



Franklin County

A Natural Setting for Opportunity

AGENDA

FRANKLIN COUNTY BROADBAND AUTHORITY

MONDAY, OCTOBER 18, 2021

B75

- 2:30 Call to Order, Broadband Authority Chairman Mitchell
- 2:31 **Fixed Wireless Project Updates (VATI 2020 Project)**
Steven Sandy, Assistant County Administrator
Anthony Smith, Blue Ridge Towers
John Manning, Briscnet
- 3:00 Request for Closed Meeting in Accordance with 2.2-3711, (A) (29) discussion of the terms of a public contract, of the Code of Virginia, as Amended.
- 3:25 Adjournment

Board of Supervisors work session to immediately follow



Is 5G Harmful to People?



Medically reviewed by [Madeline Knott, MD](#) — Written by [Kirsten Nunez](#) on May 10, 2021

[What is it?](#) [Does it affect health?](#) [Animals](#) [False claims](#)
[Controversy](#) [Summary](#)



Marlon Trottmann/EyeEm/Getty Images

5G is the latest network of wireless technology. It's used to transmit data between appliances, like mobile phones and [Bluetooth devices](#).

5G works by producing a type of energy called electromagnetic radiation. It uses higher frequencies than previous wireless networks, making it faster and more efficient.

Electromagnetic frequencies, like those produced by 5G, create an area called an [electromagnetic field \(EMF\)](#). Some people believe EMFs have negative health effects.



Read on to learn about 5G and what research says so far.

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What is 5G?

Wireless technology is constantly evolving. Approximately every 10 years, mobile companies release a new generation of wireless systems. Each generation is an upgraded, more advanced version of the last one.

In 2019, 5G networks were released. The term “5G” stands for “fifth generation.”

5G provides faster mobile communications. This is expected to support the increasing number of electronic devices and services, including:

- self-driving cars
- virtual reality appliances
- telemedicine
- remote surveillance
- telesurgery

5G works by using higher frequencies on the electromagnetic spectrum. The frequencies range from 3.5 gigahertz (GHz) to several tens of GHz.

Before 5G was launched, these higher frequencies weren't used in

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It's worth noting that electromagnetic frequencies are produced by anything that uses electricity. This includes:

- microwaves
- power lines
- computers

5G also uses a method called beamforming, which sends data directly to devices. This is different from previous generations, which sent signals in all directions.

Does 5G technology have any effects on health?

According to the [World Health Organization \(WHO\)](#), there is limited research on the frequencies used in 5G.

There is more research on the health effects of electromagnetic fields across the spectrum. However, the results are inconsistent.

To date, EMFs have been potentially associated with:

Tissue heating

A [small 2017 study](#) showed that mobile phones use frequencies of 1.8 to 2.2 GHz. These frequencies cause tissue heating, according to WHO.

Tissue heating occurs when your skin absorbs electromagnetic energy. This causes a slight rise in temperature in your brain and body.

A [2021 study](#) also found that people experience more EMF-related tissue heating as they get older. Plus, the higher the EMFs, the more they absorb. That's because older individuals tend to have reduced skin thickness and blood flow.

However, tissue heating is considered to be short-term and minimal. The [Federal Communications Commission \(FCC\)](#) also states that the public is

More research is necessary to determine how 5G specifically affects human tissue.

Cognitive function

The effects of 5G exposure on cognitive function have not been studied yet.

There's some research involving EMFs from other sources. In a [small 2017 study](#)[📄], researchers examined how using a mobile phone affects cognitive function. The researchers found that using a mobile phone for at least 90 minutes a day is associated with attention difficulties.

A [small 2018 research review](#) found conflicting evidence. The researchers examined 43 studies regarding EMFs and cognitive function. They concluded that there is no solid link between EMFs and cognitive concerns.

Cancer

In 2011, the [International Agency for Research on Cancer \(IARC\)](#) stated EMFs are “possibly carcinogenic” to humans. The classification was determined by 30 scientists from 14 countries.

To date, most studies have examined the potential link between EMFs and brain cancer. But the results have been inconsistent.

For example, a [2017 research review](#) found that EMF radiation from mobile phones are associated with glioma, a type of brain cancer. A [2018 study](#), on the other hand, did not find a clear association between high frequency EMFs and brain tumors.

Again, more studies are needed to determine if 5G frequency can contribute to cancer development.

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Is 5G frequency or radiation harmful to animals?

There's limited research on how 5G specifically affects animals.

