essential elements of training.

The difficulties of contact tracing operations are increased by a range of social factors, many of which are further intensified in lockdown situations, including the stigma of infection; food insecurity; the risk of domestic and gender-based violence; geographical barriers and the remoteness of some communities; the specific vulnerabilities of certain populations; and the effects of all of these on compliance with public health measures. These issues can be worsened by problems of trust: in many places, tracers who are not from the communities in which they are working are not trusted, meaning that outbreaks can impose a sudden and urgent need for contact tracing capacity right down to community level. Training plans should take this into account, and recognise the ability to work and engage with communities is a vital part of any response. Successful examples around the world have achieved this by cooperating with community leaders, adapting traditional methods of organizing community action, and focusing active contact tracing on transmission hotspots and vulnerable communities. When people need to be isolated, establishing systems to assist the most vulnerable populations – for example, providing food, shelter and facilities for self-isolation, and targeted support such as substance abuse counselling – is essential to make sure that isolation is successful. Selecting and implementing such measures again requires cultural competency in the contact tracing workforce.

Technology offers a number of ways to potentially improve and scale up contact tracing, mainly by facilitating data collection and accelerating data analysis for decision-making. But new approaches also raise new challenges, including data privacy and security issues, and the need for very high adoption rates to make certain proximity apps effective and reduce the risk of imprecision (false positives). New technology needs to be integrated into the public health information system to maximize effectiveness, and the use of technology for contact tracing raises issues of ethical and cultural sensitivity – for example, the choice between mandatory and voluntary registration to use proximity apps. With all these factors in play, the contact tracing workforce must be appropriately trained for the deployment of new technologies to be effective, imposing further burdens on resources. To mitigate these risks, new technology can be used to enhance rather than replace traditional, manual contact tracing approaches.

Across all of these themes, the key messages that emerged from the meeting were as follows:

- It is possible in many contexts to mobilize an expanded, scalable workforce, if the effort is coupled with a strong training package, and leveraging of existing FETP networks where necessary.
- The implementation parameters for contact tracing should always be adapted to local settings and the evolution of the outbreak.
- Contact tracing suppresses transmission even when as few as 40% of contacts are followed up. It is not always necessary to identify and trace 100% of cases and 100% of contacts.
- Implementing contact tracing requires considerable community engagement, including having members of the community as part of the contact tracing teams.
- Contact tracing should continue even when transmission is widespread, but it can be prioritized for high-risk, vulnerable populations.

[1] Available, along with other resources, at https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/covid-19-critical-items

- Effective contact tracing includes providing families and other vulnerable individuals in quarantine or self-isolation with support packages adapted to local and individual needs.
- Digital tools, including proximity apps for contact tracing, cannot replace a trained workforce, but they might be able to augment some traditional contact tracing steps. Even those contact tracing programmes that have introduced digital apps rely mainly on a trained workforce, human interactions, and traditional data management approaches.
- Detailed evaluations of digital tools, including proximity apps, are needed in order to provide robust evidence of how effective they are.

A number of further areas were identified as important but not fully discussed in the meeting. These included best practices for managing contact tracing operations; how to implement contact tracing for international travellers; the interoperability of digital tools for sharing information between countries; operational and analytical opportunities offered by real-time contact tracing; and prioritizing work in settings where contact tracing really is not feasible (whether for a lack of testing capacity, the impossibility of isolating people, or other reasons).

The next steps following this meeting may include some or all of the following:

- **developing** a frequently asked questions (FAQ) resource for discrete questions;
- **enhancing** the GOARN knowledge platform;
- **establishing** evaluations of digital tools, both for their intrinsic effectiveness and for their use in the context of contact tracing as a public health measure;
- **providing** continuous updates on contact tracing to WHO Member States;
- **conducting** a global questionnaire to improve understanding of country activities;
- **convening** weekly meetings on contact tracing;
- **convening** a follow-up consultation in three months;
- **convening** a round-table meeting of donors;
- **holding** regular webinars on contact tracing to address those gaps that have been identified.

Day 1 introduction

***Michael Ryan**, Executive Director, WHO Health Emergencies Programme*

The extent and quality of contact tracing remains a major pillar of control for COVID-19. To a greater or lesser extent, all countries responding to COVID-19 have gaps in public health workforce, policy, strategy, funding or commitment to this essential function. The role of this consultation is therefore to rearticulate what contact tracing means in the context of COVID-19 – what is unique and important in its role in suppressing and containing this disease – and to identify, for the benefit of policy-makers, what investments are needed in processes, legal frameworks and workforces to make it more effective. We need improved advocacy for contact tracing and surveillance as core parts of COVID-19 control, and clear strategies for building the right skills and ensuring their sustainability – supported by the right training approaches, modules, and political, social and technical environments.

The public health world has an additional duty to explain to wider communities what this means and encourage acceptance. Community engagement strategies, digital tools and other technical approaches have important roles in supporting this. But while technology can undoubtedly strengthen COVID-19 control, the overarching task is to redefine, reimagine and relaunch contact tracing as a central pillar of the response, not least to help avoid further massive lockdowns in future, and to build a future in which strong, sustained public health action suppresses the disease to a point where societies can live with it, even if they cannot eliminate it.

There is an emerging body of evidence that strong, public health-driven case identification and tracing has been a significant contributor to controlling COVID-19 in many countries: this consultation must distil the learning to date and start the process of defining the lessons, guidelines and training methods we need to create that future.

Keynote presentation: contact tracing for COVID-19

***Tom Frieden**, Resolve to Save Lives*

COVID-19 is here to stay, and has changed two important things in the world of public health: on one hand, we now have to be smarter and safer, re-engineering our processes for the age of COVID-19 in order to prevent spread and drive cases down to lower levels; on the other, we have to box the virus in with strengthened core public health services. Those countries where the COVID-19 response has been guided by and fully supported public health have done better, experiencing lower levels of disease, death and economic damage.

There are four components to the boxing-in process: (a) testing widely and strategically, targeting the right people, not just many people; (b) isolating the infected rapidly; (c) finding everyone who has been in contact with infected patients; and (d) quarantining contacts for 14 days in a supportive environment. There are also four steps to the contact tracing process: initial notification; interviewing patients; locating and warning exposed contacts; and quarantining and monitoring them.

These tasks raise a range of questions and challenges. It is necessary to build a corps of capable contact tracers, but the job is difficult and specialized, requiring people skills, detective skills and counselling skills. Reporting and privacy concerns must be acknowledged and allayed; voluntary isolation and quarantine must be provided for and supported; and strategies must be in place for mandatory quarantine or isolation where required, and, possibly, for coping with infectious cases who refuse to isolate. Behind all of these lies the question of resources: what is available and what is required, including for people who, while they might not require hospitalization, still need support. Core needs might include such measures as daily check-in phone calls; instructions on how to keep shared spaces clean; hotlines for counselling, information, social services and medical support; waste removal; and access to telehealth and care.

Best practices from around the world suggest that incentives and care packages are crucial to managing isolation and quarantine. Such packages can include basic medical and protective resources such as masks, thermometers, hand sanitizers and cleansers, and health education materials; food, laundry and pharmaceutical services; and passwords for on-demand movies, e-books and learning channels, with access to high-speed internet and the devices needed to access it. Financial support can also be crucial, including government stipends for those without sick leave or who need to take care of dependents, and support provided jointly with employers

In this context, Dr Frieden argued that proximity tracing is a distraction: an unproven technology-driven concept that has not been shown to work as hoped anywhere in the world, despite media reports to the contrary. Its feasibility is questionable, it requires very high uptake levels, and the proportions of false negatives and positives are still not known. Worse, it has the potential to undermine trust in and focus on traditional, proven contact tracing techniques. While some geolocating technology may have a useful role to play – for example, providing notifications of location exposures, or using digital diaries to track movement – it will never be possible to replace contact tracing with an app. Digital technology can, however, support workflows and increase efficiency in a number of ways – perhaps most importantly, helping case investigators find cases, sharing names and location information to assist tracers, and connecting those in isolation with support and supplies (and entertainment and learning resources to incentivize them to stay isolated).

The key lessons of contact tracing experiences to date are as follows: contact tracing is essentially the process of supporting patients and warning people who have been exposed, and, as such, it only works as part of a strategy that includes strategic testing and effective, supportive isolation of cases and quarantine of contacts. Success hinges on public participation and support. It is a labour- and time-intensive skill that requires training and expertise. It requires access to resources to help find and support index cases and their contacts. Given all of these complexities, it also requires supportive, expert supervision. Finally, new and emerging technologies can support but not replace traditional contact tracing.

Important ways forward include identifying and responding to the key epidemiological questions that can be answered by contact tracing; sharing the epidemiological insights from the contact tracing process; and identifying and validating key indicators that can improve that process. In all these things, the use of simple analysis and indicators is crucial. Sustainability is based on very basic core principles: simplicity, speed, and scale.

A short question and answer session covered a few further themes:

- During the community transmission phase in densely populated countries, the role of contact tracing is more complex. There are times when it becomes less feasible and less effective, and health departments can be rapidly overwhelmed. At that point, it is necessary to assume exposure for everyone and lock societies down; pragmatically, there may be times when this is necessary in order to cool the epidemic. But countries that can effectively distance people and reduce risk can avoid this explosive phase.
- Managing the fact that contacts may have asymptomatic infection requires prioritization, one of the most important, but also one of the most difficult, parts of the equation. Resources are never infinite, but at this moment public health holds the balance of society in its hand. If the right steps are taken, we will help restart society. Economies can only recover through implementing public health programmes well – not through indefinite lockdowns, but by smart measures adapted to local contexts using alert levels and based on societal consensus.
- It is important to test all contacts if the resources are there, because there will be asymptomatic cases, and until asymptomatic spread is understood, the level of spread is unknown. But for testing, the clear priority is anyone with COVID-19 symptoms, especially those going into hospitals and in congregate facilities. Protecting health workers is crucial, and health worker infection rates to date are unacceptable.
- Continuous improvement and learning from data are good core principles: public health should use data in real time to optimize and improve performance.
- Public health – and the public – should recognize and celebrate the fact that changing recommendations is a sign of strength and success: using data to improve performance is the essence of good public health.

Regional updates and country experiences

WHO REGIONAL OFFICE FOR THE WESTERN PACIFIC

Mathew Griffith

Contact tracing is not a new thing in infectious disease control, but it has certainly been tested in this pandemic, which has imposed the need to adapt and scale up existing methods at speed, so that the public health workforce is not overwhelmed.

Technology cannot replace a sound foundation in contact tracing; with this in mind, the WHO Regional Office for the Western Pacific has been observing and encouraging adaptations to traditional approaches – for example, prioritizing hotspots and areas of amplified transmission and removing people from susceptible populations, especially in contexts where the number of cases is too high to trace everyone. Work is being done to use contact tracing to bring together different teams and skill sets (such as risk communication and community engagement) so a wider range of stakeholders can own, and help increase compliance with, quarantine and isolation measures.

Almost all Member States in the region are at zero or low rates of transmission at the time of the consultation, and it is hard to predict what comes next. The societal and economic costs of the pandemic and the response will emerge over the coming weeks and months, and with that will come an assessment of the control methods used to date, and whether those can be continued. Strong contact tracing does reduce the need for movement control, and should be supported; but this is a crucial moment and the need for solidarity is paramount.

COUNTRY EXPERIENCES: REPUBLIC OF KOREAAND VIET NAM

Kunhee Park, Sangnoksu *District Health Office, Ministry of Health, Republic of Korea, and Pham Quang Thai, Ministry of Health, Viet Nam*

The Republic of Korea has 254 district health offices for a population of 54 million, serving populations ranging in size from 30 000 to 400 000. The COVID-19 response – from risk communication to the mobilization of local resources – is the responsibility of the district health authority, following guidelines from the Korea Centres for Disease Control and Prevention. During the pandemic, these offices have restructured; Dr Park's authority now runs a response team and a support team. To fill the new roles thus created, staff have been relocated and trained in new roles, increasing the numbers of surveillance officers, contact tracers and those trained to manage self-quarantine operations.

