A New Way of 911 Call Taking: Criteria Based Dispatching

A Review of the Literature

Frankie Wunschel and Daniel Bodah

Contents

Vera Institute of Justice

Introduction

The 911 emergency call line was first implemented in 1968, in Halleyville, Alabama, as a fire emergency number.[1] The scope of 911 expanded over the years to include police and emergency medical responses. As the world and the 911 system have changed throughout the past 52 years, the goal of 911—to enhance public safety—has not. Although extensive changes have been made in the technological infrastructure of the 911 system (such as adding GPS, Computer Aided Dispatch [CAD], and the Enhanced and Next Generation 911 applications), there have been few advances in the call-taking and dispatching aspects of the system. Modernization is needed if 911 is to provide fully effective service.

In recent years, a few alternative approaches to call taking and information processing have surfaced. One of these alternative approaches is known as Criteria Based Dispatch (CBD). CBD was developed in King Country, Washington, in 1989 and was initially developed for emergency medical services.[2] Whereas the traditional 911 approach involves the call taker collecting as much information as possible—what is happening, as well as why—CBD focuses on "here and now" questions.[3] CBD was constructed as a central triage guideline system focusing on two key areas to understand this here-and-now framework:

1. The necessary level of care

2. The urgency of the need for care.[4]

CBD systems categorize multiple call types together and supply a list of corresponding questions for use during the call-taking process.[5] These questions and prompts are guidance suggestions for the call taker, ultimately trusting that the call taker will exercise discretion to use them appropriately.[6]

The system was initially developed for medical emergency-based calls and utilizing symptom criteria similar to those utilized in medical offices and hospitals.[7] CBD has since expanded and been used in multiple departments for fire-related calls as well. Although readily used for medical and fire emergencies, CBD has been introduced in only a handful of jurisdictions for police calls.[8] As a movement across the country has begun demanding changes to policing and public safety, the need to revisit 911 call-taking and dispatching methods has become urgent. As discussed below, CBD has revolutionized the

---

[1] S. Rebecca Neusteter, Megan O'Toole, Mawia Khagali, and Abdul Rad, *Understanding Police Enforcement: A Multicity 911 Analysis* (New York: Vera, 2020).

[2] King County Emergency Response, "Emergency Medical Dispatch (EMD) Program," https://www.kingcounty.gov/depts/health/emergency-medical-services/emd.aspx.

[3] Tucson Fire Foundation, "About Criteria-Based Dispatch," http://www.tucsonfirefoundation.com/wp-content/uploads/2012/07/About-Criteria-Based-Dispatch.pdf.

[4] King County Emergency Response.

[5] Michael Levy, *Criteria Based Dispatch: How One System Changed*. (Anchorage, AK: Anchorage Fire Department, March 2017).

[6] Ibid.

[7] King County Emergency Response.

[8] Washington, D.C. Metro and Seattle, Washington.

call-taking process for medical and fire calls to 911. This review of the literature on CBD frames how this approach could also lead to improvements in the policing space.

Research on CBD is limited. The bulk of research has focused on understanding the structural components of the system and how they affect traditional 911 success metrics such as diagnosis accuracy, sensitivity, specificity, and over- or under-triage.[9] CBD research is practically nonexistent in the context of its use in the United States, so international research must be used to fill this gap. CBD processes in the United States and Europe are largely the same, although European CBD has adopted a three-level urgency approach that is less robust than the U.S. version.[10]

In exploring the landscape of CBD literature, researchers at the Vera Institute of Justice (Vera) searched numerous academic databases, as well as the Internet, to identify academic, professional, and nonprofit reports and studies of CBD. The identified publications consisted of field explorations, scientific evaluation studies, training guides, news publications, and promotional materials. A wide range of literature types was used in order to gain a comprehensive understanding of the field and supplement the limited amount of formal research available.

This literature review explores the literature on CBD with a focus on reviewing the potential benefits of CBD seen by those working in the public safety response sector. The literature review also highlights strengths and weaknesses of CBD, maps the comparative research on CBD with that on competing dispatch system Medical Priority Dispatch (MPD), and finishes with a discussion of the potential for using CBD to improve responses in the policing space and support appropriate diversion of 911 calls to nonenforcement responses.

