Public Perceptions of 5G Technologies

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About This Report

This report will help the U.S. Department of Homeland Security (DHS) understand current public perceptions of fifth-generation (5G) technologies and how those perceptions might hinder DHS adoption of these technologies. We used various methods and data sources to triangulate insight on the perceptions that people in the United States have of 5G. These methods and data sources included literature reviews, secondary data analysis of segmentation data from the insight industry, social media analysis, expert panels, stakeholder meetings and interviews, and focus groups.

This report is intended to assist homeland security program managers and should also be of interest to the research community. It summarizes the key findings of each study method without extensive technical discussion. The purpose of this research was to assist DHS in adopting 5G technologies to increase the safety, efficiency, and effectiveness of its mission to protect critical infrastructure. Public perception can slow or even prevent DHS adoption of some technologies. By understanding public perception prior to any technology rollout, DHS will be able to plan for and carry out a plan to improve adoption. These findings should be of interest to audiences of DHS stakeholders, as well as public perception researchers and practitioners of technology implementation in organizations.

This research was sponsored by DHS's Science and Technology Directorate and conducted in the Management, Technology, and Capabilities Program of the RAND Homeland Security Research Division, which operates the Homeland Security Operational Analysis Center (HSOAC). The research reported here was completed in March 2023 and underwent sensitive information review with the sponsor and the DHS Science and Technology Directorate (S&T) before public release.

About the Homeland Security Operational Analysis Center

The Homeland Security Act of 2002 (Public Law 107-296, § 305, as codified at 6 U.S.C. § 185) authorizes the Secretary of Homeland Security, acting through the Under Secretary for Science and Technology, to establish one or more federally funded research and development centers (FFRDCs) to provide independent analysis of homeland security issues. The RAND Corporation operates HSOAC as an FFRDC for DHS under contract HSHQDC-16-D-00007.

The HSOAC FFRDC provides the government with independent and objective analyses and advice in core areas important to the department in support of policy development, decisionmaking, alternative approaches, and new ideas on issues of significance. The HSOAC FFRDC also works with and supports other federal, state, local, tribal, and public- and private-sector organizations that make up the homeland security enterprise. The HSOAC FFRDC's research is undertaken by mutual consent with DHS and is organized as a set of

discrete tasks. This report presents the results of research and analysis conducted under task order 70RSAT21FR0000140, Public Perceptions of 5G Wireless Technologies.

The results presented in this report do not necessarily reflect official DHS opinion or policy.

For more information on the RAND Homeland Security Research Division, see www.rand.org/hsrd. For more information on this publication, see www.rand.org/t/RRA1714-1.

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Summary

Issue

Public perceptions of emerging technologies, such as fifth-generation (5G) communication, can affect the uptake and adoption of these technologies. The integration of 5G wireless technologies into the U.S. Department of Homeland Security (DHS) mission could increase the safety, efficiency, and effectiveness of efforts to support DHS's responsibilities to safeguard critical infrastructure and conduct missions across the homeland security enterprise. These potential benefits could be delayed or prevented if there are significant public concerns about the use of 5G technology and technology enabled by 5G.

Research is needed to understand these public perceptions and their potential impact on DHS mission effectiveness and to design a path forward for the most-effective research, development, procurement, and employment of emerging 5G technologies. Understanding the relationship between public perceptions and 5G technologies (including relevant conspiracy theories and concerns about data collection and privacy more generally) could help DHS increase the likelihood that the public will embrace the applications of 5G technology and could also expedite the transition of the technology and the associated benefits, such as securing critical infrastructure. Understanding the public perceptions of government and public use of these technologies could also help DHS mitigate the negative impacts that these perceptions could have on mission effectiveness.

Approach

For this project, we used several methods to investigate public perceptions of 5G technologies in order to better inform DHS's future planning for rollout and adoption of 5G technologies to carry out its mission. Using a combination of literature review, social network and lexical analysis, reviews of existing data and studies in the commercial space, interviews, focus groups, workshops, and expert panel interviews, we summarized perceptions of 5G across various stakeholders relevant to homeland security uses of 5G technology.

Key Findings and Recommendations

Findings

- Applications of 5G could improve DHS's ability to protect critical infrastructure in ways that the public will observe in airports, border crossings, and emergency services. How-

ever, little information has been disseminated about how DHS intends to use 5G, such as to protect critical infrastructure or to improve efficiencies of other technologies.
- Beyond the use for cell phone services, people have little awareness of the intended applications and of potential risks or benefits of 5G to the security mission, which includes cybersecurity and critical infrastructure protection, or to other aspects of their lives, including health. As they are with other technologies, people are concerned about privacy but have little awareness or concern about specific 5G applications.
- Public awareness and perceptions about 5G for security are likely to change as more details about applications are released. Public perceptions should be tracked and reassessed as 5G applications move through the different stages of technology readiness and implementation.
- Privacy-related concerns about 5G are likely to be derivative of privacy-related concerns about other kinds of technology (especially social media). People are more concerned about these privacy issues with data in corporate hands than in government hands.
- A conspiracy theory is a special type of public perception that reflects a salient and often extreme perception held by a segment of society. Many 5G conspiracy theories exist, some of which have been connected to violence. However, most of the public does not engage with these theories, suggesting that such theories are a latent but not prominent threat.
- The volume and magnitude of conspiracy beliefs can change quickly because of environmental factors (e.g., coronavirus disease 2019 [COVID-19]) and should be monitored as new technologies are integrated. However, support for conspiracy theories tends to decline over time, making those theories less threatening to mature technologies.

Recommendations

- More data collection and analyses are needed to understand key issues related to public perceptions of technology integration, including measures of baseline levels of trust in technology, confidence in DHS, and privacy issues.
- Additional research is needed to identify concerns of different demographic and geographic segments to tailor communication plans as technologies are introduced and integrated.
- DHS has an opportunity to clarify government capabilities and intentions before misperceptions and conspiracy theories become widespread. Messaging should note that, independently of technology, legal frameworks govern DHS collection and use of data and that, as technology evolves, protections will evolve with it.
- Finally, we recommend that, to prepare for the next wave of technology and attendant public perceptions, DHS undertake a future study on the implications that sixth-generation (6G) development could have on 5G and public perceptions.

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CHAPTER 1

Introduction

The integration of fifth-generation (5G) wireless technologies into the U.S. Department of Homeland Security (DHS) mission could increase the safety, efficiency, and effectiveness of efforts to support DHS's responsibilities to safeguard critical infrastructure and conduct missions across the homeland security enterprise. These potential benefits could be delayed or prevented if there are significant public concerns about the use of 5G technology and technology enabled by 5G. Such concerns might include health, economic, privacy, and conspiracy theories that cause the public to believe that 5G technologies are threatening, and such beliefs could lead to public resistance to adoption. For instance, a Pew Research Center survey found that 78 percent of U.S. adults said that they lacked understanding about what the U.S. government did with the data it collected and that 64 percent said that they were concerned about government data collection (Auxier et al., 2019). These findings suggest that increased government data collection enabled by the greater use of sensors facilitated by 5G technologies might add to public concerns about 5G.

Research is needed to understand these public perceptions and their potential impact on DHS mission effectiveness and to design a path forward for the most-effective research, development, procurement, and employment of emerging 5G technologies. Understanding the relationship between public perceptions and 5G technologies (including relevant conspiracy theories and concerns about data collection and privacy more generally) could help DHS increase the likelihood that the public will embrace the applications of 5G technology and could expedite the transition of the technology and the associated benefits, such as securing critical infrastructure. Accurate public messaging about the true nature of the technologies, the benefits they provide to protecting U.S. critical infrastructure, and the precautions taken by DHS in designing and implementing 5G applications can help DHS's Science and Technology Directorate (S&T) assist critical infrastructure partners with informed research and investments. This could ultimately benefit the technical transfer and rollout of 5G wireless and related technologies to end users by providing a compelling narrative that enhances public trust in 5G applications. Understanding the public perceptions of these technologies, as well as government and public use of these technologies, could also help DHS mitigate negative impacts that these perceptions could have on mission effectiveness.

Purpose of This Study

For this study, we had several objectives: (1) to identify and assess the impact that public perceptions (including relevant conspiracy theories) could have on DHS current and planned (in the next three to five years) uses of 5G technologies in selected critical infrastructure sites and their potential impact on DHS mission effectiveness; (2) to develop site-specific recommendations, including compelling narratives, to support the research, acquisition, and deployment of these technologies currently and in the future for critical infrastructure; and (3) to explore multiple data collection methods that might inform development of a communication strategy. The recommendations include specific use cases to test during development, messaging to the public, compelling counternarratives to 5G conspiracy theories to inform and educate the public about the technologies' benefits to the critical infrastructure, and acquisition pathways with clear privacy and data protections. A better understanding of the potential for public resistance to 5G technologies will support DHS's mission, including DHS's responsibilities to safeguard critical infrastructure, through recommendations for the development, acquisition, and fielding of these technologies across DHS. Such understanding will also enable site-specific recommendations about research, investments, and technology transfer for partners within the homeland security enterprise.

Data Collection Approach

We employed multiple data collection methods to explore the feasibility and benefits of each. Table 1.1 summarizes some of these methods and what they can contribute to insight into public perceptions.

Limitations of This Approach

We designed this study to be both exploratory and innovative to meet the research objectives of advancing our understanding of 5G and laying the foundation for future studies of perceptions and security technologies. This approach allowed us to conduct a variety of analyses to identify patterns in public perception and potential methods for future studies. This report is designed to be used by security program managers and the research community. It summarizes the key findings of the study without extensive technical discussion.

The limitations of this approach and the overall study include the following:

- Many of the methods and lines of research were exploratory and did not yield full assessments of the relevant questions. As noted in this report, some of the exploration will be valuable as a foundation for future studies.
- One of the exploratory methods was to reduce the costs and public burden of original data collection (e.g., surveys) by using existing market research data about consumers

TABLE 1.1
Summary of Data Collection Methods

Data Collection Method	Topic Covered	Subject-Matter Contribution	Methodological Contribution
Marketing data	• Public interest in 5G • Public perceptions of 5G • Trust in technology • Trust in government • Trust in industry	• Perceptions held by 5G consumers	• Develop methods to analyze existing data • Inform focus groups and expert panels • Segmentation
Literature review	• 5G technologies and use cases • Online conspiracy theories about 5G	• 5G enablers of missions and use cases • Perceptions held by members of the public	• Inform online data collection • Inform focus groups and expert panels
Online data (web searches, social media)	• Public interest in 5G • Online conspiracy theories about 5G	• Perceptions held by members of the public	• Develop 5G search parameters for online platforms
Focus groups and expert panels	• Public perceptions of 5G • Conspiracy theories and beliefs • 5G technical information • DHS use of 5G	• 5G enablers of missions and use cases • Perceptions held by members of the public	• Qualitative insight about perceptions • Qualitative insight about 5G technology • Qualitative insight about DHS missions and use cases

and 5G. We were unable to identify any directly relevant existing data and instead relied on data about adjacent topics (e.g., trust in government, trust in technology).

- One of the original goals of the study was to evaluate communication procedures being used to inform the public about DHS use of 5G at critical infrastructure locations. At the time the research was conducted, DHS was not able to identify specific critical infrastructure public use cases or 5G applications that were either currently or nearly operational. This prevented us from examining the relationship between specific applications and public reactions. It also prevented us from testing specific public messages; therefore, we developed a general communication strategy that can be tailored to emerging technology applications.
- Finally, it was difficult to identify key stakeholders at DHS without insight into a clear use case or program focused on integrating the technology.

CHAPTER 2

5G Technology

5G promises dramatically improved connectivity between devices, applications, and machines (International Telecommunication Union, 2022). Compared with earlier generations of mobile technology, 5G provides increased reliability and throughput, higher speeds, lower battery consumption, and extremely low latency (Adebusola et al., 2020; Qualcomm, undated). Three service types enable these advances:

- Enhanced mobile broadband yields greater capacity to handle massive amounts of data (Schafer, 2019).
- Ultrareliable, low-latency communication, as its name suggests, allows fast, secure, reliable connections between multiple devices (Schafer, 2020).
- Finally, massive machine-type communication (mMTC) allows connections between a high density of devices operating in proximity to one another (Pham et al., 2020).

Applications based on 5G networks could benefit multiple missions and operational components within DHS. S&T's research and development span the following areas (S&T, 2023):

- border security
- chemical, biological, and explosive defense
- counterterrorism
- cybersecurity and information analysis
- first-responder, community, and infrastructure resilience
- food and agriculture defense
- physical security and critical infrastructure resilience
- S&T's COVID-19 response.

We explored three areas of critical infrastructure that were of particular interest to the sponsor—air and land ports, border crossings, and emergency services—and how 5G enabling technologies could drive mission success in them. These were selected because they were expected to have applications that were apparent to the public (air and land ports), have use cases that could create public distrust in a vulnerable population (border crossings), or were likely to be applied in emergency response with a large amount of media coverage (emergency services). For instance, even though some wireless sensor networks are in use, 5G-backed wireless sensor networks provide much lower-latency and high-speed data transmission.

5G allows more devices to work together at greater speeds, which could allow monitoring, situational awareness, tracking, and faster response to incidents. Although we were unable to identify ongoing or planned uses of 5G related to these critical infrastructures, existing research suggests ways in which 5G technology could be used by DHS components in each of these areas. Researchers from the Johns Hopkins University Applied Physics Laboratory identified specific use cases in which 5G deployment could contribute to missions around air and land ports and border crossings for U.S. Customs and Border Protection (CBP) or for emergency services for either the Federal Emergency Management Agency (FEMA) or other first responders and public safety agencies. A summary of their findings and recommendations are shown in Table 2.1.

TABLE 2.1

Potential 5G Use Cases for Selected U.S. Department of Homeland Security Critical Infrastructures

DHS Stakeholder	Use Case	Mission Need Addressed	Potential 5G Solution
CBP	• Situational awareness at the southwest U.S. border provided by 5G-backed wireless sensor network • Border surveillance and search and rescue management via swarms of 5G-backed uncrewed aerial vehicles	• Access to sensor information in rural environments and integrated coordination among sensors, systems, and end users • Real-time access to surveillance footage of rural environments via remotely operated uncrewed aircraft systems	• mMTC • IAB
FEMA	• Enhanced MERS detachments with 5G capability	• Rapid deployment and automated communication configuration of MERS at disaster response site, interoperability with other operational components, and ease of removal when no longer needed	• Virtualized radio access network • 5G-enhanced nonterrestrial network, (i.e., MERS satellite communication capabilities) • IAB
First responders and public safety	• Managing a public safety incident in a smart-city environment requiring enhanced situational awareness	• Connectivity for a dense sensor network with varying information characteristics and performance requirements; advanced communication infrastructure	• Spectrum versatility • Vehicle to everything • Network slicing

SOURCE: Adapted from Das and Annis, 2021.

NOTE: IAB = integrated access and backhaul; MERS = mobile emergency response support.

CHAPTER 3

5G Conspiracy Theories

Conspiracy theory surrounding 5G has been widely discussed in social and traditional media sources and has had real-world impact to 5G infrastructure security. This chapter introduces some of the major false narratives within 5G discourse, including the relationship between 5G and prior conspiracy theory surrounding electromagnetic radiation, as well as with coronavirus disease 2019 (COVID-19). Follow-on chapters will provide additional insight on the major 5G conspiracy-theory themes introduced here.

Method

We conducted a literature review of 5G conspiracy content in several databases, including those containing interdisciplinary academic research, science and business literature, and major news outlets. Our search terms included *5g*, *conspiracy*, *Qanon*, *hoax*, *rumor*, *propaganda*, and *fake news* (see Appendix D for the full list). The literature pull yielded 1,629 documents, of which two reviewers deemed 148 as relevant and 32 as semirelevant to the research objectives of this study, as shown in Figure 3.1.

FIGURE 3.1
Literature Review Methodology

What Is a Conspiracy Theory?

We adopt the definition of *conspiracy theory* from Introne et al. (2020, p. 186):

> A conspiracy theory is a narrative explaining an event or series of events that involve deceptive, coordinated actors working together to achieve a goal through an action or series of actions that have consequences that intentionally disenfranchise or harm an individual or population.

Per this definition, a conspiracy theory is a false narrative that deceptive actors are coordinating to achieve a goal to harm some individuals. As the next section further elucidates, conspiracy theory about 5G typically holds that deceptive actors (such as so-called global elites) have introduced 5G to harm or control other parts of the population.