Most research has involved mice or rats. For example, a [2019 animal study](#)[📌] found that EMFs from mobile phones are linked to DNA damage in mice and rats. Another [2016 animal study](#)[📌] found that EMFs of any frequencies can harm the nervous system.

A [2020 research review](#)[📌] also examined how EMFs affect organisms like snails and frogs. The researchers determined that it is unclear if EMFs

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False claims about health risks

Since the release of 5G, many false claims about its health appeared on social media. Examples of these myths include:

- COVID-19 vaccines contain 5G microchips
- 5G release is used to cover up the COVID-19 pandemic
- 5G causes headaches, migraines, and dizziness

There is no proof behind these claims.

5G and the new coronavirus

There's also a myth that 5G mobile networks are associated with the [new coronavirus SARS-CoV-2](#), which causes the condition COVID-19. This is false.

According to rumors, 5G is said to directly spread the virus. But viruses spread through respiratory droplets, not wireless networks.

Some rumors claim that 5G suppresses your immune system, increasing your risk of contracting SARS-CoV-2, which causes COVID-19. But this is also false. There is no proof that EMFs or 5G affects your risk of developing viral infections.

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The IARC, which classified EMFs as “possibly carcinogenic,” is part of WHO. But WHO is completing its separate health [assessment of EMFs](#).

The [International EMF Project](#) manages the assessment. WHO established the International EMF project in 1996.

Dr. Lennart Hardell, an oncologist in Sweden, spoke out against the EMF project. In a [2017 research review](#), Hardell stated that five of the six members of EMF’s core group are affiliated with the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

According to Hardell, this is a conflict of interest. He also states that many members of ICNIRP are affiliated with industries that use wireless networks.

Takeaway

5G is the newest wireless network. It provides faster mobile communication by producing higher electromagnetic frequencies.

Currently, there’s no solid evidence that 5G causes negative health effects in humans or animals. Most researchers have studied EMFs in general and found mixed results.

Though more studies are needed to understand 5G, it’s not associated with contracting SARS-CoV-2, which causes COVID-19. 5G does not spread the new coronavirus or make you more susceptible to viral infections.

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Last medically reviewed on May 10, 2021

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Medically reviewed by [Alana Biggers, M.D., MPH](#)

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Written by [Kris Gunnars, BSc](#)

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5G is not hazardous to your health

Busting the radiation risk myth

Paul Lee, Kevin Westcott, and Cornelia Calugar-Pop

AS 5G BECOMES more widespread, some have sounded alarm bells about its supposed health hazards. Two main concerns have been voiced, both related to the radiation associated with the technology. The most common perception is that 5G causes cancer. The second fear is that 5G-emitted radiation weakens the immune system, enabling COVID-19 to spread.

Both of these fears, in our view, are grossly overblown. We predict that in 2021, it is very unlikely that the radiation from 5G mobile networks and 5G phones will affect the health of any single individual, be it a 5G user, a user of any other generation of mobile phones, or any individual in the vicinity of a mobile network but not actually using a mobile device. There is no link between the growth in COVID-19 infections and the roll-out of 5G networks.

Unfortunately, while extensive scientific evidence proves that mobile phone technologies have no adverse health impacts—not just for 5G but also earlier generations—we also predict that between 10% and 20% adults in many advanced economies will mistakenly equate 5G with possible harm to their health. A Deloitte consumer poll in May 2020 found a fifth or more adults in six out of 14 countries surveyed agreed with the statement “I believe there are health risks associated with 5G” (figure 1).

Radiation ≠ radioactivity

What has led to this high level of concern about 5G’s health impacts? It may have its roots in a simple confusion of terminology.

