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Describing the Current Health Communication Ecosystem

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Introduction

The health communication ecosystem that people experience every day has changed dramatically over the past generation and is currently more complicated and complex for people to navigate than ever before. Broadly considered, the health communication ecosystem refers to myriad dynamic and diverse individuals, networks, organizations, and structures that influence how people understand and experience wellness and illness through the production and exchange of health-related information. This *communication* ecosystem includes the production and exchange of information by individuals, networks, organizations, and structures, as well as exposure to, and interaction with, information in the ecosystem. The health communication ecosystem extends beyond people and information and includes the relational dynamics between messages, actors, and structures that make up the system. A better understanding of this ecosystem's ever-changing, complex, and dynamic nature is essential for health communicators working within and outside of the federal government because it underscores the need to consider new capacities and approaches to health communication to achieve communication goals for improving public health.

I have prepared this paper to inform a workshop of the National Academies of Sciences, Engineering, and Medicine, *Effective Health Communication within the Current Information Environment and the Role of the Federal Government*. This paper **(1) characterizes the current health communication ecosystem, (2) provides an overview of how people navigate this ecosystem, (3) notes opportunities to improve understanding of the ecosystem, and (4) discusses how changes in the ecosystem in the future would benefit from more infrastructure and innovation.**

Key Takeaways

- The health communication ecosystem, is more complicated and complex for people to navigate than it ever has been before, given conflicting and competing health information, mis- and disinformation, and persistent health communication inequalities.
- Reaching audiences in the current communication ecosystem has become more challenging in the last 10 to 20 years.
- People are increasingly looking first to online sources for health information, including social media.
- While trust is complex and variable, most people consistently indicate they trust health information from their doctors and health care providers.
- People navigate the health communication ecosystem by engaging in four important information behaviors: seeking (i.e., looking for information), scanning (i.e., encountering information), avoiding, and sharing.
- Current systems of monitoring health information and public messaging practices within the health communication ecosystem are insufficient to keep up with an evolving communication landscape.
- Current practices of communicating with the public too often use an outdated approach (e.g., "set it and forget it"). Effectively communicating information in the current health information ecosystem requires the adoption of communication practices that are not top-down approaches, like collaboration, conversation, community-building, and co-creation.
- The current health communication ecosystem requires communication infrastructure and innovative strategies to allow for the dissemination of accurate, credible, evidence-based, and actionable information to audiences engaged in complex navigation behaviors.
- Innovative strategies and improved infrastructure are required to effectively communicate with diverse audiences in the current health communication ecosystem.

Where People Get Health Information & Who They Trust

This section reviews the sources people in the United States use to get health information, the sources they trust, and how source use and trust have changed over time.

Where Do People Go for (Health) Information?

Most Americans are now using online sources to seek health-related information. Estimates suggest that over 90% of people in the U.S. use the internet, up from 52% in 2000 and 76% in 2010. Most people (77%) in the U.S. have broadband (i.e., high-speed internet) at home. However, there are disparities in population subgroups' access to broadband (e.g., white, higher-income, more educated, and non-rural populations have greater access; Pew Research Center, 2021a). Research from the Health Information National Trends Survey (HINTS, 2023a) indicates that about 80% of people in the U.S. seek information about health and medical topics. When those people seek information, over 70% indicate they use “the internet” first (HINTS, 2023b).

Online sources.

While reliance on the internet has remained stable for information seeking, the types of online sources that people use have changed. For example, the number of social media platforms has considerably increased from the early 2000s to now. Today people often rely on smartphones and digital devices to consume news and health information, which could come from a variety of sources (i.e., a cable news channel makes a post on a social media platform, someone reads health information on a news app, etc.). Over 80% of adults in the U.S. currently get news from a digital device (Shearer, 2021), and smartphone ownership increased to 85% from 35% in 10 years, from 2011 to 2021 (Pew Research Center, 2021b). Younger people are more likely than older people to use news websites, though the youngest adult demographic group (18-29) is most likely to use social media sites. Slightly less than half of U.S. adults overall get news from social media sites at least some of the time, and news use varies by platform; for example, 31% of U.S. Facebook users get news on the platform compared to 4% of Snapchat users (Walker & Matsa, 2021). The use of smartphones and social media to consume news introduces complexity, as people use news websites and apps from traditional sources (e.g., TV news channels or newspapers) or content from search engines. For example, 26% of YouTube visitors use the site for news; however, the popular video-sharing site features content from established news organizations, public health agencies, celebrities, and other user-producers (Stocking et al., 2020). Also worth noting is that 22% of U.S. adults get news from podcasts, similar to its offline equivalent of radio (Shearer, 2021). Approximately 43% of social media users search for information of interest (e.g., brands) on social media (GWI, 2022), a behavior that presumably applies to other information domains (e.g., health) as well. **Determining how, when, and why people seek or encounter information online, particularly for health topics, is challenging due to constraints in our ability to observe, monitor, and track private information seeking and scanning behaviors.**

During the COVID-19 pandemic, for example, 48% of Americans got some (or a lot of) news about vaccines on social media, even though most people believed social media was an unimportant way to keep up with such information (Mitchell & Liedke, 2021). Those who reported using social media platforms for news were more likely to have heard about pandemic-related misinformation than those using traditional news outlets like network TV, cable TV, and print media (Mitchell et al., 2020). U.S. adults rarely use alternative, non-mainstream social media sites (e.g., Parler, Truth Social, Gab, etc.) for news. Only 6% of people use such sites, although those sites often feature content that is deeply skeptical of particular topics or offers conspiratorial ideas (e.g., vaccines and COVID-19; see Stocking et al., 2022). Regardless of site, researchers have noted concerns about the quality of health information online (see Kong et al., 2021; Xu et al., 2022; Zhang et al., 2015).

Offline sources. **People do not just seek information from online sources, though offline sources are far less common for people to consult initially.** Among people who have looked for health or medical information, the most common offline sources include doctors/health care providers (~16%), family (~3%), and brochures/pamphlets (~3%; see HINTS, 2023b). Additionally, while people rarely look for health information from television and newspapers (e.g., less than 1% of U.S. adults;

HINTS, 2023b), they still encounter health information when they use these sources. Even though the majority of Americans get their news on digital devices, Americans also get news information via television (68%), radio (50%), and print sources (32%), with older populations being much more likely than younger populations to use these sources (see Shearer, 2021). More specifically, people over 50 are much more likely to use television or print sources than those under 50 (Shearer, 2021).

How do current communication ecosystems differ from previous media ecosystems? **People currently have access to more sources and channels of health information than ever before, which necessitates reconsidering past approaches to provide information that resonates with and reaches intended audiences.** Thirty years ago, people may have encountered health information in a local newspaper story, a local/syndicated radio segment, a local/national broadcast news story, viewed a PSA or poster with health information, and perhaps discussed a health concern with a family member or friend (or a physician). There were fewer outlets through which people would consume information, a stark contrast compared to today's communication environments. The increase of sources and channels for health information can play out in multiple ways:

- The unpredictability of what health information gets coverage or goes viral with audiences (and for how long it stays relevant, how many people see the information, etc.).
- Microtargeting of advertising to audiences based on massive, aggregated data streams to maximize engagement and (likely) monetization related to health products and behaviors.
- Loss of large, "live" broadcast audiences for most news and entertainment programs (save some older population segments and specific programming like sports).
- Greater diversity in content creators and distribution channels may lead to largely unregulated content with (possibly) questionable accuracy and effects on audiences, especially for complex topics like health and medicine.

- Regulatory structures that have not kept up with changes in the evolution of content creation and distribution, including how to identify and mitigate mis/disinformation.
- Lack of knowledge about how people encounter and seek health information given the diversity of sources and outlets available.

Communicating in the current ecosystem requires innovation and new ideas. One cannot overstate the differences between the health communication ecosystem now and in the past. **Previous approaches to reaching audiences are unlikely to work as they have in the past.** Traditional top-down approaches to public communication are unlikely to be effective when trying to reach various audiences of interest. Current trends in communication technology use means that engaging in communication through public channels requires two-way communication practices. There is a critical need to move beyond one-way, top-down communication strategies as preferred practice. A one-way strategy is, unfortunately, how many government agencies communicate science (and health) information on digital platforms (see, e.g., Lee & VanDyke, 2015; Lee et al., 2018). **Effectively communicating information in the current health information ecosystem requires adopting communication practices like collaboration, conversation, community-building, and co-creation** (see Macnamara, 2010, e.g., Kim et al., 2022).

Who Do People Trust about (Health) Information?

Trust influences critical outcomes related to health (e.g., Netemeyer et al., 2020). Although concerns about eroding trust are not new (Cummings, 2014), trust in medical scientists (and other public institutions) shifted and often decreased during the pandemic (e.g., white, Black, and Hispanic Americans all had their confidence decrease; see Kennedy et al., 2022). COVID-19 provides a recent example of the importance of trust. Geographic areas where people had higher levels of trust (e.g., trust in government and interpersonal trust) had lower COVID-19 infection rates, and areas with lower levels of trust had lower COVID-19 vaccination rates (COVID-19 National Preparedness Collaborators, 2022). Still, public perceptions of trust often depend on the topic (see, e.g., Pechar et al., 2018) and source (e.g., SteelFisher et al., 2023), and assessing trust about sources can be challenging (see Besley & Tiffany, 2023 for a relevant example).