Dr Park outlined the impact of COVID-19 in his district – to date relatively mild – and the steps of the contact tracing process. In cases where more contacts need to be found, searches are opened to the public. All operations are rooted in legislation and guided by privacy law. For initial cases, information is collected

through a decentralized electronic system, but initial investigation includes only family members and high-frequency contacts; after that, a detailed epidemiological report includes all contacts, but is done on paper and needs to be transferred to an electronic system for analysis.

Even in places with higher numbers of confirmed cases, where contact tracing is not possible because systems are overwhelmed and resources limited, minimum essential contact tracing capacity is still important. Even without a global positioning system (GPS), credit card and other information can be used along with a diary approach that should cover around 80% of close contacts, and which can prioritize high-risk locations or populations. In the beginning, health staff can be relocated and trained, but when cases go up past a certain point it is necessary to mobilize non-health public officials, students, retirees and other volunteers. In the Republic of Korea there is ongoing discussion about the implications of all this for privacy, human rights and data sharing.

In Viet Nam, the approach is similar. Diagnosing cases is important because the priority is support: ensuring that cases have access to medical care and social services, offering treatment and social services, limiting further contact with others, and identifying those they may have infected. Dr Pham outlined the Vietnamese case and contact definitions and approaches to isolation and quarantine, then provided some details on approaches to contact tracing for incoming air passengers and the technical tools used for contact tracing in Viet Nam, which include phone apps for tracking, proximity and diary-based approaches. In particular, the Bluezone app records contact histories and shares relevant information with the user community when a case is confirmed, so that those at risk are warned and advised on how to contact the health authorities.

WHO REGIONAL OFFICE FOR SOUTH-EAST ASIA

***Sirenda Vong**, WHO Regional Office for South-East Asia*

In the WHO South-East Asia Region, COVID-19 is on the rise, with strong evidence of community transmission. In late January, the WHO Regional Office for South-East Asia recognized support for "detect, isolate and contact tracing" as a key strategic objective of the COVID-19 response, and on 1 February 2020 it introduced transmission scenarios and guidance to develop national standard operating procedures for early detection and contact tracing (including the use of Go.Data, an outbreak investigation tool for field data collection during public health emergencies). Countries have been given direct technical support for contact tracing and a contact tracing curriculum has been promoted among Member States, based around Go.Data, OpenWHO and Johns Hopkins University Coursera online courses, and reinforced by a series of country and regional technical webinars. Strategies and standard operating procedures have been mapped in all 11 Member States; 13 webinars have been held on Go.Data (nine with countries and four with partners); four countries are using Go.Data; and five countries have been given advocacy and support.

The main regional challenges have been a lack of prior understanding of the scope and requirements for contact tracing, both among country office staff and in Member States; a lack of financial and human resources to implement at scale in countries; low willingness to share contact tracing data or key performance indicators; issues around data confidentiality, privacy and sharing in humanitarian settings (particularly the refugee camp at Cox's Bazar in Bangladesh); a lack of consultation between the public and private sectors, as a consequence of which the landscape of tools for contact tracing is challenging and the requirements for those tools poorly defined and understood; and lack of a common monitoring and evaluation framework.

Solutions include deploying more human resources for contact tracing and Go.Data use in the Regional Office and in some countries; promotion of stronger engagement with new and existing GOARN partner institutions (such as the International Clinical Epidemiology Network in India); and more proactive support to build contact tracing capacity using Go.Data or other platforms.

COUNTRY EXPERIENCE: INDIA

***Himanshu Chauhan**, Ministry of Health, India*

Contact tracing has been a mainstay of the Indian response so far, even in densely populated clusters in cities, where it presents a severe challenge. Progression of the disease makes the job difficult: at the start, the goal was to trace and isolate 150–200 contacts, but when the epidemic changed its shape and the number of cases passed 100 000, that became less feasible. State responses vary widely because state governance structures are very different: some states trace over 40 contacts per positive case, and in others there are only three or four contacts.

Every recorded case is confirmed positive on a real-time polymerase chain reaction (PCR) test, and the testing system runs from district up to state and national level. The moment a person tests positive, their information is pushed to district level through an online laboratory portal, the district surveillance officer receives a mobile alert of a new case, and contact tracing operations start. Contacts are classified into two groups – high risk and low risk. Under current testing guidelines, close and high-risk contacts have to be tested; low-risk contacts are followed up and only tested when symptomatic. Information is captured on a special surveillance portal dedicated to monitoring COVID-19.

A government-promoted Bluetooth-based contact tracing app had been downloaded over 120 million times at the time of the consultation: this app has a packet system that tracks mobile numbers and alerts anyone who has been in contact with a confirmed positive case to warn them of probable exposure. Every positive case is automatically registered on the app; if they do not have a mobile number, the mobile of a friend or close relative is used instead, and it is mandatory for testing laboratories to provide those data. Every single contact identified by the app has to be identified and closed by the district health units. This poses some challenges: the sheer volume of cases is difficult, especially in cities, and pressure on the system is immense. Testing capacity has been expanded in the last few weeks, but the need is ever growing and is further compounded by shortages of human resources and decimated contact tracing teams, especially in containment zones. This is addressed in many ways, including by involving workers from outside the health system, volunteers, and other agencies.

WHO REGIONAL OFFICE FOR THE EASTERN MEDITERRANEAN

Pierre Nabeth, *WHO Regional Office for the Eastern Mediterranean*

The countries of the Eastern Mediterranean Region are very different: some are stable and resource rich, others are unstable, poor and politically fragile. All are affected by COVID 19 – with Egypt, the Islamic Republic of Iran, Pakistan and the United Arab Emirates worst affected at the time of the meeting – but numbers of reported cases have to be treated with caution because testing strategies vary widely. The Gulf countries, for example, report high numbers of cases because of aggressive testing, but this is not the case elsewhere.

Contact tracing is very important in the region, where transmission is either in communities or clusters, but historically community transmission is probably underrated. Mitigation measures are implemented in all countries but insufficiently respected, and national surveillance systems are often weak, without systematic detection, testing or isolation of mild cases.

There is no official regional guidance available, but the WHO Regional Office has been adapting global guidance for use in each country, providing training for rapid response teams and supporting education campaigns. In parallel, many countries have developed different technical tools, of which there is a now a wide range, across surveillance, diagnostics and other areas. All have links with contact tracing systems. The Syrian Arab Republic and Yemen are already using Go.Data, which is being translated into Arabic for wider regional use, and an agreement is in place with the Eastern Mediterranean Public Health Network (EMPHNET) to support scale-up of contact tracing.

The main regional challenges include a lack of resources to sustain high-quality contact tracing; difficulties with implementation because of physical distancing and lockdown measures; the difficulty of scaling up in emergency and conflict settings; insufficient community compliance with follow-up; complex ethical considerations around the use of digital tools in a context where there is often insufficient national legislation on privacy rights and data ownership; and limited access to new technologies.

COUNTRY EXPERIENCE: STATE OF QATAR

Juliet Ibrahim*, Ministry of Health, Qatar*

Qatar's approach to COVID-19 is collaborative, led by the Ministry of Public Health and implemented jointly with stakeholders, including government health care providers and front line public health teams. It has a strong governance and committee structure for coordination and alignment, with different teams identified to lead specific components of the response. At the time of the consultation about 5000 tests were being carried out daily, with the total number at over 260 000. Laboratory testing capacity has been increased and public health teams from multiple organizations and academic institutions are deployed in the joint response. Teams perform detailed contact tracing for all positive cases, applying a unified protocol for quarantine. Drive-through testing is available for those at high risk (for example, people with multiple chronic conditions and co morbidities), and awareness campaigns are run to sensitize the population.

The Surveillance and Vaccination Electronic System (SaVES) went live early (in mid-March 2020) in response to COVID-19. Government health care providers are directly integrated into the system via electronic medical records, and supply COVID-19 laboratory results and case reports (100% of the COVID-19 response is

currently implemented by the government, but in future the private sector will be more deeply integrated). Health care facilities that cannot integrate through electronic medical records can use a web portal. SaVES is linked to a geospatial information system for identifying clusters, with automatic import of the bulk contacts of an index case, which enables epidemiological analysis of cases within the country. Data are shared with academia and research centres for research and analysis. A local technology solution collects demographic information when swabs are taken, which is then sent to the main government electronic medical records, and forwarded to SaVES.

Qatar uses a Bluetooth-based proximity app to support contact tracing – the Ehteraz app. This identifies contacts based on proximity (2 metres for 15 minutes) and provides notifications of current proximity and any change of status in a close contact. The app database categorizes people into four different statuses: healthy, suspected case, positive case and quarantine. Specific health data related to COVID-19 are fed directly to the app, but determination of an individual's status is done by health sector business intelligence and then fed to the app. In future, this may be enhanced with additional functionality in a number of areas, possibly including support for expanded home isolation or quarantine protocols; risk assessment and stratification capability; predictive identification of high-risk locations; targeted awareness-raising and communication; and integration with databases to support research.

Challenges to developing and rolling out this approach include issues of public awareness and communication (including perception and understanding of the benefits of contact tracing); issues related to adoption of new technologies; the frequent changes in protocols and guidelines for contact tracing, isolation, and other parameters, which have to be built into the technology; uncertainty about the course and future of the pandemic; and defining the phases for reopening society and how best they can be supported by technology.

WHO REGIONAL OFFICE FOR AFRICA

***Charles Lukoya Okot**, WHO Regional Office for Africa*

After outlining the current status of the pandemic in the WHO African Region – still the least affected region, though vulnerable because health systems are relatively weak – Dr Okot summarized the results of a survey of country approaches to contact tracing follow-up. The survey of 23 of the region's 47 Member States found that six countries rely on self-reporting; three use home visits; two use phone calls; and 12 use a combination of phone calls and home visits. A wide variety of data collection tools are in use in different places. In a separate performance analysis of 11 countries, nine were found to be performing well, with about 80% of contacts followed up within 24 hours; the other countries reported relatively low performance.

Having realized the challenges related to contact tracing, the Regional Office developed technical guidance for countries in early April, and has also developed and disseminated an Excel-based data collection tool and user guide for following up contacts. In addition, the Regional Office is running online training sessions on the use of those tools and methodologies for contact tracing, and is carrying out periodic follow-up with countries to refine and improve their processes.

In a region of 47 countries with diverse geographical settings and a high degree of cross-border transmission, challenges include a lack of technical capability, with limited or delayed systematic case investigation and laboratory shortages affecting diagnostic capacity and slowing contact tracing, which begins after a case is confirmed. Data management is difficult, with poor-quality contact tracing data and difficulties using technology and tools to collect the data. Despite the international nature of transmission, there is also very

limited sharing of contact tracing data between countries. Only 11 Member States in the region share data with the Regional Office, which makes analysis very difficult.

Estimating the workforce required is a major challenge in the region: it has not been possible to quantify the requirements for more effective contact tracing. The Regional Office has been collaborating with the African Centres for Disease Control and Prevention, which has suggested innovative measures to increase the number of contact tracers, particularly through deployment of community health workers, though this initiative has yet to be implemented.

COUNTRY EXPERIENCE: NIGERIA

Rhoda Atteh, *Nigeria Centre for Disease Control*

Nigeria's strategy is to identify and follow up every contact for every case. The data show the benefit of continuing even in areas where the level of community transmission is significant, or where transmission chains are unclear.

