Sara Alert: An automated symptom monitoring tool for COVID-19 in 11 jurisdictions in the United States, June – August, 2021

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Abstract

Objectives: Health department personnel conduct daily active symptom monitoring for persons potentially exposed to SARS-CoV-2. This can be resource-intensive. Automation and digital tools can improve efficiency. We describe use of a digital tool, Sara Alert, for automated daily symptom monitoring across multiple public health jurisdictions.

Methods: Eleven of the 20 U.S. public health jurisdictions using Sara Alert provided average daily activity data during June 29 to August 30, 2021. Data elements included demographics, communication preferences, timeliness of symptom monitoring initiation, responsiveness to daily messages, and reports of symptoms.

Results: Participating jurisdictions served a U.S. population of over 22 million persons. Health department personnel used this digital tool to monitor more than 12,000 persons per day on average for COVID-19 symptoms. On average, monitoring began 3.9 days following last exposure and was conducted for an average of 5.7 days. Monitored persons were frequently < 18 years old (45%, 5,474/12,450) and preferred communication via text message (47%). Seventy-four percent of monitored persons responded to at least one daily automated symptom message.

Conclusions: In our geographically diverse sample, we found that use of an automated digital tool might improve public health capacity for daily symptom monitoring, allowing staff to focus their time on interventions for persons most at risk or in need of support. Future work should include identifying jurisdictional successes and challenges implementing digital tools; the effectiveness of digital tools in identifying symptomatic individuals, ensuring appropriate isolation, and testing to disrupt transmission; and impact on public health staff efficiency and program costs.

Keywords: COVID-19, digital health, contact tracing, public health practice, informatics, symptom assessment

Abbreviations: Code of Federal Regulations (CFR), coronavirus disease 2019 (COVID-19), standard deviations (SD)

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Introduction

Contact tracing, including active monitoring of identified contacts, is a key public health strategy to contain SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19) [1]. Close contacts of persons with COVID-19 are recommended to quarantine and monitor symptoms for 14 days following exposure; under certain conditions, options exist to end quarantine after 7–10 days [2]. Daily active monitoring of persons in quarantine can help improve compliance with quarantine and promptly identify symptomatic persons who may need clinical evaluation [3]. Effective monitoring must be initiated in a timely manner [4]. Daily monitoring is resource-intensive for state, tribal, local, and territorial public health staff [1, 4, 5]. Because of resource constraints, some health departments use technology, including digital tools, to automate aspects of daily monitoring. Digital tools can expedite initiation of symptom monitoring, streamline communication with monitored persons, and integrate data about their status into other public health information systems [6].

Sara Alert (MITRE Corporation, McLean, VA) is an open-source [7], web-based, automated symptom monitoring tool launched in April 2020 [8]. This digital tool can be used for daily symptom monitoring of persons with COVID-19, close contacts recently exposed to persons with COVID-19 [9], and other groups with potential exposure to SARS-CoV-2, including travelers [10], students in K-12 schools [11], and critical infrastructure employees [12]. Each public health jurisdiction determines how to incorporate Sara Alert into their contact tracing workflow [13]. The objective of this report is to describe the use of Sara Alert across multiple jurisdictions for monitoring for COVID-19 symptoms following exposure in terms of the persons monitored, timeliness of initiation in daily monitoring, responsiveness to daily messages, and reports of symptoms.

Methods

Automated Monitoring

Sara Alert can be used to monitor symptoms following confirmed or suspected exposure to SARS-CoV-2 (“exposure monitoring”) or following identification of a confirmed or probable case of COVID-19 (“isolation monitoring”). Each jurisdiction determines the population to be monitored via Sara Alert, and implements procedures to initiate monitoring, including securing permissions as appropriate. Monitored persons must have access to a telephone, mobile phone, or computer to interact with Sara Alert. Monitored persons are sent daily reminders to report symptoms during their monitoring period, via their preferred method (telephone call, text message, texted weblink, or emailed weblink). Monitored persons can respond directly, through a parent or other proxy, or a public health staff member can enter responses collected through follow-up contact. Public health staff are alerted to persons reporting potential COVID-19 symptoms or not responding to that day’s reminder [13]. Once monitoring is completed and a record is closed, potentially identifiable data are purged to maintain privacy.

Data Source

Jurisdictions actively using Sara Alert during summer 2021 were invited to participate in this study (N=20). Only those providing consent to share data are included. Data on persons refusing automated monitoring (opt-out) are not consistently available through Sara Alert.

Notable data elements and collection methods for this report are: (1) monitored persons or a designated proxy (e.g., parent or guardian) self-report date of birth (required), and sex, race, and ethnicity (all optional); (2) preferred mode of communication (required); (3) preferred contact time and primary language (optional); and (4) public health staff enter last date of exposure during enrollment when known, otherwise, date of last exposure defaults to date of enrollment into Sara Alert. Additional data elements details are available in the data dictionary [14].

