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Identifying Critical Psychological Characteristics Related to Successful Performance as a Contact Tracer: Results of an Initial Job Analysis

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COVID-19, contact tracing, job analysis

ABSTRACT

The COVID-19 pandemic highlighted the need for a massive workforce of contact tracers to help end the global pandemic. Rapidly accelerating the recruitment, selection, and training of contact tracers proved to be difficult though, due in part to the lack of a valid, structured, and systematic approach to hiring and training contact tracers. This demonstration presents the results of the first steps in developing a systematic selection and training program: a combined (worker- and task-oriented) job analysis of the contact tracer job. Using archival records and structured interviews with 15 subject matter experts, we identified 25 unique characteristics related to successful performance as a contact tracer. We also identify which KSAOs are needed as part of selection versus those that can be trained and develop predictive hypotheses for each. Results jump-start the process of developing a systematic approach to selecting and training contact tracers to help navigate current and future public health emergencies.

Problem Statement

Contact tracing is a powerful method for collecting information about individuals who may have interacted with a person infected with a communicable disease to take necessary steps to contain further spread. Although not a new job (Mooney, 2020), the COVID-19 pandemic highlighted the importance of and need for this role to slow the spread of COVID-19, end the pandemic, and safely reopen schools and businesses. Indeed, early in the pandemic, public health officials called for building a massive workforce of contact tracers to help slow the spread of this highly communicable disease—a "contact tracer army" (Watson et al., 2020). Although the number of contact tracers has changed as the landscape for the COVID-19 public health crisis has shifted, this work remains critical to manage the spread of communicable diseases moving forward.

There are myriad reasons for maintaining a robust contact tracing workforce. First, case identification and tracing are central to limiting disease spread, not only for COVID-19 but also other communicable diseases (Mooney, 2020). Researchers estimate that at least 80% of infected individuals need to be contacted, and 100% of the infected persons' contacts need to be compliant with contact tracing instructions to reduce disease spread (Kretzchmar et al., 2020). Given the rate of disease spread for COVID-19, a large number of contact tracers were originally called for to contact the number of infected individuals and the people with whom they were in contact in order to ease pandem-

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ic restrictions (Watson et al., 2020). Second, although the availability and effectiveness of vaccines is paramount, their development and distribution take time and face logistic and other hurdles. For example, COVID-19 vaccine distribution was slower than needed in the U.S. (e.g., King, 2021; Simmons-Duffin & Huang, 2021) and globally (e.g., Frayer, 2021; Schmitz, 2021), and vaccine hesitancy remains prevalent (Chou & Budenz, 2020). Additionally, breakthrough cases occur even among the fully vaccinated (CDC, 2021), and as diseases spread and mutate, new variants emerge that may be more contagious and vaccine resistant (Doucleff, 2021). As such, contact tracing remains an important prevention method for the spread of communicable diseases (Herman, 2021).

Third, although technological innovations can be very valuable in contact tracing efforts, the most successful mitigation of infectious disease spread is likely to include a combination of technology and human contact tracing. There are barriers to solely relying on technological innovations like smartphone applications for contact tracing, such as lack of access to the applications among older and poorer community members (Soltani et al., 2020; Vaugh, 2020), potential technology failures when relying on systems like Bluetooth (Almagor & Picascia, 2020; Soltani et al., 2020), and potential for counterproductive outcomes if not part of a comprehensive testing and tracing program (e.g., inadequate follow-up information/instructions after notifications of exposure; Almagor & Picascia, 2020). Moreover, these applications can be less successful due to false positive and false negative test results, the potential for notification fatigue (Soltani et al., 2020), the fact that different localities use different applications (Vaugh, 2020), and general distrust of the security and privacy of the data (Soltani et al., 2020).

Even as the landscape of COVID-19 changes, contact tracing will remain critical to public health emergency responses in the future. Indeed, public health experts expect the COVID-19 pandemic to become an endemic with new variants that are predicted to be more virulent (Florido et al., 2022). Likewise, new public health emergencies necessitating contact tracing will emerge (Associated Press, 2021). Indeed, the recent rise of monkeypox cases (Shapiro, 2022), being declared a public health emergency (Schneider, 2022), as well as emerging cases of polio (Jones, 2022) highlight that new infectious disease spread is likely, and that contact tracing will be necessary to stop the spread of these diseases as well. Finally, as an anonymous reviewer noted, contact tracing may even be necessary to respond to biological/chemical weapons attacks. In short, there remains a need for recruiting, selecting, and training contact tracers to not only continue mitigating COVID-19 spread but also to address future disease outbreaks.

Rapidly accelerating the recruitment, selection, and training of contact tracers in response to COVID-19 proved to be difficult, however, with many states' contact tracer workforces well below recommended levels—even after hiring spikes (Simmons-Duffin, 2020). To be sure, many reasons for this understaffing exist including systemic underfunding of the public health workforce and reduced federal funding for health preparedness in general (Watson et al., 2020, p. 8). The unique aspects of the COVID-19 pandemic—such as needing to build an applicant pool from scratch without the aid of existing recruitment efforts, hire quickly without preexisting hiring procedures, and hire for almost exclusively remote work—also contributed to the understaffing as need for contact tracers outpaced localities' abilities to hire. A particularly troubling aspect of the COVID-19 pandemic, though not unique to it, is the disproportionate impacts of COVID-19 on marginalized communities and the importance of contact tracing in these communities (Randall et al., in press). Hiring personnel who can successfully contact trace within these communities is important for mitigating disease spread and, as discussed later, likely requires specific knowledge, skills, abilities, or other characteristics (KSAOs; Randall et al., in press). Importantly, these inequitable conditions will likely occur in future emergency situations (i.e., future healthcare crises) if not remedied and built in to existing public health emergency responses (Associated Press, 2021).

We posit that an additional reason the need for contact tracers outpaced hiring was the lack of a validated, systematic approach to recruitment, selection, and training. Indeed, using a well-validated selection and training program can help quickly and efficiently hire and train individuals, improve performance, and reduce turnover (Cascio & Scott, 2017; Guion, 2011; Hausknecht & Heavey, 2017; Ployhart & Weekly, 2017). This presents a challenge for addressing the current, and future, healthcare crises: Whereas there is a need to be able to quickly and efficiently recruit, select, and train contact tracers, no such approach exists. Indeed, as Watson and colleagues (2020) note, "Local and state health departments should be able to hire quickly…If not, state action will be needed to remove barriers to workforce development and to rapidly expand the recruitment of needed contact investigators" (p. 9).

Structuring selection and training systems is beneficial for several reasons. First, knowing on which KSAOs to select versus train informs recruitment and initial screening decisions (Guion, 2011; Highhouse et al. 2016). Furthermore, using validated selection instruments will result in better quality hires in terms of performance and reduced likelihood of turnover (Cascio & Scott, 2017; Guion, 2011; Hausknecht & Heavey, 2017; Rotundo & Spector, 2017) and limit the potential for biased selection decisions (Dalal et al., 2020). Well-developed training programs are crucial for learning job-relevant information and training transfer—the better developed the training delivery, the more successful will be training (Aguinis & Kraiger, 2009; Arthur et al.,

2003; Ford et al., 2018; Goldstein & Ford, 2002; Kraiger & Ford, 2021). In addition, standardizing the training delivery will ensure that employees who are geographically dispersed are equivalently trained (Johnson & Randall, 2018).

Further evidence for the efficacy of structured selection and training systems to facilitate the rapid staffing of critical positions is seen in the response to the September 11 terrorists' attacks (Blalock et al., 2007; Kondrasuk, 2004; Mabee, 2007). Utilizing structured recruitment, selection, and training, the Department of Homeland Security rapidly hired and trained an unprecedented number of passenger and luggage screeners for the Transportation Security Agency (TSA; Blalock et al., 2007; Kondrasuk, 2004). Utilizing structured approaches to recruiting, hiring, and training contact tracers to address disease spread may result in similar benefits to fill the large personnel needs for this type of public health emergency. Such a system, however, has not heretofore been implemented.

The lack of a structured approach to selecting and training contact tracers is likely attributable to two main factors. First, although contact tracing existed prior to COVID-19 (Mooney, 2020; Ramstedt et al., 1990; Swanson et al., 2018), the unprecedented need for contact tracers during the pandemic shined a light on the lack of approaches to quickly hiring and training individuals to serve specifically as contact tracers. That is, public health workforces had not, thus far, selected specifically for contact tracers, let alone as quickly as needed. To be sure, prior to the COVID-19 pandemic local health departments used contact tracing to trace isolated disease spread (e.g., tuberculosis, measles, etc.). Community healthcare personnel conducted contact tracing, though, as part of other responsibilities, not as a standalone job (Marcroft, 2020). The unprecedented need for contact tracing during the COVID-19 pandemic highlighted the necessity for personnel to serve only as contact tracers.[1]

This underscores the second impediment to quickly selecting and training contact tracers, namely, that the role/responsibilities of contact tracers are typically subsumed under other roles. For example, a search on O*NET, a database that records detailed information about over 1,000 jobs (Rivkin et al., 2017), did not reveal an entry for contact tracer. The most closely aligned entry is "community health workers" (position code 21-1094.00). However, the tasks identified for this job do not list activities related to contact tracing to address disease outbreaks.

