

Understanding Law Enforcement Strategies and Needs for Combating Human Trafficking

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ABSTRACT

In working to rescue victims of human trafficking, law enforcement officers face a host of challenges. Working in complex, layered organizational structures, they face challenges of collaboration and communication. Online information is central to every phase of a human-trafficking investigation. With terabytes of available data such as sex work ads, policing is increasingly a big-data research problem. In this study, we interview sixteen law enforcement officers working to rescue victims of human trafficking to try to understand their computational needs. We highlight three major areas where future work in human-computer interaction can help. First, combating human trafficking requires advances in information visualization of large, complex, geospatial data, as victims are frequently forcibly moved across jurisdictions. Second, the need for unified information databases raises critical research issues of usable security and privacy. Finally, the archaic nature of information systems available to law enforcement raises policy issues regarding resource allocation for software development.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing; Collaborative and social computing theory, concepts and paradigms; Computer supported cooperative work;**

KEYWORDS

Law Enforcement, Human Trafficking, needs analysis, qualitative

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1 INTRODUCTION

Human trafficking is a complex crime where victims are forced to engage in commercial sex, labor, or other services for the financial gain of others [41]. Human trafficking remains a top societal concern both globally [41] and for several US government agencies [42, 43]. Despite increasing attention towards this problem, human trafficking remains a significant global phenomenon and is continuing to rapidly increase in size [18].

In efforts to combat human trafficking, law enforcement plays a significant and critical role as they are often the first to identify and respond to human trafficking cases [5]. Many survivors mentioned that they had some contact with law enforcement while they were being trafficked and further noted that their interactions with law enforcement helped them leave their traffickers [34]. Additionally, law enforcement is often in the unique position to connect victims to appropriate social service providers. A study for the US Department of Justice noted that the majority of victims who were referred to service providers were initially identified by law enforcement [5]. As a result, designing new tools to support law enforcement in this effort has a major impact on combating human trafficking.

However, little is known about what the current needs of law enforcement personnel are - particularly with respect to their technological needs. Furthermore, there is a gap in research concerning the role technology plays in an investigation (despite current research efforts into the development of new tools) and a gap in understanding how collaboration occurs and the role technology plays in facilitating these interactions.

Thus, the goal of this paper is to understand the needs of law enforcement personnel working on human trafficking cases from a sociotechnical perspective and understand

how HCI researchers can design better tools to support law enforcement in these efforts. To address these points, we conducted an interview study with sixteen law enforcement personnel working on human trafficking cases. Through analyzing their investigation process and understanding their social technical needs, we highlight areas where future research in HCI can assist and discuss the complex challenges associated with designing for law enforcement. Our contributions outline a path forward for the development of new tools for anti-trafficking efforts.

2 BACKGROUND

To better understand the context of this research, we first define human trafficking. We then lay out some background information about law enforcement in the US and the role law enforcement plays in combating human trafficking.

Human Trafficking Defined

Human Trafficking refers to the crime of recruiting, harboring, transporting or obtaining a person for the purposes of exploitation through the use of force, fraud, and/or coercion [1]. In the US, human Trafficking is a federal crime as established by the Trafficking Victim Protection Act (TVPA) of 2000 [1].

Human trafficking is often separated into two types: labor trafficking and sex trafficking. Labor trafficking refers to cases where an person is forced against their will to work in typically an otherwise lawful industries such as agriculture or domestic work [42]. Labor traffickers often lure victims through false promises of gainful employment and then force them to work long hours for little to no pay in unsafe working environments [42]. Sex trafficking refers to cases where a victim is forced to perform commercial sex acts such as prostitution or pornography [42]. Note that sex trafficking is distinct from cases in which adults willingly engage in sex work without coercion - victims of human trafficking do not consent to their exploitation.

Due to the underground and hidden nature of sex trafficking, it is difficult to estimate the number of victims or the scope of the problem [31]. Currently, there are no reliable estimates for the number of trafficking victims in the US [8, 34]. The most reliable estimate comes from the International Labor Organization which conservatively estimates that globally there are currently 24.9 million victims of labor trafficking and 4.8 million victims of sex trafficking [19]. One in four of these victims are children [19].

Law Enforcement in the US

Law enforcement agencies in the US operate at the local, county, state, and federal level. While departments at each of these levels have overlapping jurisdictional regions, these departments are completely separate entities - e.g. a city

police department does not report to the state police department. This separateness creates unique collaboration and technological barriers. For example, each department may use different tools, so two police departments located next to each other might use different databases, which complicates the process of finding overlapping crime records.

Human trafficking is investigated at all levels (local, county, state, and federal) and often requires multiple departments to investigate a case together, because victims move across jurisdictions [10, 29, 31]. Some departments have investigators who specialize in human trafficking cases; however, this is less typical and most investigators who have worked human trafficking cases work in units that also handle other types of cases [10]. For example, an investigator working a human trafficking case might work in a Special Victims Unit (SVU) that deals with sex related crimes or a VICE Unit which deals with crimes relating to gambling, prostitution, and narcotics. Some departments do not have any investigators who are trained to investigate human trafficking cases or who have sufficient resources to investigate such a complicated crime; thus, human trafficking cases identified by those departments are often handed off to a county, state, or federal department [10].

3 RELATED WORKS

There is limited research on the role of law enforcement in anti-trafficking efforts; much of the prior work has focused on law enforcement attitudes towards human trafficking [32, 45], the role officers play in victim identification [5, 10], and understanding law enforcement training needs [10]. To the best of our knowledge, there are no studies concerning the role of technology in a law enforcement investigation of human trafficking. Instead, much of the prior work has focused on the role technology plays in facilitating trafficking [25, 30] and the potential methods law enforcement can use to exploit such technology [9, 35]. Additionally, prior work has lead to the development of analytics tools to support law enforcement investigations for sex trafficking [22, 38]. Note that there are no complementary tools designed to combat labor trafficking [26]. As such, we draw on the body of work on information and communication technologies (ICTs) and big data with respect to law enforcement to situate our work.

