

NISTIR 8295

**Voices of First Responders – Examining  
Public Safety Communication from the  
Perspective of 9-1-1 Call Takers and  
Dispatchers**

*Findings from User-Centered Interviews  
Phase 1, Volume 4*

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**National Institute of  
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## Voices of First Responders Series

This report is a part of a series of publications amplifying the voices of first responders (VoFR) in four public safety disciplines: Communication Center & 9-1-1 Services (COMMS); Emergency Medical Services (EMS); Fire Service (FF); and Law Enforcement (LE). The VoFR series reports on the experiences of first responders with communication technology, including their needs for, and problems with, communication technology. Publications in this series are primarily intended for designers, developers, vendors, and researchers of public safety communication technology, as well as for public safety administrators and decision-makers.

Published as a part of the VoFR series include NIST reports, conference papers, presentations, posters, articles and blog posts, a book chapter, and a web tool for disseminating the research results and data collected from the interviews with and survey of first responders. The reports from which all published materials are derived are listed below and can be accessed from the ***PSCR User Interface/ User Experience Publications*** webpage at: <https://www.nist.gov/ctl/pscr/user-interface-user-experience-publications>. The ***PSCR Usability Results Tool***, providing access to results of the large-scale survey and in-depth interviews with first responders across the U.S. about their communication technology use, can be accessed via <https://publicsafety.nist.gov/>. The datasets from this research project are available via <https://doi.org/10.18434/mds2-2820>.

### Voices of First Responders

- ❖ How to Facilitate Adoption and Usage of Communication Technology: An Integrated Analysis of Qualitative and Quantitative Findings (NISTIR 8443) <https://doi.org/10.6028/NIST.IR.8443>
- ❖ COMMS (NIST SP 1286pt1) <https://doi.org/10.6028/NIST.SP.1286pt1>
- ❖ EMS (NIST SP 1286pt2) <https://doi.org/10.6028/NIST.SP.1286pt2>
- ❖ FF (NIST SP 1286pt3) <https://doi.org/10.6028/NIST.SP.1286pt3>
- ❖ LE (NIST SP 1286pt4) <https://doi.org/10.6028/NIST.SP.1286pt4>

### Phase 1: Findings from User-Centered Interviews

- ❖ Volume 1 - *Identifying Public Safety Communication Problems* (NISTIR 8216) <https://doi.org/10.6028/NIST.IR.8216>
- ❖ Volume 2 - *Examining Public Safety Communication Problems and Requested Functionality* (NISTIR 8245) <https://doi.org/10.6028/NIST.IR.8245>
- ❖ Volume 3 - *Examining Public Safety Communication from the Rural Perspective* (NISTIR 8277) <https://doi.org/10.6028/NIST.IR.8277>
- ❖ Volume 4 - *Examining Public Safety Communication from the Perspective of 9-1-1 Call Takers and Dispatchers* (NISTIR 8295) <https://doi.org/10.6028/NIST.IR.8295>
- ❖ Volume 5 - *Applying Human Factors and Ergonomics Knowledge to Improve the Usability of Public Safety Communications Technology* (NISTIR 8340) <https://doi.org/10.6028/NIST.IR.8340>

### Phase 2: Nationwide Survey

- ❖ Volume 1 - *Methodology: Development, Dissemination, and Demographics* (NISTIR 8288) <https://doi.org/10.6028/NIST.IR.8288>
- ❖ Volume 2 - *Mobile Devices, Applications, and Futuristic Technology* (NISTIR 8314) <https://doi.org/10.6028/NIST.IR.8314>
- ❖ Volume 3 - *Day-to-Day Technology* (NISTIR 8400) <https://doi.org/10.6028/NIST.IR.8400>
- ❖ Volume 4 - *Statistical Analysis Results* (NISTIR 8444) <https://doi.org/10.6028/NIST.IR.8444>

## Abstract

With the newly created Nationwide Public Safety Broadband Network (NPSBN), the public safety community has a unique opportunity to review and improve communication technology for first responders, 9-1-1 communications, emergency medical services (EMS), fire, and law enforcement. Understanding the problems and challenges currently experienced by first responders provides the basis for addressing and developing solutions to improve public safety communication. The National Institute of Standards and Technology Public Safety Communications Research (PSCR) usability team conducted in-depth interviews with approximately 200 first responders representing 13 states in eight Federal Emergency Management Agency (FEMA) regions across the United States. From this larger dataset, this report, the fourth volume in the series, focuses on the contexts and challenges specifically facing 9-1-1 communications personnel. The findings reported here stem from 30 interviews with public safety answering point responders. A qualitative analysis of the transcribed interview data revealed unique issues resulting from significantly different contexts and primary tasks of communications personnel in contrast to first responders from other disciplines. Challenges include 9-1-1 incoming calls from wireless devices, continuity of operations related issues, as well as, technology implementation and infrastructure problems. Communications personnel are concerned that new technologies will demand additional focus which will increase their cognitive loads. Just like their colleagues in other emergency response disciplines, communications personnel stressed the need for utility in technology that emphasizes usability, interoperability, and reliability. Understanding the specific challenges faced by communication personnel can provide insight into the types of new technology, as well as technology improvements, to help them best respond to incidents effectively and efficiently.

## Keywords

First responders; Public safety communications research; 9-1-1 Communications Centers; Qualitative research; Usability; User-centered design; User needs and requirements.

## Audience

This report is primarily intended for developers and researchers of public safety communication technology.

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## Executive summary

With the newly created Nationwide Public Safety Broadband Network (NPSBN), the public safety community is in the process of supplementing the use of land mobile radios (LMR) with a technology ecosystem that will include a variety of new and improved communication tools, including a range of broadband data sharing platforms. It is imperative to have a clear understanding of first responder needs, requirements, and contexts of use across four disciplines (9-1-1 communications, emergency medical services, fire service, and law enforcement) in order for successful deployment and adoption of new communication technology. This Volume 4 report is part of a multi-phase project that is designed to provide an in-depth look at the population of first responders, along with their work environments, their tasks, and their communication needs. In the initial research phase, the National Institute of Standards and Technology Public Safety Communications Research (PSCR) usability team conducted in-depth interviews with approximately 200 first responders representing 13 states in eight Federal Emergency Management Agency (FEMA) regions across the United States.

From the larger dataset, this Volume 4 report focuses on the contexts and challenges specifically faced by 9-1-1 communications centers personnel. Focusing specifically on communications centers' first responders allows identification of their contexts of work, how the communications centers environment influences the problems they face, and the needs they have related to communication and technology. Understanding the unique challenges faced by communications center personnel can provide insight into the types of technology that might help them best respond to incidents effectively and efficiently.

This Volume 4 report draws on interviews with 30 communications center personnel from urban, suburban and rural communities. Findings from this subset of the data show that communications center personnel are in many ways similar to their emergency medical services (EMS), fire, and law enforcement counterparts. For example, communications personnel see utility in technology that is reliable, usable, and interoperable. However, the contexts in which they work are very different, which leads to differences in the communication-related technology problems and needs they experience. First, for emergency medical services, fire, and law enforcement personnel communication is an enabling task, but for those working in 9-1-1 communications whether call taking or dispatching, communication is the primary task. A second defining characteristic is working in a call center rather than at the scene of the emergency. While all first responders work under extreme pressures that result in stress, the confined physical environment and infrastructure of call centers as well as the invisibility from being off-scene have implications for physical, cognitive, and emotional stress for communications center personnel. Technology is integral to the work of all first responders; however, due to being off-scene, communications personnel rely on technology to do their job—communicate with others. The communications personnel interviewed identified many different types of technology currently in use, as well as problems experienced with these technologies. The challenges facing communications centers fall into three broad areas: 9-1-1 incoming calls, continuity of operations related issues, along with technology implementation and infrastructure problems. Additionally, public safety access point administrators are concerned that new technologies will result in new responsibilities that will increase communications personnel's cognitive load and liability. These findings illustrate the unique characteristics of the

communication center's environment, the challenges faced by communications center personnel related to technology, and the need for technology to embrace the concept of utility.

### *Contributions*

This report is primarily intended to be a resource for developers and researchers in the public safety communication technology domain. It provides PSCR-relevant information and significant details about the views of first responders' problems and new functionality for communication technology. Tables and graphics are provided for easy comprehension of the large dataset. Understanding the issues with current systems and first responders' communication technology requests provides the basis for addressing and developing solutions towards improving public safety incident response.

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## List of Acronyms

APCO .....	Association of Public Safety Communications Officials
CAD.....	Computer-Aided Dispatch
COMMS .....	Communications Centers, Communications, 9-1-1/Dispatch
COOP .....	Continuity of Operations
EMS .....	Emergency Medical Services
FEMA.....	Federal Emergency Management Agency
FF.....	Fire Service, Fire Fighting
IT .....	Information Technology
ISO .....	International Organization for Standardization
KVM.....	Keyboard, Video, and Mouse
LE.....	Law Enforcement
LMR .....	Land Mobile Radio
LTE.....	Long Term Evolution

NCIC.....	National Crime Information Center
NCIS.....	Naval Criminal Investigative Service
NFPA .....	National Fire Protection Association
NG 911 .....	Next Generation 911
NPSBN .....	National Public Safety Broadband Network
PS.....	Public Safety
PSAP .....	Public Safety Answering Point
PSCR .....	NIST’s Public Safety Communications Research Program
PTSD .....	Post-Traumatic Stress Disorder
RDS .....	Radio Data System
R&D .....	Research and Development
RMS .....	Records Management System
UI.....	User Interface
US .....	United States
[state]CIC.....	[state]Crime Information Center for example Colorado Crime Information Center (CCIC)

## 1. Introduction

The public safety community is in the process of supplementing the use of land mobile radios (LMR) with a technology ecosystem that will include a variety of new and improved communication tools, including a range of broadband data sharing platforms. The network, currently under development, is a dedicated Long-Term Evolution (LTE) network for public safety known as the Nationwide Public Safety Broadband Network (NPSBN). The goal of the NPSBN is to improve communication for first responders by providing an independent, interoperable communication platform during incident response including network priority and preemption. With the emergence of the NPSBN, the public safety community is beginning to transition to more widespread, data-based communication technology. NIST's Public Safety Communications Research (PSCR) program is dedicated to supporting the Research and Development (R&D) of this technology. Research within the PSCR program focuses on identifying and recommending ways to mitigate the issues faced in emerging public safety communication technology.

Within the larger PSCR program [12], the NIST PSCR usability project focuses on the human factors issues surrounding use of communication technology. The research within this project centers on the technology users—the first responders. This project seeks to better understand first responders' environments, tasks, and communications needs. In doing so, part of the project plan is to directly engage with first responders to examine their perceptions about their use of communication technology during incident response. The ultimate goal is to capture the requirements for the effectiveness, efficiency, and user satisfaction of first responders' use of communication technology, and to share their concerns with the wider public safety community. Three initial research questions guided this work:

1. How do public safety personnel describe the context of their work, including their roles and responsibilities as well as process and flow?
2. How do public safety personnel describe their communication and technology needs related to work?
3. What do public safety personnel believe is working or not working in their current operational environment related to communication and technology?

It is imperative to have a clear understanding of first responder needs, requirements and contexts of use in order for successful deployment and adoption of new communication technology. This report is part of a multi-phase, mixed methods project that is designed to provide an in-depth look at the population of first responders, along with their work environments, their tasks, and their communication needs. Phase 1 data collection focused on interviews with approximately 200 first responders from 9-1-1 communications centers (COMMS), emergency medical services (EMS), fire service (FF), and law enforcement (LE) across the country. The Volume 1 report [3] presents findings from the initial phase of qualitative data collection. Volume 2 [4] specifically identifies the technology problems and needs of first responders from the full qualitative data set. Volumes 1 and 2 present examinations of the larger dataset. During the analysis phase for the Volume 1 report, it became clear that there were differences between contexts and challenges specifically faced by rural first responders. Volume 3 specifically focuses on rural first responders and how the rural environment influences the problems they face, as well as, the needs they have regarding communication and technology. The second phase of the project, Phase 2, utilized

the results of the Phase 1 qualitative interviews to inform a large-scale, online, quantitative nationwide survey in order to provide a more comprehensive view of first responders and communication technology.

Similarly, it became clear that the COMMS context was in many ways different than those of other first responder disciplines we examined, EMS, FF, and LE. However, at that point the data from COMMS was not substantial enough to make the analysis meaningful. Subsequently, additional data were collected. Now, with the full qualitative data set, there are 30 COMMS transcripts from across the country. This report focuses on analyzing the specific COMMS subset—the COMMS interview data. We were interested in exploring the following questions:

1. What makes COMMS work unique?
2. What are the specific challenges faced by COMMS first responders?
3. What are the communication and technology problems and needs of COMMS personnel?

These questions provide for a more in-depth and nuanced understanding of the COMMS experience.

Findings from this subset of the data show that COMMS personnel are in many ways similar to first responders from other disciplines. However, the contexts in which they work can be very different, which leads to differences in the technology and communication problems and needs they experience. To improve current technology and design new technology to address their problems and needs, requires an understanding of COMMS personnel as users, along with their specific tasks and work contexts. This document provides an in-depth analysis of the COMMS experience, including the problems and challenges they face related to communication and technology.

### 1.1. Why Is It Important to Look at COMMS?

The work of COMMS is critical in emergency response. They are typically the first point of contact with the public. They also serve as the interface between the public and the first responders who they often send to the emergency scene. They act as a central hub for the information exchange between the public and responding units. COMMS work generally takes place at a Public Safety Answering Point (PSAP) which is a call center responsible for answering calls to an emergency telephone number for EMS, FF, or LE.

There are over 6,100 PSAPs in the United States, with over 100,000 COMMS personnel. It continues to be a growing field with about 10,000 new hires each year [10]. According to the *Wall Street Journal*, most PSAPs are short-staffed and struggle to hire enough, in part due to the current tight labor market, but also due to the stressful nature of the position [9]. COMMS workers handle over 200 million 9-1-1 emergency calls every year, calls that often require split second decisions in high stakes situations. However, few people know what they do and their work often goes unnoticed [5]. Many people interested in becoming first responders do not consider a career in 9-1-1 communications, preferring instead to pursue a career law enforcement or fire service, one that allows them to be part of the “action” [5].

Having a deeper understanding about what it means to be a COMMS worker, their experiences, and the contexts in which they work can aid in the improvement of current technology and the development of new technology for emergency response. The COMMS role in information gathering, interpretation, and dissemination is unique and important work, especially since they have the dual responsibilities of both

keeping the public safe as well as ensuring that the first responders they send to the scene are as safe as possible.