Research

Initially, it is important to understand the benefits expected from CBD. These potential benefits provide a lens to evaluate the research and determine whether the outcomes of CBD implementation meet expectations.

An early review of CBD was conducted in 1995 by Andrew K. Marsden.[11] Marsden looked at several jurisdictions in which CBD or a similar system was deployed and reviewed the effect on outcomes including resource consumption in emergency medical systems.[12] As this was a multisystem review rather than a study, no quantitative success metrics were explored. Instead, Marsden's research resulted in a list of possible enhancements that could result from a CBD system.[13] The list, in summary, highlighted two major positive outcomes:

1. Heightened accuracy, yielding more efficient allocation of emergency dispatch resources

---

[9] Sensitivity refers to a correct diagnosis when the ailment is present. Specificity refers to a correct non-diagnosis when the ailment is not present. See "Key Terms" on page 5.

[10] Matthew W. Cooke, "The Use of Criteria Based Dispatch in the Prioritization of 999 Emergency Ambulance Calls" (PhD diss., University of Birmingham, January 2001). The three urgency levels in European CBD are A. Life threatening, immediate response needed; B. Immediate response needed, non-life threatening; and C. Non-life threatening, no immediate response needed.

[11] Andrew K. Marsden, "Getting the Right Ambulance to the Right Patient at the Right Time," *Accident and Emergency Nursing* 3, no. 4 (1994), 177-183.

[12] Ibid.

[13] Ibid.

      a. More accurate response reduces over-dispatch of unneeded units, resulting in
           i. Increased traffic safety by reducing emergency vehicles on the road
           ii. Increased units available for dispatch to other incidents
2. Improved quality of information collection and customer service
      a. More succinct and pointed questions benefit both call taker and caller, improving understanding of the situation for the responding unit
           i. Including pre-arrival prompts in the system limits potential impediment when responding units arrive

Although Marsden's review did not collect data about the effectiveness of the CBD system, it provided a framework useful to evaluate whether CBD meets the expectations and advancements expected by early adopters of CBD systems.

Twenty-five years later, in 2019, Tucson, Arizona, implemented CBD, expecting similar benefits. The public safety department anticipates decreased response times, improved customer service, and an overall betterment of public safety as a result of implementation.[14]

The expected improvements from CBD are consistent with a belief that CBD implementation will lead to progress. The question is: are these expected benefits theoretical, or are they present in measurable outcomes?

Key Terms

Much of the research into the outcomes of CBD comes from the field of emergency medical services. Below are some of the key terms that are commonly used in this research.

Sensitivity Rate: The rate at which a call taker correctly identifies the presence of a medical complication when it is present, a "true positive."
Specificity Rate: The probability a call taker correctly identifies the lack of presence of a medical condition when it is not present, a "true negative."
Over-triage: An unnecessary and/or over-prioritized response to a call.
Under-triage: An under-prioritized response to a call.

European studies

Research into CBD in Europe over the last 10 years has shown some promising results. In 2016, Søren Viereck and colleagues conducted an observational study of acute stroke emergency calls over two years.[15] Copenhagen, the study site, had recently overhauled its emergency intake process to include

---

[14] "New Tucson 9-1-1 Call System to Help Wait Times," *Tucson KGUN 9*, February 12, 2020, https://www.kgun9.com/news/local-news/new-tucson-9-1-1-call-system-to-help-wait-times.
[15] Søren Viereck, Thea Palsgaard Møller, Helle Klingenberg Iversen, Hanne Christensen, and Freddy Lippert, "Medical Dispatchers Recognise Substantial Amount of Acute Stroke During Emergency Calls," *Journal of Trauma, Resuscitation and Emergency Medicine* 24 (2016), 89.

