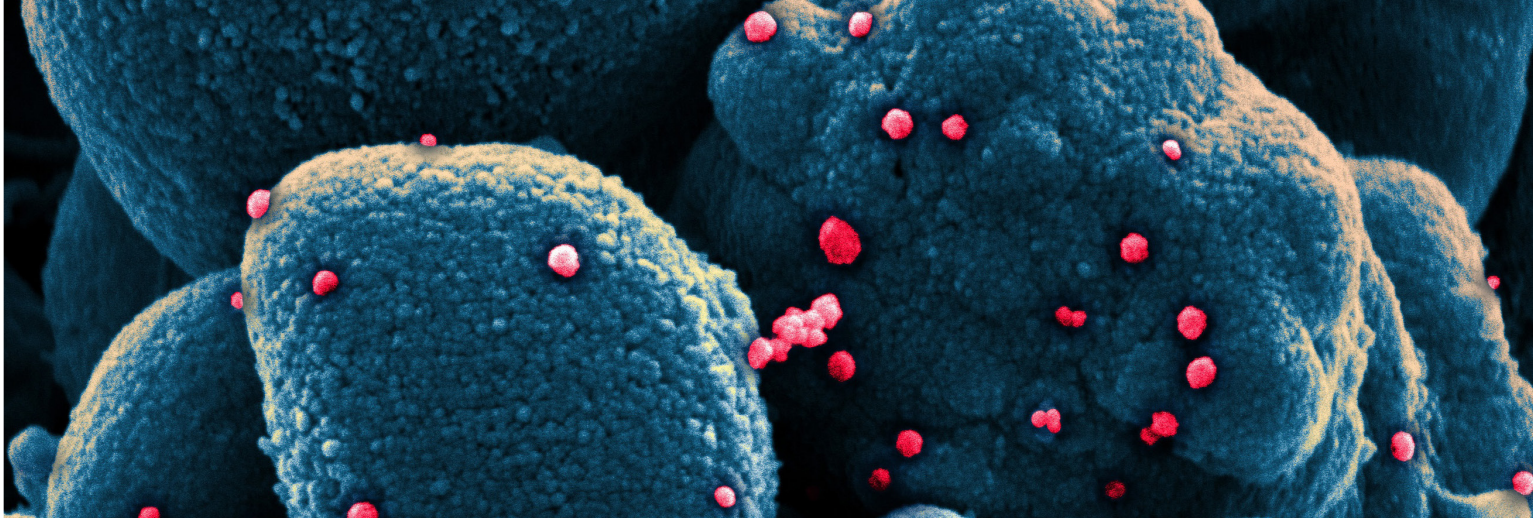

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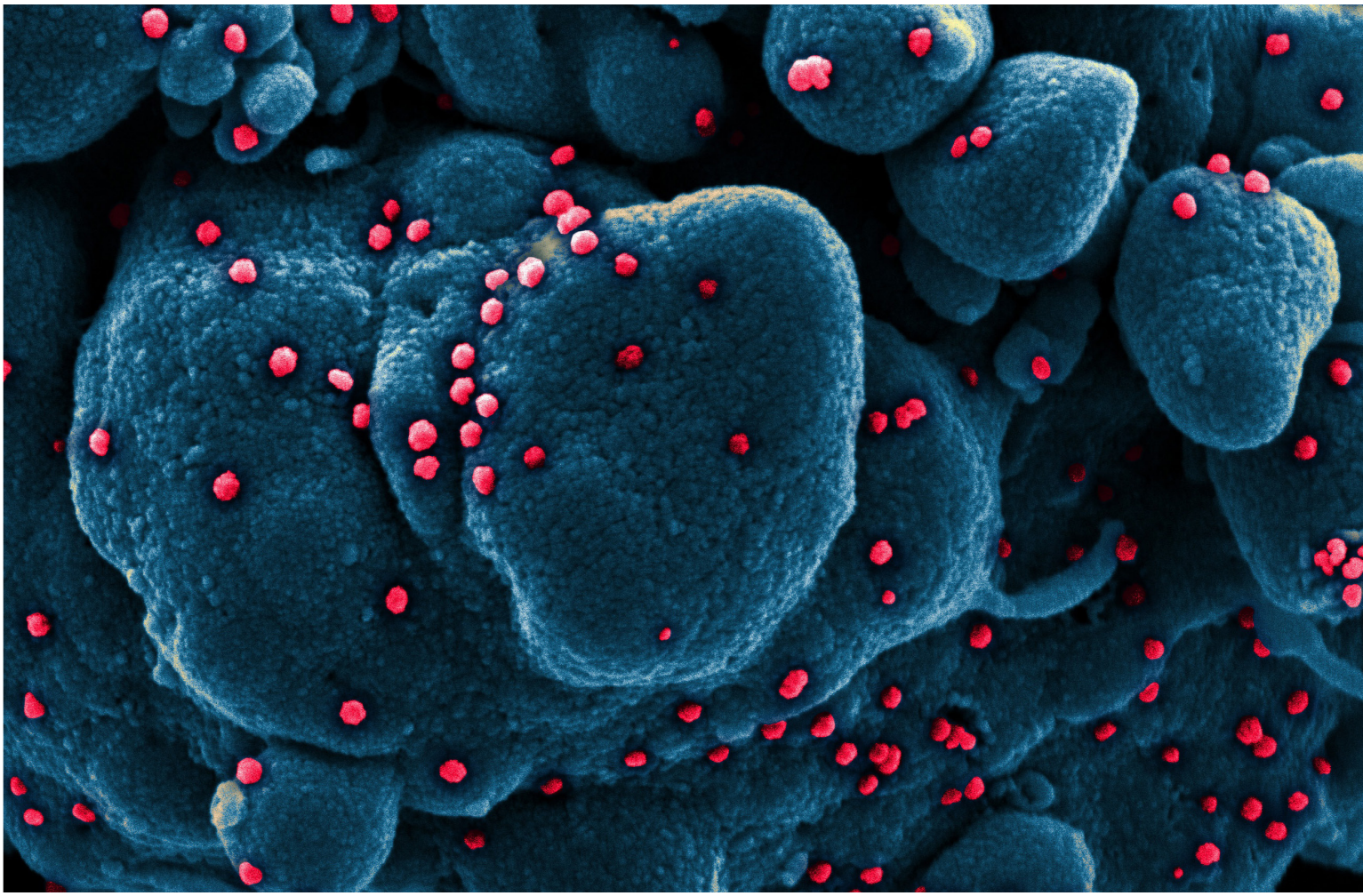

CIDRAP

COVID-19: The CIDRAP Viewpoint

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Part 4: Contact tracing for COVID-19: Assessing needs, using a tailored approach

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CIDRAP, founded in 2001, is a global leader in addressing public health preparedness and emerging infectious disease response. Part of the Office of the Vice President for Research (OVPR) at the University of Minnesota, CIDRAP works to prevent illness and death from targeted infectious disease threats through research and the translation of scientific information into real-world, practical applications, policies, and solutions. For more information, visit: www.cidrap.umn.edu.

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Part 4: Contact Tracing for COVID-19: Assessing Needs, Using a Tailored Approach

Preface

Welcome to "COVID-19: The CIDRAP Viewpoint," our series of reports that add key information, address issues that haven't garnered the attention they deserve, and reflect the unique expertise among the CIDRAP team and our expert consultants. In our reports we address timely issues with straight talk and clarity. And the steps we recommend are based on our current reality and the best available data. Our goal is to help planners envision some of the situations that might present themselves later this year or next year so that they can take key steps now, while there's still time.

Our first report laid out potential pandemic scenarios, our second report covered crisis communication, and our third report was on "smart testing."

Our hope is that our efforts can help you plan more effectively and understand the many aspects of this pandemic more clearly—and for you and your family, friends, and colleagues to be safer. Thank you.

– Michael T. Osterholm, PhD, MPH, CIDRAP Director

"We must remain devoted to the canons of science that are so much part of the practice of medicine and the practice of the allied arts. To do otherwise would be to build public policy on quicksand."

– David Axelrod, MD, former Commissioner, New York State Department of Health

Introduction

Officials have used contact tracing as a public health tool to control the spread of several infectious diseases, notably tuberculosis, sexually transmitted infections (including HIV), Ebola, measles, and severe acute respiratory syndrome (SARS), which, like COVID-19, is caused by a coronavirus (Eames 2003, Fox 2013, Saurabh 2017).