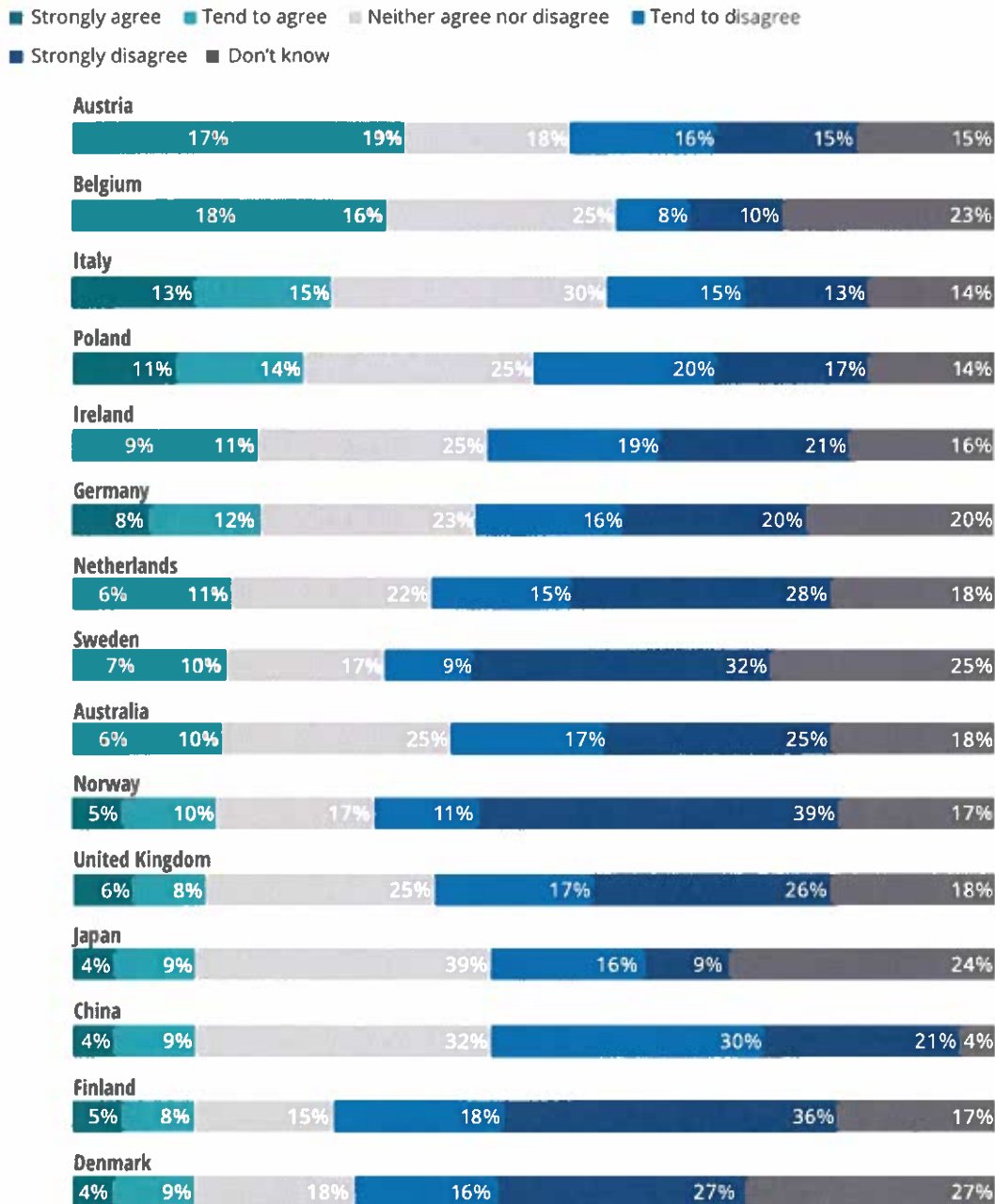
Radiation is commonly assumed to involve radioactivity, but this is not necessarily the case. The confusion arises because the words “radiation” and “radioactivity” have been conflated, a confusion that has persisted since the dropping of the Hiroshima and Nagasaki nuclear bombs in 1945. As a result of these events, as well as incidents at several nuclear power plants in the 75 years since, the term “radiation” has often mistakenly become associated with destruction on a massive scale. In a similar vein, “radiation”—in reality, radioactivity—is also associated with cancer, reinforcing the word’s connotation of mortal peril.

The point here is that radiation is *not* inherently radioactive. The literal definition of radiation is merely any process by which an object (from a human to a radiator to a star) emits energy (whether heat, light, or radioactive particles), which then travels through a medium (such as the air or hot water) and is absorbed by another object (a human body, a frying pan, a steam engine, or anything else). Radiation thus spans multiple everyday processes to which most people do not give a moment’s consideration. In our daily lives,

FIGURE 1

A substantial proportion of consumers in advanced economies believe that 5G can be harmful to their health

Agreement with the statement “I believe there are health risks associated with 5G,” by country



Note: Weighted base: Respondents who own or have access to a mobile phone or smartphone in Australia (1,915), Austria (952), Belgium (1,909), China (1,880), Denmark (518), Finland (520), Germany (1,868), Italy (1,902), Ireland (948), Japan (1,791), Netherlands (1,953), Norway (475), Poland (1,909), Sweden (903), United Kingdom (3,841).

Source: Deloitte Global Mobile Consumer Survey, May–August 2020.

most of us are regularly exposed to multiple types of radiation, most commonly in the form of sunlight.