dispatchers with a medical background coupled with use of a CBD tool.[16] The study found a sensitivity of 66.2 percent, far higher than rates found in previous research (where sensitivity rates were found to be as low as 31 percent).[17] Viereck et al. attributed increased sensitivity to the implementation of CBD in the newly reorganized dispatch centers.[18] Similarly high sensitivity values have been found in studies of centers across Europe that utilized CBD. Studies in Denmark, Sweden, and Finland have observed sensitivity rates hovering around 65 percent when emergency call centers use CBD.[19]

Another study that found benefits of the CBD system was conducted by Michal Plodr and colleagues in the Czech Republic.[20] The study examined the effect of triage systems including CBD on the speed with which dispatchers diagnosed the need for Dispatcher Assisted CPR (DA-CPR), using jurisdictions with no standardized approach as experimental controls. Findings included a significant reduction in time to DA-CPR from 47 to 36 seconds, a decrease in nonrecognition of the need for DA-CPR, and an overall increase in the probability the patient survived 30 days after the call.[21] These findings are promising, though it is important to note the possibility that decreased nonrecognition was a product of over-triaging, a flaw that is discussed in the next section. Nevertheless, the results of Plodr and colleagues' study provide evidence for some of the hypothesized benefits of CBD.

The studies mentioned above illustrate positive research results that fulfill many of the expected benefits of CBD and suggest that the approach holds merit. Though there have been positive findings on the outcomes of implementing CBD in call centers, flaws have also been found, as with any system. Failure to adequately address the systematic problem of over-triage rates is one of the most consistent shortcomings found in evaluations of CBD systems. Studies note that the over-triage rates remain high enough to be problematic even when CBD implementation lowers them.[22]

One study that highlights this issue for CBD was conducted in 2015 by Fabrice Dami and Christel Golay. Though most studies focus on 911 calls regarding a single medical ailment, such as stroke or cardiac arrest, this study instead reviewed a large range of call types.[23] Dami and Golay found CBD to have a startlingly high over-triage rate of 78 percent, as well as an under-triage rate of 4.6 percent. Sensitivity was 86 percent and specificity was 48 percent.[24] The researchers found it difficult to compare systems or decipher superiority due to the heterogeneity of emergency systems in composition and process,

[16] Ibid.

[17] Ibid.

[18] Ibid.

[19] Eiren N. Ellensen, H. Naess, T. Wisborg, S. Hunskaar, and E. Zakariassen, "Stroke Identification by Criteria Based Dispatch—A Register Based Study," *Acta Anaesthesiologica Scandinavica* 62, no. 1 (2018), 105-115.

[20] Michal Plodr, Anatolij Truhlar, Jaroslava Krencikova, Monika Praunova, Vladimir Svaba, Jiri Masek, Dana Bejrova, and Jiri Paral, "Effect of Introduction of a Standardized Protocol in Dispatcher-Assisted Cardiopulmonary Resuscitation," *Resuscitation* 106 (2016), 18-23.

[21] Ibid.

[22] Camilla Hardeland, Theresa M. Olasceengen, Rob Lawrence, Danny Garrison, Tonje Lorem, Gunnar Farstad, and Lars Wik, "Comparison of Medical Priority Dispatch (MPD) and Criteria Based Dispatch (CBD) Relating to Cardiac Arrest Calls," *Resuscitation* 85 (2014), 612-616.

[23] Fabrice Dami, Christel Golay, Mathieu Pasquier, Vincent Fuchs, Pierre-Nicolas Carron, and Olivier Hugli, "Prehospital Triage Accuracy in a Criteria Based Dispatch Centre," *BMC Emergency Medicine* 15, no. 32 (2015).

[24] Ibid.

Vera Institute of Justice

even when using consistent success metrics. The high over-triage results, in the medical context, led to waste of time and resources.

More detailed findings of a similar kind arose in a study by Eirin N. Ellensen in 2018, which reviewed stroke identification in emergency call centers using CBD in western Norway. Ellensen found a sensitivity rate of 57.9 percent, substantially lower than the rates of approximately 65 percent that prevailed in other call-center measurements in the same region.[25] This raised concerns about over-triage in CBD implementation. However, other regional call centers with higher sensitivity were found to place greater emphasis on training operators, suggesting that training might reduce misassignments and over-triage in CBD.[26] Ellensen's study also identified positive outcomes. Firstly, a measured 99.1 percent specificity rate meant that incidents not involving a stroke were almost always correctly identified as non-stroke. Secondly, even where the CBD system resulted in an incorrect diagnosis, it still identified the need for acute response correctly 91.9% of the time. This suggests that over-triage was, in effect, compensating for incorrect classification problems.

