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The 911 Call Processing System: A Review of the Literature as it Relates to Policing

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From the Director

Police spend an inordinate amount of time responding to 911 calls for service, even though most of these calls are unrelated to crimes in progress. Many are for quality-of-life issues like noise, blocked driveways, or public intoxication. Others are for problems like drug abuse, homelessness, or mental health crises that would be better resolved with community-based treatment or other resources—not a criminal justice response. But even when the underlying problem is minor or not criminal in nature, police often respond to service requests with the tool that is most familiar and expedient for them to deploy: enforcement. All of this exhausts police resources and exposes countless people to avoidable criminal justice system contacts. And managing this large call volume also poses operational challenges for police agencies.

There is a pressing need for data-informed strategies to identify 911 calls that present a true public safety emergency and require an immediate police response, while responding to other calls in ways that do not tax limited policing resources and promote better outcomes for the people involved and the communities where they reside. To do this, though, we first need to know more about how 911 and policing intersect. When is it used, how, and by whom? Why do people call 911, and what happens when they do?

But the 911 system itself poses one of the greatest barriers to developing this understanding. Established only about 60 years ago, America's emergency response system grew quickly and organically, with each call center operating independently. The business of call-taking did not professionalize until decades later, and even today protocols and training for this critical link in the emergency response chain are inconsistent and frequently inadequate. And although

each call center collects a vast amount of data, it is difficult to analyze, to compare one jurisdiction to another, or to aggregate information nationally.

Many studies exist on medical emergency response, but relatively few focus on 911 as it relates to policing. Of those, many depend on oversimplified and even outdated metrics as a way to compare data. Little is known about which 911 calls received by police actually require sending a sworn officer to the scene. A few studies, however, focus on more granular data, and those show us how that data can be used to improve policing practices while maintaining public safety. But much more research is needed. As the next generation of 911 call systems is rolled out nationwide, the time is ripe to identify what information call-takers, responders, researchers, and policymakers need, so that we can unify 911 systems and increase their efficiency and effectiveness.

A safer, stronger, fairer justice system hinges on our ability to deploy enforcement only when necessary. Developing a deep systemic understanding of 911 calls, responses, processes, outcomes, and opportunities for improvement is a key component of this process. With this literature review of 911 studies in the context of policing and a call for more research, Vera hopes to move the field closer to identifying a new suite of alternatives to police enforcement in emergency response situations.



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Contents

1	Introduction
3	The history of 911
6	The technology of emergencies
6	The call
6	Locating the emergency
7	Intake and processing
9	The response
11	Challenges for researchers
14	Findings from the literature
14	Studies analyzing broad 911 metrics
26	Studies analyzing more granular 911 datasets
31	New options within police departments
34	Conclusion

Introduction

When people think of 911, they may think first of emergency medical services. But a significant portion of the 911 calls made every year in the United States are routed to police departments. There's only one problem: nobody knows how many.

The 911 system is complex and involves many actors. First there is the caller. He or she places a call for help that is connected to a call-taker. The call-taker gathers information about the emergency and inputs it into a system designed to identify the caller's location and categorize the call. Next, a dispatcher (who may also be the call-taker, depending on the jurisdiction) uses this information to assign emergency responders to the location of the emergency. Once they arrive, the responders provide assistance. Even after that, the system is still gathering data: responders are filling out their own reports, comparing their assessment of the emergency to the call-taker's, and logging the amount of time spent arriving at and then responding to the emergency.

The development of PSAPs allowed 911 to spread rapidly through the United States, but today it is one of the greatest hindrances to actually understanding the system we use and its effects.

With 911 systems capturing all of this information, it might seem like 911 would be easy to study, and there would exist a broad body of literature analyzing patterns among calls and helping police do their jobs. But 911 call centers (called public service answering points, or PSAPs) operate

independently and locally. They cannot transfer calls to each other and, if your call is routed to the wrong PSAP—for example, if you are traveling near a state line and calling from a cell phone—they may not be able to send responders to your emergency. The development of PSAPs allowed 911 to spread rapidly through the United States, but today it is one of the greatest hindrances to actually understanding the system we use and its effects.

For this report, the Vera Institute of Justice (Vera) examined the body of literature that has developed as researchers have attempted to collect and study 911 data in the context of policing. Researchers have taken two main approaches to the study of the 911 system. First, there are studies using simplified, but more readily available, metrics such as call volume, call type, and response time. These studies allow researchers to draw broad generalizations about several jurisdictions at the same time, but are limited in their ability to inform about trends with any specificity—they simply collapse too many variables into too few categories. Then there are complex studies modeling caller behavior, call type patterns over time, and factors affecting the ability to respond in a timely fashion. These latter studies demonstrate the richness of 911 data available from individual jurisdictions, but are limited in scope because researchers can't compare this data across jurisdictions. The report concludes with a call for research to fill gaps in the current 911 literature in order to chart a path forward using 911 data to improve police efficiency and provide the most effective and appropriate responses to true emergencies.

The history of 911

In 1957, the International Association of Fire Chiefs began to lobby for a single telephone number for fire reporting.¹ A decade later, the Commission on Law Enforcement and Administration issued a report recommending the same system for contacting police departments.² In 1968, AT&T—then the provider for most U.S. telephone service—designated 911 as that emergency number.³ The first U.S.-based 911 call was made in 1968 in Haleyville, Alabama.⁴ Although it was originally envisioned as a fire reporting system, 911 quickly became an all-purpose emergency response system and—by connecting callers with police—one of the fastest-expanding components of the U.S. criminal justice system.⁵ By the end of the 20th century, 93 percent of the country’s population—and 96 percent of its geographic area—was covered by 911 service.⁶ But despite the ubiquitous nature of 911, Congress did not officially adopt it as the nation’s emergency calling number until the Public Safety Act of 1999.⁷ This may have something to do with its piecemeal growth: each jurisdiction independently developed its own 911 system—and only later did national-level guidelines begin to emerge.⁸

Today’s 911 systems bear little resemblance to the rudimentary, ad hoc dispatching of the early 1970s. Technological advances have made it possible for call-takers to communicate more clearly and reliably with both callers and dispatchers. Enhanced 911 (E911, the system most people are familiar with today) was developed in the mid-1970s.⁹ It added critical features to call-takers’ repertoires, like selective routing (responsible for making sure that 911 calls reach emergency services covering the address the call is made from), automatic caller location information, automatic telephone number identification, and call recording.¹⁰ And public safety Computer Aided Dispatch (CAD) systems—a parallel policing dispatch system that enables dispatchers to assess available resources, send messages, and store data—which developed in the 1960s to provide support for and assist in the dispatch of patrol units, also quickly became integrated into the 911 system.¹¹

Early 911 call-takers did not necessarily have specialized dispatch training and created their own descriptions for fire, medical, or police services to explain the emergency. As the system aged, the business of call-taking began to professionalize, and call-takers in many locations received training

not only in generalized dispatch, but also in specialized medical, police, or fire dispatch. One of the services that modern callers are most familiar with through media depictions, the “pre-arrival instruction,” was not used until almost a decade after 911 came into service. In 1976, a woman whose baby wasn’t breathing called 911 and, rather than making her wait until responders could reach her, the call-taker gave her instructions that were instrumental in saving the baby’s life.¹² By 1997, emergency medical dispatchers had access to a protocol database—called the Advanced Medical Protocol Dispatch System (AMPDS)—with 88 million question-and-answer combinations developed by the International Academy of Emergency Medical Dispatch available to guide them through analysis and care instructions.¹³

Today’s 911 systems bear little resemblance to the rudimentary, ad hoc dispatching of the early 1970s.

911 is still evolving, largely in response to the advent of wireless communications. One of E911’s greatest limitations is that it did not anticipate the widespread use of cell phones, which results in complications for call-takers and dispatchers.¹⁴ Cell phone calls are typically associated with the address of the cell phone tower closest to the call’s point of origin, rather than the exact location from which the emergency call has been made. This means that automated location databases—which inform the call-taker where the call is coming from based on the telephone billing address—do not typically display the location from which the wireless call is being made.¹⁵ This can be particularly problematic for 911 hang-ups: most police agencies dispatch officers to investigate abandoned 911 calls—even if sometimes that means merely searching the vicinity of the cell tower in question—which cannot be easily done if no address is available.¹⁶

A digital system referred to as Next Generation 911 (NG911), which allows callers to provide information through a variety of media including

voice, photo, interactive video, and text message, addresses many of the limitations of E911, including location and accessibility concerns for such populations as people who are Deaf or hard of hearing or for whom English is not their first language, as well as individuals who are in need of police assistance but a call to 911 and communication with a call-taker itself may put the caller at risk of harm.¹⁷ As of 2017, 16 states, regions within or among states, or U.S. territories had adopted plans to implement NG911; eight had sought proposals from vendors for statewide components for a NG911 system; 11 had awarded a contract for at least one NG911 system component (such as an IP network); and 13 had a fully functional NG911 system and were processing NG911 emergency calls for service.¹⁸

But for all 911's advantages, the system is still far from perfect. Its decentralized nature means that each of the thousands of PSAPs across the nation operates independently.¹⁹ Some locations still do not have the full range of E911 services, let alone NG911.²⁰ And, although CAD systems and AMPDS are widely used and valued tools, they are not necessarily standardized across the country—or even among cooperating local jurisdictions.²¹ For example, some jurisdictions are using versions of the AMPDS database that may be out of date. And, although CAD as a system is in wide use, each locality is likely to have its own set of CAD codes to convey information between dispatcher and responder.