Trust related to the internet and online sources. **People's trust in the internet and online sources has fluctuated—and will likely continue to do so—over time.** The trust that Americans have in information on the internet about health has decreased slightly in the past few years. People indicated they decreased in their belief that they had "some" or "a lot" of trust in the internet as a source of health information from 2011 (~72%) to 2017 (~65%; see HINTS, 2023c). While no data are available to examine people's trust and related concepts like credibility for all online sources, there is limited trust in social media information overall. Only 27% of adults trust information (across contexts) from social media in 2021, down from 34% in 2016 (Gottfried & Liedke, 2021). While trust in social media information is low, research suggests that social media news use is associated with greater trust in science overall (Huber et al., 2019). For social media information, Republicans have decreased trust levels (32% to 19%) compared to Democrats (36% to 34%) from 2016 to 2021 (Gottfried & Liedke, 2021). Differences in trust depend on factors other than just political party affiliation.

Across all age groups, trust in local and national news organizations is higher than trust in social media sites—though the gap in that trust increases with age: for those aged 18-29, the gap is 6% (i.e., 50% trust social media sites and 56% trust national news outlets), which increases to 22% for those 30-49, 37% for those 50-64, and 47% for those 65 and over (Liedke & Gottfried, 2022). Trust also differs on various demographic factors. Among white Americans, only 26% trust social media sites compared to 43% trust among Black Americans, 47% among Hispanic Americans, and 46% among Asian Americans (Liedke & Gottfried, 2022). Increasing trust in social media sources is worth noting since other findings suggest misinformation is more likely to be shared through these outlets (see Wang et al., 2019). Discussing trust about social media sites and other online sources/outlets is undoubtedly more complicated than these simple categorizations and differences. **People's trust in *other* sources that may appear on social media sites could be much higher**

(e.g., a popular news channel tweets, a friend or family member shares a social media post, or a medical doctor appears in a YouTube video).

Trust related to offline and other sources. **Americans most consistently trust health information that comes from doctors and other healthcare professionals.** Since 2005, over 90% of people had at least some trust in doctors and healthcare professionals (HINTS, 2023d). Trust in family and friends as a source of information decreased from 2005 (~67%) to 2019 (~54%; HINTS 2023e). Trust in television as a source of health information—which could include news, advertising, and entertainment content—decreased as well, from ~71% in 2005 to ~40% in 2011, the last year the question was asked (HINTS, 2023f). Americans trust local news organizations (71%) than national news organizations (61%; Liedke & Gottfried, 2022).

Americans do not trust government health agencies about health information as much as they once did—dropping from 74% in 2008 to 62% in 2019 (HINTS, 2023g). During the COVID-19 pandemic, trust in the Centers for Disease Control and Prevention decreased. In contrast, trust in other federal agencies (the United States Postal Service and Federal Emergency Management Agency) increased. However, agency trust decreased most notably among non-Hispanic white and Hispanic respondents (Pollard & Davis, 2022). Nuances in estimates of trust and credibility are common, likely due to diversity in people's experience of health systems and institutions, as well as many other social factors (see Kington et al., 2021).

The shifts in trust of various federal agencies during COVID-19 indicate a need to learn more about how people perceive specific agencies and governmental sources about various health/medical topics. Many studies of health information trust, from the HINTS data, for example, depend on single items that ask people how much they trust information about "health or medical topics" from particular sources/channels (e.g., doctors/health care providers, the internet, family or friends, government agencies, charitable organizations, etc.). The issue is that many studies about trust are vague in evaluating information type and source reference. Someone might trust information from their doctors about blood pressure medication but not a new vaccine. People may trust their religious leaders about a new vaccine recommendation but not about pain management. There are no definitive answers about which health/medical issues people trust the federal government and other community organizations. Knowing the answer to such questions—and how to respond to specific losses or gains in trust—would benefit health communicators in federal agencies.

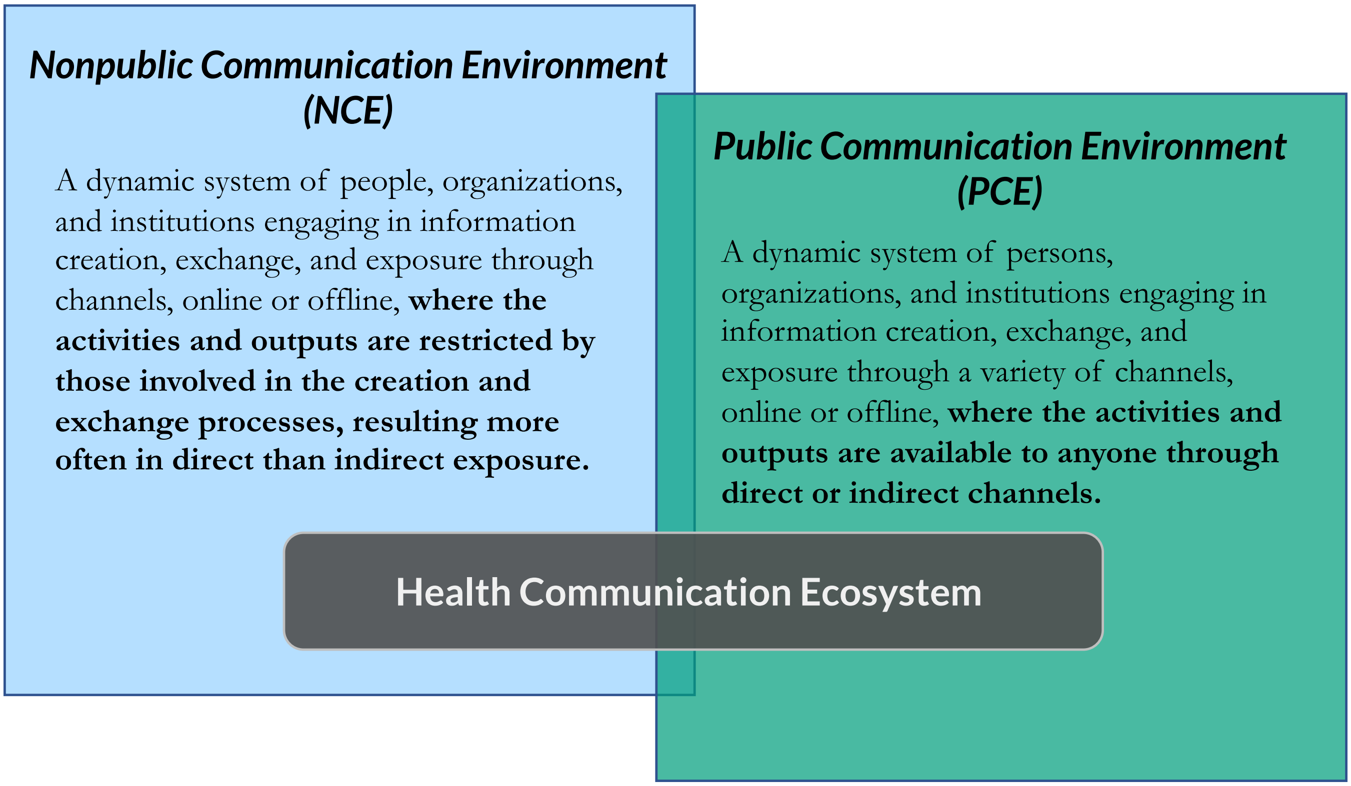
Concluding Thoughts on This Overview

Reaching audiences in the past was, arguably, less challenging because there were fewer outlets through which you could disseminate any message. The current health communication ecosystem, which is part of a vast and rapidly changing public communication environment, undermines the utility and effectiveness of old communication strategies. Persistent disparities and divides also affect the health communication ecosystem, particularly among racial/ethnic minorities and other groups based on factors like rurality, socioeconomic status, language preferences, digital skills, etc. (Goulbourne & Yanovitzky, 2021; Viswanath, 2006). **A better understanding of the current health communication ecosystem and how people navigate it will assist in developing and innovating communication infrastructure and strategy moving forward.**

Characterizing the Health Communication Ecosystem

The health communication ecosystem is a component of larger communication environments, which include the public communication environment (PCE) and the nonpublic communication environment (NCE) (see Figure 1). The PCE (see Hornik 2002a; 2016; Hornik et al., 2022) refers to a system of content produced by people, organizations, and institutions about various topics, not just health and medicine. Individuals can be exposed to content from these sources at any point in time through multiple tactics (e.g., public service announcements, entertainment programming, advertisements on public transit, billboards, podcasts, social media, etc.). The NCE represents a system of more private interactions and information exchanges in which people or organizations engage in protected or small-group information exchanges. Examples might include discussions with a doctor during an annual exam, direct messages with a friend about a health concern on social media, a community group meeting, a living room chat, or any other communicative experience not available to everyone. **In other words, the PCE contains information and interactions anyone could experience, while the NCE represents any other information and interactions about health one might experience.**

These two communication environments (CEs) overlap and underlie the health communication ecosystem (see Figure 1). The health communication ecosystem one experiences is unique based on individual routines, media choices, social networks, and other individual and structural factors. Information can flow in and out of one's NCE and PCE, and to their health communication ecosystem, depending to whom one provides information, through what channel, and what people do to access that information.