National protocols and guidelines are in place: most teams are set up at state level and are composed mainly of health workers who go from place to place doing follow-up. Before tracing operations start, the teams are trained on how to line-list contacts and follow up accordingly. Close contacts in self-isolation are visited at least three times before the end of a 14-day period. The 14th day is tagged the critical visit because a critical assessment is carried out to inform the decision as to whether to discharge the contact. As cases increase, this is harder to manage centrally, so a process of decentralization to local government area level has begun, and local governments are setting up their own response teams. At least 12% of current cases were identified through contact tracing; management of contacts is therefore important to this response. Priority is placed on contacts assessed as high risk to ensure that such individuals self-isolate effectively. Though the contact-to-case ratio varies widely across states, most states were still able to follow up 90% of line-listed contacts.

A system is in place for collection of data around the country for analysis, and key performance indicators have been established. COVID-19 is tracked nationally, and performance issues are isolated and analysed on a state-by-state basis in an attempt to determine what proportion of all cases are identified through contact tracing. Contact tracing data are managed and visualized using the Surveillance, Outbreak Response Management and Analysis System (SORMAS), an electronic platform with a relational database that integrates epidemiological, laboratory, case management and port of entry data. National challenges include difficulties in ensuring adherence of contacts to self-isolation; low testing capacity; limited availability of isolation and treatment centres; the cost of operations, which is enormous in states and local government areas with a high burden of the disease; and rising issues of stigma and resistance from communities.

Considerations for meeting these challenges and improving and expanding the contact tracing operation include integration of contact tracing at local government area level into existing health structures to improve effectiveness and ensure sustainability; use of digital tools and other strategies to monitor self-isolation; community engagement work to support the process and reduce stigma and resistance; and, in areas with widespread community transmission, conducting contact tracing in special populations or spaces (for example, camps for internally displaced populations, hospitals, dormitories, prisons and barracks).

WHO REGIONAL OFFICE FOR EUROPE

***Richard Pebody**, WHO Regional Office for Europe*

The European Region has 53 very diverse Member States, most of which have had communitywide transmission. The region has been hit hard by the pandemic so far, having experienced, at the time of the consultation, 2.3 million confirmed cases (33% of the global total) and 185 000 deaths (46%).

In this context, the Regional Office's central message to Member States is that contact tracing, wide testing, isolation and quarantine are all important, but these interventions have been challenging to maintain as cases and contacts have climbed quickly. There is, however, some important good news: some countries have gathered early data from contact tracing that have helped to answer key epidemiological questions on transmissibility and the effectiveness of different interventions.

As traditional contact tracing systems have been overwhelmed, most countries have had to resort to implementing public health and social measures, assuming all to be close contacts. A wide range of measures, limitations, closures and border controls have taken place across the region to reduce transmission; this has been successful in terms of transmission rates, but it is important to avoid complacency as countries relax use of those tools. Member States will require strong public health systems to manage cases and contacts, and national experiences vary. At the time of the meeting, some countries were already seeing transmission increasing again.

Europe needs sustainable systems with adequate capacity to manage large numbers of contacts. Faced with the important question of how to enable Member States to expand and strengthen existing contact tracing and health systems, the Regional Office is responding in three areas:

- Identifying models for organizing contact tracing service delivery by carrying out in depth interviews with countries, and assessing models in use to organize service delivery and increase human resources. A short report will be available soon.
- Assisting surge capacity by developing a tool to help countries estimate their contact tracing workforce and the resources needed to manage cases and contacts.
- Addressing the question of digital solutions. These have the potential to be a distraction, and evidence on their role is limited, but tools are available that could be useful. Regional guidance describing potential tools and approaches and how they might assist public response, and the potential trade-offs between different solutions, is in development. The use of Go.Data is a key approach that the Regional Office is promoting strongly.

The Regional Office is collecting information on the tools and solutions in use in different countries, but no formal evaluation is known to be in place.

COUNTRY EXPERIENCE: SPAIN

***Lucia Garcia San Miguel**, Ministry of Health, Spain*

Spain is composed of 17 autonomous communities and two autonomous cities, and the role of the Ministry of Health is usually to coordinate and harmonize health policies in different areas. During a state of alert (such as the current pandemic), however, the ministry takes over for the whole country. There has been a significant increase in resources for contact tracing since the pandemic, and there are many more public health officers and contact tracers than previously.

Contact tracing was rapidly overwhelmed early on; then, once a strict lockdown was in place, community transmission ceased; and now, as lockdown is de-escalated, each community must reinforce its own surveillance system and undertake high-quality tracing. Systems have many challenges: contact tracing must be exhaustive and large scale because the numbers of cases are so high. Some communities have implemented Go.Data, and others are using different tools. Reconciling these different tools has been a major challenge for a long time. An adapted system with immediate national information is desirable but currently every region has its own system, and a newly adapted national system is also functional.

Indicators for contact tracing are the percentage of new cases that are not contacts of known cases; the percentage of cases with contact tracing investigation completed; the percentage of cases reached to organize quarantine and follow-up; and the percentage of contacts that turn into cases. New proposals, starting the week of the consultation, are to perform PCR testing on asymptomatic contacts on day 0–1, to reach more contacts, and/or day 7, to shorten quarantine – in the hope that total quarantine time can be shortened to 10 days.

PAN AMERICAN HEALTH ORGANIZATION (PAHO)

***Andrea Vicari**, Pan American Health Organization*

The Pan-American history of measles elimination is a good basis for contact tracing for COVID-19. Critical actions for the response to the pandemic have been (a) saving lives through reorganizing health services and planning for surge capacity, maintaining infection prevention and control, optimizing clinical management and ensuring essential supply chains; (b) protecting health care workers; (c) slowing the spread of the disease through tracing, containment, community engagement and social measures; and (d) maintaining surveillance and reference laboratories and generating evidence for action. These are built on the foundations of pandemic management: detecting and isolating cases and tracing and quarantining contacts; treating patients; shielding the vulnerable; and regulating movements and gatherings. PAHO has supported key capacities throughout the region by establishing and expanding laboratory confirmation, scaling up and maintaining surveillance, and establishing an expectation for line lists to be submitted regularly to PAHO, as well as introducing Go.Data (with 30 countries trained and 10 implementing at the time of the consultation). PAHO has also issued a regional contact tracing guidance document, *Considerations for the implementation and management of contact tracing for COVID-19 in the Region of the Americas,* which includes a section on ethics and a range of detailed steps and indicators.

COUNTRY EXPERIENCE: ARGENTINA

Dr. Analía Rearte, *National Director of Epidemiology, Ministry of Health*

Contact tracing started in March 2020, with strong quarantine measures implemented on 19 March. Almost all cases were imported – particularly from Europe – and quarantine was successful, though many new cases continue to appear. Argentina is very large, with very different populations across the country and epidemics in different phases in different places. Most areas have few or no cases: but while only 9.2% of departments have community transmission, those departments are home to around 42% of the population.

Public health efforts are therefore focused on particular areas, particularly Buenos Aires and other metropolitan areas. Strategies to confront vulnerable areas have included moving away from contact tracing by phone, which was ineffective in reaching all contacts with symptoms, to active surveillance carried out in neighbourhoods, moving from house to house to interrogate about symptoms and testing everybody with at least one symptom – crucially, in the neighbourhood where they live, so they do not have to go anywhere else for testing, which has been a major barrier in the past. This strategy has been an important part of the response, and only works with a health system based on social organization, neighbourhood references, and close work with community and religious leaders and others to reach people. Before tracing begins, health workers meet social and religious leaders and local authorities to design strategies that use local referents to build trust.

Where some neighbourhoods are difficult to assess, controls are established at all points of ingress or egress to lock down entire areas so that people cannot go in or out. This type of measure is challenging because it requires a very high level of social support, and it is necessary to provide all relevant supplies for people inside the lockdown. But it has had very successful results: many close contacts are found and isolated using these approaches who would not be found through phone calls. This is a good strategy for places where symptomatic people are not reached in time, and it is now being implemented not only in vulnerable neighbourhoods but also throughout Buenos Aires and elsewhere, as well as in jails and other closed institutions. Argentina is also starting to use Go.Data, with almost all provinces trained, and in the next weeks it is hoped that Go.Data will be implemented for all regions.

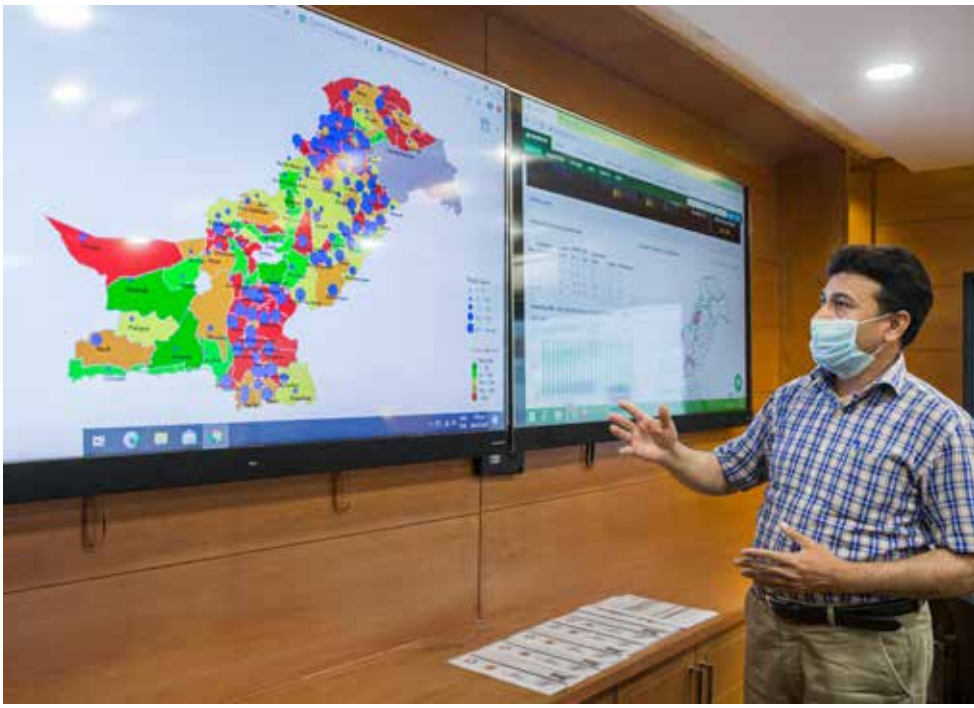
Latin America is completely different to Europe: many neighbourhoods are overcrowded, making tracing difficult and transmission levels high. In the face of these challenges, active tracing working with neighbourhood referents builds trust from citizens and enables better results.

Day 2 introduction

***Mariano Bernardo**, WHO Headquarters*

The health care sector is behind many others in its digital transformation, resulting in a need to push for quicker, more effective technological interoperability and integration and better tools – but most importantly, for tools and technology that add value to positive health outcomes. Many countries and companies try to innovate new contact tracing tools, but any such innovation has to be part of the public health response. New tools often arrive with hype and inflated expectation, but their use touches life, health and well-being, and great care is needed with adoption and use in order to avoid any negative impacts on health. Innovation is hard even in a normal period, but is subject to additional challenges during a crisis – but that crisis also enhances the hype cycle.

There are, however, some known tools that work – Go.Data, for example, which has shown its worth in responses to Ebola virus disease – and there are enhancements of technologies for use in contact tracing based on what has been done and learned in other settings. Not forgetting the importance of innovation, the ability to bring maturity to products already in the market is crucial.



WHO's Digital Health and Innovation Department can add value in two areas. One is to assess the entire demand for digital innovation and the myriad of existing solutions, creating a big picture to help address challenges. To this end WHO has created a digital solutions clearing house, launching on 23 June 2020, to help Member States navigate the gamut of digital tools, highlight those that countries have used successfully, and assess the huge number of proposals and innovations in the public and private sectors, applying assessment criteria to narrow the list. The second is to apply WHO's convening power to bring digital innovators and users together, reconsidering the plans and strategies we all had before the pandemic in light of new realities and seeing how best to adjust and adapt. Global strategies for innovation are needed now more than ever, and mature technologies need policy change to drive their adoption and improve the health care sector.