ICT and Law Enforcement

With efforts to reform policing strategies in the US, law enforcement departments over the past several decades have increasingly adopted ICTs [20, 39]. Adoption of ICTs has the potential to increase the effectiveness and efficiency of a police force while lowering costs [20]. However, recent research has indicated that adoption of ICTs alone does not improve productivity of a particular police department unless adoption is paired with support from management and

strategic deployment of such tools [11]. In particular, community policing and data-driven policing are strategies that most often correlate with increases in successful technology adoption [11, 39]. Adoption of ICTs is also associated with certain organizational changes within a police department; departments who adopted ICTs are associated with increases in hiring specialized staff (particularly staff with IT backgrounds), increases in the number of specialized units, and increases in the educational and training requirements for staff across the board [11].

Despite these advantages, law enforcement adoption of ICTs is not universal. Police departments in the US face a serious lack of funding and training for new technology, which is a barrier for effective investigations. This is especially true for human trafficking investigations which (as discussed in our findings section) rely heavily on technology for data mining and analytics. As noted in a study by the non-profit research institute RTI International, many police departments lack technology capable of those tasks. In 2017 only 14% of police departments in the US had technology to share and search for data across silos [39]. Additionally, only 10% had tools for data-mining and only 5% had tools to uncover connections between data points [39].

Furthermore, police departments continue to struggle with collaboration and information sharing despite the increased efforts to use ICTs for this purpose [14–17]. While departments have increasingly adopted policies to support information sharing, the lack of software standards across multiple platforms makes sharing almost impossible [15]. As discussed in our findings and discussion section, this remains a serious barrier for human trafficking investigations.

Big Data and Law Enforcement

Prior work has also looked at the role of big data in policing contexts. Technology to support data collection and analysis for police departments has been discussed by researchers as a solution towards police accountability and as a solution to help mitigate policing biases like racial profiling [6, 21]. However, recent work by Verma and Dombrowski has found that the technology to support big data in its current form is not enough to support police action and judgment [44]. Furthermore, data collected and analyzed has the potential to either confirm or counter an officer's bias depending entirely on how the data is collected and displayed [44].

In practice, adopting big-data oriented practices in law enforcement faces a number of technical issues - from dealing with siloed databases to issues with mistyped data entries [33] - and faces a number of important social criticisms. Police departments are increasingly working with new data sources including social media, which leads to new questions concerning the potential for mass surveillance [3, 21]. Additionally as the collected data is inherently not objective in

nature, researchers have noted that data-driven policing has the potential to perpetuate biases rather than mitigate them [44]. With human trafficking cases, there is the concern that data collection at a national scale will reinforce stereotypes (such as victims of sex trafficking are more likely to be foreign nationals despite domestic victims being more common), and lead to continued problems with victim identification [36]. Additionally, researchers warn that unchecked data collection could infringe on the rights of individuals [17, 24]. With the development of modern tools, careful attention must be paid to ensure that such tools do not cause harm. Notably, data about voluntary sex workers is intermixed with data about trafficking victims. The rights of voluntary sex workers remains a controversial issue; however, as we will see, our law enforcement informants have little to no interest in arresting them (and often actively help them, connecting them with social services). As human trafficking investigations often rely on big data practices, our work examines the role of technology noting issues with current implementations. Additionally, we discuss potential strategies to mitigate these issues drawing from lessons from prior work that notes that efforts require a mix of social and technical solutions [36, 44].

4 METHODS

For this study, we performed semi-structured interviews with 16 law enforcement personnel working on human trafficking cases. Our participants worked in a variety of roles within law enforcement agencies including analyst, detective, and senior personnel (see Table 1).

Drawing methods from prior work [7], we used convenience sampling [28] to recruit initial participants and used snowball sampling to gather additional participants. We recruited participants for the initial 3 interviews through personal and professional contacts. Additionally, 3 were recruited through a relevant mailing list, and the remaining were recruited through a random sample of a contact list provided by an NGO partner (see Table 1 for complete breakdown). We continued to recruit participants for this study until we felt that the data was saturated [13].

The interviews were conducted over the phone or in person, lasting between 30-90 minutes. During the interviews, the participants were asked questions about their background, investigation process, technology use, and collaboration. We also asked participants to explain their technological needs and how researchers could design better tools for them. One researcher qualitatively coded the interviews using inductive thematic analysis [2], and throughout the process, emerging themes were discussed by all the authors.

Researcher self disclosure is an important part of qualitative research. The research team are passionate about combating human trafficking, and are persuaded by the body

	Sex	Job Description	Region	Department Type	Recruitment
P1	M	Detective in a VICE unit	Southeast	Mid-size county police department	Personal Contact
P2	M	Detective in a Tech unit	Southeast	Mid-size county police department	Referral
P3	M	Detective in an SVU unit	Southeast	Large city police department	Personal Contact
P4	M	Analyst	Midwest	Smaller city police department	Mailing List
P5	F	Senior Analyst	West	Large city police department	Mailing List
P6	F	Analyst	Southeast	Large city police department	Mailing List
P7	M	Retired lieutenant, specializes in Human Trafficking investigations	West	large city police department	Referral
P8	M	Retired US Marshall	Southeast	Federal police department	Personal Contact
P9	F	Detective in a Human Trafficking Unit	Southwest	Large city police department	NGO contact list
P10	M	Human Trafficking Investigator	Canada	Mid-sized municipal department	NGO contact list
P11	M	Analyst	Southwest	State Police organization	NGO contact list
P12	M	Retired Detective, current director of a related non-profit	Southwest	Large city police department	Referral
P13	F	Investigator specializing in Human Trafficking	West	Large county police department	NGO contact list
P14	M	Analyst specializing in Human Trafficking	Southwest	State police organization	Referral
P15	M	Retired Major, currently Coordinator for Human Trafficking	Southeast	State police department	NGO contact list
P16	M	Human Trafficking Investigator	Southwest	State police department	NGO contact list

Table 1: Overview of study participants. Note that we interviewed one Canadian participant. Police departments in Canada and the US are largely comparable and the investigation process described by our Canadian participant matched the process described by our US participants.

of evidence that suggests that collaborating with law enforcement is one of the most effective means to that end. We have collaborated with multiple non-governmental organizations (NGOs) in this space, and the first author was an intern at Marinus Analytics during summer 2018.

