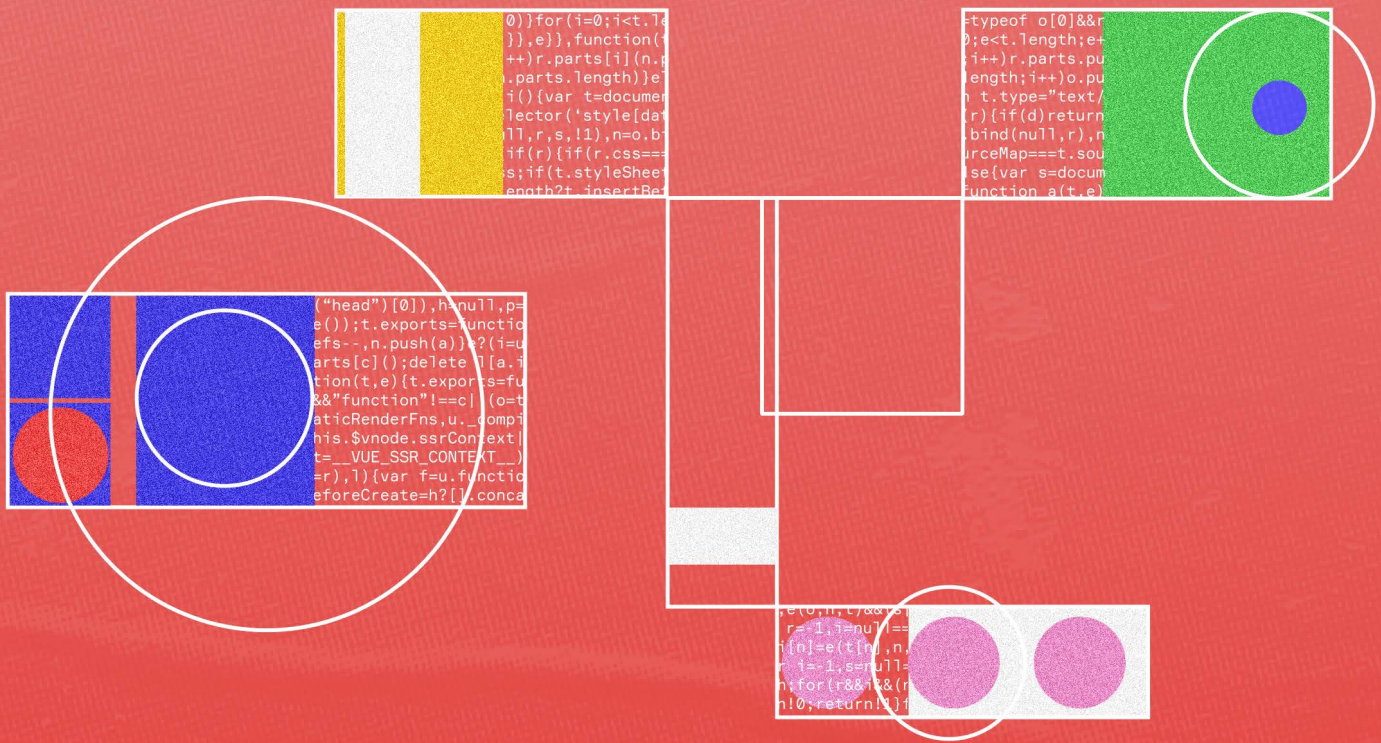


Leveraging AI for effective emergency management and crisis response

AI can help emergency response agencies provide personalized care to match the large scale of modern crises.

