



Evidence-Based Reporting Tools and Tips for 2025

A newsroom guide to reaching polarized audiences with scientific research

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To readers:

The likelihood of a drastic change in policy priorities from a new presidential administration poses a significant challenge for newsrooms in 2025. A dizzying number of urgent policy debates are coming simultaneously on issues with deep implications for local communities—from vaccines, to immigration, to climate change. Scientific consensus will be challenged, and misinformation will spread. Journalists who push back will be met with distrust from a big swath of a heavily polarized audience.

We built this toolkit as a strictly nonpartisan resource for newsrooms seeking to cut through the political back-and-forth.

With reliance on the incredible, complementary work being done by collaborators including [The Journalist's Resource](#) at Harvard University's Shorenstein Center and [The Open Notebook](#), we built this toolkit as a strictly nonpartisan resource for newsrooms seeking to cut through the political back-and-forth to reach people with evidence-based information that can inform decisions about their own health and well-being, how they treat others, and how they influence public policy in their communities, states, and country.

Evidence-based research is essential to help newsrooms improve the accuracy of their reporting, to thwart misinformation, to hold policymakers accountable for unscientific claims, and to shed light on solutions to societal problems. Unfortunately, many journalists have trouble reaching scientific experts on deadline, don't know which experts to cite, and don't know how to identify high-quality research, which can lead to errors and the absence of important context.

Research has shown that people who understand how research methods work, how scientific consensus on an issue is built—and how it can evolve, change or be corrected over time as we learn more—are [less susceptible to believing misinformation and pseudoscience](#). Journalists can play a critical role in that.

There are two main parts to this toolkit: A collection of tip sheets on understanding how scientific research works and advice on how to incorporate it into your journalism, and a series of briefings and context from experts on some of the biggest and most polarizing issues newsrooms will confront in 2025.

In addition, this toolkit includes a guide to free ongoing services offered by SciLine and others. That includes training for journalists in understanding the essentials of scientific research, background briefings on the biggest issues of 2025 and our unique on-deadline expert matching service for newsrooms. Bookmark the online version of this toolkit (at <https://www.sciline.org/resource-list/evidence-based-reporting-2025/>) to keep up with programming we'll be offering throughout the year.

Please also consider this an invitation to reach out to us if we can help with the unique circumstances your newsroom is facing or if you're interested in partnering with SciLine in some other way.

Matt DeRienzo

Director, SciLine

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SciLine is a strictly nonpartisan, nonprofit organization that was founded in 2017 to help journalists without science backgrounds better understand scientific research and evidence and incorporate more of it into their reporting.

Its team of 15 includes scientists and journalists working together to connect newsrooms with expert sources on deadline, including experts with broadcast interview experience for local TV; to provide free training to journalists on science essentials; to train scientists on how to communicate with journalists; and to provide deep expert background briefings on timely issues for newsrooms.

SciLine has served more than 3,600 reporters at more than 1,400 news organizations in all 50 states and has worked directly with more than 4,000 scientists at nearly 1,000 research institutions.

SciLine is based at the American Association for the Advancement of Science, the world's largest multidisciplinary science organization and publisher of the Science family of journals.

Generous founding and sustaining support for SciLine has been provided by the Quadrivium Foundation, with additional support from individual donors and the Chan Zuckerberg Initiative, the John S. and James L. Knight Foundation, MAC3 Impact Philanthropies, The Eucalyptus Foundation, the Simons Foundation, Daniel Pinkel, the Rita Allen Foundation, Schmidt Futures, the Google News Initiative, Howard Hughes Medical Institute Science and Educational Media Group, the Alfred P. Sloan Foundation, the Heinz Endowments, the Zakaria Family Foundation, and the Leo Model Foundation.

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Free tools and resources from SciLine:

As you're covering issues raised by the transition to a new presidential administration, SciLine can help you ground your reporting in scientific evidence and deliver clarity for your audiences. We can provide expertise on breaking news stories in the moment and prepare you to rigorously report on topics that are likely to come up. Here's how to take advantage of our free services:

- ▶ [Expert Matching](#): Do you need to quickly put a politician's claim in context or to find out the impacts of prior policies like those being proposed — before your deadline? Fill out our webform to request an expert who's available to answer questions on your specific topic, whether that's within social science, economics, or another scientific realm.
- ▶ [Media Briefings](#): Register for one-hour, on-the-record media briefings to get a primer on science that can inform your coverage of policies proposed by the new administration. And peruse our backlog of recently recorded briefings covering topics that are newly making headlines. They're designed to spark story ideas and build your knowledge on these topics so you can report deeply and accurately on issues in the news.
- ▶ [Experts on Camera](#): Sign up for broadcast-quality video interview slots with a slate of TV-ready researchers whose expertise is relevant to the new administration's proposals. And use our library of expert interviews to add quotes, tape, or context to your evolving coverage as plans emerge in Washington.
- ▶ [Trainings](#): Register for our one-hour crash course on science essentials for journalists — and for our specialized courses on using statistics, editing science coverage, and diving deeper into science reporting — so you're ready to find the best evidence on a question as news breaks.
- ▶ [Advice for Reporters](#): Need some quick guidance on getting the gist from a study, or finding scientist sources with just the right expertise to answer your questions? Read these brief rundowns of our advice, which include useful resources, to build your skills so you can cover the new administration with crucial context.

Free tools and resources from others:

A variety of free, evidence-based resources is available to help you in your reporting on the presidential transition. This includes tools that will help you find sources and data, trainings to hone your science reporting skills, and summaries of evidence relevant to current legislative and political issues.

- ▶ [The Journalist's Resource](#) offers research guides to topics in the news, like this [roundup of studies](#) and [answers to common questions](#) about fluoride in water. Its “[Know Your Research](#)” feature includes tip sheets and explainers to help journalists understand academic research methods; find and recognize high-quality research; investigate scientific misconduct and research errors; and avoid missteps when reporting on new studies and public opinion polls.
- ▶ [The Association of Health Care Journalists](#) publishes tip sheets on timely subjects, such as the potential loss of health insurance if funding is cut for [Affordable Care Act tax credits](#) or [Medicaid](#). They also host [webinars](#) on topics to help journalists cover topics like vaccine policy and the powers of the [Health and Human Services secretary](#).
- ▶ [The Open Notebook](#) runs self-directed, online [science journalism classes](#), and has an array of guides relevant to issue-focused reporting during the presidential transition, such as these focused on [health care for trans youth](#) and [critically evaluating claims](#).
- ▶ There are a range of expert source databases, such as [500 Queer Scientists](#), [500 Women Scientists](#), and the [NPR Diverse Sources Database](#) to help you find sources who can deepen your coverage with expertise. (The NPR database is no longer being updated but is still a rich resource.)
- ▶ [Climate Central](#) provides localized data and graphics that can enrich your coverage with concrete evidence on climate change and that can put climate policy stories into context. They also offer a range of [tools](#) and [reports](#) on climate change impacts.
- ▶ [The Conversation](#) features expert commentary on current issues, including evidence on topics like [inflation](#) and [flood monitoring](#).
- ▶ [The Society of Environmental Journalists](#) has compiled a [guide to environment and energy topics in 2025](#), such as background on [the state of charging stations for electric vehicles in the United States](#).



Part One:

Understanding scientific research

Overview of resources for understanding scientific research:

Sara Whitlock, SciLine

Academic research papers contain key insights into societal problems, but they can be challenging to parse during the reporting process. We've pulled together resources to help you find and read scientific research papers, as well as identify expert sources who can assist you in interpreting and reporting on them.

Finding and reading scientific papers

Gaining access to the full text of scientific papers can be a challenge in its own right, so start with these [ways journalists can access academic research for free](#). As you identify papers, it's important to keep in mind whether or not a text is peer reviewed, so see this [context on peer review](#) next. With research papers in hand, use this [guide to reading a scientific paper](#) to understand where to start and the right order to read different sections of the paper. While reading, see this [overview of five common research designs](#) to contextualize why the authors took a particular approach to investigate the problem at hand.

Statistics

The studies you report on will often contain statistics, and these numbers can strengthen your stories by backing up claims or reinforcing concepts. See this guide to [six important statistics terms for covering science](#), then drill down into [statistical significance](#) with five important things to know.

Consulting expert sources

Once you've read relevant scientific papers, interviews with expert sources will help you get the science right. Use these [tips for finding scientific sources](#), and keep in mind the many dimensions of diversity as you seek to [include diverse sources in your story](#).

Tips and pitfalls

One of the most common mistakes in science reporting is saying that a study "proves" something. Instead, use these [tips for reporting on the conclusiveness of research findings](#), and be sure to also include context on [how a study fits into the body of research](#) on that question. Finish with guidance on [avoiding mistakes in health and medical news headlines](#), and these tips for [using academic research in investigative journalism](#).

Covering scientific consensus: What to avoid and how to get it right

Three researchers explain how journalists can use scientific consensus to bolster their coverage and battle misinformation about public policy topics.

by Denise-Marie Ordway | November 23, 2021

When reporting on controversial policy topics such as vaccine safety and climate change, journalists can look to scientific consensus to bolster their coverage and battle misinformation.

If you're unsure what scientific consensus is, don't understand its significance or have no idea how to gauge it, keep reading. This tip sheet features practical advice from three researchers with expertise on those topics.

Scientific consensus is the collective position scientists in a given field have taken, based on their interpretation of the available evidence. For example, the overwhelming majority of doctors say childhood vaccines are safe. Surveys of physicians and medical researchers "have repeatedly indicated that over 90% of doctors agree that adults and children should receive all recommended vaccines," [according to a paper](#) published in 2016 in the medical journal BMJ Evidence-Based Medicine.

Knowing what experts think about an issue can help the public make informed decisions about it. When a reporter interviews a source whose views match the collective position, it's a strong signal the information is trustworthy, explains [Eric Merkley](#), an assistant professor of political science at the University of Toronto who studies expert consensus.

[His research](#) finds that news outlets do a poor job informing the public about the scientific consensus on hot-button issues such as vaccination, nuclear power and genetically modified foods — even when it's directly relevant to their coverage.

When Merkley analyzed U.S. news coverage of 10 science and economic policy issues on which there's clear consensus, he discovered "information related to expert consensus is contained in an extremely small portion of a news consumer's diet on these issues." He examined nearly 300,000 news articles and transcripts from six national and local newspapers, three cable news networks, three TV news networks and the Associated Press newswire service going back to 1980.

The resulting paper, "[Are Experts \(News\) Worthy? Balance, Conflict, and Mass Media Coverage of Expert Consensus](#)," was published last year in Political Communication.

Merkley urges journalists to make a habit of pointing out when there's broad expert agreement on the policy questions they're covering. Audiences need that information.

"A lot of people only really get information about these issues through the news media, so when the opportunity arises to provide this contextual information, I believe it's very important to do so," he says.

This tip sheet aims to help with that. Below, Merkley joins two other researchers — Teresa Myers, an assistant research professor at George Mason University's Center for Climate Change Communication, and [Sara Shipley Hiles](#), an associate professor at the Missouri School of Journalism and veteran science journalist — to offer advice on how journalists can strengthen their work.

Here's what to avoid when covering scientific consensus — and how to get it right.

WHAT TO AVOID: Citing individual researchers without noting how their views on a given topic compare with those of other scholars in the field.

Reporters often quote researchers without explaining whether their statements represent the views of researchers in the same field as a whole, Merkley says. Without that context, audiences might not know when an expert's statement is considered extreme or contradicts consensus.

When expert consensus exists on a subject being covered, Merkley recommends journalists include that in their stories. He also warns that journalists do the public a disservice when they ask researchers to weigh in on topics outside their area of expertise or when they quote researchers providing highly contested points of view.

"We need some more critical interrogation of how expert sources are being used in news coverage," Merkley says.

HOW TO GET IT RIGHT: Look to peer-reviewed research and scientific organizations for help gauging whether and how much agreement exists among scientists on a topic.