In situations involving major outbreaks or high rates of endemic disease, contact tracing is most effective either early in the course of an outbreak or much later in the outbreak when other measures have reduced disease incidence to low levels. In the latter instance, contact tracing is more manageable and can be used to eliminate remaining small foci of infection. Contact tracing, for example, was key in the late stages of the smallpox eradication program and has played an important role toward global polio eradication.

Traditional contact tracing usually includes in-person notification of the contact by a public health official who arranges for treatment, preventive therapy, and isolation and quarantine as indicated by exposure or infectious status. When outbreak circumstances dictate deviation from proven methods, variations from in-person interviews are used, including counseling infected persons regarding how to notify their own contacts of their exposure, training surrogates to conduct the notification, and relying on telephone or other communications tools to notify individuals or clearly delineated exposed groups (e.g., church members).

Traditional contact tracing involves a number of steps, including: (1) case identification (usually through reporting cases to a public health surveillance system), (2) interviews with cases by trained public health workers to identify close contacts, (3) notifying those contacts of their potential exposure to the infectious agent (while maintaining confidentiality of the source case), and (4) successful implementation of a disease control strategy, such as testing, quarantine, case isolation, prophylactic therapy, immunization, or treatment. This fourth step depends on the ability and willingness of exposed persons to comply with public health recommendations, which

in turn reflects issues related to health literacy, social and cultural factors (such as trust of government authority), and the capacity to offer testing, medications, or other therapies to exposed people.

While contact tracing can be a valuable public health tool, its success depends on certain characteristics of the pathogen; the epidemiology of the disease involved; the thoroughness and follow-up of the contacts identified; the availability of rapid testing, preventive treatment and/or a vaccine; and the acceptance and effectiveness of quarantine for those potentially incubating an infection and of isolation for those found to be infected. Characteristics of the pathogen that influence the potential success of contact tracing include the routes of transmission (such as via aerosol, contaminated surfaces, or bodily fluids), the incubation period, the serial interval (the time between contact with a primary case and development of symptoms in a secondary case), the asymptomatic ratio (the percentage of infected people who remain completely asymptomatic during the course of their illness), the timeframe that people can transmit the disease before they develop symptoms, and the degree to which asymptomatic people can transmit the pathogen.

> Contact tracing is most effective when the incidence of infection in a given population is low and when cases and contacts can quickly and easily be identified.

Contact tracing is most effective when the incidence of infection in a given population is low and when cases and contacts can quickly and easily be identified, such as for sexually transmitted infections (Eames 2003). Contact tracing is less effective when contacts are difficult to trace (such as situations involving airborne pathogens), the incidence of infection is high, or when a large proportion of transmissible infections are asymptomatic (not having symptoms) (Eames 2003). If many cases are asymptomatic and many contacts are untraceable, it may not be possible to reach a threshold for which a contact tracing program is able to keep pace with the spread of an outbreak and lower the transmission rate. Effective contact tracing relies on having a program in place that allows professionals to: (1) thoroughly identify all high-risk or close contacts, (2) conduct timely notification of contacts in time to prevent further transmission, (3) ensure resources are available for appropriate medical evaluation of any contacts who are or become symptomatic, and (4) ensure successful quarantine or isolation of contacts during the potential timeframe when they may be infectious (whether they are asymptomatic or not).

Contact Tracing for COVID-19

At the beginning of the COVID-19 outbreak in the United States, health authorities in some jurisdictions initiated containment activities to curtail spread of the virus; isolation and contact tracing of imported cases with quarantine of contacts was part of that initial strategy. As more community-based spread began occurring, public health authorities generally abandoned containment activities and moved into mitigation strategies (Parodi 2020). Mitigation strategies include activities to slow the spread of the virus and to dampen surges in cases, such as physical distancing and stay-at-home orders. As communities begin to ease these types of restrictions, a national movement to return to contact tracing is under way to allow the economy to open, control the outbreak at the same time, and prevent future surges in case numbers that would likely stress or overwhelm healthcare resources (Watson 2020, Resolve to Save Lives 2020a, Rockefeller Foundation 2020).