A report from the Deloitte Center for Government Insights



02 . . . *Introduction*

03 . . . *AI is already at work in EP&R, just at a limited scale*

04 . . . *AI has the power to transform emergency preparedness
and response*

06 . . . *Organizational, not technical challenges, have kept AI
from scaling in EP&R*

08 . . . *The path forward: Embracing AI for enhanced EP&R*

09 . . . *EP&R organizations at a crossroads: The opportunity and
necessity of adopting AI*

10 . . . *Endnotes*



Introduction

Wildfires, bridge collapses, epidemics, intense hurricanes. Disasters seem to be getting more severe and more frequent. Yet, budgets and workforces remain largely stagnant for many emergency preparedness and response (EP&R) organizations, which include public health, disaster, and other professionals that help the public prepare for and respond to emergencies. Estimates project a need for the US public health workforce to grow by 80%.¹ However, the workforce has lost more than 45,000 workers in a little over a decade.² Many organizations are strained to unprecedented levels trying to match the enormous scale of disasters while still delivering the individualized care each survivor needs.

Fortunately, generative AI has emerged as a transformative force that can potentially ease the pressure on EP&R personnel. What sets generative AI apart is its ability to personalize outputs while harnessing AI's vast scalability, thus providing an ideal combination that can help public EP&R agencies.

While there are several strengths associated with the use of generative AI in EP&R, it is also important to consider the challenges that come with it. Ignoring these issues can lead to problems with accuracy, trust, competing investment priorities, and overreliance on automation, which can negatively impact the quality of EP&R work. Learning lessons from previous generations of automation can help generative AI pair its strengths with those of human workers to help transform EP&R.

The intersection of AI opportunity and EP&R imperatives creates a pivotal moment for leaders. Many legacy systems simply cannot keep up with today's vast data sets or real-time processing needs. Change is needed, and generative AI can help. If EP&R leaders adapt their processes based on the strengths and weaknesses of the technology, they can uncover new ways to deliver the personalized care survivors need at the speed and scale of the modern world.



AI is already at work in EP&R, just at a limited scale



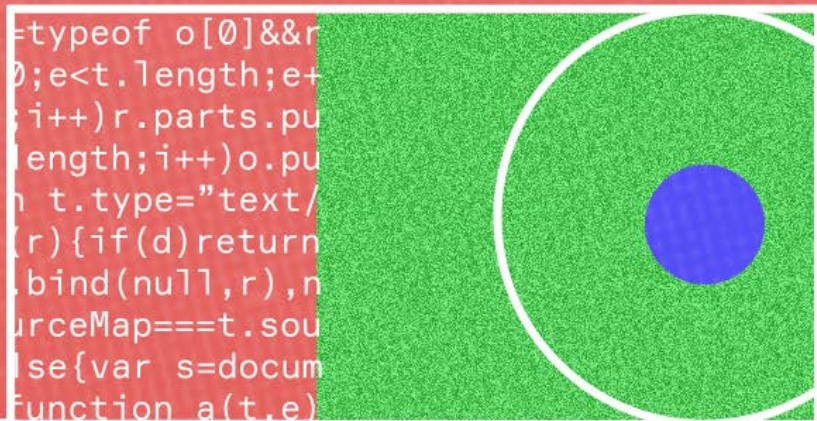
EP&R organizations have been using automation to improve work for more than half a century.³ Even AI is not new to the sector, with many small-scale successes being seen nationwide. For instance, the California Department of Forestry and Fire Protection uses image recognition to identify wildfires even before humans notice them, helping to control fires before they can spread.⁴ AI is also being utilized to tackle complex issues that involve human behavior. For example, researchers have successfully used AI to identify when tuberculosis patients have missed doses, thus helping patients better stick to their treatment regimens and decreasing the risk of further drug-resistant TB.⁵

But the use of AI in EP&R is still limited and often confined to smaller-scale proofs of concept.⁶ This is not uncommon and follows a [similar pattern of adoption](#) seen in other public sector organizations.⁷ A challenge with AI adoption at scale is the need for different skills, technologies, and governance compared to small

proofs of concept.⁸ Luckily, the recent emergence of powerful generative AI tools can help overcome some of those challenges.

Unlike narrow AI tools that excel at one particular task, generative AI can produce results across a broad spectrum of domains. With its multifaceted capabilities, generative AI has the potential to amplify the effectiveness of emergency responders and their existing tools.⁹ Generative AI is not a stand-alone solution to all problems. But when layered with other tools and appropriate human judgment, it can bring more accurate early warning systems, predictive analytics for disaster management, innovative approaches to crisis response, and more.

