RETROSPECTIVE CONTACT TRACING:

A PRIMER FOR STATE AND TERRITORIAL HEALTH AUTHORITIES

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Retrospective Contact Tracing: A Primer for State and Territorial Health Authorities

This memo is the work of the authors and was inspired and informed by conversations with the BKC Policy Practice: Digital Pandemic Response program, which works with public and private decision makers on urgent policy questions around the use of digital tools and data to help attenuate the COVID-19 pandemic.

Many **states are missing clusters of COVID-19 cases**. People are getting sick and dying, and yet, too often policymakers and public health leaders are in the dark about how the virus spreads through their communities. States need better tools to break chains of transmission more quickly and they need better information to make more responsive policy. **Contact tracing is a key piece of this puzzle**.

Currently, **most states are relying solely on prospective or "forward" contact tracing** to identify infected individuals. However, **states have an additional tool at their disposal** to break chains of transmission: **retrospective or "backwards" contact tracing**.

Dually **deploying both prospective and retrospective contact tracing can save more lives** by **1) uncovering how and where clusters are formed, which uncovers more chains of transmission**[1] and **2) yielding actionable health intelligence about COVID's transmission in communities**. This health intelligence can better inform precise and impactful responses and public health outcomes statewide, as demonstrated in Massachusetts.

On November 12, the Berkman Klein Center for Internet and Society's Digital Pandemic Response Policy Practice at Harvard University, along with Harvard Medical School's Program in Global Public Policy and Social Change, the National Governors Association, and Partners In Health's U.S. Public Health Accompaniment Unit, co-hosted a live event featuring practitioners experienced in implementing prospective and retrospective contact tracing.

The following memo summarizes the event and explains prospective and retrospective tracing. It highlights **five key recommendations** for states to reinvigorate their contact tracing efforts and protect their populations.

What Are Prospective and Retrospective Contact Tracing?

Contact tracing helps states identify new cases of COVID-19 based on exposure to an infected person. **Prospective or forward contact tracing** begins with a new case and then identifies additional people to whom the infected individual might have transmitted the virus.[2] This method helps anticipate where future cases might arise and, if done quickly enough, helps break ongoing chains of transmission.[3] But on its own, forward tracing does not capture useful information about *where* the person was infected and whether the individual was part of a group of cases, or a "cluster."[4] **This is a major shortcoming**

1 Endo et al. "Implication of backward contact tracing in the presence of overdispersed transmission in COVID-19 outbreak." *Wellcome Open Research*, (2020), doi: 10.12688/wellcomeopenres.16344.1

2 "Retrospective Contact Tracing: How States Can Investigate Covid-19 Clusters," Berkman Klein Center for Internet and Society, Harvard University, November 12, 2020, https://cyber.harvard.edu/events/retrospective-contact-tracing-how-states-can-investigate-covid-19-cluster Dr. Hitoshi Oshitani at 5:58-7:27; Dr. KJ Seung at 25:00-45.

3 Ibid.

4 "Retrospective Contact Tracing: How States Can Investigate Covid-19 Clusters," Berkman Klein Center for Internet and Society,

because COVID-19 largely spreads through cluster transmission at indoor venues, often termed "a superspreading event", rather than via individual transmission from person to person.[5] Identifying clusters is crucial because without them, "there is no sustained outbreak," according to Dr. Hitoshi Oshitani, a member of Japan's Subcommittee on Novel Coronavirus Disease Control whose pioneering work helped develop the retrospective tracing methodology.[6]

Retrospective or backwards contact tracing can help fill this gap, as it looks backwards to find when and where a person was infected and to identify who else might have been infected simultaneously as part of a cluster or superspreading event (e.g. a nightlife setting, a large gathering, or a hockey match).[7]

Retrospective tracing yields actionable health intelligence to identify high-risk venues and to prevent further spread in and from these locations. Officials gain insight into high-risk activities in their communities that would not be revealed by prospective tracing alone.[8] At a micro-level, retrospective tracing can alert officials about problematic activities within their own communities, such as a bar failing to enforce social distancing or a venue ignoring indoor capacity requirements.[9] At a macro-level, health officials might uncover activity patterns or venue types that are consistently resulting in cluster formation throughout their state. In response, state authorities can speak to local businesses or schools, develop policies, and take action to keep their populations safe.[10] (See Figure 1).