Myers suggests journalists look to these four sources for information about levels of agreement:

- Studies of scientific agreement — Academic journals occasionally publish papers analyzing existing research to establish the level of consensus on a given issue. Just last month, Environmental Research Letters published the paper, "[Greater Than 99% Consensus on Human Caused Climate Change in the Peer-Reviewed Scientific Literature](#)," which finds "there is no significant scientific debate among experts about whether or not climate change is human-caused. This issue has been comprehensively settled, and the reality of [anthropogenic climate change] is no more in contention among scientists than is plate tectonics or evolution."
- Surveys of subject experts — When it's unclear whether consensus exists, scholars, health care professionals and other experts may be asked to complete a survey to share their views on an issue or research question.
- A [paper published in PLoS ONE](#) last year examines the results of a series of surveys asking leading health informaticians how machine learning will influence primary care in the U.S. over the next several years. The main takeaway: The consensus is that machine learning "will engender training and primary care work force changes, improve rates of diagnostic accuracy, and increase access to primary care" within the next decade.
- Consensus statements — Independent scientific organizations such as the [National Academy of Sciences](#), [American Association for the Advancement of Science](#) and [American Medical Association](#) issue [consensus statements](#). These statements typically communicate either scientific consensus or a collective opinion of a convened panel of subject experts. Earlier this year, for instance, the [Association of American Medical Colleges](#) issued a consensus statement advising [face masks be worn](#) to prevent the coronavirus from spreading.
- State-of-the-Art Reviews — This type of research paper synthesizes current thinking in a field, focusing on research published within the last decade or so. A recent example: The Journal of the American College of Cardiology last month published, "[Exercise Intolerance in Older Adults With Heart Failure With Preserved Ejection Fraction: JACC State-of-the-Art Review](#)."

WHAT TO AVOID: Assuming a certain percentage of scientists in a given field need to agree in order to reach scientific consensus on a policy issue or question.

There's no set threshold for achieving consensus. In other words, journalists shouldn't make assumptions about how many scientists or what proportion of scientists in the field have come to the same conclusion. Having a consensus, Myers explains, simply means there's broad agreement among subject experts on an issue or the answer to a policy question.

“There isn’t a very clear, bright-light legal standard,” she says. “If 99% of scientists agree, this is consensus. It can be a supermajority or it can be a majority. Broadly defined, it’s the reasonable level of agreement on a topic.”

HOW TO GET IT RIGHT: Explain what scientific consensus is and why it’s important. Use numbers, when possible, to convey levels of agreement.

Journalists won’t be able to find information on experts’ exact level of agreement on all topics in the hard sciences and social sciences. But scholars tend to track whether consensus exists on controversial topics with significant consequences.

Myers urges journalists to make clear the strength of agreement by pointing out the percentage of researchers in agreement, when possible. Including this number in news coverage not only reflects the reliability of the information, it appears to help correct misconceptions about what experts consider to be true, Myers and her colleagues write in the paper, [“Simple Messages Help Set the Record Straight about Scientific Agreement on Human-Caused Climate Change: The Results of Two Experiments,”](#) published in PLoS ONE in 2015.

Myers and her co-authors found that news articles using numbers to communicate the level of scientific consensus were more effective at correcting widespread misunderstandings about the consensus on human-caused climate change than verbal descriptors such as “most” and “the majority.”

Taking time to explain the meaning and value of scientific consensus also helps, according to a September 2021 paper in the journal Psychological Science, [“Boosting Understanding and Identification of Scientific Consensus Can Help to Correct False Beliefs.”](#) That study suggests news articles that describe scientific consensus and report what most scientists have to say about the safety of genetically engineered foods help correct misconceptions about the topic.

WHAT TO AVOID: Giving equal weight to the contrasting views of researchers, politicians, community leaders and others.

Journalists’ tendency to be fair and balanced sets them up for failure when covering science. Giving all sources’ views equal weight — for example, giving a vocal critic with an extreme stance as much space as a scholar who has studied the issue at hand for decades and whose views represent scientific consensus — creates the perception that science is divided or that no one knows what’s true.

“*Journalists need to understand that covering science is not like covering politics. There aren’t ‘two sides’ to a science story.*”

Journalists need to understand that covering science is not like covering politics,” Hiles wrote in an email interview. “There aren’t ‘two sides’ to a science story.”

Many news outlets, she noted, have gotten it wrong when covering climate change. “For years, we presented [climate change](#) as a two-sided story, often a 50-50 story that quoted some people saying that humans

caused climate change and some saying they didn't," Hiles wrote. "In reality, the science was already clear: The evidence for [anthropogenic \[human-caused\] climate change](#) was strong."

HOW TO GET IT RIGHT: Take a "weight-of-evidence" or "weight-of-experts" approach.

Instead of resorting to both-sides-ism, spotlight the evidence and sources whose views match the scientific consensus, recommends Hiles, who's leading a new journalism initiative called the [Mississippi River Basin Ag & Water Desk](#), a project placing 10 reporters in newsrooms in the region to cover agriculture, water and related issues.

Hiles learned while studying an elite group of environmental journalists that they regretted having covered climate change as a controversy in prior years. They began advocating a "weight-of-evidence" approach in which "mainstream scientists are the focus of global warming science stories and 'skeptics' are given little, if any, ink," Hiles and a co-author write in a paper published in Science Communication in 2014, "[Climate Change in the Newsroom: Journalists' Evolving Standards of Objectivity When Covering Global Warming](#)."

Journalists taking a "weight-of-evidence" approach also should emphasize the findings of high-quality research, including studies published in academic journals. Hiles suggested via email that reporters use caution when covering issues that haven't been well researched or when most of the research on a topic is composed of [working papers](#) or [preprint papers](#), neither of which have undergone peer review. During the [peer-review process](#), independent scholars evaluate a researcher's work, pointing out problems and shortcomings.

Communication scholar [Sharon Dunwoody](#) also has [spoken out in favor](#) of weight-of-evidence reporting. However, she and a fellow researcher re-labeled the term "weight of experts" a few years ago "to more accurately capture its emphasis on communicating the distribution of expertise rather than evidence per se," they explain in "[Using Weight-of-Experts Messaging to Communicate Accurately About Contested Science](#)," which appeared in Science Communication in 2017.

That paper describes weight-of-experts narratives as "a straightforward expression of how experts are arrayed in a contested truth situation" whereas a weight-of-evidence frame is "a more comprehensive reflection that includes not only where experts sit on the continuum but also information about the evidence undergirding those judgments."

A weight-of-experts approach is better at helping people determine the validity of scientific claims, Dunwoody and her colleague assert. They conducted an experiment in which 759 people read and answered questions about different versions of a made-up news story about pharmaceutical pollution. They learned that the story offering a weight-of-experts narrative led participants "to greater certainty about what scientists judged to be true and, importantly, to then use that perception to reach greater certainty about what they personally thought was true."

ANOTHER WAY TO GET IT RIGHT: Remember that scientific consensus isn't an ironclad guarantee that what scientists believe now will hold over time.

Journalists need to keep in mind that levels of agreement can change over time, rising or falling as scientists learn more about a topic.

A famous example of how scientists' views can change: In 2005, two Australian researchers who discovered that the bacterium *Helicobacter pylori* caused peptic ulcers, received a Nobel Prize in Physiology or Medicine. At the time they revealed their findings, "it was a long-standing belief in medical teaching and practice that stress and lifestyle factors were the major causes of peptic ulcer disease," [Niyaz Ahmed](#), a prominent epidemiologist, [writes in the Annals of Clinical Microbiology and Antimicrobials](#).

"New information comes along, and that is part of the scientific method," Hiles explained. "We have to be humble and follow the facts where they lead us. Give as much context as possible and help the audience understand that science is a process, not a destination."

Making sense of scientific studies

Science reporting quick tips from [SciLine](#) and [The Open Notebook](#)

When you're reading a scientific paper, you don't have to understand everything perfectly. Allow yourself to reread sections and look up words you don't know. Next, gather questions to ask experts who do understand the details. Remember: As a reporter, you already have the skills needed to [figure those questions out](#).

Start at the top, then read the introduction.

- You'll find a list of the [authors' names](#) and affiliations under the title of the study. One author—often a senior scientist—will usually be designated the corresponding author, and their email address will be listed.
- The abstract is right underneath the authors. It's a summary, with a sentence or two each about the problem to be solved, what the researchers did, what they found, and the significance of the findings.
- The abstract can help you figure out if there's a newsworthy story buried in the results and orient you as you read the rest. But don't only read the abstract—treat it as a starting point, not an end point.
- The introduction (sometimes called “background”) describes the big picture problem, previous research on it, why the new work is important, and what the researchers intend to do. This section can help you get up to speed on the reasoning behind a specific study and the bigger context.
- The other papers cited in the introduction are a great way to find additional information and experts to interview.

Skip down to the discussion.

- The discussion section (or “conclusions”) summarizes the findings and puts them in context of other studies. The researchers might also hypothesize about why they found these results and what may have influenced them.
- It will tell you what's particularly new or interesting about the findings, possible weaknesses of the study, and what the researchers think the next steps should be—all great interview question fodder.

Head back up to the results section.

- This is where you'll find the actual findings the researchers recorded, which may be presented as numbers or as written summaries of the data.
- There will often be statistical terms accompanying the results, which experts can help you interpret.
- This section usually includes figures and graphs—don't ignore these! Read the captions closely to understand what the researchers are showing.

Now take in the methods section.

- This is where you'll find the step-by-step details of how the study was done.
- Good questions to ask from this section are why someone might have chosen this method and what its limitations are.

Take a look at the end of the paper.

- The reference list will be at the bottom of the paper with links to the studies cited.
- There will usually be a section describing funding sources and potential [conflicts of interest](#), such as patent filings or a company funding their own research. Examine these critically as you would any potential COI.
- Some papers may have links to supplementary information, including extra analyses, images, videos, or more detailed methods. They aren't critical to understanding the paper but can have interesting details.

➤ Further reading: [how to read a scientific paper](#) and [advice for journalists](#).

Using academic research to do investigative journalism: 5 tips

Tips from Pulitzer Prize-winning investigative journalist Neil Bedi and criminologist Rachel Lovell.

by Denise-Marie Ordway | January 6, 2023

If more journalists incorporated academic research into their investigative reporting process, they might have been able to alert the world about the [Mpox outbreak](#) sooner. For years, researchers studying the virus, formerly known as monkeypox, had been noting its spread in parts of the world in studies published in scholarly journals.

Academic research is a crucial tool for investigating societal problems and holding the powerful accountable. On Dec. 15, The Journalist's Resource held a one-hour training to explain how consulting academic studies and collaborating with researchers can strengthen news coverage and aid journalists at each stage of the investigative reporting process.

Those who attended the webinar left with practical tips and insights from [Neil Bedi](#), a Pulitzer Prize-winning investigative reporter at ProPublica, and [Rachel Lovell](#), a criminologist at Cleveland State University who advocates for and [has participated in reporter-researcher collaborations](#).

I shared some of my own tips for working around common challenges reporters face in incorporating [peer-reviewed research](#) — the gold standard in academia — into their work.

If you didn't get a chance to attend the training, or want a refresher, please watch [our recording](#). Below, I've spotlighted five of my favorite tips from the event. Toward the bottom of the page, you'll find links to several tip sheets on finding and interpreting academic research.

1. Before beginning an investigative project, or in the early stages of one, seek out academic research and researchers to get a broad overview of what's known and unknown about an issue or problem.

"At the start of any investigation, you are typically not the expert on the topic you're looking into," Bedi said. "Often, you might be coming at the topic completely fresh. But there are people who have been researching and looking into these topics for years as a living. And so, if you learn to tap into these people and their work early, you can get pretty good at building a foundation of sourcing, a foundation of your own expertise, through interviews, through reading their work. And that's important because any time you're going to do an investigation, you kind of need that expertise because you're about to say something usually damning or negative about something and you need to know your stuff."

Lovell noted that reporters and researchers often have the same types of questions about an issue or problem. Because researchers often have already started trying to answer those questions, they can help journalists track down data and other information.

"Especially for these big policy-type [projects], you really need a researcher to help you understand," she said. "Talking to the individuals who are also asking similar questions I think is an important way to contribute to this, to the conversation. And [researchers] often use data, but in different ways. Researchers tend to be able to know where to find the data to answer those questions or have done their own stuff and/or can help point a reporter toward where to start looking for or where data might exist to answer some of the questions that they're interested in."

2. Once you've found relevant research and data, ask researchers for help interpreting and explaining that information in plain language. Don't be afraid to ask a researcher to read a key document or review your

data analysis and give feedback.

Researchers are passionate about their area of expertise and want the public to have correct information, Lovell said. Many would be willing to help a journalist beyond answering some questions or sharing a journal article.