The importance of training was highlighted by a study headed by Soren Mikkelsen in southern Denmark in 2015. Mikkelsen examined the impact of operator credentials and training on the success of outcomes in a CBD call center. Call centers utilizing medical professionals as call takers were compared to those employing police-oriented lay call takers.[27] The results showed that the centers using medical professionals dramatically increased the percentage of calls designated for emergency response from 11.5 percent to 14.9 percent.[28] This evidence suggests that the use of medically trained call takers may be a way of solving the well-documented tendency toward over-triage in CBD systems.

Additional data about over-triage comes from a study conducted by Mikkel Andersen in 2013. Andersen analyzed the content of emergency medical calls in Denmark after the implementation of a CBD system known as the Danish Index for Emergency Care. The study primarily focused on how well the system assigned calls to the correct level of urgency. In contrast to most studies, which focus on critical calls of high urgency, Andersen addressed triage and dispatch in the context of low-urgency calls. The study discovered lower rates of dispatch for low-urgency calls—a promising finding, contrary to the over-triage problems identified in other studies of CBD systems. This raises the question whether over-triage is a problem for CBD generally, or if the problem is isolated to specific contexts, such as certain call types or jurisdictions with particular characteristics.

Another area of concern around CBD was identified in a 2001 dissertation study by Matthew W. Cooke. Cooke found a lack of agreement by experts in the European CBD system on the correct urgency and group classification of calls within CBD systems.[29] The European classification of call urgency into three categories may be too broad to yield accurate triage outcomes and call classification.[30]

---

[25] Ellensen et al., 2018.

[26] Ibid.

[27] Søren Mikkelson, Hans Morten Lossius, Palle Toft, Annmarie Touborg Lassen, and Anne Craviero Brøchner, "Criterion Based Dispatch Carried Out by Health Care Workers. Implications on Triage," *Resuscitation* 96, no. 1 (2015), 124.

[28] Ibid.

[29] Cooke, 2018.

[30] Ibid.

Vera Institute of Justice

American CBD/Call taking

In the United States, the landscape of call taking includes a different set of options. CBD has not been widely implemented in the United States and research is therefore limited. Multiple medical call-taking frameworks compete in the United States, with the three main systems being CBD, MPD, and standard 911 call taking. Though the benefits of a standardized call system compared to traditional intake have been previously noted, the debate between the two standardized systems continues in the United States.[31]

MPD is similar to CBD. They share the same focus but differ in structure. MPD is a proprietary system developed by physician Jeff Clawson in 1977.[32] MPD is a strict protocol-based intake system that requires a linear question-and-answer technique. Based on the answers, the system auto-generates a dispatch priority level. This differs from CBD, which utilizes a question-and-answer technique that produces guideline suggestions, allowing call takers more autonomy.[33] MPD is the centerpiece product of the company Priority Dispatch, which also offers MPD-related products ranging from ProQA (the company's current implementation of MPD), to a quality review accessory service, to multiple training and certification programs.[34] While privatization of the 911 field raises concerns about profit motives intruding on public safety goals, MPD should be considered to determine its effectiveness in comparison to CBD and other alternatives.[35]

MPD creator Jeff Clawson and his colleague Robert Martin argue that MPD avoids inaccuracies arising from call-taker discretion.[36] When a guideline-based approach such as CBD is used rather than a strict protocol such as MPD, call takers ask unnecessary questions that slow response and decrease accuracy. Clawson and Martin's research suggests that a guidelines-based system results in uncertainty, risk of liability, and reduced public safety, setting MPD above CBD.[37] In their view, MPD protocols are aligned with the manner in which emergency rooms and medical offices around the globe identify root issues.[38]

These are valid concerns; liability and accuracy to ensure public safety are two essential issues for call centers, so a system that addresses both is an asset. Yet Priority Dispatch's MPD may not be as effective as advertised. ProQA has been shown to be problematic when implemented in call centers, where reports claim that the strictly ordered question-and-answer protocols are not flexible enough to allow call takers to ask the most pertinent question at the necessary time.[39] Many practitioners fear that the call takers' inability to record the necessary information or ask the right question in a timely manner

---

[31] Viereck et al., 2016.