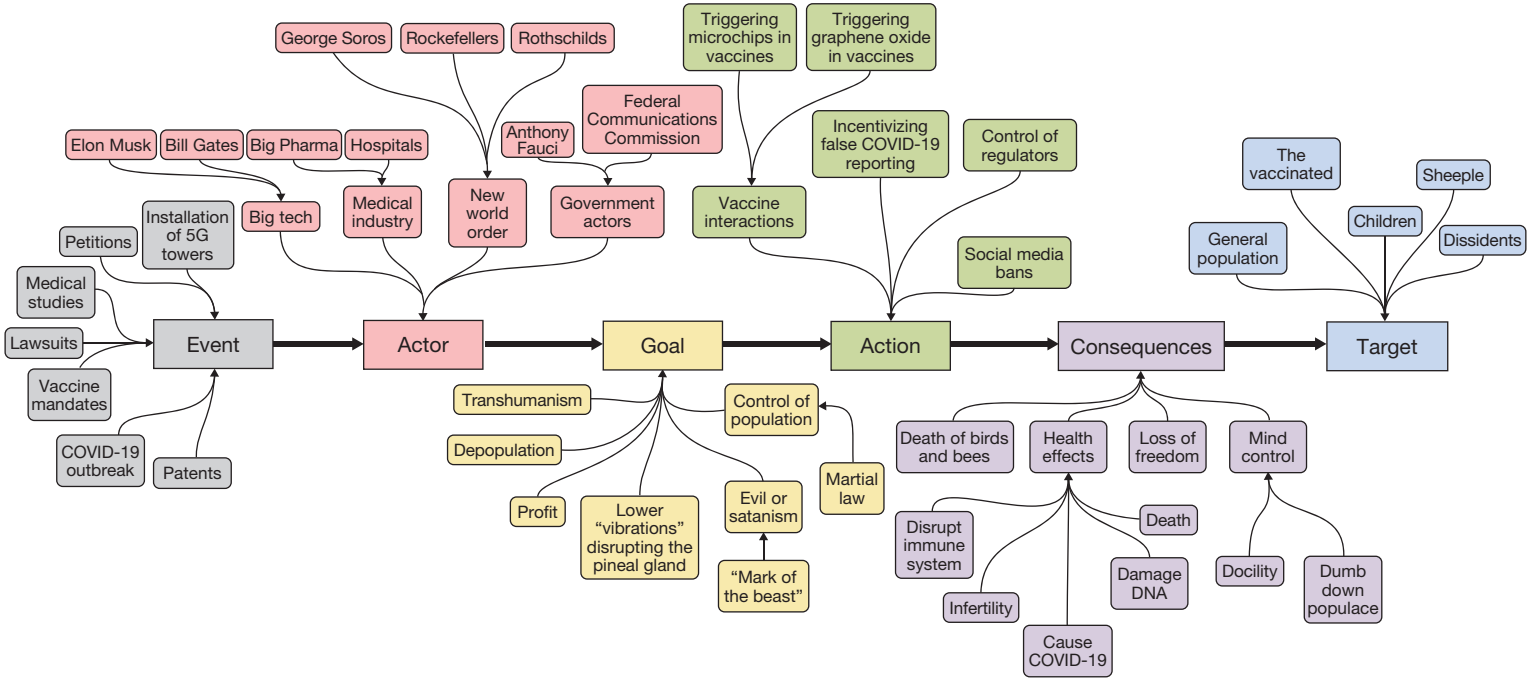
Why Conspiracy Theory Matters

Conspiracy theories have long been rooted in communities that are mistrusting of government, and some conspiracy theories have been associated with political violence. Conspiracy theory around 5G has been correlated with anger toward the national government, which itself is correlated with increased justification for engaging in violence and a greater intent to conduct violence against the government and more generally in the future (Jolley and Paterson, 2020).

Per the definition of *conspiracy theory* presented above, we developed a concept mapping of 5G conspiracy that illustrates the relationships between various 5G conspiracy claims (see Figure 3.2). With this mapping, we sought to unpack the various narratives associated with 5G by linking an event (such as the installations of 5G towers) to a set of actors (such as global elites) that supposedly seek a goal (such as population control) through an action (such as triggering microchips in COVID-19 vaccines) that have certain harmful consequences (mind control) for a target population (such as the general public).

FIGURE 3.2

5G Conspiracy Content Map



NOTE: This map relates specific events (gray) with actors (red) and actors' goals (yellow) and actions (green) that produce consequences (purple) in a specific target population (blue). DNA = deoxyribonucleic acid.

CHAPTER 4

5G Insights from Online Data

To understand the public's perception of 5G technologies, we analyzed online data from social media platforms. In this chapter, we explore insights on public perceptions of 5G from these platforms and map upticks in 5G conversations taking place on the platforms to current events. A summary of the sources used to understand public perceptions of 5G and corresponding methods used are shown in Table 4.1.

Search Interest in 5G

We used Google search data to gauge public interest in 5G over time. Google Trends is a public website that allows users to query specific words or phrases and provides measures of their popularity in different parts of the world, for a given time frame, and in different languages. Users can also search using topics, which are automatically generated entities that group related searches, such as *London*, *Londres*, or *capital of UK*. To compare interest in 5G technology with interest in previous cellular technology, we searched for the topics *5G*, *4G* [fourth generation], and *3G* [third generation]. As shown in Figure 4.1, interest changed over time, and the amount of time from the onset of the interest in 3G until it died out was approximately ten years. A similar pattern can be observed for 4G. Another thing to note is that the interest in 4G started about two years after the interest in 3G started, while the interest in 5G took approximately nine and a half years after interest in 4G began. 5G is a topic that has been increasing interest over time and, during 2022, surpassed trends in interest in 4G and 3G.

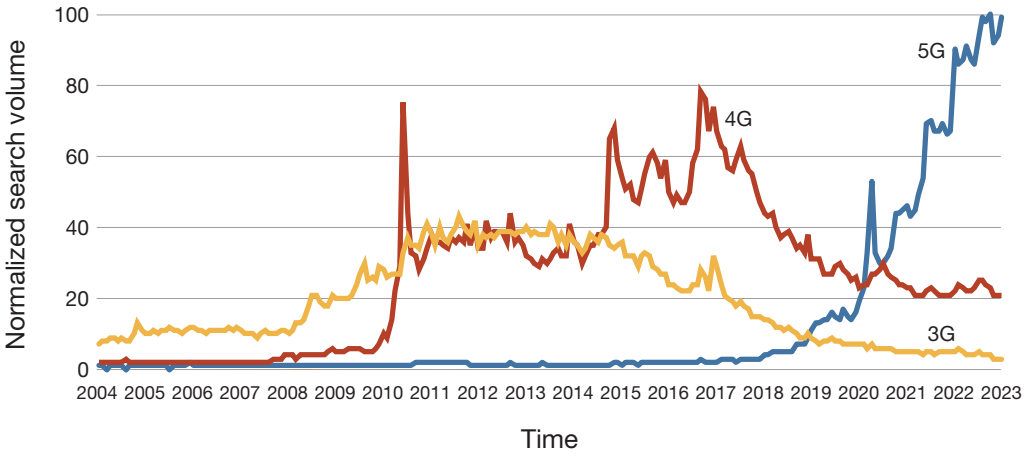
The interest in the topics can also be analyzed geographically. Figure 4.2 represents the amount of interest by region, showing yellow for 3G, red for 4G and blue for 5G. Greater

TABLE 4.1
5G Insights from Online Data Methods

Online Data Source	Method
Search interest in 5G	Google Trends analysis of search interest in 3G, 4G, and 5G from January 2004 to December 2022 Google Trends analysis of search interest by country and U.S. state from January 2004 to December 2022
Social media discussions of 5G	Search for mentions of 5G on Twitter from October 2019 to February 2022 (more details in Appendix D)

FIGURE 4.1

Topic Search Interest over Time of 5G, 4G, and 3G, According to Google Trends



SOURCE: Features data from Google Trends on the topics 5G, 4G, and 3G from January 2004 to December 20, 2022.

NOTE: Numbers on the vertical axis are normalized search volume numbers for 5G (blue), 4G (red), and 3G (yellow), where each point in the graph is divided by the highest point, or the maximum number of searches, from January 2004 to December 20, 2022.

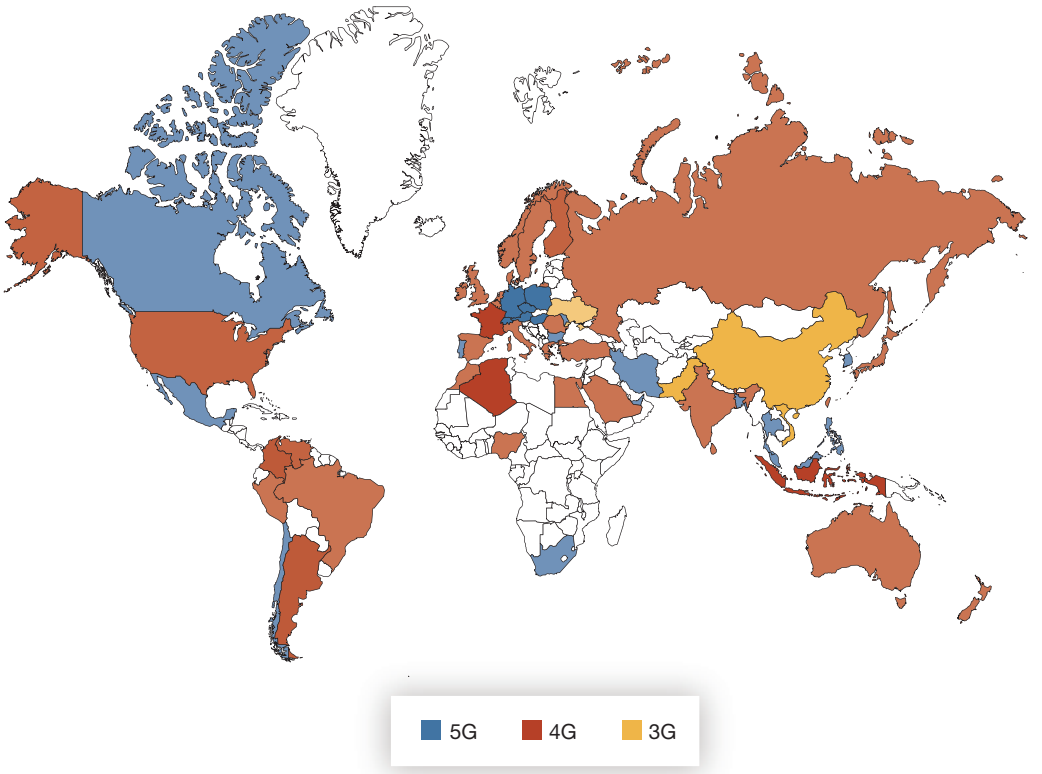
intensity of a color indicates a larger number of searches in that country. For example, we can say that there were more searches in the United States for 4G than in Mexico. The global interest in all three technologies points to a predominant interest in 4G and a localization of the 5G interest in Europe and Canada. Note that a higher value means a higher proportion of all queries, not a higher absolute query count.

An analysis of the searches for the three terms in the United States specifically shows a similar behavior to that in Figure 4.1: a shifting interest over time with trends that have interest in 4G dying out by mid-2017 and in 5G starting to increase in mid-2018. The compared breakdown of 5G by state in the United States shows an almost all-blue map, with the exceptions of Montana, Idaho, and South Dakota, where 5G takes up a small percentage more than 4G. This means that the predominant searches among these three terms during January 2004 and December 2022 were for 4G. In Figure 4.3, we can see where 5G was the most popular of the three during the search period. New Mexico was the location with 5G having the most popularity as a fraction of total searches.

Social Media Discussion of 5G

To dive deeper into the 5G discussion and public interest, we explored social media data. Social media sites have different ways to present information and rules for content sharing that shape the type of speech that is likely to occur. For example, some are more visual, while others have limitations on the characters that can be shared. User demographics can

FIGURE 4.2
Global Topic Search Interest in 5G, 4G, and 3G, According to Google Trends



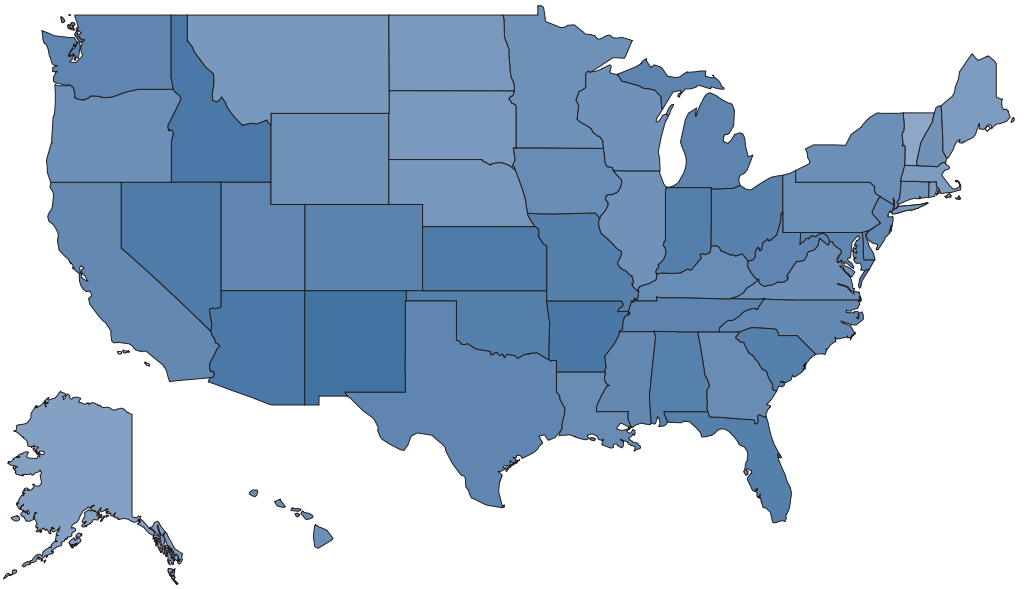
SOURCE: Features data from Google Trends on the topics 5G, 4G, and 3G from January 2004 to December 20, 2022.
NOTE: More-intense color indicates a higher proportion of searches on the topic relative to the total volume of searches in that country. Data are normalized search volume numbers for 5G (blue), 4G (red), and 3G (yellow) from January 2004 to December 20, 2022.

also shape the speech on social media platforms. Pew Research Center's research has shown that demographic distributions of the users change by social media platform (Pew Research Center, 2022), although we were unable to track user demographics in the current analyses. Our data pulls were limited to Twitter; studying data from other social media might reveal other insights.

Query Design

Our social media queries were iterative. An initial search for all the content related to 5G revealed that 5G was linked to many advertisement products, such as different cellular service providers, brands and models of mobile devices, and other types of technology, such as artificial intelligence. The data were thus cleaned by excluding irrelevant terms, such as *iPhone*, *Samsung*, *Verizon*, and *machine learning*, and each round informed subsequent

FIGURE 4.3
Popularity of 5G Topic Search in the United States

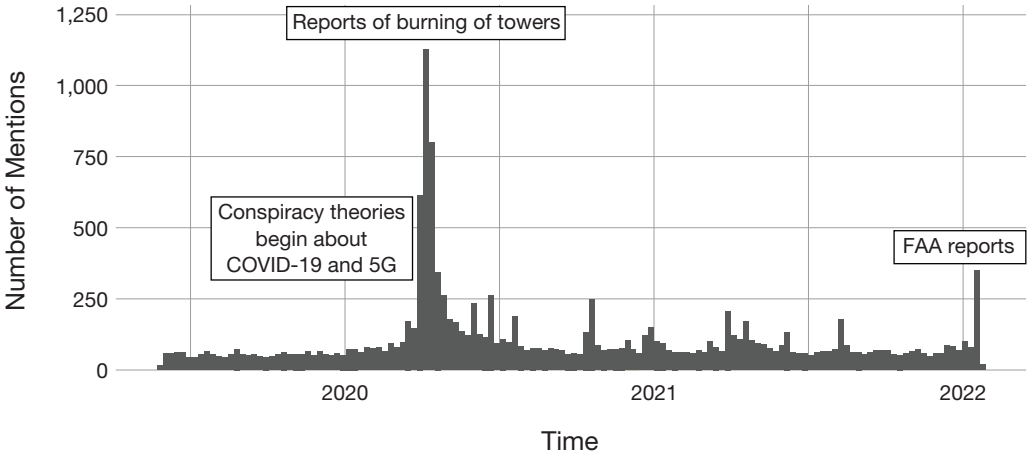


1.	New Mexico	100
2.	Idaho	92
3.	Arizona	88
4.	Nevada	86
5.	Washington	84

SOURCE: Features data from Google Trends on the topic of 5G from January 2004 to December 20, 2022.
NOTE: Values were calculated on a scale from 0 to 100, where 100 is the location with 5G having the most popularity as a fraction of total searches in that location, and a value of 50 indicates a location where 5G was half as popular a search term. A higher value for a location means a higher proportion of all queries, not a higher absolute query count, and is represented by a darker blue in the map.

rounds, where every step revealed new terms to be excluded from the original query on 5G mentions. The next step in the process was to examine engagement with conspiracy sites and authors—that is, we harvested data that included *5G* and linked to conspiracy sites. In addition to examining 5G content on Twitter linking to conspiracy sites, we studied 5G content on the sites themselves. The final query can be found in Appendix D. This resulted in approximately 109,000 tweets from 45,000 accounts. Figure 4.4 illustrates the number of mentions of the term *5G* on Twitter over time with no restrictions. It is worth noting that increases in volume align with events in the timeline. The two most-notable increases correspond to the reports of the burning of cellular service towers in the United Kingdom (UK) in April 2020, and the most-recent reports issued by the Federal Aviation Administration revising the landing requirements for certain Boeing 737–series airplanes at airports where 5G interference could occur (Federal Aviation Administration, 2022). Comparatively, general engagement

FIGURE 4.4
Charting Public Interest in 5G Through Twitter Data



SOURCE: Features data from a Twitter search using parameters detailed in Appendix D.
NOTE: This figure shows the total number of mentions of 5G on Twitter from October 2019 to February 2022.

with the 5G topic on Twitter at its peak around April 2020 was close to 3 million hits, and COVID-19 engagement was approximately 250,000 tweets. In other words, the volume of conspiracy theories related to 5G was a very small fraction of the overall discussion.

