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Original article

# Assessment of contact tracing for COVID-19 among people experiencing homelessness, Salt Lake County Health Department, March–May 2020

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PEH = people experiencing homelessness
RT-PCR= reverse transcription-polymerase chain reaction

ABSTRACT

*Purpose:* Contact tracing is intended to reduce the spread of coronavirus disease 2019 (COVID-19), but it is difficult to conduct among people who live in congregate settings, including people experiencing homelessness (PEH). This analysis compares person-based contact tracing among two populations in Salt Lake County, Utah, from March–May 2020.

*Methods:* All laboratory-confirmed positive cases among PEH ($n$ = 169) and documented in Utah's surveillance system were included in this analysis. The general population comparison group ($n$ = 163) were systematically selected from all laboratory-confirmed cases identified during the same period.

*Results:* Ninety-three PEH cases (55%) were interviewed compared to 163 (100%) cases among the general population ($P$ < .0001). PEH were more likely to be lost to follow-up at end of isolation (14.2%) versus the general population (0%; $P$-value < .0001) and provided fewer contacts per case (0.3) than the general population (4.7) ($P$-value < .0001). Contacts of PEH were more often unreachable (13.0% vs. 7.1%; $P$-value < .0001).

*Conclusions:* These findings suggest that contact tracing among PEH should include a location-based approach, along with a person-based approach when resources allow, due to challenges in identifying, locating, and reaching cases among PEH and their contacts through person-based contact tracing efforts alone.

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## Introduction

Contact tracing is an essential public health intervention used to reduce transmission of serious infectious disease, including SARS-CoV-2, the virus that causes coronavirus disease 2019 (COVID-19) [1]. Person-based contact tracing involves interviewing individuals with COVID-19 to ask about family members, friends, co-workers, and other individuals with whom they might have had contact while infectious [1]. This process prevents further transmission of disease by separating people who possibly have an infectious disease from people who do not [2]. In congregate set-

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tings such as homeless service sites and encampments, crowding, mixing of clients and staff, and other constraints may limit the effectiveness of person-based contact tracing [3]. During a COVID-19 outbreak in San Francisco, Imbert et al. reported that solely focusing on bedmates within six feet of cases and self-reported contacts was of limited utility [4]. However, the outcomes of person-based contact tracing among PEH during COVID-19 have not yet been described.

During March–May 2020, Salt Lake County Health Department carried out comprehensive person-based contact tracing of all laboratory-confirmed COVID-19 cases to identify their close contacts. This provided an opportunity to evaluate person-based contact tracing data from cases among PEH compared to the general population. This analysis aims to: 1) describe case interviews and contact tracing for cases among PEH, 2) compare the yield (number of contacts per case identified) among PEH to the yield among the general population, and 3) describe challenges in contacting and following up with cases among PEH throughout an investigation.

## Material and methods

### *Contact tracing methodology used by Salt Lake County Health Department*

During March–May 2020, health department staff used person-based contact tracing to identify close contacts of all COVID-19 cases. A confirmed COVID-19 case was defined as detection of SARS-CoV-2 RNA by real-time reverse transcription polymerase chain reaction (RT-PCR). During this timeframe, close contacts were defined as anyone within six feet of a laboratory-confirmed case for at least 15 minutes during the presumed infectious period of the case (defined as $\leq$2 days prior to the case's symptom onset or two days prior to test collection, if asymptomatic, up until the case began strict isolation or until the contact's last exposure to the case) [1].

In Utah, components of contact tracing efforts included collecting demographic data, asking about close contacts, providing quarantine/isolation recommendations, notifying businesses or people who might have been exposed to confirmed cases, and distributing resources such as information on quarantine/isolation housing and medical care (Fields, manuscript in preparation). Contact tracers entered demographic and contact data into the Utah National Electronic Disease Surveillance System (UT-NEDSS, or EpiTrax) for linkage and tracking.