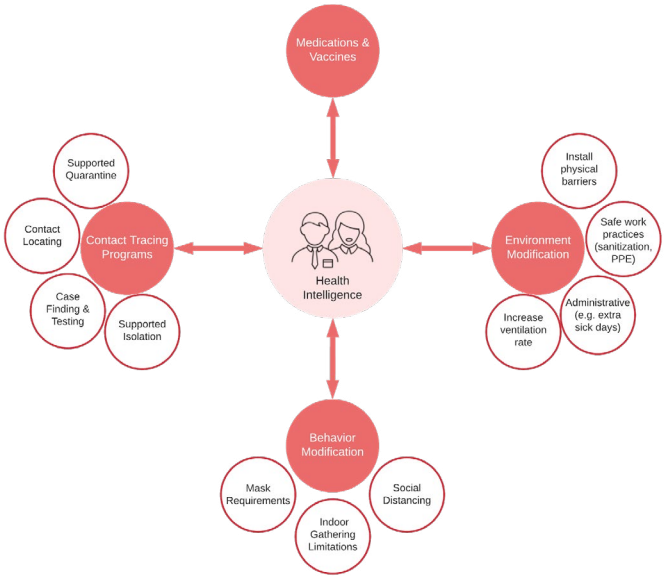

Figure 1. Retrospective tracing enhances our health intelligence system which sits at the center of the public health response to COVID-19 and informs four critical elements of response. Image by Adam Nagy.

Combining prospective and retrospective tracing approaches also enables public health authorities to more effectively "interrupt the chain of transmission" compared to prospective tracing alone.[11]

Harvard University, November 12, 2020, https://cyber.harvard.edu/events/retrospective-contact-tracing-how-states-can-investigate-covid-19-clusters Dr. KJ Seung at 25:00-32:06; Dr. Margaret Bordeaux at 20:33-53; Dr. Hitoshi Oshitani at 7:13-12:54.

5 Dillon C. Adam et al. "Clustering and superspreading potential of SARS-CoV-2 infections in Hong Kong." Nature Medicine (2020), https://doi.org/10.1038/s41591-020-1092-0; Akira Endo et al. "Estimating the overdispersion in COVID-19 transmission using outbreak sizes outside China." Wellcome Open Res, (July 2020), 10.12688/wellcomeopenres.15842.3; See generally, Zeynep Tufecki, "This Overlooked Variable Is the Key to the Pandemic," The Atlantic, (Sept 30, 2020), https://www.theatlantic.com/health/archive/2020/09/k-overlooked-variable-driving-pandemic/616548/ ; Dr. Hitoshi Oshitani, "Retrospective Contact Tracing: How States Can Investigate Covid-19 Clusters," Berkman Klein Center for Internet and Society, Harvard University, November 12, 2020, https://cyber.harvard.edu/events/retrospective-contact-tracing-how-states-can-investigate-covid-19-clusters, 4:01-7:37; Martha Bebinger, "Mass. takes a Close Look at Cluster Origins to Stop Coronavirus," WBUR, updated October 30, 2020, https://www.wbur.org/commonhealth/2020/10/30/massachusetts-covid-cluster-data; Dr. KJ Seung, "Retrospective Contact Tracing," 45:00-46:16.

6 Dr. Hitoshi Oshitani, "Retrospective Contact Tracing," 6:05-35 and 9:20-45.

7 "Retrospective Contact Tracing," Dr. KJ Seung at 26:38-27:50, 33:56-37:32; Dr. Margaret Bourdeaux at 46:22-48:00.

8 "Retrospective Contact Tracing," Dr. KJ Seung at 45:00-46:16, Dr. Margaret Bourdeaux at 46:22-51.