Participant Backgrounds

Our inclusion criteria was that our participants had to have worked at least one human trafficking case prior to the interview. However, all of our participants had worked on human trafficking cases for at least a year before the interview. When we reached out to police departments, we were often directed to speak to the more senior person on a unit because that person had worked more cases and was more familiar with what the overall needs were for their unit. In particular, P7 and P15 had both worked over 10 years on human trafficking and are experts on the topic.

In terms of familiarity with Human Trafficking, all our participants had received some training about trafficking and were largely familiar with recent policy and research on trafficking. Participants who specialized in trafficking

received more training than their other counterparts and our participants who worked as analysts typically had the least training. Training for human trafficking tends to happen after a person joins or is assigned to a human trafficking case. Officers tend to move between units frequently mostly as a mechanism to gain a promotion (i.e., a person might join the VICE unit because there was an opening for a detective). However, our participants noted that units that deal with human trafficking cases tended to self-select more (i.e., officers choose to join those units specifically). As such, we find that our participants are self-motivated to investigate these cases.

Expertise and comfort with technology varied between participants, with all being at least familiar with the majority of the tools discussed in the findings section and highly proficient with using the case management tools and police databases. More experienced participants (P2, P9, P15) used the more complicated visual analysis tools. How experienced a person was with technology depended on how much training they had access to. Our participants described getting training for the various tools through a mix of formal

trainings provided by the tool's manufacturer and informal trainings where a colleague trained them. Access to sufficient training was mentioned by our participants as a serious barrier to technology adoption.

Limitations

Our participants are not representative of law enforcement in general. We limited our study to include only those who have worked on human trafficking cases. Officers with experience with human trafficking cases tend to work in larger police departments and tend to be more specialized than might be otherwise be typical. Additionally, our participants have access to more technology than is typical for police departments. As mentioned in the related works section, only 10% of police departments have access to data mining tools; whereas the majority of our participants describe having access to some tools in this space. Like other qualitative studies on law enforcement working in human trafficking [7], our participants were mostly from the southeast and southwest regions. Many states in these areas have policies that list human trafficking as a high priority and have a long history of participating in human trafficking task forces. As such, we did not interview participants in departments who have only recently begun to investigate human trafficking cases.

5 FINDINGS

In this section, we first describe the overall investigation process our participants described. It is important to understand how an investigation progresses in order to contextualize the role technology and collaboration play in this process. We then discuss participants' technology use and collaboration process. Finally, we present our main findings, the sociotechnical needs of our participants.

Overview of Investigation Process

At a high level, most investigations as described by our participants go through the same general steps (see Figure 1). Note that these stages don't always go in this order and some investigations perform these stages in parallel. Also investigators often work multiple cases at once. In terms of timeline for this process, our participants noted that typical investigations take a long time - ranging from several months to several years. Human trafficking investigations are often more complex and take more time than other criminal investigations [10].

Starting a New Investigation. There are two main processes through which an investigator starts a case: proactive and reactive [31]. The proactive process starts with the investigator actively seeking out new cases. The reactive process starts with a case that has already been identified by someone else. Seven of our participants noted doing a mixture

of both processes (with P1 and P15 working proactive cases almost exclusively) and nine mentioned working reactively only.

In a typical proactive process, an investigator starts a case by examining online advertisements for sex work to look for indicators of trafficking. Investigators use tools such as Marinus Analytics' Traffic Jam¹ and Thorn's Spotlight² to assist with this process. These tools provide users with a searchable database of these advertisements and an interface to explore connections across selected advertisements. P16 describes this process noting that he uses his experience to identify trafficking indicators: *"I can literally go get on Traffic Jam right now, find a girl³ or find a posting that looks like she looks kinda young or she looks like she might not be doing this on her own or something like that."* With the rise in adoption of internet sources to facilitate trafficking, combating human trafficking is increasingly a big data problem [24] and investigators rely on technology to support this proactive process. Much of the software designed specifically for human trafficking cases targets this investigation stage.

In contrast, reactive cases rely far less on technology and instead begin with collaboration. In a reactive process, an investigation starts with some form of a tip from established collaborators, civilians, or other police departments. As P9 describes cases can begin from many different sources: *"It's all different 'cause we get tips from so many areas, we might have a report from patrol, we might have a civilian tip, we might have an anonymous tip."*

All of our participants noted working with a wide range of individuals as collaborators. For example, several participants mentioned working with human trafficking hotlines to get tips for cases. Others mentioned working with government agencies like Child Protective Services or non-profits like the National Center for Missing and Exploited Children. Additionally, a few participants mentioned working with the medical community.

Tips may also come from civilians, sometimes anonymously through programs like Crime Stoppers that allow members of a community to pass along information about a crime through a neutral party. Some departments use civilian informants such as cab drivers to get tips on recent trafficking-related crimes. For example, P1 described starting many of his cases based on tips generated by his local community:

"There are some cases that will get assigned to us. There are certain reports that they'll say 'Hey, we want you guys to take a look at this.' Or they'll assign us what would be referred to as a suspicious activity report. Then go out there, a citizen saw

¹<http://www.marinusanalytics.com/>

²<https://www.wearethorn.org/spotlight/>

³Our participant is referring to a child victim. However, law enforcement do sometimes refer to adult female sex workers as "girls."