WHO is open to partner with countries, private sector actors, civil society, academia and others to extract some good from the pandemic and accelerate the digital transformation of the health care sector for positive outcomes.

Keynote presentation: COVID-19 contact tracing in Germany

***Lothar H. Wieler**, Robert Koch Institute*

At the start of the pandemic, Germany had good resources for contact tracing, but nonetheless quickly recognized that those resources were insufficient for COVID-19. Caseloads were overwhelming the capacity of local authorities, but lessons were being learned – as in the first cluster, in Bavaria, which was well managed both by the index case – who informed her company of her illness quickly – and by the company, which immediately informed all other staff and closed down its factory.

Technical guidelines for contact tracing are continuously modified depending on two factors: epidemiological situation and testing capacity. Early on, there were strict regulations as to who should be tested, focusing on risk areas and symptoms; but as the outbreak went on these barriers were loosened, and at the time of the consultation over 3.5 million tests had been done. Germany has many practitioners in over 300 000 medical practices, so this type of response has been relatively easy.

A package has been established to support local health authorities, based on a traffic light system through which those authorities report their status to the Robert Koch Institute. The institute also manages any cross-border tracing events.

Another epidemiologically driven aspect of the response has been the deployment of "containment scouts" in support of local public health: teams of five students providing support to local health authorities under pressure. Paid on six-month contracts, these teams are drawn from a large pool of labour, given that universities are closed – there were 10 000 initial applications for 500 posts. The plan is to use this resource to fill in the gaps that were identified in the more intense moments of the pandemic in March and April, involving a prolonged effort that may continue until the end of 2020 or further. Ideally, these posts will be retained in the long term as a sustainable resource to assist in contact tracing.

The key emerging issue is the need to strengthen public health. To this end, a further package is available for public services, providing sustainable support for local infrastructure. Part of a massive economic stimulus of around 130 billion euros, this is an investment in future pandemic preparedness designed to improve cross-level communication within the system, and support local public health authorities through improved infrastructure, equipment, digitalization, human resources, statistics capability, and payment for local staff.

Professor Wieler then outlined the details of the German contact tracing app, which was to be launched shortly after the meeting.

Contact tracing scaling up

Chair: ***Armand Sprecher****, Médecins Sans Frontières*

■ COVID-19 SURGE PLANNING: WORKFORCE TOOLS ■

Pryanka Relan*, WHO headquarters, and* ***Cris Scotter****, WHO Regional Office for Europe*

Work to strengthen health systems during COVID-19 is built on local expertise, processes and services; where these are not available, it is necessary to create processes to scale them up. The "four S's" approach to building surge capacity relies on the creation or expansion of spaces or structures; staff; supplies; and systems. WHO is working to respond to the needs of those four S's.

Spaces and structures are addressed through WHO guidance on how to set up COVID-19 facilities, building scalable, modular, temporary solutions for COVID-19 patients.

Staff needs are addressed with health workforce surge calculators. The Adaptt Surge Planning Support Tool and the COVID-19 Health Workforce Estimator are Excel-based tools for policy-makers and planners that help plan surge capacity by calculating the number of beds required, the dates of predicted shortages, and the human resource needs based on the projected number of mild, moderate, severe and critical patients per day. These are supplemented by a wide range of clinical and public health training materials provided through OpenWHO and the WHO Academy.

On the supplies front, the WHO COVID-19 Essential Supplies Forecasting Tool forecasts the need for essential supplies such as personal protective equipment, diagnostics and consumables.

For systems, WHO provides operational guidance on strategic planning of coordinated, targeted, action at national, regional and local levels to reorganize and maintain access to high-quality essential health services for all.

With contact tracing key to stopping the pandemic, WHO is adjusting and adapting surge tools for contact tracers, providing much needed global definitions of the "contact tracing" process and the "contact tracer" workforce category and defining the skills, competencies and time required for each task, as well as the digital adjuncts and their impact. WHO guidance documents – *Contact tracing in the context of COVID-19*[2] *and Digital tools for COVID-19 contact tracing*[3] – are available online.

Cris Scotter provided more detail about the contact tracing component of the COVID-19 Health Workforce Estimator, which was created in response to a call from a number of Member States for guidance in planning contact tracing workforces. A particular call from colleagues in low- and middle-income countries was for a simple interface that allowed rapid development of national responses using only a small number of variables. WHO has used a Microsoft Excel-based platform for increased ease of adoption by Member States. The tool can accommodate further digital tools (such as an outbreak response signal tracker or proximity trackers), and provides a large degree of flexibility from a small number of user-definable inputs. It does not produce precise numbers, but it does provide a broad picture of what Member States should consider in workforce terms. This tool is available on its own, but is also built into the wider Health Workforce Estimator tool.

2 https://www.who.int/publications/i/item/contact-tracing-in-the-context-of-covid-19
3 https://www.who.int/publications/i/item/WHO-2019-nCoV-Contact_Tracing-Tools_Annex-2020.1

COUNTRY EXPERIENCE: ITALY

Alberto Mateo Urdiales, *Italian National Public Health Institute,*
and ***Stefania Iannazzo,*** *Ministry of Health, Italy*

In Italy, health care and public health are decentralized to the regions and contact tracing is coordinated in local, subregional health units. Operations take place at an even lower level, sublocally. Because this structure was already in place, and was strengthened during the pandemic, contact tracing in Italy has never stopped, even in the most affected regions at the most intense times.

National institutions provide resource calculations, training and technical support. To this end, the National Public Health Institute has created an online course on contact tracing that is available to all working in that area, and which has seen very good uptake. This includes a guide resource that contact tracers can use to universalize methodologies around the country. On the technical support side, the institute has been providing technical support to regions using Go.Data for contact tracing and case and contact management, and has been working to simplify the process of linking data with surveillance systems.

Dr Stefania Iannazzo shared the experience at local level, from the point of view of Local Health Unit "Roma 3". Local health units have many responsibilities, but the response to the COVID-19 epidemic has been prioritized over all other activities. The whole department has been reorganized, new personnel hired, and staff from other units assigned to the local health unit. Every medical or veterinary professional assigned from outside has been given a public health referent and trained using three parallel strategies: peer to peer; vertical coaching, mentoring and direction; and exchanges of experience across levels and professions.

While the national indication for contact tracing is to go back two days to find those who might have been infected by the diagnosed case, in Rome tracing generally goes back 14 days to find the possible source of infection. Allocating resources depends on the level of the epidemic, and local authorities are responsible for decision-making and for allocating the right numbers of the right people to the right tasks.

The key lesson of this experience has been that the most important factor in achieving and maintaining success is the human factor: the professionals, their experience, and their attitudes.

Contact tracing training

Chair: ***Amrish Baidjoe****, International Red Cross and Red Crescent Movement, London School of Hygiene and Tropical Medicine, and European Programme for Intervention Epidemiology Training Alumni Network*

■ COUNTRY EXPERIENCE: AUSTRALIA ■

Tambri-Ann Housen*, Australian National University*

Australia, where the epidemic has been largely driven by returning travellers, has a decentralized, jurisdictional approach to public health, and therefore many different approaches to contact tracing. Surge capacity includes nursing agencies, students, military personnel and the wider public health workforce, and contact tracing training programmes are making use of digital tools – including breakout rooms in Zoom – for scenario training and feedback. A buddy system is in place within public health units, whereby new personnel work alongside trained tracers until they are fully confident. Psychological stress is an increasingly obvious issue during the pandemic, including for contact tracers themselves, so psychological first aid has been made a core component of training.

Two new e-learning modules are being developed, with funding from the Training Programmes in Epidemiology and Public Health Interventions Network.

The core lessons learned from this experience have been that contact tracing needs to be embedded in any response; that university students are a ready and capable source for surge capacity; that online training through Zoom is feasible and breakout rooms work well; that the ongoing supervision of new trainees is essential; and that the use of a buddy system is important. Contact with humans is essential, and new technology must be implemented in line with trusted, established methods.

■ COUNTRY EXPERIENCE: STRENGTHENING CAPACITY FOR COVID-19 CONTACT TRACING IN SOLOMON ISLANDS ■

Stephanie Wheeler*, Health Protection, Hunter New England Health, and Australian National University*

In the Solomon Islands, around 650 000 people live in nine provinces distributed across 900 islands and atolls. Around 80% of people live rurally (though urbanization is increasing), and the main threats to health are communicable and noncommunicable diseases and climate change, with natural disasters on the rise. There is a chronic shortage of trained health care workers, with only 22 nurses and midwives and two doctors per 10 000 people. No cases of COVID-19 had been reported at the time of the meeting.

This project is based in a culturally and linguistically diverse region on the east coast of Malaita, which is made up of clustered coastal communities and more remote mountain communities composed of multigenerational households with limited sanitation. The region has one hospital that is accessible by foot, boat or light aircraft, but no roads. Access has been further hindered by suspension of previously regular flights. Specimens for COVID-19 testing are sent to Honiara, the capital, and results come back in about a week. There is a shortage of clinical workers and no epidemiological workforce.

In this context, a strengths-based approach is used to meet challenges, and makes the most of established and traditional resources. Communities have existing leadership models for decision-making and implementation, and there are strong communication networks within and across villages and regions. A system of perception of family and society – the Wantok system – gives people a clear understanding of their interconnectivity and extended relationships, so it is easy to link potential contacts, and find and contact people when necessary. There is an understanding that it is not feasible for the hospital to be solely responsible for COVID-19 prevention and control measures across the region, with communities taking the responsibility for active involvement in the village-level COVID-19 effort.

The strategy is, therefore, to have contact tracing implemented by and with communities, not to them. Known, trusted and respected community leaders are trained (and can then train others in contact tracing principles for other public health issues); community calendars are used to identify potential sources or shared sites of interest, such as church meetings or weekly markets; maps of houses show interlinking contacts against a simplified paper line list; and a "hospital in the home" approach is to be deployed to take pressure off the central hospital.

For longer-term benefit, health education is embedded into contact tracing activities, and includes promoting cultural strengths that protect communities, such as supporting elders, family and the vulnerable, making food for others (including those in isolation), maintaining family gardens to avoid reliance on crowded marketplaces, and sharing time together outside. Communities are helped to create their own preparedness and response plans through village-level consultation using risk-based scenarios, identifying triggers for initiating internal "lockouts" (whereby remote villages isolate themselves entirely), allocating key roles, and identifying quarantine sites.

■ REGIONAL EXPERIENCE: AFRICAN FIELD EPIDEMIOLOGY NETWORK (AFENET) ■

***Herbert Brian Kazoora**, African Field Epidemiology Network*

The African Field Epidemiology Network (AFENET) is a non-profit networking and service alliance of field epidemiology training programmes (FETPs) in sub-Saharan Africa. It works with ministries of health and agriculture and national public health institutes to help ensure effective prevention and control of epidemics and other priority public health problems in Africa through strengthening field epidemiology and public health laboratory capacity. Three of its strategic priorities are to develop capacity for field epidemiology, public health laboratories, and public health disease surveillance and response.

In workforce development terms, AFENET has trained public health professionals in 23 countries over about 20 years, preparing 3000 health workers for front-line service. In 2018, it established the AFENET Corps of Disease Detectives, through which FETP graduates have been mobilized in response to the COVID-19 pandemic and deployed for screening travellers at points of entry; case investigation and contact listing; contact tracing and follow-up; alert management; risk communication and community engagement; and sample collection. AFENET is also working with the African Centres for Disease Control and Prevention to secure and distribute test kits across the continent and help fill testing gaps.

Digital contact tracing approaches currently in use across AFENET countries include Go.Data in Uganda and Sierra Leone; District Health Information System 2 software in Guinea; SORMAS in Nigeria; and the KoBo Toolbox in Liberia. Nigeria in particular has built up considerable experience with SORMAS during Ebola outbreaks.