Lovell suggested journalists take steps to establish trust, considering researchers usually are unfamiliar with the journalistic process and many have had negative experiences with journalists — or know someone who has. Journalists should explain what they mean when they use terms such as “on the record” and “off the record,” and whether the researcher helping them will be cited in their news stories.

Lovell said researchers might ask to review a portion of the coverage or provide input in some other way.

“If a researcher wants to go on record, sometimes it just feels better to be able to have that last ability to look at exactly how the reporter or the journalist is writing up the thing – just to kind of give [feedback] like ‘OK, you got this right’ or ‘It’s not quite right. Change the wording a little bit here and then it’s a correct interpretation of our research,’” she said.

Newsrooms typically prohibit reporters from sharing drafts of stories. But there are other ways researchers can help journalists double-check their work. For instance, journalists can read quotes back to their sources. Some news outlets, under certain circumstances, may allow researchers to read specific passages of a news story or review a statistical analysis to ensure accuracy.

3. If an agency you’re investigating is relying on a specific study or group of studies to guide its actions, find that research and make sure you understand it.

Government agencies and other organizations often rely on academic research to help guide their decisions. But research findings can be misunderstood and misapplied.

That’s why journalists need to confirm whether the research an agency has consulted says what the agency says it does.

“If you’re a reporter, if you’re working on an investigation, you should second-guess everything, and that includes the research itself.”

“If you’re a reporter, if you’re working on an investigation, you should second-guess everything and that includes the research itself,” Bedi said.

In 2021, he won a Pulitzer Prize for his investigation into a predictive policing program that a county sheriff’s office in Florida used to harass residents and profile schoolchildren. Law enforcement officials told Bedi and the Tampa Bay Times reporter who worked with him on the series, [Kathleen McGrory](#), that the project was based on research suggesting youth who experience childhood trauma are more likely to commit violent crimes later in life.

Bedi and McGrory contacted criminal justice scholars, who confirmed the sheriff’s office had misinterpreted the research. Renowned criminologist David Kennedy told them making predictions about someone’s future behavior based on childhood experiences “[flies in the face of the science.](#)”

Researchers’ responses to the sheriff’s office program became a major component of the investigative series.

“As we started calling these researchers, who [sheriff’s office officials] were citing over and over and over again, they were saying, ‘What do you mean my work is being used this way? That’s a terrible program. My work should never be used this way. They are going way off of our conclusions and creating a program that is harassing children,’” Bedi said. “I think one researcher equated it to child abuse.”

4. Don’t ignore studies just because they rely on older data. Ask the authors to explain whether and why their findings are or aren’t still relevant.

There are lots of reasons the data in journal articles can seem outdated to a daily news reporter. For one, some types of information can take years to collect. Even after a paper is finished, it can take months to a year or more for it to complete the peer-review process and get published in an academic journal.

By the time a journalist reads a study, the data and statistics in it can be several years old, prompting questions about whether the research is “too old” and its findings remain relevant.

My advice: Reach out to the study’s authors — or other scholars in the same field — and ask them those questions. They can explain whether the trends and patterns they discovered likely still exist today. They can also discuss how any major events occurring after the data was first collected could influence those trends and patterns. Such context is probably worth including in your coverage.

Lovell noted that some data doesn’t change much over time. In that case, “having data that’s a couple years old isn’t changing your findings really in any meaningful way,” she added.

Journalists might need to help newsroom editors who are opposed to relying on older data understand that.

“I would just push back and say, ‘Is there a logical reason to think that data from a couple years ago, that the pattern no longer holds now?’” she said.

5. No matter how broad or narrow the subject you’re investigating, remember that researchers somewhere have probably been studying it for years.

“I can say with almost 100% certainty that whatever the topic is going to be, especially as it relates to like policy work and investigative journalism, that there is a researcher out there who is studying that topic,” Lovell said.

Bedi said he typically begins searching for researchers by reading studies that examine the issue he’s interested in.

“I’ll go in and start reading academic papers even if half of it is completely confusing to me and doesn’t make any sense,” he told webinar attendees. “You should make it part of your process to try to read the papers, understand what you can understand and notice the authors on the papers. If you find papers that seem very relevant, start building a list of the authors on those papers. Reach out to them. Talk to the ones who are willing to talk.”

Both Bedi and Lovell suggested reaching out via email first. Bedi said he typically asks the researchers he contacts to recommend other experts who might be helpful.

He stressed that finding the right researcher or researchers can take time. And once you find them, you’ll want to cultivate that relationship over the course of your investigation.

“If this is a months-long investigation, you don’t make it just one phone call and then never talk to them again,” he said. “It is a process. Early on, you are learning a lot about a topic and you are asking them to explain complicated things as if you were 5 years old — because that is important and you need that as journalists, because you’re going to have to explain it to your readers who know nothing about this topic. But then, as you begin to hit difficult questions that they’ve probably hit and you’re going really deep into this investigative reporting process, you’re reaching back out to them to start discussing stuff that they love talking about. And [through] those conversations over time, you build a really good relationship with these people.”

Related resources

For even more pointers from Bedi, read [our article](#) about his award-winning investigative series “Targeted,” which uncovered a predictive policing project that law enforcement officials in Florida used to harass residents and profile schoolchildren.

Lovell offers additional tips in [this Q&A](#), in which JR’s senior economics editor, Clark Merrefield, asked her about a collaborative partnership she formed with Rachel Dissell, then a reporter at the Plain Dealer, that revealed how and why rape kits were going untested in Cleveland.

Please check out the “[Know Your Research](#)” section of our website. We’ve created a host of tip sheets to help you find, interpret and explain academic research, including these:

- [How to tell good research from flawed research: 13 questions journalists should ask](#)
- [7 ways journalists can access academic research for free](#)
- [5 common research designs: A quick primer for journalists](#)
- [What’s peer review? 5 things you should know before covering research](#)
- [White papers, working papers, preprints, journal articles: What’s the difference?](#)
- [5 things journalists need to know about statistical significance](#)

5 common research designs: A quick primer for journalists

If you're not sure how a cross-sectional analysis differs from a randomized, controlled clinical trial, keep reading. We offer a broad overview of five of the most common research designs journalists encounter.

by Denise-Marie Ordway | July 9, 2021

Journalists who read and cover academic research know scholars take a variety of approaches to investigate a problem, trend or intervention. But if you're not familiar with research methods, it can be difficult to know what scientists mean when they say they have conducted, for example, a cross-sectional analysis or a randomized, controlled clinical trial.

Researchers often do not explain why they picked a particular study design or how it differs from others they could have chosen to interrogate the topic at hand.

We created this brief explainer to offer journalists a broad overview of five of the most common research designs they will encounter: longitudinal, cross-sectional, correlational, experimental and clinical trials. We'd like to point out that some research falls into more than one category — a study can be both longitudinal and correlational, for instance.

It's also worth noting these five study types generally are considered [quantitative research](#), which employs a mathematical analysis of the data collected to try to explain what's being observed. [Qualitative research](#), on the other hand, usually examines some aspect of human behavior by observing and interacting with people and their environments.

Longitudinal study

Here's what it is: This type of study allows scholars to follow the same group of people over time, whether a few dozen people over a few weeks or millions of people over decades. Researchers monitor and measure changes through observation or by analyzing information gathered at regular intervals, often with surveys or in-person interviews.

Keep in mind: Longitudinal studies can be helpful for collecting data on a single topic or a wide array of topics across time. Some of these studies follow groups of people from childhood into and through adulthood, asking questions about their health, employment, relationship status and opinions on certain issues along the way.

An example: The [Pre-Elementary Education Longitudinal Study](#) followed a nationally representative sample of children with disabilities as they progressed from preschool into their early elementary school years. The study offers insights into special education services available to young children at the time, the family characteristics of kids with disabilities and the academic performance of students with disabilities during this stage of their lives.

Cross-sectional study

Here's what it is: A cross-sectional study provides a snapshot of a group of people at a point in time. Researchers use cross-sectional studies to examine such things as U.S. doctors' attitudes toward euthanasia or the prevalence of soda consumption among women over age 40. These studies often allow scholars to compare subgroups of the study population — for instance, comparing soda consumption among women over age 40 according to their race, country of origin, household income and education level.

Keep in mind: Because a cross-sectional study captures data from a single moment in time, its timing can affect

results. People might behave or answer questions differently after a major event such as a natural disaster or international controversy.

An example: A paper published in the BMJ Open medical journal in 2019 examines the characteristics that police reporting symptoms of professional burnout have in common. The authors of [“Associations Between Shift Work Characteristics, Shift Work Schedules, Sleep and Burnout in North American Police Officers: A Cross-Sectional Study,”](#) learned that of the 3,140 North American police officers who participated in the study, those working irregular schedules were most at risk of burnout.

Correlational study

Here's what it is: Scientists perform correlational studies to determine whether a relationship exists between two or more variables — weather and indoor air quality, for instance, or exercise and mental acuity.

Correlation can tell researchers if the relationship is positive, meaning the variables being studied increase or decrease together, or whether it is negative, meaning one variable decreases as the other increases.

This research design can provide some insight into how strong that relationship is. However, scientists must use more advanced statistical analysis methods such as [regression](#) to determine the strength and nature of the relationship. They also can extrapolate data to make predictions about how the variables will behave in each other's presence over time or as conditions change.

Just because scholars find a relationship exists between two variables does not mean one variable causes the other.

Keep in mind: Just because scholars find a relationship exists between two variables does not mean one variable causes the other to behave in a certain way. Establishing causation requires additional research and analysis. Researchers can use an experimental study design, which we explain below, to determine causal relationships between variables in a controlled environment.

An example: An article that appeared last year in Human Behavior and Emerging Technologies looks at the relationship between social media use and the mental health of Latinos living in southern California. In the paper, [“Social Media Use and Depression, Anxiety, and Stress in Latinos: A Correlational Study,”](#) researchers find that social media “is a significant predictor of stress but not of depression or anxiety” for study participants and that the impact of social media varied depending on how long they and their families had lived in the U.S.

Experimental study

Here's what it is: Experimental research, which employs one of the most rigorous research designs, is best suited for examining cause-and-effect relationships. When conducting this type of study, scholars typically introduce an intervention of some sort into a controlled environment that allows scholars to isolate and investigate the effect of the intervention. The intervention could be a new program, product or procedure. Researchers also can use an experimental study to test how people react to stimuli such as violence in news videos or changes to food labels.

Keep in mind: Often in experimental studies, researchers create a [control group](#) for comparison purposes. The control group will be similar to the group testing the intervention but won't be exposed to the intervention. By including

the control group, researchers can more accurately determine whether the intervention led to changes.

An example: A study published in 2019 in *Political Behavior* features three experiments aimed at gauging how white voters in the U.S. respond to seeing Democratic presidential candidates courting Latino voters. As the author explains in “[The New White Flight?: The Effects of Political Appeals to Latinos on White Democrats](#),” white voters viewed presidential campaign ads or read news headlines about the election and then responded to questions about how they felt about the candidates, including who they planned to support in the election.

Clinical trial

Here’s what it is: If scientists want to evaluate the safety and effectiveness of a health-related intervention, they conduct clinical trials. “Clinical trials are [research studies performed in people that are aimed at evaluating a medical, surgical, or behavioral intervention](#),” according to the U.S. Department of Health and Human Services. “They are the primary way that researchers find out if a new treatment, like a new drug or diet or medical device (for example, a pacemaker) is safe and effective in people.”

Clinical trials of new treatments have four phases, beginning with testing the safety of a new treatment and ending with monitoring its use after the U.S. Food and Drug Administration licenses and approves it.

Keep in mind: [Randomized controlled trials](#) are widely considered the gold standard in research, but [they’re also expensive](#). For these studies, patients are randomly assigned to groups that usually are the same or similar in size. One group receives or participates in the intervention. The group that serves as the control receives a placebo or participates in an activity unrelated to the intervention being tested. Researchers compare what happened with the intervention group against what they learned about the control group.

An example: Researchers tested whether tailored messaging would encourage U.S. mothers who expressed concerns about the human papillomavirus vaccine to get their adolescent children immunized. Their findings are described in “[Tailored Messages Addressing Human Papillomavirus Vaccination Concerns Improves Behavioral Intent Among Mothers: A Randomized Controlled Trial](#),” published in the *Journal of Adolescent Health* in August 2020.

If you found this explainer helpful, please check out our tip sheets on [covering scientific failures, spotting bias in clinical trials](#) and [differentiating between good and flawed research](#).