The US Centers for Disease Control and Prevention (CDC) has recently indicated, “Contact tracing, a core disease control measure employed by local and state health department personnel for decades, is a key strategy for preventing further spread of COVID-19. Immediate action is needed. Communities must scale up and train a large workforce and work collaboratively across public and private agencies to stop the transmission of COVID-

19."(CDC 2020a) The CDC has also recently posted detailed training materials for how best to conduct contact tracing for COVID-19 (CDC 2020b); these materials address many of the operational issues related to program implementation.

In its guidance, the World Health Organization (WHO) advocates for contact tracing when cases are sporadic and widespread community transmission is not occurring. The WHO states, "Contact tracing may be difficult when transmission is intense" and recommends focusing on household contacts, healthcare workers, high-risk closed settings, vulnerable contacts, and case clusters (WHO 2020). In late April, the Association of State and Territorial Health Officials (ASTHO) and the National Coalition of STD Directors released a new online course aimed at training entry-level contact tracers (ASTHO 2020). In May, Johns Hopkins University released a free, online, entry-level contact tracing training course with a certificate option (Gurley 2020).

While the above organizations are advocating for contact tracing in the United States, data to support the success of this strategy specifically for COVID-19 in other areas of the world are limited. Although we know that contact tracing, including use of digital technologies, has been employed in several Asian countries to combat COVID-19, we don't know exactly what methods were used, how many cases were involved, and what the estimated impact was in reducing transmission since other mitigation strategies were employed at the same time. Also, if a second wave of cases occurs in the fall of 2020, case numbers could be much higher than what contact tracing programs can manage. In that scenario, reinstitution of other mitigation strategies (such as returning to stay-at-home strategies) may be necessary. Metrics are needed to be able to gauge the effectiveness of contact tracing so that proactive changes in outbreak response strategies are not delayed. For example, Resolve to Save lives has identified several key outcome indicators for contact tracing that can be tracked (Resolve to Save Lives 2020b).

The quarantine period for COVID-19 is currently considered to be 2 weeks after the time of exposure (if several people in a household sequentially become ill, however, the quarantine period will reset for remaining non-ill household members). If a person becomes symptomatic during the quarantine period, the CDC recommends that he or she be placed in isolation, which may be discontinued when (1) at least 3 days (72 hours) have passed since recovery (defined as resolution of fever without the use of fever-reducing medications), (2) the patient shows improvement in

Pressing Issues

1. Data are needed to address the following issues regarding contact tracing for COVID-19:
   - Determine if there is sufficient benefit to justify the cost of widespread contact tracing for COVID-19 in the United States.
   - Define what level of exposure is truly significant for COVID-19 and requires self-quarantine of contacts.
   - Evaluate compliance with self-quarantine, particularly when the source case is not readily apparent to the contact.
   - Define benchmarks for success.
   - Clarify the usefulness of digital technologic tools for contact tracing, particularly with regard to addressing privacy concerns.
2. Guidance should be provided on how to prevent potential adverse impacts of widespread contact tracing for COVID-19.
3. Technology standards are needed for using digital tools for contact tracing.
4. Public health officials need to define parameters for using contact tracing during different phases of the COVID-19 pandemic, including determining the "end game" for when this effort can be de-escalated or completely demobilized.

respiratory symptoms (e.g., cough, shortness of breath), and (3) at least 10 days have passed since symptoms first appeared (CDC 2020c). Contact tracing for COVID-19 is predominantly being done by telephone, given the potential exposure risk. Ideally, regular ongoing follow-up with contacts should be done to monitor for symptoms. At a minimum, contacts should be asked to report any symptoms to the appropriate health department as soon as they occur.

While contacts of confirmed cases are at increased risk of being infected, data are lacking to clearly define the time course between exposure and a positive test result, which complicates the interpretation of test results for asymptomatic contacts. For example, a negative test a few days after exposure does not necessarily confirm that the person tested is not infected. COVID-19 testing for asymptomatic contacts identified through contact tracing, therefore, is not generally recommended, except in select circumstances, such as in congregate living situations, where there may be a public health benefit.