A dynamic system of people, organizations, and institutions engaging in information creation, exchange, and exposure through channels, online or offline, **where the activities and outputs are restricted by those involved in the creation and exchange processes, resulting more often in direct than indirect exposure.**

A dynamic system of persons, organizations, and institutions engaging in information creation, exchange, and exposure through a variety of channels, online or offline, **where the activities and outputs are available to anyone through direct or indirect channels.**

Figure 1. The Overlap and Intersection of the Health Communication Ecosystem with Broader Communication Environments (CEs)

Within the health communication ecosystem and the broader CEs, people, organizations, and institutions are *source-receivers* of messages and information they create, exchange, and otherwise disseminate through channels accessible to others (i.e., PCE) or more restricted (i.e., NCE). Regardless of CE, these people, organizations, and institutions can be the sources and receivers of information. *Channels* for messages and information might be interpersonal (e.g., a face-to-face conversation), mediated (e.g., using a digital device to connect), or blended (e.g., communicating through means like direct messaging, emails, video calls, etc.). To navigate the health communication ecosystem, people engage in various *behaviors* that connect them to health-related content. People might actively look for health information within their CEs, an information behavior called health information seeking. People might encounter information in their CEs about health unintentionally, which is called health information scanning. People might avoid engaging with certain health content in their CEs, a behavior called information avoidance. People can also decide to share health information with others in their CEs—acquired via seeking or scanning—or may have information shared with them that they typically avoid via others in their CEs. Table 1 provides a list of examples of these source-receivers, channels, and behaviors.

The overlap of the NCE, PCE, and health communication ecosystem an individual experiences depends explicitly on the source-receivers, channels, behaviors, and the respective interactions of those ideas within a person's (or organization's) day-to-day activities. **In other words, there is no single "health communication ecosystem." Instead, any potential communication source-receiver experiences a health communication ecosystem that varies in size and overlap based on individual, organization, and institution-/system-level factors**. These include, but again are not limited to, broadband access (e.g., Rains, 2008), quality of available information (e.g., Graham, 2022; Osman et al., 2022), the necessities and complexities of message exposure (e.g., Dillard et al., 2021; Hornik, 2002b), overwhelming amounts of content (e.g., Khaleel et al., 2020), existing mistrust of medical or health systems (e.g., Cuevas et al., 2019; C. Zhang et al., 2020), previous experiences with racism and discrimination in health and other contexts (e.g., Manning et al., 2023; Williamson et al., 2019), or more broadly a limited communication infrastructure (Goulbourne & Yanovitzky, 2021). These aspects of the health communication ecosystem in the U.S. are persistent, documented inequalities that affect how much and how often people participate in health communication behaviors.

Table 1. Health communication ecosystem examples of PCE/NCE communication source-receivers, channels, and behaviors

Source-Receivers	*Examples*	**Channels**	*Examples*	**Behaviors**	*Definitions*
Persons	Citizens Doctors Nurses Influencers Celebrities	Interpersonal	Face-to-face talk In-person group meetings In-office doctor appointment	Seeking	The purposive, intentional, and active effort of obtaining information—outside of the performance of one's normal information behaviors—in response to an information need or imminent concern.
Organizations	American Cancer Society Red Cross Other NGOs For-profit companies Advertisers Industry/lobbying groups Insurance companies	Mediated	Facebook TikTok Any social media platform Broadcast media Blogs Online news sites Any internet site	Scanning	Encountering information accidentally or unintentionally in routine engagement with one's communication environments and recalling that information with relative ease.
Institutions	Federal government/agencies State government/agencies Local government/agencies Universities Hospital systems Foreign governments/agents	Blended	Email Phone/video calls Texting Social networking sites WhatsApp Other private messaging apps	Avoidance	"Any behavior designed to prevent or delay the acquisition of available but potentially unwanted information." (Sweeny et al., 2010, p. 314)
				Sharing	Any behavior where a message source distributes, refers, or otherwise attempts to expose others to information.

Note: This table is not an exhaustive list for any category, but is intended to give a framework that readers can applying to interpreting the PCEs/NCEs in which they operate. There are too many possibilities to list in one table. "Source-receivers" refer to people who contribute to the health communication ecosystem and their CEs, *even if they are usually just passive receivers of information*. "Blended" channels refer to those that could be used to convey messages in an interpersonal sense (e.g., an email to one person) or a mediated sense (e.g., a public email list to hundreds of people). Similarly, specific social media platforms (e.g., Facebook and TikTok) are both mediated channels for communication and platforms that can be used as private or restricted social networking sites for individuals or groups. Historically, "the internet" has been considered both a source and a channel, but current internet use is too heterogenous to simply isolate or discuss "the internet." "The media" is also nondescript and lacks utility in describing a dynamic system of organizations and individuals providing content via mediated channels. Definitions for seeking, scanning, and sharing are based on previous discussions of these concepts in the literature (see, e.g., Case & Given, 2016; Johnson & Case, 2012; Kelly et al., 2010; Liu & Niederdeppe, 2023; Niederdeppe et al., 2007; Southwell, 2013; Worthington & Nussbaum, 2020; Yang & Van Stee, 2023)

Factors Influencing the Health Communication Ecosystem

Individuals have distinct experiences of the health communication ecosystem. At the same time, some factors and inequalities influence people's experiences of their ecosystems, like exposure to competing, contradictory, or conflicting information and experiences of digital inequality.

Exposure to competing and conflicting information. The health communication ecosystem is rife with competing, contradictory, and conflicting information about health topics and a wide variety of sources generating information within the ecosystem (see Table 1). Below are some examples of competing and conflicting information, as well as a discussion of how each could affect health communication ecosystem experiences.

Example 1: Vulnerable populations and predatory marketing. Numerous commercial entities produce unhealthy products (e.g., cigarettes, alcohol, sugar-sweetened beverages, foods with little nutritional value, etc.) and advertise these products regularly. Companies use approaches like product placement to embed their products in non-advertising outlets like kids' movies and other entertainment content (Naderer et al., 2019), which can influence kids' food consumption choices (e.g., Brown et al., 2017). Product placement is not limited to "traditional" media. Researchers have found that kid influencers on YouTube also use product placement, resulting in millions of exposures to unhealthy products for children (Alruwaily et al., 2020). Fast food restaurants also use child-directed marketing inside and on the exterior of buildings (Ohri-Vachaspati et al., 2015). Public health advocates have tried to engage in policy change related to these practices, which have been labeled predatory marketing; that is, "the practice of aiming misleading, aggressive, emotional, and pervasive advertising of unhealthy products to vulnerable populations" (CUNY Urban Food Policy Institute, 2020).

Marketers use these predatory marketing practices on audiences other than children. Researchers found that predatory marketing was more likely to be found in low-income neighborhoods that experienced more negative health outcomes (compared to higher-income neighborhoods; Fraser et al., 2022). Similarly, researchers found that less-healthful ads in subway stations did not maximize total impressions (e.g., reach the most subway riders) but instead appeared in impoverished areas where people with lower education levels lived (Lucan et al., 2017). Of course, predatory marketing has occurred in non-food and drink contexts historically as well (e.g., cigarettes, see Iglesias-Rios & Parascandola, 2013).

Predatory marketing affects one's experience of the health communication ecosystem because the consistent repetition of message exposures to unhealthy products is not countered by messages promoting healthy products. For example, the budget for tobacco and nicotine product marketing outpaces the funding for quitlines and cessation programs. In the subway station study mentioned earlier, for example, researchers found no ads promoting healthier foods in any of the subway stations. Indeed, there are fewer sources for messages promoting healthy food choices than messages advertising unhealthy choices. Even when competing messages aim at improving one's health, those sources typically have less money for messaging and, as such, are less likely to ensure exposure among those who might benefit most.