## 1.2. Methods

As noted above, this report grows out of a multi-phase, mixed methods research project that elicited first responder experiences about the context of their work, specifically related to communication and their use of technology. The data collected for the larger project include 158 interviews with 193 First Responder participants across the United States. This report focuses on the 30 interviews completed with staff from PSAPs in order to present what makes their work unique as well as the specific issues and challenges they face. Methodological details related to sampling strategy, data collection instruments, and data analysis processes can be found in Appendices A-C as well as Volume 1 [3].

### 1.2.1. Sampling Strategy

The sampling strategy for the larger project included ensuring representation of first responders from all four domains: COMMS, EMS, FF, and LE. Geographic diversity was also important since the public safety issues faced by first responders may be different based on geographic location. Across the U.S., first responders from urban, suburban, and rural areas were included, to ensure that communities of different sizes and different economic realities were represented. In addition, in order to be representative of the first responder population across the United States, attention was paid to first responders at different jurisdictional levels (local, county, and state) as well as different ranks and levels, recognizing that their work, and the technology needed to accomplish that work, might vary across these factors. This strategy provides insight into the variety of experiences faced by first responders across the country and ensured coverage of both typical and unique experiences. This diversity is also present in the COMMS data.

### 1.2.2. Participant Demographics

The 10 regions defined by the Federal Emergency Management Agency (FEMA) served as the structure for data collection for the project and ensured representation of first responders across the United States (US). Of the 193 first responders interviewed for the overall project, 30 (15 %) were in COMMS. Table 1 shows the distribution among location types: urban, suburban, and rural.

**Table 1: Total Number of COMMS Participants Interviewed by Type of Area**

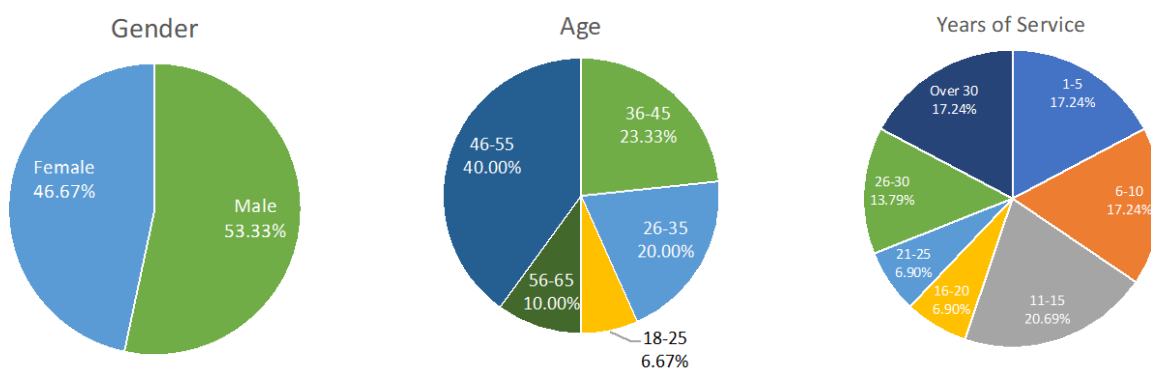
	URBAN	SUBURBAN	RURAL	TOTAL
COMMS	9	3	18	30
	30 %	10 %	60 %	

At the start of each interview, participants were asked to complete a demographics questionnaire (APPENDIX C). The questionnaire captured information about responders' characteristics, experiences, and levels of comfort with technology. In many ways, the demographic variables for COMMS personnel are similar to those of the full data set, with a few interesting exceptions. Not surprisingly, the percentage of females interviewed (46.7 %) was much higher in the COMMS data than in the overall data (9.84 %), reflecting the higher number of women in this discipline than in the other three examined. However, within our COMMS data there were still more men interviewed than women, something that does not

reflect the actual numbers in the field, where approximately 55 % of dispatchers are women [14]. This may be due to the fact that managers were intentionally interviewed due to staffing concerns, most of whom were men, including several emergency managers who oversaw PSAPs. One study participant specifically addressed the demographic leaning towards women:

Yes, it's kind of a demographic for dispatch where it is much more lean towards female...So in our center we have employed I believe it's 52 employees with the capability for more. We've lost a few and out of that on the actual dispatch floor I believe that we have maybe 5 male dispatchers and in the back office the administrative side of it we have another 5 so out of 52 there's 10 males. (COMMS-U-007<sup>1</sup>)

As shown in the Gender chart, Figure 1 (left), there were more males than females interviewed in this COMMS dataset. Approximately half of the males worked in administration. This situation was typical of



**Figure 1: Participant Demographic Information**

the sites visited for this study. More than half of all COMMS participants fell between the ages of 36 and 55 years (23.33 % from 36-45; 40.00 % from 46-55) shown in the Age chart, Figure 1 (middle). This is consistent with the overall data set. The distribution of total years of service for the COMMS interview participants also mirrors the larger dataset, with a diverse sample ranging from those just beginning in the field to those with over 30 years of experience, shown in the Years of Service chart, Figure 1 (right).

Participants were also asked to self-identify their level of experience with various technologies, as well as their tendencies when adopting new technology, data shown in Table 2. Of COMMS participants, 72.41 % indicated they could do most things with technology with occasional assistance, and 20.69 % noted they could do everything they wanted/needed without assistance, both of which are consistent with the percentages in the larger dataset. Given their training and the extent to which they utilize technology for their everyday work, this is not surprising, and one would expect COMMS personnel to be competent technologically. In spite of this, approximately 14 % of COMMS participants indicated they had some experience using technology, and often needed help. This is somewhat higher than in the larger dataset where only 7.38 % of participants self-reported as having some knowledge about and experience with

<sup>1</sup> Participant responses are followed by a notation that is comprised of three parts: 1) first responder discipline (COMMS; EMS; FF; LE); 2) location type (Urban=U; Suburban=S; Rural=R) and 3) interview number. Thus (COMMS-U-007) refers to a COMMS interview, from an urban location, with interviewee number 007.

technology. Participants were also asked about adoption of new technologies. COMMS participants were similar to the overall dataset in all categories except for one: ‘I only adopt new technologies when it’s required.’ COMMS respondents chose this category almost 3 times more than those in the overall dataset.

**Table 2: Experience with Technology for COMMS Interviews**

<b>Q1. Experience with different kinds of technology:</b> (including desktop or laptop computers, tablets, smartphones, and the internet).	<b>9-1-1 Percentage*</b>
<input type="checkbox"/> I have limited experience using technology and I don’t know much about how technology works.	0.00 %
<input type="checkbox"/> I have some knowledge about how technology works, but often need to ask for help to perform more advanced activities – such as to configure the privacy settings on my cell phone.	13.79 %
<input type="checkbox"/> I can do most things that I want to do with technology and only need help occasionally.	72.41 %
<input type="checkbox"/> I can do all things that I want to do with technology without help from others.	20.69 %
<b>Q2. In general, when do you adopt new technologies?</b>	<b>9-1-1 Percentage*</b>
<input type="checkbox"/> I try the latest technologies as soon as they come out.	27.59 %
<input type="checkbox"/> I follow technology trends.	37.93 %
<input type="checkbox"/> I let others work out the kinks first.	34.48 %
<input type="checkbox"/> I wait until my old technology dies.	6.90 %
<input type="checkbox"/> I only adopt new technologies when it’s required.	10.34 %

\*The percentages do not add up to 100 since participants could select more than one option

## 2. Results

According to the International Organization for Standardization (ISO), usability is defined as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [8]. This standard definition identifies who, what, where and how to measure. The first tenet of usability is to know thy user. This includes user characteristics as well as demographics (the who). Second, the definition requires a thorough understanding of the user’s goals and tasks (the what). A final factor that highly influences the outcome is the context of use (the where).

The results are presented according to the ISO definition of usability with a focus on users, tasks, and contexts of use. The best way to present the findings is by using the words of the first responders who participated. All direct participant responses are verbatim, in blue text, and come directly from participant transcripts. Participant responses are followed by a notation that is comprised of three parts: 1) first responder discipline (COMMS; EMS; FF; LE); 2) location type (Urban=U; Suburban=S; Rural=R) and 3) interview number. Consider the following direct participant response:

I'm the police dispatcher. (COMMS-R-005)

The verbatim response is in blue followed by the attribution. COMMS-R-005 refers to a COMMS interview, from a rural location, with interviewee number 005. This convention provides assurances to the reader of the data's provenance and that the data can quickly and easily be located within the larger dataset. The direct participant responses are used to illustrate the findings in the following sections. They represent exemplars from the coded transcriptions. Each was chosen as a representative example from the set of extracted quotes to describe the concept. Some quotes contain identifying information that have been redacted; this is indicated by square brackets, for example, [name], indicates a name was redacted from the quote.

As the research questions highlight, this study seeks to address what makes communications work unique in the first responder world, what specific challenges COMMS personnel face, and the communication and technology problems and needs they confront. First, results related to characteristics of the work and the qualities and skills needed by COMMS workers are presented. Subsequently, the physical context of communications work and the stressors specific to communications work are examined. Finally, we describe the technology challenges discussed by participants and their requests for future technology.

## 2.1. Characteristics of COMMS Work and Workers

The work of COMMS personnel is multi-faceted, however, in this report we focus on their two tasks that are integral to emergency response: call taking and dispatching. Those COMMS personnel taking calls gather specific information from the caller related to an emergency incident and, as appropriate, provide instruction prior to arrival of the on-scene response. The call taking task places COMMS personnel as the initial point of contact during emergency response. Once the information is gathered and appropriate instructions conveyed to the caller, COMMS personnel oversee Computer-Aided Dispatch (CAD) operations. They maintain contact with responding units to ensure unit safety but also to coordinate additional resources or gather additional information in support of responding units. In many ways, they act as the lifeline for first responders on-scene.

You're seen as the first point of contact for everything. (COMMS-U-017)

Not all PSAPs provide the same services. Within a PSAP, the call taking and dispatching tasks may be performed by the same person, while in other instances the two tasks are performed by different COMMS staff members. In many ways, the size of the department influences whether the call takers and dispatcher responsibilities are performed by the same or different staff members within a PSAP. Larger departments are often more highly specialized. In contrast, COMMS personnel in smaller departments may have



additional responsibilities to call taking and dispatching, such as providing a wide variety of services for walk-ins from the public.

I'm the police dispatcher. But I also do the record management. I register sex offenders. I do purchase permits. We have probationaries that come in. So I have various things that I do in addition to the dispatching and taking all the calls.... We fingerprint, we're one of the few agencies-- there are agencies that do it, but they have very restricted hours. So we get a lot of people that come in here for CPL, Concealed Pistol License, fingerprints.... So I mean we have that percentage that are just everyday citizens coming-- and a lot of notaries because again, I'm the only notary in the city. (COMMS-R-005)

Regardless of what other services may be provided by an individual PSAP, call taking and dispatching are the critical tasks and the technologies COMMS personnel use to accomplish those tasks play a crucial role.

Call center personnel juggle a great deal of computer technology to perform their two primary tasks of call taking and dispatching. (COMMS-R-002)

COMMS workers rely on technology—some technologies are specifically designed for PSAPs, while other technologies must integrate with technologies used by the first responders they dispatch to the scene. As such, it is no surprise that the COMMS workload typically includes infrastructure planning and management, as well as, the implementation of new mandates, technology, and policies. It also includes Continuity of Operations (COOP)—ensuring the capabilities to continue operation of essential functions under a broad range of circumstances from natural, man-made, and technological threats, to national security emergencies. While these elements were discussed during the interviews and are a primary concern in operations, they are not a central concern for this report, which specifically focuses on PSAP call taking and dispatching.

#### 2.1.1. Qualities and Skills Necessary for 9-1-1

According to the Department of Labor, some of the top skills necessary for dispatchers are: speaking; active listening; critical thinking; social perceptiveness; and a service orientation [15]. These necessary skills are mirrored in other resources, such as *“Steps to Becoming a 911 Dispatcher”* [1]. As COMMS personnel spoke about their work during their interviews in this study, the same skills surfaced as important.

#### ***The Importance of Being a Really Good Communicator***

Communication is clearly at the core of the work done by 9-1-1 call takers and dispatchers. For many other first responders, communication is an enabling task, but for 9-1-1 communicators, it is at the heart of what they do.

That's the biggest thing really. You've got to be a really good communicator. You have to be good with people. We do have people sometimes coming into our offices, so you know you've got that one on one and you have to be able to deal with people. Sometimes they're not happy, sometimes it's just you know have a chat. We have a lot of older folk in our community and sometimes they just like to stop in have a good old chat and then go on their way and so got to be good with that. You have to be able to follow a protocol right because when people call, we have to be able to get the right

information to give that information to the deputies so they can go out and do their job and actually help those people. So, communication skills, communication skills, communication skills, you've got to have those. (COMMS-R-009)

Well you just basically just convey the information that the caller gave you and try to remain as calm as you can, speak as clearly as you can so they can understand and just try to do it as quickly as you can. (COMMS-R-014)

I think what makes a good one is having--knowing your technology, knowing what you need to do, definitely have a listening ear for officers that are calling in, different things, to be respectful of people calling in, to get all the help they need, to get all the pertinent information that you need to get an officer out there, and make sure that the officer is safe once they get out there. (COMMS-U-018)

In order to obtain the information needed for emergency response, COMMS personnel must be attentive listeners who are able to process information, quickly identify gaps in that information, and speak clearly and calmly to callers to elicit additional information and render instructions. Typically, this verbal communication and decision making is performed while also entering information into the computer in a clear and succinct form for other first responders.

Technology is the mechanism engaged by COMMS personnel to communicate with callers and with responding units. Technology is an enabler of their communication. COMMS personnel must be completely knowledgeable about the technology in order to effectively and efficiently communicate with both the public and with other first responders.

### ***Critical Thinking: Judgment and Decision Making***

The capabilities of establishing priorities, extracting, processing, and passing on information in a usable form involves high-level critical thinking. Often situations are fluid and COMMS workers must analyze, evaluate, as well as judge the relevancy and the necessity of their information before sending it to others responding to emergencies.

...use my experience to make decisions, "Okay, you don't need that for this call." Send that unit to there. Send that unit to that call. (COMMS-R-004)

You're not supposed to vary from it [the protocol] only mildly but there is a lot of decision making processes that are happening outside of that related to the CAD because calls can change or escalate in seconds so you're listening to what is happening in the background. So you might have somebody that's just making little noises but then you can hear something else. So you have to be able to think outside of the box and kind of capable of building a bigger picture of what's actually happening if we're willing to, but yeah decision making and decision making in short time frames. (COMMS-R-008)

I answer emergency and non-emergency calls from the public. I interpret that information and I translate that into a language that public safety and first responders can understand. I collect important and pertinent information. I disseminate it appropriately and I also assist in the dispatching of emergency services to a need. (COMMS-U-006)

The ability to interpret and translate information is a key component of communications work that relies on critical thinking. COMMS personnel, like their first responder colleagues in other disciplines, often make split-second decisions based on this information and their judgments about it.

