Retrospective Evaluation of the COVID-19 Contact Tracing Program at the Maine Center for Disease Control and Prevention

Elisabeth Brewington MHA, MPH
University of Southern Maine

Et al.

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Authors

Elisabeth Brewington MHA, MPH; Ben K. Greenfield PhD; and Jessica Purser PhD

ORIGINAL RESEARCH

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Elisabeth Brewington, MHA, MPH,[1] Ben K. Greenfield, PhD,[2] Jessica Purser, PhD[3]

[1]Muskie School of Public Service, University of Southern Maine, Portland, Maine, [2]Muskie School of Public Service, University of Southern Maine, Portland, Maine, [3]Arnold School of Public Health, University of South Carolina, Columbia, South Carolina

Introduction:	Despite the widespread use of contact tracing efforts throughout the COVID-19 pandemic, there are limited findings available about best practices and recommendations. The Maine Center for Disease Control and Prevention contracted staff to conduct COVID-19 contact tracing from August 2020 through February 2022. A retrospective evaluation of this program was conducted to share lessons learned with public health and health care leaders for future use.
Methods:	Contracted contact tracing staff participated in facilitated discussions structured by the Strengths, Weaknesses, Opportunities, and Threats analysis framework. Three sessions were recorded and transcribed, and qualitative analysis through thematic review and evaluation coding was conducted.
Results:	The thematic review identified 27 codes of participant responses. Codes were categorized into 4 overarching themes: pandemic collective, organizational placement, team structure, and team environment. These themes led to several recommendations for future efforts.
Discussion:	External networks and partnerships, strong engaged leadership, staff specialization, and use of innovative technology to foster regular communication were identified as contributors to the program's success. The supportive team environment and collective purpose found in COVID-19 work were also important to the contact tracing team experience.
Conclusion:	This study is a retrospective evaluation of the Maine Center for Disease Control and Prevention's COVID-19 contact tracing team. Best practices in hiring, staff engagement and retention, and collaboration were identified. These lessons are valuable for future public health emergencies and more broadly for contract tracing of other infectious diseases. Building a national consensus of best practices through systematic review or larger evaluation efforts is an important next step.
Keywords:	COVID-19 pandemic, contact tracing, quality improvement, program evaluation

After the first positive presumptive case of COVID-19 was identified in Maine on March 12, 2020,[1] the Maine CDC started contact tracing, the systematic tracking of close contacts of confirmed cases.[2] Contact tracing was used to reduce and interrupt the transmission of COVID-19 and to support people who needed to isolate or quarantine due to an exposure or diagnosis. In

May 2020, Maine State Governor Janet Mills announced the expansion of these efforts through increasing personnel resources, deploying new technologies, and establishing social support networks.[3] Redeployed state employees and trained volunteers were enlisted to conduct these efforts. In August 2020, contracts were established with staffing agencies to hire new staff, most of which had no public health or health care experience. Alongside parallel teams, such as case investigation and outbreak investigation, contact tracing was conducted through the Maine CDC's Division of

Correspondence: Elisabeth Brewington, MHA, MPH
Muskie School of Public Service, University of Southern Maine
Portland, Maine
Elisabethsbrewington@gmail.com

Disease Surveillance. The contact tracing program ended in February 2022.[4]

Contact tracing was an essential part of COVID-19 investigation and intervention in the state of Maine and globally.[5–8] For viral pandemics, including COVID-19, effectiveness of contact tracing is influenced by multiple factors, such as staff capacity and caseload, number of contacts traced, timeliness, contacts' compliance to interventions, and outbreak size and rate of spread.[2,8]

As with any public health intervention, a range of methods is warranted to understand how to effectively conduct contact tracing in different settings. As of 2023, most literature on the effectiveness of COVID-19 contact tracing programs is quantitative.[5] However, multiple qualitative and mixed-methods studies have recently been published on this topic, including studies that elicit perspectives of contact tracing staff and volunteers. Many of these qualitative studies focused on demonstrating the usefulness and end-user experience with digital and technological contact tracing tools and data systems,[9–14] as well as limitations of existing data systems.[14] Additional studies examined specific experiences of contact tracers who were members of volunteer groups,[15] university students and employees,[16] logistics sector employees,[17] or frontline health care workers.[18]