The combined effect of needing to address a dynamic global health crisis and limited information about the standalone role meant that local health officials were left on their own to grow the contact tracer workforce (Watson et al., 2020). Importantly, the Centers for Disease Control and Prevention (CDC) provided an example job description to help localities with this effort.[2] A job description, however, is just one aspect of developing a standardized selection and training system. Furthermore, as our results show, there are critical attributes needed to perform as a contact tracer that the CDC job description does not explicitly mention. In other words, the scientific analysis of the role of contact tracer we undertake here provides more nuanced information about the KSAOs needed to be a successful contact tracer. With this information, standardized selection and training systems, particularly beneficial when selecting and training for a new job, can be more comprehensive. The first step in developing a standardized selection and/or training program is to identify the KSAOs needed to perform the job; in short, conducting a job analysis (Brannick et al., 2007; Brannick et al., 2017).

To this end, we present the results of a combined (i.e., work-oriented and worker-oriented) job analysis we conducted to identify the critical KSAOs needed to perform successfully as a contact tracer. This effort addresses the first step in the process of developing a systematic recruitment, selection, and training program for increasing the contact tracer workforce (Brannick et al., 2007, 2017; Highouse et al., 2016). We investigated the role of contact tracer alone, without reference to any other responsibilities of public health workers. In addition, we utilized the limited available archival records on contact tracing as well as studies of past contact tracing efforts during other public health emergencies such as the HIV/AIDs epidemic of the 1980s (Ramstedt et al., 1990) and the 2014-2015 Ebola epidemic in Liberia (Swanson et al., 2018) to inform our efforts.

Proposed Solution

In this study we utilized a combined job analysis technique (C-JAM) to identify critical work behaviors performed by stand-alone contact tracers, as well as critical KSAOs for successful performance as a contact tracer (Brannick et al., 2007, 2017). We proceeded with our job analysis in two phases. First, we reviewed available archival information about contact tracing. Second, we conducted structured interviews with contact tracer subject matter experts (SMEs), individuals with knowledge of this job. From these archival records and interviews we identified critical tasks performed by contact tracers, linked those tasks to performance domains, identified KSAOs necessary for performing successfully as a contact tracer, and performed a linkage analysis to connect the KSAOs to these

1 Importantly, as noted earlier, the chronic underfunding of public health is an additional impediment to hiring workers only to serve as contact tracers. Most localities are unlikely to have the budgets to be able to hire individuals whose only job is to engage in contact tracing. These constraints, though, do not minimize the need for this role, and, as described in detail later, the results of our work can be used by public health officials even in this limited funding climate.

2 https://www.cdc.gov/coronavirus/2019-ncov/downloads/php/contact-tracing/COVID19-contact-tracer-508.pdf

performance domains to provide predictive hypotheses on which future research can expand. Finally, we differentiated whether or not KSAOs should be used for personnel selection, training, or some combination of the two (see Figure 1). When we identified a KSAO as appropriate for selection, we also provide potential methods for measuring the KSAO.[3]

Phase 1: Archival Records Review

Procedures and Materials

In Phase 1, the project team located and reviewed archival records pertaining to the work of contact tracers. Using these documents, we identified critical tasks performed by contact tracers. From these tasks, we developed an initial set of KSAOs relevant to contact tracing performance. Finally, we used the archival records review to develop a list of questions for the structured interviews conducted in Phase 2. Two research team members read the documents independently and identified critical tasks and KSAOs. We then wrote 26 structured interview questions for Phase 2 (see supplemental materials for questions).

In total, we identified 13 records for review (see supplemental materials for list of archival records). Of these 13, 8 records proved particularly useful as they presented direct information on contact tracing. The other records, though useful, did not provide direct information on contact tracing; this was likely due to the fact these records were news media articles.

Phase 2: Subject Matter Experts Interviews

Procedures

The same two research team members conducted all the online structured interviews with New York State contact tracing SMEs. The interviewers were advanced graduate students in industrial-organizational psychology, and both had training with interview techniques. They recorded and transcribed individual interviews with SMEs using the transcription software Otter (https://otter.ai/). Prior to their interview, SMEs completed an online survey to gather information on experiences as a contact tracer and demographic information. A project team member later contacted the SME to schedule a time for the interview.

All the structured interviews were conducted between August and October 2020—within 5 months of the World Health Organization declaring COVID-19 a global pandemic (March 11, 2020), and between 2 and 3 months into states, including New York, beginning to lift their first set of COVID-19 initiated lockdowns (Kantis et al., 2020). Given the structured nature of the interview, all SMEs were asked the same questions in the same order—specifically, one interviewer asked all of the questions while the other interviewer took handwritten notes to supplement the transcripts. Furthermore, the SMEs were not asked any questions other than those in the protocol, and the only unscripted communication allowed from the interviewer to the SME was to ask for clarification or to repeat something. To this end, interviews proceeded in the exact same eight question sets. First, interviewees answered two sets of questions pertaining to their background and the critical tasks performed as contact tracers. Question sets three through six then asked questions regarding necessary knowledge, skills, abilities, and other personality/individual difference constructs, respectively.

COVID-19 disproportionately affects marginalized communities (Hooper et al., 2020). One possible reason for this may be attributable to individuals in these communities not trusting, therein not complying with, contact tracers (Randall et al., 2020). Therefore, in question set seven of the interview, SMEs answered questions regarding the KSAOs needed to contact trace in marginalized communities. Finally, the last question set of the interview gave the SME an opportunity to clarify or add anything to their previous responses, and to share any additional information. Respondents received a $25 gift card to Amazon.com as a thank you for participating in the study. As described in greater detail below, the interviewers coded the interview responses iteratively after each interview session.