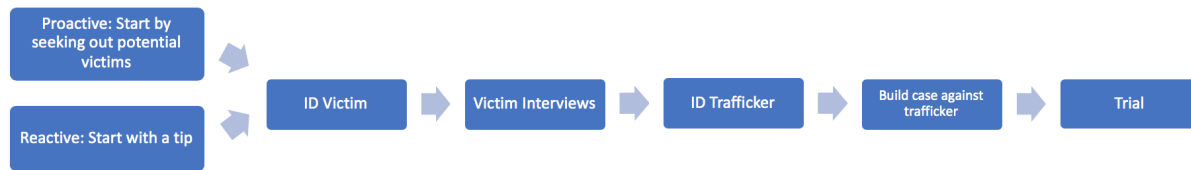


Figure 1: Overview of general investigation process

this type of activity. I'll go out there and take a look at it and see if there's anything to it. We'll conduct our own independent investigation and we'll go from there."

Social media also plays a key role in gathering civilians tips as noted by P5: "Social media's driving a lot of things, anywhere from litter, almost like a crime stoppers real time sort of. So you see a lot more crime tips and stuff come in off Twitter and Instagram and Facebook."

More often, however, our participants described scenarios where a case was identified by a different police department investigating other crimes. For example, P3 described an investigation that began when a patrol officer responded to a noise violation and accidentally uncovered a trafficking ring. Other participants such as P13 and P8 work in request-based agencies - meaning they take on or assist with cases when requested to by other departments. Other departments may request help if they either do not have the experience or do not have the resources to investigate human trafficking cases. P13 describes this process below, noting that other officers will call her when they need help investigating a suspected trafficking case:

"They'll call us, hey I came out to a hotel. Initially came out as a domestic violence. It kind of looks maybe more like human trafficking. I need some help. I need some direction. We'll go out and help them ... Or someone just on scene right then and there and they call us, like hey I need help. I need some direction. I'm not really sure what I have. We'll go out there and assess."

These cases highlight an important issue with reactive cases: victim identification is largely dependent on collaborators and other police officers recognizing the signs of trafficking. These cases highlight the need for more pervasive training for law enforcement beyond those who investigate human trafficking cases and the need for more widespread public awareness of the realities of trafficking. Additionally, as supported by the findings of prior work, these findings point towards the importance for police communication with the public [16, 17].

Identifying a Potential Victim. At this stage, investigators begin a process of evidence gathering with the goal of getting enough information to make contact with the victim and to access the situation the person is in. Investigators are looking for information concerning the victim's real identity,

location, and/or contact information. Additionally, investigators look for information that may confirm the victim is in a human trafficking situation. P9 describes this process noting that she uses several databases to find this information: "We try to figure out as much as we can from our databases before we go out in the field to do anything so we're trying to use Traffic Jam to find ads, we are on our portals ... and so on to try to research addresses and names to just try to build up the best idea of what's going on that we can."

This process involves using a large number of tools at once to look for this information across disparate data sources. A typical process for this is described in detail by two participants:

"We will look on our database to find reports for our victim. There may be a report out there that they don't know about, or they forgot about. We'd look on the computer, on police computer databases for those reports ... Then another option would be through Traffic Jam. We would put in whatever information we had about the person. For example, their phone number, punch that in and then get the list of all the locations that they had been working in. Usually you'll find that they're transient, and moving about. Who knows where they were, but then you could follow up on that based on the information from Traffic Jam. Maybe then trying to get hotel records, or video surveillance." - P10

"I'll take that phone number, I'll search it in Facebook, I'll search it in Google, see if it comes back to any place or any thing. I'll do the reverse image search of her image on Traffic Jam to see if she posted it on other websites or what other phone numbers she's posted under. I'll then check it against Facebook or Instagram or anything like that ... Some people put their phone number on their Facebook page. I've had a girl to use the same number and post on Backpage, so that was a super easy find. I just plugged it in there and we found her. Then we actually found out who she was and her actual name, and then we can use our ... law enforcement databases to search their name, date of birth. We can find addresses and things like that." - P16

Note the sheer number of tools both participants described using. This process requires the investigators to keep track of a number of new leads and past search histories at once. Our participants all emphasized the importance of keeping

case information organized, and some mentioned using tools like note-taking systems or Microsoft Excel to keep track of case information. Others mentioned relying on memory to keep track of a case's progress.

Victim Interviews. Once a victim is identified, investigators will try to make contact with the person and get an interview. Victim interviews are critical for an investigation because often the information in the interviews is the basis for the entire case at a trial. P2, a former SVU detective that worked on cases relating to sexual assault including trafficking, noted the importance of interviews: *"Special victims, particularly dealing with children, a lot of the crimes you won't find out about until afterwards, there is no physical evidence, so everything relies on our interviews. The majority of our cases, it comes down to talking to the victims and talking to the suspect and it's purely interviews."*

Additionally, our participants noted that they needed to perform multiple interviews with the victim before they can fully understand the situation. This requires investigators to locate a victim multiple times before they can help the person. P9 describes the difficulty with this below:

"They lie a lot and there's reasons for that, there's a common bond, and psychological issues and so on but it can be real difficult to get to the truth of what they're saying especially often it will take three or four interviews before you kind of get the whole story of what went on and in between that time, they'll often have run away or disappeared so you never quite know what part of what they told you know was the total truth and what wasn't."