Because public health agencies are typically responsible for contact tracing, there is value in understanding public health staff experiences and recommendations on how to run effective contact tracing programs. Studies that elicited perspectives of contact tracers in public health agencies focused on specific themes, including transmission across national borders,[19] social inequalities in health,[20,21] and implications for controlling HIV.[14] One prior study analyzed how general perspectives of staff at public health agencies influence challenges and effective practices for contact tracing.[22] In this study, perspectives were examined of contact tracing staff, supervisors, and contacts of COVID-19 cases in Accra, Ghana. They found specific needs for program improvement, including program coordination, public outreach, and contact compliance with quarantine protocols.[22]

In March 2022, contact tracing staff and leadership of the Maine CDC were invited to participate in a retrospective evaluation of the contact tracing program to provide insights and recommendations to the agency. The study goal was to capture the best practices and deduce useful findings that are especially applicable for future use by health care and public health agencies. Complementing the previous studies described above, our study contributes employee perspectives from the Maine CDC on the strengths, limitations, opportunities, and threats for their contact tracing program. These perspectives should aid in understanding effective practices for state agencies to rapidly develop contact tracing and other non-pharmaceutical interventions for future pandemics.

METHODS

Data Collection

Facilitated discussions were conducted by following the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis framework. SWOT analysis is widely used by organizations for strategic planning and management,[23] including for studies evaluating the COVID-19 response at national scales[24,25] and in individual health care settings.[26] To document the perspectives and recommendations among those implementing contact tracing, transcriptions of these meetings were analyzed using thematic review and evaluation coding. This thematic analysis used an inductive approach and was not restricted to the SWOT framework.

Members of the contact tracing team who were contracted through local staffing agencies with at least 60 days of employment were eligible to participate in discussions. Eligible staff (N = 59) were emailed an invitation to participate. The email message outlined the facilitated discussion framework and explained how these findings may be used. Staff were informed that discussions would be recorded, but transcriptions would be deidentified to ensure anonymity of responses. Twelve staff opted in and were enrolled to attend 1 of 3 separate sessions.

One group comprised 4 leadership team members, including program managers and team supervisors. Eight staff in non-managerial roles were placed in the other 2 peer group sessions based on their availability, 3 in one session and 5 in the other session. Sessions were hosted virtually, recorded, and automatically transcribed by Microsoft Teams. The leadership team session was 57 minutes, the session with 3 contact tracers was 41 minutes, and

the session with 5 contact tracers was 53 minutes. Two facilitators were present at all 3 sessions, both of which were members of the contact tracing team in managerial roles. The main facilitator guided the meetings by posing questions, and the other summarized participant responses on a shared screen. In accordance with the SWOT framework, discussions were led by participants.

Analysis

Both facilitators checked the transcripts for accuracy against the recordings, copied the data to Excel, and deidentified the data for qualitative analysis. Transcripts were first coded for thematic review, which entailed a line-by-line review of the data set to identify repeated patterns, referred to as codes.[27] These codes were grouped into overarching themes to categorize findings. Evaluation coding was then conducted to supplement the thematic review findings. Evaluation coding describes the perceptions and judgments related to a program or team through descriptive codes.[28] If a code was identified for a line, it was assigned a "+" symbol to mark it as a positive attribute and "-" symbol to mark it as a negative attribute. Recommendations identified by participants were also marked. See Kiger & Varpio[27] and Saldaña[28] for more information on both thematic review and evaluation coding.

Both facilitators independently reviewed the transcribed data in Excel. Thematic review and evaluation code findings were compared to assess inter-rater reliability, and final results were agreed upon by both facilitators. The Office of Research Integrity and Outreach at the University of Southern Maine reviewed the submitted Request for Determination of Research Involving Human Subjects form and deemed this project exempt from review by an institutional review board.

RESULTS

Thematic review resulted in 27 codes categorized in 4 overarching themes (Figure 1). Evaluation coding findings were largely similar to thematic review results. The resulting recommendations are described and summarized in the Discussion section.

The pandemic collective theme contains codes relating to interactions between the contact tracing team and external populations and organizations: *collective response*, *partnerships*, *politics*,

messaging, and *best practices*. The organizational placement theme contains codes related to how the contact tracing team functioned within the agency: *human resources*, *schedule*, *software*, *specialization*, *positioning*, *transparency*, and *case investigation*. The team structure theme contains codes that explain how the team was developed and sustained: *hiring*, *homogeneity*, *leadership*, *change management*, *protocols*, *outreaches*, *training*, and *meetings*. The team environment theme contains codes that describe the team's psychosocial and interpersonal dynamics: *empowerment*, *camaraderie*, *pressure*, *self-care*, *supportive environment*, *team activities*, and *teamwork*.