When developing protocols for contact tracing, state and local health departments, with support and guidance from the CDC, should ensure that questions specific to COVID-19 are addressed or should have mechanisms in place to share best practices. Examples of such issues include the following:

- What is the appropriate timeframe for public health action after a person tests positive?
- Is it appropriate to quantify the risk associated with the exposure (proximity to the case, duration of exposure, outdoor vs. indoor exposure) and could algorithms be developed to identify higher-risk contacts to be prioritized for follow-up?
- Are there contact tracing triggers for high-risk transmission where more aggressive action may be necessary (e.g., high-density settings such as assisted living and long-term care facilities, indoor events, family or other large gatherings)?
- Can the degree of exposure be used to define appropriate public health messaging or to modify recommendations for different types of contacts?
- When might it be appropriate to reveal the identity of the source case to contacts, provided that local policies allow for that possibility?
- Are there exceptions to self-quarantine of contacts, such as if they have had a positive SARS-CoV-2 antibody test and are not symptomatic?
- Are mandatory isolation and quarantine sometimes indicated, such as with ongoing intentional exposure to others in high-risk settings?

According to the national plan developed by the Johns Hopkins Center for Health Security, Bloomberg School of Public Health, and ASTHO, success of a contact tracing program at the national, state, or local level will require massive expansion of diagnostic testing of anyone with symptoms to identify as many cases as possible (Watson 2020). The plan suggests that up to 100,000 contact tracers may be needed in this country for contact tracing programs to be successful, although the evidence base for this number is not clear. Planners estimate the cost of the program to be $3.6 billion, potentially in federal funding to states.

Another plan from the Rockefeller Foundation suggests that a community healthcare corps of between 100,000 and 300,000 people will be needed to implement a "vigorous campaign of test administration and contact tracing," with staff to distribute, administer and oversee testing (Rockefeller Foundation 2020). A number of states have been ramping up contact tracing programs, and the US Department of Health and Human Services, through the Paycheck Protection Program and Health Care Enhancement Act (PPPHEA), has recently provided $10.25 billion to CDC specifically for states, localities, and territories to develop, buy, administer, process, and analyze COVID-19 tests; conduct surveillance; trace contacts; and perform other related activities (CDC 2020d). This makes it even more important to expeditiously address the questions raised in this report.

Recommendations

These recommendations should be implemented as soon as possible, as community transmission in this country is ongoing and may accelerate as states ease their physical distancing constraints.

1. As contact tracing programs for COVID-19 are expanded in the United States, efforts to rapidly assess the value, outcomes, and benefit of such programs are urgently needed to ensure that limited public health resources are targeted to the most effective strategies. Adapting a "one-size-fits-all" approach is not optimal.
2. National guidance is needed to define the parameters for using contact tracing during different phases of the COVID-19 pandemic, including determining the "end game" for when this effort can be de-escalated or completely demobilized (e.g., will this be based on declining case numbers? will it be continued until a vaccine is available and deployed? should it be continued until the pandemic is declared over?).
3. Public health leaders should determine if targeted contact-tracing approaches—such as for household contacts, healthcare facilities, assisted living and long-term care facilities, congregate living facilities, correctional facilities, worksites with confirmed cases or case clusters, and community settings where localized outbreaks appear to be occurring—are more feasible and more effective for COVID-19 than broad-brush efforts. This could be determined through comparative assessments or modeling. If so, guidance on targeted approaches should be developed.
4. Efforts are needed to define benchmarks for success, such as what percentage of contacts need to be identified in what timeframes, what are the most critical types of exposure for which follow-up is needed, and what proportion of contacts need to be managed appropriately. Modeling studies could help to identify such benchmarks.
5. State and local health departments need to ensure that messaging from the contact tracing workforce is culturally appropriate and that adequate social and economic support systems are in place for those who are identified as contacts.
6. Ongoing assessment is needed to evaluate training methods for contact tracers and identify strategies for improvement.
7. A national public education campaign should be developed that stresses the importance of isolating when ill with COVID-19 and that provides a rationale for quarantine of contacts.
8. Technical standards are needed for use of contact tracing technologic tools that allow for protection of privacy, address ethical considerations, prevent scams related to contact tracing, and can be customized locally.
9. Guidance is needed for health departments on how to pair traditional contact tracing with Bluetooth-based technologic tools that support contact tracing, and methodologies are needed to assess the efficacy of Bluetooth-based technology for contact tracing in different populations and US regions.
10. National guidance is needed on how to promote compliance with contact tracing efforts, such as communication tools that can be used by health departments or incentive programs, since contact tracing will likely rely to a large degree on voluntary compliance.
11. An easy mechanism should be put in place for health departments and the Centers for Disease Control and Prevention to share and discuss best practices for performing COVID-19 contact tracing and related activities. For example, if additional operational issues and questions arise, they will need to be addressed.