Many participants mentioned that the first goal of the interviewing process is to get the person the help they need. They work with victim services or victim advocates as part of this process to ensure the needs of the victims are met. P13 describes below that before a formal interview, she first makes sure the person's basic needs are met:

"First and foremost, we don't care about the situation in a sense. We don't want to know the story. We're not going to grill you. Do you want to eat? When was the last time you ate? Are you hungry? Are you cold? We have backpacks that we carry in our cars and it comes with clothes, toiletries and socks of different sizes. We want to meet their needs number one. Medical care. Just show care and concern." - P13

Building rapport with the victim is absolutely crucial - not just for getting the necessary information for a case but to also ensure that the person gets the help they need when they are ready for it. For example, P13 notes that being non-judgmental across multiple interviews is critical: *"But just being there for them really consistently and always and not judging them and listening to them and you know taking them back again, again no matter how many times they've run away and really showing that you care for them is a big part."*

P10 additionally notes that building rapport is important for getting the person the help they need when they are ready: *"Often times the person doesn't want to come forward at the time. What you do is develop some rapport, and sometimes they'll come back to you a month later and say, 'I met you a couple months ago. You probably don't remember me.' Most of the time you do remember them, but say, 'Yeah. At the time ... Yeah, I want to tell you about a situation where things aren't okay.' Then we would investigate it."*

Identifying the Trafficker. From the information gathered in the victim interviews, the next stage requires investigators to identify the trafficker. Our participants often relied on subpoenas for the victim's phone and social media to do this. As P11 described, investigators look at information in conversations or look at who owns the phone to identify the trafficker: *"We can tell they're in control because of conversations they're having where, a lot of times the trafficker's directing what the traffic person should do."*

Using a similar evidence-gathering process as described in the earlier stages, investigators search to uncover the trafficker's name and address. Some participants noted that they often had to be resourceful to get this information. P15, for example, noted that he sometimes uses his connection with a local restaurant to get the address of a trafficker: *"If I'm looking for somebody and I think they're local, I'll call a friend of mine that works at a pizza place and see if they get food delivered to them, because generally they give you the right address"*. This process requires investigators to keep track of the case's progress and organize the different aspects of the case. This is even more challenging at this stage because investigators are working with more information from multiple sources. As some of these sources do not come from technology (like interview data), investigators often rely on physical systems like sticky notes and folders to keep track of a case's progress.

Building a Case Against the Trafficker. Once the trafficker is identified, then the investigator must build a case against that trafficker and issue arrest warrants. This process requires corroborating information from the victim interviews and evidence gathered in earlier stages. In contrast to the previous evidence-gathering stages, this process focuses on proving the links between the evidence so as to build a strong case that convinces a jury. For example, investigators like P3 might gather evidence like hotel receipts or cash payments records to prove the trafficker is behind the operation:

"The goal is to try and corroborate some of the things that we are hearing ... let's say we've got someone who is running an organization dealing with human trafficking, well they're keeping tabs on their clients and the money and all of that. We would like to take a look at that to prove that this is their organization, that they're running it. This is who we're seeing."

Telephone numbers that match some of the victims that we've recovered. That we're seeing cash payments that match some of the payments that received on this particular day ... Everything has to correlate." - P3

Additionally, prosecutors in collaboration with investigators decide what charges can be brought against the trafficker. The charges will depend on what can be proven and how likely the victim is to go to trial. The process of a trial can be traumatizing for the victims; for this reason, some of our participants have recently pursued other charges besides human trafficking to avoid having to rely on victim testimony. P12 noted this shift in his own investigations where he now typically pursues a financial charge rather than a traditional human trafficking charge:

"We're going after [a financial case]. And then at that point we don't need the testimony as much, which they tend to back out on, for a lot of different reasons. So we're focused on following the money, and see if we can find who's in control of that, and go after money laundering charges, have good strong case on that." - P12

Tools Used During an Investigation

As discussed above, our participants use a wide range of tools during an investigation. Broadly speaking, the tools described by our participants fall into the following categories: police databases, human-trafficking-specific tools, visual-analysis tools, case-organization tools, and general websites.

Police Databases give investigators access to a searchable database for government records, criminal records, or prior case records. Investigators have access to multiple databases at once. Most of our participants named three or more databases when describing their investigation process. Investigators use these databases to find information such as name, address, and criminal records on a victim or trafficker. Other tools mentioned by our participants in this area include LexisNexis's Accurint and Kaseware that allow for more advanced searches on their databases and some basic visualizations of connections between data points returned by a search. Most participants who used either of these tools noted that as part of the searching process, they had to verify the results using other data sources, noting that these databases can often be inaccurate.

Human-Trafficking-Specific Tools mentioned by our participants include Thorn's Spotlight and Marinus Analytics' Traffic Jam. Both tools provide a web-based platform for investigators to use to search through records of sex-work advertisements. Additionally, these tools allow investigators to run facial recognition search on images in the advertisements. In an investigation, these tools are predominantly used either to proactively begin a new case or to help investigators gather evidence on a victim's background.

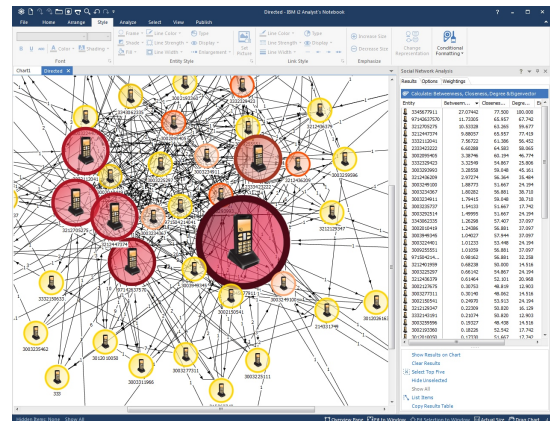


Figure 2: Example screen shot of a link chart made with IBM's i2 Analyst Notebook. Image courtesy of IBM

Visual Analysis Tools most often mentioned by our participants were IBM's i2 Analyst Notebook, ArcGIS, and Microsoft's PowerPoint. Investigators use i2 Analyst Notebook to visualize social networks for a case. For report writing and quick visualizations for court hearings, many participants mentioned using PowerPoint. Only two of our participants mentioned using ArcGIS, a geographic information system for creating maps, which they mostly use to visualize heatmaps of general crime trends for reports or their department's web-page. Investigators used visualizations to explain their insights into a case to co-workers and prosecutors working with them. Others mentioned using visualizations to explain complicated aspects of a case in court like link charts to explain the connections between different call records (an example of such a visualization can be seen in Figure 2).