### *Case identification*

All laboratory-confirmed positive cases among PEH during March–May 2020 and all close contacts listed by these individuals and documented in EpiTrax were included in this analysis. Cases among PEH were identified through a secure quarantine/isolation spreadsheet that listed individuals who needed housing assistance for quarantine/isolation, and also specified people experiencing homelessness, which could include individuals from shelters, encampments or who otherwise were without housing. Nursing staff used the spreadsheet to track medical and epidemiological information on each person from testing date to admission and discharge (if positive) from the quarantine/isolation facility. Positive SARS-CoV-2 test results were confirmed in EpiTrax. Most cases among PEH came from a men's shelter that had an outbreak in April. (One of these cases and related contacts were excluded because contacts were exclusively identified using a location-based method.) The general population comparison group were part of a separate contact tracing evaluation in Salt Lake County and were systematically selected from all laboratory-confirmed cases identified during the same period ($n$ = 2757) (Fields, manuscript in preparation). From this sample, a daily line list was used to ensure that 10 individuals were selected per day. This resulted in an approximately 1:1 ratio of PEH to general population cases.

In March, state guidelines prioritized testing symptomatic close contacts of confirmed COVID-19 cases. Starting in June, testing was available for anyone wanting testing and approved by their provider. However, PEH in congregate settings could be tested even if they were asymptomatic, which was based on each shelter's protocol.

### *Data management and analysis*

EpiTrax surveillance data were extracted for laboratory-confirmed cases and all reported close contacts. Demographics, SARS-CoV-2 testing status and results, interview status, symptoms (reported at the interview or obtained by a shelter worker on the investigation form for PEH), co-morbidities, location at time of diagnosis, and pertinent information from investigation notes were analyzed for each case. Contacts were analyzed by their SARS-CoV-2 testing status, positive test results, and if they could be reached for interview.

For cases in the general population, contact tracers conducted interviews by phone. For cases among PEH, an investigator would request designated staff to visit the quarantine/isolation facilities to interview cases using a standard investigation form. Visits were made daily, and if an individual could not be found, repeat visits occurred over the next 4–5 days with up to four attempts to locate the individual. Initially, these interviews were done in person, and later by using pre-paid cell phones or walkie talkies at the facilities.

To compare contact tracing between PEH and the general population, the number of contacts identified and traced (median and range), number of contacts traced per case, percentage of cases interviewed and that received follow up, and test results of close contacts were analyzed.

Contact disposition (interviewed/not interviewed) was compared between groups. Reasons cases were not interviewed included inability to be contacted or located by staff visiting the shelter for interviews, inability to be reached by phone, and refusal to participate. Loss to follow-up was documented for cases that could not be reached at the end of the isolation period. When cases could not be interviewed, contact tracers relied on nurses' notes, medical records, and the quarantine/isolation spreadsheet to complete the investigation.

Variables for PEH and the general population were compared using $X^2$ tests and Student's $t$-test and statistical significance was defined by a $P$-value $< .05$. SAS 9.4 was used for data management and analysis (SAS Institute Inc., Cary, NC).

### *Ethical considerations*

This activity was reviewed by the Centers for Disease Control and Prevention (CDC) and was conducted consistent with applicable federal law and CDC policy.[1]

## Results

### *Demographics and clinical characteristics of cases among PEH and the general population*

A total of 169 laboratory-confirmed cases among PEH and 163 from the general population were included in the analysis. Of the 169 cases among PEH, the median age was 48 years (range: 4–89); 159 (94.1%) were male. Most were white (107 [63.3%]) and non-Hispanic (111 [65.7%]). Twenty-three (13.6%) were hospitalized