AFENET supports capacity-building for Go.Data, and some epidemiologists have done training of trainers sessions with GOARN, with the goal of working with WHO to scale this up and use it across the network. AFENET teams have also worked with WHO to undertake rapid training in outbreak contexts, and these quick orientations have proved very helpful, as has the ability to use some of these tools with Android smartphones.

Regional challenges have included the high mobility of non-quarantined contacts, especially in cities; prolonged stays in quarantine sites, especially when positive cases are detected, leading to resentment among contact tracers; limited laboratory capacity to test contacts rapidly; a lack of personal protective equipment for contact tracing teams; and limited funds for field deployment.

In conclusion, FETP graduates and residents are – and will remain – critical in contact tracing in Africa, and can help ensure high-quality contact tracing data. AFENET and FETPs provide an effective platform to train public health workers on contact tracing and related tools before and during outbreaks. To maximize their effectiveness, the use of uniform tools across different countries should be promoted. Resources are needed to ensure the sustained deployment of this skilled workforce.

Risk communications and community engagement

Chair: ***Armand Sprecher,*** *Médecins Sans Frontières*

EXPLORING COMMUNITY PERCEPTIONS AND EXPERIENCES OF THE COVID-19 OUTBREAK AND ITS IMPACT ON LIVES, HEALTH AND WELL-BEING

Grazia Caleo*, Médecins Sans Frontières*

Previous experiences have emphasized that the indirect health and social impacts often outweigh the direct impacts of an outbreak, and that the role of community response in prevention, care seeking and outbreak control is critical. To this end, perspectives and experiences from communities can enhance understanding of the contexts of, and interactions with, COVID-19 public health measures and actual and potential reactions to them; how to design health and social activities with communities to make them safe, feasible and acceptable; how best to reduce mortality and morbidity; and how to promote the social value of public health.

Médecins Sans Frontières (MSF) is therefore carrying out a series of community assessments to describe community and local perspectives and attitudes towards the measures that may be taken to control the COVID-19 outbreak. These seek to document gaps, barriers and influences impacting control and care measures (including ongoing health access), and to consider the subsequent value placed on control measures and care to inform future outbreak responses. Taking place in sites around the world, these assessments are based on multiple consultations over time with leaders (identified contextually as those with responsibility and influence, including traditional leaders, church and mosque leaders and healers) and community members, including people particularly at risk from or vulnerable to infection with COVID-19. The assessment process uses generic and context-specific protocols, and local implementation activities are supported with community approach guidance, video training, and assistance from MSF headquarters.

Field teams consisting of an epidemiologist, a translator and a note taker follow a stepwise approach: interviews are carried out first with community leaders and the qualitative data are analysed using anthropological theory to examine emerging themes. Findings are discussed to identify key gaps and activities requiring support, and the assessment is repeated with community members to validate the needs, gaps and priority activities. Once this round of data is gathered, the plan for action is finalized and discussed with the community, who will help choose the activities to be implemented and the implementing partners, assisting the promotion of comprehensive support.

Work to date has highlighted a number of community concerns. Prominent among these are issues of food security and water and sanitation; sexual and gender-based violence and child abuse; malaria; maternal health; practical issues around shielding the elderly and other vulnerable populations; the stigma attached to testing, tracing and isolation; problems with responses that overlook the need for community consultation or sensitization; and poor use of trusted information sources for communicating preventive messages. Another key concern, especially in Sierra Leone where communities have had prior experience of Ebola outbreaks, is that testing leads to isolation from families: here, social isolation and stigma are

the strongest concerns. Communities are not against contact tracing, but they want it done by trusted, educated people. Contact tracing by people from outside the community is problematic.

Communities have their own ways of addressing multiple crises affecting them, and are willing to work hand in hand with organizations to implement context-adapted solutions. In some contexts, considering the reality and dynamics of communities and the social impact of public health responses beyond COVID-19, it may be worth considering switching from classical health promotion approaches to community consultations to inform and promote good practices.

COUNTRY EXPERIENCE: CANADA

***Rachel Rodin**, Public Health Agency of Canada,*
*and **Stephanie Poliquin**, Health Canada*

Management of COVID-19 is a matter of shared jurisdiction in Canada, whereby provincial and territorial governments collaborate to ensure consistent efforts that work in context. Coordination is key to the response. The role of data management systems that allow an understanding of case and contact information is critically important, and there is a need to examine further how these can help in estimating workforce requirements and surge capacity. Canada is working at all levels of government to expand testing and contact tracing capacity, through strengthening both human and technical resources.

Canada is "looking at all of the toolbox" between the extremes of full lockdown on one hand and massive mobilization of human contact tracers on the other, trying to improve understanding of where the middle road may lie and drawing from the experience of other fields (such as the control of sexually transmitted infections) to look at less intensive ways of contact tracing. As the lifting of restrictive measures is considered, contact tracing will be essential to slow transmission and protect the capacity of the health services. All people with whom a case has had contact will be considered as potentially infected and responses will be driven by risk assessments.

Contact tracing falls under the jurisdiction of provinces and territories, but early in the epidemic it was apparent that federal authorities might need to supplement that capacity at short notice. Health and public health workers and defence colleagues in non-critical services were therefore trained as contact tracers and mobilized to support provinces, where they took on surge work as required. These workers were loaned to the provinces, so health data remained under provincial jurisdictions – important for national privacy regulations. The national statistics authority also has a pool of interviewers who can be trained quickly as contact tracers if needed. Together these people comprise a bilingual workforce – important in Canada – with proficiency in 35 other languages, supported by five call centres covering Canada's main time zones. Further resources are available for the provinces if needed, and possibilities are being examined for further training of students, public servants and others to fill possible capacity gaps in future. This is being supported by an online learning platform for contact tracing that provides a consistent training resource – supplemented by examples of best practice, chat rooms and other resources – that can be delivered across the country in different languages.

REGIONAL EXPERIENCE VANCOUVER ISLAND

***Charmaine Enns**, Island Health*

Dr Enns described the experience of contact tracing in a remote indigenous city on Vancouver Island, an area of 4 square kilometres that is home to 1000 people, highlighting the values important to success in this context. While tracing is essential to reduce transmission of COVID-19 in such communities, it is difficult. In Vancouver Island, a positive test triggers an intensive follow-up including further testing, identification of all contacts, and quarantine for 14 days. This is not easy in an isolated place with challenges related to social determinants and food security, and where the quarantine requirement can be particularly onerous. Understanding the community is hugely important, knowing its capacity and responding to its values, and planners in such contexts should not make prior assumptions about the process or how it will go.

Planners on Vancouver Island first spoke with elected community leaders and decision-makers to tell them there was COVID-19 on the island, and that support would be needed to help contacts isolate or quarantine: "It is one thing to tell people to stay home for two weeks, but another to support them." A community emergency operations centre was set up in part to make sure people had what they needed to stay at home. Many said they did not want to leave their community for self-isolation or quarantine, so locations were established for people to isolate or quarantine in self-contained hotel units. There are challenges with substance use in the city, so an existing city-managed, community-developed alcohol programme was adapted to support those in isolation. Confidentiality is always crucial, and particularly so in small communities vulnerable to stigma, so planners encouraged a view of the whole island as potential contacts, to try to minimize this issue.

Contact follow-up was done by two main routes: visual monitoring and personal contact. Using local people for follow up is critically important. Responders are trained to handle personal data and receive security clearance and training on contact tracing and some scripts. Follow-ups are rigorous and responders sign privacy statements and commit to proper information handling and disposal.

Echoing the earlier description of experiences in Sierra Leone, perception of outsiders can be problematic: this community is not comfortable with outsiders coming in and telling them what to do, and responses have to be as local as possible. Success is built on relationships that already exist: this foundation is essential and critical in remote and rural communities. Support from outside is welcome, but faces in the community should be local ones.

Digital tools for contact tracing

Chair: ***Amrish Badjoe***

■ CONTACT TRACING IN THE COVID-19 PANDEMIC ■

Nuria Oliver, *European Laboratory for Learning and Intelligent Systems*

Traditional approaches to contact tracing in Spain have been based on epidemiological teams carrying out phone interviews, an approach that has not been scalable for COVID-19, given the large number of daily cases. It also has limitations because it relies on the memory of infected individuals; those individuals must know their contacts and be able and willing to share personal information. It also works poorly across borders.

Smartphone-based approaches offer some solutions to these issues, with the promise of quick, automatic determination of whether people have been in contact with infected persons. Early approaches used GPS or cell tower information, sometimes combined with other data, such as credit card information; these have serious practical and privacy implications. Using Bluetooth, however, smartphones can detect devices in close proximity in a passive way that better preserves privacy and anonymity; is decentralized; and is more accurate indoors and in moving environments (such as public transport). There are now dozens of such systems in place around the world.

These systems work by generating an encrypted pseudonym for each phone (a temporary contact number, or TCN) that can be exchanged with other phones running the app and in range. As people move around and encounter others, their phones exchange TCNs, each storing their own list of TCNs locally on the phone. If a user tests positive, they input a special code provided by health officials into their app, which results in an alert being sent to each person on the TCN list who has been in close contact with them in a given time period – for example, the previous 14 days. There are centralized and decentralized versions of this approach.

Phone-based contact tracing faces a range of challenges common to most approaches. Very high adoption is needed, over 60%, for full effect, and testing and quarantine infrastructure is needed to make use of the information generated by the app – the number of results could potentially be huge. Interoperability between apps is needed when contacts from different places, running different systems, meet one another. The risk of false positives and negatives is high, due to the imprecision of Bluetooth, interference, and a number of environmental and individual factors, and precautions need to be taken to avoid deliberate false positives from pranks or attacks. Installing and upgrading apps can be complex and challenging, and about 25% of the 3.4 billion smartphones around the world cannot run the Bluetooth Low Energy standard required by the Google and Apple approach. The app needs to run in the foreground on Apple's mobile operating system and can drain the battery. Issues of privacy and security are always pertinent.

Dr Nuria presented a hypothetical approach to meet these challenges. A significant portion of infections comes from encounters with unknown individuals, and research on number and frequency of social contacts has noted large differences by profession, with those working in essential services and health and social professions particularly highly exposed. Targeting interventions by profession could therefore be important. Research on the effect of contact tracing on infectious cases suggests that tracing 40% of contacts could

lower the impact of a possible second wave. This could be achieved through scalable, fully anonymous, citizen-driven contact tracing, or "ACDC-tracing", whereby a patient diagnosed positive receives a testing voucher that they share with a limited number of likely infection recipients, and those people use the code to book tests.

General assumptions for contact tracing programmes to be effective are that all contacts with high possibility of infection can be tested, and that all positive contacts can isolate. Manual contact tracing might be sufficient, monitoring households and co-workers of positive cases. Achieving success requires a number of measures: quarantining household members and monitoring co-workers; protecting the elderly; having absolute control in nursing homes; and protecting health care workers and essential services, including by providing separate areas in hospitals for COVID-19 and non-COVID-19 patients. Behind all of this, the ability to provide high numbers of tests for close contacts – including asymptomatic ones – is essential, as is the provision of quarantine infrastructure for around 25–40% of people.

COUNTRY EXPERIENCE: MALTA

Daniel Cauchi *and* ***Raquel Medialdea-Carrera****, , Ministry of Health, Malta*

Early in March 2020 the Maltese Ministry of Health implemented a rapid roll-out of Go.Data. Go.Data is being used by a range of COVID-19 response teams in the ministry to support a number of tasks and roles: running the helpline and investigating suspected cases; swabbing; case management; contact tracing; follow-up and discharge; data management; COVID-19 management; and coordinating laboratories, clinics and primary health care. Go.Data has been installed on ministry servers and automatically interconnected with local data management systems. It is accessible online from anywhere, and all teams involved in the COVID-19 response have been trained to use it.