Case Organization Tools are used by investigators to organize their case notes, keep track of connections, and track the overall progress of their investigation. These tools include a mix of physical systems (like note taking systems, sticky notes, and printouts in binders) and software tools. Software tools again include software used to create link charts. Some also used Microsoft Excel to create checklists to keep track of their progress. As investigators work multiple cases at once, our participants noted that it was absolutely important that they were organized about each case so that leads are not forgotten. Many of our participants described using mostly physical systems to organize their case notes.

General Websites that investigators use include social media sites and search engines. Investigators use these sites to uncover a victim's identity and examine their social network to identify their trafficker. The majority of our participants noted that they searched across social media frequently to uncover new leads.

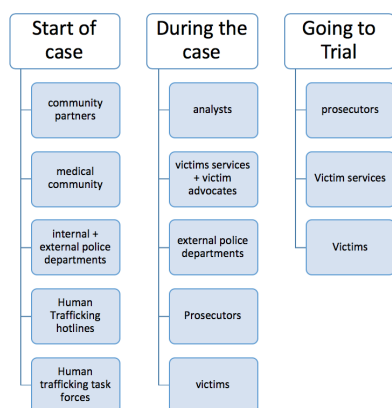


Figure 3: Examples of collaborators and their roles in the investigation process

Collaboration During an Investigation

Because victims of human trafficking travel across multiple jurisdictions, collaboration between police departments is essential [8]. Furthermore, multi-sector collaboration between law enforcement, service providers, and other disciplines is critical for the identification and support for victims [31]. In regular reports, the US government emphasizes the importance of collaboration for combating human trafficking [40, 42, 43].

All our participants echoed these sentiments in our interviews. As mentioned above, our participants all described working with individuals and groups across multiple disciplines. In this section, we describe the roles of each of these collaborators with respect to an investigation.

In the start of a case, collaborators play the critical role of identifying the potential victims of trafficking. These collaborators include health professionals, social services, governmental agencies, other local police departments, civilians, and even hotel employees. P7 noted the importance of building relationships with collaborators as the primary mechanism for identifying new cases: *"you have to have local partnerships. You all have to know how to work together and be working together and have protocols in place to do this work. Because if you have that, then the cases will present themselves"*.

Additionally, collaborators assist with other stages of the investigation. Analysts, for example, assist with the evidence-gathering and case-building process acting as support for the investigator. Analysts can perform some of the data analysis and visualizations tasks and assist investigators by providing distilled insights from their analysis in reports. Victim advocates assist with the interviewing process - ensuring that the needs of the victim are met. Law enforcement also regularly collaborate with various victim service providers

which they rely on to help meet the victim's needs as P10 notes:

"With Victim Services, they provide more resources for the victim than we would. They're a partner ... let's say a victim comes forward and they don't have a phone for example. They had it taken away by the trafficker, or they don't have enough money because they lost the money through the crime, then Victim Services can arrange to get them a phone. There's a whole lot of other resources that they provide, but that'd be an example of something that they could do. They have some funding for tattoo removal as well ... branding is sometimes used by traffickers to indicate that somebody's working for them ... Getting that branding or tattoo removed or covered, can sometimes be of huge value for the victim."

Throughout the entire investigation, several participants noted that they had to work with other police departments because victims move frequently across different jurisdictions. Other police departments can share information relating to the investigator's case or even agree to work the case together.

Sociotechnological Needs

Tools to Support Collaboration. We see two main problems with collaboration that a socio-technological solution could improve: the problem of a lack of shared data and the problem in identifying key partnerships especially across state lines.

Many participants noted that a lack of shared data between law enforcement departments is a major issue in solving human trafficking cases. Because trafficking victims often move between jurisdictions, multiple departments will accidentally work the same case, thus duplicating efforts. Compounding this issue is the fact that different departments have access to different information and tools. Consequently, some cases can only be solved when those departments collaborate as P9 describes when discussing the main barrier in her cases: *"It's incredible the information is out there that we have no access to just 'cause there's no automated sharing so it's kind of ridiculous ... I feel that could probably solve most of the crime in the world if we had access to all this information that everyone has. Probably would solve a lot of these a lot faster"*.

Technology can assist with this problem in a number of different ways. One solution could be to build a central repository that consolidates case information for human trafficking cases as described by P15: *"The type of technology that would really be needed is the type to have a central repository that is searchable, where everybody could put information in and then there would be deeper access levels for people."* Another solution is to add features to existing tools that let users know who else is looking at the same information. For example, when an investigator searches in a database for a particular record, the system could display the name and

contact information for the other officers who searched for that record.

Related to this issue is the problem in identifying key partnerships. In particular, our participants noted having trouble figuring out who would be best to collaborate with across state lines. Currently, most partnerships are established through word-of-mouth and inter-personal relationships. However, victims may move to areas where the investigator has no contacts, leading to issues with continuing the investigation.

"If you have a personal contact, that's always going to be better of course because it's just the personal relationship there that makes it more likely for you to get the action done. If not, then you have to refer to different directories or go to an agency's website and find the phone number of a particular division within the department and hopefully get the right person on the phone to pitch the information to." - P14

Technology can help mitigate this problem in a number of ways. Developers can create platforms such as apps or online forums that support communications between law enforcement personnel working trafficking cases. Recently, some solutions have come out such as the app BLUE⁴ for communicating within a law enforcement department. However, none of these solutions are universally adopted yet. Additionally, researchers can develop methods to find common pathways victims travel between areas to discover connected regions. Uncovering these regions will help law enforcement and policy makers form inter-state task forces to tackle those cases. Similar methods have been applied in the past to tackle drug trafficking in the US through the High Intensity Drug Trafficking Areas (HIDTA) program.