The technology of emergencies

To someone experiencing an emergency, 911 is designed to be simple: press three numbers, get help. But dialing these three digits sets in motion a complicated process involving several layers of technology and multiple personnel—and data on each decision is logged every step of the way.

The call

When a caller dials 911, she is connected to a PSAP, the call center responsible for responding to emergencies.²² There are more than 6,000 PSAPs in the United States, each operating independently—some by state and local governments, others by law enforcement agencies, fire departments, and emergency management agencies.²³ Practices vary by jurisdiction in terms of whether call-takers can double as dispatchers; whether they exclusively or collectively respond to fire, medical, or police emergencies; and whether they are required to be certified in specific or general dispatch techniques.²⁴ (For more information about call-takers, see “911 call-takers: Their training, role, and well-being” on page 10.)

Locating the emergency

To route an emergency call to the correct PSAP, the phone company must be able to associate a phone number with a location. If a call is made from a landline, it is automatically directed to the nearest PSAP based on the address associated with the landline, and the address the phone number is registered to appears on the call-taker’s screen.²⁵ Calls from wireless phones, however, are more complicated. If a call is made from a cell phone, the phone’s signal is transmitted to the nearest cell phone tower, and that signal is then transmitted to the “nearest” PSAP.²⁶ This can cause problems when a call is made near a jurisdictional border, because the nearest cell tower may route to a PSAP that does not serve the caller’s location.²⁷ Because PSAPs are not necessarily networked, this can mean significant

delays in—or even failure to provide—service.²⁸ This is a rapidly growing and significant problem. In 2016, approximately 80 percent of 911 calls came from cell phones.²⁹

Moreover, cell phones do not remain in a fixed location and providers do not necessarily release location data for these phones.³⁰ In PSAPs with E911 service, the cellular provider is required to transmit the phone number and at least the location of the cell tower to which the call connected, as well as location data that includes the latitude and longitude from which the call was made (accurate to within 50 to 300 meters), depending on which E911 features have been implemented in that region.³¹ This enables PSAPs to follow-up on abandoned cell phone calls and ensure that there is no emergency, where before they would have been unable to dispatch services.

As noted above, in 2016, 80 percent of 911 calls came from cell phones.³² But voice over Internet protocol (VOIP) calls are accounting for an increasing share of 911 calls.³³ VOIP calls, because they come through an Internet service provider, also may not be associated with an address. One reason for the number of VOIP calls is that businesses and homeowners have begun bundling phone and Internet services together. Another is that a cell phone will make a VOIP call if it is connected via Wi-Fi to a network, rather than using cellular network data.³⁴ VOIP calls pose a unique challenge to PSAPs that may not be resolved until NG911 is fully implemented.

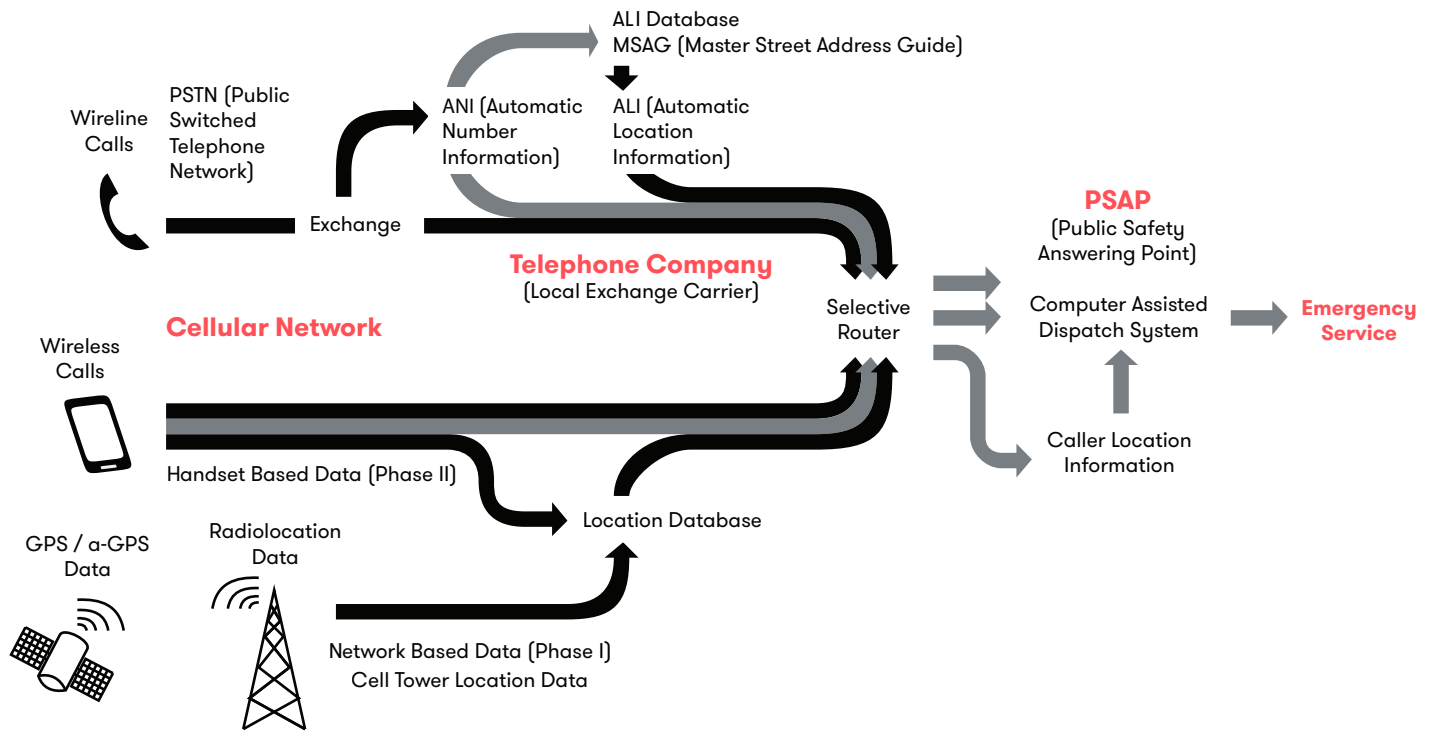
As an additional failsafe, 911 call-takers in many jurisdictions have begun asking “where is your emergency?” as their first question, rather than “what is your emergency?”³⁵ (For an overview of the 911 process, see Figure 1, below.)

Intake and processing

Assuming the caller has not abandoned the call, the call-taker will ask a series of questions dictated by the PSAP’s protocols, which—like most processes related to 911—vary from jurisdiction to jurisdiction.³⁶ These questions are designed to triage the emergency, identify appropriate services, and give the emergency service providers—whether medical, fire, or police—the information they need to respond. At this point, the call itself is often being recorded and both the information provided by the caller and the call-taker’s responses can be reviewed later by supervisors or researchers.³⁷

Figure 1

How the 911 system works: From call to response



Source: Adapted from Evan Mason, “9-1-1 System,” via Wikimedia Commons. Licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license.

The National Emergency Number Association (NENA), a professional organization for 911 providers, recommends that, at minimum, the following information should be gathered by call-takers:

- > the address or exact location of the incident;
- > a call-back number;
- > the type of emergency;
- > the time of occurrence;
- > any known hazards; and
- > the identities of those involved and their location.³⁸

As call-takers process calls, they will either transfer them to a specialized dispatcher or perform dispatch services. This requires decision making on the part of call-takers. Do they send only medical services to an accident? Medical and police? How many responders are required? Dispatchers

convey these decisions to responders not only verbally but also by entering a series of priority and descriptive codes into their CAD system that tell responders how quickly to respond and what response is desirable. For example, Houston, Texas, has 10 priority codes for police calls, ranging from “E” (an emergency response with sirens and lights) through priorities “One” down to “Nine” (a delayed call-back).³⁹ Often, one piece of information can change the priority level of a call: the presence of a knife might make the difference between a Priority Two and a Priority Three call.⁴⁰

The response

Because there is no standardized protocol for police call-taking, the information gleaned during the call may not align with the categories provided for in dispatchers’ CAD systems. And it may not be optimized to give responders the information they need before arriving at the emergency. A handful of codes is likely insufficient to cover all eventualities—and, in some departments, the “other” code is the most-used description of the emergency.⁴¹ (The “other” code, designed as a catchall for situations not already designated in a CAD system, enables call-takers to fill in their own descriptions.) And the nature of emergencies is to evolve: by the time responders arrive, a burglary may no longer be in process, a drug deal may be over or, if the delay between call and response is long enough, the caller may have left the location.⁴²

Because of these circumstances, the 911 data collected by local jurisdictions does not terminate at the time of dispatch. In fact, one of the most common metrics used to assess police performance is response time.⁴³ Police departments also collect data on the responding officers’ assessment of the emergency and may compare that to the call-taker’s initial assessment.⁴⁴

911 call-takers: Their training, role, and well-being*

911 call-takers perform a critical function in emergency response. In some PSAPs, the call-taker serves both the interrogatory and dispatch functions, liaising directly with police, medical, or fire resources. In others, the call-taker routes the caller's information to a separate dispatcher through the CAD system, and that dispatcher then sends appropriate personnel to the location. During this transfer of information, the call-taker either terminates the call—by instructing the caller to await field response—or, depending on the circumstances related to the event, remains on the call with the caller. Whether the call-taker is also the dispatcher or not, their role in assessing the emergency and ensuring that the right resources are directed to it shapes the entire interaction.