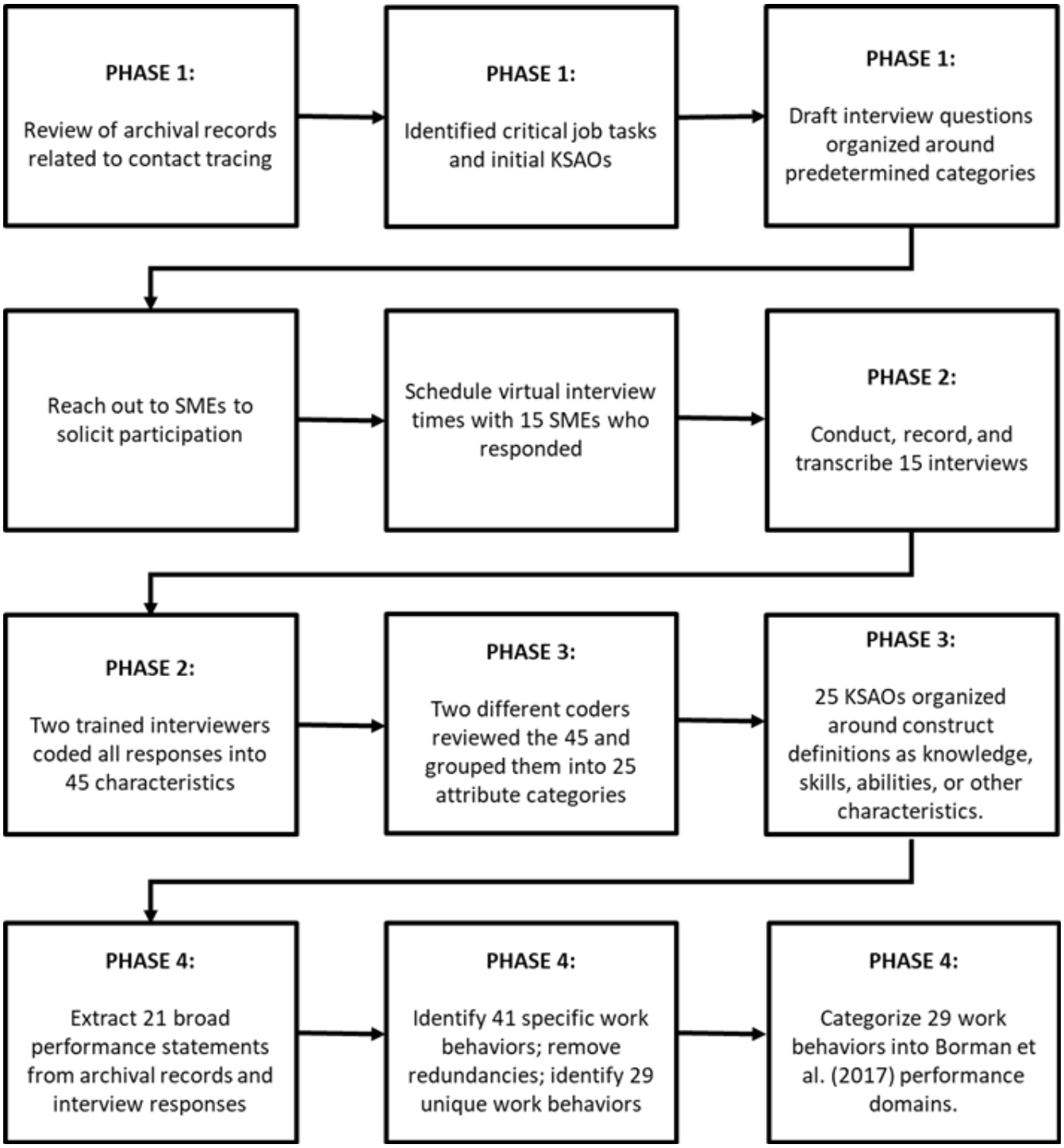
Participants

The use of iterative coding procedures allowed us to assess data saturation in our qualitative responses. Data saturation occurs when interviewees no longer provide information unique from past interviews (Carlsen & Glenton, 2011). To ensure we could reach data saturation, we used power tables developed by Fugard and Potts (2015) to determine the minimum number of people to interview. Interviewing 10 individuals would result in a 94% chance of hearing a specific KSAO at least five times if 25% of the population of SMEs believe that said KSAO is related to contact tracer performance. As such, the goal was to recruit as many SMEs as possible with a minimum of 10 completed interviews. To recruit SMEs, we sent e-mails to various contact tracer groups in New York State (e.g., county health offices; schools of public health) with the link to the prescreening survey embedded in the e-mail. As such, SMEs worked in different locations within New York State (see demographic information next).

About 50 individuals accessed the prescreen survey, but only 30 provided complete responses and e-mails. Due to difficulties scheduling interviews with all interested respondents (as this was an extremely busy time for contact tracers), the project team was unable to schedule interviews

3 Importantly, we do not offer recommendations for a specific measurement tool. This is because each locality will have different requirement for selecting public sector employees (Jacobs & Denning, 2017), so recommending methods of measurement, rather than a specific measurement tool, offers the most flexibility.

FIGURE 1.
Flow of Research Phases/Steps



with half of them. Nevertheless, we were able to interview 15 SMEs. As such, these interviews had sufficient power to detect KSAOs that are prevalent across interviewees.

SME Demographic Characteristics

The final sample of 15 SMEs was, on average, 33.92 years old (SD = 12.77) and was about equally self-reported male (53.30%) and female (46.70%). Furthermore, the sample was about equally self-reported White (46.67%) and non-White (53.33%). The entire sample had at least a high school-level education, and 69.23% of the sample had a master's degree or professional degree.[4] We ensured a wide representation of SMEs in order to capture the varied experiences of contact tracers who work in different settings. To gauge this, we asked SMEs to provide some information about their experiences as a contact tracer during the pre-interview survey. Of the 15, 10 reported serving as a contact tracer at the time of the study, 3 reported serving as a contact tracer in the past, and 2 reported that they were not employed as a contact tracer at the time of the study but were familiar with the role based on training received and/or as a supervisor of current contact tracers. Furthermore, respondents completed a five-item scale asking how experienced they believed they were with contact tracing at the time of study (sample item: "I have a good understanding of what it takes to succeed as a contact tracer"). On average, they reported moderate amounts of experience (M = 3.86, SD = 0.85 on a 5-point scale). In addition, 46.67% of the sample reported that they had at least 4 months of experience contact tracing. Finally, the sample reported their cumulative experience contact tracing across a variety of communities (Table 1). In sum, SMEs had a variety of experiences with contact tracing, and represented varying perspectives on this job. We note, however, that we do not know the specific agencies/localities for which the contact tracer worked as this was not asked in the prescreening survey nor the interview—this choice was made to help maintain the confidentiality of the interviewee.

TABLE 1.

Self-Reported Experiences With Contact Tracing by Type of Community

Urban communities	53.85%
Rural communities	30.77%
Communities of color	46.15%
Immigrant communities	46.15%
Low income communities	38.45%

Note. Percentages add up to over 100% as respondents reported on all communities in which they served.

Data Coding Procedures

Coding of the archival records and interviews to extract contact tracer tasks and KSAOs proceeded in four phases (see Figure 1). Phase 1 involved the coding of the archival records, Phase 2 was coding of the interview responses, Phase 3 was the refining of the Phase 2 coding, and Phase 4 was the coding for performance domains.

Phase 1: Archival Records

In Phase 1, the two interviewers independently coded the archival records. Each extracted critical tasks performed by contact tracers and KSAOs for performing as a contact tracer from these records. They independently coded them into inductively derived categories, and then met to discuss their categories and coding. This list of critical tasks and KSAOs also informed the interview questions written by all project team members.

Phase 2: Interview Responses

In Phase 2, the two graduate student interviewers coded the interview responses by conducting iterative coding within 2 days of the conclusion of an interview. Specifically, at the conclusion of each interview, both graduate student researchers independently extracted all KSAOs mentioned by the SME and categorized the extracted KSAOs into the aforementioned inductively derived categories to which the KSAO most appropriately fit. As the interviews proceeded, frequencies of repeat KSAO were recorded. Following completion of all the interviews, the interviewers discussed their individual full list of KSAOs to agree on the KSAO label and proper classification as a knowledge, skill, ability, or other attribute. At the conclusion of the interviewers' coding phase, a total of 45 attributes categorized as knowledge, skill, ability, or other attribute, along with attribute descriptions were sent to the first two authors of the research team for further synthesis in Phase 3 of coding.

Phase 3: Coding Refinement

During the third phase of coding, the first two authors (PhDs trained in job analysis) reviewed the full list and independently collapsed overlapping KSAOs, where necessary, to eliminate redundancies. Given the tendency for SMEs to confuse skills, abilities, and individual differences, we further rearranged KSAOs into more appropriate categories. For example, although an SME noted that active listening was a necessary *ability*, we reclassified this as a *skill*.

We also identified KSAOs from the narrative responses of the interviewees when the SME did not directly state a KSAO, but their interview response pointed to a necessary psychological characteristic. For example, one interviewee,

4 The supplemental materials contain a detailed comparison of the interviewed and not interviewed samples. In general, the interviewed sample was slightly younger, more diverse, and more educated than the not interviewed SMEs.

when asked about essential personality traits, said "realize your job doesn't fit in a certain box," which was categorized as *adaptability*. We utilized the O*NET KSAO taxonomy (Rivkin et al., 2017) to align narrative descriptions with KSAOs. This process resulted in narrowing, rearranging, and relabeling the 45 initial KSAOs to 25 KSAOs deemed important for performance as a contact tracer. Finally, the first author defined all KSAOs based on the extant literature and/or definitions provided by the O*NET taxonomy, and the second author reviewed and edited these definitions.

Phase 4: Identifying Performance Domains

To identify the contact tracing performance domains, the interviewers collected the raw tasks identified from the archival records coded in Phase 1 and the interviews coded in Phase 2. The first two authors refined the extracted tasks into specific work behaviors. More specifically, we collected 21 broad performance statements from the archival records and interviews (e.g., "Be culturally sensitive and aware that COVID-19 impacts differ across communities."). From these 21 broad statements, we were able to extract 41 specific work behaviors (e.g., demonstrate cultural sensitivity).[5] We then independently identified redundant work behaviors among the 41 extracted. After eliminating redundancies, we were able to identify 29 unique work behaviors.

Following this, these 29 unique work behaviors were independently categorized into performance domains. These performance domains represent categories of work behaviors that share similar purposes/goals. To identify appropriate performance domains for the specific work behaviors, we utilized the taxonomy developed by Borman and colleagues (2017). For example, a critical work behavior identified by every source we reviewed/interviewed was "calling individuals to confirm positive case." We categorized this specific work task into the *communicating and interacting* performance domain from Borman et al.'s (2017) taxonomy. These performance domains provided a broad picture of job performance as a contact tracer and provided the criteria for the predictive hypotheses. We showed strong agreement (93%) after the first round of categorizing and discussed the few discrepancies to agree 100% on the categorization of work behaviors into the specific domains. Details about the number and nature of these performance domains are presented in the Results and Evaluation section below.

Predictive Hypotheses

After identifying the critical KSAOs required for successfully performing as a contact tracer and defining the performance domains, we developed predictive hypotheses regarding why these KSAOs relate to performance as a contact tracer (Guion, 2011; Highhouse et al., 2016). Predictive hypotheses offer a theoretical reason for why a specific KSAO is related to which aspect(s) of performance. These predictive hypotheses guide future selection validation as well as training evaluation efforts (Guion, 2011; Highhouse et al., 2016).