Example 2: Direct-to-consumer advertising of prescription drugs. The U.S. is one of the only countries allowing direct-to-consumer (DTC) advertising of prescription drug products. Almost twenty years ago, estimates suggested that an average U.S. adult was likely to view over 30 hours of direct-to-consumer advertising for prescription drugs annually (Brownfield et al., 2004). Pharmaceutical companies spend around $6 billion yearly on DTC advertising, with most of that money going to television ads but an increasing proportion directed toward digital outlets (U.S. Government Accountability Office, 2021). These ads feature prescription drugs and their possible effects, often without mentioning how other lifestyle changes have similar or more beneficial effects than some drugs (Avery et al., 2022). While there may be some benefits of DTC ads on consumers (e.g., information seeking, increased requests for appropriate prescriptions, and improved perceptions of patients of their communication with their provider), there are also potential harms (e.g., receiving unnecessary prescriptions, ads interfering with medication adherence; see DeFrank et al., 2020). These benefits and harms are unlikely to be equitably experienced, though, as

Hispanics and African Americans (compared to whites) were less likely to be exposed to DTC ads, more likely to be influenced by the ads they did see, were more positive about the exposure to ads, and, for African Americans only, were more likely to ask their physicians for an advertised drug (Lee & Begley, 2010).

The DTC advertising of prescription drugs complicates the health communication ecosystem because it provides a one-sided source of information about medical treatment options that may or may not be relevant to people and their healthcare decision-making. These ads appear in the public communication environment (e.g., ads on TV or social media platforms) but then come up in conversation and potentially influence health communication in nonpublic contexts (e.g., an appointment with one's primary care physician). Opportunities to counter messages in DTC ads, which, as noted, often ignore the similar or greater benefits of healthy lifestyle changes, are limited.

Example 3: Conflicting (and contradictory) health and science information. Sometimes conflicting and contradictory information comes from news and government sources unintentionally. For example, researchers might make a discovery (e.g., eating oranges prevents balding) opposite to another recent discovery (e.g., eating oranges contributes to balding). In this situation, conflicting and contradictory research findings may receive news coverage. That situation results in the presentation of conflicting information done without malice. **Unfortunately, people exposed to conflicting information may doubt recommendations about health-related topics in the future, even when those recommendations are unrelated to the conflicting information people saw initially** (Nagler, 2014). Across topics, there is evidence to suggest that exposure to conflicting or contradictory information makes people discount other (unrelated) health information and recommendations (Nagler et al., 2022; Nagler & Shi, 2023). Further research on conflicting information has found that when evidence or sources conflict, people tend to have lower trust in those delivering the messages (e.g., scientists, Iles et al., 2022). Related to COVID-19, people reported frequent exposure to conflicting information from politicians and health experts (Nagler et al., 2020). **Exposure to conflicting information influences people's**

experiences with the health communication ecosystem because that exposure can change what people trust, pay attention to, or otherwise respond to in the future.

Of course, the health communication ecosystem might also include complementary information from sources often in conflict. While advertisers of unhealthy products and federal agencies promoting healthy eating choices may offer competing messages, there are situations in which the message may be complementary and beneficial for consumers. For example, during the COVID-19 pandemic, companies producing disinfecting products advertised that their products killed the COVID-19 virus, which complemented messages from the CDC recommending engaging in more disinfectant use. There is less research on how public health communicators might best leverage and adapt their communication strategy to take advantage of such complementary information within the ecosystem. There is, however, evidence that people learn a lot from health advertising (see Tomes, 2016). **Building communication infrastructure that allows for an agile and rapid response to such events, including collaborations with commercial entities in certain circumstances, may be strategically advantageous for federal (and local) health communicators due to the budgets such marketing efforts often have.**

Example 4: Misinformation and disinformation. **Health misinformation is currently a prominent concern among public health communicators.** Health misinformation (and disinformation) is not a new problem for health communicators (Southwell et al., 2019). Some health misinformation is unlikely to be harmful (e.g., someone drinking tea or water with lemon and cayenne pepper to reduce cancer risk; see Southwell et al., 2019). Other misinformation might be harmful and negatively affect patient treatment outcomes (see Johnson et al., 2022). Misinformation and disinformation differ slightly in their origins, motivations, and content (see Table 2). Disinformation assumes, whereas misinformation indicates the information is inaccurate regardless of intent.

Most recent research on health misinformation has focused on COVID-19 (see Enders et al., 2020) and vaccinations (see Swire-Thompson & Lazer, 2020). Researchers continue to research the specific harms of misinformation. Before COVID-19, there were few examples of actual harm. Still, such estimates are hard to gauge in the context of things like alternative treatments for diseases like cancer, where tracking specific harmful outcomes presents challenges (Swire-Thompson & Lazer, 2020). Recent evidence shows that sharing COVID-19 misinformation negatively influences one's mental health (Verma et al., 2022) and that online misinformation negatively correlates with vaccination rates (Pierri et al., 2022). There is also evidence that the spread of health misinformation and health disinformation is sometimes politically motivated (e.g., Broniatowski et al., 2018) and that political beliefs or ideology play a role in accepting misinformation (e.g., Jamieson & Albarracín, 2020; Uscinski et al., 2020).

Table 2. Defining and exemplifying misinformation and disinformation

Concept	Definition	Examples
Misinformation	**"…information that is false, inaccurate, or misleading according to the best available evidence at the time." (Office of the Surgeon General, 2021, p. 4)**	Images in social media posts showing tankers "transporting" SARS-CoV-2 (Brennen et al., 2021) Cancer can be cured with cannabis oil (Johnson et al., 2020)
Disinformation	**"Misinformation…spread intentionally to serve a malicious purpose, such as to trick people into believing something for financial gain or political advantage." (Office of the Surgeon General, 2021, p. 4)**	Suggesting vaccines do not work to promote people purchasing unproven alternatives (Center for Countering Digital Hate, 2021) Bots and trolls promote discord and erode public confidence about vaccination (Broniatowski et al., 2018)

Note: Disinformation refers to misinformation distributed intentionally. Misinformation is typically used as a catch-all term to describe any inaccurate information (about health, politics, science, history, etc.). The definitions provided are general, whereas examples focus on instances of health-related misinformation and disinformation, respectively.

A recent review of misinformation research summarized factors that make people more susceptible to accepting and being affected by misinformation. That review found that conspiracy thinking, religiosity, conservative ideology, and conservative party identification were associated with greater susceptibility to misinformation (Nan et al., 2022). Indeed, misinformation and politicized health (and science) information often go together (e.g., Druckman, 2022; Havey, 2020; Peng et al., 2022). Conversely, being older, as well as having greater educational attainment, subject knowledge, literacy/numeracy, and trust in science, resulted in greater resistance to misinformation (Nan et al., 2022). These findings are important because misinformation might exacerbate extant communication inequalities and health disparities (see Southwell et al., 2023). Most people's health communication ecosystems likely have a greater volume of accurate information than inaccurate information. Still, confusion, uncertainty, and feeling overloaded are common for people trying to navigate and manage health information (e.g., Jensen et al., 2022; Southwell et al., 2023; Zimbres et al., 2021).

Exposure to misinformation can complicate people's experiences of the health communication ecosystem. Misinformation exposure might reinforce distrust of certain sources or produce confusion and uncertainty about medical decision-making. There is some evidence that exposure to health misinformation affects the health behaviors that people engage in, though more research is needed to track how and when people are exposed to misinformation, what amount of exposure results in adverse outcomes, how sharing affects individuals' well-being and health decisions, and what specific harmful effects exposure to health misinformation may have on people, as well as how health misinformation might exacerbate and reinforce communication inequalities and health disparities.

Digital inequality. **Limited digital access and digital inequalities affect people's abilities to navigate, and benefit from, the health communication ecosystem (and, more broadly, their communication environments).** The term digital divide describes disparities related to access to information communication technologies (ICTs, e.g., high-speed connectivity via broadband or personal ownership of a network-connected mobile device; see DiMaggio et al., 2004). Focusing on access gives a skewed perspective on broader digital inequalities. There are currently more people with broadband internet access (77%) and mobile communication ownership (i.e., 88% smartphone ownership; 97% ownership of cell phones, including smartphones) than ever before (Pew Research Center, 2021a; 2021b). Researchers have identified persistent digital inequalities (e.g., related to socioeconomic position, less use of e-health services by minority populations, and rural populations lacking high-speed internet access; see Robinson, Schulz, Blank, et al., 2020).

Additionally, other digital inequalities continue to emerge related to algorithms, cyber safety, and assistive technologies (Robinson, Schulz, Dunn, et al., 2020). The following section highlights two known factors influencing how people experience their health communication ecosystem—racism and geographic location.

More Differences in Health Communication Ecosystem Experiences

People's experiences of their health communication ecosystem—which include doctors and other healthcare professionals, entertainment programming with health content, health-related advertising, health news, social media, internet sites, state health departments, federal agency sites, and other source-receivers in their NCE and PCE—are influenced by other social and structural factors. A complete discussion of these social and institutional factors and how they influence individual health and health communication experiences is beyond the scope of this paper. Two examples that illustrate areas of well-known influence are discrimination (including racism) and geographic location.