Because they are the first point of contact for callers, call-takers have a unique opportunity not only to provide the resources callers ask for, but the ones they actually need. For example, they may be important team members of diversion programs that help keep people out of the justice system.^a They may assist in building a record that can supplement law enforcement's ability to identify and document escalating intimate partner violence.^b And, with appropriate training, they can even help to interrogate caller motives and determine the best response to emergency and nonemergency calls.^c

But call-takers are vulnerable to the same perils of decentralization as the PSAPs they work in: the fragmented, jurisdictional nature of their work means that standardization, support, and even training vary by locality.^d The International Academies of Emergency Dispatch (IAED) is a nonprofit organization that provides certifications for a variety of dispatch roles.^e The Association of Public-Safety Communications Officials (APCO) also provides professional development, technical assistance, and best practices for members of the emergency dispatch community.^f Their “Minimum Training Standards for Public Safety Telecommunicators” guidelines outline the optimal standards that all telecommunicators should meet,

including knowledge of receiving, processing, transmitting, and conveying public safety information to key personnel.^g But these are opt-in standards, not a central mandate, and it is unclear how many—if any—jurisdictions mandate this type of training for their call-takers.

In recent years, call-takers have come under scrutiny as the first point of contact in a disturbing pattern of calls: callers who misuse police resources to pursue personal—often racially motivated—agendas. Social media—and news media—have made it impossible to ignore the fact that people are calling 911 to report people of color doing innocuous things like having a barbecue, waiting for a friend in Starbucks, taking a college tour, or even napping.^h Sometimes very little happens; but other times—as in the cases of Tamir Rice or Gregory Hill—the results of the call are tragic, with far-reaching consequences for communities.ⁱ Caller expectations, PSAP trainings and protocols that overly emphasize customer service, and risk aversion may encourage call-takers to request and dispatchers to send police for most calls, however innocuous the situation may seem.^j But improved call-taker training and clearer protocols for handling potentially problematic calls—by, for example, encouraging callers to articulate their underlying suspicions—as well as public awareness campaigns to redefine expectations between callers and call-takers could help preserve both scarce police resources and community well-being.

Being a 911 call-taker has a significant impact on a person's wellness. One 1997 study found that they are emergency workers—no less than responders who are physically at the scene—for purposes of assessing the impact of disaster on their lives.^k Their proximity to trauma can lead them to experience secondary trauma: a 2017 study found that 31 percent of call-takers experience post-traumatic stress disorder (PTSD) as compared to 8.3 percent of police and 3.5 percent of the general population.^l The job can be physically taxing as well. One 2015 study found that 911 call-takers are at increased risk of voice stress disorders, with nearly a third of call-takers reporting at least some symptoms of disorder.^m

* Box notes at end of report.

Challenges for researchers

A review of the existing literature on 911 and policing requires first a discussion of the challenges associated with and limitations of the data needed to conduct such research. In order to analyze 911, researchers need data from the nation's many 911 systems. But, because 911 systems and PSAPs are locally operated and monitored, it is not always easy to compare “apples to apples” when talking about data. Different PSAPs use different protocols, codes, and formats for recording and storing data, which presents challenges to researchers who want to look beyond the limits of a single jurisdictional boundary.⁴⁵

Both CAD systems and modern phone systems (especially NG911 systems) by their very nature collect and log tremendous amounts of data.⁴⁶ This data—from call time and duration to call type codes entered into dispatch logs—is available, and police departments across the nation are using it to develop police officer performance metrics, agency policies, and emergency response practices. But, except in a few instances, this data is not aggregated so that it can be compared in a meaningful way across jurisdictions to allow for broader policy development and national standardization.⁴⁷

Part of the problem is likely technical: different CAD systems may have different categories for call logging, or may store information in different formats. No nationwide analysis has examined the categories under which calls are logged, nor has there been any national-level attempt to standardize the categories, so individual departments are likely to be using lists developed locally. Greater uniformity in category identifiers would allow for more accurate cross-jurisdictional comparisons as well as national-level analyses.

Other problems are more likely political: no central authority or database exists where this data can be analyzed on a national level. NENA simply aggregates 911 call volume as a whole, without disaggregating it into police, EMS, and fire calls for service, or even separating out nonemergency calls.

In the absence of centralized data collection, individual departments are using the data they have, but they may be using it in inefficient ways, such as focusing on overall response times rather than disaggregating

emergency and nonemergency response times. Several studies have shown how this data can be used more efficiently to develop predictive policing models that increase efficiency and safety.⁴⁸

Finding a unifying metric for assessing police emergency performance is also a significant challenge. Historically, researchers have turned to broad and oversimplified metrics like total call volume and overall response time to study police emergency performance. As computing capacity has improved, better data gathering and processing abilities have given researchers new advantages in comparing and manipulating information, but in other, perhaps critical, ways, they are still stymied by the lack of uniformity among jurisdictions.

The most commonly collected data about 911 calls tends to be broad—like the number of calls for service as an aggregate for fire, medical, and police—and produced voluntarily by PSAPs and local jurisdictions.

The most commonly collected data about 911 calls tends to be broad—like the number of calls for service as an aggregate for fire, medical, and police—and produced voluntarily by PSAPs and local jurisdictions. It is also incomplete. For example, according to NENA, about 240 million calls for service are made annually.⁴⁹ However, the data sources and research used to inform this estimate are not publicly available, and this number may well be conservative.⁵⁰ And, because NENA does not distinguish its national data by call type, it is difficult to know how many of the nation's 911 calls each year reach police departments, as opposed to emergency medical services or fire departments.⁵¹ It's also impossible to tell how many calls go unanswered.

The U.S. Department of Justice (DOJ) launched the Law Enforcement Information Sharing Program (LEISP), which aims to allow information to be shared routinely across jurisdictional boundaries—but again, participation is voluntary.⁵² Still, this program has the potential to improve access to and manipulation of data to allow researchers to develop studies with broader application. The Police Data Initiative, a policing “community of practice” that includes police agencies, researchers, and technologists, provides a platform for police agencies to upload a variety of datasets—including calls for service—to promote research and transparency.⁵³ The initiative has made it possible for users to view some level of 911 call data from 31 police agencies.⁵⁴ Although these datasets provide previously unavailable information, they can be unwieldy for people who are not familiar with manipulating or downloading large datasets or analyzing statistical tables. And, with only 31 of 18,000 U.S. policing agencies reporting data, the ultimate statistical validity of assumptions drawn from that data may be of concern.⁵⁵

But information-sharing on this level is still relatively new, and many 911 systems—especially those with only limited E911 functionality—do not support it. In the absence of shareable, uniformly identified data, researchers have fallen back on the broad categories of call volume, response time, and—at a local level—call location. Although useful information can be gleaned from this data, it is not always—or even often—focused on effective police response.

Findings from the literature

Vera researchers viewed studies of the 911 system and selected 35 of them for inclusion in this report. Researchers began by sorting the body of literature into broad categories depending on whether studies were focused on dispatch, medical, police, or fire response. Studies primarily focused on medical and fire response were excluded from analysis. Of the studies focused on dispatch, Vera researchers retained those that studied the mechanics of and training surrounding call-taking and dispatch. An additional body of literature focused on call-taker stress and well-being is discussed in “911 call-takers: Their training, role, and well-being” on page 10.

The remaining studies fell roughly into two types:

- › studies using simplified, easily comparable metrics like call volume, call type, and response time; and
- › studies incorporating more granular data like call subtypes, locations within a city, and neighborhood characteristics. Of this second category, a smaller subcategory of studies analyzed 911 data theoretically to determine what data is gathered and what can be done with that information to improve police response and efficiency more generally.

Studies analyzing broad 911 metrics

Call volume

According to the National 911 Program, an organization that produces annual reports on the progress of NG911 implementation, 38 states and U.S. territories reported their overall call volume data for 2017, which can be seen in Figure 2 below.⁵⁶ Since it was first published in 2012, the number of states reporting their data has almost doubled, potentially signifying a growing recognition of the value of national-level aggregation of calls for service data, reporting, and standardization.⁵⁷

Figure 2

2017 911 call volume by jurisdiction

Jurisdiction	Call volume	Population	Call rate ¹	Jurisdiction	Call volume	Population	Call rate ¹
AK	447,451	739,795	60	MP²	4,215	55,144	76
AZ	4,299,711	7,016,270	61	NC	757,065	10,273,419	74
CA	25,727,909	39,536,653	65	ND	245,561	755,393	33
CO	6,152,554	5,607,154	110	NE	1,152,512	1,920,076	60
CT	2,198,755	3,588,184	61	NJ	8,100,000	9,005,644	90
DC	1,407,012	693,972	202	NM	1,315,194	2,088,070	63
FL	22,208,165	20,984,400	106	NY	23,048,141	19,849,399	116
HI	1,402,800	1,427,538	98	OH	7,798,078	11,658,609	67
IA	1,119,306	3,145,711	35	OR	1,813,503	4,142,776	44
IL	10,346,413	12,802,023	81	PA	9,536,270	12,805,537	74
IN	5,037,955	6,666,818	76	PR³	2,320,804	3,663,131	63
KS	2,095,193	2,913,123	72	SD	307,866	869,666	35
KY	3,468,994	4,454,189	78	TX	27,247,770	28,304,596	96
LA	4,176,460	4,684,333	89	UT	1,022,955	3,101,833	33
MA	3,691,748	6,859,819	54	VA	4,470,764	8,470,020	53
MD	5,005,403	6,052,177	82	VI⁴	331,692	104,901	316
ME	559,632	1,335,907	42	VT	203,142	623,657	33
MI	6,357,656	9,962,311	64	WA	6,706,648	7,405,743	91
MN	2,883,120	5,576,606	52	WY	248,222	579,315	43
Total	204,880,732	240,341,478	85				

¹ Call rates are per 100 people² Northern Mariana Islands³ Puerto Rico⁴ United States Virgin IslandsSource: State call volume data comes from National 911 Program, 2017 Progress Report, 2017, 19. Population data for each state comes from U.S. Census Bureau, "Quick Facts," <https://perma.cc/6HL9-CYEC>.