### ***Social Perceptiveness: “Reading” Voices and Noises***

Another requirement for COMMS workers is social perceptiveness, a type of social intelligence where someone is able to discern information and make inferences about other people based on information gathered during an interaction. In the case of COMMS personnel, this interaction is generally verbal, in the form of a phone call.

And hearing that voice, hearing the background noise of a particular call gives us so much more information than just the words that that caller is saying. (COMMS-R-016)

...you just have to rely on your common sense and experience. (COMMS-S-004)

It's--sometimes it can be difficult, but you just have to stick with it and try to be as patient as you can, try to be as understanding as you can, and as calm as you can be. And try to keep your emotions down to, you know, so you can get the information that you need. (COMMS-R-014)

COMMS employees often make decisions based on what they “hear” in a person’s voice or in the “background.” They use their knowledge and experience about people and about calls types to elicit information and make inferences about that information all while curbing their own emotions about people and situations in order to “get the information that you need.”

### ***Multitaskers***

In addition to critical thinking and social perceptiveness, the ability to multitask and prioritize information and tasks is also an important capability. “Multitasking and balancing competing demands is a common feature of the role” [6]. Many COMMS participants in this study described how they juggle a wide variety of tasks and demands.

We do everything. So we do fire, police, EMS. If we need to send out facility services on campus, we do that. We do everything. So, I basically tell them that I'm like a one-woman circus, up in COMMS. (COMMS-U-017)

Plus we have to manage our records. So I mean, you're call taking. You're dispatching. You're handling the window traffic. You're running all the officers' paperwork....I know when the officers have to sit here they don't like it. They say, as long as just one line's ringing at a time and they only have to do one thing they're okay. But if four lines light up, and then a PBT<sup>2</sup> comes in, and somebody comes to the window, they just want to get up and run. And they would tell you that they'd rather deal with a barricaded gunman than sit here and deal with all this nonsense. (COMMS-R-005)

In addition to the multiple tasks performed by many COMMS employees, the work also involves being able to receive and process information from multiple sources simultaneously.

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<sup>2</sup> PBT used by the interviewee to mean “probationary.”

You need to be able to listen and you need to be able to multitask. Multitask is probably the most important one. Attention to detail and the ability to remain calm and professional under stress. (COMMS-U-006)

Multitasking is the number one thing. Being able to truly multitask, not only in doing typing, but in hearing. (COMMS-R-020)

And then if we get a fire call or a big major incident, that will go on a separate talk group, and I'll listen to that as well. So there's times when I have nothing but chatter in my ear from four different radio channels, and I'm trying to decipher... (COMMS-S-004)

COMMS workers often have multiple screens and radio channels to monitor as well as multiple phone lines to answer. While performing all these tasks, they must remain calm, attend to detail, decipher all incoming information, and prioritize appropriately.

### ***Service Orientation***

Working in COMMS takes dedication and a desire to serve the public. However, it also means working in a call center and being removed from the “chaos” and action of on-scene emergency response.

It takes a certain person to work in a dispatch center. You know you have those people that get that call and they want to go out there and do it. It takes a certain person to sit behind a desk during that call and manage all that chaos that's going on with it and be able to sit there and hold it all together and do your job. (COMMS-R-013)

Dedication. You have to want to do this job. It's not a job that just anyone can just jump into. They have to realize that they're going to get screamed at, hollered at, fussed at... (COMMS-R-011)

It's in your blood to -- you got to, you learn to love it, you don't necessarily do it for money, if you know what I am saying. (COMMS-R-019)

The service of COMMS personnel is often invisible. Often they are perceived as “just a secretary” by other first responders, rather than as an integral part of emergency response.

...expected to do so much with, with not just the technology but with learning new things, keeping up with multiple policies and procedures and being able to apply them in a situation that is very, very fluid. An emergency situation is not just, oh, it's the same old thing. Everyone has its different challenges. And...I don't think that it's a job, I think it's a career and I think it's a specialized career. There are many, many police officers that walk into this room, firemen that sit here and go, God, I never thought it was like this. I mean I thought you were just a secretary. Just answering the phone. And I couldn't sit here all day and do that. Well it's a specialized job. (COMMS-R-016)

COMMS workers provide service to the public and to other first responders, but it is service that often goes unrecognized due to misimpressions of the work.

#### 2.1.2. The Role of COMMS Work: Often Misunderstood

The role of COMMS work in emergency response is not well understood by the public, and sometimes even by other first responders. Because COMMS personnel are not on-scene, they become invisible to the

public who do not recognize the integral role they perform in emergency response. Operating “behind the scenes,” they are not visible in the ways emergency medical services personnel, fire fighters, and police officers are.

So for us having the citizens expect one thing but not know what reality is like in the 911 center we’re kind of just the forgotten public safety realm I would say. (COMMS U-007)

While they are not the “face” of emergency response, they are often the first interaction the public has during an emergency with response, making them a vital component. Despite this, COMMS personnel are often not considered first responders.

I think when you look at the people who actually physically respond, and not to say when a dispatcher answers the phone that's not a response, but to me that's a very controlled environment, and if they had to step away for some reason, someone else could fill in, there's not that immediate sense of peril and they're talking on the phone, and that they're doing a lot more stuff on the computer screens and looking at stuff, but they're not out there where the sights, the sound, the smells. To say taste comes in, but on a heavy wet foggy day, you get those tastes sometimes in your mouth.....I guess that's where I see the differentiation on who's a first responder, someone responding to a scene or in the field versus all the other people who are certainly part of the public safety system and may be on the front lines but don't get that full sense of engagement. To really have those impacts you've-- I've never heard about dispatchers getting tunnel vision or auditory exclusion or all the other things that we're regularly trained on and discussed to recognize in ourselves and in others because it creates a safety situation that can affect others. I think there is a line there and I think it's continuing to be defined... (LE-R-019)

The preceding LE participant’s quote exemplifies some responses about what and who constitute a first responder. This view of COMMS personnel can lead to a devaluing of the position and those who fill it.

And sometimes you kind of feel like, especially in communications, like you're not valued I guess 'cause you're not the one that's going out and doing it. (COMMS R-015)

From these quotes, there seems to be a divide between those who are “on-scene” and those who are “not out there.” The fact that COMMS personnel are in a “controlled environment” and not on-scene is a unique characteristic of this work. As one COMMS participant noted: “...we're looked at as secretaries” (COMMS-R-007).

However, other participants viewed COMMS personnel quite differently.

We--I guess the way that we view from law enforcement is that our dispatchers are the lifelines. They are the informational resources of these deputies and police officers and firefighters out there. If they need something on that scene, they look to the dispatcher to find that resource for them. And being in a controlled environment it's much easier for us to start looking things up, the resources for them, rather than it is that incident commander in most cases to look it up... (COMMS-R-016)

The view of COMMS workers as clerical personnel, rather than as first responders, is clearly not held by everyone.

### 2.1.3. Physical Work Environment

This section focuses on the physical environment and infrastructure of PSAPs, with a focus on how these contribute to the unique nature of COMMS work.

#### ***Constancy and Consistency in Space and Infrastructure***

The physical work environment of PSAPs and the use of technology in them can be summed up as constant and consistent. This is true from the physical building to the workstations to the infrastructure. COMMS personnel go to the same building every day. Their scenery does not change, as it does for other first responders who are on-scene. They sit at a workstation for long shifts—generally 12 hours. The technology infrastructure, both the software and hardware, is relatively fixed as changes to infrastructure are significant and often disruptive.

Each PSAP has individual characteristics, as well as those characteristics shared by all PSAPs. An important factor related to the physical infrastructure is the number of personnel needed to staff the PSAP. This can vary widely across PSAPs and is often related to the size and call volume metrics of the community served. However, there are some characteristics that they share. In general, the physical workspace is a room containing PSAP workstations. There are no individual offices except for those of supervisors. COMMS workers sit at individual workstations that are alike and typically in close proximity to each other.

So it's basically probably a 20 X 17 room or maybe 25 X 20 room not real big. We have 4 primary call stations and then a fifth that is more of a supervisory station that is capable it has capability of handling most of the duties of all of the stations except for accepting 911 calls. The 4 stations all are exactly alike ... basically whatever one person is doing the other person is able to see it. (COMMS-R-008)

Additionally, some centers have no windows or are below ground, making the space seem even more closed.

It's closed in 'cause we don't have any windows or anything like that. It's always very--sometimes it feels like a dungeon. We call it the dungeon [Laughing]. But it's okay. (COMMS R-015)

We have no windows. So the only way I can see outside is pulling the cameras to see if it's raining or if it's sun-shining....So it's kind of comical sometimes. A lot of people, they can't get over it that we work in a building that has no windows. But at the same time it's kind of a safeguard more than anything, so it's pretty neat. (COMMS-R-011)

Other participants noted how their communication centers had been renovated and upgraded to provide more room and facilitate ergonomics.

It's definitely much bigger than our older office. Our older office is probably the size of this room and the room next to us. So it got a little crowded. And unfortunately, when you're on top of each other like that, not everybody gets along, so you'd be surprised what a little room does [laughter], but yeah, this building is a complete shock. Like it's, we went from sitting at a desk with just one computer that worked when it wanted to, to we came to this building, I mean everything's I guess fancy right down to the desks. The desks move up and down. (COMMS-R-012)

We made sure that we had furniture that would accommodate them to work 12-hour shifts because at a minimum you're in here for 12 hours. ...But we made sure that, you know... they could be as comfortable as possible at their station. Their stations go up and down whether they want to stand up, sit down. They each have fans. They each have a heater. They have dimmable lighting. (COMMS-R-013)

As the description above illustrates, all the workstations are typically the same at a PSAP. COMMS personnel know what to expect when they sit at a workstation. Because the stations are identical, they can perform their tasks at any workstation and get straight to work in a familiar environment. When changes are made to a PSAP's workstations, they are often made for all workstations within the facility.

The types of technology used are also similar across PSAPs. Workstations typically have the following types of equipment: computer, monitor, keyboard, mouse, headset, microphone, and foot-pedal. Some PSAPs have multiple computers and monitors at each workstation. Some have phones and radios, while in other PSAPs the phones and radios go through the computers. There are essentially three main communication systems used by COMMS personnel: a phone system, a CAD system, and a radio system. These are present in almost all PSAPs.

Well, each one of our consoles has four computers. There's a what we call a console computer, which is your basic. We have our remote desktop for the town of [town redacted] with email. You get your calendar, all that kind of stuff, Outlook stuff. And then that computer also controls the CCIC and NCIC. ... And that's about it on that one. It's just a regular computer. [The console computer] ... that has two screens. So one for RDS and one for CCIC. The next computer is our CAD computer. So it's got two screens as well, and these two are 24 inch, these are 27 inch, and they have our CAD database, and then there's also a CAD map, as well as our texts to 911 comes into that....And then, to the right, there's two more 24-inch monitors. Those are the radio phone on those two. And of course, then you have three keyboards, four mice. And then, on the side, we also monitor about 200 alarm accounts in the county. (COMMS-R-002)

While not all PSAPs have the same technology configurations, the types of communication technology that COMMS personnel use are relatively similar. Additionally, within a PSAP, the constancy of workstation and technology allows COMMS workers to be more productive.

### ***Change is a Big Deal with Big Consequences***

Infrastructure changes in PSAPs are infrequent for many reasons including technology expenses and funding cycles, as well as the interoperability challenges. The need for interoperability extends beyond the systems within an individual PSAP; interoperability with partnering organizations is an important consideration. Partnerships may span response disciplines within a jurisdiction as well as neighboring jurisdictions. Changes in technology and infrastructure within a PSAP can result in learning curves for COMMS workers for new processes and procedures as well as developing new muscle memories. Overall, making changes to infrastructure is viewed as a difficult and prolonged process.

It's like I have said a minute ago in you know, everything that we have a public safety takes so long to get there and, you know what I mean, it's got to go through regulations, then it's got to go through funding and by the time you finally get it, it's that old. (COMMS-R-019)

It's time for us to upgrade again but that's a five-year process roughly so technology can come slow. (COMMS-U-007)

What I want, I just applied for, is a-- it's a KVM software, and it took forever to find one that was affordable to the public sector. (COMMS-R-013)

Finding the funding for improvements to technology and infrastructure can be difficult and time consuming, especially for technology that is often not affordable for many PSAPs. The timeframe for funding often means that technology can be outdated by the time it is purchased and implemented.

The impact of change on COMMS workers is not always closely considered, or even known, prior to technology and infrastructure changes.

Things are very spread out so the old CAD I used to be able to just I knew all the commands, my hands could stay on the keyboard and I never had to lift my hands. I have a foot pedal that I can push to talk on the radio and my hands I would just type commands, I had it memorized how to type the line segments and it was great. We get a new system that is great on the technology side but it takes me 2 to 3 steps to what used to take me one. (COMMS-U-007)

In many cases, upgrades to new equipment and infrastructure cause disruption for COMMS personnel. What was simple on the old system now requires two or three additional steps, sometimes resulting in users being less efficient and effective for interactions.

When PSAPs make decisions to upgrade infrastructure, they often face issues with interoperability, causing them to question whether or not the upgrades are actually worth the investment.

Okay, first of all we bought a phone switch that is [system redacted] ready. So, okay [...] things have changed in the past year or so, things have changed. So, you have to do an upgrade your phone system to make it compatible to [system redacted]. Oh, okay. Okay, so, you know, the funding and all the stuff. And so okay, we are going to upgrade the phone switch, which we did. But then, our wall boards that tells us how many calls are waiting...they quit working. Well, we found out that the computers that are driving the wall boards are not powerful enough to drive the wall boards with the upgrade. (COMMS-R-019)

Interoperability is a major issue for PSAPs that influences their trust in technology and their willingness to adopt new infrastructure. It can cause unanticipated consequences, leading to frustration for COMMS workers and managers. Overall, it is not surprising that change for PSAPs, especially change to technology, is viewed as significant, given that COMMS workers rely on constancy and consistency in their work environment.

### ***Ensuring Continuity of Operations***

PSAP managers are tasked with, among other things, ensuring essential services under a broad range of circumstances. Continuity of Operations (COOP) planning considers altered procedures, as well as redundant systems and facilities depending on the nature of the circumstance that is disrupting operations. PSAPs need to be prepared for the most extreme circumstances. One PSAP manager expressed it quite succinctly.