By this definition, 5G does generate radiation, but at very safe levels, and none of it is radioactive radiation. 5G base stations and phones, and the frequency ranges within which 5G operates, are very likely to be operating well within safe parameters in 2021 and throughout 5G's lifetime, which may extend to two decades. Radiation within these parameters does not significantly raise the risk of cancer. It also does not weaken the immune system, and thus has not contributed to the spread of COVID-19.

Radio waves, 5G, and health: A new variation on a familiar theme

Understanding in more detail why 5G and other cellular mobile technologies are safe requires an elementary knowledge of how mobile networks and similar radio transmission-based services work.

Mobile phone networks are a variation on a conventional radio setup. A central transmitter relays sound via radio waves to a device equipped with an antenna (indeed, what is commonly referred to as “radio” today is a reference to the use of radio waves to distribute radio stations’ content). Radio waves, also known as radiofrequency electromagnetic fields (EMF), are a form of radiation, but a harmless one. Traditional television also uses the same distribution technique: A central transmitter relays sounds and images that are then received by antennas.

Today, billions of people receive TV and radio content via a network of transmitters that connect with receivers in homes, offices, and vehicles around the world. Although the proportion of video content delivered on demand has steadily risen over the past decade, most of the hours of video consumed

globally are still likely to be transmitted wirelessly via national networks of transmission towers.

All generations of mobile phone technology, including 5G, take the same familiar underlying approach. A mobile network consists of a nationwide grid of cell sites. These sites feature transmitters that generate radio waves, which are received by a mobile phone’s antenna.

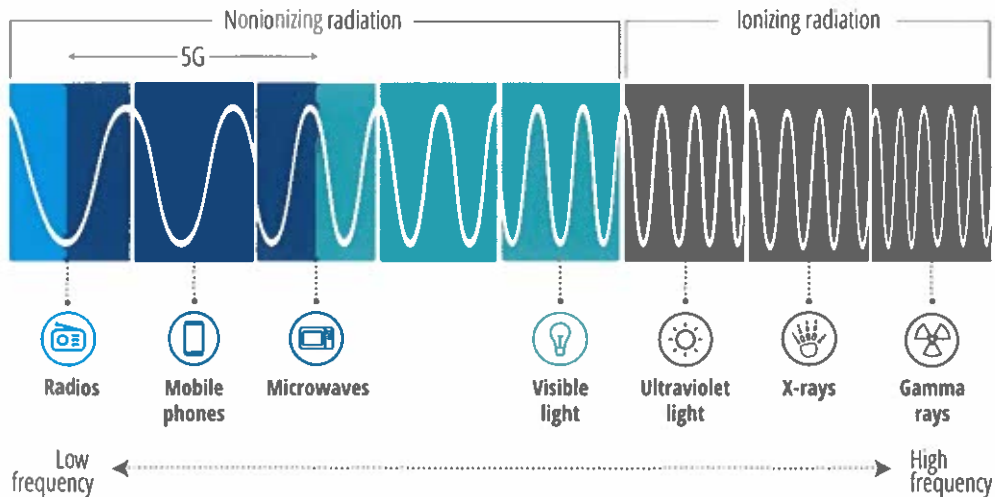
The radio waves generated by mobile networks, TV stations, and radio stations are innocuous. On the very broad spectrum (known as the electromagnetic spectrum) in which radiation exists, radio waves fall on the low-frequency, very low-energy end. Such radiation is sometimes referred to as nonionizing radiation. This contrasts with radiation such as X-rays, gamma rays, and some types of ultraviolet light, which fall into the high-frequency, very high-energy end (figure 2). These types of radiation are referred to as ionizing radiation, so called because it has sufficient energy to damage DNA by removing electrons from atoms, potentially leading to cancer.

Admittedly, one difference between broadcast radio and TV and mobile telephony is that the receiving device can also transmit. But even this capability is not wholly new. Walkie-talkies were first used in the 1940s; mobile phone networks, though designed to be scalable to whole countries and used for person-to-person calls, work on the same principle.

Another minor variation is the reach of each transmitter. For television, most transmitters in use today have a range of 65 to 90 kilometers.¹ For FM radio, the range is likely to be up to 45 kilometers.² Mobile phone tower transmitters, in contrast, typically have a range of between 50 meters and 20 kilometers, with the majority being low-range transmitters of less than 500 meters. The average range per base station has generally decreased over time as the number of base stations has increased, with the majority of additional base

FIGURE 2

The radio waves generated by 5G fall on the low end of the electromagnetic spectrum



Source: Adapted from SCAMP/Imperial College London/EBU.

stations covering much less territory. With the rollout of 5G networks, cell size may be as little as 10 meters in radius (known as small cells), with a transmission power of 100 milliwatts.³ (The rationale for reducing cell size is to enable higher performance with regard to download speeds or the number of users per square kilometer.) With small cells, the base stations are small enough to be wall-mountable or attached to lampposts.⁴ As cell size decreases, transmission power required declines.