The Journalist’s Resource would like to thank [Anne M. Cafer](#), an assistant professor of sociology and co-director of the University of Mississippi’s [Community First Research Center for Wellbeing & Creative Achievement](#), for offering her guidance and insights in creating this explainer.

8 ways journalists can access academic research for free

A lot of academic research exists behind paywalls. We outline eight ways reporters can get free access to high-quality scholarship.

by Denise-Marie Ordway | July 7, 2023

This tip sheet outlining ways journalists can access academic research for free, originally published in September 2018, has been updated with new information.

Here at The Journalist's Resource, we're big fans of research — especially [the peer-reviewed kind](#). We know academic research is one of journalism's most valuable tools for covering public policy issues and fact-checking claims.

Unfortunately, journalists often have trouble accessing studies published in academic journals. Many journals keep scholars' work behind paywalls, and subscriptions can be prohibitively expensive for newsrooms and individual journalists. For example, a subscription to the Proceedings of the National Academy of Sciences, a journal of the National Academy of Sciences, is [more than \\$200 a year](#) for one person for personal use only. There are thousands of journals worldwide.

Resourceful journalists find other ways to get that information. Here are eight of them:

1. Go to the library.

Public libraries often subscribe to academic journals and anyone with a library card can read them. The good news for busy journalists is some libraries allow their users to access online databases of peer-reviewed research from any location.

U.S. colleges and universities provide online access to academic journals through their academic libraries. State university libraries generally are open to the public. Private institutions often extend library privileges to alumni.

2. Ask academic journals for a free account.

Many of the most popular journals give journalists complimentary access, although some limit free accounts to journalists covering specific topics or beats. The [American Economic Association](#) (AEA), for instance, offers news media professionals free access to all eight of its journals, including the American Economic Review. You can request an account through the [association's press page](#).

"I don't think it's something that's widely known, but it's a message we want to get out there," says Chris Fleisher, the AEA's web editor. "We want journalists to know they can access our journals if they like."

It's worth noting that many journals will share embargoed copies of research articles with journalists and alert them to new research on a topic of interest. Contact the journals you're interested in to learn more.

3. Search open access journals and platforms.

A growing number of scholarly journals known as open access, or OA, journals offer their online content for free to the public. Be aware that while there are many high quality OA publications, some engage in unethical practices. A trusted source of reputable OA journals is the [Directory of Open Access Journals](#). Examples of top OA journals include [PLOS One](#), the world's first multidisciplinary OA journal, and BMC Biology.

Several online platforms also allow the public to access research at no cost. One is [Unpaywall.org](#), a free database

of almost 48 million free-to-read academic articles.

4. Check Google Scholar.

[Google Scholar](#) is a web search engine that indexes research from various sources. Often, Google Scholar will provide PDF documents of research articles in its search results. However, some PDFs contain earlier versions of an article, including drafts that have not been [peer reviewed](#) or published.

While these earlier versions can be helpful, it's important to contact the author before reporting on their findings. The findings highlighted in working papers are preliminary and may differ substantially from the final version published in a journal article. (To better understand the differences between a working paper and an academic article, [check out our explainer](#).)

5. Install browser extensions.

Browser extensions can help you check the web for free versions of academic articles. The [Unpaywall browser extension](#) gathers content from more than 50,000 journals and open-access repositories worldwide. The [Open Access Button](#) searches “millions of articles” from sources that include “all of the aggregated repositories in the world, hybrid articles, open access journals, and those on authors’ personal pages,” according to its website.

If the Open Access Button does not find free versions of the articles you’re looking for, it will contact the authors and ask them to share their work by putting it into an open access repository.

6. Reach out to the people who did the research.

If you find a research article you’re interested in reading but can only access the abstract online, call or e-mail the authors and ask for a complete copy. Journal abstracts generally include contact information for the authors or, at the very least, an e-mail address for the corresponding author.

Researchers usually will share copies of their work with journalists. If a scholar shares a pre-published version of an academic article, be sure to ask how closely it resembles the published version and whether the findings are the same.

Another option: Researchers often post links to their academic research on their personal websites. Those who work for colleges and universities tend to list their published articles on their faculty pages.

It's often faster and easier to reach out to authors directly.

7. Call the media relations office.

The media relations office of a university or research organization can help you track down a copy of an article written by one of its researchers. It can help you reach the authors as well.

The main drawback: While media relations offices generally are sensitive to newsroom deadlines, they may be busy helping many journalists at the same time. It's often faster and easier to reach out to authors directly. If you have trouble getting researchers to respond, media relations staff members are usually willing to give them a nudge.

Universities also send out press releases promoting new academic research conducted by their faculty and research centers. Ask how to receive alerts about topics key to your beat.

8. Sign up for newsletters and press releases from organizations that promote the scholarly work of various colleges, universities, research centers and other groups.

A quick way to get information about new research from a bunch of different research entities is by signing up for emails from organizations such as Futurity and EurekAlert!

[Futurity](#) is a partnership of 47 universities in the U.S., Canada, Europe, Asia and Australia. It highlights the work of scholars in four broad topic areas: culture, health, environment and science.

[EurekAlert!](#) is a news-release distribution platform run by the [American Association for the Advancement of Science](#). It hosts news releases from higher education institutions, medical centers, government agencies, academic journal publishers, corporations and other groups involved in research across all fields.

If you're looking for more help covering academic research, check out the "[Know Your Research](#)" section of the Journalist's Resource web site. We've created a series of tip sheets to help you get it right, whether you're trying to make sense of key terms such as "[statistical significance](#)" and "[standard deviation](#)" or need guidance on [spotting weaknesses in research](#) and determining [whether scholars have reached a scientific consensus](#) on an issue.

Finding expert scientific sources

Science reporting quick tips from [SciLine](#) and [The Open Notebook](#)

Interviewing scientists actively conducting research on your topic can help you get the science right. Finding a scientist with exactly the right expertise for your story may require a little digging but will bring important context and detail to the final product.

Plan what types of sources you'll need for a story.

- **If you're reporting on a specific study**, interview at least one of the scientists who did the study and at least one source who wasn't directly involved but is familiar with the methods of the study or the field.
- **Avoid using quotes from press releases** about the study — these are often reviewed and approved by the sources themselves, and make for less genuine, lively material.
- **Don't just rely on people quoted** in other stories or who have a large social media presence. They might not be doing research on the specific question you have.
- **Look out for potential [conflicts of interest](#)**, such as a researcher's financial ties to a certain company. COIs aren't always dealbreakers, but they will inform what questions you ask, and you will likely need to reveal them in your story.
- **Remember your journalistic responsibility** to seek sources with diverse backgrounds and perspectives.

Find scientists actively conducting research on a topic by using scientific paper databases or expert lists.

- **Check out** [Google Scholar](#), [PubMed](#), and [ScienceDirect](#) to start. Most use standard Boolean operators and allow you to search by keywords and filter by year, so you can avoid outdated research. (Try limiting your search to the last five years.)
- **Scan the titles** and the summary paragraph (Abstract) for each result. For those that appear most relevant, reach out to one or more of the study authors.
- **Consider which of a paper's [multiple authors](#)** to contact. The first author is often a more junior scientist who can cover the details of the study. The last author is often a more senior researcher who can provide broader context. A "corresponding author" will have their email address listed.
- **To go further, look at particularly relevant citations** in the Introduction and Discussion sections of a relevant paper, and reach out to *those* authors.
- **Use [expert databases compiled by](#)** universities, societies, and special interest groups, some of which are organized by topic. Social media lists curated by scientists or other journalists may also turn up relevant sources.

Leverage networks.

- **During interviews, ask your sources** to recommend one or two other sources, particularly someone who might disagree with them or offer another perspective.
- **If you're covering a regional issue**, try reaching out directly to nearby universities' communications offices to see if they can connect you with someone local.

➤ Further reading: [sourcing stories](#) and [finding scientists](#).

Finding and including diverse sources

Science reporting quick tips from [SciLine](#) and [The Open Notebook](#)

Including diverse sources in science stories can add important context, amplify the perspectives of historically marginalized communities, and improve public trust in science and journalism.

Make source diversity a habit, not an afterthought.

- **There are many dimensions of diversity**, including race, ethnicity, gender identity, sexuality, disability status, institution type, career stage, and [geographical location](#).
- **Seek out diverse forms of expertise**. Including a social scientist or a [community member](#) may give you a better understanding of how your topic directly affects readers' lives.
- **Every person you quote** in a story should have expertise, experience, or perspective that adds something to the story.
- **Don't overuse the same few sources from underrepresented groups**. Set aside time to [build a database](#) of diverse sources relevant to your beat.
- **Go beyond your sources!** Think about what photos are accompanying a story and whether you're using [inclusive language](#) in the piece.

Leverage all available resources to broaden your expert pool.

- **Databases of scientists from diverse backgrounds** exist for a lot of scientific fields. Some are field-specific, and some are identity-specific. Make a habit of searching through these.
- **Check social media**. Scientists from diverse backgrounds may be less likely to be published in high profile journals or quoted in other news stories, so they may be harder to find by traditional means.
- **Ask university public information officers** to suggest diverse sources, or reach out to PIOs at [minority-serving institutions](#).
- **Ask your sources** for suggestions, but be careful not to inadvertently veer into tokenism, and don't expect people from historically marginalized groups to find sources for you.

Track source diversity to reflect the communities you cover.

- **Set goals** for a minimum percentage of your sources that you want to come from historically excluded groups.
- **Sources that reflect the demographic makeup** of your audience can help your audience relate to them.
- **Start by tracking diversity across just a few dimensions**, such as race, gender, and geography, then expand over time.
- **Don't infer a source's identity** based on appearance or name. You could be wrong, and, in some places, may violate privacy laws. Instead, ask sources to self-identify, or send an optional survey after the fact.
- **Be transparent** about why you want these data and what you plan to do with them.

➤ Further reading: [finding](#) and [including](#) diverse sources.

Don't say 'prove': How to report on the conclusiveness of research findings

This tip sheet explains why it's rarely accurate for news stories to report that a new study proves anything — even when a press release says it does.

by Denise-Marie Ordway | February 13, 2023

When news outlets report that new research studies prove something, they're almost certainly wrong.

Studies conducted in fields outside of mathematics do not “prove” anything. They find evidence — sometimes, extraordinarily strong evidence.

It's important journalists understand that science is an ongoing process of collecting and interrogating evidence, with each new discovery building on or raising questions about earlier discoveries. A single research study usually represents one small step toward fully understanding an issue or problem.

Even when scientists have lots of very strong evidence, they rarely claim to have found proof because proof is absolute. To prove something means there is no chance another explanation exists.

“Even a modest familiarity with the history of science offers many examples of matters that scientists thought they had resolved, only to discover that they needed to be reconsidered,” [Naomi Oreskes](#), a professor of the history of science at Harvard University, writes in a [July 2021 essay](#) in *Scientific American*. “Some familiar examples are Earth as the center of the universe, the absolute nature of time and space, the stability of continents, and the cause of infectious disease.”

Oreskes points out in her 2004 paper “[Science and Public Policy: What's Proof Got To Do With It?](#)” that “proof — at least in an absolute sense — is a theoretical ideal, available in geometry class but not in real life.”

Math scholars routinely rely on logic to try to prove something beyond any doubt. What sets mathematicians apart from other scientists is their use of mathematical proofs, a step-by-step argument written using words, symbols and diagrams to convince another mathematician that a given statement is true, explains [Steven G. Krantz](#), a professor of mathematics and statistics at Washington University in St. Louis.

“It is proof that is our device for establishing the absolute and irrevocable truth of statements in our subject,” he writes in “[The History and Concept of Mathematical Proof](#).” “This is the reason that we can depend on mathematics that was done by Euclid 2300 years ago as readily as we believe in the mathematics that is done today. No other discipline can make such an assertion.”

If you're still unsure how to describe the conclusiveness of research findings, keep reading. These four tips will help you get it right.

1. Avoid reporting that a research study or group of studies “proves” something — even if a press release says so.

Press releases announcing new research often exaggerate or minimize findings, [academic studies have found](#). Some mistakenly state researchers have proven something they haven't.

The [KSJ Science Editing Handbook](#) urges journalists to read press releases carefully. The handbook, a project of the [Knight Science Journalism Fellowship at MIT](#), features guidance and insights from some of the world's most talented science writers and editors.