It is important to note that while technology has the potential to assist with maintaining and forming these connections, for any collaboration to be effective, departments and policy makers should continue to prioritize collaboration and information sharing.

Tools to Support Case Building and Organization. Many of our participants noted using physical systems to keep track of an investigation such as sticky note systems to organize key information or note-taking strategies to track what has been discovered. With investigators working multiple complex cases at the same time, it can be hard to keep track of all the relevant information for a particular case with these existing systems. Additionally, some investigators rely on memory to recall connections to previous cases which means that there is the potential for investigators to forget key links. P16 describes using physical systems like notepads to keep track of multiple ongoing investigations:

"Sometimes I grab a notepad and write it down as I go so I don't forget, but I think it becomes the toughest when let's

say you needed all that information for court. Like you needed a printout of their Facebook, you needed the law enforcement database search for that person, you needed the backpage ad. Well that's when it becomes kind of confusing. You just want to make sure you have all of the right information, and also that you're not printing out excessive information that's not relevant."

Investigators need tools to help conceptualize their case-building process including the process of organizing the results of their investigations and keeping track of the case's progress. Some software exists for this purpose. Notably, participants mentioned creating link charts in IBM's i2 Analyst Notebook or in Kaseware to organize case information. However, participants found the process of creating link charts was too cumbersome for routine investigations and instead only used the software for unusually large cases. Further, prior work has noted that existing software still struggles with displaying uncertain, incomplete, or dynamic data [46], which is problematic as human trafficking data tends to have all three of those attributes.

Borrowing from other techniques developed by the information visualization community, researchers can develop new systems to support investigators. As mentioned above, there are some notable challenges that make this space an active area for future research.

Tools to Support Pattern Identification and Forecasting in Geospatial-Temporal Data. As we have seen, human trafficking victims often move across multiple locations. As part of the evidence gathering process, investigators need to map out where a person has been at what times for a number of reasons including proving travel in court. P16 comments:

"With that map, that is super useful for us to be able to go to court and say, 'Hey, this is where they were posting at. This is the time, the day, and then if you look on the timestamps, two days later they were posting in a different city.' So, for us that kind of proves the travel. We can get a better federal charge if we can show that they were traveling traffickers." - P16

Many participants mentioned working with geospatial and temporal data as part of their investigation but lacked tools to visualize and identify patterns in their data. While some had access to tools like ArcGIS for this purpose, the data the investigators have access to is not in a format that can easily be ported into ArcGIS. Most of their data comes from online advertisements, so the locations are often vague (i.e. an ad might list a region or state) and the times uncertain (i.e. ads can be posted in advance of traveling to a location).

Additionally, participants wanted tools to help them understand the victim's movement patterns. Two main reasons were given for this. First, investigators need to identify where the victim is headed so that they can alert other law enforcement officers who can intervene as P11 describes

⁴<http://bluethapp.com/>

below: *"The issue that we have is figuring out where these girls are going to be, what times they're gonna be at. How long they're there. Figuring out patterns of the activity, see if there's any discernible patterns so we can try and get a hold of law enforcement in some other state to help us interdict the person, so that we can then follow back."* - P11

Second, investigators mentioned needing such a tool to discover the identity of victims based on known travel information. P14 describes this need when discussing what kinds of cases he struggles to investigate:

"So, it's just about a layered attack, basically, it's trying to find the ads. I don't have a phone number, I don't know her alias, so I can't queue by phone. I can't queue by alias. I might have one city that I know she was at but there's just too many ads in that city so it's just impossible. Facial recognition doesn't work because she's using fake images. So what else can we do? I think that's the next step in terms of trying to find ads for someone who you know is probably out there and using the geography and the time frames to do that." - P14

Tools that Unify Existing Software and Methods. Our participants all noted using a large number of unconnected tools at the same time as part of their evidence gathering processes. Because all these tools are disconnected, investigators end up spending a lot of time keeping track of the connections across each of the tools.

"It can be time consuming. It can definitely become kind of a hassle ... I'm not exaggerating about this, but normally when I'm searching for ads I have Thorn's Spotlight pulled up, I have Traffic Jam pulled up, I have my undercover Facebook page pulled up. Sometimes I'll have the AdultFriendFinder because somehow everyone ends up there in some kind of way. And then sometimes I'll have the actual website like SkipTheGames, CityVibe, you know whatever they're using ... that's like five different programs to find out who one person is. It can kind of overlap and get confusing and time consuming." - P16

Investigators have a real need for their tools to integrate with one another. Many of our participants note that they would like a platform that unifies these tools or at least connects the results from one tool into another.

"For me, I forget a lot. Like I'll look at a phone number or name and then I'll go to the next tab over, a few tabs over, and I'll have no clue what I just looked at ... if there was a way we could like kind of combine a couple programs like SocialNet⁵ along with Traffic Jam to where some of those searches could be done automatically that would be beneficial. It would save a lot of time too as far as I'm concerned." - P16

⁵SocialNet is a tool that helps investigators visualize a person's social network based on social media relationships

6 DISCUSSION

Design Challenges for Building Solutions for Law Enforcement

When designing new tools for law enforcement there are a few notable challenges to consider. Police officers may need to explain the results of an algorithm or how a tool works in court. When designing tools for law enforcement, it is important to choose algorithms that are human interpretable and design visualizations that help officers get an intuition for how the process works. Recent work in [37] and [27] demonstrate some techniques for making complex machine learning models more interpretable by users. Additionally, training, funding, and experience with advanced technology is unequally distributed across police departments. Tools to support law enforcement have to support both tech-savvy users and users with limited computer skills. To the greatest extent possible, we should design tools that don't need a lot of training to use. Finally as part of the case building process, investigators have to verify the results returned by a tool. Therefore, we need to build interactions in the tool that allow the investigator to verify and manipulate the results.