The reason for mentioning these similarities is to point out that mobile telephony, including the latest 5G standard, relies on the same underlying transmission methods that have been used for decades. Content is created, relayed over radio waves, and received—a technique that has been delivering content wirelessly for more than 100 years.

Like the technology itself, concerns about the health effects of wireless transmission are not new. Some individuals were concerned about the impacts of earlier mobile network generations as

well as of other types of wireless networks, principally Wi-Fi and TETRA (a type of private radio communications network often used by emergency services). Looking further back still, some people worried about the health impacts of emissions from television transmitters too.⁵

A common concern going back decades has been the risk of brain and skin cancer from mobile phones. However, this concern has been demonstrated to be unproven. A 2019 study of mobile phone use and the incidence of brain tumors in Australia found no increase in the incidence of brain tumors since the 1980s. The researchers looked at the periods 1982–1992, 1993–2002, and 2003–2013, which covered the introduction of analog cellular (1G), 2G, 3G, and the beginning of 4G. Their conclusion: “[There have been] no increases in any brain tumor types, including glioma and glioblastoma, during the period of substantial mobile phone use from 2003 to 2013.”⁶ As for skin cancer, a 2018 review of medical studies undertaken between 1995 and 2017 found that “overall evaluations showed that

the effects of mobile phone radiation on skin diseases are weak and have no statistical significance.”⁷ These skin cancer studies alone comprised data from 392,119 individuals—a very large sample size.

What has been different about 5G is that the means of amplifying misunderstandings about its health impacts, either deliberately or ignorantly, are greater than ever, because the capability to share true or false information is greater than ever before. Many individuals who believe 5G may cause them harm have had these ideas suggested to them, most typically via social networks, in sensational but plausible language.

Extremely low power, extremely low risk

Of course, nonionizing radiation is not *always* completely harmless. The most common form of nonionizing radiation is visible light, which has a higher energy level than radio waves. An excess of visible light—or even radio waves—can produce heat, and in extreme cases cause burns and body tissue damage. However, the power behind the radiofrequency radiation generated by mobile networks is controlled and poses virtually no risk to consumers.

Power transmission from mobile telephony, including 5G, is far lower than that from light bulbs, TV, radio towers, or even sunlight on an overcast day. The quantity of this power is measured in watts, and a single watt is a *tiny* quantity of energy. The power transmitted by the mobile phones used in 2021 and into the foreseeable future can reach up to two watts, depending on the age of the phone; it can be as low as 0.001 watt, with the vast majority of devices in use this year peaking at 1 watt. By comparison, the power transmitted by CB radios, which have been in use for decades, reaches up to four watts.⁸

As with a car journey, the shorter the distance, the less the power required. A phone held next to the head or kept in a pocket would have the greatest impact. The radiation level from a phone or speaker placed on a table near the user would be lower. A smartphone will transmit more power when base stations are relatively distant, but most smartphones are used predominantly indoors, and tend to be connected to Wi-Fi routers (which are effectively miniature base stations), which are often mere meters away. In all of these cases, the amount of power transmitted is minimal—certainly much lower than required to be harmful. Further, a smartphone transmits power only when sending or receiving data, a mechanism designed to prolong battery life.

The power generated by mobile network base stations is similarly low. A base station’s transmissions range in power from a quarter of a watt for a small cell (which would often be indoors and cover a small range) to 200 watts⁹ for a minority of 5G base stations.¹⁰ More typically, an outdoor base station with the greatest range would have a power output of between 10 and 100 watts. The output of indoor base stations, which usually have a range of hundreds of meters or less, is much lower.¹¹

As with a phone, a base station’s power level declines with distance from its transmitter. An individual 100 meters away from a 5G macrocell antenna located at 30 meters’ height would absorb less than one microwatt (one-thousandth of a watt) of power.¹² When one is directly next to a base station supporting any generation of mobile standard (not just 5G), exposure limits may be exceeded.¹³ But these areas are inaccessible to the public, sometimes because of their height (20 meters or higher for larger sites), their location (often at the top of buildings), or their design (because the units are enclosed). In the case of indoor base stations, excessive exposure would only happen within a few centimeters of the transmitter.