CHAPTER 5

5G Insights from Commercially Available Data

5G wireless and related technologies have been examined by the technology industry and consulting firms, including panel studies used to understand the consumer market. We attempted to leverage existing insights, market research, and segmentation data to measure public perceptions about the technology and levels of trust in its safe and responsible use. The intent was to focus on public perception about the technology use in the critical infrastructure sectors.

For the purposes of this chapter, we define *market segmentation* as a target market being split into subsets based on demographics or behaviors (see Qualtrics, undated). We attempted to leverage this information to determine whether groups of people and their associated traits (e.g., education, income) held specific beliefs toward 5G technology or conspiracy theories related to 5G. Similarly, we pursued customer insights so we might better understand consumer behaviors and their wants and needs related to 5G technologies.

Approach

We started by reviewing available, public-facing documents on 5G technology. To understand what was available in the marketplace, we used several strategies to identify questions, polls, and reports:

- reviewing data and contacting polling firms for available segmentation data on public perceptions of 5G
- searching databases and archives of research questions and variables
- identifying pertinent public-facing documents from consulting companies
- reviewing any other information, surveys, or research uncovered during the initial process.

This exploratory approach reduced costs and public burden associated with original data collection but, as previously noted, would not necessarily provide a full assessment of the relevant questions. A summary of search strategies and resulting polls and survey data corresponding to each strategy are shown in Table 5.1.

TABLE 5.1
5G Insights from Commercially Available Data Search Strategies and Results

Search Strategy	Results
Reviewing data and contacting polling firms for available segmentation data on public perceptions of 5G	• HarrisX/T-Mobile 5G Consumer Index (HarrisX, undated) • POLITICO/Qualcomm 5G Global Survey (POLITICO and Qualcomm, 2020) • YouGov poll (YouGov, 2021) • *Washington Post*/Schar School Tech poll (*Washington Post* and Schar School of Policy and Government, 2021) • Uscinski et al. (2022) survey data
Searching databases and archives of research questions and variables	• Pew Research Center poll (Pew Research Center, undated; Pew Research Center, 2012) • General Social Survey (NORC, undated)
Prior RAND research	• American Life Panel data reported in Matthews, Parker, Martineau, et al. (2021) and Matthews, Hertzog, et al. (2023)
Published 5G survey data search	• Enders et al. (2021) survey data • Uscinski et al. (2022) survey data

NOTE: NORC = National Opinion Research Center.

Public Polling Firms

We first reviewed reports available from prominent public opinion polling firms and from firms that sell targeted marketing data based on individual-level purchase records. Following the review of public-facing documents, we contacted polling and marketing firms to find out whether there was additional segmentation data pertinent to 5G that could inform our study. We contacted these firms via email, online submission portals (e.g., contact forms), and telephone and virtual meetings. We contacted a total of 11 firms: Acxiom, Experian, Gallup, Gartner, the Harris Poll, LexisNexis, Nielsen Global Solutions, Pew Research Center, Ipsos, YouGov, and SSRS.

Once we made positive contact with a firm, we attempted to locate and purchase existing segmentation data for the analysis. This was done by describing the goal of the study, how it would be used (in a report), key variables of interest that might affect 5G perceptions, and that we sought existing segmentation data only and did not want to run a new poll or add questions to an omnibus panel.

As indicated earlier, there is a lack of a dedicated, recent data on public perceptions of 5G, especially as those perceptions relate to trust, confidence, and use. However, other polls are useful and available from or conducted by HarrisX (a company owned by the same company that owns the Harris Poll), Ipsos, YouGov, and SSRS. These polls include information specific to 5G (whether in the United States or in other countries), support and understanding of new technologies, and other relevant technology-related topics.

The HarrisX/T-Mobile poll revealed questions helpful for focus groups. For example, the excitement about technological innovation and emergency services could possibly apply to DHS use cases. However, there is less excitement about expanded drone use, which includes drones for emergency response and surveillance. We have highlighted key insights in Table 5.2 based on cross-tabulation data available for public download. It should be noted that raw data by participants were not available. Overall, this poll also showed that there was a gap in knowledge of 5G technologies as of December 2018: Of 5,009 participants, 2,857 reported being "aware" of 5G; 43 percent of those aware reported being "not that familiar" or "not at all familiar" with the technology.

We also examined other insights from this poll to inform focus groups. For example, Figure 5.1 shows the responses by market to the following question: "Which of the following is closest to your view? Technological innovation will mainly benefit: 'your life,' 'government,' or 'the US economy.'" The differences in responses by market show strong support for the feeling technological innovation will benefit respondents' lives in some markets—for instance, Los Angeles (65 percent) and New York (57 percent)—in contrast with some other markets, such as Phoenix (8 percent) and St. Louis (4 percent). Similar trends are seen in the perceived benefit for the U.S. economy: Respondents in San Francisco also reported stronger levels of benefits than other markets (53 percent). In terms of technological innovation

TABLE 5.2
HarrisX/T-Mobile Poll

Question	Response	Percentage of Responses
Emergency services—How strongly do you agree or disagree that technological innovation can address issues in the following industries?	Strongly agree	58
	Somewhat agree	37
	Somewhat disagree	4
	Strongly disagree	2
Expanded drone use (unmanned aircraft that can be remotely controlled and can be used for delivery, emergency response, surveillance, etc.)—How excited are you about each of the following 5G use cases?	Very excited	19
	Somewhat excited	28
	Not that excited	33
	Not at all excited	20
5G is expected to benefit a wide range of industries. Which of the following are you most excited about?[a]	Healthcare	29
	Emergency services	12
	Transportation	5
	Travel/Tourism	4

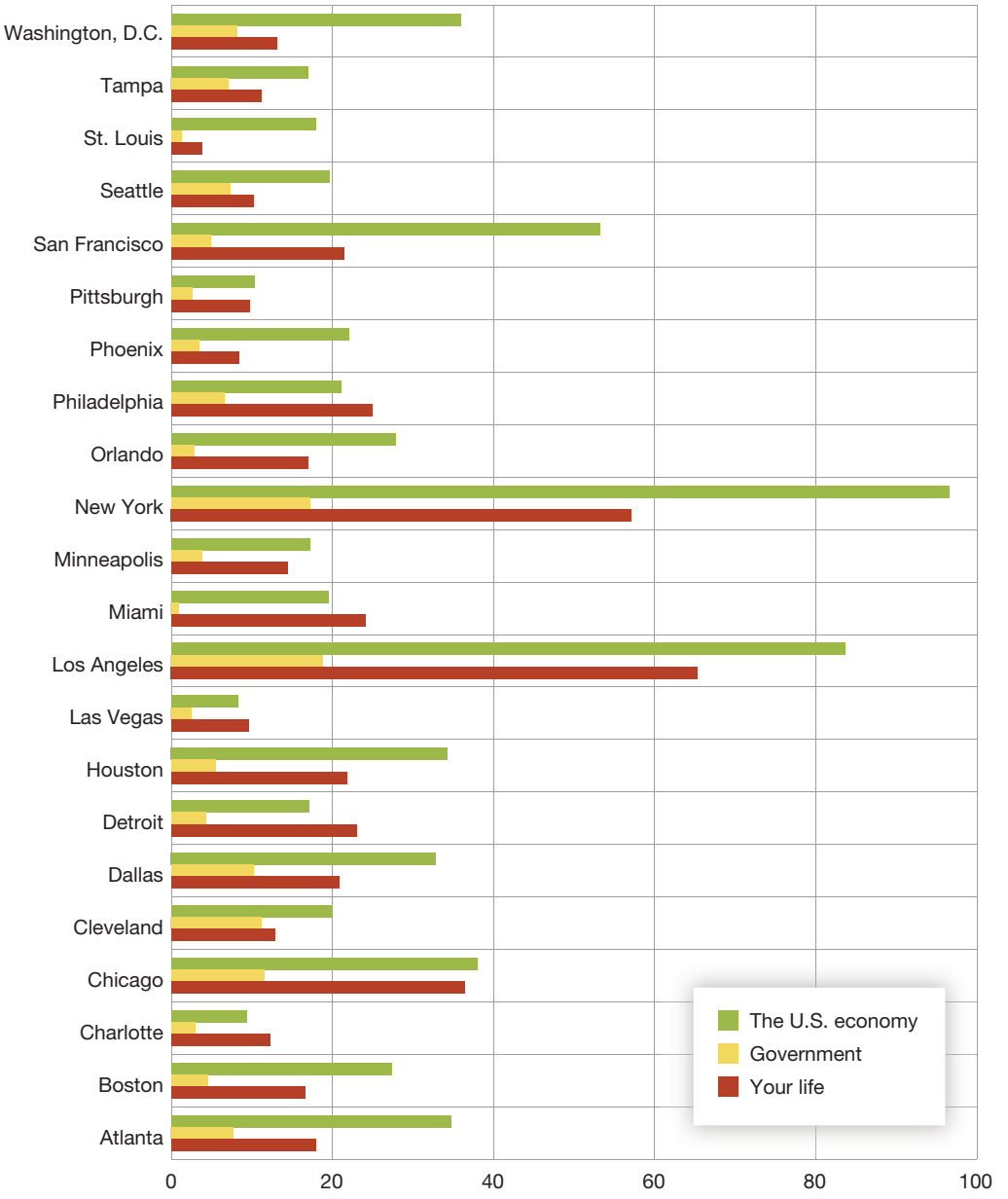
SOURCE: Features data from HarrisX, undated.

NOTE: These responses are percentages of responses from respondents who reported being "aware" of 5G (n = 2,857).

[a] We selected these four industries of the ten in the survey item because they are important to and align with DHS critical infrastructure and stakeholders.

FIGURE 5.1

Perceived 5G Benefits for the Economy, Government, and Personal Life, by City



SOURCE: Features data from HarrisX, undated.

NOTE: Percentage of respondents in each city who responded that technological innovations would benefit mainly the U.S. economy (green), the government (yellow), or "your life" (red).

benefiting the government, respondents appeared to be generally less optimistic when given the choice between technology benefiting "your life," "rural areas," "cities," "businesses," "the government," or "the US economy." Those in Los Angeles (19 percent), Orlando (17 percent), and Chicago (12 percent) reported the highest levels of perceived benefit, while those in Miami (1 percent), St. Louis (1 percent), and Las Vegas (2 percent) reported the lowest levels of perceived benefit when given these choices. This suggests that respondents typically believe that technological innovation will benefit other areas of their lives and environs.

The POLITICO/Qualcomm 5G Global Survey, conducted between December 2019 and January 2020 on a sample of consumers and a sample of experts, sheds further light on understanding of 5G. Relevant results for U.S. consumers are shown in Table 5.3. First, the table shows some unfamiliarity with 5G—30 percent of U.S. consumers reported having heard about the term but not being familiar with it, an additional 19 percent said that they had heard the term but knew nothing else about it, and 7 percent said that they had never heard of 5G. U.S. consumers also showed concerns about privacy: Thirty-eight percent reported that they trusted the government more than businesses to respect their privacy; 62 percent said that they trusted business more than government. Privacy continued to be valued as important: Seventy-nine percent of U.S. consumers also reported that they were "not willing to accept lower privacy standards even if it would make service faster and enable me to connect more devices together." In terms of additional questions pertinent to this study, U.S. consumers ranked protecting national security interests second (27 percent) to protecting citizens' individual privacy (30 percent) when asked to rank their top two issues for the government to consider during 5G rollout.

TABLE 5.3
POLITICO/Qualcomm 5G Global Survey

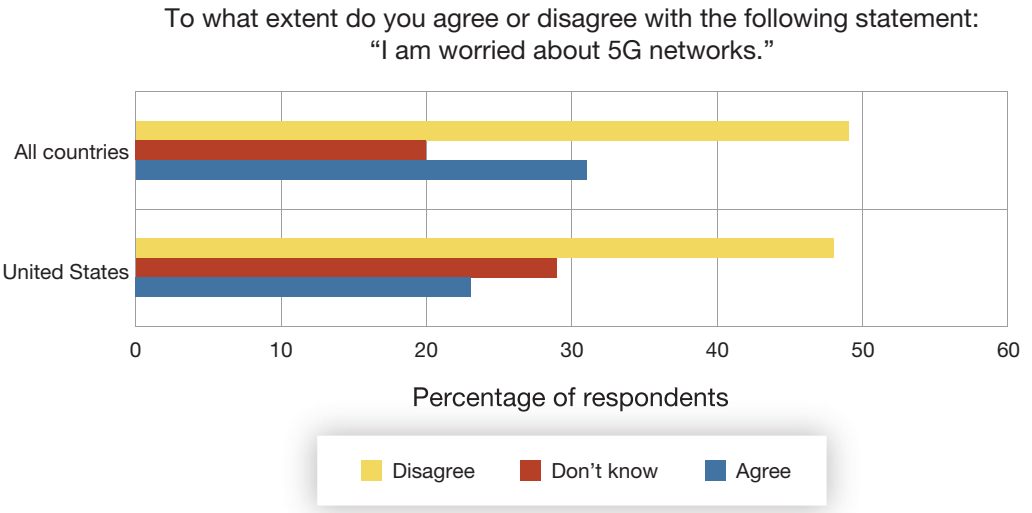
Question	Response	Percentage of Responses
How familiar are you with 5G?	Very familiar—I would feel comfortable explaining what 5G is to others	9
	I've heard/read about 5G and have basic knowledge about it	34
	I've heard the term, but am not that familiar with 5G	30
	I've heard the term but nothing else about 5G	19
	I've never heard of 5G	7
Which of the following is closer to your view?	I trust the government more than businesses to respect my privacy	38
	I trust businesses more than the government to respect my privacy	62
Which of the following is closer to your view?	I am not willing to accept lower privacy standards even if it would make service faster and enable me to connect more devices together	79
	I am comfortable accepting lower privacy standards if it makes service faster and enables me to connect more devices together	21
In your opinion, which of the following is most important for the government to consider when it comes to the rollout of 5G technology? Please select your top two choices. (Rank 1)	Protect citizens' individual privacy	30
	Protect national security interests	27
	Enable the broadest deployment of 5G	6
	Enable the most affordable access	15
	Enable the fastest deployment of 5G	7
	Other	13
	Don't know	1

SOURCE: Features data from POLITICO and Qualcomm, 2020.

NOTE: Responses based on U.S. consumers (n = 701).

As shown in Figure 5.2, a YouGov poll of May 2021 indicated that 23 percent of Americans responded, "I am worried about 5G networks," which contrasts with the global average of 31 percent. However, an additional 29 percent of Americans responded that they "don't know" whether they agreed or disagreed. This continues to show a lack of awareness about

FIGURE 5.2
U.S. and Global Worry About 5G Networks



SOURCE: Features data from YouGov, 2021 (May 2021 YouGov poll data of more than 18,000 adult consumers in 17 global markets).

NOTE: Percentage of respondents from the United States and all countries surveyed answering "Disagree" (yellow), "Don't know" (red), and "Agree" (blue) when asked to rate their agreement with the statement, "I am worried about 5G networks."

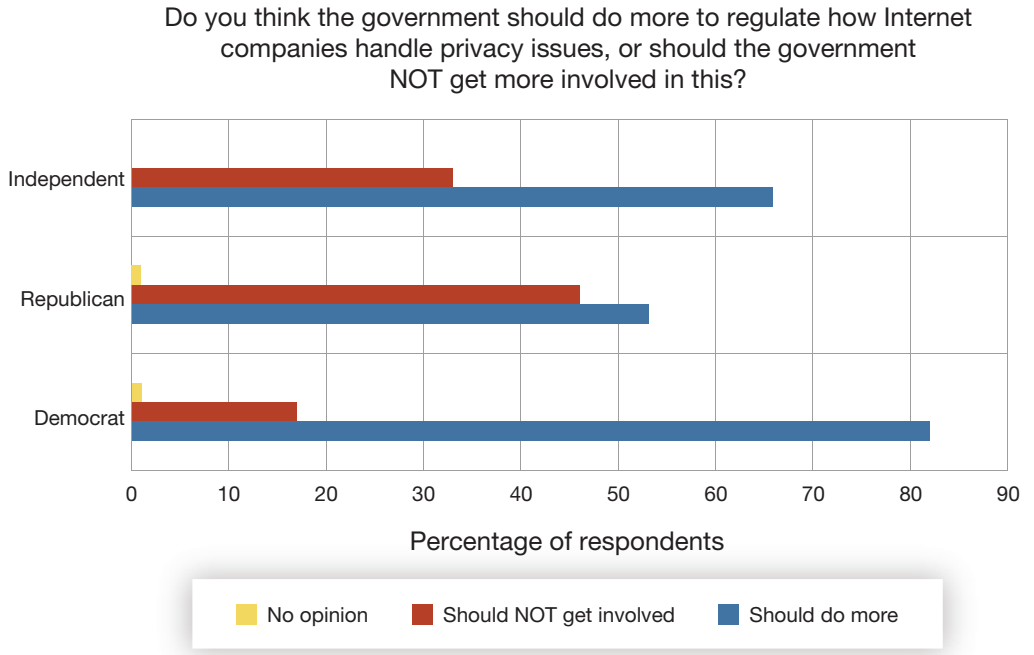
either 5G technology itself or at least its relative benefits and risks, as well as some concern about it.