So, while at-scale adoption of generative AI will still likely require new capabilities, its breadth means that EP&R organizations may only need to add those capabilities once to solve several problems.





AI has the power to transform emergency preparedness and response

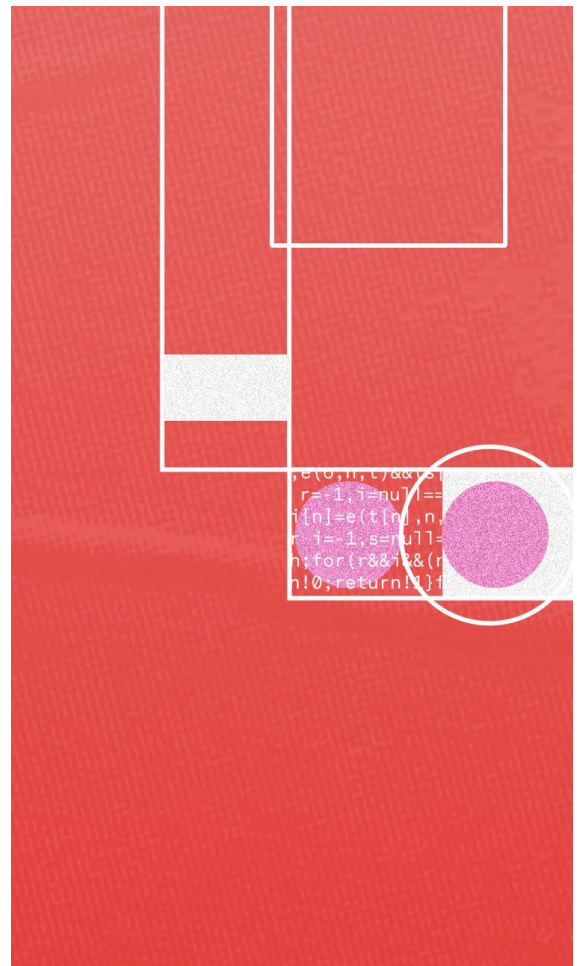
When generative AI is paired with other automation tools and human workers, it can bring new capabilities to EP&R organizations.

Enhanced situational awareness: Seeing the unseen

Imagine having an extra set of eyes that can process information at lightning speed, spotting anomalies, and predicting risks. AI-driven algorithms and real-time data analysis can do just that. Whether it's monitoring the spread of a wildfire or tracking the progression of a disease outbreak, AI can empower responders with a clearer, real-time picture of what's happening. For example, the HealthMap project, a free, open-source health solution, uses AI to scan social media and other data sources to provide public health organizations worldwide with early warnings and real-time disease outbreak monitoring.¹⁰ Layering generative AI atop these algorithms could help workers quickly pull relevant insights out of the data even as its size grows exponentially. For instance, an AI-enabled emergency notification system can take weather data from the National Oceanic and Atmospheric Administration, input it into forecast models, and then automatically create a series of alert messages for affected areas, giving people greater advanced warning of an impending hurricane or other severe weather events.

Optimal resource allocation: Making every resource count

In the chaos of an emergency, decision-makers often face the daunting task of allocating limited resources efficiently. AI's data processing abilities can compare thousands of scenarios to help select the optimal course of action. From dispatching emergency personnel to distributing relief supplies, AI can help streamline the decision-making process, helping deploy resources where and when they are needed most. For instance, during the COVID-19 pandemic, AI helped hospitals navigate the shortage of personal protective equipment kits.¹¹





Strengthened preparedness: Ready for anything

Generative AI can improve training simulations by creating realistic scenarios and dynamic challenges so that responders are ready for a wide range of emergencies, from natural disasters to public health crises. The National Institute of Standards and Technology is developing an AI-powered simulator that leverages AI algorithms to model fire behavior and provide realistic training scenarios for firefighters.¹²

Seamless access to multiple government services: Simplifying the journey

When a disaster strikes and people need assistance, they often have to navigate a maze of bureaucracy to get the help they need. Here's where AI could help both the government and survivors. For the government, AI can rapidly assess needs, and generative AI could help quickly recode tools to link data from different government agencies without requiring specialized skills. For disaster survivors, generative AI could act as a single front door to various programs, helping people navigate processes like disaster assistance programs, financial support, and temporary housing with ease and efficiency, allowing survivors to receive timely and crucial support when they need it the most.