And that's what we have to be prepared to do because if we lose all our technology we still have to operate. We will have to serve the public. We still have to respond to their needs. (COMMS-R-016)

Because of the need to be ready at all times for any emergency, PSAPs typically have contingency plans built into their processes, procedures, and training, including the ability to re-route calls to neighboring centers.

In the event of our 911 system going down, if it ever, if it has to, normally the last time we ever had to do a rollover was during one of the hurricanes. And it hit a tower, one of the cell towers. We lost our capabilities to receive any calls coming through from...the different cell phone providers. It'll roll over to our neighboring, our sister stations as [station redacted], [city redacted]. And what they'll do is they'll call us and give us that information, what they just got from that call, and we'll give it out like that. So we have a partnering system in the event of that. We have everything in place whereas, okay, we got a problem. Let's call [city redacted], let's do this, and we have our plans. (COMMS-R-010)

But we have phone lists, just like you said. We have [product redacted]. We have radio. So there's a whole bunch of communications technology that we have. We have satellite phones here as well. And satellite radio. So we have a system that allows us to push to talk over satellite to different communications centers as well. So there's a bunch of different technologies that we can use. And that's not just for our operational area, that's for the whole [name redacted] area. (COMMS-S-001)

We had [storm redacted] that came through this area and it actually knocked out, we have way more 911 trunks than was recommended for us but we did that on purpose so that we had some additional which really helped us because when the [storm redacted] came through we lost half of everything. (COMMS-U-007)

Some PSAPs have separate COOP facilities in the event that their permanent facility is damaged or becomes inoperable. These additional facilities are often smaller, less well-equipped, or not ideally located.

I don't remember the year, before my time, but a couple of years ago there was a suspicious vehicle that they thought may have contained a bomb and that was parked right on the street between the backup center and the main center and if that had gone off [city name redacted] would not have a public safety answering point, it would not have a PSAP. So that is great and that's something that's been expressed to the county but one of the frustrations I feel like that we have here is we do feel like they don't, the county does not, prioritize public safety as much as you know maybe we should and so when we've expressed that we need a geo-diverse separate building for public safety specifically for the PSAP they're like you know interested. They don't want to pay for it because it is expensive to set up and they just don't really see the value because they don't think the way that we have to think." (COMMS-U-006)

Well we have--we had a flood, [event redacted] in August of 2016 that covered about 80 % of the [County]. About 75 % of all structures in the [county redacted] received some type of flood damage. And including our 911 communications facility which had to move overnight into a backup facility. (COMMS-R-016)

Large-scale natural and human-triggered disaster events can cause disruption to PSAP operations, making COOP a high priority for PSAP managers and COMMS workers. However, nothing is foolproof, and even when every effort is made to ensure COOP there is no guarantee that things will work.

So, it was a fiberoptic system and they said it had a redundant to the backup, to the backup to the backup, it'll never go out of service. Well, apparently one of the main fiberoptic lines, a squirrel chewed through it and the whole system shut down. There were supposed to be backups to the backups to the backups and..., we don't understand the details, but apparently this squirrel hit something and chewed through something that bypassed the backup to the backups to the... (COMMS S-003)

When all else fails there is always the old school way—the use of paper and pencil or regular land line phones.

Yes. When our systems fail or they go down, that causes a headache, because then we have to resort back to paper and pencil. So we never forget about paper and pencil. We use that as our training. You learn it this way. Then you will never have any trouble because if the computer fails, you know where to go at and get the, jot it down, and then you can enter it into the system later. (COMMS-R-010)

The bottom line is that PSAP managers and COMMS personnel try to the best of their abilities and resources to plan and be prepared for unexpected events. In the end they do what is necessary to address the public's needs in an emergency.

#### 2.1.4. Process and Procedure in COMMS Work

Just as the physical space and infrastructure of PSAPs are similar across locations, so too are the processes and procedures that COMMS personnel are expected to follow. What they do and how they do it is very scripted and standardized, as described below.

#### ***Constancy and Consistency in Process and Procedures***

All communications centers have well-defined processes and procedures to address emergency calls and other functions performed by COMMS personnel. There is tremendous standardization in the procedures, from the scripts utilized to elicit information to the monitoring of calls. It is important to note that the scripts are followed irrespective of call volume. PSAPs typically use a software application that prompts COMMS personnel regarding information elicitation and instruction paths based on answers to each question. These applications are often based on the Association of Public Safety Communications Officials (APCO) cards. COMMS personnel follow and repeat standardized sets of procedures and scripts throughout each shift.

The protocol is the protocol. (COMMS-R-013)

We had APCO cards for a long time, so you ask the same questions: where are you calling from, the number you're calling from and what's your location? That way if we get disconnected we can at least or help that way and then try to re-establish to find out....But on the computer screen, it's set up to when you answer that question, depending on the answer it gets rid of all the others, goes directly to that third card down. Makes it quicker, makes it more efficient. (COMMS-R-020)

So we have to go through from scratch and ask everything. So, once we get their name, their phone number, and the address, then we ask usually, 'Do you need the ambulance or the fire truck?' ....Then the first thing we ask is, 'Okay, tell me exactly what happened.' That's the first protocol question. Then based upon that we're trained, because someone can say....'I'm not feeling well, I have a fever, and I don't know what to do.' Then we know automatically, sick person card. We have 33 different cards. Yes, 33 different cards and each card has a specific set of questions .... We call them cards because the original set is actually physical cards. In case our computers go down. (COMMS-S-003)

This standardization also means that COMMS workers can fill in or take over for each other when circumstances dictate.

We usually--the phone is ringing, and if we're both on something, I'll take over a call, or she'll take over a call... (COMMS-U-018)

Some PSAPs also monitor the time to answer calls. This is for liability purposes and to meet professional standards. The following quote describes this monitoring.

But we do have to file an NFPA 1221, which is the answering, one part of that chapter seven I think it is, is the answering section of it to where all incoming emergency lines have to be answered within 15 seconds 95 % of the time, within 40 seconds 99 % of the time. (COMMS-R-011)

As the quotes in this section illustrate, COMMS personnel follow standardized procedures and scripts which provide a consistency to PSAP emergency response. While critical thinking, social perceptiveness, and multitasking are skills needed to handle incoming calls, they are applied within the structure of the protocol.

To perform effectively and efficiently within this system, COMMS employees receive extensive training on call taking, dispatching, or both. Some COMMS personnel are also certified as officers.

If you are a full-time employee in the dispatch center you actually attend what is called the 360 post academy, just like a regular police officer. We have a night academy and a day academy hosted at our agency. Our communications officers attend the night academy from 5:00 p.m. to 10:00 p.m. Monday through Friday after shift. They get paid and compensated for that. And at the end of it you are a post certified deputy just like a police officer on the road. (COMMS-R-013)

Most of the jurisdictions here near [name redacted] have a civilian corps of dispatchers and 911 call takers. Here in [name redacted] we have paid firefighters that have gone through all the fire training. They've spent years out in the field. And then at a minimum of five years, then they're allowed to come up here and be in the communications division. (COMMS-S-003)

Yeah, so I am personally I'm trained on phones. I'm really strong on phones and I'm also trained on we have like two radio I'll say two we really have three but I'll say two radio positions on the police side so I'm released on one of those and then I'm training on our primary channel right now and then I'm also close to the end of my training on teletype phones. (COMMS-U-006)

We have a little more than-- almost 700 users on the platform up and trained. That means they've been through the training classes and gotten their credentials and all that kind of stuff... (COMMS-S-001)

This training represents a significant investment on the part of emergency communications centers, making retention an especially important issue.

### **Staffing and Retention in COMMS Work**

The majority of PSAPs run 24 hours a day, 7 days a week, 365 days a year. Two notable challenges to adequate staffing are the current shortage of COMMS workers and retention. Adequate staffing is also related to call volume, which fluctuates.

The current shortage of COMMS workers makes staffing a difficult task.

So to my understanding keep in mind I've only been here since January but to my understanding it is a chronic issue. Independent research would suggest that it is a nationwide issue. It is especially felt here. We just sometimes we barely have enough people to cover our minimum and in fact we've had several studies that have been conducted by various contractors with the county that have suggested that our numbers should be around 15 given our population and our call volume and we most of the time will have eight... And our minimum staffing is ten and mostly we'll have eight. (COMMS-U-006)

Attracting new hires is also difficult. As noted above, there is often a divide between those on-scene, those in the "action," and those who are perceived to perform peripheral roles in emergency response. People want to be "in the action" not in a call center, in part because communications work is often misunderstood. The misunderstanding of 9-1-1 communications work by other first responders and the public may explain why there are fewer people interested in pursuing a career in COMMS. "[H]ow can a public service communication agency attract quality and dedicated individuals and encourage emergency dispatch as a career in a mindset swirling with misconceptions and partiality?" [5]

We do have trouble getting dispatchers and keeping dispatchers....It's a good job but we do have trouble getting people. It's not like it's a lot of money or a glamorous job but it's a good job that helps your community and I hope we can get more people here to do this work because we do need help, we do need help. (COMMS-R-009)

...we're understaffed as it is. (COMMS-S-003)

We were concerned about our staffing levels. (COMMS-U-007)

These quotes, from a variety of different agencies in rural, suburban, and urban environments illustrate the difficulty agencies have in finding and retaining COMMS personnel. While this is not unique to communications within the public safety realm, particularly in rural areas [7], it is especially challenging in communications due to lack of visibility, misperceptions, and undervaluing of the work itself.

In order to keep PSAPs adequately staffed, COMMS managers often resort to long shift requirements for existing staff, typically 12 hours at a time with few breaks, as well as, overtime.

I work the same shift every two weeks....So, I work a total of seven 12-hour shifts over two weeks. (COMMS-R-012)

We have shift work. So they used to be straight 6 am to 6 pm when I took over two years ago and it wasn't efficient....So I staggered the shifts, so we now have...three 6 to 6, we have a 7 to 7 and then we have a 10 to 10 and then at night we have three more 6 to 6 come in and relieve the other 6 to

6's, and then we balance it after 10'o clock at night, there's just four of them in there, because we're not as busy. (COMMS-R-020)

Adequate staffing is closely related to call volume. Call volume averages do not tell the whole story. Call volumes can vary for a variety of reasons, sometimes the peaks and lows can be anticipated, at other times, they cannot.

And then also at the end of the workday it seems like kids are out of school, there's a lot more activities, so there's a lot of kids with accidents on the playground, at different sports fields, depending on the time of year, soccer, football, baseball, swimming, all that other stuff. You have accidents after school... Summertime, school's off and they drink a lot, and so you get a lot of drunks, drunk driving accidents, people hurting themselves because of alcohol-related injuries, anytime during the week. But then when school starts it's usually only on the weekends... So any Friday night, because of our geographical location, because of the local gangs that we have, Friday night we always have stabbings and shootings. (COMMS-S-003)

As discussed in [7], many rural areas, especially those in tourist areas, can face dramatic shifts in call volumes during certain times of year, making staffing even more complicated and difficult. In this situation, more COMMS personnel are needed during peak seasons while less are needed during off-season. COMMS personnel are highly trained, not part-time, seasonal workers.

So we have 53,000 people that live here, but in the winter time, the population of our county is closer to 85[000] because of all our skier visitors. And a lot of those people call 911. They're lost. They're hurt on the ski mountain. They've crashed their car because it's snowy. (COMMS-R-003)

Weather-related volumes can be particularly difficult to predict accurately. With such fluctuations in the number and type of calls, it is difficult for COMMS managers to always anticipate adequate coverage needs.

Right. So even just one person is a massive difference. So, and a lot of things contribute to the lack of personnel. Partially it's retention, partially it's recruitment and then also it's just you know when you have people that work like overtime all the time, sometimes they get really overtaxed so got to take a break and stuff so yeah. (COMMS-U-006)

Recruitment and retention issues coupled with a 24/7 workload, fluctuating call volumes, and a shortage of workers cause many PSAPs to struggle to provide adequate coverage and meet the center's call demands. Further, investments in constant recruiting, training programs, and overtime add to continued stress on staff and budgets.

## 2.2. Stress in the COMMS Workplace

All first responders work under pressures that result in stress. However, COMMS workers face unique stressors related to where they work, what they do, and how they do it. The physical stress, cognitive stress, and emotional stress faced by COMMS personnel are described below.

### 2.2.1. Physical Stress

Physical stress for COMMS workers is often related to the physical environment and the stress that can arise from being in a confined space and sitting for long periods of time. In addition, they often work in inadequate spaces with technology that is not always conducive to their work.

But it gets like that when it's like... a pretty day outside or something and we're sitting in the dark 'cause we keep the lights low because the computer screens are really bright. And we keep the light so and then you go outside and you're like, oh, fresh air. (COMMS-R-005)

The physical conditions in their work environment can lead to potential health problems for COMMS workers.

You might be able to go and go to the bathroom or go grab food but you are sitting in your position for 12 hours a day and that's all you're doing so...unfortunately that leads you to buy carry out food that's not necessarily healthy, so we have high obesity rates, we have high cholesterol rates, we have heart condition issues... (COMMS-U-007)

Sitting inside for long periods of time, without natural light and exercise, contributes to physical stress for COMMS workers.

Some PSAPs are now recognizing the stress this creates and are beginning to address the physical environment in which COMMS work takes place.

We made sure that we had furniture that would accommodate them to work 12-hour shifts because at a minimum you're in here for 12 hours...But we made sure that, you know... they could be as comfortable as possible at their station. Their stations go up and down whether they want to stand up, sit down. They each have fans. They each have a heater. They have dimmable lighting. (COMMS-R-013)

In this case, technology is being utilized to alleviate some of the physical stress experienced by COMMS workers. Much of this is not communication technology per se, but instead technology that improves the physical work environment for COMMS workers.

Other contributors to the physical overload and stress currently experienced by COMMS workers are the long shifts and short breaks that are typical of COMMS work.

I think sometimes the hours in itself gets to you. You know some people aren't cut out to do a 12-hour--it can get mundane at times even though you're not knowing what you're picking up on the next telephone call it can still be mundane in a way. And I think sometimes being cooped up in a building for 12 hours is enough, with 2, 3 or however many people you have on shift at the time and you just need to walk away from them. It's kind of like family every now and then you need a little break. Sometimes that's what needed... Yes, if there are enough personnel in the office they can step away and step outside and just take a breath of fresh air and come back. (COMMS-R-013)

A lot of jurisdictions their dispatchers work 12 hours a day and they work 4 to 5 days a week and so when you're having someone here from 7 p.m. to 7 a.m. and you are constantly giving them the worst of the worst now you're wanting them to view the worst of the worst but we're not getting the

support and the resources that we necessarily need to deal with those kind of things and because you're here for 12 hours somedays when we have only 5 employees on shift we can't give you a break. (COMMS-U-007)

Overtime hours help staff PSAPs suffering from understaffing, but also add stress for COMMS workers.