Information Visualization Implications

Designing information visualization systems for law enforcement presents a number of hard challenges including visualizing uncertain data and building systems that law enforcement can trust. This application area pushes the current boundaries of information visualization research making this a new area for current practitioners to explore.

Challenges with regards to uncertainty can arise through the data itself, or from analytic models computing potential outcomes. For instance, the data collected range from semi-structured databases to coded transcriptions of interviews. Merging these multiple data types is challenging, in part due to the variability in data quality given the source. Further, cases often leverage a significant amount of latent domain expertise of investigators. This poses challenges to the visualization community about how to integrate this knowledge into more traditional datasets being visualized.

Many visualization tools rely on computational or analytic models to compute more complex relationships among data. However, many such models have an inherent amount of uncertainty associated with the results generated. Often, this uncertainty increases when the quality (or perceived accuracy) of the data decreases. Specific to law enforcement, this may lead to significantly high uncertainty. For visualization, this raises challenges not only in how to visualize the potential uncertainty, but also how to create interactive interfaces that allow investigators to make well-informed decisions.

Policy Implications

Many of the problems that our participants shared with us are not hard to solve from a research perspective. The officers we spoke with used a patchwork of miscellaneous tools mostly not designed for their needs, and not designed to inter-operate. When one of our participants needed a professional contact in the Las Vegas area, he stood up in the squad room and yelled, "Anyone know someone in Vegas?" Law enforcement could be more effective if their computing and communications infrastructure was brought up to the standard for corporations for ten or even twenty years ago. Consequently, many of the barriers between law enforcement and more effective attempts to rescue human trafficking victims are a policy issue—the lack of resources for development of quality information technology tools. As discussed in our related works section, few police departments in the US have access for data mining and information sharing. Without these tools, many stages of the investigation process described in our findings would be extremely difficult if not impossible to complete. In light of these results, we urge policy makers and practitioners at all levels of government to consider these issues and to continue to prioritize collaboration and software development.

Privacy Implications

Our research subjects would like better, unified data solutions—national or better yet international databases to help them rescue victims of human trafficking. While this would indeed help them in their critical work, it has troubling privacy implications. Such a comprehensive database can invade the privacy of law-abiding citizens. In the case of sex trafficking, we also have the delicate issue of the rights of voluntary sex workers, whose data will inevitably be represented in those databases.

The rights of voluntary sex workers is a complex issue. Prostitution is indeed a crime in the US⁶. However, many non-governmental organizations, including Amnesty International, advocate for the right of voluntary sex workers to pursue their chosen profession. Some efforts to stop human trafficking have made voluntary sex workers less safe [4]. Reasonable people can disagree on how to approach the issue of the rights of voluntary sex workers. However, our law enforcement participants are unanimous in their lack of interest in prosecuting voluntary sex workers, and their desire to help those workers who need assistance.

The current byzantine state of information databases to help combat human trafficking, paradoxically, protects privacy. If it is so much harder to do anything, then it is harder to violate people's rights. This then raises a key research issue in the growing field of usable privacy and security: *how*

can we design databases that help law enforcement be more effective, while preserving citizens' privacy rights? Incoherent software systems do indeed provide some privacy protection by accident; however, as the research discipline of usable security and privacy evolves, we should be able to provide better privacy protection by design.

Prior abuses of databases such as the National Crime Information Center (NCIC) raise the concerns for creating new unified databases or augmenting existing ones. While the NCIC has been instrumental in solving crimes such as the assassination of Martin Luther King, the NCIC has also been used inappropriately by police officers to stalk former romantic partners, get phone numbers of romantic interests, and even look up information on reporters who wrote unflattering articles about their department [12]. While many of these officers were disciplined and in some cases prosecuted, abuses still persist and there are no clear methods to track how often such abuses happen [12]. It is clear from these cases that simply keeping records of a person's searches is not enough to safeguard against abuse. With the collection of sensitive and personally identifiable information, external oversight should be required to minimize cases of abuse and investigate suspicious search histories. Additionally, we urge policy makers to identify procedures and regulations to ensure that appropriate safeguards are put in place to protect against abuse.

Additionally, large-scale data collection concerning human trafficking investigations needs to address serious concerns about data protection. Researchers have continued to highlight the need for better data on human trafficking, especially as current efforts and policies to combat human trafficking often have to rely on anecdotal evidence [23, 30, 36]. However, human trafficking victims and survivors are an especially vulnerable population. Data breaches concerning human trafficking data can lead to further victimization and carries the risk of endangering the lives of victims and survivors [36]. Careful attention must be paid to ensure that data-collection efforts do not cause more harm than good. Best practices should be taken to ensure any solutions are privacy preserving and that the rights of the individuals are not infringed upon. Work by Mark Latonero [24] and by Felicity Gerry, Julia Muraszkievicz, and Niovi Vavoula [36] provides guidelines. More research on best practices is needed.

7 CONCLUSION

We began this research with a key question: how can HCI researchers help combat the problem of human trafficking? In this initial qualitative investigation, we have uncovered a host of questions that the research community can address. Some challenges are policy oriented: why don't professionals charged with a task as important as stopping modern-day

⁶With the exception of regulated brothels in certain Nevada counties

slavery have better tools? If you imagine giving law enforcement the kind of IT support that corporations use for everyday business tasks, tremendous progress could be made. Other challenges push the limits of the state of the art of usable security and privacy, and information visualization. These findings are a road map for our research group's efforts to build tools to assist law enforcement in rescuing victims of human trafficking.

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