[32] B. S. Zachariah and P. E. Pepe, "The Development of Emergency Medical Dispatch in the USA: A Historical Perspective," *Official Journal of the European Society for Emergency Medicine* 2, no. 3 (1995), 109-112.

[33] Ibid.

[34] Priority Dispatch, https://prioritydispatch.net/.

[35] Danielle Ivory, Ben Protess, and Kitty Bennett, "When You Dial 911 and Wall Street Answers," *New York Times,* June 25, 2016, https://www.nytimes.com/2016/06/26/business/dealbook/when-you-dial-911-and-wall-street-answers.html.

[36] Jeff J. Clawson, Robert L. Martin, and Scott A. Hauert, "Protocols vs. Guidelines. Choosing a Medical-Dispatch Program," *Emergency Medical Service* 23, no. 10 (1994), 52-60.

[37] Ibid.

[38] Ibid.

[39] Paul Van Osdol, "911 Dispatchers Say System Puts Police, Public At Risk," *Pittsburgh Action News 4,* October 31, 2019, https://www.wtae.com/article/911-dispatchers-say-system-puts-police-public-at-risk/29656745.

puts respondents' lives in danger and is a disservice to the caller.[40] These concerns have led a number of jurisdictions to discontinue use of MPD, including Minneapolis, Minnesota, and Tucson.[41] As studies have shown, however, CBD has its own flaws. This leads to the question: how do MPD and CBD compare to each other?

The bulk of U.S. CBD research tackles just this question, comparing the two approaches in terms of the efficiency metrics discussed in the literature. Plodr's research (discussed above) provides a comparative analysis of MPD and CBD, finding that standardized systems achieve greater sensitivity accuracy compared to non-standardized systems.[42] However, the study found no significant difference between the accuracy rates of centers utilizing MPD and those using CBD. Both systems showed similarly positive results.

Fabrice Dami and Eric Heymann (2015) compared outcomes of MPD and CBD systems in providing DA-CPR for out-of-hospital cardiac arrests. The study found no significant difference in diagnosis accuracy and timeliness to response.

Other studies, however, have found differences between the effectiveness of CBD and MPD. Camilla Hardeland and Theresa M. Olasveengen (2014) conducted a multicountry study between Richmond, Virginia, and Oslo, Norway. It was one of the first comparison studies on the effectiveness of CBD (Norway) and MPD (United States) in identifying and responding to cardiac arrest calls.[43] No significant difference was detected from the time a call was placed to the initiation of chest compressions on the person experiencing complications.[44] But CBD systems achieved more rapid pre-arrival CPR instructions and ambulance dispatch compared to MPD.[45] The mechanism of CBD's success was not established, but future studies may examine whether it involves CBD's overcautious triage approach, which may translate to faster (if sometimes overzealous) diagnosis.

From 2006 to 2017, Switzerland consolidated 22 dispatch centers into 17, eliminating centers using MPD and folding them into centers that used CBD.[46] Alexandre Moser found that, in all cases, over- and under-triage measures improved and there was a reduction in ambulance siren use when controlling for dispatch center performance.[47]

The findings of these studies call into question Clawson and Martin's finding about the superiority of strict protocols over more flexible guidelines in dispatching, instead suggesting that CBD may yield better results than MPD.

---

[40] Ibid.

[41] Jennifer Austin, "Mpls. to Stop Using Controversial 911 Dispatch Software," *Minneapolis Kare 11,* August 16, 2019, https://www.kare11.com/article/news/local/mpls-to-stop-using-controversial-911-dispatch-software/89-84c662ee-f3b7-4c6a-84a9-69af52cbc4cd.