When I worked at my other department, I worked every weekend and holiday for 10 years. I think the only time I ever had a weekend off was maybe if I was on vacation. (COMMS-R-005)

So there's a lot of factors that contribute to...why people work overtime but yeah so for example I don't work a lot of overtime. I work maybe a medium amount I would say compared to my other co-workers but there are some people who max out every week and so they're working 68 hours a week every week and so yeah. (COMMS-U-006)

Scheduling, including long work hours and short breaks, combined with understaffing and overtime contribute to the physical stress experienced by COMMS workers.

### 2.2.2. Cognitive Stress

Call volume is a major stress inducing factor for COMMS personnel. The sheer volume of calls per day in many PSAPs creates high levels of stress.

I think sometimes it's just the call volume. I think that's the main stressor. That sounds strange 'cause that's what we do. But when you surpass 300, 400 calls a day, and that's all you do is picking up a phone, you can't do your other tasks, it definitely stresses you out 'cause you feel like you're not, you didn't do your job to the fullest, or you didn't pay attention to your deputies or your fireman as closely as you could've, because you were picking up the phone. (COMMS-R-012)

High call volumes also limit their ability to attend other tasks and responsibilities, making COMMS workers feel like they "didn't do [their] job to the fullest."

In addition to the high number of calls answered and dispatched by COMMS personnel, the unpredictability of call volume also adds stress. COMMS workers must adjust to the peaks and lulls in workload while PSAP managers must try to plan for efficient staffing.

...it can be really hit or miss with call volume. You can have some days in the middle of the day that are slammed. You can have some like a Sunday night or a Monday night when you expect nothing's going to happen and you were busy all night long so it really fluctuates depending on what's happening and can fluctuate day to day, month to month. There's really no... we all have our sayings of when we're going to have an influx full moon especially if they're on Friday nights, if there's holidays. (COMMS-U-007)

Workload planning is almost impossible given the unpredictability of call volume. Workflow fluctuations were cited as a source of stress. Many participants commented on the stress they felt and their lack of control over their workday.

Not only are COMMS personnel responsible for call taking and dispatching, they are also responsible for monitoring a variety of screens, from security cameras and alarms to news and weather feeds.

My regular dispatchers have six [monitors]. I have eight, and then the fire room has eight. So, your regular call takers and the headquarters have six monitors. (COMMS-R-012)

With information coming from multiple screens, cognitive overload is a serious issue for COMMS workers. In many cases, it is more than just multiple screens that COMMS workers must monitor—there are also multiple phone lines, radio channels, and software programs.

We monitor security cameras around our building. We monitor over 70 securities cameras....We have several license plate readers throughout the [county redacted] that scans every plate coming through whether it be stolen vehicles and such. So, they're monitoring that. They are monitoring fleet tracking which is another program which tells them where our officers are at, how fast they're going, whether they've got a seatbelt on, whether their lights are running. We have a lot of programs. I'm trying to think.... They're monitoring the 'Are You Okay' program we have in our parish....So, the amount of programs is... quite cumbersome sometimes because of the computers and the systems and logging in and keeping track of what's going on. (COMMS-R-013)

... and there's I don't know off the top of my head probably they handle four primary channels, radio channels and then up to six it's probably about right six to eight I guess and that's also through the [brand redacted] IP based radio system and the phone system is IP based as well and okay so there's the phone. They have a CAD system so their computer system they have eight different screens so eight monitors, CAD system which is operated off of a desktop and the software programs they run would be the CAD system itself, computer aided dispatch and then the [inaudible] system which is your criminal justice information. They run that program. They have a [application redacted] which is a 911 text program that they use and then emails, general management, records management, they have the jail, they're able to take the control over from the jail so they're able to use touch screens to open doors or whatever they have to do if they have to. (COMMS-R-008)

COMMS workers must take in and process a great deal of different kinds of information from a variety of sources.

It's the hearing and being able to listen to four channels at one time and type the information and remember this officer wants this information and this officer needs this information, you kind of got to prioritize. You got to be able to work on the phone and prioritize who gets what information first, because it could determine what's going on, you know, for that officer. (COMMS-R-019)

Their ability to process and translate this information efficiently and accurately is key in incident response. When the flow of information from different sources is non-stop, it increases cognitive loading and stress for COMMS works.

In addition to taking and dispatching calls, many COMMS personnel have many other responsibilities to address during their shifts. The resulting multitasking only contributes to the cognitive overload and overall stress.

More than the eye. More than meets the eye rather. I think a lot of folks don't realize how much we actually have. It'd be nice if we had just 911. It'd be nice if we had just radio. It'd be nice if we just had



emergency management. But unfortunately, we have to wear so many different hats... (COMMS-R-011)

Many times overwhelmed with, with the amount of responsibilities that they have. They are expected to do so much with... with not just the technology but with learning new things, keeping up with multiple policies and procedures and being able to apply them in a situation that is very, very fluid. An emergency situation is not just, oh, it's the same old thing. Everyone has its different challenges. (COMMS-R-016)

Multitasking is necessary for COMMS personnel to attend to phones, radios, monitors, computer applications and programs, and the like. Demanding workloads are common across all types of PSAPs. However, there are differences in the call volumes, types of tasks, and workflow that different PSAPs experience, especially those in small or rural communities. The multitasking they do may be different, but no less stressful, than that felt by their colleagues in larger call centers.

COMMS personnel describe being overwhelmed with responsibilities, along with the expectation of mastering more and more policies, procedures, and technology. Juggling their competing demands, often in chaotic and fluid situations, results in feelings of lack of control and contributes to stress.

### 2.2.3. Emotional Stress

COMMS work, at its core, is about communicating information: obtaining the right information from a source and forwarding it to the first responders who will use the information on-scene. COMMS workers feel a responsibility for the first responders they are sending to an incident and recognize that without the proper information their safety could be compromised. However, getting the necessary information is often difficult, leading to stress. Obtaining appropriate information can be made more difficult by callers who do not or cannot give pertinent information and by device mis-dials. Other sources of emotional stress include feeling responsible for others' safety, lack of call resolution, feeling undervalued, as well as, abusive and traumatic calls.

#### ***Nuisance Calls***

Unfortunately, high call volumes often include many "nuisance" calls. Nuisance calls include: pocket or mis-dials from cell phones, smart watches, medic alert buttons and now texts from these devices. "Good Samaritan" calls and other types of non-emergency calls also fall into this category.

We have people that call and ask us what time it is. We have people that call and ask us what the animal hospital [city redacted] phone number is....We have people who ask us almost like we're a 411 call information center and that adds an additional burden onto the dispatchers which is something that we do have to be careful with the new technologies. (COMMS-U-007)

My biggest are these medical one's, I hate them, oh yeah because only 2 % of all those calls are true calls... And we get so many calls, you get to them and it's, 'oh I didn't push the button.' (COMMS-R-020)

And then with that we have received somewhere in the range of two hundred and thirty texts. A good probably 80 % or more of that are accidental texts to 911... Or believe it or not we get butt texts not sure how you do that (COMMS-U-007)

Now with cell phones, you have 400 people calling for the homeless man on the corner who appears in distress. That's a waste of 911, it's a waste of resources because the guy is fine but all these people with cell phones don't know. None of them wants to stop and help, they just use their phones. (COMMS-S-003)

These calls burden COMMS personnel and take time and resources away from their ability to respond to legitimate emergency calls and other tasks as the protocol is followed for each call. Several participants expressed concern about the introduction of new technology and the unexpected consequences for call volume, specifically nuisance calls and texts. Having to address these “accidental” calls and texts result in emotional stress for COMMS workers who are worried about genuine emergencies and keeping people safe.

### ***Getting “Good” Information***

The lack of control in acquiring necessary caller information was identified as another source of stress by COMMS participants. Without question, the most important piece of information COMMS workers need to elicit from callers is location.

Location is number one. We can dispatch. We can do anything else in the world with that call if we have the location. But getting that location is just paramount. We can't do anything if we don't get a location. (COMMS-R-016)

Responsibility is getting the most accurate information and location that I can. (COMMS-U-017)

Yet, obtaining location information can be particularly challenging resulting in frustration.

They think that if they call 911, we know where they are and we don't. We know what cell phone tower your cell phone hit off of and that's it and then if you call on a VoIP phone or a voice over IP phone it's wherever your VoIP was registered to. (COMMS-U-007)

...so most important question is always where are you? Where is the location? Always ask, try to get the street address. If they don't have a street address or they don't know ask for the closest intersection and then if they don't know the intersection or they don't even know that I'll ask for like a hundred block or something like that just like what street are you on and then I'll ask them for landmarks for a last resort if they really don't know where they are. I don't like using landmarks because there are some areas of the county that I'm really familiar with and some areas that I really know and if you describe something to me I'll know what you're talking about but a lot of that is very subjective and it's based off of my own experience. (COMMS-U-006)

Across the board, COMMS participants indicated that location is the most important piece of information to obtain. Yet, as noted above, it is sometimes difficult to elicit. Callers do not always know where they are: the street address, the cross street, or the name of the business or location. Other times, callers hang up without providing the location or they provided an incorrect location. The inability to obtain accurate caller (incident) location creates emotional stress for COMMS workers who understand that first responders in the field are relying on them for accurate location data.

While location information is paramount to all incidents, COMMS workers are tasked in general with gathering information and passing it on to the first responders who they send to the scene.

Getting the important information from the caller and relaying that information to the responders timely and accurately. Getting it from that caller, no matter what the circumstances are and then relaying it timely and accurately. (COMMS-R-016)

So, we got the dispatcher talking to the field units and of course they have a different responsibility to make sure that they are responsible for the safety of the officer that's answering the calls and then to make sure that the information that comes from the person on the phone to what the officer gets in the car is correct. So, we are that conduit that passes that information. (COMMS-R-019)

The most important task is acquiring accurate information from the caller. Again, COMMS workers know how much is on the line based on their ability to obtain all the information necessary for incident response. Given that a timely and effective emergency response relies on the call taker obtaining the necessary information, the struggle to acquire the information only adds to the pressure and perceptions of lack of control, and stress.

Language barriers, the mental and emotional state of the caller, or the audio quality of the call are among the factors that also impede acquiring accurate information.

Stressors, for a lot of people, are the language barriers...we have a large Ethiopian, Ukrainian, and Vietnamese population in [county redacted]. And they don't speak a lot of English. So when someone calls on the phone and they speak Ethiopian, Ukrainian, or Vietnamese, we need language line assistance. So we have a language line that we can call immediately and it has close to 100 different languages that are available to us...So when you're receiving a call it's a huge stress trying to figure out what language they're speaking. And then there's a delay in service, because you got to get the language line involved... (COMMS-S-003)

It definitely does because if you aren't asking what that person, what they, you need to find out, or you need to tell your deputy, then you have a lack of communication 'cause that person is failing to tell you. And at the same time you're putting your officer in danger 'cause you don't know what's going on. (COMMS-R-012)

Even with the best protocols in place, COMMS workers are not always able to obtain the necessary information from callers. Recognizing the potential consequences this may have for their colleagues on-scene leads to additional stress.

There are times when COMMS workers are unable to elicit or find complete or accurate information. Consider for example: a caller who just doesn't know the information (for example, a young child), a database that has inaccurate information, or a map that is not up-to-date. These examples demonstrate that complete, accurate information may not be available. However, sometimes responders in other disciplines do not understand these limitations.

Like I think it's like either they think like we don't give them enough information, or we didn't ask or something like that but it's like how could you not get enough information. Like I understand you're going but there's no way for us to sit there and tell you every little thing. All we can tell you is what we were told. And we have questions that we ask. We know the questions to ask. So sometimes it feel like belittling, like well I'm the one that's doing this and you just sitting there all night. Like they'll

say stuff like that. Like you just--I mean you just sit there all night. But I'm not just sitting here like... (COMMS-R-015)

The lack of understanding on the part of on-scene first responders and the insinuation that COMMS workers have not worked hard enough to get and provide accurate information only adds to their stress and frustration.

### ***Feeling Responsible***

COMMS workers feel personally responsible for the safety of the colleagues they dispatch, who they often talked about as “family.” They recognize that the information they collect and disseminate from callers is crucial in keeping responding units safe.

To get all the pertinent information that you need to get an officer out there, and make sure that the officer is safe once they get out there...basically just to keep the officer safe. (COMMS-U-018)

... you're also stressed for the officers because or the paramedics or whoever's responding you know because we're all kind of one family and we all care about each other and your job and this is how we think of ourselves our job is to keep them safe and make sure they get the resources they need. Make sure that they are prioritized you know and we're sending them into these crazy situations and we want to make sure that they're going to be okay. (COMMS-U-006)

It is not surprising then, that COMMS personnel view themselves as the lifeline to responding units.

If they need something on that scene, they look to the dispatcher to find that resource for them. And being in a controlled environment it's much easier for us to start looking things up, the resources for them, rather than it is that incident commander in most cases to look it up, look at an iPhone and start Googling something rather than calling dispatch and saying, hey, I need additional manpower, I need hazardous materials, I need the coroner, I need whatever resource, it's much easier for this dispatcher in a controlled environment to get that. (COMMS-R-016)

On-scene first responders often “look to the dispatcher” for additional resources that can help them stay safe and help them address an incident. While COMMS personnel are in a better situation to find and provide these resources, they still have very little control over the “crazy situations” to which they sometimes have to dispatch on-scene first responders. This responsibility is coupled with their concern for liability.

So there's a lot of stress about just again the unpredictability just don't know what's going to happen and then in addition to that the liability that if anything that goes wrong you are responsible. (COMMS-U-006)

The lack of control to be able to keep their friends and colleagues safe, combined with the potential liability they might face, is another stressor for COMMS workers.

### ***Lack of Resolution***

COMMS workers are not on-scene but are often the first to interact with the public—they are the first point of contact in most emergency situations. The work they do is integral to incident response, but not being on-scene and can be “painful.”

...it can also be really painful sometimes and mostly when there's a call that's you know that is really difficult. We get those calls sometimes medical calls or accident calls and you know that it's bad there on the scene and you want to do everything you can to help but part of it is you're not there and you're kind of this middle person so you're kind of limbo almost. (COMMS-R-009)

Being behind the scenes means that COMMS workers are in a “kind of limbo” since they are not physically there to help. This also results in COMMS personnel rarely hearing how an incident ended. They typically do not get closure for the incidents they handle. They are left wondering about how particular incidents were resolved.