In addition, we identified which of the KSAOs are needed at the time of being hired and are, therefore, candidates for a selection system, and differentiate these from the KSAOs that can be trained later and are candidates for a posthire training program. Predictive hypotheses and proposed position in the human resource management system are included in the tables of results below (Tables 4-7). For space considerations, we present only the final list of KSAOs here; full results are available in the supplemental materials. We present the results of the job analysis in seven categories, combining the results from the archival review as well as the interviews.

Results and Evaluation

Performance Domains

As noted above, we identified 29 unique work behaviors and categorized them into broader performance domains. Specifically, we classified all of the tasks into one of four domains (see Table 2 for definitions). As would be expected for this job, the majority of work behaviors (55%) fell under the *communicating/interacting with others; proficiency* performance domain. *Conscientiousness; organizing/planning* was the next most frequent performance domain (21%), followed by the *conscientiousness; dependability* (14%) then *problem solving* (10%) domains.[6]

Minimum Qualifications

Minimum qualifications (MQs) are education, experiences, and/or related personal attributes that employees need to perform a job satisfactorily (Levine et al., 1997, p. 1009). Organizations, particularly public sector organizations, use MQs as "threshold requirements" (Jacobs & Denning, 2017, p. 726) meaning applicants must demonstrate the necessary knowledge, experiences, or other attributes prior to proceeding in the selection process. Stated differently, an MQ is a characteristic that an applicant has before applying, suggesting that the MQ will not be trained (Jacobs & Denning, 2017; Levine et al., 1997).

When asked during the structured interviews, respondents included characteristics that would not meet the definition of an MQ either because the characteristic is reasonably trainable (e.g., knowledge of contact tracing) and/or because it is not possible to learn prior to the job (e.g., specific spread mitigation strategies for the disease being

5 Note that we could extract more specific behaviors from the raw task statements because an individual performance/work statement might reference multiple specific behaviors. See the supplemental materials for more details.

6 The supplemental materials contain the specific work behaviors we coded, as well as into which domain we coded them.

traced).[7] As such, we reviewed the SME responses to this question and removed any characteristic that would not meet the aforementioned definition of an MQ. Table 3 presents the ideal minimum qualifications for being a contact tracer based on this review of SME responses. We note that our review includes two MQs not included in the CDC template job description highlighting the added detail this job analysis provides.

Knowledge Domain

The knowledge domain represents information about specific areas that contact tracers need to be successful in their role. Knowledge domains are the general facts and/or principles of an area. For example, to play the piano, one must know information about what notes each piano key produces. In total, the project team identified four critical knowledge domains concerning health regulations, disease spread, and technical software. Table 4 provides definitions of these critical knowledge domains, whether these knowledge domains are needed at the time of hire or can be reasonably trained posthire, and a predictive hypothesis regarding why these knowledge domains are related to contact tracer performance.

Skills Domain

The skills domain represents actions and/or behaviors that develop through practice. Skills not only facilitate actions themselves but also facilitate learning new information. Continuing our piano playing example, playing the piano is a skill learned through practice; piano playing skill also facilitates learning to play other instruments. As noted earlier, because SMEs can confuse skills and abilities, we identified skill and ability domains based on the content described by the interviewee rather than the labels provided. For example, interviewees noted the need to "think on one's feet and effectively change one's thinking habits in certain situations," labeling this "adaptive thinking." In our review of transcribed responses and the O*NET taxonomy, we identified this as a combination of two skills: active learning and critical thinking. We identified four critical skills based on interviewee comments, and three additional skills based on minimum qualifications. Collectively, the identified skills are needed to be an engaged listener, critically evaluate this information relative to existing and new information to provide well-reasoned and accurate advice to slow the spread of a communicable disease (Table 5).

Ability Domain

The ability domain represents capacities to act or perform a behavior; these relatively stable attributes facilitate performance. As noted earlier, piano playing is a skill learned through practice; however, the ability to differentiate tones (hearing sensitivity) and the ability to manipulate one's fingers across the keys of a piano (finger dexterity) are enduring capabilities. Similar to the skill domain, we extracted relevant abilities from the content of SME descriptions and our knowledge of KSAO taxonomies (e.g., O*NET) rather than just using the labels provided by interviewees. We identified two critical clusters of abilities needed for successful contact tracing work. The first relate to the need for contact tracers to understand what is being said to them and the ability to effectively communicate with those with whom they are speaking; the second relate to being able to effectively make decisions and adapt to changes as needed (Table 6).

Personality Trait Domain

Personality traits are general patterns or tendencies to behave, think, and feel in a certain way across different situations (Fleeson, 2004; McCrae & Costa, 2008). As such, these are individual psychological characteristics that

7 We are grateful to the editor and an anonymous reviewer for pointing this out.

TABLE 2.
Contact Tracing Performance Domains and Definitions

Borman et al. (2017) domain	Definition as related to contact tracing
Communicating/interacting with others; proficiency	Work behaviors associated with core functions of the role of contact tracer centering on communication with infected individual and/or known contacts.
Conscientiousness; dependability	Work behaviors associated with a need for attention to detail and adherence to rules and regulations.
Conscientiousness; organizing/planning	Work behaviors associated with a need for attention to detail and recording/organizing information, and keeping records in order.
Problem solving	Work behaviors associated with reasoning, judgment, and decision making about complex problems with varying levels of information.

represent a person's expected response to situations that are, for the most part and with some exceptions, unlikely to change. To continue to improve at playing the piano, a musician likely needs to show a tendency toward being disciplined/conscientious to engage in the necessary deliberate practice. Although situational pressures can affect the expression of personality traits (Mischel & Shoda, 1995), these behavioral patterns/tendencies do tend to be cross-situational (Fleeson, 2004). After accounting for overlapping traits, we identified four critical personality traits related to being a successful contact tracer, largely centered on showing compassion and trustworthiness (Table 7).

Working Within Underrepresented Communities

The final area of inquiry in this job analysis was to identify any KSAOs specifically related to working with underrepresented communities, given, as noted above, the disproportionate impact of COVID-19, as well as other health disparities, in these communities (Hooper et al., 2020). First, SMEs identified a series of work context factors that affect the performance of contact tracers in these communities. These included factors such as uncertainty and mistrust of contact tracers and fears of immigration and/or law enforcement actions initiated by contact tracing. Furthermore, SMEs noted that contact tracers working in underrepresented communities interact with individuals who are likely to be less engaged, less likely to answer their calls, and less compliant with contact tracing requests because of a distrust in the credibility of contact tracers. As such, when considering candidates for contact tracing roles in underrepresented communities, hiring managers may want to emphasize KSAOs listed in Table 8. Contact tracing in underrepresented communities presents unique challenges that contact tracers need to be able to address. Results of our job analysis suggest the critical KSAOs for contact tracers working in underrepresented communities are those that promote trust in the contact tracers' skills, trust in the contact tracers' motives, and communicating accurate information about contact tracing work (see also Randall et al., 2020).

TABLE 3.

Minimum Qualifications for Contact Tracers Identified by SMEs

1. At least a high school diploma (but a bachelor's degree is ideal)
2. Customer service experience[1]
3. Experience with communicating to others[1]

Note. 1 - identified as minimum qualification not included in CDC job description.

Ethical, Legal, and Professional Issues

We faced some challenges in conducting this initial job analysis that future research can address. First, as noted above, hiring employees whose sole job responsibility is to conduct contact tracing was rare prior to the COVID-19 pandemic. Indeed, past contact tracing efforts were typically performed by public health professionals as one aspect of a host of job responsibilities. As such, there is limited archival information on this job and little guidance for how to select and cross-train public health workers in other positions to perform these critical tasks. Although the need for standalone contact tracers depends on the nature and proliferation of various contagions, one thing COVID-19 has taught us is that we must have the infrastructure in place to respond to public health crises more quickly and effectively, which often involves contact tracing. To address this, we turned to SME interviews as part of our job analysis. We then identified tasks and KSAOs from these interview responses. Although informative, future research should further validate these inferences. The results can be further refined by surveying SMEs on the criticality of these tasks and KSAOs. Specifically, a large sample of SMEs can read the identified tasks and KSAOs, and their definitions from this study and rate their importance for successful contact tracer performance. This information would provide more guidance on which KSAOs to target for selection given that not everything can be included in a selection system (i.e., screening for 20–25 different KSAOs may be too unwieldy, but screening for 8–12 KSAOs may not). Importantly, we started this effort by reaching out to our initial list of SMEs as well as contact tracing SMEs in the state of Louisiana; given the dynamic and emergent nature of COVID-19, though, response rates were low (i.e., fewer than 20 participants). Given that the stability of the ratings with such a small sample size is questionable, we do not provide these results here, but preliminary results are presented in the supplemental materials (see Section 6) and, in general, support the criticality of the KSAOs identified.

Relatedly, we faced a challenge of getting ahold of SMEs during the height of the pandemic. As noted earlier, although over 50 people accessed our survey, we struggled to schedule many of the contact tracers who completed the survey because of their hectic work schedules (reinforcing the severity of the staffing crisis motivating this project). To circumvent this potential issue, we offered interview slots in the evening and on the weekend. Unsurprisingly, though, many of the overworked tracers were unable to devote time to participating in an interview. Due to confidentiality concerns (e.g., HIPAA laws), other methods, such as direct observation, may also be challenging and/or unethical.