In addition to traditional contact tracing approaches, digital technologies have been employed in some countries, including China, Singapore, South Korea, and Taiwan, to support contact tracing efforts. Significant privacy concerns have been raised with some of these approaches (Carroll 2020; Center for Health Security 2020, Kahn 2020), however, and we don't know how feasible they would be in the United States. One strategy is to use Bluetooth technology to determine whether people have crossed paths without tracking or publicizing location data and thereby better protect individual privacy. Apple and Google are working on changes to the iOS and Android systems that will enable use of Bluetooth-based contact-tracing apps on smartphones, and a number of companies are developing apps for this purpose (Apple.com). The CDC is in the process of creating a landscape analysis and evaluation of these tools (CDC 2020e).

Key Questions to Answer

Several major questions need to be addressed as more states embark on implementing contact tracing for COVID-19, keeping in mind that a "one-size-fits-all" approach would not be in the best interest of public health.

Is there a sufficient benefit to widespread contact tracing for COVID-19 to justify the cost?

The unprecedented contact tracing efforts now under way in many areas of the country represent a bold move to reduce transmission to enable opening the economy and reduce the burden on healthcare systems. At this point, we don't know how much transmission these expansive programs will actually prevent to offset the degree of social activity in the community and how much they will alter the course of the pandemic state-by-state. Furthermore, implementing extensive contact tracing programs for COVID-19 will come at a significant cost to many state budgets, particularly since case numbers are still expanding in some areas and reaching all recently diagnosed cases and their contacts represents an enormous effort.

"Implementing extensive contact tracing programs for COVID-19 will come at a significant cost to many state budgets.

Factors that could hinder success include the following:

1. Many people with SARS-CoV-2 infection are asymptomatic but apparently able to transmit infection (He 2020, Pham 2020); the CDC currently estimates that 40% of transmission occurs before symptom onset (CDC 2020f). We don't have mechanisms in place to identify people who do not show symptoms.
2. We still don't have adequate testing in some areas of the country—primarily because of supply chain constraints—to ensure that we can test all symptomatic people to identify those who are infected.
3. Because the virus is relatively easily transmitted via the respiratory route, it will not be possible to accurately identify all exposed contacts, making the process less effective. Targeted contact tracing in select situations (household contacts, congregate living settings, etc.) may be more effective at a lower cost than a blanket approach. Also, we don't know the role of super-spreader events and how best to detect those as early as possible.
4. An effective medical countermeasure is not available to treat COVID-19 or to be used for prophylaxis to prevent infection. Rather, the purpose of contact tracing for COVID-19 is for cases and contacts to self-isolate or self-quarantine, respectively.
5. As noted above, contact tracing for COVID-19 is predominantly being conducted by telephone because of exposure risks for contact tracers. Limited acceptance of a telephone-only approach could reduce cooperation, in which case other strategies would need to be considered to improve compliance.

What are the key public health lessons we can learn from this effort?

Contact tracing at this point in the pandemic could provide useful information for future outbreaks or pandemics. Key questions include the following.

- What are the best practices for rapidly scaling up a contact tracing program (e.g., training, deploying, and paying a large workforce)?
- Is contact tracing effective at limiting transmission (and to what level) when cases are still increasing or occurring at high levels in the community?
- What level of contact tracing is needed to have a public health benefit, and what are the benchmarks for success (e.g., what percent of contacts must be identified, which contacts are most important, and what is the most meaningful timeframe for contact tracing to be effective)?

Forward thinking is needed now to develop mechanisms to answer these questions rather than trying to answer them after the pandemic is over.

How effective will quarantine measures be for contacts?