A more recent poll (November 2021) conducted by the *Washington Post* and George Mason University with data collection by SSRS also shed some light on 5G information. Some raw data were available, with pertinent information shared in Figures 5.3 through 5.5.

We included these charts to illustrate differences between groups in their opinions of technology that could be useful in understanding possible public reactions to the adoption of 5G technology for security applications. For example, key variables, such as age, education, and political party identification, might, based on these results, influence opinions on 5G technology and government use thereof. Other demographic variables, such as gender, did not seem to have differences in questions of interest: Men and women had comparable responses on government regulation (64 percent of men and 65 percent of women reported believing that the government should do more).

Only one study examined changes over time in 5G beliefs. Uscinski et al. (2022) used Qualtrics to survey an online sample of just over 2,000 Americans who were representative of the American adult population in terms of race and other demographics. Responses to a generalized 5G conspiracy belief ("The dangers of 5G cellphone technology are being covered up") were stable, from 26-percent agreement in March 2020 to 23-percent agreement in October 2020. However, a more specific 5G conspiracy belief ("5G cell phone technology is

FIGURE 5.3
Opinions of Government Regulation, by Party Identification



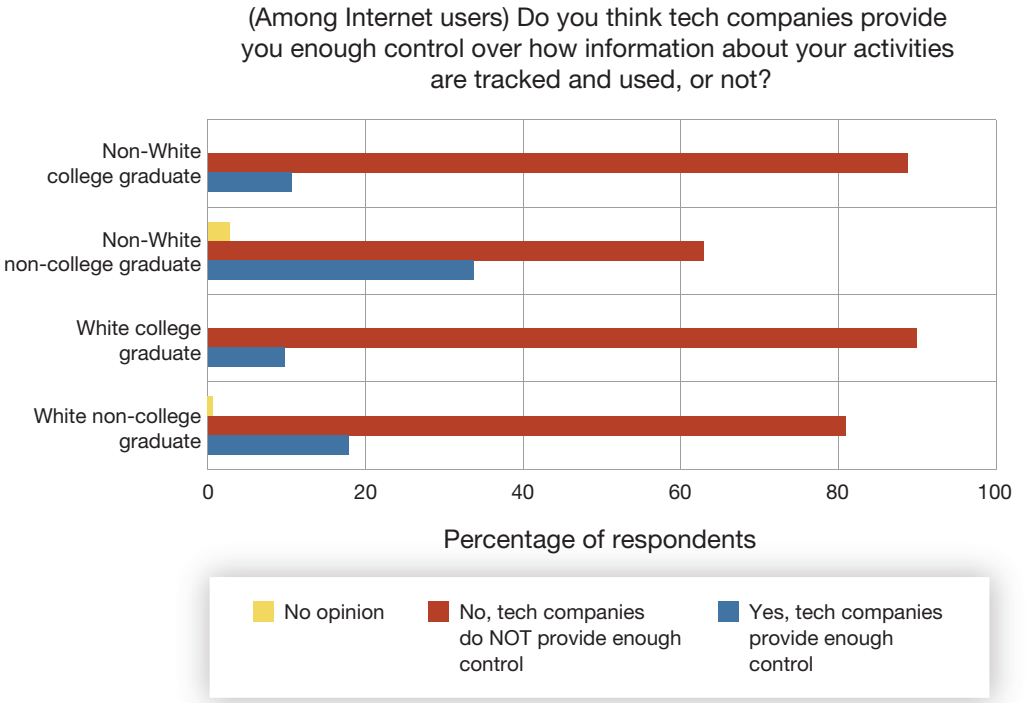
SOURCE: Features data from *Washington Post* and Schar School of Policy and Government, 2021.
NOTE: Percentage of U.S. adults (n = 1,122) answering "No opinion" (yellow), "Should NOT get involved" (red), and "Should do more" (blue), by political party, when asked whether the government should do more to regulate how internet companies handle privacy issues.

responsible for the spread of coronavirus") showed a clear downward trend over time, declining from 11-percent agreement in June 2020 to 7-percent agreement in May 2021.

The decline in reporting of the belief that 5G caused the COVID-19 pandemic is consistent with prior research findings that conspiracy thinking might be a form of creative causal reasoning with strong similarities to magical intuitions (e.g., astrology, voodoo) (Brotherton and French, 2014; Bryden et al., 2018; Eckblad and Chapman, 1983; Matthews, Hertzog, et al., 2023). As greater empirical evidence was presented for the causal origins of COVID-19, people logically might have discounted their prior creative riffing through conspiracism (Sobo, 2019) similar to how belief in ritual magic that seeks to have real effects appears to decline over time at least in part from improvements in scientific understanding of causal relationships (Hong, Slingerland, and Henrich, submitted; Matthews, Hertzog, et al., 2023).

FIGURE 5.4

Opinions of Control over Data from Tech Companies, by Race and Education



SOURCE: Features data from *Washington Post* and Schar School of Policy and Government, 2021.

NOTE: Percentage of U.S. internet users (n = 1,058) answering "No opinion" (yellow); "No, tech companies do NOT provide enough control" (red); and "Yes, tech companies provide enough control" (blue) by race and education level when asked whether tech companies provide enough control over how information about activities is tracked and used.

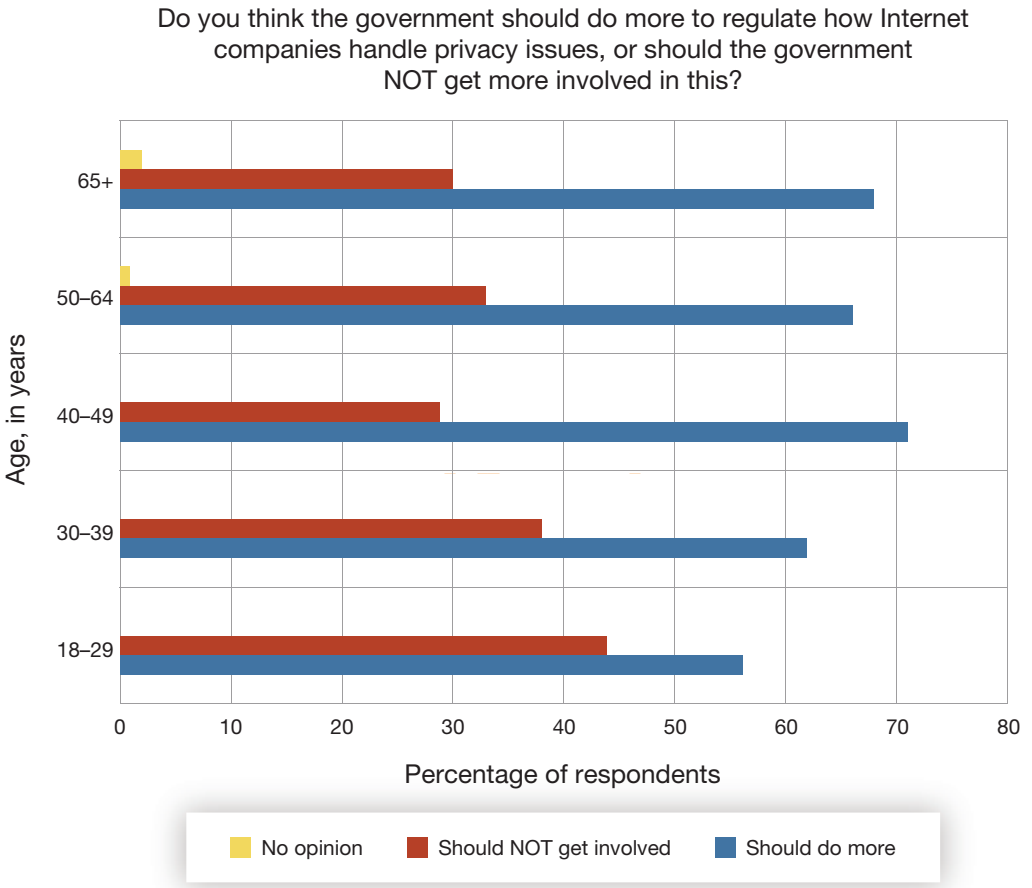
Uscinski et al. (2022) demonstrated similar patterns of decline over time in many other specific conspiracy beliefs (see Figure 5.6 and Table 5.4). These patterns are relevant in that they show a consistent pattern for conspiracy beliefs as a class of ideas: Any given belief has a limited life span.

Figure 5.6 makes clear that, as more time passes between the initial and second measurements of a conspiracy belief, the percentage of people who report agreement with the belief decreases. The color pattern by decade, however, also shows a strong pattern that beliefs measured in decades further back in time also show greater decreases. This pattern might account for the other apparent pattern of decreases based on the time interval between the belief measurements.

Multiple regression is a commonly used tool to disentangle these types of competing associations with an outcome of interest (Venables and Ripley, 2002). Table 5.4 shows the results from a multiple linear regression to predict the change in the percentage agreement with each belief on both the decade in which it was measured and the time interval. We also included the percentage who agreed at the first measurement time because that could also

FIGURE 5.5

Opinions of Government Regulation of Internet Companies and Privacy, by Age



SOURCE: Features data from *Washington Post* and Schar School of Policy and Government, 2021.

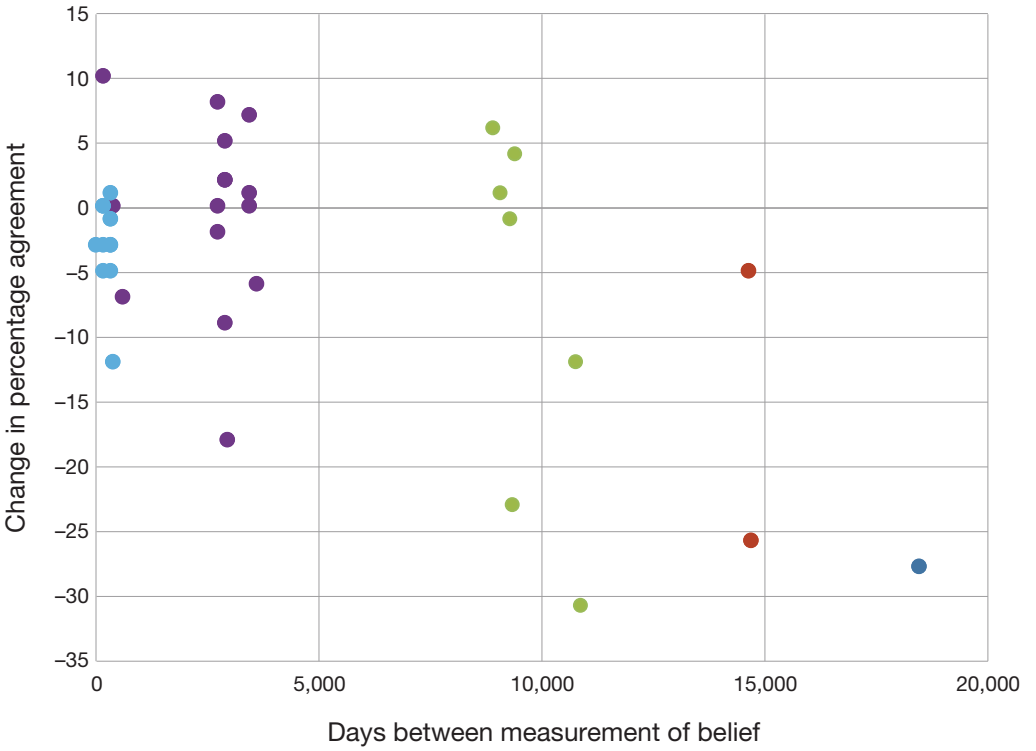
NOTE: Percentage of U.S. adults (n = 1,122) answering, "No opinion" (yellow), "Should NOT get involved" (red), and "Should do more" (blue), by age, when asked whether the government should do more to regulate how internet companies handle privacy issues.

have an important and independent effect if, for example, more-common beliefs are likelier to decrease. That is, a rare belief (e.g., one held by less than 5 percent of population) can go down by only single-digit percentages, whereas a more common belief can change much more in a negative direction.

The results suggest that all three variables likely play a role in the population-level dynamics of conspiracy beliefs. Beliefs with higher starting percentages of agreement tend to decrease over time, as do beliefs measured across greater time intervals. However, we found that, when we controlled for the effect of time interval and percentage initially agreeing, beliefs measured in prior decades showed higher levels of agreement than those of beliefs measured in

FIGURE 5.6

Changes in Percentage Agreeing with Conspiracy Beliefs over Time



SOURCE: Features data from Uscinski et al., 2022.

NOTE: Each dot represents a different conspiracy belief measured at two time points. A negative change in percentage agreement indicates a decline in belief between the two time points, while a positive number indicates an increase in the belief over time. Colors correspond to decades in which beliefs were measured: Conspiracy beliefs were measured in 2020+ (light blue), 2010–2019 (purple), 1990–1999 (green), 1980–1989 (red), and 1970–1979 (dark blue). As shown in the figure, tendency to continue to subscribe to a particular conspiracy theory declines over time.

TABLE 5.4

Linear Model for Change in Conspiracy Beliefs over Time

Variable	Coefficient	*p*-Value
Percent Agree Time 1	–0.22	0.03
Decade	–0.86	0.06
Days Between Measurement of Belief	–0.0032	0.02

NOTE: Outcome is change in percentage agreeing at the second measurement point from the first. $N = 37$ conspiracy beliefs; 33 degrees of freedom; adjusted $R^2 = 0.40$. As shown here, greater time elapsed between surveys is correlated with a statistically significant decrease in reported belief.

more-recent decades (i.e., the coefficient is negative, meaning that higher decadal values, 2010 compared with 1990, show lower belief agreement).

The observation that every individual conspiracy belief has a life span with a beginning and an end does not answer, however, whether conspiracy thinking has increased or decreased over time. Rather, analyzing the frequency of specific conspiracy beliefs is analogous to examining the frequency of specific dishes on the menus of Italian restaurants to identify trends in the popularity of Italian food. Although the observation is informative about the popularity of particular conspiracy beliefs and of the general life span of such beliefs, it does not speak directly to the popularity of conspiracist thinking relative to that of other, alternative cognitive strategies that people could employ. It also does not speak to what is perhaps the most important question for DHS policy: Has the population's willingness to engage in political acts, including acts of violence, changed on the basis of conspiracy beliefs? Survey methods that engage more directly with these cognitive and behavioral aspects of conspiracism than asking about specific conspiracy beliefs have not yet been developed. Given the potential for even fringe beliefs to lead to real-world impact (e.g., violence), this is a possible direction for research that can inform 5G policy.

Database Searches

We also searched data from the Roper Center for Public Opinion Research. According to Roper, the center provides an archive that

> includes polling data from nearly every major organization that has conducted polls in the United States today, including academic, media, foundation, nonprofit and private industry pollsters. The archive also includes data from polling organizations based in other countries. Our data providers understand the importance of research transparency, and making their studies available to future generations of researchers. (Roper Center for Public Opinion Research, undated)

Using a search of Roper's archive for *5G*, two results were returned, and one was deemed to be unrelated to the technology. The single relevant survey item is provided in Box 5.1.

We then tracked that information to its source at Pew (Pew Research Center, 2020). Although the findings might be somewhat dated, some 12 percent of respondents replied that they had heard "a lot" about the connection between 5G technology and COVID-19; this poll was conducted between April 20 and 26, 2020.

We searched NORC at the University of Chicago. In particular, we reviewed any data available from the General Social Survey (GSS) via NORC's GSS Data Explorer (NORC, undated). The GSS Data Explorer did not have any variables related to 5G. The search was then widened to include the term *technology* and constrained to the time period 2002 to 2022. The results yielded 23 questions; five were relevant to this study and are described in Box 5.2.

BOX 5.1

5G Survey Question Identified

How much, if anything, have you heard about each of the following? A connection between 5G mobile-phone technology and the coronavirus:

- A lot
- A little
- Nothing at all
- No answer.

SOURCE: Features information from Pew Research Center, 2020.