Likewise, our SME sampling pool was contact tracers in the state of New York. On the positive side, New York was the early epicenter of the COVID-19 pandemic in the

TABLE 4.
Critical Knowledge Areas Identified in the Contact Tracer Job Analysis

Construct	Definition	Hire or train	Predictive hypothesis
Knowledge of HIPAA/local health regulations	Information regarding the rules, regulations, and guidelines for recording and sharing health information as legislated in the Health Insurance Portability and Accountability Act, as well as specific state and local regulations	Train	Predicts performance in the domain of *conscientiousness; dependability* because adherence to national and local rules and procedures requires a knowledge of said laws and regulations.
Knowledge of community health impact	Information about how the communicable disease has affected different communities/ stakeholder groups	Train	Predicts performance in the domain of *communicating/ interacting with others; proficiency* because understanding contacts' unique needs will improve the accuracy and effectiveness of communication. This will also facilitate the anticipation of different community members' needs and challenges, thereby predicting performance in the domain of *problem solving*.
Technical knowledge	Information regarding using computer technology, including specific reporting software used for tracing	Hire (general knowledge) Train (tracing software)	Predicts performance in the domain of *communicating/ interacting with others; proficiency* because core contact tracing functions are completed with the use of computers and tracing software. Also predicts performance in the *conscientiousness; organizing/ planning* domain because this knowledge facilitates orderly tracing and documentation.
Knowledge about the communicable disease	Information about the disease being tracked, including symptom presentation, differential diagnosis of the disease from similar illnesses, and information on appropriate actions to be taken by the person being contacted	Train	Predicts performance in the domain of *communicating/ interacting with others; proficiency* because sufficient knowledge of the disease is necessary to be able to communicate accurate and up-to-date information to ensure the health and safety of contacts and the community.

U.S. (Thompson et al., 2020), meaning the contact tracers interviewed in this study had plenty of examples from which to draw. A limitation, though, is that these results may be contaminated by some New York State specific viewpoints and may be deficient in representing contact tracing in other states/countries. We took care in our sampling approach to ensure that the contact tracers we interviewed had experience in different community settings, including both urban and rural (Table 1). Nevertheless, future research should assess the applicability of these tasks

TABLE 5.

Critical Skill Areas Identified in the Contact Tracer Job Analysis

Construct	Definition	Hire or train	Predictive hypothesis
Active Listening	Giving full attention to what someone is saying, making sure one understands the points being made, and avoiding interruptions.	Hire (basic listening skills) Train (active listening techniques)	Predicts performance in the domain of *communicating/interacting with others; proficiency* because listening is necessary to extract complete and accurate information from contacts, and to build trust and rapport.
Active learning	Understanding the ramifications of new information for problem solving and decision making	Hire	Predicts performance in the domain of *problem solving* because continuous learning is required to stay up to date on changes in disease transmission, treatment, and public health policies and regulations, as well as for the needs of different contacts.
Critical thinking	Using logic and reasoning to identify potential solutions or approaches to a problem	Hire	Predicts performance in the domain of *problem solving* because contact tracers need to identify and understand potential problems and workable solutions to contacts' unique questions and challenges.
Judgment and decision making	Analyzing the positives and negatives of potential choices to select the most appropriate course of action	Hire	Predicts performance in the domains of *problem solving* and *conscientiousness; dependability* by enabling contact tracers' appropriate responses to individuals' unique queries and circumstances (e.g., health, home, financial) in ways that uphold regulations while still ensuring individuals' health and safety.
Organizational skills	Planning, prioritizing, and structuring activities to achieve goals on time and with minimal errors	Hire	Predicts performance in the *conscientiousness; organizing/planning* domain because organizational skills are required to effectively perform core contact tracing functions and complete work tasks in a timely manner.
Speaking skills	Talking to others to effectively convey information	Hire	Predicts performance in the domain of *communicating/interacting with others; proficiency* because clear and effective communication are critical to perform the core job functions of contacting others.
Service orientation	Actively looking for ways to help people	Hire (customer service experience) Train (service skills)	Predicts performance in the domain of *communicating/interacting with others; proficiency* because contact tracers with service orientation skills will be better equipped to demonstrate respect and care, answer questions, provide support, and otherwise communicate with contacts to meet their needs and build trust.
Complex problem-solving skill	Identifying difficult challenges/issues and using relevant information to evaluate and implement solutions	Hire	Predicts performance in the domain of *problem solving* because complex problem solving skills will help tracers identify unique situations and to amend recommendations accordingly.
Cultural sensitivity	Understanding individuals from differing cultural backgrounds, and using this information to successfully serve individuals within their own communities	Train	Predicts performance in the domain of *Communicating/interacting with others; proficiency* because sensitivity to the unique needs, customs, and experiences of different cultural groups will enable a contact tracer to more effectively communicate with all contacts and to increase the likelihood of compliance with tracing requests.

TABLE 6.

Critical Ability Areas Identified in the Contact Tracer Job Analysis

Construct	Definition	Hire or train	Predictive hypothesis
Oral comprehension	The ability to listen to and understand spoken information	Hire	Predicts performance in the domain of *communicating/interacting with others; proficiency* because listening is necessary to extract complete and accurate information from contacts, and to build trust and rapport.
Oral expression	The ability to communicate in an understandable way through speech	Hire	Predicts performance in the domain of c*ommunicating/interacting with others; proficiency* because tracers need the ability to express themselves through intelligible speech. The ability to speak non-English languages, although not required, will aid tracing for contacts who do not speak English.
Speech recognition	The ability to understand another's speech	Hire	Predicts performance in the domain of c*ommunicating/interacting with others; proficiency* because understanding others' speech via telephone conversations is essential for core job functions (especially since contacts' oral expression, accents, and other circumstances may impede speech recognition).
Speech clarity	The ability to speak clearly	Hire	Predicts performance in the domain of *communicating/interacting with others; proficiency* because tracers must speak clearly in order to plainly communicate information to those contacted by phone.
Inductive reasoning	The ability to combine different information to form general conclusions	Hire	Predicts performance in the domain of *problem solving* because making sense of the information obtained through tracing protocols, particularly when such information is outside the bounds of established protocols, aids risk assessment and targeted recommendations for individual needs.
Deductive reasoning	The ability to apply rules to specific problems	Hire	Predicts performance in the domain of *problem solving* because applying deductive logic will help tracers determine when and how to implement specific protocols based on individual needs. Also predicts performance in the *conscientiousness; dependability* domain because the recommendations tracers provide will display adherence to the appropriate rules and regulations guiding their work.
Category flexibility	The ability to use different rules to combine information in different ways	Hire	Predicts performance in the domain of *problem solving* because tracers will more successfully resolve potential discrepancies that arise from different sources and changing regulations, while also accommodating different individuals' needs. As a cautionary note, we acknowledge potentially reduced performance in the *conscientiousness; dependability* domain if the recommendations tracers provide are applied so flexibly so as to create inconsistencies or violations of rules and regulations.
Problem sensitivity	The ability to identify when something is or could go wrong; identifying that something needs addressing	Hire	Predicts performance in the domain of *problem solving* because this ability will allow contact tracers to anticipate and identify possible challenges to their work and contacts' ability to comply with their requests.

and KSAOs to other localities, and users of this work are encouraged to evaluate these lists relative to their specific communities. Specific tasks and KSAOs can be removed from or added to this list to more appropriately represent the needs of contact tracers serving different communities (as we attempted to do by surveying contact tracers in Louisiana to verify KSAO criticality). Related, as an anonymous reviewer notes, some localities might require certifications for this healthcare work. Our results do not speak to this requirement in New York State, but other localities might require this, so future work should consider this as well.

Finally, the results of this study present contact tracer KSAOs that are candidates for selection systems versus training programs. However, we were not able to fully develop systems to select or train applicants. Future research should develop the selection tools and training programs using these results to provide public health officials with standardized and efficient methods for hiring and training contact tracers. Regarding the former, this could include the development or utilization of standardized tests and/or structured interview protocols to assess these KSAOs; such an approach is more valid and less biased (Dalal et al., 2020) while still working within the locality specific regulations for public sector employment (Jacobs & Denning, 2017). To facilitate this, we provide potential methods for assessing specific KSAOs identified in our job analysis (Table 9). Again, given locality specific rules for preemployment selection (Jacobs & Denning, 2017), we do not provide specific assessments, instead providing methods localities can consider for their screening procedures.

Regarding the latter, training programs that deliver new information on the trainable knowledge and skill areas should be developed such that training is delivered quickly and effectively while also putting mechanisms in place to evaluate the training. Existing training programs for new contact tracers, such as the popular (and free) Coursera module[8] offered by the Johns Hopkins Bloomberg School of Public Health, may also be adapted to ensure satisfactory coverage of trainable KSAOs identified from this research. Finally, these selection and training programs should be carefully and systematically validated. Organizations/localities are encouraged to work with trained personnel psychologists[9] to accomplish the goals of developing, implementing, and validating selection and training systems for hiring and training contact tracers.