“Press releases that are unaccompanied by journal publications rarely offer any data and, by definition, offer a biased view of the findings’ value,” according to the handbook, which also warns journalists to “never presume that everything in them is accurate or complete.”

Any claim that researchers in any field outside mathematics have proven something should raise a red flag for journalists, says [Barbara Gastel](#), a professor of integrative biosciences, humanities in medicine, and biotechnology at Texas A&M University.

She says journalists need to evaluate the research themselves.

“Read the full paper,” says Gastel, who’s also director of Texas A&M University’s [master’s degree program in science and technology journalism](#). “Don’t go only on the news release. Don’t go only on the abstract to get a full sense of how strong the evidence is. Read the full paper and be ready to ask some questions — sometimes, hard questions — of the researchers.”

2. Use language that correctly conveys the strength of the evidence that a research study or group of studies provides.

While studies usually unearth new information, it’s seldom enough to reach definitive conclusions.

Researchers investigate an issue or problem to better understand it and build on what earlier research has found. While studies usually unearth new information, it’s seldom enough to reach definitive conclusions.

When reporting on a study or group of studies, journalists should choose words that accurately convey the level of confidence researchers have in the findings, says [Glenn Branch](#), deputy director of the nonprofit [National Center for Science Education](#), which studies how public schools, museums and other organizations communicate about science.

For example, don’t say a study “establishes” certain facts or “settles” a longstanding question when it simply “suggests” something is true or “offers clues” about some aspect of the subject being examined.

Branch urges journalists to pay close attention to the language researchers use in academic articles. Scientists typically express themselves in degrees of confidence, he notes. He suggests journalists [check out the guidance](#) on communicating levels of certainty across disciplines offered by the [Intergovernmental Panel on Climate Change](#), created by the United Nations and World Meteorological Organization to help governments understand, adapt to and mitigate the impacts of climate change.

“The IPCC guidance is probably the most well-developed system for consistently reporting the degree of confidence in scientific results, so it, or something like it, may start to become the gold standard,” Branch wrote via email.

Gastel says it is important journalists know that even though research in fields outside mathematics do not prove anything, a group of studies, together, can provide evidence so strong it gets close to proof. It can provide “overwhelming evidence, particularly if there are multiple well-designed studies that point in the same direction,” she says.

To convey very high levels of confidence, journalists can use phrases such as “researchers are all but certain” and “researchers have as much confidence as possible in this area of inquiry.”

Another way to gauge levels of certainty: Find out whether scholars have reached a [scientific consensus](#), or a collective position based on their interpretation of the evidence.

Independent scientific organizations such as the National Academy of Sciences, American Association for the Advancement of Science and American Medical Association issue consensus statements on various topics, typically to communicate either scientific consensus or the collective opinion of a convened panel of subject experts.

3. When reporting on a single study, explain what it contributes to the body of knowledge on that given topic and whether the evidence, as a whole, leans in a certain direction.

Many people are unfamiliar with the scientific process, so they need journalists' help understanding how a single research study fits into the larger landscape of scholarship on an issue or problem. Tell audiences what, if anything, researchers can say about the issue or problem with a high level of certainty after considering all the evidence, together.

A great resource for journalists trying to put a study into context: editorials published in academic journals. Some journals, including the [New England Journal of Medicine](#) and [JAMA](#), the journal of the American Medical Association, sometimes publish an editorial about a new paper along with the paper, Gastel notes.

Editorials, typically written by one or more scholars who were not involved in the study but have deep expertise in the field, can help journalists gauge the importance of a paper and its contributions.

“I find that is really handy,” Gastel adds.

4. Review headlines closely before they are published. And read [our tip sheet](#) on avoiding mistakes in headlines about health and medical research.

Editors, especially those who are not familiar with the process of scientific inquiry, can easily make mistakes when writing or changing headlines about research. And a bad headline can derail a reporter's best efforts to cover research accurately.

To prevent errors, Gastel recommends reporters submit suggested headlines with their stories. She also recommends they review their story's headline right before it is published.

Another good idea: Editors, including copy editors, could make a habit of consulting with reporters on news headlines about research, science and other technical topics. Together, they can choose the most accurate language and decide whether to ever use the word ‘prove.’

Gastel and Branch agree that editors would benefit from science journalism training, particularly as it relates to reporting on health and medicine. Headlines making erroneous claims about the effectiveness of certain drugs and treatments can harm the public. So can headlines claiming researchers have “proven” what causes or prevents health conditions such as cancer, dementia and schizophrenia.

Our [tip sheet on headline writing](#) addresses this and other issues.

“‘Prove’ is a short, snappy word, so it works in a headline — but it's usually wrong,” says Branch. “Headline writers need to be as aware of this as the journalists are.”

What's peer review? 5 things you should know before covering research

Is peer-reviewed research really superior? Why should journalists note in their stories whether studies have been peer reviewed? We explain.

by Denise-Marie Ordway | May 8, 2021

As scholars and other experts [rush to release new research](#) aimed at better understanding the coronavirus pandemic, newsrooms must be more careful than ever in vetting the biomedical studies they choose to cover. One of the first steps journalists should take to gauge the quality of all types of research is answering this important question: Has the paper undergone peer review?

Peer review is a formal process through which researchers evaluate and provide feedback on one another's work, ideally filtering out flawed and low-quality studies while strengthening others. Academic journals generally do not publish papers that have not survived the process. Researchers often share studies that have not been peer reviewed — usually referred to as working papers or [preprints](#) — by posting them to online servers and repositories.

It's worth noting the world's largest preprint servers for life sciences — [bioRxiv](#) — and health sciences — [medRxiv](#) — screen papers for plagiarism and content that is offensive, non-scientific or might pose a health or biosecurity risk. But there are preprint servers in other fields that do not apply the same level of scrutiny.

While peer review is intended for quality control, it is imperfect. For example, reviewers, who often are college faculty with expertise in the same field as the work they are examining, sometimes fail to detect fraud, data discrepancies and other problems. Even some of the most prestigious journals with the most rigorous peer-review processes have had to retract articles. Retractions are rare, however.

"Only about four of every 10,000 papers are now retracted. And although the rate roughly doubled from 2003 to 2009, it has remained level since 2012," Science magazine [reported in 2018](#).

As of early May 2021, [a total of 108 papers](#) about COVID-19, the bulk of which appeared in journals, had been withdrawn, according to [Retraction Watch](#), which maintains an online database of research retractions going back decades.

Despite its flaws, researchers, overall, seem confident in peer review. During a [2019 survey](#) of more than 3,000 researchers across disciplines in multiple countries, 85% agreed or strongly agreed that without peer review, there is no control in scientific communication. The survey — conducted by [Elsevier](#), one of the world's largest journal publishers, and [Sense about Science](#), a London-based nonprofit promoting public interest in science and evidence — also finds 90% of participating researchers agreed or strongly agreed that peer review improves the quality of research.

Several published studies present similar findings. A [2017 paper](#) in *Learned Publishing* indicates early career researchers are "generally supportive of peer review" but complain the process is time-consuming and that reviewers, who typically work on a volunteer basis, should be rewarded with some sort of professional acknowledgement or payment.

Regardless of the type of research journalists cover, they should have at least a basic understanding of the peer-review process and its benefits and shortcomings.

Below, we explain some of the most important aspects with help from several experts, including [Diane Sullenberger](#), executive editor of *Proceedings of the National Academy of Sciences*; [Miriam Lewis Sabin](#), a senior editor at The

Lancet; and [John Inglis](#), executive director of Cold Spring Harbor Laboratory Press and co-founder of bioRxiv and medRxiv.

1. Peer reviewers are not fraud detectors. They also do not verify the accuracy of a research study.

The peer-review process is meant to validate research, not verify it.

The peer-review process is meant to validate research, not verify it. Reviewers typically do not authenticate the study's data or make sure its authors actually followed the procedures they say they followed to reach their conclusions. Reviewers, sometimes called referees, also do not determine whether findings are correct, given the data and other evidence used to reach them.

Reviewers do examine academic papers to answer a range of relevant questions. They look at whether the research questions are clear, for example, and whether the study's design, sampling methods and analysis are appropriate for answering those questions. They also assess whether the paper answers such questions as:

- Is the study explained clearly enough and in enough detail that another researcher could replicate it?
- How does the study challenge or add to the body of knowledge on this topic?
- Does it fit the standards and scope of the journal to which it was submitted?
- If the study involves humans or animals, did the authors acquire the required approvals and meet ethical standards?
- Does it give proper attribution to earlier research?

When German theologian [Henry Oldenburg](#) created the first journal dedicated to science in 1665, he considered the [key functions of a research journal](#) to be registration, certification, dissemination and archiving, writes [Robert Campbell](#), a senior publisher at Wiley-Blackwell Publishing, in the book *Academic and Professional Publishing*.

Peer review is considered the gold standard for assessing research content, Sullenberger explained in an email interview. But journalists must understand it is not infallible, she added.

"Science is self-correcting through replication and reproducibility, and research fraud can be difficult to detect in peer review," she wrote.

2. Journalists can help the public recognize the value of peer review by noting whether the studies they cover have been peer reviewed.

Scholars, research organizations and others regularly criticize news outlets for failing to explain whether new research they report on or the older studies they incorporate into their stories have undergone peer review. It's important that journalists differentiate between peer-reviewed research and preprint papers, which often present preliminary findings.

Sullenberger told JR: "Greater clarity when journalists cover unreviewed preprints is needed; they should not be reported as having the same validity and authority as peer-reviewed research papers."

A [recent study](#) in the journal *Health Communication* finds that many of the news articles written about COVID-related preprints during the first four months of 2020 did not indicate the scientific uncertainty of that research.

About 43% of the stories analyzed did not mention the research was a preprint, unreviewed, preliminary or in need of verification.

At the time of that study, however, many of the journalists drawn into reporting the frenzy of stories about the pandemic were unfamiliar with preprints, Inglis says. Today, he adds, journalists covering the coronavirus are much more likely to include phrases such as “not yet peer reviewed” to describe preprints.

Sense About Science urges the public to pay attention to whether a study being discussed in a government meeting or in the media has been peer reviewed. “The more we ask, ‘is it peer reviewed?’ the more obliged reporters will be to include this information,” the organization [asserts in a leaflet](#) it created to help the public scrutinize the scientific information featured in news stories.

Knowing whether research has been peer reviewed helps a person judge how much weight to give the claims being made by its authors, [Tracey Brown](#), the managing director of Sense About Science, explained during [an interview](#) with The Scholarly Kitchen blog.

“We have to establish an understanding that the status of research findings is as important as the findings themselves,” Brown says in [a prepared statement](#). “This understanding has the capacity to improve the decisions we make across all of society.”

3. Peer reviewers help decide a study’s fate.

Journal editors typically assign two or more reviewers to each research paper. Some also employ a statistical specialist.

While the selection process differs, journals choose reviewers based on factors such as expertise, reputation and the journal’s prior experience with the reviewer. While it can be difficult to recruit scientists willing to examine manuscripts because of the time required for proper scrutiny, many do it because of “a sense of duty to help advance their disciplines, as well as the need for reciprocity, knowing other researchers volunteer to peer review their manuscript submissions,” Science magazine [reported earlier this year](#).

Reviewers can make recommendations about whether a journal should accept, reject or send a paper back for minor or major revisions. Reviewers usually submit reports offering their overall impressions of a paper and suggestions for improvements. Most often, though, the final decision lies with one or more of the journal’s editors or its editorial board.

Inglis, a former assistant editor of The Lancet who is now a publisher of five peer-reviewed journals, says a common criticism of the peer-review process is its lengthy timeline, which can span from weeks to a year or more. Another complaint: Sometimes, journals send a study back and notify the authors that they would be willing to accept or reconsider the paper for publication if the authors do more research.

“Sometimes, the demands made are completely unrealistic,” Inglis adds. “The criticism from the authors is that editors don’t know that when they say ‘Do this additional experiment,’ that’s another year [added to the timeline]. Meanwhile, the work is perfectly valid.”

Inglis says bioRxiv (pronounced “bio-archive”) and medRxiv (pronounced “med-archive”) were created so researchers could disseminate preliminary versions of their papers, allowing the scientific community to immediately use and start building on those findings and data.

4. The peer-review process varies significantly among academic journals.

There are several kinds of peer review, and journals often state on their websites which one they use. The most common are single-blinded peer review, which allows reviewers to know the authors’ identities while reviewers’ identities remain anonymous, and double-blinded peer review, in which authors and reviewers are unaware of

each other's identities.