Data Analysis

We extracted aggregate data on currently monitored persons daily from June 29 to August 30, 2021. To focus on monitoring of symptoms during a quarantine period following a confirmed or possible exposure (as opposed to continuous monitoring of persons with ongoing exposure), we limited our analysis to jurisdictions where automated monitoring was conducted for a mean of ≤ 14 days over the duration of our data collection period, aligning with recommended duration of quarantine for close contacts following SARS-CoV-2 exposure at the time of analysis.

We determined the number of monitored persons, summarized their demographic characteristics, calculated symptom monitoring timeliness initiation, examined responsiveness to daily messages, and summarized use of the digital tool to report potential COVID-19 symptoms. We totaled categorical data (sex, race, ethnicity, age group, and contact preferences) across jurisdictions and calculated percentages among all persons monitored. We weighted continuous data by the proportion of persons contributed by each jurisdiction and calculated weighted means and standard deviations (SD).

This non-research activity was reviewed by CDC and conducted consistent with applicable federal law (45 CFR part 46 did not apply) and CDC policy.

Results

Of the 20 jurisdictions invited to participate: five were excluded because automated monitoring was conducted for a mean >14 days; three did not respond by consent deadline; and one declined to participate. Eleven jurisdictions (5 state, 1 territorial, 5 local) contributed to this analysis: Arkansas; Commonwealth of the Northern Mariana Islands; Weld County, Colorado; Berrien County, Michigan; Clay County, Missouri; Jackson County, Missouri; Montana; Vermont; Virginia; Washington; and Teton County, Wyoming. The population within the 11 participating jurisdictions is 22,369,182 [15]. In these jurisdictions, each day on average, public health staff initiated automated monitoring of 1,318 persons, monitored 12,450 persons automatically, and sent 70,218 automated messages.

Among 11,165 persons with sex reported, the majority were female (5,823, 52%). Nearly half (5,474, 45%) of persons monitored were aged ≤ 18 years (Table 1). Race and ethnicity were not available for 64% and 30% of monitored persons, respectively. Monitoring preferences were to be contacted via text message (47%), in the morning from 8:00-12:00 AM (51%). Among 10,616 persons with a recorded self-reported primary language, their preference was predominately English (10,350, 97%%).

Table 1. **Demographic characteristics and communication preferences among persons monitored for COVID-19 symptoms using an automated symptom monitoring tool (Sara Alert), 11 U.S. public health jurisdictions, June 29-August 30, 2021 (N=12,450)**

Characteristic	**Monitored persons, No. (Percent)[a]**
Sex	
Male	5,342 (43%)
Female	5,823 (47%)
Unknown	33 (<1%)
Not reported	1,252 (10%)
Race	
White	3,316 (27%)
Black or African American	917 (7%)
American Indian or Alaska Native	15 (<1%)
Asian	146 (1%)
Native Hawaiian or Pacific Islander	10 (<1%)
Multiple races	111 (1%)
Not reported	7,935 (64%)
Ethnicity	
Hispanic or Latino	698 (6%)
Non-Hispanic or [not] Latino	7,879 (63%)
Not reported	3,735 (30%)
Age[b] group, years	

≤ 18	5,474 (45%)
19-29	1,540 (13%)
30-39	1,604 (13%)
40-49	1,426 (12%)
50-59	1,044 (9%)
60-69	652 (5%)
70-79	299 (2%)
≥ 80	100 (1%)
Probable miscalculation[b]	312 (3%)
Preferred mode of communication from public health jurisdiction	
Telephone call	833 (7%)
Text message	5,900 (47%)
Texted weblink	4,275 (34%)
Emailed weblink	1,442 (12%)
Preferred contact time	
Morning (8:00 to 12:00)	6,317 (51%)
Afternoon (12:00 to 16:00)	3,226 (26%)
Evening (16:00 to 20:00)	1,111 (9%)
Not reported	1,796 (14%)
Primary language	
English	10,350 (83%)
Spanish	247 (2%)
Other[c]	19 (<1%)
Not reported	1,832 (15%)

[a]Numbers and percentages may not sum to 100 due to rounding, since values are daily averages across the study period.

[b]Sara Alert calculates age as the difference between date of birth and the current date. Outlier records with calculated age > 110 years are flagged as probable miscalculations.

[c]As of August 2021, Sara Alert also supports French, Somali, and Puerto Rican Spanish messaging from the health department.