Finally, as an anonymous reviewer raised, public health agencies are underfunded (Associated Press, 2021). As such, hiring individuals specifically to serve as contact tracers, and only contact tracers, may not be feasible now or in the future. To be sure, future public health emergencies for which large contact tracing efforts will be needed are like-

8 https://www.coursera.org/learn/covid-19-contact-tracing

9 Appropriately trained personnel psychologists can be found by using the "Consultant Locator" on the Society for Industrial and Organizational Psychology website (https://www.siop.org/Business-Resources/Consultant-Locator), or by partnering with College/University faculty with expertise in personnel psychology.

TABLE 7.

Critical Personality Areas Identified in the Contact Tracer Job Analysis

Construct	Definition	Hire or train	Predictive hypothesis
Attention to detail	The tendency to be thorough in accomplishing all aspects of one's tasks	Hire	Predicts performance in the domains of *conscientiousness; dependability* and *conscientiousness; organizing/planning* because attention to detail supports contact tracers' attempts to follow all rules and regulations to ensure the right information is shared, gathered, and stored correctly, and that other work tasks are completed well and on time.
Trait positive affectivity	The tendency to have a positive and upbeat disposition	Hire	Predicts performance in the domain of *communicating/interacting with others; proficiency* because being pleasant and positive improves communication, rapport and trust, especially when sharing sensitive, challenging, and important or alarming information regarding disease and disease prevention.
Empathy /compassion	The tendency to be understanding of and show concern for others' challenges.	Hire	Predicts performance in the domain of *communicating/interacting with others; proficiency* because expressing understanding and concern for the challenges, needs, and fears of those with whom they are communicating will help establish trust and care for individuals, increasing effectiveness.
Friendliness/ sociability	A tendency to be actively engaged with other people	Hire	Predicts performance in the domain of *communicating/interacting with others; proficiency* because friendly and sociable interactions with contacts will aid two-way communication and improve tracer effectiveness.

TABLE 8.

KSAOs Identified as Critical to Contact Tracing in Underrepresented Communities

1.	*Knowledge of HIPAA, state, and local health information regulations*. In order to gain the trust of individuals in marginalized communities, a contact tracer must understand and communicate how federal and local laws and regulations protect their privacy and the confidentiality of shared personal information.
2.	*Knowledge of community health impact*. Contact tracers can establish legitimacy and trust by possessing and sharing knowledge about how a communicable disease is affecting different communities. This signals an understanding of the interviewee's unique situation and may also inform the guidance provided so it is appropriate for the interviewees' particular community.
3.	*Active listening skills*. Contact tracers who work in predominantly underrepresented communities need to be particularly adept at active listening to foster trust. This skill is critical for working with marginalized individuals who may be particularly distrusting of healthcare and/or government officials as a result of past experiences in which they have been made to feel ignored.
4.	*Complex problem solving skill*. Individuals in underrepresented communities have unique challenges to compliance with certain tracing requests (e.g., inability to physically isolate; lack of access to groceries during quarantine). As such, contact tracers who work with underrepresented communities will need complex problem solving skills to help the contact anticipate and solve barriers to successful communication (e.g., native language services) and compliance (e.g., access to telehealth services, grocery deliveries, temporary housing or other methods for isolating safely when space is limited).
5.	*Cultural sensitivity skill*. Having cultural sensitivity means that a contact tracer has the skills needed to. Contact tracers have to understand individuals from different backgrounds and use this information to serve these individuals within their own communities by being sensitive to their unique needs. This will not only help improve communication and build trust but also result in more effective guidance.
6.	*Empathy/compassion*. Contact tracers working in underrepresented communities need to show a heightened amount of empathy and compassion to understand and work through the increased distrust in healthcare and government systems often exhibited in marginalized community members that may lead to apprehensions about trusting the motives contact tracers.

ly (Associated Press, 2021). However, as the COVID-19 pandemic shifts, the need for standalone contact tracing appears to be reduced for now. Nevertheless, our results are useful for structuring selection practices to ensure that public health agencies are selecting new hires who have some of the KSAOs needed to perform as contact tracers or to use such information when assigning certain staff members to perform contact tracing work. Similarly, public health agencies can use our results to develop training programs to cross-train public health official to perform contact tracing. In short, although our goal was to help select and train individuals whose sole job responsibilities are to engage in contact tracing, these results can also be used to select and/or train public health officials for whom contact tracing is *a* job responsibility. This is part of the critical infrastructure needed to help the public health workforce respond more adeptly to the unexpected yet urgent need to manage disease spread as current and future contagions arise and proliferate.

Value to I-O Research and Practice

We conclude our demonstration with a discussion of the value of our results to science and practice. First, we note that I-O psychologists have a role to play in addressing public health emergencies. In particular, this work presents avenues for exercising organizational scholars to utilize our skills in support of scientific personnel management to help address not only global health emergencies but any emergency (Murthy et al., 2017). Well-validated selection and training systems can be a boon to organizational effectiveness; this is more important during emergency and rapid response. Indeed, Murthy and colleagues (2017) noted that a barrier to public health emergency preparedness "included a lack of trained personnel" (p. S180). Local and federal government response to emergencies will be facilitated if the right people are in the right jobs, as was seen in response to the September 11 attacks (Blalock et al., 2007). Scientific personnel management can make this happen and do so in a quick and systematic way—which is critical for emergency response. More immediately, other scientists can pick up where our results end by continuing to refine the list of contact tracing KSAOs and to carry out the important work

TABLE 9.
Methods of Measuring Knowledge, Skills, Abilities, and Other Characteristics Identified as Candidates for Selection

Method of measurement (reference)	Constructs assessed
Biodata/past experiences	Technical knowledge
(Mumford et al., 2012)	Active learning
	Active listening
	Organizational skills
Situational Judgement Tests	Critical thinking
(Weekley et al., 2006)	Judgment and decision making
(Whetzel et al., 2020)	Complex problem solving skills
	Inductive reasoning
	Deductive reasoning
	Category flexibility
Behavior-based structured interview	Problem sensitivity
(Society for Human Resource Management, 2016)	Complex problem solving skills
	Oral comprehension
	Oral expression
	Speech recognition
	Speech clarity
	Speaking skills
Self-report measure	Attention to detail
(Hinkin, 1998)	
Measures of service orientation	Positive trait affectivity
(Hausknecht & Heavy, 2017)	Empathy/compassion
	Friendliness/sociability
	Service orientation

of developing and validating the selection and training recommendations outlined below (including the predictive hypotheses presented in Tables 5–7).

Second, although the importance of contact tracing was made particularly apparent during the COVID-19 pandemic (Kretzchmar et al., 2020), contact tracing is not new (Mooney, 2020) and will continue to be necessary for mitigating future disease spread, such as the current monkeypox emergency (Schneider, 2022; Shapiro, 2022) and future public health epidemics (Associated Press, 2021). A scientific study of contact tracing, then, is not only important now but will continue to be important moving forward. A combined effort of human contact tracers and technological innovations will be necessary to address future disease outbreaks because technology alone is unlikely to work (Soltani et al., 2020; Vaugh, 2020). In addition, human contact tracers are central to addressing health disparities among marginalized groups (Randall et al., 2020). Here we draw on I-O psychology principles and practices to lay the groundwork for a critical part of the human infrastructure of the public

health workforce.

Third, the hybrid job analysis conducted in this study lays the foundation for continued scientific studies of contact tracing. To be sure, our results are the first step in a comprehensive understanding of the job of contact tracer, and future work is needed to build on these efforts. Nevertheless, after reviewing archival records and conducting structured interviews with 15 contact tracing SMEs, we identified 25 KSAOs critical to the performance of contact tracers. These KSAOs were then distinguished between those that are needed at the time of hire (and should therefore be selection criteria) and those that could be trained after being hired into the position. To this end, we identified 18 KSAOs as candidates for selection systems, 4 as candidates for training, and 3 with aspects that make them suitable for either prehire screening or posthire training. We also drew on our job analysis data to create predictive hypotheses detailing why these KSAOs would facilitate job performance of contact tracers, therein facilitating future research. For public health professionals and organizations, the results of this job analysis can be the starting point for developing a comprehensive human resource (HR) management program around contact tracing as a standalone job.