Malta is also developing an app to detect potential COVID-19 contacts using Bluetooth. Based on the decentralized privacy-preserving proximity tracing (DP-3T) protocol, this will preserve privacy in line with European Union regulations, to the extent that it will not link between cases and contacts. Its main benefit is expected to be improved containment through more accurate targeting of testing. It is expected to launch in July 2020.

The lessons of the contact tracing experience in Malta to date have been as follows. Training is important, and the implementation of a buddy system with experienced tracers is helpful. It is impossible to rely only on volunteers for effective tracing – contracted, committed tracers are essential – and some degree of additional risk assessment is usually necessary at the contact tracing level. Remote working is possible, but difficult: contact tracers require a team leader they can refer to instantly while calling on cases. Language barriers pose challenges, and contact tracing protocols and procedures should be flexible enough to take human and social aspects into account: for example, burnout and stress of tracing teams are important considerations.

When implementing new health technology, non-digital natives need to be helped, and time for training is required. Using digital tools requires investment of time early on, but improves efficiency, data collection and performance later. Digital health professionals with expertise both in health and information technology are essential assets, and teamwork is key to success.

COUNTRY EXPERIENCE: MALDIVES

***Ibrahim Afzal**, Ministry of Health, Maldives*

Maldives established the National Emergency Operations Centre and a multisectoral National Disaster Management Authority to manage the response to COVID-19. The main area of concern is infection in the capital Malé, one of the most densely populated capitals in the world, with 27 000 people per square kilometre. When COVID-19 first appeared, the whole city was locked down, with no travel in or out.

A team of about 70 health staff and volunteers runs the contact tracing programme, operating on phones, laptops and via an app, TraceEkee (though this is new and has yet to achieve sufficient traction with the population). Data entry is done using Google Sheets, Go.Data and an online SQL-based database. When a test is positive, a case number is assigned and the contact tracing team alerted; tracing data are collected and verified; then the data are analysed and the analysis shared with the relevant sectors. Contact tracing starts from two days before onset of symptoms up until the time when the case was confirmed and isolated. Contacts are classified as high or low risk and data are collected on a range of factors, including demographic data, type and risk level of contact, symptoms, and co morbidities. These data are used, among other things, for deploying rapid response teams, call centre management and epidemiological analysis.

The main challenges to this work are the human and financial resource needs, which are not sustainable in the long run; the fact that sometimes contacts cannot be located, and those that do occasionally provide incorrect information; poor public uptake of TraceEkee; and the fact that volunteer staff often have no experience of data entry, meaning a high error rate and an ongoing need for data cleaning. There has been a steep learning curve all round. When quarantine was starting, the main concern was to educate staff on how to do contact tracing, and they signed confidentiality agreements for data protection. However, there were break-ins and systems were hacked, and the press became privy to sensitive information. These issues were gradually overcome and security systems have been strengthened.

Day 3 keynote presentation: Contact tracing and the Nigerian response to COVID-19

Chairs: ***Oliver Morgan,*** *WHO headquarters, and* ***Mirna Panic,*** *Public Health Agency of Canada*

Presenter: Chikwe Ihekweazu, *Nigeria Centre for Disease Control*

Nigeria's contact tracing and response actions during COVID-19 have been "the same as everyone else": contact identification and line listing; classifying contacts into high- and low-risk categories; follow-up with tracers assigned to contacts for daily monitoring and continuous sensitization; testing of symptomatic and high-risk contacts; and management of positive contacts in isolation centres. WHO guidelines are always a first port of call, but these are then adapted to the local context. It is not possible or efficient for every country in Africa – or elsewhere – to do the years of research needed to develop guidelines, and WHO's work in this area is crucial.

This experience reveals a number of problems. First, effective tracing of many contacts requires significant financing if it is to be performed properly. Second, stigma is a serious challenge: it has been difficult to get people to see contact tracing as a normal response to a health issue, and it has been necessary to take measures such as removing emblems from vehicles and putting contact tracing teams in plain clothes. Approaching contacts without identifying themselves to the general population is a big challenge for tracers in Nigeria. Third, training is a challenge: many people think contact tracing is straightforward, but in reality it is a very complex set of activities if done well, and the best ways to do it are really only beginning to emerge. Getting engagement from leadership can be hard – though in a way this has been useful, as it has brought to light problems that have been ignored for years.

Some of these problems are being solved by performance monitoring, including the development of a state dashboard to monitor performance via daily tracking of key performance indicators; stepping up risk communication to address misinformation and stigmatization; and capacity-building and training for logistics and community contact tracers. All is done to improve prompt identification of cases, increase sample collection across Nigeria, and isolate cases and halt community transmission.

Dr Ihekweazu offered a few broader areas for reflection based on the Nigerian experience.

First, the contexts in which contact tracing is done are different; Nigeria has many different settings, from the high population density and extreme traffic of Lagos to sparsely populated rural areas, from settings of peace to the long-standing conflict zone in the north-east. Contact tracing is difficult in places where people are hard to find, or where they are already sceptical of each other, and trust between people and government is crucial. Only where the social contract is strong is contact tracing easy. Careful attention must be paid to who asks the questions, what language they speak, and what approaches they take.

Second is the question of precision. Previously, contact tracing has been a broad activity, with precision not a priority; now Nigeria uses SORMAS for surveillance and contact tracing and response management. But looking at the level of precision that technology has provided in other aspects of the economy, it is an inescapable conclusion that the health sector is years behind the levels of precision required for good public health.

Third is the perception of effectiveness of contact tracing for different diseases. When Nigeria was contact tracing for Ebola virus disease, authorities were confident of identifying chains of transmission, because of the nature of contact that transmission requires. But for COVID-19, or Lassa fever, for example, there is a level of uncertainty about sources of infection, meaning the premise that contact tracing can work becomes vague. This raises questions about how to communicate uncertainty to the workforce during tracing operations, and how to manage their confidence in their own ability to identify contacts.

Fourth is the issue of how to include other professionals, increasing interaction with scientists to define the future of contact tracing, or including more cutting-edge information technology. Even though the use of digital tools has started, progress has thus far been slow. The public health sector is not having the necessary conversations with other professionals who could improve its effectiveness.

Fifth is the need to respect the complexity of contact tracing, which has never received the attention it deserves. Nothing brings this to the fore better than COVID-19; we all think we can do it, but this outbreak shows that that is not really the case. We need to redefine the place of contact tracing in outbreak response – where, how and why it should be used, and how to adapt it to context.

Finally, it is necessary to face the challenge of exhaustion. In Nigeria, colleagues have been working to capacity every single day for the last four or five months, still seeing the infection curve go up, with no end in sight and constant criticism from society for not doing enough. This work can be extremely challenging, and it is necessary to find ways to keep this community going around the world – not just with technical solutions and new methods, but also by providing mutual support. This will be extremely important in the future.

Sustainability is always a tricky question. We have to learn and improve from outbreak to outbreak, but this is easier said than done because resources, effort and energy come with outbreaks, then fall away again. The goal is to ensure that the bar at which we start the next outbreak is a bit higher than it was at the start of the last one. Nigerian authorities are careful not to spend all their resources on acute responses, and work hard to build back better for the future. Equipment and infrastructure are relatively easy; changing behaviour and practice is harder.

This is another reason why global solidarity and community are so important, not only for what they can teach, but also for the sense of community they can create. Knowledge is only shared when people like and trust and share with one another.

GOARN KNOWLEDGE HUB CONTACT TRACING REPOSITORY

***Lina Moses**, Tulane University and GOARN*

Dr Moses outlined GOARN's recent review of contact tracing guidance, which was done to assist countries by making it easily available through the GOARN knowledge hub (an open access resource). There are currently 42 relevant documents in the repository, including government, private sector and academic publications, providing guidance from global, to regional, to city level. Most contain definitions for contact tracing, recommendations for quarantine and the like, but there is very little information on monitoring and evaluation plans and not much on workforce estimators. For the purposes of research, GOARN has collected protocols, tools and instruments so that partners do not have to reinvent wheels, and is keen to assist at country and regional levels, with operational research in particular.

Much more information may be available elsewhere, but it has not been easily accessible online. Initial searches were done to see what is available, but GOARN is keen to include anything not currently accessible: if there are partners who have not had the time or capacity to make their resources public, GOARN would be keen to represent them in the knowledge hub.

One major concern is that while much information is available on broad definitions of contacts and different kinds of exposure, and there is an abundance of guidance and information on mobile apps and digital approaches, much of that information is independent and not integrated into any official contact tracing guidance. Recommendations on how to use mobile apps are beginning to emerge from the European Centre for Disease Prevention and Control (ECDC)[4], WHO and others, but more engagement is required with the industries and sectors developing these apps.

Another area requiring attention is that of performance and capacity indicators. Searches have not found anything that is not embedded in other guidance, but this is an important area that needs thought. Contact tracing is valuable not just as a mechanism for containment, but also because it provides the guidance and critical information needed to understand transmission, risk behaviour, protective behaviour, and other aspects of disease control. As more contact tracing guidance is developed, it should build in guidance on analytics, critical key performance indicators, and how data gathered through contact tracing can be best used to inform responses.

DAY 1 AND DAY 2 RECAP

***Giovanna Jaramillo-Gutierrez,** World Health Organization*

Dr Jaramillo-Gutierrez presented a recap of the first two days of discussion, which she organized around four themes.

The first identified theme was establishing definitions and guidelines. With the key challenges of establishing cohesive definitions across countries, maintaining and updating existing guidelines and ensuring public compliance, there is a need for a knowledge hub to share existing guidelines and develop a clear categorization of cases, contacts and risk levels.

[4] The ECDC guidelines have been published to help public health authorities considering the development of apps to address relevant epidemiological considerations in the development process, and calibrate and evaluate them over time. The guidelines are available at: https://www.ecdc.europa.eu/en/publications-data/covid-19-mobile-applications-support-contact-tracing

The second theme was workforce scaling and training. The main areas of discussion included the need for surge capacity and a range of responses, including reorganizing the workforce to add capacity from other areas; the difficulty of workforce calculations, including defining the skills and competencies of contact tracers, and tools that can be used to assist this; and various established and novel training and capacity-building methods that can be used rapidly and effectively during the outbreak. Challenges in this area include a widespread lack of prior knowledge and understanding of the scope of and requirements for contact tracing, and the difficulty of using tracers who are not trusted because they do not hail from the communities in which they work.

The third theme was community engagement. Working with communities is vital for building trust. The success of contact tracing operations can be helped by recruiting and using community leaders; deploying active contact tracing in hot spots; designing safe social activities; providing targeted assistance for vulnerable populations to ensure successful isolation; and ensuring that tracers are given cultural competency training. Key challenges include issues of stigma, compliance and trust; meeting the needs of specific vulnerable populations; the challenges of geographical variability; and issues that can complicate isolation, such as food security and domestic violence.

The fourth theme was the use of technology in contact tracing. This should be used alongside – not instead of – manual contact tracing, and without losing sight of low-technology alternatives such as voucher-based programmes or approaches based on text messaging. Technology should be closely integrated into the health care system to be most effective. Challenges include difficulties related to mandatory versus voluntary registration for tracing apps, and privacy and security concerns affecting trust; the fact that very high adoption rates are needed for proximity apps to be effective; false negatives and positives from current technologies; and the need for training to ensure proper use.

From all of these, Dr Jaramillo-Gutierrez extracted some key messages for consideration:

- There is an impact on transmission even when only 40% of contacts are followed up.
- The implementation parameters of contact tracing should be adapted according to local contexts and the evolution of the outbreak, and should consider the need for contact tracing care packages for families or vulnerable individuals in quarantine.
- Effective implementation of contact tracing requires considerable community engagement.
- It is possible to mobilize an expanded, scalable workforce supported by strong training packages.
- Digital tools, including proximity apps for contact tracing, may increase the effectiveness and turnaround times of tracing programmes, but do not replace a trained workforce. The use of digital tools for contact tracing requires evaluation to determine their effectiveness.
- Contact tracing capacity and effectiveness can be supported by leveraging FETP networks across the globe.