**Table 1**
Demographics and clinical characteristics of COVID-19 cases, Salt Lake County, Utah, March–May 2020

| | People experiencing homelessness $N = 169$ | | General population $N = 163$ | |
|---|---|---|---|---|
| Demographics | | | | |
| Median age in years (range) | 48 (4–89) | 42 (15–93) | | |
| | N | % | N | % |
| Gender | | | | |
| Male | 159 | 94.1 | 76 | 46.6 |
| Female | 10 | 5.9 | 87 | 53.4 |
| Race | | | | |
| White | 107 | 63.3 | 122 | 74.8 |
| African American or Black | 20 | 11.8 | 4 | 2.5 |
| Asian | 1 | 0.6 | 5 | 3.1 |
| American Indian/Alaska native | 5 | 3.0 | 1 | 0.6 |
| Native Hawaiian/other Pacific Islander | 4 | 2.4 | 4 | 2.5 |
| Other* | 9 | 5.3 | 24 | 14.7 |
| Unknown | 23 | 13.6 | 3 | 1.8 |
| Ethnicity | | | | |
| Hispanic/Latino | 35 | 20.7 | 65 | 39.9 |
| Non-Hispanic/Latino | 111 | 65.7 | 89 | 54.6 |
| Unknown | 23 | 13.6 | 9 | 5.5 |
| Comorbidities (reported at least 1) | | | | |
| Yes | 11 | 6.5 | 39 | 23.9 |
| No | 21 | 12.4 | 61 | 37.4 |
| Unknown | 137 | 81.1 | 63 | 38.7 |
| Smoking status | | | | |
| Current | 10 | 5.9 | 4 | 2.5 |
| Former | 0 | 0 | 8 | 4.9 |
| Never | 21 | 12.4 | 71 | 43.6 |
| Unknown | 138 | 81.7 | 80 | 49.1 |
| Symptoms | | | | |
| Yes | 65 | 38.5 | 162 | 99.4 |
| No | 62 | 36.7 | 1 | 0.6 |
| Unknown | 42 | 24.9 | 0 | 0 |
| Symptoms Documented (if Yes)† | | | | |
| Cough | 39 | 60.0 | 116 | 71.6 |
| Shortness of breath | 23 | 35.4 | 72 | 44.4 |
| Muscle aches | 19 | 29.2 | 93 | 57.4 |
| Chills | 17 | 26.2 | 81 | 50.0 |
| Subjective fever (felt feverish) | 16 | 24.6 | 88 | 54.3 |
| Runny nose | 16 | 24.6 | 53 | 32.7 |
| Sore throat | 14 | 21.5 | 63 | 38.9 |
| Headache | 13 | 20.0 | 88 | 54.3 |
| Nausea or vomiting | 13 | 20.0 | 38 | 23.5 |
| Diarrhea | 10 | 15.4 | 45 | 27.8 |
| Fever>100.4 (38C) | 9 | 13.8 | 76 | 46.9 |
| Loss of taste | 9 | 13.8 | 58 | 35.8 |
| Loss of smell | 8 | 12.3 | 62 | 38.3 |
| Abdominal pain | 5 | 7.7 | 21 | 13.0 |
| Other | 21 | 32.3 | 58 | 35.8 |
| Hospitalized | | | | |
| Yes | 23 | 13.6 | 17 | 10.4 |
| Symptomatic | 19 | 29.2 | 17 | 10.5 |
| No | 145 | 85.8 | 146 | 89.6 |
| Unknown | 1 | 0.6 | 0 | 0 |
| Died | | | | |
| Yes | 2 | 1.2 | 2 | 1.2 |
| Symptomatic | 2 | 3.1 | 2 | 1.2 |
| No | 167 | 98.8 | 161 | 98.8 |

Total for column is not 100 percent because of multiple choices.
* Other is an option in EpiTrax, however, there is not an associated specify field.

and two died (1.2%). While symptom status was known for all general population cases, it was unknown for 42 (24.9%) of the cases among PEH. Of the 127 individuals with available information on symptom status, 65 (51.2%) were symptomatic. Comorbidities were unknown for 137 (81.1%) (Table 1). Most PEH were from Shelter A (142 [84.0%]), with the remaining cases from seven additional locations (Table 2).

Of the 163 cases in the general population, the median age was 42 years (range: 15–93). Almost half (76 [46.6%]) were male. Most were white (122 [74.8%]) and non-Hispanic (89 [54.6%]); 17 were hospitalized (10.4%) and two died (1.2%). Almost all (162 [99.4%]) were symptomatic and 24% reported at least one co-morbidity (Table 1).

**Table 2**
Location of people experiencing homelessness at the time of their COVID-19 diagnosis, Salt Lake County, Utah, March–May 2020

| Shelter | $N$ = Total (%) |
|---|---|
| Shelter A | 142 (84.0%) |
| Shelter B | 5 (3.0%) |
| Shelter C | 10 (5.9%) |
| Shelter D | 3 (1.8%) |
| Shelter E | 2 (1.2%) |
| Other | 7 (4.1%) |
| Total | 169 |