State methodology for collecting call volumes is unknown, and calls are not disaggregated by type, so researchers cannot use this data to review how many police calls for service are made in a given state. Nor can they determine how call volumes are distributed between, for example, urban and rural areas or night and day. Without access to this type of data, important questions remain about states like Colorado, where in 2017 nearly 11 calls for service were made for every 10 residents. Other states with high call volumes, such as New York, have populations substantially affected by tourism and commuter traffic: New York City has approximately 8.6 million residents, but in 2018, 65 million tourists visited, and its population fluctuates substantially throughout the day because of workforce commuters.⁵⁸ Data about what time of day calls are made and whether they are made from business or personal phones could help establish whether local residents or commuters are driving call traffic and allow the New York City Police Department (NYPD) to allocate resources accordingly.

Examining call volume, with additional data for location and time, can yield useful predictive information about when PSAPs are likely to be overburdened and how to plan for unexpected volumes as well as predictable ones. But as yet, this data has been sparsely examined by researchers and only at very local levels.

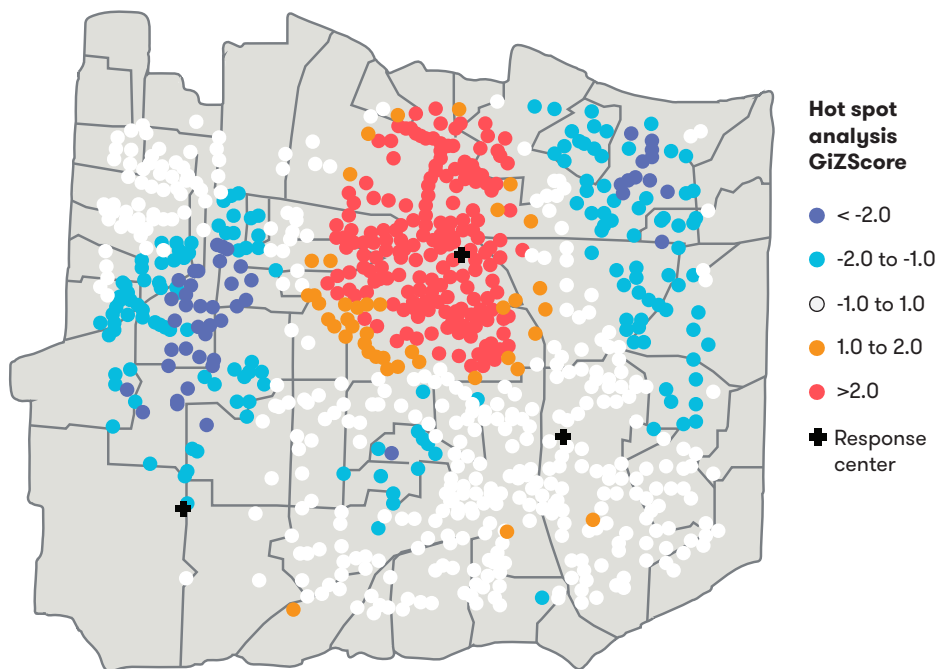
- › Researchers in 2015 examined NYPD's 911 call volumes by time and location to help determine which communities or populations are driving call volume and to predict future call patterns to increase policing efficiency.⁵⁹ Using the model they developed, they were able to successfully “forecast” the heaviest concentrations of 911 calls on days with predictably high call volume such as the Fourth of July.⁶⁰

- › Researchers analyzed 2,000 calls made to 911 between January 1 and May 31, 1998, in the Portland, Oregon, metro area to determine where “hot spots”—areas of concentration—of call volume occurred and what factors influenced high call volumes.⁶¹ Figure 3 on page 17 provides a visual representation of the final hot spot analysis, where clusters of red dots represent areas with high call volumes (hot spots), and clusters of blue dots represent areas with relatively lower call volumes (cold spots). Equipped with this information, the researchers used regression analyses to investigate what factors influenced 911

call volumes for the city and found that neighborhood characteristics such as the number of people renting, the presence of businesses, the number of available jobs, the number of college graduates and those not in the labor force, and the proximity to an urban center all significantly predicted an area's call volume.⁶² Businesses, job availability, people out of the labor force, and percentage of rentals all correlated to an increase in call volume; college graduates tended to correlate to a decrease in call volume.⁶³ However, the researchers cautioned that with only five months of data collected from a small geographic area, they were unable to state definitively that those correlations would hold true over time even for the city studied.⁶⁴

Figure 3

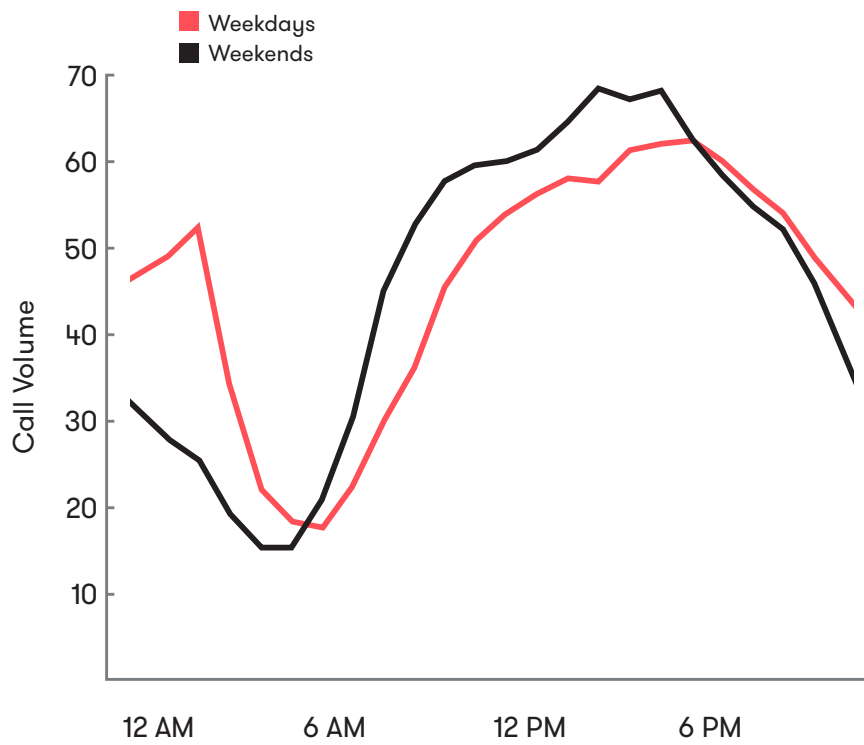
911 hot spots and cold spots, Portland, Oregon, January 1–May 31, 1998



Source: Adapted from Dan Cramer, Albert Arthur Brown, and Gongzhu Hu, "Predicting 911 Calls Using Spatial Analysis" [paper presented at the 9th International Conference on Software Engineering Research, Management and Applications, SERA 2011, Baltimore, MD, August 10-12, 2011], 8 (used with permission).

Figure 4

Average hourly call volume for San Francisco Emergency Communications Center PSAP, September 1, 2004–August 31, 2006



Source: Adapted from Hector Jasso, Tony Fountain, Chaitan Baru et al., *Prediction of 9-1-1 Call Volumes for Emergency Event Detection* [paper presented at the 8th Annual International Digital Government Research Conference, Philadelphia, PA, May 20-23, 2007], fig. 3 [used with permission], <https://perma.cc/JY4K-RY63>.

- › In 2007, researchers examined whether the data California uses to make staff allocation decisions for PSAPs could also be used to understand call trends and help emergency service providers respond to large-scale emergencies.⁶⁵ To do this, they analyzed data from emergency calls made between September 1, 2004, and August 31, 2006, in San Francisco.⁶⁶ The model they generated revealed that the volume of calls for service follows a cyclic pattern, which can be seen in Figure 4 on page 18. The researchers also closely examined trends that surfaced in response to two medium-to-large scale events (a fire and a hit-and-run incident in which a driver in an SUV struck 19 pedestrians across 20 blocks) to investigate whether the prediction model would still be effective at detecting unusually high call volumes that resulted from larger emergency incidents.⁶⁷ The study found that it was.

Similar studies in other jurisdictions could help unpack not merely how many calls are being made, but who is calling 911.