Average broadcast transmission power has declined as the number of base stations deployed has increased, resulting in a smaller distance between base stations and users. Transmitter power levels for 1G and 2G networks were far more powerful, on average, than those used for 4G or 5G, since 1G and 2G transmitters covered a far greater range, often tens of kilometers in each direction. In contrast, 4G and 5G masts in city centers and other traditionally congested areas may cover just 100 meters.

It is worth reiterating how minuscule a watt is. An incandescent bulb, which radiates light via a wire filament that is heated until it glows, is rated between 25 to 200 watts. In domestic settings, people may be less than half a meter away from a light bulb. A person this distance from a 25-watt bulb would be exposed to thousands of times more radiation than an individual who was 10 meters (unusually close) to a relatively high-powered 5G base station.¹⁴ This is not just the case in 2021—it should hold true always. Similarly, people absorb five times more radio frequency exposure from FM radio and television broadcasts than from mobile network base stations.¹⁵ The broadcaster transmitter power levels used for TV and FM radio can reach up to 100,000 watts.¹⁶ For AM radio, the transmission power may reach 500,000 watts.¹⁷

Humans have coexisted with incandescent light bulbs, and their radiation, since the 1880s with no known malign effects (except, of course, from being burnt from touching a lit bulb). As for broadcast power, the first television station went on the air in 1928,¹⁸ and the first commercial radio station launched in 1920¹⁹—yet no reliable account of people being harmed by the radiation these stations generate has ever been reported.

5G is even safer than previous mobile network generations

In 2021, consumers who are concerned about the health impacts of mobile networks are likely to be most worried about 5G, the latest generation of mobile technology. However, in some ways, 5G is likely to have even lower potential health impacts than earlier generations of mobile telephony.

5G has been designed to use less power than previous generations to reduce operational costs; as a result, it emits less power as well. This is accomplished via the new, advanced radio and core architecture used in the 5G standard, with 5G networks assisting 5G devices in minimizing power transmit levels.²⁰ 5G base stations also can be put into sleep mode when there are no active users (for example, at night). This capability is not available with 4G networks, which transmit control signals even when there are no users in range.²¹

5G also incorporates a technique known as beamforming, an approach that involves directing a narrow beam of radio waves to the user device (such as a smartphone). This method is equivalent to directing a narrow beam of light from a pocket flashlight at a target, focusing the radio waves on the device. This method not only enables higher connection speeds, but also leads to lower radio wave exposure than prior network generations,²² which would often spread radio waves across a wide arc, similar to a car's headlight.

Some people may conflate the risks associated with beamforming with industrial-grade laser beams. A manufacturing-grade laser beam, which is 100 million times as powerful as a typical laser pointer, is capable of melting steel.²³ But beamforming in 5G networks involves innocuous levels of power.

As a final note, tests of 5G sites in 2020 by regulators such as Ofcom in the United Kingdom have found that their EMF levels are well within International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines.²⁴ ICNIRP is an independent scientific commission based in Germany that works with the World Health Organization (WHO), the International Labour Organization (ILO), and the European Commission. The highest EMF level recorded among the 22 locations tested was 1.5% of the acceptable level—in other words, 98.5% below the acceptable level. Most of the sites tested supported four generations of mobile technology; that is, a combination of 2G, 3G, 4G, and 5G (in many markets, 5G-only base stations remain relatively rare). At all of these sites, 5G contributed the *least* to the EMF fields measured. In 19 of the 22 locations, the highest 5G band value was less than 0.01% of the acceptable ICNIRP level.

5G and the spread of COVID-19

One myth about 5G's impact on health that has been widely spread in 2020 is the fictional association between the roll-out of 5G and the spread of COVID-19.²⁵ Put plainly, the idea that 5G

transmits COVID-19 is as bogus as it is impossible. COVID-19 is a virus spread through respiratory droplets from other people. A virus does not travel via radio waves.

A variant of 5G misinformation related to COVID-19 is that 5G emits radiation that weakens people's immune systems, making them more susceptible to illness.²⁶ This is similarly false.

It is likely that misinformation about 5G's relationship to COVID-19 will be as pervasive in 2021 as it was in 2020. An Ofcom survey at the end of June 2020 found that 29% of respondents had come across false or misleading information about COVID-19 in the prior week.²⁷ The most common topic, seen by 21% of respondents, was "theories linking the origins or causes of COVID-19 to 5G technology." Misinformation about 5G was even more prevalent earlier in the year: An Ofcom survey undertaken from April 10–12, 2020, found that 50% of respondents had seen false or misleading statements about 5G. The good news is that these people recognized the misinformation as such.²⁸ The bad news is that the majority (57%) of those who saw what they regarded as misinformation did nothing about it.