Racism and discrimination disrupt the quality and use of people's health communication ecosystems. In a nationally representative survey, 21% of respondents report having experienced discrimination based on race/ethnicity, socioeconomic position, weight, sex, age, or ability to pay (Nong et al., 2020). Persistent negative experiences in healthcare settings shape expectations of future interactions and can contribute to skepticism or mistrust of healthcare systems (e.g., Quinn et al., 2019), as well as lead to stressful encounters that may limit recall of information shared (Biksey et al., 2011). Researchers discovered that community-level negative responses to race-related issues (e.g., Black Lives Matter) associated with more negative health outcomes for minority populations (Park et al., 2023). A recent study found that direct experience with racism-related events decreases sleep quality (McKinnon et al., 2023). Decreased sleep quality can result in social withdrawal (Simon & Walker, 2018), worsen one's mood, decrease attention, and have other negative affective and cognitive effects (Kilgore & Weber, 2013). If one experiences racism or discrimination, one's experience of a health communication ecosystem will likely be quite different from someone who has not.

Geographic location also exerts a meaningful influence on one's experience with a health communication ecosystem. People living in rural areas are more likely to experience digital inequalities (Robinson, Schulz, Blank, et al., 2020; Vogels, 2021). Rural health disparities include being at a greater risk for death than people living in urban areas for heart disease, cancer, unintentional injury, chronic lower respiratory disease, and stroke (CDC, 2017). These disparities are experienced even more frequently by racial and ethnic minorities among these rural populations (James et al., 2017). For certain topics, like cancer, rural populations report feeling more overloaded by information and more fatalistic about the disease (Jensen et al., 2022). There are also geographic disparities related to healthy food access, where lower-income, minority, and rural areas are more likely to have limited access to grocery stores and healthy foods (Larson et al., 2009). Combined with the predatory marketing practices discussed earlier, which target low-income and minority neighborhoods, where one lives could profoundly affect how one experiences their health communication ecosystem.

Discussing all of the factors, features, and inequalities is not possible in this paper. Other issues to consider include language preference, literacies, social network size, community involvement, algorithms, dis/misinformation, built and natural environments, housing, transportation, socioeconomic position, and various other social determinants of health (see NIMHD, 2018).

Navigating the Health Communication Ecosystem

People do not passively experience the health communication ecosystem. Navigating the health communication ecosystem, like the PCE and NCE more broadly, occurs through various behaviors related to the information available. These behaviors include information seeking, scanning, avoidance, and sharing. The processing of information is also important to understand but is beyond the scope of this review.

Health Information Seeking

People seek information to make informed decisions about their health, most commonly using the internet. In the U.S., about 80% of the population seeks information about health and medical topics (HINTS, 2023a), and about 70% who seek use the internet as their first source (HINTS, 2023b). That means approximately 127 million people use the internet to look for health and medical information online, a number more than double that of 20 years ago (see Cline & Haynes, 2001). There are few data about how much time people spend seeking health information or how often they do so over time, but there is a robust research literature focused on what prompts health information seeking and how health information seeking affects the people who do it.

Factors associated with health information seeking.

Numerous factors determine if, when, and why people seek health information. A recent meta-analysis (Wang et al., 2021) considered a variety of health information seeking theoretical frameworks and defined four conceptual categories that motivate and predict health information seeking: psychosocial (e.g., attitudes toward seeking, perceived knowledge), instrumental (e.g., information utility and trustworthiness), contextual (e.g., internet use), and demographic (e.g., age, gender, social status). People's perceptions of the quality/accuracy, trustworthiness, and utility of online information were significant determinants of people's online health information seeking behavior (Wang et al., 2021). Emotional states can also influence health information seeking behavior (Myrick & Willoughby, 2019).

Another study examined differences in antecedents of online health information seeking behavior in 2002 and 2012 (Li et al., 2016). Researchers identified three factors associated with online health information seeking in 2012 data that did not appear in 2002 data: age (older), income (higher), and status as a child guardian (being one). The study additionally reported numerous antecedents that did link to health information seeking behavior in 2002 and 2012, including gender (women), education (higher), and self-rated health status (healthy) (Li et al., 2016).

Beyond factors that predict or are associated with health information seeking, there has also been research on people's motivations to seek health information. Situational motivations for seeking health information include someone they know is dealing with a new health issue, the seeker managing a new health issue themselves, the prescription of a new medication or treatment, management of an ongoing health condition, following up on questions from a medical encounter, interested in changing health-related habits (e.g., diet, exercise), and being a caregiver (Rice, 2006). Researchers call information seeking on behalf of someone else (e.g., friends and family) surrogate, or proxy, information seeking (e.g., Reifegerste et al., 2020). Other work has found that press coverage of changing health recommendations (e.g., in 2009, when breast cancer screening recommendations changed) can increase online information seeking (Weeks et al., 2012). Using computational approaches, some researchers have looked at collective information seeking to understand multilevel factors influencing seeking behaviors (Xu & Margolin, 2023). These motivations exist (theoretically) *before* health information seeking occurs.

Outcomes associated with health information seeking. **Health information seeking is a behavior that can positively and negatively influence people.** Regarding positive effects, researchers have found that information seeking about fruit/vegetable consumption and healthy lifestyle behaviors (e.g., physical activity) increases the performance of those behaviors (e.g., Lee et al., 2015; Lewis et al., 2012; Ramírez et al., 2013). Searching for COVID-19 information was positively associated with the intent to take recommended preventive actions (Li & Zheng, 2022). Information seeking also associates with colon cancer screening behaviors (Liu et al., 2020) and general cancer prevention behavior recommendations (Swoboda et al., 2021).

Lewis et al. (2022) noted in a recent review of health information seeking work that researchers examining unintended or negative effects of this information behavior is a relatively new pursuit, so research is somewhat limited. Regarding adverse effects, researchers have suggested that too much information seeking could lead to cyberchondria (i.e., emotional distress in response to problematic seeking behavior; see Zheng et al., 2021).

Other work found that seeking, in this case about COVID-19 information on social media, was related to information overload and information avoidance (Soroya et al., 2021). Dillard et al. (2021) found that fear about an infectious disease (Zika) led to information seeking, producing fear in the future, regardless of information relevance. Other work found that adolescents and young adults (ages 13-25) who sought information about vaping were more likely to report vaping months after information seeking (Yang et al., 2019).

Known health information seeking inequalities or disparities. **Some people are more likely than others to seek health information, which results in and reinforces communication inequalities.** People with lower levels of formal education seek health information less frequently (Richardson et al., 2012). Researchers found that cancer patients with higher education levels were more likely to seek information than those with lower education levels (Lee et al., 2012). This finding is important given cancer patients often need more specific information (e.g., about treatment) and could be vulnerable to misinformation about alternative treatments (see Johnson & Bylund, 2023).

There are few documented racial/ethnic disparities in how often populations seek health information (see Jacobs et al., 2017). There is some evidence of differences related to how many sources are used (e.g., Black Americans used more sources than white Americans when health information seeking; Liu et al., 2020). Language spoken can be a source of health information seeking disparities, as Spanish-speaking Hispanics were less likely than white respondents to seek cancer-related information (Viswanath & Ackerson, 2011). Other known communication inequalities, like internet access and use issues experienced by low-income individuals, affect health information seeking abilities (McCloud et al., 2016).

Some concluding thoughts on health information seeking. More than any other health information behavior, health information seeking has been the focus of consistent research for decades. In part, health information seeking is complicated to understand because one performs the behavior in the already complicated health communication ecosystem and often in private. The three other health information behaviors—scanning, avoidance, and sharing—are also complex but have not been as thoroughly researched.

Health Information Scanning

People do not constantly search for information. Instead, people encounter all sorts of information in their daily lives from their exposure to mediated content and interpersonal conversations. When this happens with health information, we call the behavior health information scanning. This scanning behavior is distinct from health information seeking because scanning occurs while engaging in broader exposure to one's communication environments. One challenge in understanding and studying health information scanning is people's ability to remember information they encountered, meaning that people's exposure during scanning is not entirely passive. Liu and Niederdeppe (2023) argue that scanning is distinct from similar concepts like browsing, non-strategic information acquisition, casual seeking, and information encountering because it is not entirely passive.

When researchers evaluate if people have engaged in health information scanning across all topics, people report high levels of the behavior: 90% of people engaged in scanning about at least one behavior in one study (Kelly et al., 2010). In another study, 80% of people reported they paid attention to health information in mediated sources (Shim et al., 2006). Overall, health information scanning is more common than health information seeking—this is true in every study of information scanning and seeking reviewed for this paper—though people are generally influenced more by information they seek than scan (Niederdeppe et al., 2007).

Like information seeking, people are varied in exactly what health information they scan. Research findings have indicated varied results about how people report their information scanning behavior. For example, Kelly et al. (2010) found that 54% of people indicated scanning for information about colonoscopy, while Liu et al. (2020) found 41% indicated they scanned for similar information. People often use multiple sources to scan for health information (Kelly et al., 2010; Liu et al., 2020; Nguyen et al., 2010) and are more likely to scan sources they trust (Ruppel, 2016). In the context of scanning, people have indicated they trust entertainment and internet sources as much as information-oriented sources (Ruppel, 2016). This could be related to what researchers have called the news-finds-me perception of information behavior (see Gil de Zúñiga et al., 2017), which refers to the idea that if relevant information is available (about health or other topics) and important enough, then that information will appear through one's social network (see Lee et al., 2023 and Lin et al., 2023 for health-related examples and how this perception may result in problematic outcomes).