BOX 5.2

General Social Survey Tech Survey Questions

I'm going to read to you some statements like those you might find in a newspaper or magazine article. For each statement, please tell me if you strongly agree, agree, disagree, or strongly disagree. . . . Because of science and technology, there will be more opportunities for the next generation. (2006, 2008, 2010, 2012, 2014, 2016, 2018)

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree.

Nanotechnology works at the molecular level atom by atom to build new structures, materials, and machines. People have frequently noted that new technologies have produced both benefits and harmful results. Do you think the benefits of nanotechnology will outweigh the harmful results or the harmful results will outweigh the benefits? (2006, 2008, 2010, 2016, 2018)

Science and technology are making our lives, healthier, easier, and more comfortable. (2014)

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree.

Here are some things the government might do for the economy. Circle one number for each action to show whether you are in favor of it or against it. . . . Support for industry to develop new products and technology. (2006, 2016)

All of the greatest advances for humanity have come from science and technology (2021)

SOURCE: Features information from NORC, undated.

Following this search strategy, we also reviewed variables from the Inter-university Consortium for Political and Social Research (ICPSR). ICPSR is a host of research files, including various social surveys.[1] Our search strategy commenced as follows: First, we ran a query for the term *5G*, which returned more than 600 variables. We narrowed this to a time frame of five years (December 2016 to December 2021), which returned 25 variables. None of the variables was related to 5G technology or public perceptions thereof.

The results for databases that include variables and questions reveal a gap in the literature related to 5G technology from an academic or research standpoint. Although there are technology-related polls and questions for some studies, questions related to 5G specifically are lacking in academic and public opinion research. Whether this is an area of knowledge that needs filling in obviously depends on whether the U.S. population provides or would provide substantial resistance to 5G technology, which at present is not known but clearly must be prioritized alongside other potential risks and opportunities.

The American Life Panel

To examine both segmentation and opinions on 5G or technology in general and related topics to inform our focus groups, we accessed prior work conducted by RAND researchers on the American Life Panel (ALP). RAND researchers have conducted this panel and related surveys since 2003; the sample is nationally representative and has 6,000 members ages 18 and above.[2] Multiple studies have asked questions of the ALP that could relate to acceptance of or resistance to adoption of 5G technology. The most relevant study proposed multiple dimensions to the Truth Decay phenomenon, each measured with a set of approximately six questions, and, by doing so, allowed the research team to characterize demographic and personal background factors that were associated in a regression model with individuals' resistance to Truth Decay (Matthews, Parker, Carman, et al., 2022).[3] Results are provided in Table 5.5.

The overall pattern in Table 5.5 suggests that Americans' stances on the topics measured are determined more by whether they perceive American society to be on their side or they feel disenfranchised from the American social order. Evidence of this is suggested by several people from minority racial groups being less likely than people identifying as White to endorse consensus scientific views or to reject false conspiracy theories. Given these racial patterns, it at first might be surprising that some of the same patterns of rejecting scientific consensus and endorsing conspiracy theories are evident among religious service attenders, evangelical Protestants, and Trump voters (especially compared with people who voted for

[1] Additional information is available at ICPSR, undated.

[2] More about the ALP can be found at ALP, undated.

[3] Full methodological details, including statistical methods, can be found in Matthews, Parker, Martineau, et al., 2021.

Hillary Clinton) in 2016. This observation is consistent, however, with a shared social stance by many religious conservatives, evangelicals, and Trump voters that they too are disenfranchised and not represented well in American society. Notably, educational attainment has only a very weak association with the resistance to Truth Decay items, and all the aforementioned racial and political associations hold after the multiple regression has already removed variation associated with education and income. Again, this is consistent with these patterns being about enculturated feelings of enfranchisement that various segments of the American population have about their society because the racial, religious, and political associations are not "explained away" by controlling for other factors, such as education and income (Matthews, Parker, Carman, et al., 2022).

The findings from the prior RAND research on resistance to Truth Decay set a context for research questions relevant to 5G acceptance. These center on evaluating whether 5G acceptance is another example of the perception-of-disenfranchisement type of social dynamic or whether it might be a more focused dialogue about the technology itself.

TABLE 5.5

Select American Life Panel Regression Results Derived from Matthews, Parker, Carman, et al. (2022)

	Scale of Resistance or Susceptibility to Truth Decay				
Regression Coefficient (unstandardized)	**Endorsement of Scientific Consensus**	**Endorsement of Verifiable Facts**	**Rejection of False Conspiracy Theories**	**Ability to Distinguish Fact from Opinion**	**Willingness to Accept Expert Recommendations**
Age	0.005	0.01***	0.01***	−0.01**	−0.003
Female	−0.06	−0.27***	−0.07	0.002	0.03
Education					
Less than high school	−0.08	−0.11	−0.27	0.02	−0.13
Some college	0.01	0.13	0.02	−0.002	−0.11
College degree	0.31*	0.26*	0.15	0.17	−0.02
Income midpoint (divided by 10,000)	0.02***	0.02**	0.02***	0.01*	0.01***
Race					
Black, non-Hispanic (*N* = 81)	−0.82***	−0.13	−0.55***	−0.49***	−0.13
Hispanic (*N* = 148)	−0.41**	−0.18	−0.40***	−0.27*	0.11
Asian (*N* = 33)	−0.54*	−0.21	−0.35*	−0.24	−0.26
Other (*N* = 26)	−0.96***	0.04	−0.37*	−0.37	−0.38*
Born in United States	−0.17	0.21	−0.19*	−0.01	−0.03

Table 5.5—Continued

Regression Coefficient (unstandardized)	Scale of Resistance or Susceptibility to Truth Decay				
	Endorsement of Scientific Consensus	Endorsement of Verifiable Facts	Rejection of False Conspiracy Theories	Ability to Distinguish Fact from Opinion	Willingness to Accept Expert Recommendations
Religion					
Mainstream Protestant	−0.17	0.16	0.01	−0.13	0.05
Evangelical or Pentecostal	−0.56**	0.28	−0.19	−0.21	0.24*
Nondenominational Christian	−0.44***	0.23*	−0.13	−0.07	0.05
Other Christian groups	−0.05	0.29	0.06	−0.31	−0.04
Jewish	−0.13	−0.23	−0.07	0.09	−0.07
Other religions	−0.3	0.23	−0.17	0.03	0.02
No religious affiliation	−0.25	−0.02	−0.09	−0.01	−0.15
Atheist or agnostic	0.19	0.14	0.20*	0.24	−0.09
Religious service attendance	−0.13***	−0.04	−0.08***	0.01	0.002
Political affiliation					
Democrat	0.04	0.12	0.11	−0.06	0.22***
Republican	−0.06	0.02	0.03	−0.08	0.04
Clinton voter 2016	0.61***	0.17	0.22**	0.38***	0.29***
Trump voter 2016	−0.67***	−0.03	−0.14*	0.08	−0.1

Table 5.5—Continued

Regression Coefficient (unstandardized)	Scale of Resistance or Susceptibility to Truth Decay				
	Endorsement of Scientific Consensus	Endorsement of Verifiable Facts	Rejection of False Conspiracy Theories	Ability to Distinguish Fact from Opinion	Willingness to Accept Expert Recommendations
Constant	2.53***	0.24	3.01***	3.51***	2.77***
Overall model performance					
R^2	0.49	0.22	0.5	0.35	0.15
Adjusted R^2	0.48	0.2	0.49	0.34	0.13
Residual standard error (1,259 degrees of freedom)	1.21	1.05	0.74	1.03	0.75

SOURCE: Features data from Matthews, Parker, Carman, et al., 2022.

NOTE: Base levels: male, high school, non-Hispanic White, born outside the United States, Catholic, independent voting affiliation, voted for other candidate in 2016. Responses of "unsure" have been recoded as the mean of an individual's responses to related questions. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Sample size = 1,291.

Published 5G Survey Data

RAND researchers undertook an extensive search for published survey or behavioral (e.g., consumer purchasing) data about the uptake of or resistance to 5G mobile technology. After contacting many academic and industry data vendors, the team identified two studies published that provided publicly available data on the frequency of 5G conspiracy beliefs (Enders et al., 2021; Uscinski et al., 2022). No other sources of data were found that provided data specifically about 5G.

The authors of both articles (Enders et al., 2021; Uscinski et al., 2022) analyzed 5G beliefs in combination with beliefs in other conspiracy theories, as is common practice for social scientific research oriented toward understanding generalizable principles of human behavior. Our task, however, was to understand patterns specific to 5G beliefs, regardless of whether those patterns were or were not components of more-generalizable belief structures, such as worldviews. Thus, we sought out to examine how well a model could predict the outcome of belief in 5G conspiracy theories using the sorts of demographic variables that are frequently available at national scales for market segmentation work. To accomplish this, we undertook a reanalysis of these published data that used agreement or not with the 5G beliefs as a binary outcome in logistic regression models. For the predictors, we used an expanded set of demographic variables (gender, education, race, income, and political and religious features) because we thought these were the most-relevant predictors for policy applications. We recognize that nuances of individuals' social networks, personal life experiences, and enculturated belief systems might all be more-important causal drivers of endorsement of some beliefs, such as 5G conspiracy theories, than demographics would be (for examples of RAND work that supports this notion, see Matthews, Nowak, et al., 2022, and Matthews, Hertzog, et al., 2023). In policy applications, however, detailed social network, personal, and cultural variables usually are not available. Even if these variables are not causal of 5G beliefs, they still can be usefully predictive of where and when stakeholders, such as DHS, can anticipate more or less resistance to the deployment of 5G technology.

With all that as prelude, the results specifically for 5G beliefs in general reproduce social patterns that are known from prior research on endorsement of conspiracy beliefs. Specifically, members of groups that perceive themselves (often rightly) as relatively disenfranchised are likelier to endorse conspiracy beliefs. Although endorsement of any specific belief might be unjustified by the evidence at hand, the pattern of disenfranchised groups endorsing conspiracies can be seen as metarational in the sense that some of these groups have been the victims of actual conspiracies as one process of their disenfranchisement. For example, the results in Table 5.6 show that Black Americans were likelier than White Americans to endorse the view that "[t]he dangers of 5G cellphone technology are being covered up." Similarly, younger Americans, who experience less wealth and career status than older Americans, endorsed the belief more.

Table 5.6 omits the religious attendance variable from the October 2020 survey results because it was unavailable for this survey. For this reason, we fitted the March 2020 regres-

TABLE 5.6

Logistic Regression Model for Agreement (4 or 5 on 1–5 Likert scale, 3 is undecided) with the Prompt, "The dangers of 5G cellphone technology are being covered up"

	March 2020 Survey (*N* = 2,023)								
	Including Religious Attendance			Excluding Religious Attendance			October 2020 Survey (*N* = 2,019)		
Variable	Coefficient	Odds Ratio	*p*-Value	Coefficient	Odds Ratio	*p*-Value	Coefficient	Odds Ratio	*p*-Value
Intercept	–0.97		0.004	–0.54		0.09	0.15		0.71
Woman	**–0.26**	**0.77**	0.017*	**–0.28**	**0.76**	0.01*	–0.16	0.85	0.18
High school or GED	0.17	1.19	0.51	0.17	1.19	0.51	0.03	0.97	0.93
Some college	0.07	1.07	0.81	0.05	1.05	0.84	–0.35	0.70	0.30
Associate's degree	0.05	1.05	0.87	0.08	1.08	0.78	–0.17	0.85	0.65
Bachelor's degree	0.11	1.12	0.69	0.16	1.17	0.56	–0.51	0.60	0.16
Postgraduate degree	**0.61**	**1.84**	0.047*	**0.74**	**2.10**	0.01*	0.62	1.86	0.10
White	0.25	1.28	0.10	0.23	1.26	0.14	–0.25	0.78	0.13
Black	**0.46**	**1.59**	0.012*	**0.57**	**1.77**	0.002*	**0.65**	**1.93**	<0.001*
Hispanic	0.10	1.11	0.56	0.09	1.09	0.57	–0.06	0.94	0.70
Age	**–0.03**	**0.97**	<0.001*	**–0.03**	**0.97**	<0.001*	**–0.03**	**0.97**	<0.001*
Income	0.02	1.02	0.55	0.04	1.04	0.29	–0.03	0.97	0.45
Republican	0.20	1.22	0.15	**0.31**	**1.36**	0.03*	0.20	1.23	0.27
Democrat	–0.06	0.94	0.62	–0.03	0.97	0.82	–0.02	0.98	0.92

Table 5.6—Continued

	March 2020 Survey (*N* = 2,023)						October 2020 Survey (*N* = 2,019)		
	Including Religious Attendance			Excluding Religious Attendance					
Variable	Coefficient	Odds Ratio	*p*-Value	Coefficient	Odds Ratio	*p*-Value	Coefficient	Odds Ratio	*p*-Value
Religious attendance	**0.23**	**1.26**	<0.001*	—	—	—	—	—	—

SOURCES: Features data from Enders et al., 2021, and Uscinski et al., 2022.

NOTE: GED = general educational development test. Agreement with this belief was stable over time. Twenty-six percent agreed in March 2020, while 23 percent agreed in October 2020. Base levels: Man, less than high school, Asian and other, independent political party. Bolded values are coefficients and odds ratios that are associated with statistical significance where p-value < 0.05. * $p < 0.05$. The table omits the religious attendance variable from the October 2020 survey results because it was unavailable for this survey. For this reason, we fitted the March 2020 regression with and without this variable to maintain comparability but also show all the results.

sion with and without this variable to maintain comparability but also show all the results. The exercise illustrates that, at least in March 2020, there was apparent association of the 5G belief with Republican political party identification that appears to be better explained by an association with frequency of religious service attendance. No political party association, however, is significant in the October 2020 data, with religious attendance absent from the model.

We fitted similar logistic regression models to predict endorsement of a more specific form of 5G conspiracy belief, "5G cell phone technology is responsible for the spread of the coronavirus." The results were similar to those we obtained for the less specific 5G conspiracy belief but with one exception: that, by May 2021, all racial groups were likelier to endorse the connection of 5G with coronavirus than the base-level group consisting of Asian Americans, Native Americans, and mixed-race Americans (Table 5.7). This likely occurred because, by May 2021, the spurious association of 5G with COVID-19 was well-understood to be a xenophobic anti-Asian trope, which means that Americans of Asian heritage in the base level would have been much less likely to endorse this specific 5G belief.

TABLE 5.7

Logistic Regression Model for Agreement (1 or 2 on 1–5 Likert scale, 3 is undecided) with the Prompt, "5G cell phone technology is responsible for the spread of the coronavirus"

	June 2020 Survey (*N* = 1,040)			May 2021 Survey (*N* = 2,021)		
Variable	Coefficient	Odds Ratio	*p*-Value	Coefficient	Odds Ratio	*p*-Value
Intercept	–1.56		0.07	–1.62		0.04
Woman	**–0.69**	**0.50**	0.002*	**–0.39**	**0.68**	0.05*
High school or GED	–0.06	0.94	0.93	–0.52	0.59	0.28
Some college	–0.32	0.73	0.65	–0.85	0.43	0.09
Associate's degree	0.43	1.54	0.55	–0.52	0.59	0.34
Bachelor's degree	–0.09	0.91	0.89	0.11	1.12	0.83
Post-graduate degree	0.55	1.73	0.44	–0.16	0.85	0.78
White	0.17	1.19	0.60	**1.04**	**2.83**	0.02*
Black	0.65	1.92	0.07	**1.50**	**4.48**	0.002*
Hispanic	0.54	1.72	0.08	**1.13**	**3.10**	0.02*
Age	**–0.06**	**0.94**	<0.001*	**–0.06**	**0.94**	<0.001*
Income	**0.19**	1.21	0.009*	–0.11	0.90	0.10
Republican	0.56	1.75	0.11	**0.71**	**2.03**	0.01*
Democrat	0.03	1.03	0.92	**0.74**	**2.10**	0.002*
Religious attendance	0.35	1.42	<0.001*	0.41	1.51	<0.001*

SOURCE: Features data from Enders et al., 2021, and Uscinski et al., 2022.

NOTE: Agreement with this belief decreased over time. In June 2020, 11% agreed, while 7% agreed in May 2021. Base levels: Man, less than high school, Asian and other, independent political party. Bolded values are coefficients and odds ratios that are associated with statistical significance where p-value < 0.05. * $p < 0.05$.

CHAPTER 6

Public and Expert Views of 5G

As part of our effort to identify and assess the potential impact of public perceptions of 5G technologies, we first engaged the public through focus groups and then engaged relevant experts and DHS stakeholders through semistructured discussion sessions and interviews. These engagement efforts allowed us to collect original qualitative data about public perceptions of 5G and to contextualize those perceptions in relation to expert and stakeholder knowledge of 5G technologies and their current and planned uses.