DISCUSSION

Theme I: Pandemic Collective

This theme captures how the contact tracing team interacted with people external to the organization, including members of the general public and other government agencies, as well as the team's response to the COVID-19 pandemic. The pandemic led to relationships and partnerships rooted in a shared mission and *collective response* in a time of challenge. This collective response gave greater meaning to contact tracing efforts and attracted employees from a wide variety of professional backgrounds to help with efforts. This response was identified as a key strength by staff.

These *partnerships* across groups involved in the COVID-19 collective response were similarly noted as a strength and opportunity to consider again in the future (as seen elsewhere[16]). Contact tracers were able to offer support through the COVID-19 Community Care Program at the Maine Department of Human and Health Services. The coordination of services, such as grocery delivery, medical supplies, vaccination and testing access, and cultural brokerage, allowed for people affected by COVID-19 to isolate or quarantine safely.[29] The contact tracing leadership team also consulted members of other groups to help them establish their own contact tracing programs. These groups included the Maine Department of Education, the University of Maine system, Maine Tribal Governments, and various hospital and health care systems.

Primary threats to effective public health work were identified as polarizing *politics* and fragmented or inconsistent *messaging* from sources of information.

Figure 1. Overall themes, with codes

PANDEMIC COLLECTIVE

COLLECTIVE RESPONSE
PARTNERSHIPS
POLITICS
MESSAGING
BEST PRACTICES

ORGANIZATIONAL PLACEMENT

HUMAN RESOURCES
SCHEDULE
SOFTWARE
SPECIALIZATION
POSITIONING
TRANSPARENCY
CASE INVESTIGATION

TEAM STRUCTURE

HIRING
HOMOGENEITY
LEADERSHIP
CHANGE MANAGEMENT
PROTOCOLS
OUTREACHES
TRAINING
MEETINGS

TEAM ENVIRONMENT

EMPOWERMENT
CAMARADERIE
PRESSURE
SELF-CARE
SUPPORTIVE ENVIRONMENT
TEAM ACTIVITIES
TEAMWORK

The politicization of the COVID-19 pandemic significantly impacted the public's understanding of the pandemic and their ensuing health behaviors. Consequently, the public held varying perceptions of the Centers for Disease Control and Prevention, levels of public health knowledge, personal and political beliefs, and attitudes about the COVID-19 pandemic. These issues also impacted contact tracers' experiences in Ohio university settings.[16] The use of clear, consistent, and accessible public health messaging would have greatly improved health literacy and perception of public health organizations.

Contact tracers in 1 session also discussed the need for communication with teams from other states or organizations as an opportunity for improvement. Sharing of *best practices* between organizations and states would support greater mutual insight, streamlined transfer of new knowledge, and improved camaraderie in a shared mission.

Based on the pandemic collective theme, the following recommendations can be made for future practice:

- Build and maintain *partnerships* with a broad network of other organizations; establish a shared mission, goals, and sense of *collective response*.

- Use multiple platforms to expand reach and ensure effective communication and *messaging* to external audiences.

- Develop mechanisms for sharing identified *best practices* across jurisdictions and related organizations.

Theme II: Organizational Placement

The organizational placement theme relates to how the contact tracing team functioned within the Maine CDC. As previously noted, this team was primarily comprised of contracted employees from external staffing agencies. The temporary nature and volume-based staffing of contact tracing work

was challenging across positions and contributed to a lack of formal human resources processes and scheduling challenges.

Human resources tasks, such as addressing personnel issues, performance management, and staffing changes, were handled more informally than in a typical work setting. Although employee retention remained high, participants in all sessions noted that most positions came with low pay and no employee benefits, such as health insurance or paid time off. Staff recommended routine performance evaluations and a benefits package to provide a more formal and sustainable structure to their employment.

Scheduling was noted as a challenge. Throughout Maine's State of Civil Emergency (March 2020 through June 2021), the contact tracing team functioned 7 days per week.[8] After this time, most contract tracing positions were full-time during typical business hours, with some part-time positions. Participants felt that scheduling could have been more flexible, with a core group of employees retained during lower contact volume and a larger group on standby to work during case surges. Greater opportunities for part-time or per diem work could have supported greater agility in volume-based staffing.