**Table 3**
Results of COVID-19 contact tracing for cases among people experiencing homelessness compared with cases among the general population, Salt Lake County, Utah, March–May 2020

| | People experiencing homelessness | | General population | | *P*-value* |
|---|---|---|---|---|---|
| | N | % | N | % | |
| CASES | 169 | | 163 | | |
| Interview outcome | | | | | |
| Interviewed | 93 | 55.0 | 163 | 100 | <.0001 |
| Not Interviewed-Unable to locate or contact | 73 | 43.2 | 0 | 0 | |
| Not Interviewed-Refused to participate | 3 | 1.8 | 0 | 0 | |
| Lost to follow-up (unable to locate at end of isolation) | | | | | |
| Yes | 24 | 14.2 | 0 | 0 | <.0001 |
| No | 145 | 85.8 | 163 | 100 | |
| Provided contacts | 20 | 11.8 | 153 | 93.9 | <.0001 |
| Did not provide contacts† | 149 | 88.2 | 10 | 6.1 | |
| Symptomatic, reported contacts‡ | 12 | 18.5 | – | – | .16 |
| Asymptomatic, reported contacts‡ | 6 | 9.7 | – | – | |
| CONTACTS | 50 | | 758 | | |
| *Contact Tracing Yield* | | | | | |
| Number of contacts for each case: Median (Range) | 0 (0–7) | | 4 (0–24) | | <.0001 |
| Number of contacts per case§ | 0.3 | | 4.7 | | |
| Contact is Family/Household member of case | | | | | |
| Yes | 16 | 32.0 | 444 | 58.6 | .01 |
| No | 34 | 68.0 | 314 | 41.4 | |
| Contacts experiencing homelessness | 19 | 38.0 | 3 | 0.4 | |
| Unable to reach (not enough contact information) | 13 | 26.0 | 54 | 7.1 | <.0001 |
| *Testing* | | | | | |
| Contacts tested | | | | | |
| Yes | 31 | 62.0 | 322 | 42.5 | <.0001 |
| No | 9 | 18.0 | 391 | 51.6 | |
| Unknown | 10 | 20.0 | 45 | 5.9 | |
| Percent SARS-CoV-2 test positivity among contacts who had testing done | | | | | |
| Positive | 8 | 25.8 | 167 | 51.9 | .006 |
| Symptomatic | 3 | 37.5 | 155 | 92.8 | <.0001 |
| Negative | 23 | 74.2 | 155 | 48.1 | |
| Percent positivity among total contacts | 8 | 16.0 | 167 | 22.0 | .3 |

* *P*-value derived from a $X^2$ (for categorical variables) and a Student's *t*-test (for continuous variables) in which PEH was compared to the general population comparison group.

† Possible reasons for not reporting contacts include that the case was not interviewed, the individual did not feel comfortable reporting contacts, they did not know the contact's identifying information, or that they did not have any contacts to report.

‡ Excluding unknown.

§ The number of contacts per case was calculated by dividing the number of contacts among PEH by the number of cases among PEH ($n = 169$) and the number of contacts among the general population by the number of cases among the general population ($n = 163$).

Between cases among PEH and general population who were symptomatic, there were no significant differences in those who died. Among the symptomatic individuals, 19 (29.2%) PEH were hospitalized versus 17 (10.5%) in the general population group (*P*-value < .05) (Table 1).

*Identification and follow-up of contacts*

For all observed cases among PEH, 93 (55.0%) were interviewed, 73 (43.2%) were unable to be located/contacted, and three (1.8%) refused to participate. All general population cases were interviewed. Following the isolation period, 24 (14.2%) cases among PEH were lost to follow-up compared to 0% of the general population cases ($P < .0001$).

Among PEH cases, 50 contacts were reported. Among 93 PEH cases who were interviewed, most ($n = 76$, 81.7%) reported no contacts; 17 (18.3%) individuals reported 43 of these contacts. The other seven contacts were associated with three cases who were not interviewed but had contacts listed who were family members, co-workers, or provided services to the individual. Although there were only a small number of women experiencing homelessness with COVID-19, 4 of 10 (40%) were interviewed and reported contacts, and 3 of 10 (30%) had contacts linked to them although they were not interviewed. Only 13 of 159 (8.2%) men experiencing homelessness reported contacts (data not shown).