Data are not yet available to assess compliance rates and the success of this approach in the United States and some experts have raised questions about how successful such programs might be (Joseph 2020). For example, a recent report from the United Kingdom found that two thirds of people contacted through a contact tracing pilot program did not fully cooperate with public health recommendations (Mahase 2020). In some Asian countries, quarantine has been mandated. In the United States, even though state governments have broad authority to protect the public's health including mandating quarantine or isolation for communicable diseases, it will be nearly impossible for states to widely enforce quarantine restrictions on identified contacts, except potentially in very selective circumstances.

Mandatory quarantine strategies applied broadly would likely backfire, given the current civil liberties environment in the United States; therefore, contact tracing for COVID-19 will need to rely on voluntary compliance by contacts to stay home (or elsewhere) for the required length of quarantine. This could create significant financial hardship for many people at a time when the economy is struggling, and states may not have the resources to help cover people's costs if they are unable to work. Also, some people will require support during the quarantine process if they live alone and don't have a way to obtain essential items, such as food. It is not clear how these resources will be provided to those in need and how such needs might affect compliance.

Finally, some people may not be able to quarantine at home—they may, for example, live with someone at high-risk of serious consequences of infection, live in a large family or congregate setting, or be homeless—and it's not clear if alternative housing options can be provided in all areas of the country. Meeting social, economic, and health needs for those in quarantine is critical and must be part of the planning process by public health agencies. Collaboration with community-based groups and social service agencies to accomplish this is necessary and will require additional funding. As more information is obtained, it may be possible for public health officials to shorten the recommended self-quarantine period to lessen personal hardships and improve compliance with quarantine recommendations.

What is the role of technologic tools in contact tracing, and how can privacy concerns be adequately addressed?

Technologic tools have been used to support contact tracing in Asia, and a number of organizations in the United States are developing Bluetooth apps for contact tracing. The downsides and benefits of contact tracing apps need to be outlined to define their role (In-Q-Tel, Inc. 2020). While privacy concerns are the most substantive risk

associated with these technologies, other issues need to be considered, such as the fact that people who are low income or older may be less likely to use cellphones. Additionally, these technologies rely on apps that must be available in languages that reflect underlying community demographics.

Also, it's not clear if these programs can quantify the level of exposure to increase the likelihood of identifying significant exposures that warrant follow-up of contacts. To be effective, these tools will likely require a high level of use by people in the community; at this time, the degree to which US citizens will accept and use these tools is uncertain. We don't know how people will use the information if they are notified that they were near someone diagnosed as having COVID-19 at some point in the recent past. All of these issues could reduce compliance and effectiveness. Finally, other issues need to be considered, such as ethical considerations (Kahn 2020) and the reliability and accuracy of the data, including the potential for people to enter bogus information.

"If [contact tracing] is not done in culturally appropriate ways, it may lead to loss of trust in the public health system or in government in general.

What are the potential adverse impacts of widespread contact tracing?

Contact tracing programs could actually serve as a deterrent to testing if people believe their civil liberties are being impinged. This occurred at the beginning of HIV antibody testing, reporting, and partner notification during the mid-1980s. Scams and other nefarious activities, particularly those that interfere with privacy, could be tagged on to contact tracing activities, particularly since contact tracing will likely mostly be done over the phone or via email without face-to-face contact (Tyree 2020). Mechanisms to protect these kinds of abuses need to be considered and addressed as part of broader planning processes.

If citizens believe they will be notified by government officials should they be exposed to COVID-19, this could potentially lead to a false sense of security, thereby causing people to relax other personal protective measures. Also, if people perceive the economic, social, or other costs of compliance with contact tracing are greater than its value, it won't be successful. For example, additional compensation or incentives to counter the economic impact and improve compliance may be needed. Otherwise, this could actually deter people being tested if the public becomes concerned about civil liberties or adverse social or economic impacts associated with isolation and quarantine. Also, if COVID-19 cases continue to occur at very high levels or to increase during periods of active contact tracing, the public will likely dismiss contact tracing as an ineffective public health countermeasure, which could significantly lower compliance.

Finally, contact tracing requires training and development of a specialized skill set (Buell 2020). If this is not done in culturally appropriate ways, it may lead to loss of trust in the public health system or in government in general. While excellent training materials have recently been produced by the CDC (CDC 2020b), if the contact tracers are not adequately prepared and trained, this could have a deleterious impact on both cases and their contacts. For example, some states are outsourcing contact tracing to third-party vendors, which could lead to less oversight of training efforts.

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