PUTTING HUMAN RESPONDERS AT THE CENTER

While generative AI holds immense potential, it's not a panacea to eliminate all challenges associated with emergencies and disasters. One of the primary risks is expecting generative AI to navigate complex, unpredictable situations with the same finesse as human responders. Generative AI, like its narrow AI counterparts, has its limitations.¹³ All forms of AI rely on the data they have been trained on, which may not encompass all possible scenarios. So, while humans can exercise judgment in new situations based on intuition, emotions, and local knowledge, AI will typically struggle if a situation is too different from its training data.

Effective human-machine teaming can play an important role in achieving success during emergencies. Generative and narrow AI can crunch huge volumes of data in ways that humans cannot, but human responders possess the ability to assess the emotional and psychological needs of affected individuals, a dimension that AI may struggle to comprehend fully. Teaming the strengths of AI with those of human workers can be critical. In disaster scenarios, responders make nuanced decisions that consider the unique characteristics of the affected region, the needs of the population, and the cultural context. While AI can provide data-driven insights, it lacks the empathy and cultural awareness of human responders. Human oversight of AI models is vital for minimizing the potential for errors that could exacerbate the disaster's impact.



Organizational, not technical challenges, have kept AI from scaling in EP&R

Combining the computational power of AI with the intuition and judgment of humans can make EP&R organizations both more efficient and more effective. However, effective human-machine teaming can be challenging. Based on EP&R's past experience with AI and automation, some common pitfalls include the following.

Balancing data integration with security

Imagine orchestrating an ensemble where each instrument plays its unique key—a dissonant symphony that echoes the complexity of data integration in EP&R. Integrating data from diverse sources, formats, and standards across various agencies and systems can be as intricate as composing harmonious music. To harness its full potential, AI needs high-quality, consistent data that flows seamlessly. However, the pandemic exposed the challenges of integrating patient data at the scale of a national health care emergency. A patchwork US public health system with disparate, fragmented data sources can make integration a major challenge. In fact, more than a third of local health agencies were unable to access surveillance data from local emergency departments during the pandemic.¹⁴ The lack of integrated data led to delays in tracking and responding to the virus' spread, underlining the importance of efficient data integration in times of crisis.¹⁵

Data is more than mere information; it can be sensitive and critical. During emergencies, handling data while protecting privacy and security becomes paramount.

Storing the large amounts of health data needed to fuel AI tools can make an attractive target for cyber-criminals. For example, the WannaCry ransomware attack of 2017 compromised patient data at numerous hospitals worldwide.¹⁶

The solution to data interoperability is not necessarily storing all data in a centralized place. New technical advances can help realize the benefits of AI, but without increasing privacy risk. For example, homomorphic encryption removes the specifics of data while retaining features needed for analysis. Federated learning can tackle the need to share sensitive data. Rather than moving data between organizations, federated learning moves AI models instead, allowing advanced models to be trained on several different data sets without organizations losing control of their data. These new technologies should be paired with new governance processes to help make the resulting insights widely available while protecting the privacy of the underlying data.

Overcoming resource constraints

While many government organizations experiment with AI tools as proofs of concept, they often struggle to adopt successful pilots on a larger scale, in part due to constraints in the size and timing of resources.