9 Ibid.

10 Dr. KJ Seung, "Retrospective Contact Tracing" 33:56-37:32 and 45:00-46:16.

11 Dr. Margaret Bourdeaux, "Retrospective Contact Tracing," 46:22-51, Dr. Hitoshi Oshitani at 11:32-12:54

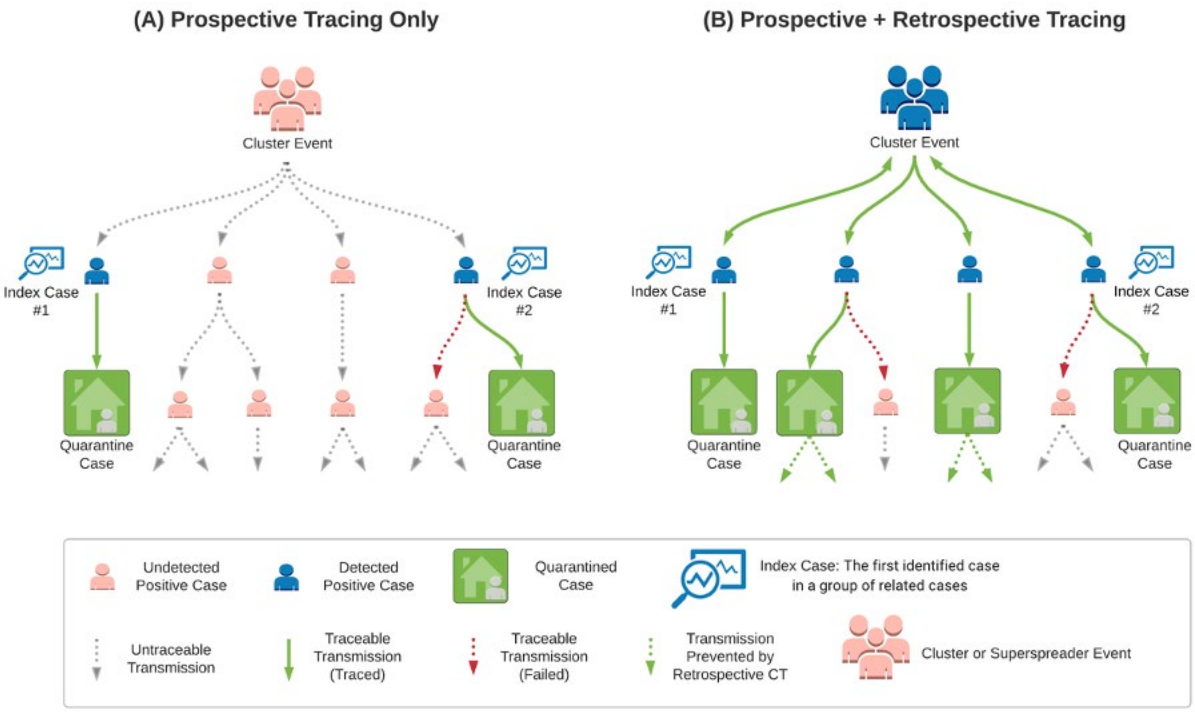

Figure 2. An illustration comparing prospective tracing only (A) against combined prospective and retrospective tracing (B). In both instances, Index Case #1 and Index Case #2 were infected at an (initially) undetected cluster event and detected through standard disease surveillance. The illustration demonstrates how the addition of retrospective tracing can break more transmission chains. In both instances some cases remain undetected due to limitations of contact tracing. This illustration was created by Adam Nagy and is a modification of a schematic found in Endo et al. "Implication of backward contact tracing in the presence of overdispersed transmission in COVID-19 outbreak." *Wellcome Open Research*, (2020), doi: 10.12688/wellcomeopenres.16344.1

When a superspreader event is detected, individuals who are part of the cluster can be identified, tested, and, if positive, forward traced to break additional chains of transmission (Figure 2).