Methods

We conducted focus groups, group interviews, and one-on-one interviews. One researcher led each research session as a facilitator and one or two other researchers served as note-takers. These sessions are summarized in Table 6.1. Our group and one-on-one interviews were semistructured, key-informant interviews. Key-informant interviews engage people with special knowledge or influence (i.e., experts) that "give them broader perspective or deeper insight into the topic area" (Wolff et al., 2018). These interviews were used as systematizing interviews, meaning that the participants were another source of information to complement the data gathered through other methods (Bogner, Littig, and Menz, 2018). Our focus groups and interviews were exploratory because it was difficult to identify key stakeholders without insight into a clear use case or DHS program focused on integrating 5G technology. As a result, these methods would not necessarily provide a full assessment of the relevant questions. All consent language and discussion prompts for all three study methods are provided in Appendix B.

For the focus groups, we worked with a recruiting vendor to convene three groups of eight to 12 people of diverse ages, races, and educational backgrounds. Because DHS might seek to use 5G technology at critical infrastructure sites, understanding the attitudes of people who live near or use these sites was central to identifying potential public concerns that might affect DHS adoption of 5G technologies. We therefore invited people who lived within 20 miles of one of three types of critical infrastructure sites (airports, seaports, or U.S. land

TABLE 6.1
Public and Expert View Methods

Method	Number of Participants	Research Staff		Sample Subject Addressed
		Facilitators	Notetakers	
Public focus group (75 minutes each)				
On airports	8	1	2	• Their interactions with mobile technologies • Their interactions with 5G technologies • Benefits or problems related to using 5G for their personal or professional activities • Whether 5G might affect their activities at a local infrastructure site (airports, seaports, or U.S. land borders) • Any perceived effects of 5G on national security and human health
On seaports	11	1	2	
On U.S. land borders	12	1	2	
Expert group interview (90 minutes each)				
With conspiracy-theory experts	6 (4 U.S. academics, 1 UK academic, and 1 U.S. think-tank researcher)	1	2	• 5G conspiracy theories and their relation to other conspiracy beliefs • The process through which beliefs are spread • Major sources that promote conspiracy thinking • Strategies that might be employed against misinformation
With 5G technical experts	5 (1 U.S. academic, 1 Italian academic, 2 U.S. industry experts, and 1 non-DHS federal expert)	1	1	• Development and use of 5G technologies • The potential benefits of 5G adoption and use • Potential impacts of 5G adoption and use on critical infrastructure, workplace environments, households, and public settings • How 5G adoption might affect particular sectors, such as law enforcement, health care, and consumer data and privacy
DHS stakeholder interview (60 minutes each)				
Group interview	4	1	1	• Anticipated and planned uses of 5G across DHS • Expected benefits and limitations of 5G • Potential impacts of 5G adoption and usage on DHS operations • Perception of how the public views 5G • Whether public perceptions are a factor in decisionmaking related to 5G adoption
Individual interview	1	1	1	
Individual interview	1	1	1	
Individual interview	1	1	1	

NOTE: DHS stakeholders were from S&T, CBP, or the Office of the Chief Information Officer (OCIO).

borders) or who reported having had at least two interactions in the past year with one of the sites. The focus groups aimed to

- assess whether members of the public who were somehow associated with critical infrastructure sites were aware of 5G technology and its potential uses
- assess any awareness of or belief in conspiracy theories about 5G.

Upon completion of the focus groups, researchers used qualitative, thematic coding to analyze the information collected and identify key takeaways. The full data and approach to coding are provided in Appendix C.

For the interviews, we used a convenience sample to convene two groups of experts, one focusing on conspiracy theories and the other on 5G technology. We likewise convened a group of DHS stakeholders interested in 5G technologies for both a group interview and one-on-one interviews.

For the conspiracy-theory expert interview, we sought participants with subject-matter expertise in conspiracy theories; mis-, dis-, and malinformation; and communications. We also ensured that they were from different academic disciplines (i.e., psychology, political science, communications, and anthropology). The assembled group included four participants from different academic institutions in the United States, one participant from an academic institution in the UK, and one participant from a nonpartisan think tank in the United States. We sought to include at least one participant from Europe to gain insights on the anti-5G activities that have occurred there (Jolley and Paterson, 2020; Sturm and Albrecht, 2021). We convened a 90-minute session with conspiracy experts aimed to

- gather additional information on conspiracy theories, how false beliefs can spread, and the impacts that those beliefs can have on public perceptions
- identify any relevant context through expert knowledge for the themes we identified during the focus groups.

Similarly, for the technical expert interview, we sought participants with subject-matter expertise in 5G technology across different disciplines (i.e., cybersecurity, electrical and electronic engineering, data analytics, and material science). The assembled group included one participant each from an academic institution in the United States and Italy, two participants from industry in the United States, and one participant from a U.S. federal department outside of DHS. As with the conspiracy-theory experts, we sought to include at least one participant from Europe to provide information in the context of the anti-5G activities there. We convened a 90-minute session intended to help us understand

- how 5G technology developed and the main actors involved in its development and use
- the potential impacts of 5G adoption in different sectors (e.g., health care, law enforcement) and risks associated with the technology

- truths and falsehoods in public perceptions of 5G (particularly those raised by our focus group participants) and any interventions that might address public misperceptions or concerns.

Finally, for the DHS stakeholder interviews, we identified 11 potential participants from across DHS with technical subject-matter expertise in mobile technologies or experience in programs that were implementing or seeking to implement 5G applications. Through consultation with the 11 potential participants, we identified 16 total DHS stakeholders across seven components (CBP, the Cybersecurity and Infrastructure Security Agency, FEMA, S&T, the U.S. Coast Guard, the Countering Weapons of Mass Destruction Office, and OCIO). We invited all 16 stakeholders to participate and completed interviews with seven participants representing three DHS components: S&T, CBP, and OCIO. We convened four 60-minute key-informant interview sessions: three one-on-one sessions and one group interview session. These sessions with DHS stakeholders aimed to help us understand

- DHS's interest in and planned uses for 5G technology and the potential benefits and limitations of 5G technology for DHS
- any relevant context through expert knowledge for the themes we identified during the focus groups
- whether there are DHS-specific considerations for identifying and addressing public perceptions of 5G and whether DHS had already made any public messaging or engagement efforts to mitigate 5G risks.

Upon the completion of the interview sessions, the lead facilitator and notetaker held a debrief session to review notes and identify key takeaways from each interview.

Findings

Public Perception Focus Groups

Overall, we found similarities across the three focus groups in relation to 5G awareness, usage, and perceived benefits. All participants reported awareness and use of 5G, and multiple people across all groups reported using 5G both personally and professionally. Although we did not select people specifically for prior use of 5G, we did enroll only people who had responded affirmatively to a screener question that they had both knowledge and opinions about 5G. Consequently, the screening criteria appeared to have effectively enrolled only 5G users. In terms of perceived benefits, all groups reported that the greater speed of 5G for devices is a desirable feature of the technology.

In addition, we found that participants similarly expressed concerns about data privacy and protections across all groups. Participants discussed their beliefs that companies were tracking user data through technology use. When prompted to consider how 5G technologies might be used by the U.S. government or law enforcement, there was consensus among

the groups that the U.S. government was not tracking user data in the same way that participants said that they believed that corporations did. However, participants generally reported believing that the U.S. government could easily gain access to any data from companies for government investigations or other government purposes. This assertion echoes the findings of a Pew Research Center study that determined that a majority of Americans reported believing that it was not possible to go through daily life without having their data collected by companies or the government (Auxier et al., 2019). Accordingly, this perception among focus group participants highlights the public's uncertainty of what is legally permissible for the government.

Although there were no significant differences across the groups seemingly related to participants' reported geographic proximity to or regular experience with the selected critical infrastructure, there were variations across the groups in their perceptions of adversaries' use of 5G in relation to national security and in their perceptions of 5G's potential impacts on human health. Across all groups, participants mentioned China and Russia most often as a foreign actor that might use 5G technology in the United States, although only participants within the airport focus group seemed aware of the backdoor-to-data potential posed by Chinese 5G hardware (Gonzales et al., 2022). Participants in the airport focus group also consistently reported perceptions that 5G technology was safe for human health. Participant perceptions in the seaport focus group diverged from those in the airport focus group on this topic. Some seaport focus group participants reported perceiving that 5G technologies posed no greater risks to human health than prior mobile technologies (e.g., 4G and 3G technologies) had, while others said that they thought that 5G definitely posed greater risks to health than prior mobile technologies had. Participants in the land border focus group exhibited a consensus that 5G technology had negative impacts on human and environmental health that were worse than those of prior mobile technologies. Given the sample sizes of each group and that there was only one focus group per critical infrastructure site, these differences in perceptions of potential impacts on national security and health cannot be generalized to the larger public based on geographic proximity to or experience with specific critical infrastructure sites. Nevertheless, these findings indicate that there are differences in terms of public perceptions of risks from 5G to human and environmental health. Additional focus groups with new participants would be needed to determine whether different patterns of health perceptions are correlated to proximity to or experience with the specific infrastructure sites.

Conspiracy-Theory Experts

We identified three takeaways from the discussion session with conspiracy-theory experts on the state of academic research on conspiracy belief formation, the relationship between belief formation and action, and strategies for combating conspiracy theories. First, our discussion yielded the takeaway that the academic literature presents several potential explanations for individual and elite conspiracy belief formation. Some experts emphasized intrinsic personal characteristics (i.e., being motivated to believe conspiracies) as a key reason people

believe conspiracy theories. One expert specified a personal characteristic of "needing to explain phenomena" as being linked to conspiracy theorizing. Another expert expressed that some conspiracy theorizing might be rational in that conspiracies sometimes do happen, leading people to be rationally suspicious of authorities.[1] In addition, we learned that the impact that elite endorsement (i.e., when notable politicians or other public figures express belief in a theory) has on people's belief formation is disputed. In discussing how increases in elite endorsements of conspiracy theories might encourage uptake by the public, one expert countered that polling in the United States indicates that beliefs in conspiracy theories have remained stable over years (Uscinski et al., 2022), with belief that there is a cover-up about the dangers of 5G cell phone technology present among approximately 20 percent of the U.S. population (Enders et al., 2021). Another expert asserted that elites might behave as opportunists who claim belief in conspiracy theories only as an appeal to potential fans or voters.

Our second takeaway from the conspiracy-theory expert discussion session was that there were also differing explanations for the relationship between the formation of conspiracy beliefs and whether someone would take action because of those beliefs. The experts were in agreement that it remained difficult to predict whether someone would take violent action based on their beliefs in particular conspiracy theories (e.g., whether someone would participate in an attack on 5G infrastructure because of beliefs that the 5G technologies cause harm). They also agreed that there were more "believers" (i.e., people who believe in conspiracy theories) than "actors" (i.e., people whose belief in conspiracy theories mobilizes them to take an associated action). However, they noted differences in explanations for why someone might be mobilized to act. Some experts suggested that researchers might need to consider additional psychometric or cultural constructs known to be linked to violence to understand the link between individual beliefs and violent actions.[2] A few of the experts argued that elites could be important to mobilizing people to move from belief to action en masse, although, as noted above, there was disagreement on the role that elite endorsement might play in the development of public perceptions and beliefs.

[1] For example, there was some discussion among participants about the hepatitis B vaccination campaign held in 2011 in Abbottabad, Pakistan, which was run by the Central Intelligence Agency to surreptitiously get deoxyribonucleic acid (DNA) from Osama bin Laden's family (Chappell, 2014; Ghattas, 2014; Summers and Morrison, 2014). Following the incident, global health officials and aid workers spoke about how reports on the fake vaccination campaign, regardless of their veracity, could fuel conspiracy theories and damage public health efforts (Brumfiel, 2011; Lenzer, 2011; Reardon, 2011). Research has connected insurgent violence against later vaccination campaigns in Pakistan to beliefs that immunization drives are a cover for espionage (Kennedy, 2017; Kennedy, McKee and King, 2015; Khan and Qazi, 2013) or that they are a part of "the West's interest in trying to regulate fertility, sterilize women, or introduce AIDS [acquired immunodeficiency syndrome]" in Pakistan (Reardon, 2011).

[2] For example, an expert noted that the dark triad personality score could be used to understand how someone might pursue violent action related to conspiratorial thinking. The dark triad personality score is a validated psychometric measure shown to correlate with self-reported violent behaviors, such as punching someone to achieve an outcome or threatening another person with a knife. It was used in a RAND study to examine white-supremacist extremism (Williams et al., 2022).

The final key takeaway identified from the conspiracy-theory expert session was that there are several approaches for combating the belief in and spread of conspiracy theories, including strategies for public messaging. The experts discussed how organizations that plan on implementing 5G technology should consider proactively identifying "easy villain narratives" in order to anticipate the types of conspiracy theories that might develop in reaction to 5G applications.[3] One strategy would be to aggressively countermessage the foundational arguments of conspiracy theories by explaining the science behind 5G and presenting studies demonstrating its safety, but a minority of participants noted that understanding the science behind a technology might be relatively unimportant to what makes most people accept technology or not. Another strategy could be to co-opt a conspiratorial leader and have them change their messaging, although this presents credibility challenges for the conspiratorial leader that could render the strategy ineffective.[4] During the session, the experts also noted that any messaging strategy should be tested before broader implementation with the public. Finally, the experts suggested that identifying and managing online and offline social spaces in which conspiracy theories are usually spread would help to combat conspiracy-theory proliferation. For example, a regulatory agency could require that social media platforms place warning labels on posts that contain known conspiracy theories, or they could label foreign-actor accounts that promote conspiracy-theory content. However, the current legal framework in the United States cannot effectively regulate social media platforms, so new laws would be required to pursue this strategy (Brannon, 2019; Napoli, 2019), and, more generally, different approaches to platform governance are a topic of continuing scholarly and government consideration globally.

Technical Expert Discussion Session

We identified two takeaways from the discussion session with technical experts on the current phase of 5G technology development and how this phase affects industry stakeholders, use cases, and mitigation of potential vulnerabilities. Most important is the first takeaway: At the time of this study, the technical experts said that they did not believe that available 5G technology and infrastructure were consistent with a true 5G network, even if such a network did provide faster speeds than standard 4G technology. One expert stated that the network was better described as "4.5G, not 5G." During the session, the experts discussed barriers to full deployment of a 5G network, including that it would be very costly, with few incentives for major, private network operators, such as Verizon and T-Mobile, to move away

[3] Easy villain narratives are existing stories or existing conspiracy theories that consistently focus on the same bad actors, such as "globalists," "international elites seeking to impose a new world order," or "interdimensional overlords."

[4] As an example, the experts discussed instances in which former president Donald Trump was booed by his own supporters for publicly encouraging them to get the COVID-19 vaccine (Blake, 2021; Smith, 2021) and revealing that he had received a COVID-19 booster shot (Colvin, 2021), after repeatedly coming out against vaccine mandates.

from legacy technology and infrastructure. In addition, one participant suggested that commercial organizations might be hesitant to accelerate deployment due to the "hysteria" in the UK around the frequency levels for 5G, even though, the expert noted, there is no scientific evidence that 5G is harmful to human health. Because of these factors, there was consensus among the participating experts that 5G network deployment and use-case development would be incremental. And, because of this incremental process, the development of a sixth-generation (6G) network could outpace that of 5G.

The second takeaway from the technical expert session is that the incremental nature of the deployment of the 5G network has influenced the variety of industry stakeholders involved, use-case development, and mitigation of potential vulnerabilities. The experts noted that there were differences between commercial entities with a business model of providing network coverage and those with a business model of developing technologies, with the network providers lacking incentives to accelerate 5G deployment. Two experts discussed how this distinction had created market space for smaller competitors to pursue use-case development, although smaller companies likely rely on off-the-shelf hardware, such as microchips, from other, larger companies as key components of their products. Without the broad deployment of 5G technology and infrastructure, commercial entities work with individual clients to provide technical solutions for use in specific settings, such as hospitals, universities, and warehouses. Participants in the session also discussed how the diversity of industry stakeholders and their solutions could help mitigate some cybersecurity threats because the varying solutions would have a variety of vulnerabilities to exploit. However, one expert stated that this technical variation could also create vulnerabilities in that it would be difficult to determine whether all the "layers" of the 5G network and its infrastructure were secure. Additionally, this expert noted that current 5G standards did not yet fully cover all needed areas in terms of security, although the National Institute of Standards and Technology was working on developing standards.

U.S. Department of Homeland Security Stakeholder Discussion Sessions

We identified three takeaways from the interviews with stakeholders on 5G technology use cases, 5G's potential benefits, limitations, and impacts in the context of DHS operations and DHS's current approach to public messaging. The first takeaway is that DHS had identified some potential use cases, although components did not have a complete understanding of how 5G might affect capabilities. During each of the interview sessions, stakeholders discussed broad potential for investigative uses of 5G, including improved video transfer capabilities and its possible interoperability with other technologies, such as low earth orbit satellites. However, all participants also suggested that the DHS components were not fully engaged with planning for use-case development and implementation because 5G technology and infrastructure were not perceived as being advanced enough. As a result, one stakeholder observed, components were pursuing individual use cases, which varied in development

timing and deployment location. In keeping with our findings from the technical expert discussion session, one stakeholder noted that the development of 6G technology could outpace 5G development and implementation, which the stakeholder perceived as a challenge for promoting interest and planning in 5G application development across the department. Nevertheless, this incremental development and implementation of 5G applications should provide DHS with sufficient time to plan for adoption and address the public's concerns through messaging. This main takeaway shapes our other conclusions from the stakeholder interviews about the technology's benefits, limitations, and impacts and DHS's approach to messaging.