THE BOTTOM LINE

Our research shows that understanding of 5G's benefits is low in multiple markets, with up to two-thirds of adults stating that they do not know enough about 5G in general as of mid-2020. Among women, the proportion is even higher, at three-quarters. The lack of understanding also peaks among older users.

In the vast majority of cases, we would hope that the widespread provision of accessible but comprehensive information about how 5G and other wireless technologies work would put consumers' minds at rest. Mobile operators, mobile handset providers, telecommunications regulators, government communications bodies, and science programs on broadcast and on-demand platforms could, in combination, counter the vast tide of misinformation about 5G. Individual companies and regulators could also work together to constrain the ability to share misinformation, despite the commercial impact that this may have.

What would make an information campaign about 5G successful? Among other things, it would need to be both proactive and reactive. It would need to be designed for all types of users, not just those with a science background. And misinformation would need to be met with information of a similar caliber. Headlines need to be met with headlines. Rebuttals to fake claims should be expressed using similar channels and similar language. Misinformation spread by well-known individuals should be countered with information from well-known individuals. Celebrities with marketing relationships on the basis of significant social media presence could be asked to become the figureheads of information campaigns. Soap operas with mass market reach could include storylines that feature discussions and explanations about 5G. Without such widespread and accessible efforts, the facts may be ignored. It may not be enough only to post a link to ICNIRP.

Information campaigns also should do more than explain why 5G is safe. They should also educate people about its positive applications—for example, making everyday mobile applications, such as browsing and maps, notably faster. Carriers could also talk about how 5G could make other mainstream applications, such as driving, easier and safer. (A car could provide regular status updates, including video footage, to manufacturers, which could enable them to identify flaws faster.) The telecom industry could also showcase the many applications that 4G has enabled and that consumers have come to depend on.

There should also be debates on effective ways of preventing the proliferation of misinformation on social media. As social media becomes a far more common source of news, checks and balances that control for accuracy while still permitting freedom of speech are becoming increasingly important. Offering the ability to fact-check is one way to help social media users filter facts from fiction, but *all* readers cannot be relied on to have the discipline to verify.

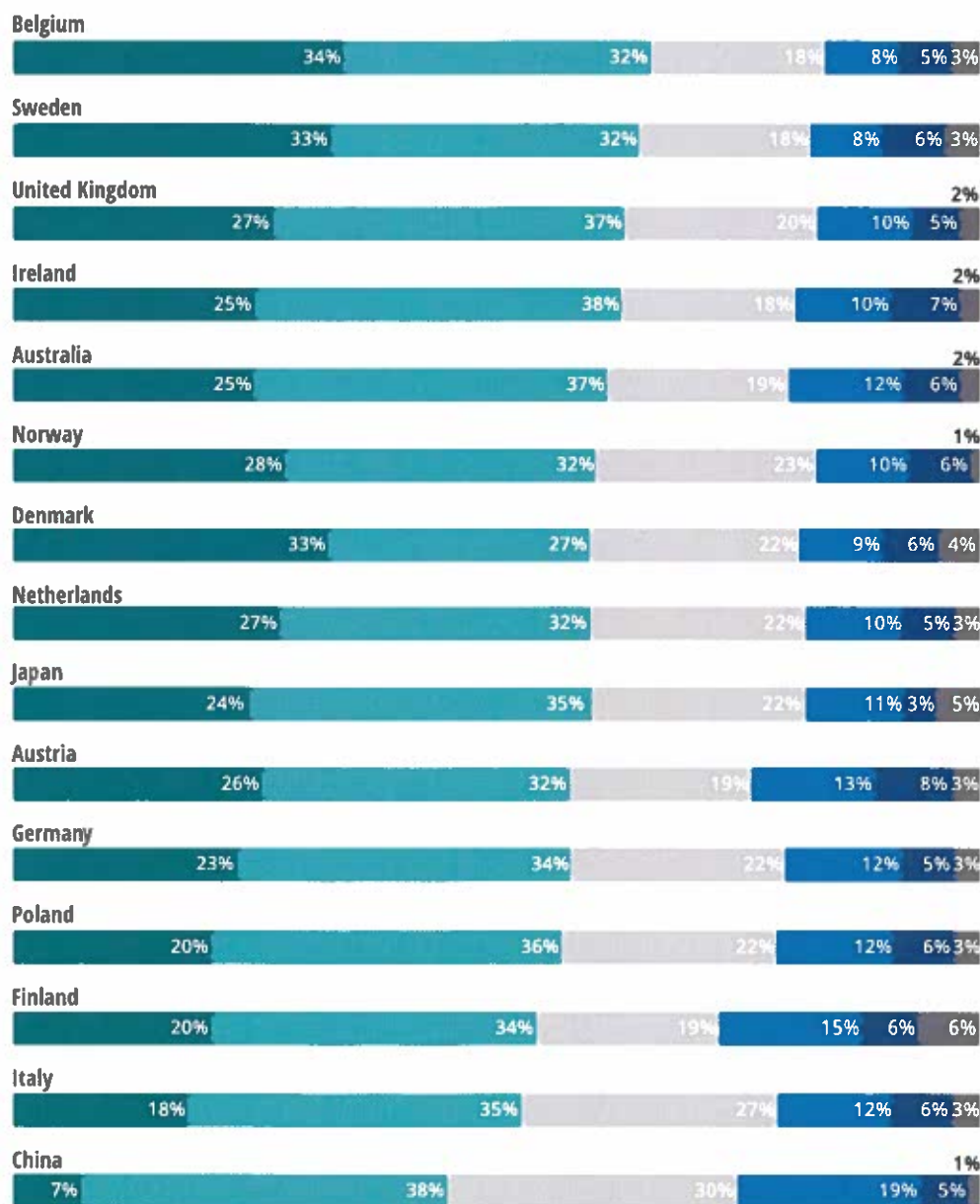
It may not be possible to persuade everyone that 5G is safe. There is likely to be a niche—perhaps less than 1% of the population—that will remain convinced not just that wireless technologies are harmful, but that their deployment is deliberate and that the intent is to cause harm. Unfortunately, while such niche views have in the past lacked widespread amplification, social media has often provided the mechanism for conspiracy theories to flourish and proliferate. If education is to be effective in curbing popular fears, it should be compelling, consistent, and pervasive, and it should begin now.