Call type

To understand 911 calls, it is important to know who is calling and what they need. But the local nature of 911 and its PSAPs presents special challenges for researchers attempting to analyze calls by type. Police calls for service must be separated from all other emergency calls. Then police calls for service must be broken down by priority, type of incident, and final assessment/disposition. But different jurisdictions categorize their police calls in different ways, making it difficult to compare call types across jurisdictions. Another issue is the evolving nature of emergencies: a call-taker may enter one call type code in the CAD system, but once officers respond to the call, they may discover that the emergency was of a different nature. For example, a call-taker may enter “burglary,” but when the officer arrives on the scene, he or she may learn that there is actually a raccoon in the caller’s attic. Or a “mugging” may turn out to be a drug deal gone wrong when the customer refused to pay.⁶⁸ Without call type data, however, it is even more difficult to analyze where police resources are being used and where they could be replaced entirely or bolstered by community resources.⁶⁹

- › A 1989 study of 265 randomly recorded phone calls over a 24-hour period delved into how call-taker behavior in police-related emergencies influences how the event is constructed before the call is even dispatched.⁷⁰ The researcher also performed 36 hours of participant observation and found that the type of questions asked by call-takers and their interactions with the callers went beyond information-gathering to serve an interpretive function and help callers construct a narrative of the event that made organizational sense.⁷¹
- › A 2004 study surveyed 420 U.S. police departments on their CAD system practices, including whether the departments used CAD data to analyze department activities.⁷² Eighty-eight percent of the agencies reported using CAD incident data recorded by the dispatcher for analysis, whereas 65 percent used the responding officers’ final assessment, highlighting the potential differences in

each type of data source.⁷³ The researchers also noted that the list of call types that communications centers employ may not be sufficient to describe issues that fall under community policing, citing the example of the “other” call category, which is the largest call volume for some departments.⁷⁴

Knowing that specific types of calls can follow predictable patterns has value for police and public safety communications agencies interested in determining where—and when—to allocate appropriate and limited resources.

- › A 2007 study of the Baltimore Police Department’s calls for service over the course of the year 2000—approximately 113,000 dispatched calls—found that officers made significant assumptions about the legitimacy of 911 calls based on the sparse information provided by dispatchers, and that those assumptions often affected their responses.⁷⁵ Officers who perceived calls as legitimate were more likely to make response a priority—in fact, perceived legitimacy (whether police could provide a service that would be meaningful) was a greater influence on their behavior than what type of service was needed.⁷⁶
- › A 2018 study compared 20,000 mental health-related calls for service to 20,000 domestic violence-related calls for service in Surrey, British Columbia, and found that mental health-related calls for service occurred most often on weekdays (particularly Mondays), whereas calls for service related to domestic violence peaked on

weekends (especially Sundays).⁷⁷ Although these results may not be generalizable to other jurisdictions, knowing that specific types of calls can follow predictable patterns has value for police and public safety communications agencies interested in determining where—and when—to allocate appropriate and limited resources.

- › A 2019 study of 514 calls to an anonymized call center in the United Kingdom found that the first substantive question asked by a call-taker carried “a diagnosis of the merits of the caller’s case and an implication of the call’s likely outcome.”⁷⁸ The researchers were able to divide these substantive questions into four categories: “On a gradient of increasing scepticism, these are requests for the caller’s location (which are treated as indicating that police action will be taken); open-ended requests for further information (treated as neutral); and queries of the relevance of the incident or legitimacy of the caller, and reformulations of the caller’s reason for calling (both projecting upcoming refusal of police action).”⁷⁹

Response time

Response time—the time between the call coming in and responders arriving at the scene—is one of the easiest metrics to review and compare either within a single jurisdiction or between jurisdictions. Response time in medical emergencies is critical: a 2002 study, for example, found that mortality rates in medical emergencies rose sharply beyond a response time of five minutes.⁸⁰ The value of response time in policing presents a more nuanced question.

Does response time affect case closure?

There are calls when response time would seem obviously critical: if a crime is ongoing at the time of the call, responding officers may have an opportunity to stop it. But, in the aggregate, response time appears to have little statistical relationship to the probability of making an arrest or even to closing the case.

- › As early as 1976, researchers in Kansas City, Missouri, reviewed 1,106 response time surveys collected over a four-month period in

the South Patrol District in 1973 and found that response time is barely, if at all, related to likelihood of positive case outcomes such as case clearance or property recovery.⁸¹ They did, however, find a positive correlation between civilian perceptions of policing quality and short response times.⁸²

- > A 1980 study conducted in York, Pennsylvania, sampling approximately 31,000 calls for service in 1976, also found that the relationship between response time and clearance rate was tenuous, although researchers cautioned that the study should be repeated with more data and better information about which crimes were reported and cleared.⁸³ They expressed concern that breaking the jurisdiction's 38 call classifications for police service into three broad categories had oversimplified the study's results.⁸⁴
- > A 1984 DOJ study sampling 3,332 cases from call through completion between April 1979 and January 1980 from four jurisdictions—Peoria, Illinois; Rochester, New York; Jacksonville, Florida; and San Diego, California—confirmed the findings of the Kansas City study and advanced the hypothesis that the negligible difference in outcome was because in many cases crimes are not reported until they are over.⁸⁵ The researchers also found a correlation between the type of crime and whether police response time had a statistically significant impact on likelihood of arrest and noted that, in most cases, it did not.⁸⁶ Ultimately, the researchers concluded that chances of arrest were most influenced by civilian response time from incident to call, not police response time to a call for service.⁸⁷
- > A 1998 project discussed the potential for research made possible by the advent of CompStat, a tracking model for policing statistics developed in the 1990s by the NYPD.⁸⁸ The author suggested that the rich data available in a CompStat system could lend itself to the development of evidence-based policing procedures, using response time as one example. He proposed that rather than focusing solely on response time, police departments could be tracking call outcomes and repeat calls to see if the first response was effective.⁸⁹

- › A 2007 study of Baltimore's Eastern District, analyzing approximately 113,000 calls made in 2000, affirmed again that response time has a minimal effect on the likelihood of arrest.⁹⁰ The study also examined whether response time has a deterrent effect on crime and concluded that it did not.⁹¹

Recent research has reexamined the link between response time and likelihood of arrest, and the results have been more mixed.⁹² This may be partly because the newer studies had access to more data—that is, rather than simply reviewing response time, category of crime, and whether an arrest was made, the researchers could readily add data points like where the call was coming from to match neighborhood characteristics and see if there were more factors at play in achieving a particular outcome than just response time.⁹³ Being able to study neighborhood characteristics to see how they affect response time may finally yield an answer to whether—and under what circumstances—response time matters for police.

What factors affect response time?

With richer pools of data to draw from, researchers can now study not only how fast police respond to calls for service, but what factors may be affecting their speed.

- › Studies in the United Kingdom in 2001 and 2005 suggested that faster response times by two-officer vehicle patrols increased the likelihood of making an arrest for in-progress burglaries.⁹⁴ However, the authors declined to extend their research to conditions in the United States, noting the significantly different challenges of policing in a U.S. jurisdiction. Another United Kingdom study in 2017 found that in Manchester, improving response time by 10 percent led to a 4.7 percent greater chance that a case would be “cleared,” or resolved with an arrest.⁹⁵ Faster response time was correlated with a larger increase in the chance of arrest in cases involving theft and a smaller increase in cases involving violent crime.⁹⁶
- › A 2012 study in Houston analyzing 5,290 in-progress burglary calls for service in 2007 found correlation between response time

and likelihood of arrest.⁹⁷ The study also examined neighborhood characteristics, finding police calls for service had faster response times in disadvantaged neighborhoods than in more affluent ones, as determined by census tract data.⁹⁸

- › A 2014 follow-up study comparing 5,898 in-progress burglary calls for service in Houston and 7,746 in Dallas in 2006 found that concentrated disadvantage, immigrant concentration, and residential stability were important predictors of the distribution of police response time patterns for in-progress burglary calls in both cities, although the results were not consistent for the two locales.⁹⁹ For example, police response was slower to neighborhoods with more concentrated disadvantage in Dallas and faster in Houston.¹⁰⁰ In both cities, however, response time was faster for neighborhoods with more immigrants and less stability.¹⁰¹
- › A 2017 study in Houston of 10,000 cases from September 2010 to August 2013 explored the factors that affect response time for a different narrow category of calls: intimate partner violence.¹⁰² They found that the race of the caller, whether a weapon was involved, and the day and time of incidents were all significantly correlated with response time—predictably, in the case of a weapon, which raised the priority code of the call.¹⁰³ Latino callers experienced the fastest response times.¹⁰⁴ At a neighborhood level, concentrated disadvantage, immigrant concentration, and residential instability were also significantly associated with faster response times.¹⁰⁵

How can police behavior be altered to improve response time?

By using demographic data, researchers have also attempted to model police behavior that will reduce or optimize response time in police calls for service.

- › A 2007 study in Manchester, United Kingdom, modeled how call congestion and increased demands on policing resources affected response time and made suggestions for reaching an “optimal” number of alarms per officer per shift to increase productivity.¹⁰⁶ Treating alarms as a “disruption” in normal service patterns, they developed a system using the officer’s experience and location to predict how

long an alarm call would take, and the likelihood that a given alarm would be “false.”¹⁰⁷

- › A 1982 study of an unnamed “large city” in the United States explored how routinely collected data could be used to monitor and improve patrol response functions.¹⁰⁸ The study focused not on collecting additional data, but how the data already in the system could inform researchers about delay factors.¹⁰⁹ The study was designed to demonstrate how individual departments could structure their own studies, rather than to return a specific result.
- › In 2018, a researcher at Stanford compared data from 40 jurisdictions’ CAD systems to derive a “Maximum Covering Model,” which would determine the optimal place for stations and vehicle patrol routes in a jurisdiction to improve response time.¹¹⁰ However, the researcher found that decreasing response time for one priority type of call produced a concurrent increase in response time for other priorities.¹¹¹

How does response time affect community relations?