Adopting an enterprise-level AI tool is not just a procurement exercise. It should have continued funding to keep developing the tool, protect it from model drift, and ensure its sustained accuracy and utility. Similarly, resources aren't just needed for technology alone but



also for the workforce. New tools can create the need for new skills and even entirely new roles, such as data scientist or algorithm auditor. Organizations that adopt AI-specific roles are 60% more likely to achieve their project goals than those that do not.¹⁷ Reskilling the workforce for AI doesn't necessarily mean adding many data scientists or creating scores of new positions. Often, it means giving existing staff the skills they need to work effectively with AI. For instance, providing IT staff the skills to deal with new forms of data traffic, frontline workers with the skills to use AI tools to augment their work, and legal staff the understanding of how AI works to help ensure regulatory compliance.¹⁸

Navigating ethical and legal challenges

AI's use in emergencies can have far-reaching consequences, making it very important to implement AI with equity, transparency, and accountability. The distribution of COVID-19 vaccines offers just one example that highlights these concerns, sparking debates globally on fairness and equity in deciding who should receive vaccines first.¹⁹ When used properly, **AI can actually improve equity** by identifying hidden patterns of bias or the roots of unequal outcomes.²⁰

However, AI governance is needed at every step of the model lifecycle to help achieve equitable outcomes. From labeling training data with appropriate uses to periodically reevaluating model outputs to check for model drift, careful AI governance is a central tool for promoting the ethical use of AI.

Good governance can help organizations use AI ethically, but broader legal challenges exist. With disasters that can span county, state, and even national boundaries, EP&R organizations may have to comply with a diverse set of potentially contradictory AI regulations. To promote not just ethical use but also legal compliance requirements, EP&R organizations need to have a deep understanding of how their AI tools work, what outcomes they produce, and how they are used in day-to-day operations.

Tailoring AI for varied disasters

Disasters come in many forms—public health, natural, and human-made—each with a unique cadence. For example, the responses to the 2014 Ebola outbreak in West Africa differed from those to the 2011 Fukushima nuclear disaster, emphasizing the importance of tailoring strategies to the unique nature of each emergency. Today's AI tools feature a trade-off between breadth and accuracy. Large language models are powerful general-purpose tools that can deal with very different scenarios but may struggle with the accuracy of certain details. On the other hand, more bespoke AI models can be extremely precise in solving specific problems they were trained on, but their scope is limited to only that problem.

As a result, agencies should balance the need to be prepared for any scenario with the need to have accurate, trustworthy conclusions. And do this, while the technology itself is constantly evolving.



The path forward: Embracing AI for enhanced EP&R

These organizational challenges can seem daunting. However, a few key steps can help leaders move their organizations beyond *pilot purgatory* and help AI deliver the transformational outcomes that constituents desire.²¹

Collaboration is often key to balancing data integration and security

Organizations can easily feel pulled apart by the opposing demands of data integration and security. However, it's important to remember that EP&R organizations aren't facing these demands alone. There is a whole ecosystem of state and federal agencies, academia, industry, and even the general public, all invested in the success of EP&R. Collaborating with this wide ecosystem can provide access to new technologies and a broader technical skill set that can help break the trade-off between data integration and security. For example, the National Institutes of Health's Bridge to Artificial Intelligence program is building an ecosystem of machine-readable data sets and automated tools to generate new ethically sourced data sets.²²