Both have advantages. Advocates argue anonymity protects reviewers from retribution. It also helps shield authors from biases based on factors such as gender, nationality, language and affiliations with less prestigious institutions, [Tony Ross-Hellauer](#), a postdoctoral researcher at the [Know-Center](#) in Austria, writes in "[What is Open Peer Review? A Systematic Review](#)," published on the European open access platform [F1000Research](#) in 2017.

Keeping identities secret can create problems, however.

"At the editorial level, lack of transparency means that editors can unilaterally reject submissions or shape review outcomes by selecting reviewers based on their known preference for or aversion to certain theories and methods," Ross-Hellauer writes. He adds that reviewers, "shielded by anonymity, may act unethically in their own interests by concealing conflicts of interest."

A newer type of peer review, called [open peer review](#), is not as prevalent. But the scientific community has ongoing discussions about whether its greater transparency might help improve research quality.

While there is no universally accepted definition of open peer review, also known as open identity peer review, the identities of both authors and reviewers typically are made known to each other. Ross-Hellauer notes that disclosing reviewers' names may force them "to think more carefully about the scientific issues and to write more thoughtful reviews."

A growing number of journals are posting not just the papers they accept but also the feedback peer reviewers gave the papers' authors.

5. Peer review continues to evolve.

Some journals have started initiating peer review after a paper is published instead of beforehand, although this still is not common. [MedEdPublish](#), an online scholarly journal, is one of those that employ [post-publication peer review](#). Its papers undergo peer review on the website by members of the medical education community, which could include the journal's editor, members of its editorial board or a panel of reviewers.

Under the MedEdPublish model, a paper has undergone formal peer review after at least two members of the journal's review panel evaluate it. The paper can be critiqued and improved over time as a living document on the journal website.

"Post-publication peer review follows an open and transparent process, which aims to avoid editorial bias while increasing the speed of publication," according to the website. "We use an 'open identities' principle, whereby all reviewers submit their feedback publicly, under their own name, and everyone visiting an article page can see all peer review reports, referee names, and comments, and can join the discussion if they wish."

Some journals are working to diversify their pools of reviewers.

Another noteworthy shift: Some journals are working to diversify their pools of reviewers by ensuring women, racial and ethnic minorities, and scientists from other countries help appraise and select studies for publication.

Research indicates the overwhelming majority of experts chosen as reviewers are men. A [study published earlier](#)

[this year](#) in Science Advances examines internal data for 145 scholarly journals across fields and finds that women comprised 21% of their reviewers between 2010 and 2016. At journals dedicated to biomedical and health research, 24.6% of reviewers were women.

The Lancet medical journal has [set targets](#) for increasing the number of women and scientists from low- and middle-income countries, Sabin, one of its senior editors, wrote in an email interview with JR. In 2019, The Lancet family of journals announced its [Diversity Pledge](#).

“We track, monitor, and report representation of authors, reviewers, and editorial advisors by gender and across geography,” Sabin told JR in an e-mail.

She added that the journal formed a task force late last year to, among other things, examine its policies and processes to find ways to increase the representation of experts who are racial and ethnic minorities.

The [Coalition for Diversity and Inclusion in Scholarly Communications](#) has focused on the issue globally. [More than 90 organizations](#) have adopted the coalition's [Joint Statement of Principles](#), which aims to “promote involvement, innovation, and expanded access to leadership opportunities that maximize engagement across identity groups and professional levels.”

Identity groups include racial and sexual minorities, military veterans, pregnant women, parents and people from lower social classes and socioeconomic backgrounds.

The Journalist's Resource would like to thank Rick Weiss, director emeritus of SciLine, and Meredith Drosback, SciLine's former associate director of science, for their help in creating this tip sheet.

5 tips for avoiding mistakes in news headlines about health and medical research

Prominent science journalists Deborah Blum, Cristine Russell and Brooke Borel offer advice to help newsrooms avoid common mistakes in writing headlines about health and medical research.

by Denise-Marie Ordway | October 19, 2021

Headlines usually are the first part of a news article people see — and, often, [the only thing they read](#) before sharing a story on social media. That's why well-crafted headlines are critical. Incorrect, incomplete or misleading headlines spread misinformation.

Bad headlines on stories about health and medical research can be especially harmful considering many people make decisions that affect their personal health and safety — and the health and safety of loved ones — based on news reports.

Audiences might pursue a particular medical procedure or even brush off guidance from their doctor in response to something they read or heard in a news report, researchers write in [“Defining and Detecting Fake News in Health and Medicine Reporting,”](#) published last year in the Journal of the Royal Society of Medicine.

To bring attention to the problem, the watchdog site [HealthNewsReview.org](#) published a series examining [patient harm from misleading news stories](#). The site, founded by veteran health journalist [Gary Schwitzer](#), rated U.S. news outlets' health coverage for many years before losing funding in December 2018. It also spotlighted problematic headlines on [its blog](#) and in its [“Headline vs. Study”](#) series.

We created this tip sheet to help newsrooms improve headlines on stories about health and biomedical research. To make sure we address some of the most common mistakes, we asked several prominent health and science journalists to identify problems they see regularly and how to avoid them.

Here's their advice:

1. Don't use these words and phrases when describing research findings: breakthrough, revolutionary, life-changing, game-changing, landmark, miracle, Holy Grail.

Journalists should take care not to exaggerate the importance or novelty of a new study. News outlets overuse these descriptors, which seldom apply to the research findings featured in their coverage.

“Breakthrough’ is the one that leaps out to me because there so rarely is a breakthrough,” says [Deborah Blum](#), a Pulitzer-prize winning science journalist who is director of the [Knight Science Journalism Program at MIT](#) and founding publisher of the nonprofit digital science magazine [Undark](#). “I and most of my science journalism friends want to go screaming down the street when we see that in a headline.”

Journalists sometimes use these words and phrases to imply a new drug or other medical intervention will drastically improve people's lives — even when it could be years before authorities are able to determine whether it's safe and effective for public use, adds [Cristine Russell](#), a senior fellow at Harvard Kennedy School's [Belfer Center for Science and International Affairs](#).

“When you're a responsible [journalist] working in health and medical science, you really have to think of the audience and how vulnerable they are,” says Russell, also a past president of both the [Council for the Advancement of Science Writing](#) and the [National Association of Science Writers](#). “You can be optimistic to some degree, but don't overpromise.”

2. If your story examines research conducted on animals, make sure neither the headline nor the first sentence implies the findings apply to humans.

Scientists use animals in various types of research, including the study of human diseases and the development of new medical treatments. According to the National Association for Biomedical Research, about [95% of all lab animals are mice and rats](#). Scientists typically test new drugs on mice or rats, which are [genetically, anatomically and physiologically similar to humans](#), before testing the most promising drugs on humans.

When news outlets report on studies conducted on animals, however, they often fail to make clear in their headlines that the findings don't necessarily apply to humans.

Research scientist James Heathers calls attention to incomplete headlines from a Twitter account he set up for that purpose, [@justsaysinmice](#). He retweets these headlines after adding the phrase "IN MICE." In [his personal blog](#), he criticizes news editors and copy editors.

"So many stories about the Latest Thing That You Need To Know About What Will Kill You Next Tuesday can have their accuracy dramatically improved by the simple addition of IN MICE," [Heathers writes](#). "I am perfectly prepared to judge your outlet, out loud and in public, if you say 'patients' when you mean 'genetically modified mice'... when you say 'obesity' when you mean 'fat mice.'"

3. Don't confuse correlation with causation. Even when researchers establish causality, remember that it's almost always inaccurate to say a study "proves" anything.

When writing headlines about research, remember that when two variables are correlated, a relationship or link exists between them. For example, if nationwide demand for daikon radishes rises at the same time U.S. teenagers reduce their soda intake, there's a correlation between daikon demand and youth soda consumption.

Never assume causation — that one variable causes the other to change or even contributes to a change. It would be wrong, in the instance above, to say or imply that teens giving up soft drinks causes a spike in daikon radish sales.

Keep in mind that research studies often examine correlations. But if scholars find or have reason to believe one variable affects another, they typically state that clearly in their publications. Look for phrases such as "causal relationship" and "causation."

The Association of Health Care Journalists [offers this guidance](#) on covering research studies showing correlations:

"Seasoned health reporters will eschew wording in their leads or headlines that reads like this:

A new study shows that short sleep may cause weight gain.

Instead, they aim for wording that suggests a less direct relationship:

A new study shows that people who don't get at least seven hours of sleep a night are more likely to gain weight compared to those who snooze less.

That's the most accurate way of describing the comparison that's being made in the study, but it can also be a little wordy. Here's another way that would work if you're tight on space:

A new study shows short sleep is linked to (or tied to or associated with) weight gain."

4. Use absolute numbers rather than relative numbers in headlines (although it's a good idea to include both in your story).

Journalists choose which numbers to emphasize when reporting on issues such as risk — the odds of dying from a particular disease, for example — and how much something has changed over time.

Journalists should include [absolute risk and relative risk](#) or [absolute change and relative change](#) in their stories because both sets of numbers convey valuable information. Spotlighting a relative number in a headline, however, can be quite misleading.

Case in point: The New York Times, Washington Post and USA Today drew sharp criticism a few years ago for running headlines proclaiming the obesity rate for young children had dropped 43% in a decade.

A closer look at the numbers, obtained from [a paper in the Journal of the American Medical Association](#), reveals that the obesity rate fell from almost 14% to a little more than 8%. That represents an absolute decline of about 6 percentage points and a relative decline of about 43%.

Slate magazine responded [with a piece](#) chiding the decision to emphasize the relative figure.

“When evaluating the total sample across age groups, rather than just 2- to 5-year-olds, there hasn’t been any change at all,” according to the Slate article. “From the perspective of the researchers themselves, the continuing obesity problem seems to be the most important finding.”

Russell, who has written about health and science for four decades, urges journalists to distinguish between absolute and relative risk to avoid unnecessarily scaring audiences. In [a working paper](#) she wrote for Harvard Kennedy School’s Shorenstein Center on Media, Politics and Public Policy, “[Covering Controversial Science: Improving Reporting on Science and Public Policy](#),” she explains how a focus on relative risk can confuse the public and make a drug appear riskier than it actually is. (The Journalist’s Resource is based at the Shorenstein Center.)

“British medical journals set off a ‘pill scare’ in England in 1996 with preliminary evidence that low-dose birth control pills doubled the risk of blood clots,” she writes. “A follow-up letter to The Lancet pointed out how small the risk was in the first place: it went from a risk of about one case per 10,000 users to two cases per 10,000 users. Going off the pill posed the obvious greater risk of pregnancy.”

5. When you turn your story over to an editor, include a suggested headline. Ask to see the final headline before publication.

“Don’t ask for changes unless you can make the case that there is a better, more accurate word.”

Editors regularly write or rewrite headlines after reporters submit their stories. Reporters can help prevent errors by including a suggested headline at the top of their pieces, advises [Brooke Borel](#), the articles editor at [Undark](#). She’s also the author of [The Chicago Guide to Fact-Checking](#) and teaches [science communication workshops](#) at New York University.

Borel recommends reporters also ask to review headlines right before they’re published.

“Sometimes, editors will change a headline later in the game to make it punchier,” she explains, adding that some of those editors might not be as familiar with the subject matter as the editor who worked with the reporter on the piece. “The editors making those later changes are not usually the assigning editor and might be a few steps removed from the [reporting] process.”

Borel suggests journalists discuss the process for reviewing headlines well in advance and not wait to broach editors on deadline. Another recommendation: Because editors don't like to make last-minute changes to stories, agree to only ask for a change to the final headline if it's inaccurate or misleading.

"Quibbling over wording might not be something the editor is up for late in the game," Borel adds. "Don't ask for changes unless you can make the case that there is a better, more accurate word, and sometimes you can."

The Journalist's Resource would also like to thank [Rick Weiss](#), director emeritus of [SciLine](#), for providing input on this tip sheet.

Stats terms for covering science

Tips from [SciLine](#) and [The Open Notebook](#)

Numbers can illustrate and strengthen stories, so it's important for journalists to interpret statistics for their audience and provide necessary context. This requires an understanding of where the numbers come from, what they do and don't mean, and what uncertainties and assumptions they carry. Six things to know:

Consider [sample size](#).