Factors associated with health information scanning. **Fewer studies examine the antecedents and factors associated with health information scanning than health information seeking.** In one study, the factors with the largest associations with health information scanning were identifying as female, a racial/ethnic minority (compared to non-Hispanic whites), and reporting greater social capital (Bigsby & Hovick, 2018). Other factors associated with scanning included age, education, and income (Bigsby & Hovick, 2018). Other work found similar patterns in demographic antecedents of scanning, but those studies differed regarding support for differences related to race/ethnicity (e.g., no association in Kelly et al., 2010, but an association in Shim et al., 2006). In research examining scanning for a specific topic (e.g., colorectal cancer screening), age and insurance status were antecedents of topic-specific scanning behavior, but race was not (Liu et al., 2020). Scanning behavior about cancer causation was associated with people identifying as women and non-white (Waters et al., 2016). Additional antecedents of health information scanning include high self-reported health status and having a family health history relevant to a topic (Shim et al., 2006). Certain demographic variables seem to be consistent antecedents of health information scanning, but, if considering specific health topics rather than overall health, the associated factors may vary.

Outcomes associated with health information scanning. **Health information scanning influences a variety of key health behaviors and behavioral antecedents.** For example, health information scanning influences healthy beliefs (Hovick & Bigsby, 2016), knowledge (Kelly et al., 2010; Shim et al., 2006), and cancer patients bringing information with them when they meet with their doctor (Lewis et al., 2009). Early studies also found cross-sectional associations between health information scanning and the performance of healthy and recommended behaviors (Kelly et al., 2010; Shim et al., 2006). There is also longitudinal evidence that health information scanning benefits various health behavior outcomes, including fruit/vegetable consumption, exercise, and repeat mammography, but the positive effects occurred within people already engaging in recommended behaviors (Hornik et al., 2013). In that same study, researchers found cross-sectional associations of health information scanning with dieting and colonoscopy uptake but no longitudinal evidence to link scanning to those behaviors (Hornik et al., 2013). Overall, considerable evidence supports that health information scanning positively affects health behavior outcomes.

There is less research on the unintended consequences or effects of health information scanning. One study of note found health information scanning different sources about vaccine safety resulted in greater concerns depending on the source and the race/ethnicity of the scanner (Moran et al., 2016). For African American respondents, scanning newspapers increased vaccine safety concerns, while using books/magazines decreased concern. For non-Hispanic white participants, talking with others increased vaccine safety concerns, an association found in Mexican American participants as well.

Known health information scanning inequalities or disparities. **There has not been research on disparities related to health information scanning specifically.** That said, previously reviewed disparities and inequalities of the health communication ecosystem apply to health information scanning (e.g., digital inequality, available resources, presence of competing/conflicting messages, skills to navigate the health communication ecosystem, etc.). Related to better understanding health information scanning disparities, Liu and Niederdeppe (2023) suggest testing messaging that could improve the quality of health information scanning among those experiencing disparities, inequalities, and inequities (e.g., increase scanning of trusted and credible sources of health information).

Some concluding thoughts on health information scanning. Health information scanning occurs as people navigate their broader communication environments. During everyday life, someone may be more or less likely to encounter and recall health information than others. Systematic differences in people's social networks likely play a role in how much health information one encounters via daily communication behaviors.

Health Information Avoidance

There are a variety of situations in which people may decide encountering or gathering more health or medical information is not in their best interest. Health information avoidance includes ignoring information or preventing information acquisition relevant to one's or others' health or medical situations. A major goal of avoidance is to delay or limit emotional unpleasantness, discomfort, uncertainty, and other negative or unpleasant cognitive or affective states. An example of information avoidance would be finding out that one's parent has been diagnosed with cancer linked to genetic markers. In response to this event, someone decides not only to avoid seeking information about cancer genetics but also to avoid looking at news channels that may prompt unwanted cognitions related to worry or fear about their health. Health information avoidance does assume some awareness of information being "out there" in the health communication ecosystem (Link, 2023) and is not just about emotional discomfort. Conceptually, health information avoidance, similar to scanning and seeking, encompasses a variety of behaviors and strategies. These include, but are not limited to, information rejection/denial, avoiding communication providers who might want to discuss such information, controlling information/disclosures within interactions, selective exposure to health-related information, actively refuting information, and many more (Barbour et al., 2012). As an example, people may avoid information about environmental health issues (e.g., radon exposure being common in their region) if they do not believe the issue will affect them personally (e.g., "it hasn't hurt me yet") or if they think that learning about the issue result in actions with considerable opportunity costs (e.g., hiring a radon mitigation specialist).

Research suggests fewer people avoid health information than seek it, but information avoidance is still a relatively common information behavior. Because information avoidance can take many forms, Howell and colleagues (2021) note that estimates of the prevalence of the behavior vary widely, though most estimates seem to suggest about 25% to 40% of people engage in some type of avoidance of health information. Some estimates for specific health conditions (e.g., cancer) can be higher (~50% in Chae et al., 2020). These estimates vary due to how people define avoidance (e.g., active ignorance about one's risk versus scheduling an appointment and not attending said appointment; Howell et al., 2021). People avoid health information from mediated sources and interpersonal/family interactions about certain topics (see Donovan, 2023).

Factors associated with health information avoidance. **Studies are inconsistent in identifying demographic antecedents and correlates of health information avoidance** (Howell et al., 2021). One of the largest studies to examine health information avoidance found that people identifying as men, white, and not having a cancer history were more likely to engage in cancer information avoidance (Chae et al., 2020), consistent with previous work on this topic (Chae, 2016). Chae and colleagues (2020) also found that people experiencing information overload were more likely to avoid information (see also Soroya et al., 2021) but that the negative effects of information overload only occurred in those with less social support (i.e., smaller social network/fewer friends). In a study of COVID-19 information avoidance, Qu et al. (2021) examined three types of information avoidance: interpersonal (information coming from others), media (information from any mediated source), and cognitive (one's thoughts). Across these types of COVID-19, people who perceived their close networks as approving of information avoidance were likelier to engage in all kinds of health information avoidance studied (Qu et al., 2021). Howell and colleagues (2021) found a handful of other antecedents of health information avoidance, including people engaging in the behavior because they want to avoid challenges to their selves, their worldviews, and their other behavioral choices or perceptions of behavioral control. Donovan (2023) notes that when operating in family units, people may avoid health information because of concerns related to stigma or family reactions.

Outcomes associated with health information avoidance. **Studies that examine outcomes associated with health information avoidance suggest, uniformly, that there is no current evidence of long-term health benefits of health information**

avoidance. Avoiding cancer risk information has been associated with lower levels of colon cancer screening (Emanuel et al., 2015). Numerous studies support the idea that avoiding health topics in families results in reduced mental and physical health (see Donovan, 2023). Cancer survivors who avoided health information were likely to rate themselves as less healthy (Jung et al., 2013).

Known health information avoidance inequalities or disparities. **There is limited research on inequalities and disparities in health information avoidance behavior specifically.** In a study of cancer patients, McCloud and colleagues (2013) found that "participants who were younger, female, had greater debt and lower income, and had difficulty using and understanding information were more likely to avoid information." This finding suggests that persistent communication inequalities related to socioeconomic position influence populations with critical information needs (e.g., cancer patients). Health information avoidance disparities and inequalities are likely linked to issues discussed above related to health information seeking, as the behaviors represent opposite actions, though the behaviors are distinct (see Link et al., 2023).

Health Information Sharing

Information sharing refers to any behavior where a message source distributes, refers, or otherwise attempts to expose others to information. The study of information sharing, broadly considered, has been central to communication research for decades (Southwell, 2013). Researchers have most frequently studied health information sharing resulting from information exposure. Southwell (2013) provides examples of information-sharing behaviors, including talk/conversation, forwarding, protest and denigration, peer referral, cooptation, and overt endorsement. While this list is not necessarily exhaustive, the list demonstrates that information sharing refers multiple and varied actions. Some research that examines the internet and social media refers to health information sharing as online health information exchange (Börsting, 2023).

Factors associated with health information sharing. **People are motivated to share information for various reasons, and numerous individual-, community-, and**

content-level factors influence information sharing. The motivations for health information sharing are diverse depending on specific source-receivers. For example, researchers have found physicians share information online due to material (e.g., attracting patients) and professional (e.g., providing health service) motivations (Yang et al., 2023; X. Zhang et al., 2020). People are motivated to share health information on social networking sites (e.g., Facebook) to gain information and emotional support (Rui, 2022). Southwell (2013) reviews evidence that people's perceptions of information utility, exchange of social capital, identity management, self-concept, and desire to be seen/heard—among many other factors—can motivate health information sharing. Another way to consider why people share information is to consider why they do *not* share information. People indicated that they did not share health information to avoid perceptions of being ill and burdening others, as well as having a lack of trust in others, the internet, and a desire to avoid information overload (Huisman et al., 2020).