FIGURE 3

Understanding of 5G is low in multiple markets

Agreement with the statement “I do not know enough about 5G,” by country

- Strongly agree ■ Tend to agree ■ Neither agree nor disagree ■ Tend to disagree
- Strongly disagree ■ Don't know



Note: Weighted base: Respondents who own or have access to a mobile phone or smartphone in Australia (1,915), Austria (952), Belgium (1,909), China (1,880), Denmark (518), Finland (520), Germany (1,868), Italy (1,902), Ireland (948), Japan (1,791), Netherlands (1,953), Norway (475), Poland (1,909), Sweden (903), United Kingdom (3,841).

Source: Deloitte Global Mobile Consumer Survey, May–August 2020.

Endnotes

1. Wikipedia, "Television transmitter," accessed November 3, 2020.
2. PCS Electronics, "HQ FM/TV transmitter superstore: How to start guide," accessed November 3, 2020.
3. For more information on small cells, see Safi Khan, "The backbone of 5G networks: A guide to small cell technology," Telit, March 12, 2020.
4. Very small base stations are also known as femtocells. Larger base stations are picocells, microcells, and macrocells. With each generation of cellular technology, base station equipment has become progressively smaller.
5. Rod Panter, "Electromagnetic radiation from TV and mobile phone towers: Health aspects," *Current Issues Brief* 26, Parliament of Australia, 1996–97. For the previous statement that television transmitters have been delivering content wirelessly for more than 100 years, see Wikipedia, "History of radio," accessed November 20, 2020. The first radio broadcasts started in November 1919, in The Hague, Netherlands.
6. Ken Karipidis et al., "Mobile phone use and incidence of brain tumour histological types, grading or anatomical location: A population-based ecological study," *BMJ Open* 8, no. 12 (2019).
7. For more information on the methodology, and for a more detailed review of the conclusions, see A. Keykhosravi et al., "Radiation effects of mobile phones and tablets on the skin: A systematic review," *Advances in Medicine*, April 2018.
8. Media Arts and Technology, "The cell phone technology," accessed November 30, 2020.
9. Christer Törnevik, "Impact of EMF limits on 5G network roll-out," Ericsson, December 5, 2017.
10. Kurt Behnke, "Is this anything to worry about? 5G health issues explained," Grandmetric, March 26, 2019; Kenneth R. Foster, Sachiko Kodera, and Akimasa Hirata, "5G communications systems and radiofrequency exposure limits," *IEEE Future Networks Tech Focus* 3, no. 2 (2019).
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