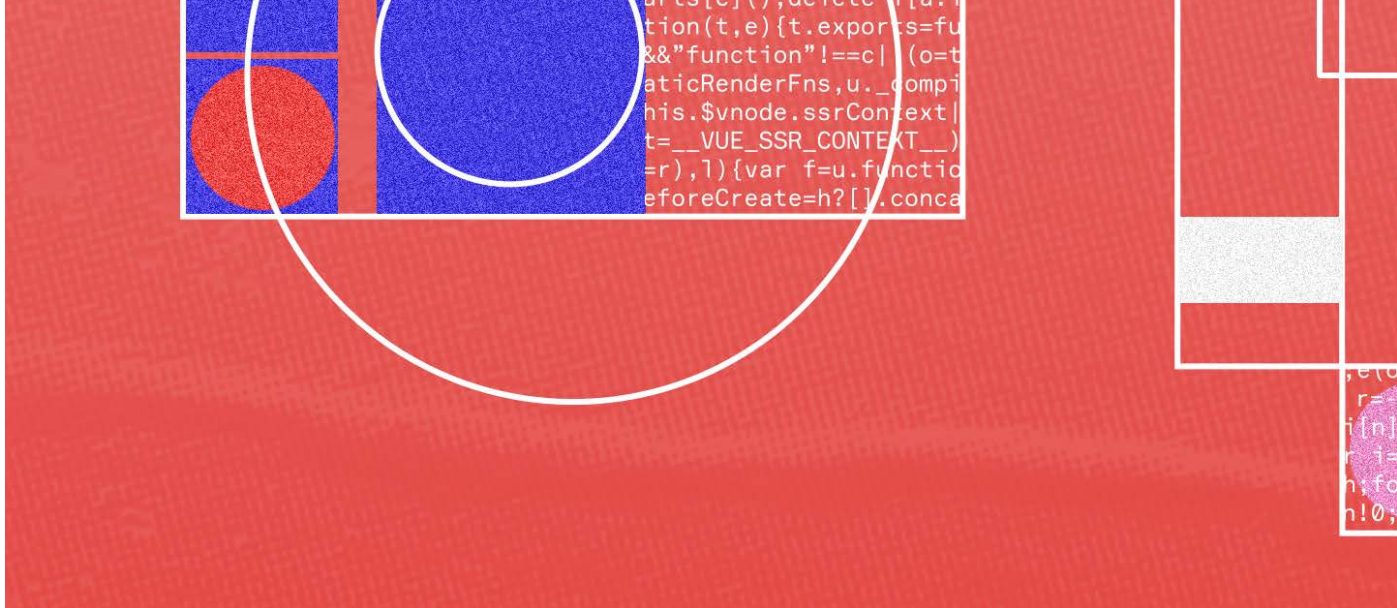
Even beyond technical collaboration, working directly with the public can help increase buy-in from key stakeholders, fostering a sense of shared responsibility for the success of AI-powered initiatives. For example, hosting listening sessions can identify concerns with the privacy or security of a project early on and help the public feel like they are part of the process.

Map tools to mission objectives to overcome resource constraints

A key part of any strategy is understanding how activities build together to achieve an organization's overall goal. AI is no different. Mapping how AI tools help an organization achieve its strategic goals is an important first step to justifying continued funding of those tools. In today's budget-constrained environment, a tool without a clear line of sight to better outcomes is unlikely to survive for long.

Adapt business processes for ethical and legal compliance

AI works differently than a human worker, and while it may require less supervision for tasks like crunching numbers or analyzing trends, it may need significant oversight and governance for tasks like making benefit eligibility determinations. As a result, leaders should not simply bolt AI onto existing business processes. Instead, adapting strategies to align with both the strengths of AI and the workers involved in each step of the process can not only improve performance but also help avoid ethical issues arising from unsupervised AI. Workflows designed with human-machine teaming in mind from the start can help the outputs be both more effective and ethical.



Tap into many AI tools to be ready for varied disasters

Disasters come in various forms, making it challenging to predict the next one. But EP&R organizations don't need to simply guess which tool to reach for because rarely is the right solution a single, monolithic AI tool. Instead, they should think of AI integration as assembling a

toolkit, with each tool paired to the sub-task it excels in. Organizations should, therefore, embrace a diverse range of AI technologies that complement each other. Whether it's machine learning for data analysis, natural language processing for text comprehension, or computer vision for image recognition, a mix of AI tools can allow EP&R organizations to be more effective in the next disaster, no matter what it is.²³

EP&R organizations at a crossroads: The opportunity and necessity of adopting AI

This is a pivotal moment for EP&R. Increased demands are straining organizations while AI technologies are offering transformational new tools. This intersection creates a unique opportunity for EP&R organizations to adopt AI.

By addressing the organizational challenges that have hampered previous automation efforts, leaders can not only improve performance but also ensure the privacy and equity of EP&R services. The result can be a future where communities are safer, more resilient, and better equipped to navigate even the darkest of hours.