Massachusetts and a few other states are piloting retrospective tracing, which could become a critical strategy, according to Dr. KJ Seung, an expert practitioner and Chief of Strategy and Policy for Partners in Health's MA COVID-19 response.[12]

Although retrospective contact tracing is relatively new to Massachusetts, Japan has relied on the approach to find cases of tuberculosis (TB) and has applied it to tracing COVID-19, according to Dr. Hitoshi Oshitani, a public health practitioner and member of Japan's Subcommittee on Novel Coronavirus Disease Control.[13] Japan's extensive experience provided leaders in Massachusetts with an example of implementation.[14] In Japan and Massachusetts, public health authorities rely on a professional workforce to investigate cases and clusters and use this data to respond to high-risk situations and keep their populations safe.[15]

12 Martha Bebinger, "Mass. Takes a Close Look at Cluster Origins to Stop Coronavirus," WBUR, updated October 30, 2020, https://www.wbur.org/commonhealth/2020/10/30/massachusetts-covid-cluster-data.

13 Dr. Hitoshi Oshitani, "Retrospective Contact Tracing" 10:31-11:14.

14 Dr. KJ Seung, "Retrospective Contact Tracing," 21:45-22:21; Bebinger, "Mass. takes a Close Look at Cluster Origins to Stop Coronavirus," WBUR, updated October 30, 2020.

15 Retrospective Contact Tracing," Dr. Oshitani at 10:04-11:14, Dr. KJ Seung at 22:22-37:32.

How Can States Implement Retrospective Contact Tracing?

State Public Health Departments with ongoing contact tracing efforts have the existing infrastructure to launch retrospective tracing. Additionally, the **CARES Act (2020)** allocates funding to states for contact tracing.[16] The efforts in Massachusetts and Japan, as discussed by Dr. Hitoshi Oshitani, a public health practitioner in Japan, and Dr. KJ Seung, a practitioner in Massachusetts, are instructive. **States should implement the following five recommendations in the short term to augment their health intelligence and achieve better long-term public health outcomes during the pandemic:**

1. **States Establish Centralized Professional Contact Tracing Program**. During the pandemic, states need a state-wide contact tracing program, which should combine prospective and retrospective contact tracing. These programs require professional teams of contact tracers that interview infected individuals and collect data about ***where*** they were infected and who else might have been exposed. Contact tracing programs also require statewide data sharing on cases to reconstruct the chains of transmission.

   A state-level, centralized approach is key. Teams reconstruct the chain of transmission by sharing information about cases across the state to connect cases to clusters. In Massachusetts, the Community Tracing Collaborative (CTC) helps integrate the efforts of the state's 351 local boards of public health.[17] The CTC established the Epidemic Intelligence Unit (EIU), which is dedicated to retrospective tracing and works with contact tracers to link the cases to clusters.[18]

2. **Contact Tracing Teams Collect Informed Data**. Contact tracers need to ask patients about their exposure up to two weeks before their symptoms begin.[19] This is because many COVID-19 positive individuals are infected before they start showing symptoms.[20] In Massachusetts, the CTC's "case investigators" interview infected individuals while "contact tracers" reach out to other people the individual may have infected, as based on interview data.[21] The CTC divides this effort into two "level[s]," designating retrospective efforts to the EIU for efficiency.[22] In Japan, public health nurses are responsible for contact tracing.[23]

3. **Contact Tracers Strategically Communicate with Centralized Investigators**. Contact tracers share "health intelligence" on cases with a unit of centralized investigators, like the EIU in Massachusetts, whose job it is to understand how disparate cases connect with each other.[24] This facilitates 'cluster-busting,' where the unit identifies where superspreading events occur and shares information with public health officials and policymakers to act to mitigate the spread of the virus.[25] In addition, "care resource coordinators" help those who test positive find resources.[26]