Next Steps for Practitioners and Scientists

To fully realize the value of this work, there are several next steps that the public health workforce and researchers, including I-O psychologists, can take. First, our results can help provide a standardized understanding of this critical role, and with this standardized catalogue of job information, localities can begin to develop consistency in job descriptions and performance expectations/evaluations. Although the CDC provided a template job description, our results extend this work to include other minimum qualifications (e.g., customer service experience) and KSAOs (e.g., working with underrepresented communities) not listed there. Second, our results align more directly with developing standardized selection and training systems. Localities can use the KSAOs identified in this work to develop comprehensive recruitment, selection, and training programs to rapidly identify, hire, and train contact tracers during public health emergencies. In other words, this work forms a critical foundation for a more scientific approach to staffing contact tracers (i.e., knowing who to hire and what to train). Our work also presents a more human-centered approach to supplement investments in technological systems (e.g., apps, workforce dashboards) to track disease spread and reach potential contacts of infected persons. Indeed, as highlighted in our results, many critical tasks and KSAOs are aided by technology systems (e.g., facilitating contact tracing, resource sharing); however, others centered on complex problem solving and building trust (e.g., active listening, empathy, cultural sensitivity) may be better suited for human-to-human interactions.

To extend these results into a comprehensive and scientific HR management system, future work will need to continue with the validation process (Highhouse et al., 2016) and to test the predictive hypotheses presented in Tables 5–7. In terms of selection validation, these constructs need to first be operationalized using methods of measurement. As noted earlier, although we do not provide specific assessments given locality-specific rules surrounding pre-employment testing (Jacobs & Denning, 2017), Table 9 provides recommended assessment methods for each construct, as well as a brief overview of the method. We also provide citations for best practices for developing and/or identifying specific assessments. We acknowledge that it is not feasible to screen on 22 KSAOs and hope that presenting the options in this way allows for the most flexibility. Following this, data on the KSAO constructs as well as contact tracing performance will need to be collected to ensure that the constructs relate to performance. Finally, localities will need to determine aspects of the selection system including the sequence with which to assess the predictors, how to combine the predictors (Aiken & Hanges, 2017), if any potential adverse impact is present (Jacobs & Denning, 2017), and potential negative applicant reactions to the methods used (Hausknecht & Heavey, 2017).

In terms of validating training systems, knowing what tasks and KSAOs are critical for a job is an essential component of a training needs analysis (Brown, 2002; Goldstein & Ford, 2002). Other necessary components include assessing individual employees' KSAO gaps (e.g., through performance evaluation and assessment) in order to determine who needs training and in what areas (e.g., McKillip, 2001). Additionally, consideration of organizational support and needs during the training needs analysis will help ensure that the emphasis of training (based on the KSAOs identified here as trainable), is consistent with specific locality and organizational objectives, and that training is not derailed by lack of resources or time (Goldstein & Ford, 2002). Knowing what needs to be trained informs how training is designed, delivered, and evaluated (Aguinis & Kraiger, 2009; Arthur et al., 2003; Kraiger & Ford, 2021). Therefore, although web-based instruction may be suitable for delivering knowledge-based content (e.g., about HIPAA, COVID-19), more active methodologies such as role play or behavioral modeling may be more appropriate for active listening, customer service, and cultural sensitivity skills that would benefit from more interactive practice (Johnson & Randall, 2018; Sitzmann et al., 2006). We recommend comparing training suggestions identified based on this job analysis with existing contact tracer training programs (e.g., Johns Hopkins Coursera training), to ensure satisfactory coverage and to consider ideal supplements to web-based instruction, such as those suggested here. Finally, proper evaluation of training outcomes at the end of training (e.g., knowledge assessments, skill demonstrations) and on the

job in the weeks and months following will be necessary to demonstrate validity evidence—that training improves contact tracers' job performance (Aguinis & Kraiger, 2009; Goldstein & Ford, 2002).

Finally, as noted by an anonymous reviewer, beyond selection and training, our results might also point to potential job redesign "levers" that localities can engage to make contact tracing more effective. Although beyond the scope of our current investigation, future work may consider leveraging these results to redesign contact tracing jobs. For example, enriching contact tracing jobs by increasing autonomy or development opportunities (Parker, 2014) may better support the "problem solving" domain of contact tracing performance. COVID-19 is still a threat in many areas, public health officials are still responding, and part of that response involves contact tracing. Furthermore, this will not be the last public health emergency for which contact tracing will be necessary (Associated Press, 2021). As such, there is still a need for research to be better prepared for the future.

Summary

Drawing on the toolkit of personnel psychology in response to a global health crisis, we conducted a job analysis (Brannick et al., 2007) to identify critical tasks and KSAOs for the position of contact tracing—a position that is central to fighting the spread of communicable diseases like COVID-19. Through a combination of archival records review and structured interview methods, we identified four critical performance domains for the standalone job of contact tracer. We also identified 25 critical KSAOs for this position and provided recommendations for hiring and training that will hopefully enable quicker and more effective personnel decisions. We hope that these efforts will help to ensure successful contact tracing both now and in the future for public health planning and emergency response.

REFERENCES

Aguinis, H., & Kraiger, K. (2009). Benefits of training and development for individuals and teams, organizations, and society. Annual Review of Psychology, 60, 451-474.

Aiken, J. R., & Hanges, P. J. (2017). The sum of the parts: Methods for combining assessment for employment decisions. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection (2nd ed., pp. 388-396). Routledge.

Almagor, J., & Picascia, S. (2020). Exploring the effectiveness of a COVID-19 contact tracing app using an agent-based model. Scientific Reports, 10, 1-11.

Arthur, W. Jr., Bennett, W. Jr., Edens, P. S., & Bell, S. T. (2003). Effectiveness of training in organizations: A meta-analysis of design and evaluation features. Journal of Applied Psychology, 88, 234-245.

Associated Press. (2021, December 6). A scientist behind the AstraZeneca vaccine is warning the next pandemic may be worse. https://www.npr.org/2021/12/06/1061752337/a-scientist-behind-the-astrazeneca-vaccine-is-warning-the-next-pandemic-may-be-w

Blalock, G., Kadiyali, V., & Simon, D. H. (2007). The impact of post-9/11 airport security measures on the demand for air travel. Journal of Law and Economics, 50, 731-755.

Borman, W. C., Grossman, M. R., Bryant, R. H., & Dorio, J. (2017). The measurement of task performance as criteria in selection research. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection, (2nd ed., pp. 429-447). Routledge.

Brannick, M. T., Levine, E. L., & Morgeson, F. P. (2007). Job and work analysis: Methods, research, and applications for human resource management (2nd ed.). Sage.

Brannick, M. T., Pearlman, K., & Sanchez, J. I. (2017). Work analysis. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection, (2nd ed., pp. 134-161). Routledge.

Brown, J. (2002). Training needs assessment: A must for developing an effective training program. Public Personnel Management, 31, 569-578.

Carlsen, B., & Glenton, C. (2011). What about N? A methodological study of sample-size reporting in focus group studies. BMC Medical Research Methodology, 11, 1-10.

Cascio, W. F., & Scott, J. C. (2017). The business value of employee selection. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection, (2nd ed., pp. 226-248). Routledge.

Centers for Disease Control (CDC). (2021, November). Ensuring COVID-19 vaccines work. https://www.cdc.gov/vaccines/covid-19/health-departments/breakthrough-cases.html

Chou, W. Y. S., & Budenz, A. (2020). Considering emotion in COVID-19 vaccine communication: Addressing vaccine hesitancy and fostering vaccine confidence. Health Communication, 35, 1718-1722.

Dalal, D. K., Sassaman, L., & Zhu, X. S. (2020). The impact of nondiagnostic information on selection decision making: A cautionary note and mitigation strategies. Personnel Assessment and Decisions, 6, 54-64.

Doucleff, M. (2021, November). Why some researchers think the omicron variant could be the most infectious one yet. https://www.npr.org/sections/goatsandsoda/2021/11/30/1059859253/why-omicron-variant-spreads-so-quickly-infectious-mutations

Fleeson, W. (2004). Moving personality beyond the person-situation debate. Current Directions in Psychological Science, 13, 83–87.

Florido, A., Dorning, C., & Burnett, E. (2022, May 5). What COVID might look like in the U.S. once we reach the endemic phase. https://www.npr.org/2022/05/05/1096738289/covid-omicron-cases-endemic

Ford, J. K., Baldwin, T. T., & Prasad, J. (2018). Transfer of training: The known and the unknown. Annual Review of Organizational Psychology and Organizational Behavior, 5, 201-225.

Frayer, L. (2021, January 7). How India plans to provide COVID-19 vaccines to its population. https://www.npr.org/2021/01/07/954562174/how-india-plans-to-provide-covid-19-vaccines-to-its-population

Fugard, A. J., & Potts, H. W. (2015). Supporting thinking on sample sizes for thematic analyses: A quantitative tool. International Journal of Social Research Methodology, 18, 669-684.

Goldstein, I. L., & Ford, J. K. (2002). Training in organizations.