Regardless of the effect of response time on crime or arrest, it is clear that response time has a significant impact on people’s satisfaction with police.

- › The same 1976 study of Kansas City 911 call outcomes that found a weak correlation between response time and outcomes found a strong correlation between response time and civilian satisfaction.¹¹²
- › A 1984 study attempted to link objective and subjective measures of performance to help police determine which objectively measurable markers they could use to set policing goals.¹¹³ The researcher reviewed survey data from Los Angeles, California, and Tuscaloosa, Alabama, regarding both objective (empirical measures like response time) and subjective (civilian satisfaction) performance rankings.¹¹⁴ Although inconclusive, the study noted that response time was conceptually linked to subjective measures of performance.¹¹⁵

- › A 1999 study sampling a primarily black population found a strong relationship between respondents' evaluation of response time and their positive evaluation of overall police performance.¹¹⁶ The researchers used survey data from 338 people in Charlotte, North Carolina, and noted that their results were significantly different from previous surveys sampling primarily white populations—suggesting that similar surveys might not contain findings that should be extended beyond the surveyed communities.¹¹⁷ They collected data about age, gender, neighborhood, education, income, and employment status to examine the survey results in more depth and found that, for example, higher levels of educational attainment in the community studied correlated with more positive civilian perceptions of police, whereas in previous, white-focused studies it had a negative correlation.¹¹⁸
- › A 2003 study of police and fire department management strategies in 50 U.S. localities, however, found little link between the measures commonly used to establish performance on an administrative level, such as number of arrests, and civilian satisfaction.¹¹⁹ The researcher noted, however, that she had experienced significant difficulty in developing a sampling strategy because the inconsistent descriptions for measures across the locations studied resulted in so many missing values and variables.¹²⁰

Studies analyzing more granular 911 datasets

A number of studies suggest not only what data could be collected and used to inform policing practice, but how to better use the data already automatically collected. As early as 1987, researchers recognized the improved data collection capabilities of E911 and envisioned how this data could shape police response to emergencies.¹²¹ Although computers at the time were limited in their ability to manipulate large datasets or develop predictive models, many of the researchers' ideas have since been explored. Police are already using this data on a local level to inform administrative decisions and monitor departmental practices and their effects.¹²² (See

“Using 911 data: Examples from the field” on page 30.) Although in the past researchers might have to make a Freedom of Information Act request to obtain this data, some jurisdictions are making their data public and accessible on the Internet. For example, New Orleans has released calls for service data on its own initiative.¹²³ This database and others like it can help realize the vision that researchers have had for decades: the ability to predict demand for police resources so well that the right responders can be where they are needed at the right time.

- › In 2001, researchers focused on how police could identify and turn their attention to “hot spots” in order to perform their duties more efficiently, re-evaluating data from nine selected studies of Houston, Jersey City, Kansas City, Minneapolis, St. Louis, and Beenleigh (Queensland, Australia).¹²⁴ In this evaluation, 911 calls for service data was an important part of locating hot spots.

A number of studies suggest not only what data could be collected and used to inform policing practice, but how to better use the data already automatically collected.

- › A 2002 study reviewed the universe of rich basic data collected by U.S. CAD systems and discussed its utility in policing.¹²⁵ Researchers noted that the largest call volume for many jurisdictions was simply coded “other” and described the greatest weaknesses of CAD systems as their insufficient categorization system and dependence on caller—rather than call-taker or responder—assessment for description.¹²⁶ In fact, the study found that “less than 20 percent of the citizen calls in a CAD system are

for serious crime incidents—the rest are for incidents that affect the callers' quality of life to such an extent that they believe police intervention is necessary."¹²⁷

- > A 2005 DOJ report discussing the advantages of managing civilian calls and expectations when duties are shared between 911 and 311 (nonemergency) systems discussed how patterns of calls could be used not only to proactively police, but also to alter how policing resources are distributed.¹²⁸ The report focused on Baltimore, Maryland's 311 implementation, and noted that capturing more data about how each line is used could help other departments successfully implement nonemergency lines to ease the burden on PSAPs.¹²⁹ (See "Emerging alternatives to 911" on page 33.)
- > Another 2005 study explored how gathering data from call through outcome—rather than stopping at response—could inform call-taker training for types of calls such as those related to intimate partner violence.¹³⁰ The study found, among other things, that only half of departments required specialized training for call-takers and dispatchers regarding intimate partner violence.¹³¹ More study is needed, and the researchers called for additional data collection as well as for the development of model policies that could then be studied to determine their effectiveness.¹³²
- > A 2006 study of 448 Seattle women who had been victimized by a male intimate partner investigated how data being gathered about calls related to intimate partner violence could be used to inform police about the callers themselves.¹³³ The study delved into commonalities between frequent callers and mapped different call patterns to severity of violence.¹³⁴ Researchers found that women were more likely to call police repeatedly if they had children, experienced severe violence, or were injured by their partner.¹³⁵
- > The 2011 study of Portland, Oregon, that analyzed hot spots demonstrated that it is possible to use this data not only to put policing resources where they are needed, but also to add call center capacity during times of predictably high call volumes.¹³⁶

- > In 2014, researchers analyzed a year of CAD data for the Lorain, Ohio, police department including calls for service type and call location in order to develop an optimized districting system for police resources.¹³⁷
- > In 2015, researchers used 911 data to examine the “broken windows” theory, which posits that order-maintenance policing is the best deterrent of crime.¹³⁸ The study used location data from more than 200,000 911 calls for service made in Boston, Massachusetts, and found that private conflict was more highly correlated with crime than was public disorder.¹³⁹
- > Also in 2015, researchers reviewed New York City police calls for service data to detect patterns in call type and to determine how to remove “noise” from data samples.¹⁴⁰ Although the researchers were unable to develop conclusions from the dataset they had, they established procedures for data manipulation and have planned future studies to incorporate richer datasets and add factors like weather and humidity.
- > A 2015 study of Baltimore dispatch data found that this data could also be used to inform proactive policing strategies, assess efficiency, and improve directives from line supervisors.¹⁴¹ The researchers suggested that, for example, rather than waiting for 911 calls to come in and then traveling to the location of the call, police could use call patterns to predict when and where calls were likely to come from, and then be in those vicinities—decreasing response time.
- > A 2015 study of San Francisco’s CAD data from May 2011 through February 2015 highlighted additional data challenges experienced by researchers after the deployment of a new CAD system in 2014.¹⁴² The new and old systems did not use exactly the same codes, and analysts had to find a way to compare similar but nonmatching data fields.¹⁴³ However, researchers were able to readily identify not only the top 20 incident codes for police calls in a given year, but also to demonstrate that the system’s two “other” codes made up more than 30 percent of logged calls (the next most common code, a dispute without weapons, made up only 6 percent of calls).¹⁴⁴ The study recommended adding

additional functions to the CAD system to more efficiently deal with duplicate calls, dropped calls, and accidental calls in the face of increasing call volume to the city's PSAPs.¹⁴⁵

- › A 2018 study that mapped different types of calls to day and time in Surrey, British Columbia, found that these calls followed predictable patterns within the jurisdiction studied.¹⁴⁶ However, because of the decentralized nature of 911 data, it was not possible to compare those patterns to other jurisdictions within the scope of the study.

Using 911 data: Examples from the field*

Because 911 data is not uniformly collected, it is difficult to compare jurisdictions except on very broad levels such as response time or call volume. There are no multicity studies analyzing calls from intake to outcome to develop training or systems that would establish not only how well police are doing their job, but also whether police response is necessary at all.^a By collecting data from intake through outcome on each 911 call and comparing this information across jurisdictions, it is likely that patterns will develop that can help shape every aspect of emergency response from call-taker training through dispatching the right team through ensuring community safety and health.

Some departments are already doing this work. In 2007, the Houston police department responded to 15,122 calls for mental health issues; by 2014, the number had more than doubled to 37,032 calls.^b Identifying this surge in *call type*, rather than merely treating it as an increase in *overall volume*, resulted in the 9-1-1 Crisis Call Diversion (CCD) program, by which dispatchers identify and refer qualifying nonemergency mental health-related calls for immediate connection to a phone counselor.^c Implementation of the CCD has resulted in hundreds of thousands of dollars in cost savings as well as the promotion of more appropriate mental-

health—rather than criminal justice—responses to crisis situations.^d In 2017 alone, CCD counselors handled 7,264 calls for service, resulting in 2,151 diversions away from responses by patrol officers.^e

Other jurisdictions have been able to use data about specific call types or patterns to implement alternate programs for people in crisis. In this regard, police can follow the examples of medical and fire personnel in establishing community partnerships that ease the burden on scarce resources. In Washington, DC, where one in four calls received is not a public safety emergency, a triage program has helped reduce the use of 911 resources.^f Triage nurses sit alongside 911 dispatchers and can set up medical appointments and arrange rides for callers if they deem the situation to be nonemergency (e.g., sprained ankles or coughs).^g Another program was created by the Baltimore City Fire Department to connect repeat callers with nurses and case managers.^h The program was developed after the department realized that the majority of calls for service were coming from people who didn't need the fire department, but who were instead calling with questions about issues such as medical and food insecurity problems or insurance.ⁱ

* Box notes at end of report.