In comparison, among 163 general population cases, 153 (93.9%) people reported 758 contacts (*P*-value < .0001) (Table 3). Cases among PEH reported 0.3 contacts per case versus 4.7 contacts per case for the general population ($P < .0001$) (Table 3). Of cases among PEH who reported contacts, differences were not statistically significant between symptomatic cases (18.5%) reporting contacts compared to asymptomatic cases (9.7%) (*P*-value = .16). A greater proportion of PEH contacts had incomplete or inaccurate contact information ($n = 13$; 26.0%) versus contacts of cases in the general population ($n = 54$; 7.1%) ($P < .0001$), which made locating them more difficult. Among contacts of PEH cases, 16 (32.0%) were family members compared to 444 (58.6%) general population contacts (*P*-value = .01). Additionally, for PEH, 19 (38.0%) contacts were also experiencing homelessness. Among the general population, two people worked in homeless shelters.

SARS-CoV-2 laboratory-testing was completed for 31 (62.0%) PEH contacts and 322 (42.5%) general population contacts (*P*-value < .0001). Eight (16.0%) of the 50 total PEH contacts and 167 (22.0%) of the 758 total general population contacts were positive ($P = .3$) (Table 3). Among contacts who tested positive, more contacts of the general population were symptomatic (92.8%) compared to contacts of PEH (37.5%) (*P*-value < .0001).

## Discussion

Person-based contact tracing is a common method of contact tracing in the United States. In our study, we found that person-based contact tracing yielded significantly fewer contacts for cases among PEH than for cases in the general population. This analysis provides some details regarding how person-based contact tracing

differs between people experiencing homelessness versus a general population comparison group during March–May 2020.

Contact tracers were less likely to find and interview cases among PEH compared with cases in the general population. There are many potential reasons for this. In Salt Lake County, although a staff member would go to quarantine/isolation shelters to conduct interviews, they were often unable to find the case. It was also difficult for contact tracers to reach these individuals by phone, as they may not have a phone, may change their number, or may not answer.

PEH also reported fewer contacts than cases in the general population. This may be because the individuals had fewer contacts, did not know with whom they were in close contact, were unwilling to provide names, or had comorbid conditions, including mental illness, that may have affected memory or cognition [5]. An unwillingness to provide contact names could be due to lack of trust of public health or medical professionals [6]. PEH also might not know with whom they were in close contact, especially if they spent time in a congregate shelter with high turnover. During an outbreak in San Francisco, Imbert et al. found that person-based contact tracing among PEH yielded vague close contact descriptions [4]. Consistent with these findings, in our analysis, cases often did not provide or know complete names, addresses, or phone numbers, resulting in contacts who were unreachable.

Since COVID-19 can spread by pre-symptomatic or asymptomatic individuals, case investigation and contact tracing activities should be thorough and occur as quickly as possible if they are to be useful [2], especially among individuals in congregate settings expected to have more close contacts, including the PEH population. One study conducted prior to COVID-19 found that in a hypothetical communicable disease outbreak, contact tracing after a single week became difficult due to the challenge of locating individuals who had left the shelter system [7]. Additionally, given the increase in the number of contacts of persons as they move between different shelters, limiting movement between shelters is strongly encouraged when a case in a facility is identified during an outbreak [7, 8, 9]. Limiting movement may help reduce the large number of PEH who could not be located or contacted. Leveraging partnerships that provide services to shelters, routinely collecting and maintaining records of shelter residents, providing educational interventions, and implementing administrative controls and policy changes are among approaches taken to facilitate contact investigations and reduce the severity of tuberculosis outbreaks [10, 11, 12]. Similar approaches can be adapted for COVID-19. Further, with RT-PCR testing there is a time lag between testing and receiving results, during which infected people can continue to spread the virus. Residents and staff in congregate settings should be prioritized for expanded screening testing with the use of antigen tests, where rapid testing can be implemented to immediately isolate infected persons (asymptomatic and symptomatic) [13]. For this population, antigen testing may also allow for more rapid implementation of contact tracing to identify close contacts, although some antigen test results will need verification by molecular testing.