Monitoring and evaluation of contact tracing

Chair: ***Lina Moses****, Tulane University and GOARN*

CONTACT TRACING FOR COVID-19: EVALUATING SYSTEM PERFORMANCE

Ayesha Verrall*, University of Otago, Wellington, New Zealand*

Good contact tracing achieves disease control, bringing R_0 ("R nought", the reproductive ratio of a virus) to less than one, and is done quickly and completely. It is built on strong capacity and effective quarantine; it is embedded in and acceptable to communities and integrates both disease control and welfare objectives; and its outcomes are equitable. While some of these components are hard to monitor, all are critical.

New Zealand operates an "end-to-end" view of the contact tracing system based on rapid case and contact management, with timeliness, completeness and capacity crucial at each stage. The stages in this model are as follows: symptoms develop; a swab test is undertaken; a positive result is found; the case is notified to the relevant public health unit; case investigation and self-isolation are done; then close contact tracing and self-quarantine are undertaken. Monitoring requires linked case and contact data and time-stamped events. Key performance indicators can be proposed by mapping targets to the following system characteristics and indicators:

- number of cases with contact tracing completed per day
- proportion of prospective cases who should have a test, who have a test done
- time from prospective case symptom onset to test
- time from prospective case sampling to test result
- time from public health unit notification of case to contact identification
- proportion of identified contacts who are traced, stratified by household or close contact
- time from contact identification to isolation
- proportion of contacts adhering to quarantine.

However, these targets do not always correlate with public health outcomes, so two additional outcome measures are proposed: a secondary transmission rate (i.e. the proportion of contacts of positive contacts who become SARS-CoV-2 positive) of <1%; and the proportion of cases quarantined within 4 days of quarantine of the index case (i.e. the measurement that best correlates with the R_0). Advanced analysis options include describing case and contact characteristics; methods for constructing a "cascade of care" along the clinical pathway; calculating risk factors for delay, non-completion or non-adherence at each point, using a cross–sectional design; and transmission studies.

New Zealand has been publishing performance indicators and applying them to prepare for future events; expanding regional and national capacity; rolling out a national contact tracing solution built on

cloud-based customer management software (Salesforce), with cases and contacts linked by exposure events and real-time reporting of timeliness and completeness; redistributing tracing work according to capacity and performance; and developing triage and handover protocols. The outbreak preparation plan is to be ready for 1000 cases per day, and the workforce at regional centres has been expanded from 60 to 300, including expansions of base staffing levels. There is a great deal of work for these staff even outside COVID-19, including routine tuberculosis and other communicable disease work that was poorly resourced before. Another part of the solution is the existence of a flexible workforce of temporary staff who can carry out contact tracing by telephone, accessible through a national call centre. The national system is highly devolved geographically, so within each unit there should be understanding of capacity at different levels of service delivery. The units might also, because of the complexity of local outbreaks, have poor performance against timeliness indicators; but these can be seen in real time. Even a public health unit that is not near capacity might feel the strain, and this triggers conversation with a central team about whether work can be diverted or supported. Concerns about health inequities affecting the Maori population mean that New Zealand stratifies health information (though not in real time) to look at outcomes for those communities, and can implement solutions and community engagement methods in response.

The pandemic came at a time where health information systems were already at breaking point and the move to Salesforce was already under way. This was repurposed in response to COVID-19, and the case contact system currently in use should eventually become New Zealand's entire communicable disease information system, integrated with digital contact tracing apps and the new vaccine register. Strengthening privacy in these approaches is integral to their long-term sustainability.

■ MONITORING AND EVALUATION OF CONTACT TRACING IN SINGAPORE ■

***Vernon Lee**, Ministry of Health, Singapore*

Professor Lee explained the steps of Singapore's contact tracing approach and outlined the technological tools currently in use, which include SafeEntry, a QR code-based system whereby people are obliged to check in and out of locations; CCTV records; TraceTogether, a Bluetooth-based, community-driven contact tracing proximity app with uptake at the time of the consultation of 1.83 million; and the use of network analysis tools to link clusters.

Another app, called Homer, is used to support quarantine: electronic quarantine orders are issued direct to phones by SMS and include a link to install Homer as part of the order. Homer prompts the case to send health status updates every three hours, and sends GPS location reports every five minutes. These can be read through a monitoring dashboard that flags people who do not submit health status reports or who breach their location. Singapore has a number of partnerships with telecommunications companies, not just for COVID-19 but also for other purposes, to inform the population of various activities using an SMS-based system.

Discussing indicators for effectiveness, Professor Lee showed that to date 583 cases had been identified from active case finding through contact tracing of the 26 245 persons who had been placed under quarantine orders in Singapore (comprising 2.2% of persons under quarantine). Of these 583 cases, 300 were quarantined before becoming cases, while 283 became cases before they were quarantined. No cases of secondary transmission resulted from delayed identification of contacts to actual quarantine.

Another metric in use is the average number of days between community case notification and issuance of a quarantine order, stratified by residents, non-residents, household members and those who are not household members. Indicator 1 is the average time from case notification to raising the quarantine order for the contact among community cases in the last seven days; and indicator 2 is the average time from receiving the list of persons under quarantine to issuance of quarantine orders among community cases in the last seven days. The percentage of orders issued via SMS for community cases is also tracked, allowing oversight of the proportion of orders that result in enrolment on Homer for monitoring. Indicators are stratified (for example, by the proportion of high-risk contacts contacted), and so far hit rates have been high. For people who cannot be found, assistance is usually recruited from other agencies or parties (such as the police and local communities) to locate them. Time between notification and quarantine orders has been progressively shortening: prior to the electronic quarantine order system the response was manual and labour intensive. Occasionally the initial ring is shown to be too large and quarantine orders are rescinded, but caution is prioritized to ensure that orders are issued quickly.

The number of COVID-19 cases to date has not been very large, so the cost of this approach is not prohibitive compared to (for example) serving legal orders in person, which requires huge human resources. Contact tracing capacity has been scaled up nonetheless, to over 1000 professionals, and partnerships are in place with other institutions (for example, many military staff have been trained for contact tracing), so trained professionals can be stood up and down as needed.

Because Singapore is a city state covering only a small area, contact tracing teams and centres are all in a single location. The teams have therefore been duplicated and isolated, so that numerous teams and headquarters run separately within the compound. If one team or centre is hit by COVID-19, the others can function independently.

Global consultation on contact tracing: final questions and answers

Karl Schenkel, *WHO headquarters*

To set the scene, Karl Schenkel gave a quick overview of the questions and discussion that had taken place on the online Slido forum, where participants in the consultation had been answering polls, posting questions and answers, and commenting in parallel to the Zoom discussions. Eighty questions covering 25 categories had been received in the first two days of the meeting, with the top-ranked questions (by number of "likes") organizing themselves into three categories.

The first category was the technical process of contact tracing, including testing and quarantine, and top questions concerned whether WHO recommends tracing of contacts back two days prior to onset of symptoms, or further; the correct approach to take when people test positive with rapid diagnostics but negative with PCR; and the rationale for 14-day versus 21 day quarantine periods.

The second category was resources and workforce for contact tracing. Top questions concerned the size of the workforce required to undertake contact tracing for given populations (for example, 10 000 contacts); at what level or stage of community transmission to consider stopping contact tracing operations; and whether (and when) WHO recommends the use less resource-intensive forms of contact tracing, such as texting contacts, or having cases reach out to their own contacts.

The last main category of questions concerned the use of digital tools for contact tracing. Top-ranked queries were whether there are data available for countries using apps, mobile phone movement data, or CCTV information on what proportion of contacts are identified using only these approaches; the recommended use rate of the phone apps for tracing in order for them to operate effectively; and how cross-border interoperability of contact tracing apps might work with countries outside the European Union.

A wide-ranging question and answer session then closed the meeting, covering a range of topics.

Contextual issues and lessons

- Beyond the specifics of how we are doing, it is critical to have broader technical discussion on the purpose and effectiveness of contact tracing as a public health intervention for COVID-19 specifically – especially given concerns about capacity in low- and middle-income countries and the thresholds and tipping points of the benefits and drawbacks of contact tracing at different phases in given countries' epidemics. Proper consideration is needed of possible alternatives that might be more beneficial and resource efficient. Many modelling papers are coming through the pipeline that look at these tipping points and thresholds of contact tracing implementation and their impact on epidemic growth. WHO has also heard discussion of resource requirements for contact tracing being prohibitive. This should be examined properly from an economic perspective in relation to some of the alternatives, improving understanding of how they are seen from a resource and investment perspective versus other measures.
- There have been many learning points from contact tracing in the Ebola virus outbreaks in the Democratic Republic of the Congo, a highly complex operation that has brought together almost every issue related to contact tracing, but this work has not been formally documented. In the Democratic Republic of the Congo, the tactical approach has been key: at the start, the response was highly centralized, and only in May 2019 did decentralization really start with a move back to subdistricts,

putting experts at decentralized levels to analyse data and take action in real time. Contact tracing is important but if information is not analysed in real time, it will not contribute to a change in the situation. Community platforms were used to start dialogues so that communities understood what was required and who was doing the tracing: "Only in this way can you have people going out and visiting houses." Adding vaccination of contacts into the contact tracing package was important because people could then derive benefit from being identified as contacts.

- Contact tracing is impossible without some community engagement. It is therefore necessary to ensure that community members are empowered to do contact tracing and linked with active case finding at local levels, with access to resources related to real field epidemiology.
- Contact tracing requires investment. Almost every country has said that contact tracing has not had the investment required to do it at the required scale.

Tools, resources and sharing

- On digital tools, there is a need for a landscaping resource or hub to make clear what is happening in different parts of the world; show what is and is not working and what the shareable lessons are; collect and showcase proper evaluations; and provide open-source products for practical tools to help contact tracers.
- The digital space is enormously confused and complicated. It is important to have open-source examples of what has been successful and to share lessons. The more electronic sharing of information and tools, the better. A lot of the technical spaces that WHO helps convene have frequent exchanges of public and unpublished data, and this should be encouraged for contact tracing.
- There are many excellent national contact tracing efforts, and many pertinent data have been collected but not yet analysed and published. It would be beneficial to all to share information more systematically in order to refine recommendations and guidance.
- A process is required – and is not yet quite there – to funnel this information into fine-tuning contact tracing guidance.
- It is crucial to use COVID-19 as an opportunity to scale up the tools in use (such as Go.Data), ensuring that these are used in preparedness so that countries are ready for outbreaks, with the right tools and resources embedded in their systems in advance. Preparedness activities should be more realistic and more evidence based: "You can't assume your system works if it's not tested and you have to do things you've never done before."
- To this end, it would be helpful to have regular webinars convening both technical developers and public health professionals. Apps are often developed by technical teams in isolation and public health staff tend to be sceptical; having both communities in regular communication, sharing key lessons and requirements, would be helpful. A subgroup for modelling with a focus on contact tracing would also be a plus, as would efforts to connect groups that have contact tracing data with groups that can utilize those data better. This is a fast developing area in a contested, tight health operations environment, competing for attention with case management, infection prevention and control, laboratory work and more. It will be important to build regular consultations into what is already happening.

Indicators, methods and lessons

- While contextualization is important, there is scope for collective work on a core set of indicators and targets for contact tracing.