The contact tracing *software* set up by the Maine CDC was a key aspect of this team's functioning as all employees worked remotely. Maine partnered with the MITRE Corporation to use SARA Alert as the automated symptom-monitoring software for close contacts.[6] Several team members were liaisons and collaborated on improving the platform and communicating updates back to the group, which was greatly beneficial. Lastly, most regular communications, such as meetings, chats, and team messaging were conducted on the Microsoft Teams platform. Contact tracers reported that this platform allowed them to easily connect with each other, reach out to supervisors, and receive updates. The importance of effective technology tools and platforms for contact tracing and other nonpharmaceutical interventions has been widely reported.[9–14]

The temporary and external placement of the contact tracing team was discussed by each group. Although efforts were made to integrate the program at the agency, staff perceived the team as siloed or somewhat separated from similar groups, such as the case investigation team and other infectious disease programs. A positive aspect of this narrow scope of practice was staff's *specialization*, high skill levels, confidence in their roles, and ability to create innovative practices. For instance, staff developed and implemented a workflow that improved the original contact prioritization process. This workflow significantly reduced the time between COVID-19 exposure and first outreach, a key measure established by the federal CDC. Decision makers at the agency trusted the team's expertise and were receptive to ideas for improvements, such as this workflow.

In contrast, many participants also noted weaknesses and threats associated with the temporary and external *positioning* within the organization. Staff reported feeling excluded and not belonging at the agency. A perceived lack of interdepartmental *transparency* and regular communications was discussed in all groups. Participants felt that the contact tracing team was excluded from conversations about changes to state-level protocols, overarching agency goals, and prioritization strategies.

These issues often related to the team that paralleled contact tracing: *case investigation*. Case investigators contacted people with a COVID-19 case and elicited their close contacts, which were sent to the contact tracing team for outreach. Siloing between these 2 teams was intentional to protect the privacy of each person with COVID-19. However, this structuring led to significant overlap in efforts and frustration for staff and for people with COVID-19 and their contacts, as there was no clear communication pathway between contact tracers and their counterparts.

Based on the organizational placement theme, the following recommendations can be made for future practice:

- Invest in support systems for employees, such as formalized processes and high-quality *software*.

- Support *scheduling* flexibility and agility through volume-based staffing approaches.

- Promote staff *specialization* and remain receptive to their input related to their work.

- Practice *transparency* and maintain connections between parallel teams with regular and open channels of communication.

- When needed to *position* separate teams in a siloed fashion, communicate and discuss rationale with team members and the public as needed.

Theme III: Team Structure

Participants emphasized the value derived from how the team structure was established and sustained throughout different phases. Much of this success was attributed to *hiring* practices. Staff stated that leadership had a strong sense of who would be a good fit for the job. Leadership staff noted the unusual caliber of high-quality candidates available for an entry-level job, likely part of this collective response. A wide variety of professional backgrounds were represented on the team, such as education, analytics, customer service, and operations. Yet, *homogeneity* of team-member demographics persisted. Members of the leadership team perceived this homogeneity as a challenge in successfully engaging with employees different from themselves.

The concept of *leadership* was also discussed often, with most staff perceiving managers and supervisors as key to the team's cohesion. A significant challenge to the leadership team was the practice of *change management*. Frequent updates to public health recommendations and practices resulted in a work climate of constant adjustment, also observed elsewhere.[16,18] The implementation of these rapid and frequent changes had varying degrees of success or buy-in. The challenge of change management was reflected in *protocols* in place, which sometimes duplicated efforts or were not up to date. Participants in 2 groups discussed the benefit of streamlining processes, especially related to phone *outreaches*. Here and elsewhere,[15] contact tracers recalled instances of redundant and inefficient phone calls, especially to larger households that had people with COVID-19 cases and their close contacts who had previously spoken to a case investigator.

Staff emphasized the importance of the *training* program, both at the time of hiring and during their role. The 2-week onboarding period consisted of instruction followed by job shadowing and a mentorship program. Many members described how this immediate support led to their success in their roles, especially because most were new to the field of public health. Continuing education offerings and refresher training were regularly available for staff.