- Sample size is the number of observations, people, or other data points in a study. It is often represented by the letter "n" (see example at right).
- Bigger is usually better, because error (see below) generally decreases with more data points. But how big is "big enough" depends on the study design.
- **Reporting tip:** Ask an outside expert about typical sample sizes for the kind of study in question.

In statistics, [error](#) is not about mistakes but refers to the difference between the result of a measurement and the true value.

A pre-election poll shows candidate A ahead of B, 52% to 47%, $\pm 3\%$. Yet candidate A loses, 49% to 50%. This fits within the poll's prediction, since the CI for A is 49 to 55% and B is 44 to 50%.

- Many surveys and polls will report a [margin of error](#). This is usually given as the researchers' estimate of the actual value plus or minus a number (see example at left).
- If you add and subtract the margin of error from the estimate, you get the upper and lower bounds of the confidence interval (CI). This should be accompanied by a confidence level, such as 90%, 95%, or 99%.
- A 95% confidence level means that if you sampled the population 100 times, the result would fall within that range of values 95 of those times.
- When the confidence intervals of measurements from two populations overlap, then statistically speaking, there is no difference between them (see example at left).
- **Reporting tip:** If the confidence intervals (whether for predicting elections, comparing populations, or assessing the effects of a medical intervention) overlap, the results are inconclusive.

[Statistical significance](#) doesn't mean that a finding is huge; it means it's acceptably likely that an observed result reflects a real effect.

- Scientists start with the null hypothesis: the assumption that one thing has no relationship with another.
- After collecting data, scientists calculate a p-value, a number between 0 and 1 that quantifies how likely it is that some apparent connection between two things (such as exposure to a virus and a specific disease) is real and the two things are not just randomly associated.
- In most cases, a p value less than 0.05 (" $p < .05$ ") is considered small enough to call a result statistically significant. This means there's a less than 5% (1 in 20) chance of that result happening randomly. In other words, there's more than a 95% chance that a real relationship exists among the things.
- **Reporting tip:** Passing the arbitrary $p < .05$ cutoff should not be considered definitive proof or disproof of any hypothesis. A result can be statistically significant but have such a small effect size (the actual difference between groups) that it doesn't have any meaningful impact in the real world. You don't want to oversell studies with small effect sizes!

- **Reporting tip:** Passing the arbitrary $p < .05$ cutoff should not be considered definitive proof or disproof of any hypothesis. A result can be statistically significant but have such a small effect size (the actual difference between groups) that it doesn't have any meaningful impact in the real world. You don't want to oversell studies with small effect sizes!
- *False negatives* occur when a real relationship exists between two things, but a study fails to detect it. This can happen for many reasons, such as if the study does not include enough data points—has too small an n —to achieve statistical significance.
- *False positives* occur when a study wrongly concludes that there is a statistically significant relationship where there is no link.
- Recall that when a result is statistically significant at the $p < .05$ level, there is still a 1 in 20 chance it is simply a random result. So if a study runs 20 statistical tests, probability tells us that one will likely have an undeserved p -value below 0.05.
- **Reporting tip:** if you see many different statistical comparisons in a single research paper without the words “corrected for multiple comparisons,” be sure to ask an expert whether to trust those results.

Colloquially, we use the words “risk” and “odds” interchangeably, but statistically, they're different.

- *Risk* is the probability of an event occurring as compared to all possible outcomes (see example at right).
- *Odds* represent the ratio of the probability of an event occurring compared to the probability of the event not occurring.
- We tend to intuitively conceptualize both “risk” and “odds” as the percent chance of something happening, but that actually corresponds to risk. Note that a lot of scientific papers actually report odds.
- **Reporting tip:** It may be useful to translate odds into risk for your readers to help ensure their understanding of the results is accurate.

If you draw 100 marbles from a bucket and get a red marble 75 times and a green marble 25 times, the risk of drawing a green marble is .25, or 25%. The odds of drawing a green marble are 1:3 (.33), drawing 1 green marble for every 3 red. Odds of .33 don't mean a 33% chance.

Be extra careful with percentage points and percent change.

If 5% of people used to drive electric cars, and now 10% do... that's a 5-point increase (10 minus 5)... but also a 100% increase (5 divided by 5 = 1, times 100).

- Percentage points are the *absolute* difference between two percents. It's just subtraction!
- Percent change is the *relative* difference; it's what you get by dividing the absolute difference by the starting value, and multiplying by 100.
- **Reporting tip:** Make sure you're using the terms appropriately to convey results fairly and accurately (see example at left).

Correlation doesn't equal causation!

- A correlation represents the strength of a relationship between two things.
- Positive correlations reflect relationships where the values of both things increase or decrease together. Negative correlations reflect relationships where the value of one increases while the other decreases.
- *Correlation strength*, represented by the letter “ r ,” ranges from -1 to 1 , with -1 being a perfect negative correlation, 1 being a perfect positive correlation, and 0 being no relationship at all.
- **Reporting tip:** Just because two things are correlated doesn't mean that one causes or even influences the other. The observed relationship could be totally coincidental, or they could both be influenced by a third, separate thing.



Part Two:

Evidence-based reporting on central issues of 2025

Overview of evidence-based background on issues of 2025

Sara Whitlock, SciLine

We have collected current resources from SciLine and from The Journalist's Resource to get you up to speed on the relevant science around topics of discussion as we transition to the second Trump administration. Consult these as you include research-based evidence in your stories:

Climate and green energy

In recent years, federal policies have created incentives to transition to clean energy. Start with overview presentations on [current U.S. greenhouse gas emissions](#) and progress towards meeting emissions targets. Next see presentations about [renewable energy and the grid](#), including details about solar and wind energy, and look through interviews about the role of [nuclear powerplants](#) in the carbon-free energy landscape, as well as individual homes' [rooftop solar](#). Finally, see questions with experts about [transitioning to electric vehicles](#) for context on integrating vehicle charging needs into the grid.

Immigration

Approximately 46 million immigrants live in the U.S.—the largest number since census records have been kept. To start, listen to presentations on [recent U.S. immigrant demographics](#), including information on whether and how immigrants affect the labor market and productivity within various economic sectors. Then see our interview about [the Latin American immigrant experience](#) to learn about policy impacts, educational opportunities, and job prospects for this group of immigrants. Finally, see presentations about [how xenophobia and racism impact the health of immigrant communities](#).

Reproductive health

Controversies exist through the whole arc of reproductive health in the U.S. Start with our interview about [sex education](#) in the U.S., including information about what sex education looks like in various U.S. communities and what the research says about the impacts of different sex education curricula. Then, look through our interview about [changes in access to birth control](#) since the Dobbs decision, as well as presentations about recent [abortion statistics and types of abortions](#). For a thorough understanding of how medication abortions work, [see this overview](#), and then consult our [Q&A with experts on mifepristone and misoprostol](#). For information about pregnancy, start with our recent interview about [in vitro fertilization](#) covering assisted reproductive technologies and impacts of fetal personhood laws, then listen to overview presentations on [pregnancy-related death in the United States](#) and take a look at our interview on [racial inequities in pregnancy-related death](#).

Social safety nets

Social programs aim to keep Americans from experiencing the worst effects of homelessness and food insecurity. Start with context from our interview about [why people become homeless](#) and research-based strategies to prevent and end homelessness. Then listen to presentations about the [cost of housing and strategies for increasing affordability](#), as well as details from our interview on [the impact of racial discrimination and short-term rentals](#) on housing affordability. To understand the current state of food costs, we interviewed an expert about [rising grocery prices](#) and the potential

impact of tariffs on food prices. Pair this with context from our interview about [food insecurity](#): what it is, factors causing food insecurity, health impacts of food insecurity, and ways to reduce or eliminate food insecurity.

Vaccines

Get up to speed on [vaccine basics](#), including how they work, how they're tested, and how they are assessed for safety. Then, for [context about vaccine hesitancy](#), listen through three experts' presentations on the role of social values and personal belief systems, including religion, in people's decisions to get vaccinated or not. Childhood vaccinations are often a point of contention, so see this overview of [childhood vaccinations and school vaccine requirements](#) and these [tips for covering school vaccination requirements](#). Children may also fear vaccination, so we interviewed an expert about [how many children aren't vaccinated because of their fears](#) and how caregivers can reduce their children's pain and anxiety. Wrap up with information about [updates to this season's COVID, flu, and RSV vaccines](#) from our fall interview.

Drinking water pollution

The U.S. has advanced water, wastewater, and sanitation infrastructure, but we still face pollution problems in our drinking water. Start with our expert interview to get an [overview of the state of water infrastructure in the U.S.](#), including needed maintenance and upgrades. Next, see this [roundup of research on fluoride in water](#) and answers to [fifteen common questions about fluoride in drinking water](#). Then, drill down into lead contamination through expert presentations about [how and where lead gets into the water supply](#) and an interview about the federal government's efforts to [eradicate lead pipes](#). For general context about PFAS, consult expert presentations on [PFAS in groundwater and wells](#) along with a recent interview about [PFAS in water supplies](#), including details about how individuals can reduce their PFAS exposure.

Vaccine basics

March 8, 2021

Vaccines have delivered enormous public health benefits including the global eradication of smallpox, the near eradication of polio, and greatly reduced incidence of measles, meningitis, and other serious and potentially fatal diseases. Even before the approval of vaccines to protect against COVID-19, which in its first year killed about 2.5 million people worldwide, vaccines were regularly preventing two million to three million deaths per year. A large body of rigorous science has clearly and repeatedly shown that vaccines in use today—which rely on several different strategies to impart immunity—are exceedingly safe, with benefits greatly outweighing risks for individuals in groups recommended to get them.

How do vaccines work?

- Vaccines vary in how they generate protection against disease and in how they are administered (usually as injections, but some can be taken by mouth or given as a nasal spray).
- But every vaccine stimulates the immune system to produce antibodies—proteins that help protect the body against a specific disease. The immune system can generate countless types of antibodies; vaccines aim to trigger the production of antibodies that attack a specific “pathogen”—the agent, such as a bacterium or virus, that causes the targeted disease.
- Some vaccines require only one dose, while others require two or more doses (booster shots) to deliver stronger and longer lasting protection. Protection against influenza requires annual re-vaccination to protect against ever-changing variants of the flu virus.

What kinds of vaccines are there?

In various ways, vaccines introduce “antigens” into the body—substances that stimulate the immune system to produce disease-specific antibodies in the blood. These antigens may be inactivated versions of toxins, viruses, or bacteria—or versions that are still active but weakened so they can’t cause disease. Some vaccines contain only certain pieces of the relevant virus or bacterium, or laboratory-synthesized particles that resemble those pieces—such as synthetic versions of the “spike protein” that is part of the virus that causes COVID-19. Some examples:

- **Inactivated vaccines** contain pathogens that have been deactivated using chemicals, heat, or radiation. These pathogens can’t sicken people anymore, but they can still cause the body to produce antibodies that protect against future infections caused by the same kind of pathogen. Some cholera vaccines, for example, are made from inactivated versions of the causative bacterium.
- **Live-attenuated vaccines** use a weakened version of a pathogen. These pathogens are still active, but they aren’t dangerous like the original pathogen. The MMR vaccine is a live-attenuated vaccine.

While inactivated and live-attenuated vaccines include entire pathogens, some vaccines only contain pieces of pathogens. These **subunit vaccines** often have the advantage of causing even fewer side effects than inactivated or attenuated vaccines, yet still stimulate the body to generate disease-fighting antibodies.

- **Nucleic acid vaccines** deliver genetic material such as messenger RNA (mRNA) or DNA into the body’s cells. This material acts as instructions, telling the cells to produce parts of a virus—viral subunits—that serve as antigens to stimulate antibody production. The COVID-19 vaccines produced by Moderna and Pfizer-BioNTech, for example, use mRNA that directs cells in the body to produce pieces of viral spike proteins, which in turn stimulate the immune system to produce antibodies that attack SARS-CoV-2, the virus that causes COVID-19.
 - ▶ Several other COVID-19 vaccine candidates, including the one produced by AstraZeneca, use **viral vectors**—such as common cold viruses—that cannot reproduce or cause disease in the body but serve as delivery

vehicles to carry laboratory synthesized genetic material into a person's cells. As with other nucleic acid vaccines, that genetic material directs the cells produce SARS-CoV-2 spike proteins, which stimulate the production of antibodies.

How can vaccines prevent disease spread?