New options within police departments

Some calls for service, even though they are not emergencies, genuinely do require a response from police—either for documentation (e.g., traffic accidents) or community relations purposes. But these calls can strain PSAPs and police departments and do not require immediate response by sworn personnel. Some police departments have already established methods to promote efficiencies in police response by creating alternative ways for community members to report issues when sworn personnel are not (or are not immediately) necessary.

The Tucson Police Department (TPD) has pioneered initiatives to expand its menu of alternative responses for dealing with large calls for service volumes.¹⁴⁷ Some of these alternatives include:

- › using nonsworn personnel to handle calls for service for incidents such as:
 - residential and commercial burglary (in cases where the victim has already checked the premises);
 - found property/evidence pick-ups;
 - shoplifting/larceny incidents where evidence is present;
 - traffic collisions involving no or minor injuries;
 - disorderly or disobedient children;
 - code enforcement/quality of life issues; and
 - traffic point control (e.g., when traffic lights are out).
- › encouraging community members to report a variety of lower-level crimes through the department's [Internet reporting tool](#);
- › establishing a Collision Reporting Center, where individuals involved in a minor crash can avoid waiting at the scene and report property damage accidents with TPD and their insurance companies;
- › encouraging community members to come to TPD stations to file reports and ask crime-related questions and extending front desk service until 10:00 p.m. seven days a week;
- › utilizing nonsworn Community Service Officers to respond to a plethora of nonurgent calls (e.g., blocked driveways or runaway juveniles);

- › establishing an appointment-based response for calls for which it is mutually convenient for police to respond at a later, less busy time;¹⁴⁸
- › eliminating certain calls for service by transferring them to more appropriate services or simply not generating a call for service, including:
 - barking dogs (redirected to animal control);
 - loose livestock (redirected to Tucson's livestock board);
 - stalled vehicles (no call for service generated if vehicle is not a hazard or blocking traffic);
 - lost electronic devices (if the device is lost and the owner locates it via GPS, no call for service is generated);
 - establishing a Theft Reduction Apprehension Program where the police department trains store loss prevention personnel to process shoplifters, complete forms, and write a trespass letter and direct the person found shoplifting to respond to the substation to receive a citation (no call for service generated); and
 - status offenses (police personnel do not intervene in any juvenile status offenses other than runaway incidents or underage drinking).

Similarly, Camden County Police Department (CCPD) (New Jersey) has implemented a variety of departmental changes to effectively deal with large volumes of calls for service. For instance, the department implemented a call deferral policy where communications operators instruct callers to fill out self-reporting forms at the police department for certain types of calls, including motor vehicle accidents (except accidents that involve injuries), nondrivable cars, deployed air bags, or drivers who are believed to be under the influence of drugs or alcohol, as well as calls involving reports of theft or lost/missing property.¹⁴⁹ Additionally, CCPD established an alarm verification response protocol: police units will not be dispatched to reports of alarms that have not been verified (with the exception of holdup, duress, and panic alarms).¹⁵⁰

Emerging alternatives to 911*

A significant burden on the 911 system is created by individuals seeking information or resources that fall outside the scope of crisis intervention. For these calls, two alternatives already exist: 211 and 311 information services. And crisis hotlines, a third nonemergency service, can help connect community members with the resources they need in a mental health crisis.

- **211.** The 211 service can be used to connect callers with community health and human services resources.^a A community resource specialist assists callers with identifying local services and resources (e.g., shelter and housing options, employment and education opportunities, veteran services, addiction and rehabilitation programs, various support groups, etc.).^b 211 services are available to 94 percent of the population across all 50 states and Washington, DC, and millions of people make use of them already.^c In 2017, nearly 13 million 211 calls were placed; the callers were most frequently referred to physical and mental health services, employment opportunities, homelessness prevention services, and housing assistance.^d Because of this, 211 has been regarded as a service that promotes early intervention and helps avoid the use of 911, highlighting the need to raise awareness of the service.^e
- **311.** 311 is a nonemergency public services line people can use to file complaints about issues such as noise, potholes, and graffiti, as well as obtain public information on a variety of topics.^f 311 call centers are still relatively rare compared to 911 call centers. An article

published in *Governing* in 2014 reported that just 300 U.S. municipalities had operational 311 call centers at that time (compared to the more than 6,000 PSAPs servicing 911 calls in 2017).^g Although this number has likely since increased, 311 is far from operating at a national scale. In locations where it has been adopted, however, its popularity is evident: a 2001 study of 311 implementation in Baltimore, Buffalo, Dallas, and Phoenix, showed that low-priority calls migrated to the 311 call center in significant numbers.^h

- **Crisis hotlines.** Another alternative response to calls for service—one centered on providing mental health crisis response in lieu of or in coordination with police, is the crisis hotline. These specialized hotlines provide services to individuals experiencing mental health issues.ⁱ Community members can use such hotlines to request help for themselves or others without notifying the police.^j Research demonstrates that hotline services are effective at reducing psychological distress in both suicidal and nonsuicidal callers.^k Crisis services can also coexist with enforcement responses. Some law enforcement agencies collaborate with mental health crisis facilities to link calls from mental health providers directly to dispatch.^l And, in some communities, residents have become familiar enough with the availability of crisis intervention teams that they will explicitly request them—instead of police—during 911 calls.^m

* Box notes at end of report.

Conclusion

The 911 call processing system has undergone significant growth and development since its inception: from its birth in the late 1960s, through the professionalization of the emergency communications field during the 1970s, to the development of new technology in E911 and what ultimately grew to be NG911. Nonetheless, there is a pressing need for more innovation in this space and for research exploring key features of the system, including call volume, type, and outcomes at the national, state, and local level. Analysis of calls for service data provides a huge and largely untapped opportunity for researchers and practitioners to inform and transform policy and practice. And understanding the landscape of 911 call processing at a deeper level gives stakeholders across the board the chance to develop sound alternatives beyond police responses to calls for service. To this end, further studies should be done to develop knowledge or aggregate existing data in the areas set out below.

- › **Coding and protocols.** In the absence of research into the protocols in place for 911 call-takers and dispatchers, as well as the processes by which information is gathered and communicated between and among call-takers, dispatchers, and responding officers, it is difficult to determine if current protocols are adequate and effective.
- › **Adequacy of coding.** Studies are needed to examine the nature and volume of “other” types of calls (and call types in general) to determine how call types are used to inform agencies’ decision making and practice, and whether new categories for call type should be included in CAD systems.
- › **Metrics other than response time.** Given that a substantial number of calls for service are unrelated to crimes in progress, there is a real question whether a rapid response is necessary or even effective. Researchers should explore whether slower responses where the *most appropriate* officer is dispatched (one who has the appropriate training, skills, tools, demeanor, etc.) produce more favorable

outcomes than prioritizing rapid response by the *first available* officer, which typically results in a lights and sirens response that can cause undue anxiety and adrenaline for officers and community members alike at the scene.

Analysis of calls for service data provides a huge and largely untapped opportunity for researchers and practitioners to inform and transform policy and practice.

- › **Call outcomes based on type of response.** Researchers have not examined the nature and outcomes of calls that are answered with police responses, precluding an understanding of whether police responses are the most appropriate way to deal with certain call types.
- › **Frequent caller protocols.** Although there is some research on frequent 911 callers, there is a need for more studies that go beyond the types of calls that the literature is currently limited to (researchers could, for example, look at frequent callers for nuisance complaints to determine whether there are more appropriate ways to address those types of calls). The ways in which data is—and is not—collected currently make analyses of frequent callers very difficult. Enhancing data collection capabilities in this area is key to better understanding the frequent caller population and to assessing what factors contribute to—and ultimately can prevent—future calls.
- › **Alternative response options.** Overall, despite the increase in alternative responses, there is still a need for additional innovation to both reduce calls for service and to improve the quality of responses,

as well as for studies to evaluate the prevalence and effectiveness of each of these options. Although it is a promising sign that programs exist, it is important to understand where there are opportunities for growth and expansion. The efforts in agencies such as the Tucson Police Department and Camden County Police Department are just the beginning—both agencies have partnered with Vera’s Policing Program to help expand alternatives locally and nationally by identifying gaps in research and practice. It is efforts like these that are necessary to fully understand the landscape of emergency communications with the goal of ultimately recognizing areas where there are opportunities to respond beyond applying enforcement.

911 and 911 call-takers play a vital role in U.S. law enforcement. As the United States continues to evaluate the role of its police in the community, understanding these critical components will be crucial to developing a system that best serves the nation.