Endnotes

1. Shannon Kolman and Claudia Meyer, *Workforce and data system strategies to improve public health policy decisions*, National Conference of State Legislatures, 2023.
2. Jonathon P. Leider, Valerie A. Yeager, Chelsey Kirkland, Heather Krasna, Rachel Hare Bork, and Beth Resnick, “The state of the US public health workforce: Ongoing challenges and future directions,” *Annual Review of Public Health* 44, (2023): pp. 323–341.
3. Michele Metych, “Emergency alert systems,” Britannica, October 4, 2023.
4. Stephanie Elam, “How California is using AI to snuff out wildfires before they explode,” CNN, September 23, 2023.
5. Teamcore, “Prevention of Tuberculosis via prediction and multi-agent planning,” accessed October 19, 2023.
6. Mohammed Yousef Shaheen, “Applications of Artificial Intelligence (AI) in healthcare: A review,” ScienceOpen Preprints, September 25, 2021. Antti Väänänen, Keijo Haataja, Katri Vehviläinen-Julkunen, and Pekka Toivanen, “AI in healthcare: A narrative review,” F1000Research, October 8, 2021.
7. Edward Van Buren, William D. Eggers, Tasha Austin, Joe Mariani, and Pankaj Kamleshkumar Kishnani, *Scaling AI in government*, Deloitte Insights, December 13, 2021.
8. Edward Van Buren, Bruce Chew, and William D. Eggers, *AI readiness for government*, Deloitte Insights, January 24, 2020.
9. Steve King, “How Generative AI will improve incident response,” Bank Info Security, August 16, 2023.
10. Healthmap, “Flu and Ebola map,” accessed October 19, 2023.
11. Morgan Frey, “AI helps hospitals navigate PPE shortages, COVID-19 hot spots,” S&P Global Market Intelligence, February 18, 2021.
12. NIST, “Fire modeling programs,” accessed October 19, 2023.
13. Dimiter Velez and Plamena Ventseslavova Zlateva, “Challenges of artificial intelligence application for disaster risk management,” *The International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences* 47, no. 1 (2023): pp. 387–394.
14. Megan Wallace and Joshua M. Sharfstein, “The patchwork U.S. public health system,” *New England Journal of Medicine* 386, no. 1 (2022): pp. 1–4.
15. S.E. Galaitsi, Jeffrey C. Cegan, Kaitlin Volk, Matthew Joyner, Benjamin D. Trump, and Igor Linkov, “The challenges of data usage for the United States’ COVID-19 response,” *International Journal of Information Management* 59, (2021).
16. William Smart, *Lessons learned review of the WannaCry ransomware cyber attack*, Department of Health & Social Care, February 2018.
17. Van Buren, Eggers, Austin, Mariani, and Kishnani, *Scaling AI in government*.
18. Susanne Hupfer, *Talent and workforce effects in the age of AI*, Deloitte Insights, March 3, 2020.
19. Kasper Raus, Eric Mortier, and Kristof Eeckloo, “Ethical reflections on COVID-19 vaccines,” *International Journal of Clinical and Laboratory Medicine* 77, no. 3 (2022): pp. 600–605.
20. Tasha Austin, Joe Mariani, Devon Dickau, Pankaj Kamleshkumar Kishnani, and Thirumalai Kannan, “How teaming artificial intelligence with humans can help de-bias decision-making,” Deloitte, accessed October 19, 2023.
21. Van Buren, Eggers, Austin, Mariani, and Kishnani, *Scaling AI in government*.
22. National Institute of Health, “Bridge to Artificial Intelligence: Program snapshot,” accessed October 19, 2023.
23. Nikos Kafritsas, “CLIP: The most influential AI model from OpenAI — and how to use it,” Medium, September 27, 2022.

About the authors

Alex Haseley

ahaseley@deloitte.com

Alex Haseley, a principal with Deloitte & Touche LLP, is responsible for Deloitte's relationship with the Federal Emergency Management Agency (FEMA). In this role, he is responsible for overseeing the delivery of a variety of services to FEMA clients. He also leads Deloitte's Crisis and Grants Management Practice for Government & public Services (GPS) clients. Haseley is also responsible for Deloitte's Close As You Go, which helps state and local governments recover faster from disasters.