- Indicators for contact tracing are even more complex in humanitarian situations, where it is hard to identify contacts and large numbers of people move through small spaces, making record keeping challenging or impossible. Under these circumstances first investigation is crucial: strong investigation teams are required to find high-risk contacts, with methods to prioritize follow-ups.
- There are significant resource implications to contact tracing going back two days as opposed to 14 days. Greater understanding is needed of the added value of the longer period. If it can be shown that this approach only rarely finds the index case, it would suggest that focusing resources on two to four day efforts would be better.
- Better understanding is needed of the balance between voluntary and more active approaches to engaging contacts. The number of questions that can arise from initial contact interviews means that in many contexts app or digital approaches alone are unlikely to be effective. Contacts can have a huge range of questions and fears about what they can and cannot practically do, and this is difficult to translate into an app. Digital tools have a place to play in detecting otherwise hidden contacts, but should be used in conjunction with traditional methods that can also provide psychosocial and other necessary support.
- The consultation has stressed the benefits of engaging community leaders and health workers in contact tracing because they enjoy high levels of trust. There is therefore a need for guidance on simpler contact tracing protocols to be administered by less trained health workers. Simplified SMS systems or decision support apps could also extend the capacity of more specialized contact tracing teams. The COVID-19 digital classroom is developing a short course with animations for community health workers, aggregating existing trainings and open-source animations. Some existing courses are too complex for this audience so there is a need for contextually appropriate, easily understood resources available in a wide range of languages.
- A key lesson of Go.Data has been the length of time it takes to transform innovation into something usable. The challenge of innovation is to be able to introduce things effectively into a functioning system, no matter how stressed that system. One common obstacle is the difficulty of changing how people work. Even when new systems can free up hours of time, people tend to persist with old methods. WHO has tried to be nimble in its approach to innovation but the size of the problem now requires more strategic intervention, building on the best resources that each partner brings to the table. The challenge of scaling up is staggering. The International Labour Organization has published an analysis of the economic effects of improvements in testing and tracing: "Getting it wrong isn't worth thinking about".

Contact tracing and international travel

- Contact tracing for international travel raises many issues. The European Union has a mechanism for confidential communication between its Member States, the Early Warning and Response System, and a platform to share personal data that can be used for contact tracing. This was used at the beginning of the pandemic, and work is being done to scale it up as borders reopen in Europe. Work is also taking place on making various mobile apps interoperable so they can be used throughout the European Union.
- It would be useful to share information on what different countries are doing with regard to international travel. A number of approaches have been mentioned, including systems to notify partners in other countries of travel-related cases, and shortening of quarantines under certain conditions related to testing options. Another suggestion is that, taking a risk management approach, travel between countries with similar incidence rates might not warrant quarantine measures at all. Australia, for example, is looking at (although not yet committed to) a risk management matrix and "traffic light" system for managing international travel.

- The International Health Regulations (IHR) (2005) are an important tool both for sharing information on contacts and for notifications to prompt action. The faster and more effectively countries can deploy the IHR system, the faster and more successfully contact tracing can be carried out. That said, the prospect of WHO helping all countries exchange information on the movements of all contacts is daunting: the IHR systems are not designed for that, and the complexities of travel (ill passengers on multi-legged flights, for example) have many implications.
- Only a small number of countries have been sharing in-flight contact lists so far. IHR (2005) systems are not the best channel for that, especially in pandemic settings, but sharing that information can be crucially useful in establishing who to monitor or isolate on arrival.
- When we consider international travel, digitalization and other related matters it is possible to lose sight of communities and individual responsibility. In the first months of the pandemic, lockdowns have only really worked because the majority of people cooperate. Those people are a huge resource: the majority will want to take certain actions that help contact tracing if they are convinced it will help control the pandemic. It is therefore necessary to look more closely at tools and approaches that are understood and run by communities. International travel should be the responsibility of individual travellers rather than airlines. This view should be stressed: individual responsibility is a major part of the equation.

Next steps

The next steps following this meeting may include some or all of the following:

- **developing** an FAQ resource for discrete questions;
- **carrying** out enhancements to the GOARN knowledge platform;
- **establishing** evaluations of digital tools, both for their intrinsic effectiveness and for their use in the context of contact tracing as a public health measure;
- **providing** continuous updates on contact tracing to WHO Member States;
- **conducting** a global questionnaire to improve understanding of country activities;
- **convening** weekly meetings on contact tracing;
- **convening** a follow-up consultation in three months;
- **convening** a round-table meeting of donors;
- **holding** regular webinars on contact tracing to address those gaps that have been identified.

Closing comments

***Ibrahim Socé Fall**, WHO headquarters*

Outbreaks should lead the way in preparing for the future.

The world is discovering the importance of contact tracing, and professionals are reminded of the importance of context: every epidemic is different and risk profiles vary widely. COVID-19 requires us to take into account vulnerability and other factors, and widespread transmission makes it necessary to prioritize contacts. Digital tools can help quick action, but even when the tools are available it is still necessary to invest in processes and people.

It is important to continue interacting with communities, nationally and internationally, learning from one another in terms of best practices, how to maximize use of contact tracing, and developing and refining new technology for the future. These moments of not being able to travel, for example, should be a time for us to maximize and improve the use of tools for remote consultation. Regular calls will help us engage more deeply, creating gravity around this subject and moving it forward – even if, eventually, the networking and the handshakes will be resumed.

Community engagement is crucial, including in low-resource settings; and when people are asked to moderate their behaviour, it is important to offer them a support package to help them do it. Advocacy and communications are key parts of this.

Finally, work is needed to turn the results of meetings like this into country packages, fashioning resources that national centres can use to build their capacity and work better and smarter.

Annex 1: Programme

Tuesday 9 June 2020		
Time (CET)	**Session**	**Speakers**
Chair: Dr Oliver Morgan (WHO headquarters)		
13:00 – 13:10	**Conference opening and introduction**	Dr Mike Ryan (WHO headquarters)
	- Opening remarks and general welcome - Consultation objectives and expected outcomes - Review of the agenda - Housekeeping rules	Dr Oliver Morgan (WHO headquarters) and Mr Pat Drury (WHO headquarters, GOARN)
13:10 – 13:30	**Keynote presentation** (10 minutes)	Dr Tom Frieden (Resolve to Save Lives)
13:30–14:00	**Western Pacific Region**	
	- Regional update (5 minutes)	Mr Matthew Griffith (WHO Regional Office for the Western Pacific)
	- Republic of Korea's experience, challenges, lessons learned and recommendations (10 minutes)	Dr Kunhee Park (Ministry of Health)
	- Viet Nam's experience, challenges, lessons learned and recommendations (10 minutes)	Dr Pham Quang Thai (Ministry of Health)
14:00–14:20	**South-East Asia Region**	
	- Regional update (5 minutes)	Dr Sirenda Vong (WHO Regional Office for South-East Asia)
	- India's experience, challenges, lessons learned and recommendations (10 minutes)	Dr Himanshu Chauhan (Ministry of Health)
14:20–14:40	**Eastern Mediterranean Region**	
	- Regional update (5 minutes)	Dr Pierre Nabeth (WHO Regional Office for the Eastern Mediterranean)
	- Qatar's experience, challenges, lessons learned and recommendations (10 minutes)	Dr Juliet Ibrahim (Ministry of Health)
14:40–15:00	**African Region**	
	- Regional update (5 minutes)	Dr Charles Lukoya Okot (WHO Regional Office for Africa)
	- Nigeria's experience, challenges, lessons learned and recommendations (10 minutes)	Dr Rhoda Atteh (Nigeria Centre for Disease Control)
15:00–15:20	**European Region**	
	- Regional update (5 minutes)	Dr Richard Pebody (WHO Regional Office for Europe)
	- Spain's experience, challenges, lessons learned and recommendations (10 minutes)	Dr Lucía García San Miguel (Ministry of Health)
15:20–15:45	**Region of the Americas**	
	- Regional update (5 minutes)	Dr Andrea Vicari (WHO PAHO)
	- Argentina's experience, challenges, lessons	Professor Dr Analia Rearte (Ministry of Health)
15:45–16:00	**Closing day 1**	
	- • Key messages from the day	Dr Oliver Morgan (WHO headquarters) and Mr Pat Drury (WHO headquarters, GOARN)

Wednesday 10 June 2020		
Time (CET)	**Session**	**Speakers**
Chairs: Dr Armand Sprecher (MSF) and Dr Amrish Baidjoe (International Red Cross and Red Crescent Movement, London School of Hygiene and Tropical Medicine, and European Programme for Intervention Epidemiology Training Alumni Network)		
13:00 – 13:10	**Conference opening and introduction** - Consultation objectives and expected outcomes - Introduction of chairs, Day 2 - Housekeeping rules	Dr Bernardo Mariano (WHO headquarters) Dr Oliver Morgan (WHO headquarters) and Mr Pat Drury (WHO headquarters, GOARN)
13:10 –13:30	**Keynote presentation** (10 minutes)	Professor Dr Lothar H. Wieler (Robert Koch Institute)
13:30 – 14:00	**Contact tracing workforce scaling up** - Contact tracing workforce calculator (10 minutes) - Italy (10 minutes)	Dr Pryanka Relan and Cris Scotter (WHO headquarters and Regional Office for Europe) Dr Alberto Mateo Urdiales and Dr Stefania Iannazo (Ministry of Health)
14:00–14:30	**Contact tracing training** - Australia contact tracing training (10 minutes) - AFENET (10 minutes)	Dr Tambri-Anne Housen and Ms Stephanie Wheeler (Australian National University) Dr Herbert Kazoora (AFENET)
14:30–15:10	**Risk communications and community engagement** - Médecins Sans Frontières (10 minutes) - Canada (10 minutes)	Dr Grazia Caleo (MSF) Dr Rachel Rodin and Stephanie Poliquin (Public Health Agency of Canada) Dr Charmaine Enns (Vancouver Island Health Authority)
15:10–15:50	**Digital tools for contact tracing** - Valencia, Spain (10 minutes) - Malta (10 minutes) - Maldives (10 minutes)	Dr Nuria Oliver (Ministry of Health) Dr Daniel Cauchi and Dr Raquel Medialdea Carrera (Ministry of Health) Dr Ibrahim Afzal (Ministry of Health)
15:50–16:00	**Closing day 2** - Key messages from the day	Dr Oliver Morgan (WHO headquarters) and Mr Pat Drury (WHO headquarters, GOARN)

Thursday 11 June 2020		
Time (CET)	**Session**	**Speakers**
Chairs: Dr Lina Moses (Tulane University, GOARN) and Ms Mirna Panic (Public Health Agency of Canada)		
13:00 – 13:10	**Conference opening and introduction** - Opening remarks and general welcome - Consultation objectives and expected outcomes - Review of the agenda - Introduction of chairs, Day 3 - Housekeeping rules	Dr Oliver Morgan (WHO headquarters) and Mr Pat Drury (WHO headquarters, GOARN)
13:10 –13:30	**Keynote presentation** (10 minutes)	Dr Chikwe Ihekweazu (Nigeria Centre for Disease Control)
13:30–14h00	**GOARN knowledge hub** **Day 1 and Day 2 recap by six themes**	Dr Lina Moses (Tulane University, GOARN) Dr Giovanna Jaramillo-Gutierrez (WHO headquarters, GOARN)
14:00 -14h40	**Monitoring and evaluation of contact tracing** - New Zealand (10 minutes) - Singapore (10 minutes)	Dr Ayesha Verrall (University of Otago) Professor Dr Vernon Lee (Ministry of Health)
14h40-15:50	**Priorities** **Implementation/action plan and commitments** (60 minutes)	Dr Oliver Morgan (WHO headquarters) and Mr Pat Drury (WHO headquarters, GOARN)
15:50 – 16:00	**Closing of meeting**	Dr Ibrahima Socé Fall (WHO headquarters)

Annex 2: Participants

■ PRESENTERS AND CHAIRS ■

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Honorary Assistant Professor, London School of Hygiene and Tropical Medicine
President, European Programme for Intervention Epidemiology Training Alumni Network
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