For health information, the following individual- and community-level factors connect to sharing: (1) socioeconomic position (e.g., education), (2) personality (e.g., gregariousness), (3) communication apprehension (i.e., less willing to disclose information), (4) sensation seeking (e.g., desire new interactions), (5) social capital (e.g., more benefits or expectations to share with a network), (6) social network size (i.e., more access to information and more people who may want to see it), (7) residential stability (i.e., longstanding networks with strong ties more likely), and (8) cultural differences (see Southwell, 2013 for a comprehensive review). For online health information exchange, individual concerns about privacy also influence the likelihood of sharing health information (Börsting, 2023).

Certain content features also influence people's health information sharing. Content-level features and perceptions of content that influence sharing include information (1) with high utility, (2) that is controversial or novel, (3) evokes an emotional response, or (4) familiar to a receiver (see Cappella et al., 2015; Kim, 2015). Content likely to boost one's confidence in interpersonal conversations could also influence information sharing

(Southwell, 2013). For content-level features, there are differences in terms of which features and perceptions of content have been associated with sharing via certain channels (e.g., email vs. social media, see Kim, 2015).

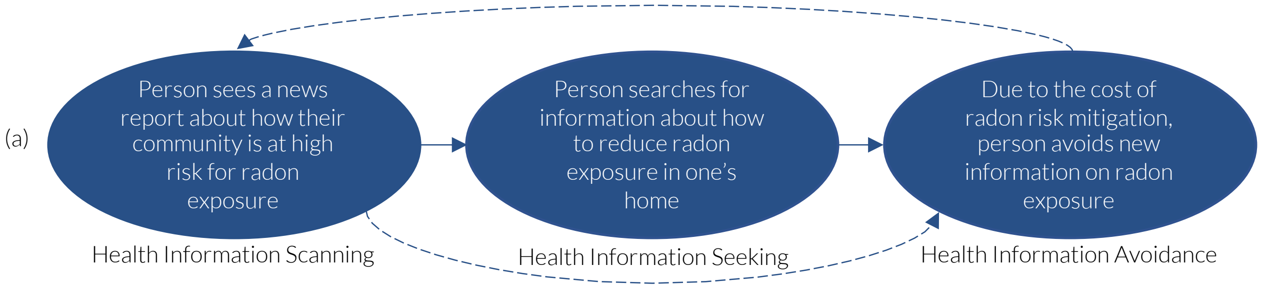
Outcomes associated with health information sharing. **The health outcomes of health information sharing are likely consistent with the other information behaviors that have positive outcomes (seeking and scanning)**. Sharing by one source is information that can be scanned or sought by another receiver/potential source. Southwell (2013) presented clear evidence that information sharing can result in knowledge gains, increases the cognitive salience of a particular topic or piece of information, and informs knowledge about in-network and out-of-network norms. Sharing health information has not been shown to result in specific behavioral adoption. People sharing health information could have positive effects. Another possibility is that people share information and that sharing has a negative influence (e.g., by presenting information people trying to avoid it for their well-being or by sharing dis/misinformation).

Known health information sharing inequalities or disparities. **There are well-documented communication disparities related to health information sharing.** Previous work on health information sharing disparities focused on conversation gaps, which refers to how "some corners of society should be predictably more likely to talk about announcements, campaigns, and other news items" (Southwell, 2013, p. 8). In other words, interactions about certain information are more likely to occur among certain individuals due in part to the many factors associated with other health information behaviors (e.g., someone is exposed to more health information via being an engaged information scanner has more access to share information than someone with no time or ability to engage in health information sharing). This idea of conversation gaps builds off of work on the knowledge gap hypothesis (see Viswanath & Finnegan, 1996), noting that often communication disparities and inequalities exacerbate existing knowledge (and health) disparities (Southwell, 2013).

The Dynamic Interplay of the Four Information Behaviors

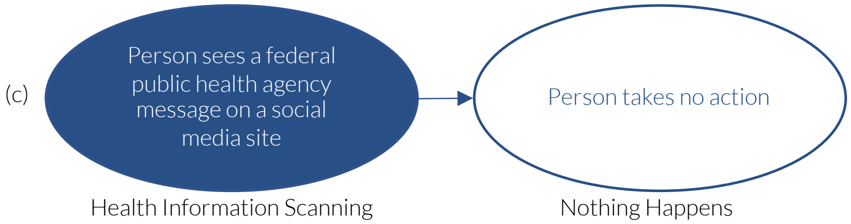
The four information behaviors reviewed within the health communication ecosystem represent common actions that communication sources/receivers might take. Depending on context and timing, these behaviors can cause or lead to other information and health behaviors (see Figure 2 for some examples). All of these information behaviors can happen concurrently when considering the broader communication environments in which people, organizations, and institutions exist (i.e., people might share recommendations for restaurants, seek information via product reviews to inform purchasing decisions, avoid information about politics, etc.). One can imagine a scenario with any sequence of these behaviors (i.e., someone tends to avoid health information, but a family member shares relevant information in a conversation, resulting in increased recognition of such content via scanning, which leads to seeking and less avoidance).

Understanding how to attract attention to health information when people are scanning and making sure accurate, credible, and actionable information is available when people seek it out are critical considerations for improving communication infrastructure and modernizing communication strategies. Accomplishing this dissemination of information, and ensuring a regular stream of content from reliable sources, is a complex challenge with few simple answers. The goal should not be just to provide a resource and assume algorithms or interest will drive exposure to that resource. Instead, the goal should be devising strategies—likely context and timing specific—to maximize exposure to information that can improve population health. Doing so successfully is more likely if two-way communication approaches—like collaboration, conversation, and community-building—are used and carefully selected third parties and storytellers are identified that can help disseminate the message to audiences of interest.

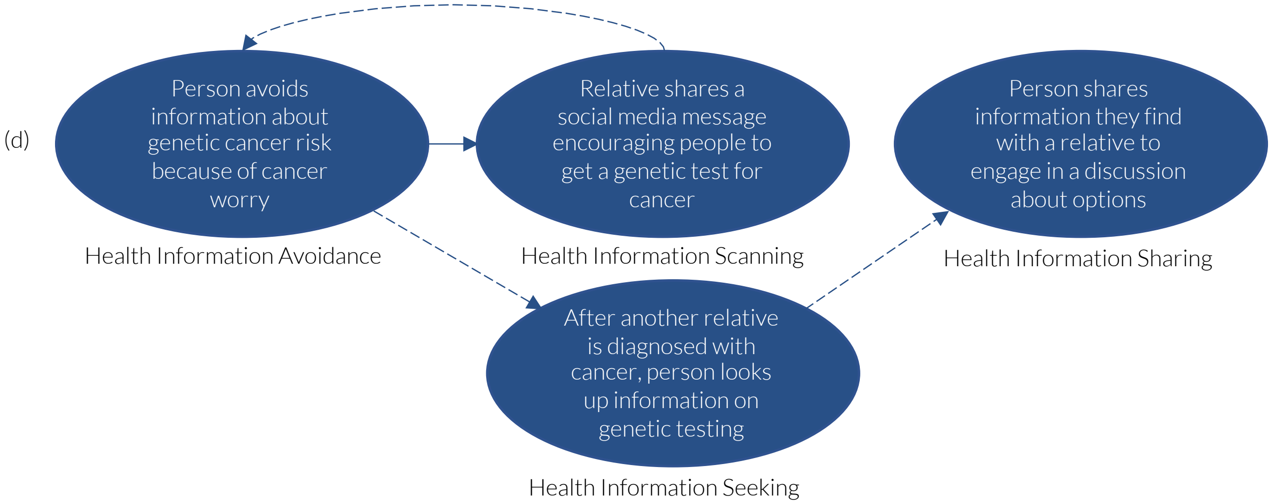


(a) In this first scenario, someone is exposed to health information from routine information behaviors (e.g., consuming news), then looks for information in response to information scanned, which in turn leads to avoiding information in the future. The dashed lines represent the possibility that, while engaging in information avoidance, the person might encounter relevant information again, but in such a situation would continue to avoid relevant information and not seek after the additional scanning occurrence.

(b) In this second scenario, someone seeks information from family and friends about weight loss strategies. Those family and friends provide suggestions and later, while looking for information online about gym memberships, this person finds a news report about a new study supporting a diet plan suggested by a friend. In response to those information behaviors, the person adopts a dietary plan. The person may seek or scan additional relevant information in the future or continue to adopt the diet plan recommended.



(c) In this third scenario, someone comes across a federal public health agency message on a social media site (e.g., TikTok) and takes no action whatsoever. While this scenario is not complex, this is often what happens.



(d) In this fourth scenario, someone is worried about their possible genetic cancer risk and avoids information about hereditary cancer risk and cancer genetic testing. While engaging in information avoidance, a relative shares a social media message with the information avoidant person, who after receiving that message continues to avoid relative information (indicated by the dashed line). After a relative is diagnosed with cancer, the person avoiding information decides to seek information about cancer-related genetic testing. Once they find information about cancer genetic testing, they share that information with another relative because they have a desire to discuss options and possibilities (which means they may or may not later engage in said behavior).