[42] Plodr et al., 2016.

[43] Hardeland et al., 2014.

[44] Ibid.

[45] Ibid.

[46] Alexandre Moser, Annette Mettler, Vincent Fuchs, Walter Hanhart, Claude Francois Robert, Vincent Della Santa, and Fabrice Dami, "Merger of Two Dispatch Centres: Does it Improve Quality and Patient Safety?" *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 25, no. 40 (2017).

[47] Ibid.

Cooke (2001) (see above) found support for the American CBD implementation framework over that used in Europe. His findings suggest that use of a greater number of call categories, as is done in U.S. CBD implementations, can resolve some of the mistaken classifications and urgency levels resulting from European CBD systems that provide call takers and dispatchers with fewer options.

Finally, the need for iterative updating of CBD systems was highlighted by Dami and Heymanns (2015). Their study found CBD resulted in problematic classification of certain breathing symptoms for cardiac emergencies.[48] Consistent mishandling of this symptom revealed the need for ongoing updates to CBD categorization and question-and-answer protocols. The study also made clear the need for standardized reporting to permit comparisons across a broad range of call centers.[49] These concerns echo those raised by Cooke (2001).

Conclusion

Studies support the potential of CBD systems to improve the appropriateness and effectiveness of emergency response by obtaining more accurate information from 911 callers. The research to date focuses on CBD implementation in the medical response space, but CBD shows promise for police dispatching as well. As jurisdictions around the United States struggle to find ways to provide non-law-enforcement alternatives to matters traditionally handled by the police, CBD holds out promise as a protocol that may allow call center staff to better sort incoming 911 calls, sending alternative responders such as community health teams, substance abuse teams, or outreach services for those without housing rather than sending police. Reframing these social needs within a public health framework will require an updated 911 infrastructure that can achieve new kinds of responses with consistent accuracy. Although the research on CBD is not yet conclusive, it suggests a promising direction for jurisdictions wishing to reduce the footprint of policing in their communities by shifting to public health and treatment options. Further study of the U.S. jurisdictions that have implemented CBD in their police 911 response systems, as well as of places that have evolved strong alternatives to police enforcement, will provide a more solid evidentiary basis for the necessary infrastructure to shift away from overreliance on criminal enforcement responses.

References

Austin, Jennifer. "Mpls. to Stop Using Controversial 911 Dispatch Software." *Minneapolis Kare 11,* August 16, 2019. https://www.kare11.com/article/news/local/mpls-to-stop-using-controversial-911-dispatch-software/89-84c662ee-f3b7-4c6a-84a9-69af52cbc4cd.

Clawson, Jeff J., Robert L. Martin, and Scott A. Hauert. "Protocols vs. Guidelines. Choosing a Medical-Dispatch Program." *Emergency Medical Service* 23, no. 10 (1994), 52-60.

Cooke, Matthew W. "The Use of Criteria Based Dispatch in the Prioritization of 999 Emergency Ambulance Calls." PhD diss., University of Birmingham, January 2001.

---

[48] Fabrice Dami, Eric Heymann, Mathieu Pasquier, Vincent Fuchs, Pierre-Nicolas Carron, and Olivier Hugli, "Time to Identify Cardiac Arrest and Provide Dispatch-assisted Cardio-pulmonary Resuscitation in a Criteria-based Dispatch System," *Resuscitation* 97 (2015), 27-33.

[49] Ibid.

Vera Institute of Justice

Dami, Fabrice, Christel Golay, Mathieu Pasquier, Vincent Fuchs, Pierre-Nicolas Carron, and Olivier Hugli. "Prehospital Triage Accuracy in a Criteria Based Dispatch Centre." *BMC Emergency Medicine* 15, no. 32 (2015).

Dami, Fabrice, Eric Heymann, Mathieu Pasquier, Vincent Fuchs, Pierre-Nicolas Carron, and Olivier Hugli. "Time to Identify Cardiac Arrest and Provide Dispatch-assisted Cardio-pulmonary Resuscitation in a Criteria-based Dispatch System." *Resuscitation* 97 (2015), 27-33.