16 National Council of State Legislatures, "Contact Tracing and COVID-19," Policy Snapshot, September 2020, https://www.ncsl.org/Portals/1/Documents/Health/COVID-Contact_Tracing_snapshot_35149.pdf, 2.
17 Dr. KJ Seung, "Retrospective Contact Tracing," 22:22-23:37.
18 Ibid. at 25:00-37:32.
19 Ibid. at 25:31-28.21, and Dr. Hitoshi Oshitani, "Retrospective Contact Tracing," 11:35-15:02.
20 Dr. Hitoshi Oshitani, "Retrospective Contact Tracing," 11:10-15:02.
21 Dr. KJ Seung, "Retrospective Contact Tracing," 24:02-25:00.
22 Ibid. at 25:31-28:22.
23 Dr. Hitoshi Oshitani, "Retrospective Contact Tracing," 10:04-11:15.
24 Dr. KJ Seung, "Retrospective Contact Tracing," 33:56-37:32.
25 Ibid. at 35:47-36:38.
26 Ibid. at 24:50-25:00.

4. **Centralized Investigators Connect and Map Cases**. The central investigators must piece together the connections between cases, identified through prospective and retrospective contact tracing efforts, and build "a cluster map" of cases, instead of just a dataset of health information. A cluster map allows policymakers to see transmission trends that can inform tailored policy (e.g. significant levels of cases are coming from one type of venue). In Massachusetts, the EIU helps reconstruct a map of cases to expand the state's "actionable health intelligence."[27]

5. **State Public Health Department Works with Communities to Decrease Risk**. State Public Health Departments and Public Health Authorities act on health intelligence shared by central investigators, to slow the spread of COVID-19 and keep their communities safe.[28] They should speak to government officials, local organizations, and other stakeholders to develop tailored policies.[29] For example, in Massachusetts, multiple clusters were tied to ice hockey practices; after discovering this, authorities were subsequently able to develop policy to adjust the environment and behaviors within hockey rinks, aimed to keep transmission from occurring during games and practices.[30]

The BKC Policy Practice: Digital Pandemic Response program is generously supported by the Ford Foundation, Hewlett Foundation, and the MacArthur Foundation.

For further information and to discuss the content of this memo: contact the Program in Global Public Policy at Department of Global Medicine & Social Change at Harvard Medical School (annmarie_sasdi@hms.harvard.edu)

27 Ibid. at 33:56-37:32.
28 Ibid.
29 Ibid. at 35:35-36:35.
30 See also Dr. Margaret Bourdeaux, "Retrospective Contact Tracing," 46:53-48:00.

Further Reading and Resources:

The Berkman Klein Center for Internet and Society. "Retrospective Contact Tracing: How States Can Investigate Covid-19 Clusters." Video and Podcast. Harvard University. November 12, 2020, https://cyber.harvard.edu/events/retrospective-contact-tracing-how-states-can-investigate-covid-19-clusters

National Council of State Legislatures. "Contact Tracing and COVID-19." Policy Snapshot. September 2020. https://www.ncsl.org/Portals/1/Documents/Health/COVID-Contact_Tracing_snapshot_35149.pdf

"Guide on Active Epidemiological Investigation for Public Health Nurses In Response to COVID-19 in Japan." https://storage.googleapis.com/responsecovid19-public/1/2020/07/Active-surveillance-guide-Japan-final.pdf

National Academy for State Health Policy. "State Approaches to Contact Tracing during the COVID-19 Pandemic." Updated October 22, 2020. https://www.nashp.org/state-approaches-to-contact-tracing-covid-19/#tab-id-3

Partners In Health. "Partners in Health's U.S. Public Health Accompaniment Unit." https://www.pih.org/us-public-health-accompaniment-unit

Partners in Health. "Coronavirus Response." https://www.pih.org/coronavirus-response

Commonwealth of Massachusetts. "Learn about the Community Tracing Collaborative." https://www.mass.gov/info-details/learn-about-the-community-tracing-collaborative

Commonwealth of Massachusetts. "COVID-19 Community Tracing Collaborative Resources." https://www.mass.gov/covid-19-community-tracing-collaborative-resources