Public health staff-initiated symptom monitoring in Sara Alert a weighted mean of 3.9 days (SD = 2.8; range 0-7.8) after last exposure, and persons were monitored for a weighted mean of 5.7 days (SD = 5.8; range 1.7-8.3). Within an individual's monitoring period, 49% (6,159/12,450) responded to every automated message, and 74% (9,242/12,450) responded to at least one automated message. Of those responding, 86% of responses were submitted directly via the digital tool (5,281/6,159 for every message; 7,944/9,242 for at least one message). Of the 51% (6,291/12,450) who did not respond to every automated message sent during their monitoring period, a weighted mean of 3.6 (SD = 0.7; range 1.4-6.7) consecutive days passed without response. Eleven percent (1,313/12,450) of monitored persons reported potential COVID-19 symptoms [16] during their monitoring period.

Discussion

Public health staff in 11 jurisdictions used Sara Alert to automate symptom monitoring for an average of more than 12,000 persons per day from June 29 to August 30, 2021. The high number of automated messages sent, and large number of individuals engaging directly with the tool suggests the potential benefit of digital tools to increase public health staff capacity and efficiency for symptom monitoring beyond what is achievable through traditional, non-automated methods.

Our findings build upon previously published experience with Sara Alert from Maine [9]. Our study incorporates a broader geographic area and monitoring experiences 18 months after the World Health Organization's declaration of the COVID-19 pandemic. The jurisdictions included in this analysis have a combined population of more than 22 million persons and include areas of higher overall COVID-19 incidence than Maine. Both the report from Maine and our study explore use of the tool during a time when COVID-19 case counts were increasing towards a single day peak, namely the July 2020 peak for Maine and September 2021 peak for our study [17]. Collectively, our findings suggest that use of a digital tool for symptom monitoring has utility, both for public health staff and monitored persons, throughout the duration of the COVID-19 pandemic and across a broad geographic area.

Uniquely, our study contributes data on engagement by monitored persons with a digital tool for symptom reporting. Only 49% of monitored persons responded to every automated message. We think this finding reflects the difficulty in getting complete monitoring data, despite using a digital tool. However, 74% of monitored persons responded to at least one automated message. This number is higher than what has been reported in other studies examining the use of automated monitoring tools for other infectious diseases [18, 19]. The majority persons monitored that responded to automated messages did so directly via Sara Alert; suggesting that persons monitored accepted use of a digital tool to report symptoms.

Interestingly, we found that 45% of monitored persons were 18 years of age or younger. Considering trends in case counts during July and August, 2021, where the age groups with the highest incidence of cases were among children or persons of reproductive age [17], combined with lower vaccination coverage in persons <18 [17, 20], it is plausible that a large portion of close contacts requiring symptom monitoring by public health departments would be 18 years of age or younger. Additionally, K-12 schools resumed in-person classes in some jurisdictions during our study period, potentially reflecting increased exposures for children attending school [21].

Limitations

A key limitation of this report is the fact that we are unable to document the reason each monitored person was enrolled in Sara Alert, and this report likely includes persons not identified as close contacts following a SARS-CoV-2 exposure. The populations eligible for automated symptom monitoring via Sara Alert shifted over time due to jurisdictional changes in policy, community transmission levels, and resource availability [9]. Based on their evolving COVID-19 response needs, some jurisdictions primarily used Sara Alert for symptom monitoring of close contacts, while others used it to monitor travelers entering their jurisdiction or persons with ongoing exposures such as critical infrastructure employees. Information to differentiate between these uses is not captured consistently across jurisdictions. However, persons were enrolled in Sara Alert based on health department policies and priorities, and as such our findings can provide relevant insights regarding the acceptability of automated symptom monitoring for a range of purposes.

This report is subject to at least three additional limitations. First, as our analysis period represents a snapshot of the COVID-19 pandemic after initiation of vaccination of persons 12 years and older and during a time of increasing but non-peak case counts, findings may not be generalizable beyond similar epidemiologic settings. Second, our findings are neither representative of all jurisdictions using Sara Alert nor of the United States. Generalizability to the U.S. population is also limited by available data on race and ethnicity of monitored persons and overrepresentation of persons aged 18 years and younger compared with the U.S. population (45% v. 22% in 2019 U.S. Census). Third, because deidentified aggregate data extracted from Sara Alert were used in this analysis, we were not able to link to other data sources (e.g., laboratory results, case surveillance) or verify values (e.g., last date of exposure, which might be biased toward zero because of system defaults).

Conclusion

Numerous digital tools emerged to support contact tracing during the COVID-19 response [6], but limited data describing their use are available. This report shows that incorporating this digital tool into public health workflows might improve public health capacity for daily symptom monitoring, allowing staff to focus their time on interventions for persons most at risk or in need of support. Evaluation priorities for future work include implementation lessons learned, challenges and successes; the effectiveness of digital tools compared to traditional non-automated monitoring methods in identifying symptomatic individuals, ensuring appropriate isolation, and testing to disrupt transmission chains; and how these digital tools helped health departments use human resources more efficiently, resulting in public health cost savings.

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Competing Interests

No Competing Interests.

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