Ellensen, Eiren N., H. Naess, T. Wisborg, S. Hunskaar, and E. Zakariassen. "Stroke Identification by Criteria Based Dispatch—A Register Based Study." *Acta Anaesthesiologica Scandinavica* 62, no. 1 (2018), 105-115*.*

Hardeland, Camilla, Theresa M. Olasceengen, Rob Lawrence, Danny Garrison, Tonje Lorem, Gunnar Farstad, and Lars Wik. "Comparison of Medical Priority Dispatch (MPD) and Criteria Based Dispatch (CBD) Relating to Cardiac Arrest Calls." *Resuscitation* 85 (2014), 612-616.

Ivory, Danielle, Ben Protess, and Kitty Bennett. "When You Dial 911 and Wall Street Answers." *New York Times,* June 25, 2016. https://www.nytimes.com/2016/06/26/business/dealbook/when-you-dial-911-and-wall-street-answers.html.

King County Emergency Response. "Emergency Medical Dispatch (EMD) Program." https://www.kingcounty.gov/depts/health/emergency-medical-services/emd.aspx.

Levy, Michael. *Criteria Based Dispatch: How One System Changed.* Anchorage, AK: Anchorage Fire Department, March 2017.

Marsden, Andrew K. "Getting the Right Ambulance to the Right Patient at the Right Time." *Accident and Emergency Nursing* 3, no. 4 (1994), 177-183.

Mikkelson, Søren, Hans Morten Lossius, Palle Toft, Annmarie Touborg Lassen, and Anne Craviero Brøchner. "Criterion Based Dispatch Carried Out by Health Care Workers. Implications on Triage." *Resuscitation* 96, no. 1 (2015), 124.

Moser, Alexandre, Annette Mettler, Vincent Fuchs, Walter Hanhart, Claude Francois Robert, Vincent Della Santa, and Fabrice Dami. "Merger of Two Dispatch Centres: Does it Improve Quality and Patient Safety?" *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 25, no. 40 (2017).

Neusteter, S. Rebecca, Megan O'Toole, Mawia Khagali, and Abdul Rad. *Understanding Police Enforcement: A Multicity 911 Analysis*. New York: Vera Institute of Justice, 2020.

"New Tucson 9-1-1 Call System to Help Wait Times." *Tucson KGUN 9*, February 12, 2020. https://www.kgun9.com/news/local-news/new-tucson-9-1-1-call-system-to-help-wait-times.

Plodr, Michal, Anatolij Truhlar, Jaroslava Krencikova, Monika Praunova, Vladimir Svaba, Jiri Masek, Dana Bejrova, and Jiri Paral. "Effect of Introduction of a Standardized Protocol in Dispatcher-Assisted Cardiopulmonary Resuscitation." *Resuscitation* 106 (2016), 18-23.

Priority Dispatch. https://prioritydispatch.net/.

Tucson Fire Foundation. "About Criteria-Based Dispatch." http://www.tucsonfirefoundation.com/wp-content/uploads/2012/07/About-Criteria-Based-Dispatch.pdf.

Vera Institute of Justice

Van Osdol, Paul. "911 Dispatchers Say System Puts Police, Public At Risk." *Pittsburgh Action News 4,* October 31, 2019. https://www.wtae.com/article/911-dispatchers-say-system-puts-police-public-at-risk/29656745.

Viereck, Søren, Thea Palsgaard Møller, Helle Klingenberg Iversen, Hanne Christensen, and Freddy Lippert. "Medical Dispatchers Recognize Substantial Amount of Acute Stroke During Emergency Calls." *Journal of Trauma, Resuscitation and Emergency Medicine* 24 (2016)*,* 89.

Zachariah, B. S., and P. E. Pepe. "The Development of Emergency Medical Dispatch in the USA: A Historical Perspective." *Official Journal of the European Society for Emergency Medicine* 2, no. 3 (1995)*,* 109-112.

Credits

For more information, contact Frankie Wunschel, research associate, at fwunschel@vera.org.