Chandan Karnik

ckarnik@deloitte.com

Chandan Karnik is a principal within Deloitte Consulting's Government and Public Services Federal Health Practice. Karnik has 25 years of consulting experience supporting multiple healthcare clients including the Department of Health and Human Services (HHS), the National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), commercial pharma and biotech, and nonprofit health clients. Karnik's broad range of expertise includes mission-driven strategic planning, operating model design and implementation, organizational redesign, governance and program design, and IT strategy and strategic communications. He is currently supporting a number of clients with an Emergency Preparedness and Response mission focus.

Brian Kamoie

bkamoie@deloitte.com

Brian Kamoie is a senior executive with over two decades of risk and crisis management experience, having worked at the highest levels of government creating frameworks to manage our country's most challenging risks and events. He is a recognized thought leader on emergency preparedness and resilience for federal, state, and local government. He's had an extensive career, including working for The White House National Security Council (NSC), FEMA, Health and Human Services, and Homeland Security.

Ipshta Sinha

ipsinha@deloitte.com

Ipshta Sinha is a research specialist with the Deloitte Center for Government Insights, Deloitte Services LP. Her research focuses on addressing key health policy issues facing government health agencies.

Joe Mariani

jmariani@deloitte.com

Joe Mariani is a senior research manager with Deloitte's Center for Government Insights. His research focuses on innovation and technology adoption for both national security organizations and commercial businesses. His previous work includes experience as a consultant to the defense and intelligence industries, high school science teacher, and Marine Corps intelligence officer.

Alison Muckle Egzi

amuckle@deloitte.com

Alison Muckle Egzi is Government Health Policy Research lead for the Deloitte Center for Government Insights. Egzi conducts research and thought leadership to address key health policy issues facing federal and state agencies. She brings 15 years of research experience working with government, academia, and nonprofits. Egzi has supported federal health agencies with program evaluation, technology innovation, and demonstration projects, and helped advance a vision for health system transformation. She earned an MPP in Health Policy from UCLA and a BA in psychology from American University.

Acknowledgments

The author would like to thank **Thirumalai Kannan D** for his contribution to the research, writing, and framing of the piece. They would also like to thank **Kavita Majumdar** and **Shambhavi Shah** from Deloitte Insights for their editorial support and inputs.

About the Deloitte Center for Government Insights

The Deloitte Center for Government Insights shares inspiring stories of government innovation, looking at what's behind the adoption of new technologies and management practices. We produce cutting-edge research that guides public officials without burying them in jargon and minutiae, crystalizing essential insights in an easy-to-absorb format. Through research, forums, and immersive workshops, our goal is to provide public officials, policy professionals, and members of the media with fresh insights that advance an understanding of what is possible in government transformation.

Continue the conversation

Industry leadership

Alex Haseley

Principal | Deloitte Consulting LP
+1 571 882 6501 | ahaseley@deloitte.com

Alex Haseley leads Deloitte's emergency preparedness and response services in the Government and Public Services (GPS) Crisis and Grants Management Practice.

Contributors

Editorial: Kavita Majumdar, Shambhavi Shah, and Aditi Gupta

Creative: Molly Piersol and Pooja N Lnu

Cover artwork: Sofia Sergi and Sonya Vasilieff



Published in collaboration with Deloitte Insights.

About this publication

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or its and their affiliates are, by means of this publication, rendering accounting, business, financial, investment, legal, tax, or other professional advice or services. This publication is not a substitute for such professional advice or services, nor should it be used as a basis for any decision or action that may affect your finances or your business. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. None of Deloitte Touche Tohmatsu Limited, its member firms, or its and their respective affiliates shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

About Deloitte

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. In the United States, Deloitte refers to one or more of the US member firms of DTTL, their related entities that operate using the "Deloitte" name in the United States and their respective affiliates. Certain services may not be available to attest clients under the rules and regulations of public accounting. Please see www.deloitte.com/about to learn more about our global network of member firms.