Figure 2. Examples of the Dynamic Interplay of Health Information Behaviors

Final Comments on Navigating the Health Communication Ecosystem

Sometimes health information is sought. Sometimes health information is scanned. Sometimes health information is avoided. Sometimes health information is shared to be later sought or scanned by someone else in the health communication ecosystem. Sometimes health information is never seen even though it is made available. While it may have once been possible to release information into communication environments with few channels and few trusted sources, expecting that eventually someone would stumble upon the information, health communicators today need to reconsider their approach to communicating with audiences of interest. **The current health communication ecosystem requires communication infrastructure and innovative strategies for disseminating accurate, credible, evidence-based, and actionable information to audiences engaged in complex navigation behaviors.** This improved communication infrastructure is likely to improve the health communication ecosystem and contribute, over time, to decreases in communication inequalities and related health disparities.

Improving Understanding of the Health Communication Ecosystem

Numerous opportunities exist to improve understanding of the health communication ecosystem dynamics and inequities. Much of what we know about how people navigate the health communication ecosystem is about cancer specifically. The COVID-19 pandemic motivated researchers to examine these various health information behaviors in an infectious disease context. There remains a possibility that there are aspects of health information behaviors for which we have an uncertain understanding because most research focuses on a long-term, chronic health condition. More research should examine information behaviors about everyday health concerns people might be trying to seek information about or come across in their daily lives like food safety, environmental health risks, or mental health. Further, there have been only a few studies of how communication inequalities play a role in influencing how and why people seek information (and what sources they use). When examining information seeking and scanning, more studies must consider digital inequality and communication inequities.

The internet offers numerous opportunities to engage with the health communication ecosystem. Until the last few years, many researchers have considered "the internet" as a source or channel of health information. **Future research should more carefully assess exposure to information online to discover what aspects of people's online information behaviors are most likely to affect intermediate and long-term health outcomes.** This approach will require agility and flexibility in adopting measurement and deploying research tools because popular online sources and platforms will continue to shift and change as people's information behaviors adapt to social and digital media innovations. Also important is improving understanding of how people in traditionally underserved areas (low SES neighborhoods, rural areas) engage in the four health information behaviors reviewed in this paper to understand more about how geographic disparities affect health disparities and communication inequalities.

Exposure is vital because repeated exposure to information improves the likelihood that said information influences people (see Hornik, 2002b). While a social media post going viral might greatly expand the reach of that message, people may only see that viral message one or two times. More critical is strategizing efficient ways to consistently increase exposure to accurate, actionable information. Doing so is one way that engaging in more community-based work, both online and offline, may benefit federal health communicators (i.e., amplify exposure to information and message content of interest, etc.). Social media platforms, and easy-to-create user-generated content, can be helpful for federal health communicators. However, the need is to both gain reach and optimize exposure.

Recently people have also started to do more research using large data sets of observations of information and messages people post on social and digital media (e.g., via scraping Twitter, YouTube, Reddit, Pinterest, and other platforms). **While "big data" research offers an exciting path to examining the health communication ecosystem and the broader public communication environment, the work often does not**

consider data absenteeism (i.e., what data do not appear in such datasets). Still, research in this area makes conclusions about the general population regardless of data absenteeism and related exclusion of information exchanged and created in the nonpublic communication environment.

For example, researchers may pull all Twitter content related to cancer screening, use natural language processing to determine information categories people have posted or shared, look at how people shared or otherwise engaged with the content, and then make grand conclusions about health information sharing behaviors (or estimate health information scanning exposure) based on those data. However, any social media platform—even the most widely used—is used by only a small portion of the population. Researchers must remain mindful of data absenteeism and chauvinism (see Lee & Viswanath, 2020; Viswanath et al., 2022). **Future efforts would be welcome that focused on innovations and improved infrastructure to allow for more efficient, inclusive, and complete monitoring of public (and nonpublic) communication of health-related information to improve health outcomes while contributing to reductions in health disparities.** One recent example of this innovative approach would be iHeard, run by Washington University, which crowdsources rumors and misinformation and offers health communicators suggestions for correcting these inaccuracies (see iHeard St. Louis, 2023; Weng et al., 2022).

The Constantly Evolving Health Communication Ecosystem

One challenge to studying, engaging with, and using the health communication ecosystem is the constantly evolving nature of such a system. **Strategies and tactics to communicate with people (and organizations) from twenty years ago are unlikely to work well today.** Instead, there needs to be a reconsideration of what it means to communicate within larger communication environments, including those we cannot access, about health-related topics. **Even more challenging is that the health communication ecosystem will likely continue to change dramatically in the coming years.** Some of these changes will be beneficial, such as continuing to increase the number of people with access to online systems and broader networks of information. A related challenge is the continued uncertainties related to the regulation and monitoring of misinformation at the local, state, and federal levels as more and more people can generate, disseminate, and consume user-generated content. **Given the rapid nature of technological development and innovation, even with aging generations being more tech savvy than previous generations, we are likely to see some generations be tech savvy in different ways that may or may not be compatible with broader technological changes relevant to the health communication ecosystem.**

Implications for Federal Health Communicators

The health communication ecosystem exists within larger communication environments where people, organizations, and institutions create and share information. People's experiences with the current health communication ecosystem are drastically different than ten or twenty years ago, due in part to the availability of more sources of, and outlets/exchanges for, health information than ever before. Messages from federal agencies about health will often get lost in the vast communication environments dominated by user-generated content with (potentially) commercial backing. Past strategies must be adapted and updated for a rapidly changing health communication ecosystem. Adjusting and updating communication approaches requires considering where people go for health information, who they trust, and how they navigate the health communication ecosystem.

Over the past decades, people have increasingly used online sources as their first outlet for health information. How much people trust online sources is variable and changing. Still, federal health agencies need to determine for what topics they are viewed as a trusted source and for what health topics trust needs to be reconsidered and redeveloped. People's experiences with the health communication ecosystem are varied, and a priority for future federal efforts should be working to direct audiences to credible health information. Directing audiences to credible health information can be challenging, given some of the characteristics and features of the health communication ecosystem, like being exposed to predatory marketing, direct-to-consumer advertising, conflicting or competing health information, and health misinformation. Additionally, people's experiences of the health communication ecosystem are affected by longstanding communication inequalities (e.g., differences in people's abilities to use communication technologies) and other health inequities (e.g., racism and discrimination).

People navigate the health communication ecosystem by engaging in various information behaviors relevant to communication (e.g., seeking, scanning, avoidance, and sharing). Health information seeking is the most researched behavior, referring to people looking for information in response to a health information need. Health information scanning occurs during routine communication patterns (e.g., interpersonal conversation or browsing social media), where one takes in health-related information and pays enough attention to recall seeing the information later. Health information avoidance is when people try not to see certain health information for some reason. Health information sharing refers to distributing health information to others in one's health communication ecosystem. These behaviors are complicated and triggered by various information needs, but they represent how most people send, receive, and acquire health information within their health communication ecosystem. Current systems of monitoring health information within the ecosystem are generally insufficient to keep up with an evolving communication landscape. More communication infrastructure and strategizing are needed to ensure credible information rises to the top of people's searches (and scans) for all health topics.

Moving Federal Health Communication Efforts Forward

Current practices of communicating with the public, from federal agencies and other public health communicators, are outdated and function under a belief that more information or the correct information will eventually make it to audiences who need it. This is simply not the case. Providing more information, an approach known as the deficit model (see Simis et al., 2016), is not the solution to addressing longstanding health communication information needs and inequities inside the current ecosystem. That approach does not work. Innovative strategies, like engaging in communication planning that includes shortterm, long-term, and crisis communication goals and incorporating agile ideas to adapt communication strategies and tactics to the public health goals at any given time, offer paths forward. Such planning for federal health communicators is challenging, given differing priorities from one administration to the next and the overall bureaucracy in which these communicators must operate. Still, engaging in as much communication planning as possible—while embracing adaptable, agile strategizing—is likely to have long-term benefits.

Improving infrastructure requires building the capacity to use modern platforms (i.e., social media) to interact with audiences instead of just delivering information in posts that few people see. Infrastructure building also means engaging more with communities—which is complicated to pursue and conceptualize, particularly during a public health crisis (see Sastry et al., 2023)—but will likely benefit and improve federal health communication efforts if done well. Related, partnering with diverse storytellers—across public and nonpublic channels—increases the likelihood that when information needs to make its way through complex communication environments, it will do so efficiently.

While there are many challenges to evolving communication strategy and infrastructure in the federal government, COVID-19 demonstrated the need to reconsider all aspects of how federal agencies develop and deliver communication efforts. None of the solutions are easy to accomplish, but pursuing them increases the likelihood of federal agency preparedness to engage with the health communication ecosystem that benefits population health and well-being as health information needs shift and change.

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