I think one of the biggest ones is that they don't get the closure that a responder gets to see. And me being coming from both side of it, I've been behind the radio but I've also been that responder in the field and being able to look at that person and say, wow... what the dispatcher did, what the call taker did that made a difference. They don't hear it. They don't get to see that difference that they made whether it was calming someone, whether it was giving them instructions or whether it was just being there to listen to that person made a difference for them...So I think those are probably the biggest of the stressors is the actual work that they do, not having any closure is probably one of the big ones. (COMMS-R-016)

Not being on-scene also means that COMMS workers rarely get to see the culmination of their work—they “don't get to see the difference that they made.”

So you don't know what happened or you could get a call of a you know someone who is screaming, you could be talking to someone who is suicidal and you're trying to talk them literally off the ledge of killing themselves and the police department gets there, you disconnect the line, they contact the person and you don't know what's happened but you spent that time investing in them trying to get them to literally walk away from the ledge and there's no resolve. (COMMS-U-007)

...being nervous for perhaps the person on the line because you do get invested in these people even though you don't know them, you're still worried about them, you care you know. (COMMS-U-006)

Just as many COMMS personnel feel responsible for the first responders on-scene, they also become invested in the incident and in the people involved—they care about and worry about them. However, rarely do COMMS workers get to meet or even hear from the people they help. They are unlikely to receive the satisfaction of hearing or seeing the positive outcomes they contribute to through their work. Dealing with emergencies, sometimes life and death incidents, yet never knowing the results is another emotional stressor for COMMS workers.

### ***Lack of Value***

Despite their integral role in emergency response, COMMS personnel often feel undervalued. This lack of appreciation may come from the public, who often does not know who COMMS personnel are or what they do. However, the lack of appreciation can also come from their colleagues in other disciplines, which makes it more stressful since these are the people they are trying to assist and keep safe.

But I think the most stressful part is the people that I work with. And sometimes you kind of feel like, especially in communications, like you're not valued I guess 'cause you're not the one that's going out and doing it. (COMMS-R-015)

An emergency situation is not just, oh, it's the same old thing. Everyone has its different challenges... There are many, many police officers that walk into this room, firemen that sit here and go, God, I never thought it was like this. I mean I thought you were just a secretary. Just answering the phone. And I couldn't sit here all day and do that. (COMMS-R-016)

COMMS personnel sometimes feel a lack of respect from their colleagues, who may consider them as “secretaries” rather than as part of a team of public safety personnel. COMMS personnel know they play an important and integral role in emergency response and they experience satisfaction from their work, but the lack of appreciation and recognition contributes to their stress.

### ***Abusive and Traumatic Calls***

Abusive and traumatic call are emotionally and psychologically stressful for COMMS personnel. Call takers suppress their own emotional reactions to handle the incident.

...so all three disciplines have protocols we have to ask the 911 caller, that helps pinpoint exactly what type of help that they need because of all those variables. And some of the public doesn't quite understand that, and they range from, "Just send me help," to the belligerent people that just go off, and they're calling for help but then you get this verbal assault and abuse of F-you and they just start cursing at you, "Just send me the help," click, and they hang up. And all you want to do is help them but you need to calm their stressors down. So that adds to your tension and your anxiety and your blood pressure because they're angry at you and you have to get through your protocols... (COMMS-S-003)

Dedication. You have to want to do this job. It's not a job that just anyone can just jump into. They have to realize that they're going to get screamed at, hollered at, fussed at, in an individual or individuals' worst time answering a 911 call. (COMMS-R-011)

And when people start screaming on the other end that's like the worse 'cause you're trying to calm them down enough to get the information from them and it's like then you get excited when you get -but you can't sound excited, you still just got to sound calm and everything. (COMMS-R-015)

In addition to abusive calls, COMMS personnel experience traumatic calls. Even though COMMS personnel are not physically on-scene they can still experience vicarious trauma from an incident [11]. Many calls are psychologically and emotionally taxing.

I guess, the next biggest would be the bad calls. The ones nobody wants to hear. The ones you should never have to hear. Yeah. So those -- and then on the other side of dispatch, you know, when you get an officer shot and you are responsible for it, you know, that's -- that's high stress. (COMMS-R-019)

“And it's more a stressor probably for our new people than it is for our old people. What I mean by that is when I said earlier, so one of them went through the whole training program got a child CPR call, had to give the mom direct instructions on how to give CPR to a 2-year-old, went through all that,

that was it, she quit, can't do it. So if you're a parent and you have a 7-year-old and you have the 7-year-old call that day, it's close to home, it's a huge stressor. (COMMS-R-020)

Traumatic calls, like abusive calls, require COMMS workers to control their own emotions and emotional responses in order to respond efficiently and effectively with an incident. However, this results in stress and emotional exhaustion, sometimes to the point where it affects their ability to continue in their position.

#### 2.2.4. The Cumulative Effect of Stress

It is clear from the data that COMMS work is highly demanding. Indeed, multiple types of stress are evident in our data—physical, cognitive, and emotional. When all of these are combined, they contribute to significant levels of stress and potential overload for COMMS workers.

...but when you still categorize us as secretaries but yet we deal with you know stress levels....an officer or a firefighter is doing something that you know upsets you on the radio then you've got a structure fire, you've got someone who is being stabbed, it's just the culmination of a day, or a shift, or a night isn't just the calls that come in. So, for us having the citizens expect one thing but not know what reality is like in the 911 center, we're kind of just the forgotten public safety realm I would say. (COMMS-U-007)

As this participant noted, it is often the cumulative effect of the work that creates stress. This cumulative effect of stress is manifested in many ways, from irritation and aggravation, to physical symptoms, to suicides.

...besides the insomnia, the night terrors, the not being able to sleep, that's probably the worst of it. But I'm still highly functional. So, when other coworkers are divorced two, three times over, they're drunks, they show up to work addicted to something, or they overdose in their own homes. I even had another fellow dispatcher, seven years ago next week, he committed suicide... (COMMS-S-003)

Because we do have a high rate of suicide actually in this industry because there's a lot of mental health and there's a lot of physical health issues that aren't necessarily recognized because we're looked at as secretaries but we have high obesity rates, we have sleep deprivation at high rates, we have suicide at high rates. (COMMS-U-007)

The stress experienced by COMMS workers affects their physical and emotional health, often with very serious consequences. Several PSAP managers spoke about the Post-Traumatic Stress Disorder (PTSD) they believe their COMMS personnel experience.

Being able to help them with recovering from PTSD because I don't think that's taken seriously enough in the dispatch side of things. (COMMS-R-016)

And if you pooled them all and made them as one dispatcher, they wouldn't have PTSD. But if you look at the results individually, a lot of dispatchers probably do. And some of them are diagnosed as having full-blown PTSD. So I'm worried about that. These young kids, especially, when you get old like me, then you worry about other people. So we're trying to promote health in our center. Mental health and physical wellness. (COMMS-S-002)

PSAP supervisors now recognize that mental and physical health issues are serious potential consequences for COMMS workers. COMMS supervisors often spoke about employee mental health, in one form or another, as an important concern and felt a responsibility to provide employees with mental health resources.

We get kind of numb to that and de-sensitized, so it's really important for me as a supervisor to understand where they're coming from. I understand what the field is going through so I really kind of want to keep check on my co-workers. And we have certain things in place with the critical incident stress management team that we can call, we have the health wellness, because again [county redacted], we're very wealthy here. We have a lot of resources that other people don't. We have our own paid psychiatric doctor that's just for the fire department full time. We have our full-time medical staff. We have our own doctors and nurses and everything, in our own medical facility, just for us. So we have a lot of resources, we have our own health and wellness division that specifically caters to the family well-being, the spousal support, the child support, the financial education for retirement, everything like that. And then the stresses. If you need time off, if you need life adjustments, if you're addicted to anything, they kind of help you with coping mechanisms for all of those things. (COMMS-S-003)

All first responders are faced with making rapid assessments, quick decisions, and working with changing and unexpected developments—and they all have stress in their work. However, PSAP personnel also experience a variety of additional demands due to the unique characteristics and challenges of their work, as detailed in this report. Some PSAPs are beginning to recognize and address these. As previously noted, sometimes this is done by finding and providing technology that can alleviate some of the physical stressors felt by COMMS workers. Other times, this is about recognizing symptoms in COMMS workers and providing appropriate wellness services.

### 2.3. Technology Issues for COMMS

Technology is integral in the work of COMMS personnel day in and day out. Technology has the potential to ease the stresses and workload of these first responders. Unfortunately, this is not always the case. In this section, we briefly describe the types of hardware and software often used in PSAPs, the types of technology-related problems COMMS personnel report as current issues, and their new functionality requests.

#### 2.3.1. 9-1-1 Communications Center Technology

As discussed in previous sections, there is a great deal of hardware and software utilized by COMMS personnel that facilitates their work. The hardware used includes: radios, cellular phones, landline-based phones, computers, monitors, keyboards, mice, desktop microphones, headsets with a microphone, and foot pedals. Commonly used software includes Email, Computer-Aided Dispatch (CAD) systems, Record Management Systems (RMS), driving directions and mapping applications, weather applications, language translation applications, criminal databases, databases of policies and laws, and emergency notification systems. As will be discussed below, COMMS personnel often experience challenges with these technologies.



### 2.3.2. Technology Challenges

COMMS personnel in this study identified a variety of different types of technology they currently use in their work, as well as problems they experience with these technologies. They also identified new functionality to improve their communication technology. Volume 2 [4] presents a comprehensive analysis of technology-related problems and requested functionality for four first responder disciplines: COMMS, EMS, FF, and LE. In the following two sections, COMMS-specific data are presented, including tables illustrating the major categories for both current problems and requested functionalities. [4] provides a more in-depth analysis and additional exemplar quotes in each of these categories.

#### **Currently Experienced Problems with Technology**

COMMS personnel identified a variety of problems with technology, some unique to COMMS and others which are common to those experienced by other first responder disciplines. Of these, three broad areas surfaced as particularly important in COMMS work: 9-1-1 incoming calls, continuity of operations concerns, and technology implementation and infrastructure problems. Table 3 presents the major problem categories COMMS workers identified, along with exemplar quotes for each.

**Table 3: Currently Experienced Problems with Technology**

<b>Currently Experienced Problems with Technology</b>	
<b>Problems</b>	<b>Participant Quotes</b>
9-1-1 Calls—e.g., caller location, nuisance calls, caller location	We get a lot of 911 hang ups mostly off the mountain. Now with the smart watches doing 911 hang ups. They move their wrist. That’s a real pain. That’s worse than the pocket dials.” (COMMS-R-008)
Disruption of operations—e.g., Continuity of operations, mobile operations	There’s also some of the sheriff’s office over here and then in addition to that we also have ECC here as well and it’s convenient but also in terms of public safety critical infrastructure this is not perhaps the wisest setup because everything is one place and then... across the street actually literally right across the parking lot is our backup center... there is an issue of geodiversity in the sense that all of our critical infrastructure is in one spot. (COMMS-U-006)
Implementation/IT infrastructure—e.g., Installation, reservations about, cost	When you start to look at the design, and you say, okay, well you know [a public safety network is] an independent system, but your core radio network is shared with the consumer. How's that going to work, right? It's going to be a challenge. So I think you'll see around here where you potentially have [a public safety network] as your primary device, then you'll have a backup cellular device with another provider, and you're right back to where you were before. It doesn't really make any sense. (COMMS-S-001)
Technology overrated—e.g., problems with new technology, technology doesn’t solve problems	We have a new CAD system that's slower than the one we had before. Well, everything about is-- it's weird. You think newer technology is going to be better... More user-friendly and it's just not-- It's not the case. The phone is horrible. If someone calls you on the radio and you

	<p>didn't catch what they said-- with our old system we could just go in and double click on the last radio transmission and play it back. (COMMS-S-004)</p>
<p>User interfaces—e.g., ineffective, inefficient</p>	<p>We get a new system that is great on the technology side but it takes me 2 to 3 steps to what used to take me one... I used to just be able to type of command out into a line... I now have to start a command, hit tab, find which section I want to go to-- so the location might be here, but to enter a license plate it's down here, and to enter a color of a vehicle here, and it's a makeup. It's-- you end up using your mouse, and for me, having to remove my hands from a keyboard when I don't need to look away from-- I can look away from the keyboard and keep doing my job. It's time consuming. (COMMS-U-007)</p>
<p>Old or outdated technology—e.g., old or outdated, personal tech better than department,</p>	<p>So in that time frame we have to deal with things we still have copper line connection to connection points so we still maintain those copper line points. We don't use IP base yet for our phone system. We have old PBX systems. We have a lot of stuff that is kind of old and in order for me to get parts I'm usually pillaging from other jurisdictions as they update to get replacement parts for mine in case something breaks which really comes into play. (COMMS-U-007)</p>
<p>Reliability—e.g., unreliable technology, redundancy, radio dead zones, transmissions</p>	<p>With something like CAD, if CAD goes down we can go manual right? We can pull out boards, we've got magnets, we've got cards, we can do what we need to do. If you lose your phones... You're done. If you lose your radios you're done so in those two you really need the reliability and that means going with those that are... versus CAD you know we can kind of try the waters and do different things but you want to make sure again that it's the best of the best for the operations world but you don't want technology to suffer either for it. (COMMS-U-007)</p>
<p>Interoperability—e.g., internal, external</p>	<p>[RE: CAD interoperability between dispatch agencies] But whenever something makes a difference here in us being able to respond and have that, then them sending that to us rather than them having to type all of this stuff in an email, send it in an email, that now we've got to type it into a CAD system, it's a lot of wasted effort. But having that data automatically transfer at the sender's request, not at the receiver's. I think that would probably be the number one thing I would look for." (COMMS-R-016)</p>
<p>Audio clarity—e.g., hard to hear</p>	<p>I think right now, they're in the process of trying to upgrade our radio system and our towers because they are old. Yesterday one of the officers called me and he called four times and it sounded like he was whispering and I said, "You're totally unreadable." Well, that's an officer safety issue, when you can't communicate with your officers and they can't communicate with you it's scary because-- sometimes we</p>

grab our cell phones, “Hey, are you okay? I've called you three times. I didn't hear anything.” I mean, all officers and dispatchers should have equipment that works. (COMMS-R-005)

COMMS workers identified problems with their current technology, many of which highlight issues presented in this report, including the ways in which problems with technology contribute to stress for COMMS workers.

***New Functionality Requested for Technology***

In addition to problems with current technology, COMMS personnel identified a variety of new functionalities for technology that they believe could improve their effectiveness and efficiency. Again, some of these are unique to the COMMS environment, while others are similar to those identified by other first responder disciplines. Table 4 presents the new functionalities COMMS workers identified as important for their work, along with exemplar quotes for each.