CDC recommends location-based contact tracing for use in homeless shelters and encampments [3]. This method is used when identifying contacts by interviewing cases is not possible. This involves interviewing people with COVID-19 about locations where they have been, starting 48 hours before their symptoms began or before the date their specimen was collected if they are asymptomatic [3]. Collecting location-based information at the time of testing may help facilitate identifying contacts if follow-up is not possible once a test returns positive. Contact tracers can also work with homeless service providers to use the Homeless Management Information System [14] and other data collection systems to identify where the person with confirmed COVID-19 utilized homeless services during their infectious period. For other sites that have been identified, investigations and facility-wide testing should be conducted if resources are available. Additional contacts may be located using bed maps or identifying social groups or coworkers [8]. In Salt Lake County, contact tracers reviewed social services records and medical records to obtain information about cases who could not be interviewed, and using this methodology identified an additional seven contacts.

Findings from a large COVID-19 outbreak in Boston early in the pandemic suggest that as the number of COVID-19 cases among PEH quickly increases, contact tracing efforts during an outbreak could be shifted from a primarily person-based focus to a location-based focus with the assumption of universal exposure across large congregate living environments [15]. Findings from a COVID-19 outbreak among PEH in San Diego goes a step further to suggest that preemptive testing prior to an outbreak, in conjunction with other containment measures, may avoid large outbreaks among PEH [16]. Timely surveillance and contact tracing could then be used to identify at risk individuals early [17]. Additionally, a contact tracing study among PEH tuberculosis patients in New York City found that homelessness independently predicted the likelihood of having no contacts identified, with their findings supporting location-based contact tracing and prompt tracing among PEH [5]. In Salt Lake County, the largest proportion of cases among PEH during this timeframe resulted from an outbreak at Shelter A. Although location-based contact tracing was the primary method used during this outbreak, person-based contact tracing resulted in the identification of some contacts that would not have been identified by location-based contact tracing alone. Although the yield from efforts to identify contacts of cases among PEH is lower than among the general population, our findings suggest that, if time and resources are available, an effort should be made to identify close contacts of any COVID-19 case, as almost 20% of interviewed PEH cases reported contacts.

For contacts identified by person-based contact tracing, we calculated percent testing positive for SARS-CoV-2. Overall, a higher percentage of contacts of cases among PEH received testing than contacts of general population cases. Of those who were tested for SARS-CoV-2, contacts of the general population tested positive more than twice as frequently as contacts of PEH. Two potential reasons for this are that the general population contacts were more likely to seek testing only if symptomatic and were more likely to have reported household contacts where transmission rates are known to be higher for COVID-19 [17,18].

This analysis has several limitations. Contact tracing findings from Salt Lake County may not be generalized to other jurisdictions and may not be representative of the current situation given that this analysis describes contact tracing early in the pandemic. For cases among PEH, more complete data were available for cases who were interviewed (and therefore also asked about contacts). Even among PEH who were interviewed, reported symptoms and comorbidities may not be as complete as for the general population and were more often recorded as unknown. There was no detailed information to understand why cases among PEH reported fewer contacts. It is possible that a difference in reporting contacts between symptomatic and asymptomatic cases could explain the differences in reporting between PEH and the general population comparison group; however, the number of contacts for PEH cases with symptoms was similar to PEH cases without symptoms. Only a small number of cases among women experiencing homelessness were identified and this limits our understanding of the role of sex and gender in participating in contact tracing and specific interventions that may be needed for this population. There may be cases among PEH not documented, as there are PEH who live outside of shelters and resource centers. Finally, as the quarantine and/or isolation spreadsheets contain both PEH and commu-

nity members, this could complicate identifying all cases among PEH during this timeframe.

## Conclusions

These findings provide baseline data related to contact tracing for PEH who had COVID-19 during March–May 2020. They also highlight the importance of obtaining comprehensive data for PEH using a focused approach and may inform the development of CDC guidance for this population. Only about half of cases among PEH were interviewed and their data are not as complete as for cases from the general population; therefore, finding ways to conduct a thorough interview and streamlining communication among the interviewer, contact tracer, and other staff, may alleviate some of the challenges associated with conducting contact tracing in congregate settings such as shelters. Future studies are needed to better understand what motivates people experiencing homelessness to participate in contact tracing and provide contacts, as well as any differences that factor into this decision, such as gender and race/ethnicity. These findings suggest that contact tracing among PEH should include a location-based approach, along with a person-based approach when resources allow, due to challenges in identifying, locating, and reaching cases among PEH and their contacts through person-based contact tracing efforts alone.

[1] See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

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