The second takeaway is that, at this phase of technology and infrastructure development, it is challenging for DHS to fully understand the potential benefits, limitations, and impacts that 5G technology could have for DHS operations. During all four interview sessions, stakeholders discussed how 5G would make communications stabler and data securer because of the technology's level of encryption. Additionally, one expert noted that the increased bandwidth of 5G would improve video transfer capabilities that can be critical for investigations by law enforcement. However, the stakeholders also noted that these potential benefits are equally available to criminal organizations and adversaries, posing challenges to law enforcement by curtailing the ability to access data critical to investigative missions. Two participants spoke about these challenges in the context of child sexual exploitation, with one noting that 5G's data transfer and encryption capabilities enable sharing of abuse materials and the creation of larger user communities that are difficult for law enforcement to identify, locate, and shut down.

Finally, stakeholders in all four sessions stated that the current stage of 5G technology development also affects DHS's approach to public messaging in that use-case implementation was too far away for DHS to seek potential public perceptions and develop related messaging at the time of the study. As a result, the participants were not aware of any current or planned messaging efforts within the department on potential DHS uses of 5G. However, when asked to consider the concerns raised by focus group participants, two participants discussed how future messaging should target public misperceptions related to data collection, privacy, and use (i.e., messaging should clearly communicate actual government capabilities, which are less expansive than the public imagines). Despite DHS stakeholders' lack of attention to public perceptions of 5G, participants did discuss engagement with other federal agencies, Congress, and industry during three of the interview sessions, suggesting that, at this stage of technology development, external stakeholder engagement was important even if public engagement did not yet seem necessary.

Contextualizing Public Perceptions and Expert Knowledge

When we consider the findings from engagement with the public through the focus groups in the context of the information collected from experts and DHS stakeholders, two important points emerge about the phase of 5G technology development and public perceptions of

5G. First, the technical experts and DHS stakeholders emphasized that full deployment of a 5G network and infrastructure has yet to be completed, which constrains use-case development and public messaging. For example, at this phase, commercial entities provide technical solutions for specific settings, such as hospitals, universities, and warehouses, rather than develop applications for broad implementation. For DHS, this phase leads components to pursue individual efforts that vary in development timing and deployment location. DHS stakeholders noted that this incremental deployment made it difficult to promote interest and planning in 5G application development across the department. Although there have been efforts to engage industry and other federal entities in information-sharing and collaboration, the DHS stakeholders who were interviewed stated that use-case implementation was not at a place for DHS to consider public perceptions of the technology and attempt engagement through messaging.

Regardless of where the technology and infrastructure actually were in development and implementation, the experts agreed, the public believed the 5G network to be fully deployed. This second point is important because, when any messaging is crafted, it will need to take into consideration the gap between expert knowledge and public understanding. Although we did not find strong conspiratorial beliefs about 5G among the focus group participants, we did identify persistent concerns about data collection, use, and privacy in general. As such, stakeholders might want to focus on explaining how data are collected and used and how privacy will be protected, particularly in relation to government access of data collected by corporations, in any future messaging about DHS use cases and implementation. Our findings indicated also variation in focus group participants' perceptions of risks posed by 5G for human and environmental health, which indicates the potential for perceived health risks to become a public concern. A larger number of focus groups or other types of public engagement might be needed to determine whether public perceptions of 5G-related health risks need to be targeted in stakeholder messaging.

CHAPTER 7

Conclusion

Public perceptions could delay or prevent the successful integration of new technologies into the homeland security mission. We examined public perceptions about new technologies, with a focus on 5G, to identify potential barriers and facilitators to adoption. Improving our understanding of public perceptions will help DHS increase the likelihood of success and will expedite the transition of new technologies into efforts for securing the critical infrastructure.

We applied both quantitative and qualitative methods, including literature reviews, secondary data analysis of segmentation data from the insight industry, social media analysis, expert panels, stakeholder meetings and interviews, and focus groups, to study public perceptions. The key findings are as follows:

- Applications of 5G could improve DHS's ability to protect critical infrastructure in ways that the public will observe in airports, border crossings, and emergency services. However, little information has been disseminated about the intended DHS applications of 5G.
- Beyond the use for cell phone services, the general public has little awareness of the intended applications, true risks, or benefits of 5G to DHS's security mission or to other aspects of their lives, including health. As with other technologies, the public are concerned about privacy issues but have little awareness or concern about specific 5G applications.
- Public awareness and perceptions about 5G for security are likely to change as more details about applications are released. Public perceptions should be tracked and reassessed as 5G applications move through the different stages of technology readiness and implementation.
- Public concerns about privacy associated with 5G are likely to be derivative of public concerns about privacy implications of other kinds of technology (especially social media). People are more concerned about these privacy issues with data in corporate hands than in government hands.
- Conspiracy theories are a special type of public perception that reflect very salient and often extreme perceptions held by a segment of society. There are many 5G conspiracy theories, and some have been connected to violence. However, most of the public does not engage with these theories, which suggests that they are a latent but not prominent threat.

- The volume and magnitude of conspiracy beliefs can change quickly because of environmental factors (e.g., COVID-19) and should be monitored as new technologies are integrated. However, support for conspiracy theories tends to decline over time, becoming less threatening to mature technologies.
- More data collection and analyses are needed to understand key issues related to public perceptions of technology integration, including measures of baseline levels of trust in technology, confidence in DHS, and privacy issues.
- Additional research is needed to identify the concerns of different demographic and geographic segments so tailored communication plans can be developed as technologies are introduced and integrated.
- DHS has an opportunity to clarify government capabilities and intentions before misperceptions and conspiracy theories become widespread. Messaging should emphasize that there are legal frameworks governing DHS collection and use of data independently of technology and that, as technology evolves, protections will evolve with it.
- Finally, we recommend that, to prepare for the next wave of technology and attendant public perceptions, DHS undertake a future study on the implications of 6G development on 5G and public perceptions.

DHS should develop a comprehensive framework to monitor and maintain the uniformity of its messaging strategy as it moves through the different technology readiness levels (TRLs). This framework would involve tracking the progress of the messaging strategy across the different TRLs and implementing quality control measures to ensure that messaging remains consistent and effective. By doing so, DHS can ensure that all stakeholders involved in assisting the department are aligned and working toward a common goal. This framework would be instrumental in ensuring that DHS's messaging is cohesive, effective, and reflective of the department's goals and objectives.

Implementing a framework requires sufficiently detailed understanding of the sociocultural dynamics that surround the technology seeking adoption. Our focus groups indicated that much 5G technology might be adopted passively as people upgrade their cell phones, but these focus groups were necessarily biased samples that focused on people with some opinion about 5G. Given the still early stage of 5G rollout, the focus groups therefore likely were early adopters of the technology and so might not reflect the resistance that might come from the broader population.

Our regression analyses of secondary data about attitudes about 5G, including endorsement of 5G conspiracy theories, suggested that the data show some similar patterns to those in other forms of technology resistance, such as vaccine hesitancy. For example, members of racial and ethnic minority groups, who have been victims of actual conspiracies by actors aligned with the U.S. government, were likelier to endorse resistance to 5G, which is a pattern in common with vaccine hesitancy research. However, a message strategy that focuses solely on minority resistance would be ineffective because the effect size is small enough that the majority of technology-resistant people are White. The minority pattern is not invari-

ant either because Asian Americans were less likely to endorse the 5G–coronavirus conspiracy theory once it was widely known to be an anti-Asian trope. Additionally, segments of the White population tied to historically low social mobility could feel disenfranchised, as reflected in some of the patterns in our analysis of secondary data and as discussed in greater detail in Matthews, Hertzog, et al. (2023, pp. 46–50, 85–86).

In aggregate, these findings suggest that trusted messengers for 5G adoption would include those who have a following among the diverse segments of the U.S. population that tend to distrust government intervention. Message content might focus on trust dynamics as well, but specific messages need to be tested prior to mass deployment to avoid massive errors that can arise from ignoring cultural specificities (e.g., most Asian Americans do not endorse the 5G–coronavirus link). The nature of culture is that each social group has a culture, specifically; culture is not some abstract statistical axis of variation.

Although this study was extensive, several relevant topics were beyond its scope that should be addressed in future research. First, we need to acquire a better understanding of how industries that develop and release 5G technologies used by the general public identify and address the interaction between the public and new applications. Future research could include various industries directly in the study through expert panels and workshops for collaboration and information-sharing, helping identify practices that are common in the technology field but might not be transparent to the policy and research communities. This research could examine

- pervasive theories, such as the deep state or the COVID-19 pandemic as related to planned technology rollouts
- methods and data used by industry to assess levels of risk, analyze target audiences, identify trusted messengers, study online behavior, and develop outreach and marketing plans with clear objectives for new products
- examples of positive applications of the technology by industry, including detailed assessments of recent use cases
- data privacy and safeguarding efforts, especially for communities of color.

Second, future research should examine how DHS employees experience, use, and consider new technologies. Technology has become an integral part of the workplace, yet its ability to beneficially affect organizations is largely dependent on acceptance from employees. In the past 50 years, focus has increased on understanding human behavior as it relates to the adoption of new technologies in the workplace. There are many factors to consider when developing a technology implementation plan, such as industry type, size of the company, and workplace composition, that present challenges to creating a one-size-fits-all guide for implementing new technology successfully (Roupas, 2008).

Finally, a general model of technology communication should be developed that aligns different communication channels and identifies the content and type of communications that are required for each TRL. Stemming from our findings that public perceptions of tech-

nologies change over time and people vary in their views of technology is our opinion that a general model of technology communication is needed that can adapt to a variety of technologies, public perceptions, and audiences. The general model could be adjusted and applied for future technologies to be introduced by DHS and align with the current stage of technology readiness so that public messaging can be both specific and timely. For example, RAND researchers have developed a communication strategy to counter misinformation related to COVID-19 vaccines based on the message, sender, and audience that could be aligned with the TRLs, with specific communication tasks associated with each level.

APPENDIX A

Technical Background on 5G

This appendix provides a brief overview of 5G technology with examples of law enforcement usage and future capabilities. It is informed by a 2022 RAND report, *Broadband Communications Prioritization and Interoperability Guidance for Law Enforcement* (Harrison et al., 2022).

The evolution of mobile broadband for the first through fourth generations can be summarized as follows: analog voice calls (first generation [1G]), digital cellular technology (second generation [2G]), mobile data transmission (3G), and internet-compatible mobile devices (4G). 5G ushers in higher data speeds, quicker responsiveness, and greater connectivity between devices—these attributes encompass the previously mentioned enhanced mobile broadband; ultrareliable, low-latency communication; and mMTC, respectively.

The ability to operate over broad bandwidth also makes 5G highly effective. The band frequencies are categorized into low, mid, and high. Low-band 5G includes frequencies below 2 gigahertz (GHz); although it is slow, this band can cover great distances. Midband range, between 2 and 10 GHz, has a decent coverage area and is widely use outside the United States. It includes Wi-Fi and current cellular frequencies. Last, high band, in the 20- to 100-GHz range (also called *millimeter wave*), has a shorter range, but the unused spectrum is ample and translates to fast speeds for consumer applications, up to 800 megahertz (MHz) at a time.

Harrison and his colleagues reported that, in recent years, mobile providers had doled out 5G to cities across the country. AT&T led the way, providing its 5G+ (high band) in 35 cities, while T-Mobile had 5G in seven cities. Verizon has estimated that it would provide its 5G high band, called Ultra Wideband, to 175 million by the end of 2022. The infrastructure for high band includes smaller, low-power base stations or more-powerful macrocells.

The authors of the 2022 report, Harrison et al., noted two valuable 5G-enabled technologies for law enforcement and emergency service usage. The first is the use of uncrewed aircraft systems, which require real-time video capability, low-latency transmission, and the ability to maintain control of the system from the ground. These systems can have diverse applications, including package delivery and air transportation for people. There are many pilot programs for uncrewed aircraft systems, and although their full-scale realization is still in its infancy, 5G technologies are critical for their missions.

Next, mobile cell sites of varying capabilities and sizes called *cell sites on wheels*, *cells on wheels*, *cells on light trucks*, and *satellite cells on light trucks* provide many advantages over traditional cell towers. These mobile cells can provide broadband in large rural areas, where

cell service has been disrupted or saturated, or in emergency or disaster zones. In the future, 5G will enable a variety of technologies, including

- communication within vehicles as they become more autonomous
- communication between vehicles and smart roadways to manage traffic and roadway safety
- virtual and augmented reality functions—including applications that require real-time responsiveness, such as remote surgery
- mixed reality—a combination of augmented and virtual reality for both entertainment and industry
- speed and capacity to create internet-of-things ecosystems
- smart cities with such applications as monitoring traffic conditions, parking availability, refuse pickup, and guidance for smart vehicles to avoid congestion.

APPENDIX B

Consent and Discussion Prompts for Focus Groups and Expert and Stakeholder Interviews

This appendix contains the consent language and discussion prompts for the focus groups and expert and stakeholder interviews completed during the study. They have not been edited.

Consent and Discussion Prompts for Focus Groups

Thank you very much for taking part in our focus group today. My name is [facilitator name], and I work at RAND, a non-profit research center.

Our discussion today is part of a larger project that is funded by the Department of Homeland Security. We are holding this focus group to try and understand public knowledge, perceptions, and support or resistance surrounding the use of 5G technology. Your full confidentiality will be maintained unless we receive written authorization from you to use your name in RAND reports.

We really appreciate that you agreed to speak with us today. You were invited because we wanted to talk with people who have a diversity of knowledge and/or opinions about 5G.

- The format is a group discussion guided by questions. There are no right or wrong answers, but there are different points of view. Please feel free to share your point of view and experience, even if it differs from what others have said. We are interested in both positive and negative comments.
- We do not expect any of this information to be sensitive or uncomfortable, but you do not have to answer any questions you do not want to answer.
- This focus group is informational and in no way constitutes an experiment of any kind.
- We want to hear from as many of you as possible, so please give everyone (at the table/on the call) opportunities to participate. It is best if only one person speaks at a time.
- The discussion is expected to last for about one hour and 15 minutes.
- As a reminder you each will receive $100 for your participation today.

If you have any additional questions or concerns about the research, you may contact one of the two the principal investigators, Dr. Douglas Yeung dyeung@rand.org or Dr. Joe Eyerman jeyerman@rand.org.

Are you comfortable with and do you agree with all of these terms? Verbal agreement: yes or no.

Background

1. Could you please tell us your first name, your occupation, and where in the US you live?

Technology

2. On a daily basis, what type of interaction do you have with mobile technology? And have you used 5G yet?
3. How would a switch to 5G affect your life?
    a. Would 5G primarily affect your work or personal activities?
    b. Are there benefits for you personally from the switch to 5G?
    c. Are their [sic] problems for you personally from the switch to 5G?
4. Would 5G affect your activities specifically near or at airports/seaports/US land borders? [use appropriate prompt for that focus group's theme]
    a. Do you have ideas more generally [clarify "outside of your own activities" if needed] about how 5G might affect airports/seaports/US land borders? [use appropriate prompt for that focus group's theme]
    b. Does anyone take different precautions when they travel internationally? Those might include not doing certain types of online activities, switching sim [sic] cards or phones, or using disposable credit cards sometimes called a burner card?
5. Do you think 5G technology will have more effect on human health than previous generations of mobile/cellular technology, or do you think it is about the same?
    a. How bad do you think 5G specifically, or cell signals generally, are for human health?
6. Do you think 5G technology will make the United States safer?
    a. In what ways?
7. Could 5G technology be used against the United States by our adversaries?
    a. How do you think?
    b. Could 5G technology be used by the government and law enforcement against US citizens? In what ways?
    c. Is use of 5G a way to track or monitor citizens daily behaviors?
    d. Would 5G be used to track or monitor schools or universities?

APPENDIX C

Themes Coded from Public-Perception Focus Groups

After the public focus groups were complete, the three RAND researchers who were present at them met several times to iteratively develop a set of themes to code from the notes. Themes were developed inductively based on the notes (to maximize participant comfort and candor, focus groups were not recorded). Each researcher reviewed the compiled notes of the focus groups and, first independently then through collaboration, developed a set of 22 themes that captured the topics discussed in the focus groups. Two researchers then coded the absence, single mention, or multiple mentions of each theme within the compiled notes. The raw interrater agreement for the coders was 68 percent for the airport focus group and 59 percent for both the seaport and land border focus groups. Because there were only three primary documents to code (i.e., one compiled note set from each focus group), iterative consultation and coding to improve interrater agreement was not feasible. Instead, the coders reviewed the notes and reconciled each coding disagreement. The results in this appendix show the codes they assigned and the codes to which they agreed (reconciled) after meeting to discuss each discrepancy in their independent coding. The findings in this report reflect that final and reconciled dataset.