Summary of research

	Authors	Date	Summary of findings
1	Bennett	2018	CAD data from 40 police departments from 2015-2016 was used to study response time. Researchers found that CAD and location data can be used to generate models of optimal coverage. However, decreasing response time in one priority category increased response time in other categories.
2	Blackstone, Buck, Hakim et al.	2007	This Manchester, UK, study modeled traffic patterns in automated alarm calls for service and response and explored ways to optimize behavior. After determining what “normal” looked like, the study treated alarms as a “disruption” and developed a model for ideal numbers of alarms per officer per shift depending on officer experience and location, including the possibility of false alarms.
3	Blake & Coupe	2001	In Manchester, UK, two-officer patrols were more successful in apprehending in-progress burglary suspects than single-officer patrols under specific circumstances because of faster response times. The study sampled 441 911 cases between July and December 1996 from an anonymized police force serving 2.6 million people.
4	Blanes i Vidal & Kirchmaier	2017	This study of the 2008–2014 internal records of the Greater Manchester Police found that for certain crimes in the UK, response time has a statistically significant effect on clearance, with a 10% faster response time leading to 4.7% increase of likelihood of clearance, overall. The effects of a faster response time were stronger for theft, less for violent crime.
5	Bonomi, Holt, Martin et al.	2006	The study explored frequent caller behavior among 448 Seattle, Washington, women who had been involved in intimate partner violence (IPV) and found that women were more likely to contact police if they experienced severe physical or psychological IPV, had injuries, or lived with children.
6	Braga	2001	This study used 911 data from nine selected studies of Houston, Jersey City, Kansas City, Minneapolis, St. Louis, and Beenleigh (Queensland, Australia) to locate “hot spots” and found that focused police actions can prevent crime and disorder in crime hot spots without necessarily resulting in crime displacement.
7	Chohlas-Wood, Merali, Reed et al.	2015	Researchers mined 911 and 311 data from 2013–2014 in New York City and disaggregated calls by type to detect patterns in types such as “noise” and “crime.” Researchers suggested that other data like weather and humidity could be included to refine results and better detect patterns.
8	Cihan, Zhang & Hoover	2012	This study of Houston 911 data for 5,290 in-progress burglary calls for service in 2007 found correlation between response time and likelihood of arrest for in-progress burglaries. The study also examined neighborhood characteristics, finding police calls for service had faster response times in disadvantaged neighborhoods than in more affluent ones, as determined by census tract data.
9	Cihan	2014	As a follow-up to the 2012 study by the same authors, this study compared 5,898 in-progress burglary calls for service in Houston and 7,746 in Dallas in 2006. Concentrated disadvantage, immigrant concentration, and residential stability were important predictors of the distribution of police response time patterns in Dallas and Houston, although not always in the same ways.

10	Coupe & Blake	2005	This study of two-officer patrols and 911 response sampled 406 911 cases between July and December 1996 from an anonymized police force serving 2.6 million people and found that quicker response times elevated the likelihood of an arrest being made in the UK, although the authors specifically declined to extend those results to U.S. policing.
11	Cramer, Brown & Hu	2011	Researchers analyzed 2,000 calls made to 911 between January 1 and May 31, 1998, in the Portland, Oregon, metro area to determine where areas of concentration of call volume occurred and compared these hotspots to neighborhood data to see what factors influenced call volumes.
12	Dankert, Driscoll & Torres	2015	Researchers analyzed CAD data from San Francisco from May 2011 to February 2015, and collected data on 475 calls by shadowing dispatchers to examine whether the city's CAD system was adequate to deal with increases in call volume. They recommended small changes to increase efficiency as well as to increase transparency into "unknown type" calls.
13	Famega, Frank & Mazerolle	2015	Researchers studied Baltimore dispatch data gathered over 1,304 hours of observation in 1999 to see how it could be used to assess efficiency and manage patrol officers' time. They concluded that analyzing call patterns and adjusting patrol routes to include predicted high call volume areas and times could increase efficiency.
14	Gardett, Clawson, Scott et al.	2016	A literature review of 149 studies of emergency dispatch research. Common topics of study were first point of contact care, professional status and consistency/protocols/training, resource allocation, and best practices for dispatch. Additional emerging topics that are ripe for study include using CAD/algorithms to determine the best response to an emergency.
15	Gilsinan	1989	This study used 265 recorded 911 calls to examine the interpretive function of call-takers in event construction before the call is dispatched and found that the types of questions asked help callers determine their narrative (and description) of the event.
16	Gonzales, Henke & Hart	2005	This DOJ report discusses the type of data gathering necessary to ensure that certain policy changes are effective in separating emergency and nonemergency policing response in the context of Baltimore, Maryland's 311 implementation.
17	Jasso, Fountain, Baru et al.	2007	Researchers developed and tested models with data from emergency calls made between September 1, 2004, and August 31, 2006, in San Francisco, then used them to predict high call volumes as a result of anomalous occurrences. "Predictions" were tested with anomalous occurrences already in the system.
18	Kansas City Police Department	1978	The Kansas City Police Department studied three years of internal records and found that overall response time was statistically unrelated to arrest probability. In addition, civilian satisfaction was more closely related to expectation and perception of response than to actual response time.
19	Kelly	2003	A study of 50 U.S. locations including both police and fire department data found that the link between objectively measurable data and subjective measures of satisfaction is tenuous at best. The researcher experienced significant difficulty in developing a sampling strategy because of inconsistencies in identifiers across the locations studied.
20	Kent & Antaki	2019	This UK study of 514 emergency calls found that the call-taker's first substantive question already carried a diagnosis of the merits of the caller's case, and an implication of the call's likely outcome.

21	Kuhn & Hoey	1987	During the implementation of E-911 in the U.S., researchers examined the ways the system could improve police response, including what data collection is possible and how the system can match demand with deployment.
22	Lee, Lee & Hoover	2017	This study focused on a narrow band of IPV calls in Houston, analyzing 10,000 cases from September 2010 to August 2013 to find factors that influence response time on a personal and neighborhood level. Researchers found that the race of the caller, whether a weapon was involved, and the day and time of incidents were all significantly correlated with response time—predictably, in the case of a weapon, which raised the priority code of the call. Latino callers experienced the fastest response times. At a neighborhood level, concentrated disadvantage, immigrant concentration, and residential instability were also significantly associated with faster response times.
23	Maxfield	1982	This paper examines how information routinely collected by urban police departments may be used to monitor the performance of the patrol response function. Data from one anonymized large city is used to examine the problem of delay in responding to civilian requests for police service.
24	McEwen, Ahn, Pendleton et al.	2002	A study combining national surveys of 420 police departments and case studies in San Diego, the District of Columbia, and Aurora, Colorado, found that CAD systems collect rich basic data that can and should be used to support community policing, and that less than 20 percent of the civilian calls in a CAD system are for serious crime incidents. The rest are for incidents that affect callers’ quality of life to such an extent that they believe police intervention is necessary.” The major identified weaknesses in CAD data are insufficient list of call types (largest call volume is “other”) and dependence on caller assessment (e.g., is it burglary or robbery?).
25	Moskos	2007	The study examined approximately 113,000 calls made in 2000 in Baltimore’s Eastern District to determine whether response time has a positive effect on odds of arrest or a deterrent effect on crime, and found that the effect in either case was minimal at best.
26	O’Brien & Sampson	2015	Researchers re-examined “broken windows” policing as a paradigm and found that it doesn’t hold up to large-scale data analysis. A study of 200,000 calls for service from Boston showed that private conflict is a better predictor of crime than public disorder.
27	Parks	1984	Survey data from Los Angeles, California, and Tuscaloosa, Alabama, shows that objective and subjective measures of police performance aren’t necessarily exclusive: conceptually linked objective and subjective measures return correlated results. More data is needed to confirm the results of this study.
28	Pate, Ferrara, Bowers et al.	1976	This Kansas City, Missouri, study of 1,106 response time surveys collected over a four-month period in the South Patrol District in 1973 showed that short response time is likely to be unrelated to positive results, but can be related to civilian satisfaction. Setting and meeting expectations was more important to satisfaction than actual response time.
29	Priest & Carter	1999	This study surveyed 338 people in Charlotte, North Carolina, most of whom were black, and found a strong relationship between respondents’ evaluations of police response time and their evaluations of overall police performance. Respondents’ evaluations of the service their neighborhood receives also influenced their evaluations of overall police performance. The authors noted that previous studies had significantly different results but sampled a populations consisting mostly of white people.

30	Sherman	1998	This project discusses the research potential of CompStat in developing evidence-based policing methods, including what evidence is necessary all the way through case outcome. At the time of the study, current data practices were to collect only time of response rather than quality of service or repeat call data.
31	Spelman & Brown	1984	This U.S. Department of Justice study of four jurisdictions— Jacksonville, Florida; Peoria, Illinois; Rochester, New York; and San Diego, California—confirmed work by Kansas City Police Department that improved response time to crime calls does not significantly increase odds of arrest. The researchers hypothesized that this is because callers delay reporting until crime is over—even with access to instantaneous reporting via 911. The researchers found a slight correlation between the type of crime and whether police response time had a statistically significant impact on likelihood of arrest, noting that, in most cases, it did not.
32	Stevens, Webster & Stipak	1980	A study of York, Pennsylvania, data, sampling approximately 31,000 calls for service in 1976 found little if any correspondence between response time and likelihood that a crime will be “cleared.” Researchers noted that more study is needed with more variables such as call type: response time almost certainly makes a difference for some calls but not others, and this was lost when aggregating all calls into three categories in the overall sample.
33	Stinson, Brewer & Liederbach	2014	Researchers analyzed a year of call for service type and location data from the Lorain, Ohio, CAD system to optimize police districting to better serve hot spots and balance workload.
34	Townsend, Hunt, Kuck et al.	2005	This study of IPV call handling from intake to outcome shows how call-taker training can be part of an early intervention to shape IPV call procedure. The study found, among other things, that only half of the 368 departments surveyed required specialized training for call-takers and dispatchers regarding IPV.
35	Vaughan, Wuschke, Hewitt et al.	2018	This study mapped 20,000 mental health-related and 20,000 IPV calls for police service in Surrey, BC, and found that they have a distinct temporal pattern for both days of the week and hours of the day. Specifically, mental health calls for police service peak during the middle of the week and in the midafternoon, while IPV calls peak on Saturday and Sunday between 6:00 pm and 2:00 am.

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