**Table 4: New Functionalities Requested for Technology**

<b>New Functionalities Requested for Technology</b>	
<b>Functionalities</b>	<b>Participant Quotes</b>
Tracking—e.g., caller location, responder location	Wouldn't that be awesome if I could have that virtual screen [from Minority Report] as a dispatcher and I see a map of the county and I can zoom into the emergency, and I can just zoom in on it and see what their problem is, look out for the closest units and just touch them and throw them at the house and just go, you, you, you, you, go. And just have it happen. And then, the system will tell them everything... I don't have to type in all these commands, that whole fat finger syndrome, or that working 18-hour shifts and there's a major storm and the 18 hours turns into 48 and you're tired, so the human factor decreases and the computer-aided part, like garbage in/garbage out, perfection in/perfection out, that will raise it. (COMMS-S-003)
Functionality—e.g., reliability, better coverage, faster devices	That would be amazing if we had--and not just out building coverage, not on the street coverage, I'm talking in the building... that type of thing. (COMMS-R-016)
Communications centers—e.g., improved dispatch interface, multimedia data packages, access to 9-1-1 caller camera, large multi-view display	What I want, I just applied for, is a-- it's a KVM software, and in took forever to find one that was affordable to the public sector. I had one guy come in and tell me it was \$150,000 to get KVM. There's just no way... KVM is keyboard video monitor switches. I was always told that the switches entailed connected it but you actually had to turn a switch to whichever one you want to get on. But I was able to find a company that has them that it automatically--you configure your monitors when you're installing the software but it automatically can tell by the movement of your mouse which screen it's on and what system you're operating at that point. So you're not sitting here with--because people

	<p>come in and they want you to run this or our radio runs off a separate computer than our network computer. Our hardware, police cameras, run off a separate computer. Then the other 2 computers, 911 is its own computer. So we have some stations that has 4 keyboards and 4 mouses on them. And it is a hindrance to switch mouse and keyboard to figure out which one you need to be on. So we're looking at that right now because that in itself will help us do our job more efficiently and easier than switching stuff... That is the biggest one right now in our communication center. All of my people, you know, want it, they asked me when are we getting it. (COMMS-R-013)</p>
Interoperability—e.g., interagency communication, software and hardware compatibility	<p>But one thing I will say is you can't do everything on a phone. I'm not going to write a report, right, on a phone. So you'll have to have different form factors. You'll have to have something that has a lot of screen real estate and that kind of stuff for certain job functions. That's not going to go away. But if I can provide an ecosystem of applications that makes a lot of the jobs simpler, that's really where I want this to go. (COMMS-S-001)</p>
Futuristic—e.g., media sci-fi	<p>The virtual reality stuff is kind of intriguing to me... I mean, they do it on NCIS, where they have one big screen, and that's got everything they need, and they just throw it around like that. I suppose that's probably possible now... But it seems it would be nice for us to be able to have a big curve TV instead of six monitors, and still be able to manage the four different computers and the information that our dispatchers need to do their jobs. Seems like maybe virtual reality would be the way to make me do that. (COMMS-R-002)</p>
Real-time technology—e.g., live video and images, language translation	<p>I would like something to where if you take the worst possible scenario, someone who doesn't speak English, who's having a panic attack about a major emergency and can't relay that. If we had that, I could see them, if there was some sort of magical technology that I could talk, it translates to their language, they could talk, it will translate to their language, so I see like a closed captioning exactly what they are saying, there's no communication breakdown, I can see what they're seeing so I could use my experience to plug in the holes of medical, traumatic, fire, whatever, and then I can tell them exactly what they need to know immediately and the communication is transparent, it's just there automatic, because of technology. Instead of having to delay and wait for all that. (COMMS-S-003)</p>
All-in-one—e.g., cameras, general, phones/radios	<p>I think with [a public safety network] coming I would like to see the whole radio thing probably go out of the window and the cell phones to be able to be the radios and I know that that's coming someday and those radios should be able to be protected on Band 14 [of a public</p>

	safety network] system and they should be able to be affordable so that it's in everybody's hand and I think that that would be huge strides towards interoperability all together. I don't know if it will ever happen but we'll see. Kind of hard to get the LMR out of the picture. (COMMS-R-008)
User interfaces—e.g., user friendly	Just ease of use [for] the end user. You know some of these systems come through and I've even seen it in other 911 centers where the technology is really supported and it's a great system but when the person on the end tries to use it it's useless and so just having that focus of what are you trying to accomplish? It's great if you can get it going here but if you can't use it it's not worth it. And we run into that with our CAD system it's somewhat outdated. (COMMS-R-008)
Physical ergonomics—e.g., interface interactions optimized for the task	Things are very spread out so the old CAD I used to be able to just I knew all the commands, my hands could stay on the keyboard and I never had to lift my hands. I have a foot pedal that I can push to talk on the radio and my hands I would just type commands, I had it memorized how to type the line segments and it was great. We get a new system that is great on the technology side but it takes me 2 to 3 steps to what used to take me one. (COMMS-U-007)

Given the importance of location information for COMMS workers, it is not surprising that the most important functionality they spoke about was the ability to track the precise location of 9-1-1 callers and on-scene first responders. Another specific request for future technology by COMMS workers was for improved dispatch and camera interfaces. Whether it is a display with multiple views, a wall of monitors for street cameras, or something more futuristic like the visual and gesture-based interfaces seen on modern crime television series, COMMS personnel want improvements made to the way they interact with their technology.

### 3. Discussion

#### 3.1. Crosscutting Themes from the Data

The Results detail the context of COMMS work and the characteristics of those who work in it as well as the technology-related problems and opportunities that COMMS personnel identified. There are three themes that cut across these results: 1) the invisibility of COMMS personnel, 2) communicating while not being on-scene, and 3) the need for utility enhancing technology. Next, we discuss these crosscutting themes from the data.

##### 3.1.1. The Invisible First Responder

When asked, young children may say they want to be police officers or fire fighters when they grow up. They can imagine what people do in these roles and what the work is like. Yet, how often, if at all, do young children, or even high schoolers, hear about COMMS work as a career? Similarly, there is generally no visible identifier of someone who works in 9-1-1 communications.

In contrast to other first responders, there is generally no visible identifier of someone who works in COMMS. How do you know someone on the street is a call taker or dispatcher? In addition, the remoteness and isolation of their work from “the scene,” is another factor that leads to the invisibility of COMMS personnel and their work.

The resulting invisibility of COMMS personnel and their work is both a result of and a contributor to many of the findings previously identified. It contributes to misunderstandings and misperceptions about the work of COMMS personnel. The isolation from the scene, the lack of respect, the confined building, and the lack of closure, to name just a few, all contribute to and are a result of this invisibility. It is easy for the public and for other first responders to forget the work they do and the integral role they play in emergency response. In many ways, technology facilitates this invisibility, since it acts as an intermediary between COMMS personnel and those they communicate with—the public and other first responders. They are the “voice” on the other end of technology, but not the “face” of first response. The official classification of COMMS workers is complex: in some departments and agencies they are deputized, while in others they are civilian employees. In some departments they are considered first responders, while in others they are considered clerical. In the clerical model, there is a view of COMMS employees as switchboard operators—they answer the phone, obtain information, and then enter it in the computer. In this model, no further thinking, processing, judgement, or critical thinking is needed. Our data clearly show this view of COMMS personnel as clerical to be a misperception. Recognition of COMMS work being integral to incident response and the first response role of COMMS personnel is increasing as evidenced by a new Texas law classifying COMMS personnel as first responders [2].

#### ***COMMS Personnel are First Responders, But...***

...their roles, tasks, and contexts of work are quite different from other first responders. For COMMS personnel, these differences are governed by the call-taker and dispatcher roles. The communication-related tasks required for these roles benefit substantially from a consolidated communications operations point—a communications hub. Having an off-scene, typically fixed location for the communications hub provides important infrastructure advantages such as a weather-hardened building, physical security, adequate power, back-up power, cell tower proximity, multiple hardwired communications feeds, hardwired telecommunications trunks, and so on. While there are many, many infrastructure advantages to this arrangement, there are certainly aspects that have negative impacts on those who work within them, as described previously. The nature of a PSAP with its substantial infrastructure and **off-scene location imposes important differences in the contexts of work for 9-1-1 Communications Center personnel** and those in other first responder disciplines. This topic resurfaces throughout this report because it is such a significant factor affecting the nature of PSAP-located work.

Despite the role-imposed differences in responsibilities and work location, there are some difficulties of emergency response that are shared by all first responders regardless of whether they are working on-scene or off-scene. These characteristics include the demands of rapid risk assessment, time-limited, critical decision-making, and coping with unexpected developments; all within the context of the overarching pressures inherent in all emergency response, since timeliness and decisions made by first responders affect life safety and property outcomes.

### 3.1.2. The Impact of Technology when Communicating Remotely

Whether call taking or dispatching, communication is the core task for those working in COMMS; for other first responders, communication is an enabling task—for COMMS personnel it is THE task. Typically, COMMS personnel are the initial point of contact in emergency response. They do not see or hear or smell the scene of an emergency. All first responders deal with people, but COMMS personnel deal with people who are not in front of them. They do not have the benefits of face-to-face interactions. They must work to elicit important information, work to keep callers on the line, work to calm callers—while remotely assessing the situation and making time-critical decisions. Additionally, they must translate their assessments for the first responders they send to the scene and, in some cases, they continue to monitor the scene—without being on-scene. The remote nature of their work is a significant factor in what makes this work difficult—they must build and share situational awareness without being on-scene.

Our findings show that technology is an enabler for communication, but it can also hinder or even completely disrupt communications between COMMS personnel and members of the public or dispatched units. When the communications technology is not working, for whatever reason, however briefly, comms center personnel cannot perform their primary task: communication. Connections are disrupted in a variety of ways: dead zones, dead batteries, outages, and so on. Even through the PSAP technology may be solid, if the connection is not maintained end-to-end with adequate service quality, COMMS personnel consider the technology unreliable. Unreliable technology contributes to feelings of lack of control. Further, unintended breaks in a communication stream disrupt the COMMS communicator’s situational awareness of the emergency incident. Without the option for face-to-face communication, remotely located COMMS personnel rely on communications technology to perform their primary task: communication.

COMMS personnel commit to be the lifeline between the public and emergency response as well as the lifeline for first responders who will go to the scene. The remote nature of their work makes them reliant on technology; that same technology can empower them to succeed or hamper their mission.

### 3.1.3. Themes Surrounding Technology Issues

Across the board, 9-1-1 personnel want technology that helps them do their job effectively and efficiently. Ultimately, their job hinges on creating and maintaining technology-enabled connections with other people. They want technology that supports these connections. They want user interfaces that support them in their tasks. In other words, their technology must provide utility for them [3], [4].

COMMS personnel have identified many areas where improvements need to be made to their existing communication technology, the most pressing of them are reported in section 2.3.2. These problems have three broad themes. COMMS personnel see utility in technology that is reliable, usable, and interoperable. New functionality requests are also presented in section 2.3.2, where the cross-cutting theme remains this requirement of utility.

For their current technology and for that on the horizon, COMMS personnel want technology to work without being a detriment to their primary task. Workarounds, extra steps, and so on represent extra work needed to accomplish the primary task at hand. If technology doesn’t work properly, doesn’t work as advertised, or doesn’t work as expected, COMMS personnel wanted it fixed or replaced with new technology, or when possible, they often prefer to revert to older methods to accomplish their tasks.

By a large margin, the functionality requests of first responders are more related to fixing or improving the problems with their current technology than any other new functionality requested. This intersection between problems and requested functionality revealed three standout categories:

- Reliability,
- Usability, and
- Interoperability.

To COMMS personnel, reliability means the technology will always work properly. This includes connectivity in technology-enabled communications. Usable technology makes it easy for the user to do the right thing, hard to do the wrong thing, and easy to recover when the wrong thing happens. Interoperability provides seamless access and use of data in a coordinated manner within and across organizational and regional boundaries.

### ***What Does “Future Tech” Mean to This Population?***

As with other first responders, PSAP personnel want their current technology problems addressed over the introduction of new technologies. Their view of “future tech” hinges on what they don’t have as opposed to “futuristic” technologies. PSAP personnel work with many systems—just logging into the various systems at the beginning of shift can take 15 or more minutes, for every shift worked. Single sign-on would be a huge win for them—this is not futuristic technology. Single sign-on is but one example of task-supporting functionalities, interfaces and applications. The systems and interfaces they have now do not always completely support the tasks at-hand. As mentioned above, workarounds and extra steps take time—and time is a life-saving factor in emergency incident response.

COMMS personnel want new functionalities when they see the value, but they also have reservations. Many new technologies provide both positive and negative aspects to their use. The capability to receive and respond to incoming 9-1-1 requests for help via text messaging is a good example. Dramatic incidents such as those involving domestic violence victims texting 9-1-1 for help when unable to communicate via voice, among others, have demonstrated the value of this capability. However, there are draw backs. Much information is conveyed to COMMS call-takers through the audio stream: how calm or frantic the caller is, how well the caller is responding to instruction, and background noises that flag a volatile or dangerous environment for responding units to name a few. Text-to-9-1-1 provides an important input stream, but it also loses much contextual information COMMS personnel need to help the caller and in providing important situational information to responding units.

9-1-1 calls originating from mobile phones also have positive and negative aspects. On the positive side, being able to call from anywhere there is service is certainly a benefit beyond measure for callers. In contrast, PSAP personnel have lost the ability to get location information that is inherent in the landline system, where every phone number connection is associated with a physical address. Since COMMS personnel must get location information to know where to send responding units, this information is critical—and it must be accurate. Many mobile 9-1-1 callers do not know precisely where they are when calling 9-1-1; this is especially true of people who are new to an area.

Another new technology type that has positive and negative aspects is the ability to initiate 9-1-1 calls from smart watches and medical devices. A negative impact of these technologies is that they can send



messages without the user's knowledge, often many such nuisance messages. Each message to a PSAP must be handled according to established protocols, which requires resources. COMMS personnel do not want to eliminate these messages, but to limit them to true emergencies.

Additionally, mobile phones have made it easy for members of the public to be "good Samaritans" by making a quick phone call. Many people may call 9-1-1 about the same situation. Because each call to a PSAP takes time and resources, repeated calls regarding the same incident can cause delayed response times for other incidents. No one wants an emergency to go unreported, however, delaying response to other emergencies is a significant negative effect. This is a different situation than the repeated smart device calls, however, both types of calls use PSAP resources that might be better spent on other calls.

While newer technologies have provided many benefits, mostly for 9-1-1 callers, unintended consequences have introduced new challenges for COMMS personnel. It is not surprising that they have reservations about new technologies.

### ***New Tech Brings New Responsibilities***

New technologies often bring new responsibilities for COMMS personnel. PSAP administrators anticipate that many of these new responsibilities will also likely have increased potential for additional cognitive loading, as well as, liability for COMMS personnel.