All staff attended internal team *meetings* daily, at the start and end of each workday. Participants in each group described how these meetings were beneficial in providing structure and staying connected with others while working remotely. Staff also attended a weekly meeting in which a representative from another team involved in Maine's COVID-19 response was invited to discuss their team's current pandemic efforts, as well as agency-wide meetings. Many participants highlighted the benefit of these opportunities to communicate updates and maintain connections.

Recommendations from the team structure theme include:

- Identify key traits required for entry-level roles in contact tracing and *hire* staff based on these priorities; supplement these practices with strong *training* and continuing education programs for content knowledge.

- Thoughtfully establish a *leadership* team and provide coaching on *change management* practices in a dynamic environment.

- Develop and update *protocols* regularly, using regular *meetings* as a platform for implementation and group problem solving.

Theme IV: Team Environment

The team environment theme describes the psychosocial and interpersonal dynamics. Staff in all sessions emphasized the value they derived in the sense of *empowerment* they felt in their roles and *camaraderie* with their coworkers. Contact tracers and members of the leadership team noted the inclusive nature of meetings and interactions with others and how teammates promoted group successes. Staff reported reduced feelings of isolation or overwhelm, especially when working with challenging situations or heavy workloads. Many contact tracers noted stress associated with their jobs, particularly a sense of *pressure* in their performance. Staff sensed a pressure to work faster during times of surges and high call volumes. Challenges with *self-care* were widely reported as

feelings of burnout and fatigue, alongside difficulties with mental health. Some mental health resources were shared later in the pandemic, but access to health insurance benefits was not available to all staff. These challenges of stress and the need for self-care were also reported for frontline contact tracers in Jordan.[18]

Despite the associated stressors, participants emphasized the value of the *supportive environment* the team established and fostered. Staff noted the support they felt from meetings and supervisors, which supported greater confidence when advising close contacts. Others noted how receptive the leadership team was to receiving questions or feedback from staff and how new employees and different perspectives were welcomed. The groups also described a variety of *team activities*, such as a mentoring program that paired new staff with an experienced colleague, a peer support program, and opportunities for continuing education. Staff noted this *teamwork* as a significant strength of the group that contributed to the supportive network and resilient team structure. Despite the challenges associated with their work, staff reported an overall sense of collective gratitude and fulfillment. The importance of organizational and team support was also observed for volunteer and frontline medical contact tracers.[15,18]

Recommendations from the team environment theme include:

- Advocate for staff by providing resources and opportunities for *self-care*, *empowerment*, and wellness to manage *pressure* from the time of hire.

- Cultivate an inclusive and *supportive* work environment of shared success and resiliency, including *team activities* to promote *camaraderie* and *teamwork*.

Limitations

This study has several limitations. Participants self-selected into a session, potentially resulting in nonresponse bias. The agency required that group sessions be hosted during business hours and follow the SWOT framework, which may have created barriers to participation for some employees and consequent selection bias. Misclassification bias and cognitive bias, such as groupthink, could have occurred in the sessions.

Individual interviews could have reduced these effects. Also, participation in these sessions was limited to contracted staff. The inclusion of redeployed state employees and trained volunteers who established the contact tracing program could have contributed to a more complete evaluation. Lastly, researcher and response bias could have existed as both facilitators were involved in contact tracing efforts. This project adds to the literature on contact tracing and contributes to the conversation on best practices, rather than creates generalizable findings across all settings in which contact tracing is used.

CONCLUSION

This project illustrates how a small group of dedicated people created and sustained a successful and supportive network throughout the COVID-19 pandemic. The pandemic collective theme shows the value of creating external networks and partnerships in working toward a shared goal, using clear and consistent public messaging, and sharing best practices. The organizational placement theme illustrates how leveraging innovative technology, enhancing staff specialization, and supporting interdepartmental communications improve employee experience. The team structure theme describes the benefits of a strong leadership group and how a program can be sustained through trainings, meetings, and managing a changing environment. Lastly, the team environment theme details how empowerment, support, and teamwork can create a culture of resiliency.

When developing a contact tracing team, public health and health care leaders could use lessons learned from this experience. It would be beneficial for a national or international consensus to be built around best practices for contract tracing while groups retrospectively evaluate their response to the COVID-19 pandemic. Whether for use in a future pandemic or to augment disease intervention activities already in place, these best practices identified in Maine could start that conversation.

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