In Tables C.1 through C.3, a code tree is represented in the first three columns, with "Category" being the grandparent code, and "CodeL1" and "CodeL2" referring to the level 1 and level 2 (or child and grandchild codes) of each category. The remaining columns record whether each coder found that topic in the focus group discussion once (1), more than once (2), or not at all (0). Each focus group has an "Agreement" column and a "Reconciled" column. "Agreement" indicates whether coders agreed on the number of times a theme was mentioned and is binary, with 1 being agreement and 0 being disagreement. Finally, each "Reconciled" column is what the code to which it was reconciled if disagreement took place.

TABLE C.1

Qualitative Coding Data from the Airports Public-Perception Focus Group

			Coder			
Category	CodeL1	CodeL2	1	2	Agreement	Reconciled
Prior 5G usage						
	Personal		2	2	1	—
	Professional		2	2	1	—
Perceived 5G benefit						
	Speed		2	2	1	—
	Specific activities improved		2	1	0	2
	Express no health concerns					
		Health issues no worse than <5G	2	2	1	—
		No health concerns	2	2	1	—
	Information security					
		Security same as <5G	1	2	0	2
		Security better than <5G	0	0	1	—
Perceived 5G problem						
Signal performance	Lacking 5G signal		—	2	0	2
	Health					
		Health issues worse than <5G	0	0	1	—
		5G unsafe for health	2	2	1	—
		Skepticism about experts	1	1	1	—
	Information security					
		Security worse than <5G	2	0	0	2
Potential 5G entities						
	Data collection and tracking					
		Tracking enhanced by 5G	0	1	0	1
		Tracking no worse than <5G	2	2	1	—

Table C.1—Continued

Category	CodeL1	CodeL2	Coder 1	Coder 2	Agreement	Reconciled
		Tracking done by companies	2	2	1	—
		Tracking done by governments	0	2	0	2
		Governments get data from companies	2	1	0	2
		Consumers trade privacy for speed	2	2	1	2
	Foreign governments					
		China backdoors	2	1	0	2
		State-backed disinformation	0	0	1	—
		China other mention (than backdoor)	0	0	1	—
		Russia mention	0	0	1	—

TABLE C.2

Qualitative Coding Data from Seaports Public-Perception Focus Group

Category	CodeL1	CodeL2	Coder 1	Coder 2	Agreement	Reconciled
Prior 5G usage						
	Personal		2	2	1	—
	Professional		2	2	1	—
Perceived 5G benefit						
	Speed		2	2	1	—
	Specific activities improved		2	1	0	2
	Express no health concerns					
		Health issues no worse than <5G	0	1	0	1
		No health concerns	2	0	0	1
	Information security					
		Security same as <5G	2	0	0	0
		Security better than <5G	0	0	1	—

Table C.2—Continued

Category	CodeL1	CodeL2	Coder 1	Coder 2	Agreement	Reconciled
Perceived 5G problem						
Signal performance	Lacking 5G signal		0	2	0	2
	Health					
		Health issues worse than <5G	1	2	0	1
		5G unsafe for health	1	2	0	1
		Skepticism about experts	0	0	1	—
	Information security					
		Security worse than <5G	0	0	1	—
Potential 5G entities						
	Data collection and tracking					
		Tracking enhanced by 5G	0	2	0	2
		Tracking no worse than <5G	2	2	1	—
		Tracking done by companies	2	2	1	—
		Tracking done by governments	0	2	0	2
		Governments get data from companies	0	0	1	—
		Consumers trade privacy for speed	0	0	1	—
	Foreign governments					
		China backdoors	0	0	1	—
		State-backed disinformation	1	0	0	1
		China other mention (than backdoor)	1	1	1	—
		Russia mention	1	1	1	—

TABLE C.3

Qualitative Coding Data from Borders Public-Perception Focus Group

			Coder			
Category	CodeL1	CodeL2	1	2	Agreement	Reconciled
Prior 5G usage						
	Personal		2	2	1	—
	Professional		2	2	1	—
Perceived 5G benefit						
	Speed		2	2	1	—
	Specific activities improved		0	0	1	—
	Express no health concerns					
		Health issues no worse than <5G	0	1	0	1
		No health concerns	0	0	1	—
	Information security					
		Security same as <5G	2	0	0	0
		Security better than <5G	0	0	1	—
Perceived 5G problem						
Signal performance	Lacking 5G signal		0	0	1	—
	Health					
		Health issues worse than <5G	2	2	1	—
		5G unsafe for health	2	2	1	—
		Skepticism about experts	1	0	0	0
	Information security					
		Security worse than <5G	0	1	0	0
Potential 5G entities						
	Data collection and tracking					
		Tracking enhanced by 5G	0	2	0	2
		Tracking no worse than <5G	0	0	1	—

Table C.3—Continued

Category	CodeL1	CodeL2	Coder 1	Coder 2	Agreement	Reconciled
		Tracking done by companies	2	2	1	—
		Tracking done by governments	0	1	0	0
		Governments get data from companies	1	0	0	2
		Consumers trade privacy for speed	0	1	0	1
	Foreign governments					
		China backdoors	0	0	1	—
		State-backed disinformation	0	0	1	—
		China other mention (than backdoor)	1	0	0	1
		Russia mention	2	0	0	2

APPENDIX D

Literature Review and Social Media Queries

Literature Review Query

In this section is the search string used for the literature review of 5G conspiracy content, as well as the databases used. This search string was developed iteratively, and the results are further discussed in the main text.

Final Search String

TITLE-ABS-KEY (((5g OR "fifth generation" OR "5th generation") AND (conspiracy* OR qanon OR hoax* OR rumor* OR rumour* OR propagand* OR "fake news" OR misinfo* OR disinfo* OR attack* OR hack* OR {physical security} OR cyber* OR vandal* OR sabotag* OR saboteur* OR terroris* OR extremist OR extremists OR extremism))

Databases Consulted

- SCOPUS
- Academic Search Complete
- American Psychological Association PsychInfo
- Business Source Complete
- Web of Science.

Social Media Query

In this section is the search string used for the social media query of 5G conspiracy content, as well as the databases used. This search string was developed iteratively, and the results are further discussed in the main text.

5G and Any of the Following Terms

reddit.com/r/TargetedEnergyWeapons
reddit.com/r/conspiracy
reddit.com/r/invisiblerainbow

reddit.com/r/conspiracy_commons
reddit.com/r/conspiracytheories
reddit.com/r/highstrangeness
disinformationindex.com
reddit.com/r/spirituality
reddit.com/r/4chan
reddit.com/r/dangerous_tech
mothering.com
naturalnews.com
patriots.win
greatawakening.win
abovetopsecret.com
bitchute.com
godlikeproductions.com
naturalnews.com
infowars.com
tv.infowars.com
wearethene.ws
forum.outpost2.net
rense.com
lunaticoutpost.com
warriormatrix.com
disclose.tv
commonsenseconspiracy.com
whatreallyhappened.com
therealconspiracyforum.com
conspiracyarchive.com
freemasonrywatch.org
jimmarrs.com
davidicke.com
unknowncountry.com
propagandamatrix.com
signs-of-the-times.com
projectcamelot.org
nexusmagazine.com
sott.net
informationliberation.com
truthseeker.co.uk
redicecreations.com
disinfo.com
wanttoknow.info
nomorefakenews.com
corbettreport.com
educate-yourself.org
nomorefakenews.com
rumormillnews.com
rinf.com
fromthewilderness.com
jonesreport.com
cuttingthroughthematrix.com
blacklistednew.com
theinsider.org
serendipity.li
stevequayle.com
worldreports.org
whatdoesitmean.com
unknownnews.org
fourwinds.com
100777.com
thememoryhold.org
conspiracies.net
decryptedmatrix.com
ourhollowearth.com
theflatearthsociety.org
therealconspiracyforum.com
altnews.org
not606.com
freerepublic.com
apocalypseparadigm.blogspot.com
roserambles.org
goyimtv.tv
naturalblaze.com
truth11.com
radiationdangers.com
altermedicine.org
gaia.com
cancer.news
shieldyourbody.com
dirtyelectricity.com
advancedliving.com
orgoneenergy.com
heartmindinstitute.com

birthofanewearthblog.com
prepareforchange.net
mypatriotsnetwork.com
rightsfreedom.wordpress.com
emfacademy.com
5gfree.org
trello.com
fightingmonarch.com
christianobserver.com
emfcommunity.com
truthstreammedia.com
howardnema.com
psychicspiritinyou.com
manutenzionecaldaie.milano.it
toxicnow.com
cyberrev.com
stop5g.cz
pizzeria.napoli.it
useecctv.com
revolutionoftruth.com
ournewearthnews.com
lobbyistsforcitizens.com
dissidentsignposts.org
plasmaenergysolution.com
ftwproject.com
ugetube.com
choosing-him.blogspot.com
fringeenergy.com
nutritruth.com
dontspeaknews.com
stateofthenation.co
eyeopeningtruth.com
elcolectivodeuno.wordpress.com
tapnewswire.com
katrinah.com
5g-emf.com
theconsciousresistance.com
prophecyinvestigators.org
mentorslinks.com
christianevidence.net
forbiddenknowledgetv.net
thenigerianvoice.com
jewworldorder.org
conspiracyrevelation.com
gangstalkingmindcontrolcults.com
followme.site123.me
climateviewer.com
christianforums.com
brandnewtube.com
miramichireader.ca
miramichireader.ca
miramichireader.ca
jfr.sitehost.iu.edu
de-program.org
civilianintelligencenetwork.ca
sarahwestall.com
wakeup-world.com
operationdisclosure1.blogspot.com
pastormiketaylor.blogspot.com
globalresearch.ca
takebackyourpower.net
saferemr.com
stillnessinthestorm.com
activistpost.com
collective-evolution.com
worldtruth.tv
peaceinspace.blogs.com
markcrispinmiller.com
takebackyourpower.net
banned.video
organi.news
naturalblaze.com
5gcrisis.com
mindcontrol.news
opdeepstate.com
usahitman.com
sonsoflibertymedia.com
5gsummit.com
londonreal.tv
stopthecrime.net
allnewspipeline.com
emfacademy.com

jabx.net
childrenshealthdefense.org
stolenhistory.org
settingbrushfires.com
mdsafetech.org
newhumannewearthcommunities.wordpress.com
thelibertybeacon.com
endtimeheadlines.org
lukestorey.com
londonreal.tv
emfacts.com
5gspaceappeal.org
vaxxter.com
momsacrossamerica.com
153news.net
beforeitsnew.com
greenmedinfo.com
drsircus.com
thecommonsenseshow.com
projectcamelotportal.com
citizensforaradiationfreecommunity.org
futuredanger.com
revolutionradio.org
iArea51.com
rfsafe.com
therayfield.com
vaccine.it
naturalhealth365.com
phibetaiota.net
jamesfetzer.org
prepareforchange.net
humansarefree.com
envirowatchrangitikei.wordpress.com
citizentruth.org
adventuresinthegold.blogspot.com
stateofthenation.co
synergyscience.org
voiceofthewy.news
elderofziyon.blogspot.com
nourishingtraditions.com
exopolitics.org

videos.utahgunexchange.com
theeconmoiccollapseblog.com
electrosmogprevention.org
nowtheendbegins.com
bibliotecapleyades.net
switchnigeria.com
jtrue.com
bioinitiative.org
fourfoldhealing.com
electromagnetichealth.org
5gawarenessnow.com
stopsmartmetersbc.com
westonaprice.org
needtoknow.news
big-jays-blog.tumblr.com
blog.nomorefakenews.com
onlinenigeria.com
lenteconservador.com
bleedingcool.com
smombiegate.org
aesopinstitute.org
bewellbuzz.com
coreydigs.com
prepforthat.com
thefreedomarticles.com
africatodaynewsonline.com
forbiddendoctor.com
thelibertybeacon.com
emfoff.com
scientists4wiredtech.com
emfscientist.org
healthimpactnews.com
wakingtimes.com
olowublog.com
globalpeacemeditation.com
livelearnevolve.com
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truthcontrol.com
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vigilantcitizen.com
theunhivedmind.com
TheInsider.org
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remnantradio.org
opposingdigits.com
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amkon.net
h2one2.com
elephantintheparlor.org
ctrl.org

cyberspaceministry.org
chemtrailcentral.com
ascensionproject.com
thesmokinggun.com
lastingnetworks.com
theconspiracyzone.podcastpeople.com
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gab.com
lopmatrix.com
anti5g.net
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brandnewtube.com
theyflyblog.com
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choosing-him.blogspot.com
emrabc.ca
lissahumanelife.wordpress.com
advancedliving.com
emfportal.com
grandmageri422.me
5gradiation.net
emfempowerment.com
lifesitenews.com
irda.org
jillcarnahan.com
nexusnewsfeed.com
5ghub.us
healmindbody.com
michaeltellinger.com
thebigvirushoax.com
drcharlieward.com
canadafreepress.com
emfmadness.wordpress.com
lifesitenews.com
coreydigs.com)

But Excluding All of the Following Terms

Vibe
cisco
“parallel wireless”
@Parallel_tw
@Verizon5g
@att
@samsungmobileus
#oneplusnord
#oneplusnord
nord
n200
#useek
@sprint
sprint
tmobile
#tmobile
#galaxyS20
at&t
#galaxyzflip3
#galaxyzfold3
#tmobiletuesdays
Samsung
Motorola
Huawei
Market
T-mobile
ipad
iphone
android
Xiaomi
Verizon
Nokia
nokianetworks
Mediatek
Galaxy
#galaxyA52s
Security
Apple
redmi
tecno
lava
LTE
Reno
Pixel
Qualcomm
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HPE
#OPPOReno6
Reno6
“Mi 11”
V23e
“dual 5g”
“Ultra capacity”
“Machine learning”
Python
tech
cloud
deeplearning
#datascience
#cybersecurity
#bigdata
IoT
IIOT
“Online classes”
Ericsson
raw:FREE
#POCOM4Pro
poco
1080p
“5g services”
#TeamEricsson
@EricssonNA
#ImaginePossible
#5GThings
#digitaldivide
@EricssonDigital
#EricssonAmbassador

“Reply #stop”
pre-order
“5g burger”
oats
#ai
#iot
#machinelearning
speed
raw:LIVE
experience
#python
#iiot
#datascience
#100daysofcode
#bigdata
#analytics
#serverless
#deeplearning
#innovation
#artificialintelligence
#nlp
#industry40
#javascript
raw:IMAGINE
s20
“IMAGINE YOUR FUTURE WITH AIS 5G”
#bambam
intelligence
analytics
smartphone
#futureofwork
NLP
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@mobileworldlive
@microsoft
@techreview
@amdocs
@wwt_inc
@chuckrobbins
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@trilogynetworks
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@axios
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@ctia
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@tmobile
@ajitpaifcc
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@jonfreier
@johnlegere
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@michelcombes
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@metrobytmobile
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@awinnovate
@psb_dc
@btsdailyinfo
@btsanalytics
@fallontonight
@btscontentvideo
@bts_bighit
@btsvotingteam
@bts_twt
@samsungph
@bbmas
@samsungmobile
@intelisyscorp

Abbreviations

3G	third generation
4G	fourth generation
5G	fifth generation
6G	sixth generation
ALP	American Life Panel
CBP	U.S. Customs and Border Protection
COVID-19	coronavirus disease 2019
DHS	U.S. Department of Homeland Security
FEMA	Federal Emergency Management Agency
GHz	gigahertz
GSS	General Social Survey
ICPSR	Inter-university Consortium for Political and Social Research
mMTC	massive machine-type communications
NORC	National Opinion Research Center
OCIO	Office of the Chief Information Officer
S&T	Science and Technology Directorate
TRL	technology readiness level
UK	United Kingdom

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Public perceptions of emerging technologies, such as fifth-generation (5G) communication, can affect the adoption of these technologies. Integrating 5G wireless technologies into the U.S. Department of Homeland Security (DHS) mission could increase the safety, efficiency, and effectiveness of efforts to support DHS's responsibilities to safeguard critical infrastructure and conduct missions across the homeland security enterprise. These potential benefits could be delayed or prevented if there are significant public concerns about the use of 5G technology and technology enabled by 5G.

Research is needed to understand these public perceptions and their potential impact on DHS mission effectiveness and to design a path forward for the most-effective research, development, procurement, and employment of emerging 5G technologies. Understanding the relationship between public perceptions and 5G technologies (including relevant conspiracy theories and concerns about data collection and privacy more generally) could help increase the likelihood that the public will embrace 5G applications and expedite the transition of the technology and the associated benefits, such as securing critical infrastructure. Understanding the public perceptions of government and public use of these technologies could also help DHS mitigate these perceptions' potential negative impacts on mission effectiveness.

To investigate these perceptions of 5G technologies, researchers used a combination of literature review, social network and lexical analysis, reviews of existing data and studies in the commercial space, interviews, focus groups, workshops, and expert panel interviews. This report summarizes their findings and recommendations.

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