These data show that COMMS personnel are under a great many demands and stresses currently. The findings, detailed in Section 2, align with those provided in [6], a meta-analysis of the academic literature related to psychological health of emergency response center responders. Golding, et al, followed a rigorous process that identified 2358 articles from which 115 were selected for full review, from which 16 articles met the full criteria for inclusion in the meta-analysis process. The alignment of these findings with the larger body of work identifying stressors runs the gamut from lack of control, time pressure, cognitive and physical overload, competing demands, long shifts, understaffing, and feeling undervalued and invisible.

COMMS personnel as a group constitute a highly stressed user population. This fact, situated in today's environment of rapid technology innovation and adoption with its attendant slower, often lacking, interface customization and true application integration for specific tasks and contexts of work, creates an alarming situation for this population. It is dangerous to repeatedly add another app, screen, channel, communication medium, protocol, task, fill-in-the-blank responsibility for this user population. To avoid potential tragedies resulting from this combination, developers need to recognize that one size does NOT fit all. Applications need to be designed to support the tasks and contexts of work of COMMS personnel and integrated into a workflow supporting the 9-1-1 communicator and their tasks—without extra steps, workarounds, and additional physical and cognitive loading that impede their primary task—communication.

## **4. Concluding thoughts**

To wrap-up, we return to the three questions posed at the beginning of this document. Each of these notions was explored in depth through the voices of COMMS personnel. We revisit each briefly here and add a fourth.

### ***What makes COMMS work unique?***

COMMS personnel interact with the public through communications technology rather than face-to-face interactions. Without the benefit of observing the situation directly, COMMS personnel are multi-tasking by assessing the situation, making time critical decisions based on information they must elicit from callers while encouraging callers to stay on the line and stay calm. Finally, COMMS personnel are responsible for translating their assessments to the first responders they send to the scene.

### ***What are the specific challenges faced by COMMS first responders?***

The remote nature of their emergency response work is at the center of what makes this work particularly difficult—they must communicate effectively and efficiently with others through technology while building and then maintaining situational awareness without being on-scene. Unfortunately, the remote nature also contributes to stress of COMMS personnel, as well as, multi-tasking that contributes to cognitive overload to nuisance calls and abusive callers, to the lack of control to acquire accurate information from distressed callers, and the responsibility to those first responders they send on-scene, to the lack of closure and the resulting view of their undervalued work.

### ***What are the communication and technology problems and needs of COMMS personnel?***

Three unique areas: 9-1-1 incoming calls; preparations for continuity of operations; and implementation and infrastructure problems were identified by COMMS center personnel as problems. Many of the concerns expressed are related to newer technology. For instance, the loss of contextual information from text messages to 9-1-1, or the nuisance calls from medical alert buttons and the pocket dials from cell phones and smart watches, to the plethora of incident calls from good Samaritans with cell phones. Not surprising, the most important technology need for COMMS center personnel is precise 9-1-1 caller location. With the expanding use of cell phones versus land-based lines many callers do not know their location or have trouble articulating their precise location. Accurate caller location is critical for effective communication from COMMS personnel to responding units.

Finally, similar to other first responder disciplines, COMMS personnel expressed the need for utility of the communications technology, particularly interoperability, usability and reliability.

### ***Will the larger PSCR R&D community make things better for COMMS personnel?***

This is the challenge for the larger PSCR R&D community. One participant put it this way:

Well...unless there's input from the users in developing and building it... that's the challenge that I see because if you're not sitting in that chair, dispatching, taking calls, well we can give that to communications as always a--but as you can see out here they have 5 computer screens in front of them. What does the technology do? Does it increase their workload, their responsibility, their--and with responsibility comes liability? Does it increase that or does it decrease that? Or is it kind of a neutral that this is going to be something new but it's going to help you take some of that workload off but it's going to replace that so is it going to be a neutral or is it going to be something that's going to increase their workload? (COMMS R-016)

Technology evolution is inevitable, but many of its undesirable effects can be mitigated while embracing its new and exciting capabilities through implementations that are designed to support the unique

COMMS user population, their strengths, tasks, and contexts of work, while respecting their human limitations. To succeed, these applications and interfaces, both hardware and software, need reliability, usability, and operability. These principles are encompassed in the concept of utility—the usefulness of the technology to the PSAP communicator in doing their job.

## Acknowledgements

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## Appendix A: Detailed Methodology

The research design for the project began by developing problem and purpose statements, along with a set of research questions that would guide the work during this first phase of the project. This important formative stage of the research served as a foundation and provided a focus for subsequent data collection and data analysis. Qualitative research is iterative in nature and focuses on the importance of participants' voices and perspectives throughout the research process. Data collection and data analysis were conducted in tandem and occurred iteratively, each informing future iterations. The project is cross-sectional including input from COMMS participants from a variety of jurisdictional areas, from a variety of different ranks and levels, and from a variety of geographical areas. As with most qualitative work, it is constructivist in that the focus is on how rural first responders construct and conceptualize their worlds—based on their individual understandings as well as based on shared meanings and social constructions.

A case study approach was used, which Yin argues is appropriate when exploring “how” questions where contextual conditions are relevant to the phenomenon under study, and where the behavior of those involved in the study is only observed [16]. For this project, the phenomenon of study is the experience of COMMS personnel, which cannot be understood outside of the context in which this work takes place. In the following sections, we present details related to sampling, data collection, and data analysis.

### Sampling Strategy

The sampling strategy for the larger project included ensuring representation of first responders from all four domains: 9-1-1/dispatch, emergency medical services, fire service and law enforcement. Geographic diversity was also important since the public safety issues faced by first responders may be different based on geographic location. Across the U.S., first responders from urban, suburban, and rural areas were included, to ensure that communities of different sizes and different economic realities were represented. In addition, in order to be representative of the first responder population across the United States, attention was paid to first responders at different jurisdictional levels (local, county, and state) and different ranks and levels, recognizing that their work, and the technology needed to accomplish that work, might vary. This strategy allowed for insight into the variety of experiences faced by first responders across the U.S. and ensured coverage of both typical and unique experiences.

This report focuses specifically on the data from COMMS personnel. Of the 193 first responders interviewed for the larger project, 30 (15.54%) worked in COMMS. These 30 participants came from urban (30%), suburban (10%), and rural areas (60%). They also came from different jurisdictional levels and different ranks, from call takers and dispatchers to emergency managers.

### Data Collection Instruments

A semi-structured interview protocol was developed for use in the larger project. Protocol questions grew out of the general problem and purpose statements and the research questions, input from subject matter experts (SMEs), the literature, and background knowledge of the first responder community. This generic protocol was then adapted specifically for workers in COMMS. An iterative approach was used to construct, review and refine data collection instruments in order to ensure that language, questions, and concepts were appropriate and that protocol questions would elicit valuable responses that would provide answers to research questions. Several content and survey experts reviewed the protocol, providing valuable input related to content validity. Pilot interviews with COMMS personnel were conducted as well in order to

provide information on timing, question alignment, and content validity. This ongoing review and refinement of the protocol is part of the iterative nature of qualitative research. The protocol questions for COMMS workers are listed in Appendix B.

A short demographic form was included at the beginning of the protocol. This form also included two additional questions related to participants' ease and comfort with technology (see Appendix C). The demographic questionnaire was purposefully kept short in order to allow maximum time for the interviews. Protocol questions fell into two main categories: context of work; and perceptions of and experiences with communication and technology (see Appendix B). These two categories focused on users, their tasks, and their context of use. Questions about context of work included descriptions of: participants' overall job, tasks, and daily routines; relationships with other people (their colleagues, other first responders, dispatch, the community, and the media, for example); and what their work is like. The NIST Human Subjects Protection Office (HSPO) and the Office of Management and Budget Paperwork Reduction Act approved the protocol and all additional documents.

### Data Collection Process

As previously discussed, the data for this COMMS analysis are part of a larger dataset of in-depth, one-on-one, semi-structured interviews with first responders across the U.S. Interviews generally took place in the workplace, in either a group gathering area or in a private office or conference room. Participants were provided with a copy of the Information Sheet about the study. They were then informed verbally that:

- their participation was voluntary,
- they could stop at any time without penalty,
- they could decline to answer any question(s),
- all data would be de-identified,
- the interview would take approximately 45 minutes, and
- the study had been approved by the HSPO.

Participants were asked for permission to audio record the interview. Due to the nature of their work, participants were sometimes called away for incident responses, which resulted in shortened or truncated interviews.

### Data Analysis

The data for this project consist of interview recordings and transcripts, demographics questionnaires, field notes, and analytic memos. The interview transcripts provide a contextual and in-depth look at COMMS personnel from their own perspective. All interview recordings were transcribed by an external transcription service. These interview transcripts form the bulk of the data utilized in the analysis.

Data analysis began with coding of the interview transcripts. In contrast to coding in the computer science and software engineering domains, qualitative coding is a process of labeling chunks of narrative data in order to capture the essence or salient features. The goal is to be able to group, manipulate, and examine similar data chunks. Coding is a process of reducing and reconfiguring data in an organized and meaningful way and is the beginning of the analysis process.

Transcripts for this COMMS analysis had been coded previously in the work done for the larger project, which provided a starting point for this more targeted analysis. Ongoing coding paid specific attention to

characteristics and experiences that seemed unique to the COMMS environment. The question that focused this phase of the coding was: What makes COMMS unique?

The initial step for the COMMS analysis team was to read all of the COMMS transcripts to gain an overview of the data. Each team member then coded three randomly chosen COMMS transcripts to recognize where there was convergence and divergence in the team's use of codes and to identify codes specific to the COMMS dataset. Additional transcripts were then assigned to different members of the team. The team met periodically to discuss and review codes, and their operationalization. Operationalizing each code consisted of providing the definition of the code, when to use it, when not to use it, and examples for each code. Each researcher then coded a subset of the remaining transcripts.

Team meetings occurred regularly in order to discuss coding, identify new codes as needed, and ensure that codes were being used consistently. As previously noted, the goal in analyzing the COMMS data focused on what made the COMMS participants, their experiences, and their environments unique. Ultimately, the major ideas emerged as important concepts for analysis: the invisibility of COMMS workers, the off-scene nature of COMMS work, and the need for utility-enhancing technology. These were further explored for the ways in which they provided insight into COMMS workers' experiences related to communication technology.

#### Validity and reliability

Qualitative and quantitative methods utilize different approaches to determine and provide validity. In general, qualitative methods rely on trustworthiness as a measure of validity. Trustworthiness consists of four different components: credibility; transferability; dependability; and confirmability [13]. See Volume 1 [3] for additional information on validity and reliability in this study.



## Appendix B: COMMS Interview Questions

### Context and Beliefs of Work

1. What is your job title?
  - a. If you were describing your job to someone who knew nothing about it (like to a kid, or someone from another planet), how would you describe it?
    - i. Ask them what adjectives they would use to describe their work.
    - ii. What makes a good [job title], what characteristics do [job title] need?
2. Describe a little bit about the community you serve (size, SES, homelessness, etc.)?
3. Tell me about the physical place where you work. (Is it a dispatch center or a station or...?)
  - a. Do you work the same shift every day?
  - b. Tell me about the different kinds of people you talk to or communicate with during a typical day (public, other dispatchers, fire/law enforcement, etc.).
    - i. Describe your relationships with the other folks you work with (not only other dispatchers, but also the fire fighters, police officers, the public, etc.).
      1. *If they work the same shift every day might want to ask if this helps them know other people they work with.*
      2. *Who do you think your “customer” is or where is your primary responsibility?*
4. Tell me about the daily routine for a [dispatcher] in your district, if you have one. How does your day begin (or end—do you have to log into programs, get things ready, write reports, or...)?
  - a. If there isn't one, ask them to list the different kinds of things they do during the day.
5. What, if any, are the stressors in your work?

### Communication and Technology

6. We know that every call is different, but could you describe a “typical-type” call, from start to finish, what's your process from the moment you answer the call? (*Ask about script if they don't bring it up.*)
  - a. What do most of your calls have to do with—are they fire or police or EMS—are they short or long or complicated or...?
  - b. In the “perfect” call, what kind of information would you be getting?
  - c. What are your responsibilities when you're on a call?
  - d. What kind of decisions are you making about that information as you get it and pass it along?
  - e. How easy or hard is it to communicate with the fire fighters, police officers, EMTs, and/or other dispatchers you work with?
  - f. How, if at all, does that process change when call volume goes up?
7. Are there times you ever have to communicate with other jurisdictional agencies? (like surrounding counties, cities; local, state, and/or federal)
  - a. When does that happen and are there any challenges with that communication?
8. Describe the different kinds of technology (applications, devices, equipment) you use to do your job (phone, headsets, cell phones, video, computers, etc.)?
  - a. What are the adjectives you would use to describe the equipment you're currently using? (old, new, up-to-date, useful...)
9. What, if anything, do you think causes communication problems in your work?
  - a. What do you think could help solve these problems?
10. Have there been times when technology has created problems with communication?
  - a. *If so*—Can you describe those problems and what happens?
11. Have there been times when technology has really been particularly helpful in a call?
  - a. *If so*—Can you describe one of those situations.
12. How have things changed, if at all, in terms of how you communicate in your job, since you began working in the field?
  - a. Do these changes make communication better or worse?

- i. Are these changes helpful? Do they get in the way? Do they work properly? Are they user friendly?

13. If we think outside the box for a minute and you could have whatever you wanted to do your job, what would it be? (*this could be technology or budget or people or...*)

#### Closing Questions

- 14. In your district, who is considered a first responder, and how do you fit into that picture?
- 15. Is there anything else you'd like to share about your job that you think is important for us to know?
- 16. Do you have any questions for me/us?

## Appendix C: Demographic Questionnaire

Your area(s):  Fire  EMS  Law Enforcement  Dispatch

Other Public Safety: \_\_\_\_\_

Total years of service: \_\_\_\_\_

Location:  Urban  Suburban  Rural  Tribal  Other: \_\_\_\_\_

City, State: \_\_\_\_\_

Gender:  Female  Male  Prefer not to answer

Age:  18-25  26-35  36-45  46-55  56-65  Over 65

### Experience with different kinds of technology:

(including desktop or laptop computers, tablets, smartphones, and the Internet).

- I have limited experience using technology and I don't know much about how technology works.
- I have some knowledge about how technology works, but often need to ask for help to perform more advanced activities – such as to configure the privacy settings on my cell phone.
- I can do most things that I want to do with technology and only need help occasionally.
- I can do all things that I want to do with technology without help from others.

### In general, when do you adopt new technologies?

- I try the latest technologies as soon as they come out.
- I follow technology trends.
- I let others work out the kinks first.
- I wait until my old technology dies.
- I only adopt new technologies when it's required.