Wadsworth.
Guion, R. M. (2011). Assessment, measurement, and prediction for personnel decisions (2nd ed.). Routledge.
Hausknecht, J. P., & Heavey, A. L. (2017). Selection for service and sales jobs. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection, (2nd ed., pp. 781-796). Routledge.
Herman, C. (2021, September 23). How some schools are using weekly testing to keep kids in class—and COVID out. https://www.npr.org/sections/health-shots/2021/09/23/1032812404/how-some-schools-are-using-weekly-testing-to-keep-kids-in-class-and-covid-out
Highhouse, S., Doverspike, D., & Guion, R. M. (2016). Essentials of personnel assessment and selection (2nd ed.). Routledge.
Hinkin, T. R. (1998). A brief tutorial on the development of measures for use in survey questionnaires. Organizational Research Methods, 1, 104-121.
Hooper, M. W., Nápoles, A. M., & Pérez-Stable, E. J. (2020). COVID-19 and racial/ethnic disparities. Journal of the American Medical Association, 323, 2466-2467.
Jacobs, R., & Denning, D. L. (2017). Public sector employment. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection, (2nd ed., pp. 722-737). Routledge.
Johnson, R. D., & Randall, J. G. (2018). A review of design considerations in e-learning. In D. L. Stone & J. H. Dulebohn (Eds.), Research in human resource management (pp. 141-188). Information Age Publishing, Inc.
Jones, D. (2022, July 22). The first U.S. polio case was discovered in nearly a decade. Should you worry? https://www.npr.org/2022/07/22/1113018772/polio-new-york-case
Kantis, C., Kiernan, S., & Bardi, J. S. (October, 2020). Updated: Timeline of the coronavirus. A Frequently updated tracker of emerging developments from the beginning of the COVID-19 outbreak. Think Global Health. Retrieved 12/16/2020 from https://www.thinkglobalhealth.org/article/updated-timeline-coronavirus
King, N. (2021, January 7). Fauci says U.S. needs more time to "catch up" on vaccine rollout. https://www.npr.org/sections/coronavirus-live-updates/2021/01/07/954324536/december-was-pandemics-deadliest-month-vaccine-process-has-been-slow
Kondrasuk, J. N. (2004). The effects of 9/11 and terrorism on human resource management: Recovery, reconsideration, and renewal. Employee Responsibilities and Rights Journal, 16, 25-35.
Kraiger, K., & Ford, J. K. (2021). The science of workplace instruction: Learning and development applied to work. Annual Review of Organizational Psychology and Organizational Behavior, 8, 45-72.
Kretzschmar, M. E., Rozhnova, G., Bootsma, M. C. J., van Boven, M., van de Wijgert, J. H. H. M., & Bonten, M. J. M. (2020). Impact of delays on effectiveness of contact tracing strategies for COVID-19: A modelling study. Lancet Public Health, 5, e452-e459.
Levine, E. L., Maye, D. M., Ulm, R. A., & Gordon, T. R. (1997). A methodology for developing and validating minimum qualifications (MQs). Personnel Psychology, 50, 1009-1023.
Mabee, B. (2007). Re-imagining the borders of US security after 9/11: Securitisation, risk, and the creation of the Department of Homeland Security. Globalizations, 4, 385-397.
Marcroft, S. (2020, July). You're a what? Contact tracer. U.S. Bureau of Labor Statistics. https://www.bls.gov/careeroutlook/2020/youre-a-what/contact-tracer.htm?view_full.
McCrae, R. R., & Costa, P. T. (2008). Empirical and theoretical status of the five-factor model of personality traits. In G. Matthews (Ed.), The SAGE handbook of personality theory and assessment, (pp. 273-294). Sage.
McKillip, J. (2001). Case studies in job analysis and training evaluation. International Journal of Training & Development, 5, 283-289.
Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. Psychological Review, 102, 246–268.
Mooney, G. (2020). "A menace to the public health"—Contact tracing and the limits of persuasion. New England Journal of Medicine, 383, 1806-1808.
Mumford, M. D., Barrett, J. D., & Hester, K. S. (2012). Background data: Use of experiential knowledge in personnel selection. In N. Schmitt (Ed.), The Oxford handbook of personnel assessment and selection (pp. 353-382). Oxford University Press.
Murthy, B. P., Molinari, N. A. M., LeBlanc, T. T., Vagi, S. J., & Avchen, R. N. (2017). Progress in public health emergency preparedness—United States, 2001–2016. American Journal of Public Health, 107, S180-S185.
Parker, S. K. (2014). Beyond motivation: Job and work design for development, health, ambidexterity, and more. Annual Review of Psychology, 65, 661-691.
Ployhart, R. E., & Weekley, J. A. (2017). Strategy, selection, and sustained competitive advantage. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection, (2nd ed., pp. 115-133). Routledge.
Ramstedt, K, Hallhagen, G., Lundin, B. I., Håkansson, C., Johannisson, G, Löwhagen, G. B., Norkrans, G., & Giesecke, J. (1990). Contact tracing for human immunodeficiency virus (HIV) infection. Sexually Transmitted Diseases, 17, 37-41.
Randall, J. G., Dalal, D. K., & Dowden, A. (2020). Improving contact tracing in minority communities by combating misinformation and distrust. White paper submitted to the Differential impacts of COVID-19 in New York state: Understanding and eliminating minority health disparities in a 21st-century pandemic. University at Albany, State University of New York.
Randall, J. G., Dalal, D. K., & Dowden, A. (in press). Factors associated with contact tracing compliance among communities of color in the first year of the COVID-19 pandemic. Social Science & Medicine
Rivkin, D., Gregory, C. M., Norton, J. J., Craven, D. E., & Lewis, P. M. (2017). Advancing O*NET data, application and uses. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection (2nd ed., pp. 874-912). Routledge.
Rotundo, M., & Spector, P. E. (2017). New perspectives on counterproductive work behavior including withdrawal. In J. L. Farr & N. T. Tippins (Eds.), Handbook of employee selection (2nd ed., pp. 476-508). Routledge.
Schneider, A. (2022, July 23). The WHO declares monkeypox a public health emergency. https://www.npr.org/2022/07/23/1113183728/monkeypox-glob-

al-health-emergency-who
Shapiro, A. (2022, July 19). Monkeypox keeps spreading. Here's what authorities are doing to stop it. https://www.npr.org/2022/07/19/1112043780/monkeypox-keeps-spreading-heres-what-authorities-are-doing-to-stop-it
Schmitz, R. (2021, January 6). Europeans criticize the slow start to COVID-19 vaccine rollout in EU. https://www.npr.org/2021/01/06/953857348/europeans-criticize-the-slow-start-to-covid-19-vaccine-rollout-in-eu
Simmons-Duffin, S. (2020, December 23). For overwhelmed and burnt out COVID-19 contact tracers, help is (hopefully) coming. https://www.npr.org/sections/health-shots/2020/12/23/949580432/for-overwhelmed-and-burnt-out-covid-19-contact-tracers-help-is-hopefully-coming
Simmons-Duffin, S., & Huang, P. (2021, January 8). Here's how the U.S. can jump-start its sluggish COVID-19 vaccine rollout. https://www.npr.org/sections/health-shots/2021/01/08/954662748/heres-how-the-u-s-can-jump-start-its-sluggish-covid-19-vaccine-rollout
Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of web-based and classroom instruction: A meta-analysis. Personnel Psychology, 59, 623-664.
Soltani, A., Calo, R., & Bergstrom, C. (2020, April 2020). Contact-tracing apps are not a solution to the COVID-19 crisis. https://www.brookings.edu/techstream/inaccurate-and-insecure-why-contact-tracing-apps-could-be-a-disaster/
Society for Human Resource Management (SHRM). (2016). A guide to conducting behavioral interviews with early career job candidates. SHRM.
Swanson, K. C., Altare, C., Wesseh, C. S., Nyenswah, T., Ahmed, T., Eyal, N., E. L. Hamblion, Lessler, J., Peters, D. H.,& Altmann, M. (2018). Contact tracing performance during the Ebola epidemic in Liberia, 2014-2015. PLoS Neglected Tropical Diseases, 12, e0006762.
Vaugh, A. (2020). The problems with contact-tracing apps. New Scientist, 246, 9.
Watson, C., Cicero, A., Blumenstock, J., Fraser, M., Hosangadi, D., Inglesby, T., Martin, E., Meyer, D., Montague, M., Mullen, L., Nuzzo, J. B., Potter, C., Rivers, C., Sell, T. K., Shearer, M., Trotochaud, M., Warmbrod, K. L., Watson, M., George, D., ….& Sharfstein, J. M. (2020). A national plan to enable comprehensive COVID-19 case finding and contact tracing in the US. Johns Hopkins University.
Weekley, J. A., Ployhart, R. E., & Holtz, B. C. (2006). On the development of situational judgement tests: Issues in item development, scaling, and scoring. In J. A. Weekley & R. E. Ployhart (Eds.), Situational judgemtn tests: Theory, measurement, and application (pp. 157-182). Lawrence Erlbaum.
Whetzel, D. L., Sullivan, T. S., & McCloy, R. A. (2020). Situational judgment tests: An overview of development practices and psychometric characteristics. Personnel Assessment and Decisions, 6, Article 1.

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