- Vaccination and natural infection both result in people having antibodies in their blood that, along with an array of disease-fighting cells, help prevent subsequent infection.
- When enough of a population is immune to a disease, whether by vaccination or past infection, that disease's spread becomes severely limited by the lack of vulnerable people to infect—a phenomenon called “herd immunity,” where even those who have not developed immunity are to a large extent protected because the odds of coming in contact with an infected person are so low. Once herd immunity is reached, cases steeply decline. Just how high a fraction of the population must become immune for herd immunity to start reducing a disease's spread varies based on characteristics of the disease-causing pathogen and the community in which it spreads—such as how infectious the pathogen is, the rates of personal contact among individuals in a population, the use of mitigation strategies such as masks, and how long an infected person remains contagious.
- Individuals who decline recommended vaccinations can interfere with the development of herd immunity within a community. This heightens risk for all members of the community, but especially for individuals who are more vulnerable to a disease's effects or who may not be able to get vaccinated safely, such as those with certain medical conditions. In 2013, measles outbreaks occurred in communities in New York, Texas, and other states, as low vaccination rates caused breakdowns in herd immunity and accelerated the spread of the virus.

Vaccine successes and current uses

March 8, 2021

A large body of rigorous science has clearly and repeatedly shown that vaccines in use today are exceedingly safe, with benefits greatly outweighing risks for individuals in groups recommended to get them. Contrary to widely disseminated misinformation about the purported dangers of vaccines, serious adverse health effects are very rare, while public health benefits are vast.

What diseases have been eradicated or significantly reduced by vaccines?

- The following represent a few of the many diseases tackled by vaccines:
- In the 1970s, capping a decades-long international vaccination effort, smallpox became the first (and so far only) human disease to be eradicated from the planet.
- Polio afflicted more than 35,000 people per year on average during the late 1940s in the United States. With the introduction of polio vaccines beginning in the mid-1950s and subsequent and ongoing vaccination efforts, no cases of polio have originated in the United States since 1979, though the disease still exists in other countries. A global polio eradication campaign has been underway for many years.
- Each year between 1953 and 1963 in the United States, measles infected three million to four million people and killed 400 to 500—most of them children. The disease was declared eliminated (no disease transmission for at least 12 months) in the United States in 2000 after a concerted vaccination program, but U.S. outbreaks have begun to occur in communities where vaccination rates have dropped. Those outbreaks have been traced to cases originating through international travel.
- In 1921 alone, 206,000 documented cases of diphtheria in the United States led to 15,520 deaths. With routine childhood vaccination, the disease is now extremely rare in the United States, though it persists in some other countries.
- For the first 25 years that U.S. whooping cough (pertussis) case numbers were reported (1922-1947), there were between 100,000 and 300,000 cases every year. The number of people infected with whooping cough declined dramatically after the introduction of a vaccine. Nonetheless, more than 15,000 U.S. cases occurred in 2018—part of a recent increase that has been linked in part to inadequate vaccination rates but also to a switch in the 1990s to a new version of the vaccine that has benefits over the original but may not provide as long-lasting immunity as earlier versions.

What vaccines are currently given to children in the United States?

- There are currently [14 vaccines](#) recommended for children by the U.S. Centers for Disease Control and Prevention (CDC), some of which are combination vaccines that prevent multiple diseases. Annual influenza vaccines are also recommended starting at the age of 6 months.
- Most vaccines routinely given to children in the United States are 85% to 95% effective in preventing disease in the vaccinated child. Evidence clearly shows that current vaccines for children approved by the Food and Drug Administration (FDA) are not only very effective but are [very safe](#); notably, the myth that there is a link between vaccines and autism has been repeatedly disproved in scientific studies.

How widespread is vaccination in the United States?

- Vaccination rates vary by vaccine and age. The most recent National Immunization Survey—the annual assessment of vaccination coverage conducted by the CDC—examined three vaccines recommended in the United States and found that nearly 95% of U.S. kindergarteners had received each vaccine during the 2018-2019 school year. Nationally, 2.2% of kindergarteners had received exemptions from state vaccination

requirements for at least one of the three vaccines due to philosophical or religious objections (“non-medical” or “personal-belief” exemptions, permitted in many states), while 0.3% were exempted from vaccination based on a medical condition that precludes vaccination.

- In the United States, more than 40,000 adults and about 300 children die annually from diseases that vaccines can prevent. From 2009 to 2018, 12 of the 18 states that allow parents to exempt their children from vaccination on the basis of religious or philosophical beliefs saw these exemptions rise, and more than a dozen metropolitan areas saw especially high numbers of exemptions (more than 400 kindergarteners each).

What happens when people delay or decline vaccination?

- Measles, an extremely contagious disease that is periodically brought into the United States as a result of international travel, provides an example: Among U.S. measles cases documented from 2000 to 2015 for which vaccination data are available, the vast majority occurred in unvaccinated people. More than 70% of the unvaccinated had an exemption based on religion or personal belief, rather than a medical exemption. In 2019 alone, there were 1,282 confirmed U.S. cases of measles — more than had been reported since 1992 — 71% occurring in unvaccinated people. About three-quarters of cases occurred in New York alone, a hotspot of non-medical exemptions from vaccinations.
- Vaccination rates are generally very high in the United States, but even local areas of lower coverage can lead to outbreaks. The percentage of the population that needs to be vaccinated to keep a disease at bay varies by disease; for some diseases, the U.S. Office of Disease Prevention and Health Promotion recommends vaccinating 90% of the population to prevent outbreaks. For measles, the World Health Organization recommends vaccinating 95% of the population, in part because it is so contagious.
- Many people without access to health care remain unvaccinated, and are made more vulnerable by those who, despite access, choose not to get vaccinated. Uninsured children have lower vaccination rates than insured children for most of the vaccines tracked by the National Immunization survey. By getting vaccinations, those with health care access help not just themselves but also others less able to receive vaccines.

Vaccine safety

March 8, 2021

A large body of rigorous science has clearly and repeatedly shown that vaccines in use today are exceedingly safe, with benefits greatly outweighing risks for individuals in groups recommended to get them. Contrary to widely disseminated misinformation about the purported dangers of vaccines, serious adverse health effects are very rare, while public health benefits are vast.

How safe are vaccines?

- Teams of scientists, including clinical trial experts, microbiologists, immunologists, epidemiologists, and biostatisticians develop and test vaccines through clinical trials and evaluate efficacy and the risks of side effects for various population groups, including people of different races and ethnicities, genders, and ages. For a vaccine to be authorized in the United States, the Food and Drug Administration (FDA) must judge its benefits to outweigh risks for those for whom the vaccine will be recommended.
- As with any medical intervention, side effects sometimes occur with vaccines. The vast majority are mild, such as redness around the injection site or a sore arm muscle for a few days—evidence that the vaccine is activating the immune system. To give one example, the measles vaccine leads to a mild reaction (such as redness) at the site where it was injected for 17 to 30 out of 100 people.
- A comprehensive 2020 study thoroughly documented the risks of side effects from vaccines routinely administered in the United States. Excluding effects seen in people at increased risk of complications due to compromised immune systems, severe allergies, or other medical conditions, for whom certain immunizations are not recommended, it found:
 - ▶ In fewer than one of every 10,000 children vaccinated with the MMR vaccine, the vaccine appears to cause an immune system reaction called idiopathic thrombocytopenic purpura (ITP; sometimes known as immune thrombocytopenia)—a condition for which medical care is sometimes required but that typically resolves without treatment
 - Context: Measles, it turns out, also sometimes causes ITP. So, although measles vaccines will very rarely cause ITP, these vaccines prevent far more cases of ITP than they cause, by preventing so many cases of measles. According to the Centers for Disease Control and Prevention (CDC), nearly 50,000 people were hospitalized annually as a result of measles infections in the decade preceding the introduction of the measles vaccine; about 1,000 per year suffered from life-threatening encephalitis (brain swelling) and 400 to 500 died. By contrast, in 2020, there were 13 cases of measles in the United States, a tribute to vaccine efficacy.
 - ▶ One to two children of every 2,500 who get the MMR or MMRV vaccinations (MMR + varicella/chickenpox) react with “febrile seizures,” which are brief (typically lasting one to two minutes) and generally harmless convulsions. Even more rarely (fewer than 1 child in 10,000), the influenza or pneumococcal conjugate vaccine (against several bacterial infections) will also cause these mostly benign reactions (1.75 in 10,000 when those two vaccines are given together).
 - Context: According to the CDC, about 5% of children get febrile seizures at some point in their first five years, even without vaccination, simply as a result of fever.
 - ▶ One to two out of every 1 million adults who get an influenza vaccine react with Guillain-Barré syndrome—an immune system disorder that usually is self-limiting but can cause nerve damage, muscle weakness, and paralysis.
 - Context: According to the CDC, hundreds of thousands of Americans are hospitalized from influenza in

a typical year and tens of thousands die from it. The CDC has concluded that people are more likely to get Guillain-Barré syndrome as a result of actual influenza infections than from the influenza vaccine.

- In adults, only one common side effect was documented for the MMR vaccine: Between 10% and 25% of adult women who receive it (typically for the rubella or “German measles” component) get mild and temporary joint pain or arthritis.
- ▶ Importantly, the 2020 study documented 34 ailments for which vaccines have not been shown to increase risk, including epilepsy, autism, chronic fatigue syndrome, diabetes, fibromyalgia, multiple sclerosis, stroke, lupus, and sudden infant death syndrome.
- Overall, a National Academies of Science, Engineering, and Medicine committee found that evidence for the net benefits of childhood vaccines is so overwhelming that it would be unethical to conduct a clinical trial in which some children would not get the vaccines as a point of comparison to vaccinated children.

Are vaccines safe for everyone?

- Everyone responds to medicine a little bit differently, so no vaccine is completely safe for every person.
- For some vaccines, there are certain groups who shouldn't take the vaccine. Those who are pregnant, people with severe allergies, immunocompromised individuals, and other groups are instructed by the CDC to not take certain vaccines.
- Individuals' immune systems vary with medical conditions, age, and other factors, so vaccine recommendations sometimes differ for certain groups—not just for safety reasons but also for efficacy. For example, the FDA approved a high-dose version of the flu vaccine for adults 65 and older, which helps compensate for the fact that older individuals have weaker immune systems and often fail to mount a strong immune response to a normal-dose flu vaccine.
- The World Health Organization produces information sheets that document the frequency of adverse reactions to specific vaccines.

What kinds of misinformation exist about vaccines?

- One of the most widespread false beliefs about vaccination is the rumored connection between vaccinations and autism—an idea that has been thoroughly discredited through rigorous scientific research.
- In one unfortunately influential and widely cited example, a research report published in 1998 in the medical journal *Lancet*, authored by Andrew Wakefield and colleagues, suggested that vaccines may be linked to gastrointestinal disease and developmental regression. That report, based on observations of 12 children, led to widespread concern about a possible link between some vaccines and autism. Britain's General Medical Council found that the study violated research ethics rules (among other issues, one of the authors had failed to disclose funding by parties suing vaccine manufacturers). In light of these and other shortcomings in the research (some symptoms were found to have started even before vaccination), the study was retracted in 2010—as was Wakefield's medical license.
- Other wide-ranging myths about vaccines persist, including false claims suggesting they cause long-term severe health problems like multiple sclerosis. Rigorous research on vaccine safety has repeatedly failed to find evidence for these claims.
- Misinformed fears about vaccine safety have been fueled in part by ongoing attention to anecdotal claims of harm by parents of children whose medical issues arose around the same time they were vaccinated. Studies carefully designed to make evidence-based distinctions between causal and coincidental correlations have repeatedly found no pattern of causal links.

- Researchers have also noted a psychological contribution to vaccine misinformation: medical science's successful reduction or elimination of many infectious diseases — largely by means of vaccination — has made the danger of these diseases much less immediate. With those risks now largely invisible, the very small risks of vaccination can seem intolerable — even though they are much smaller than the risk of the prevented disease or of many other risks accepted in everyday life. This complacency is dangerous, as evidenced, for example, by recent outbreaks of measles cases and deaths in places where immunization acceptance has dropped.

Vaccine testing

March 8, 2021

A large body of rigorous science has clearly and repeatedly shown that vaccines in use today are exceedingly safe, with benefits greatly outweighing risks for individuals in groups recommended to get them. Contrary to widely disseminated misinformation about the purported dangers of vaccines, serious adverse health effects are very rare, while public health benefits are vast.

How are vaccines tested?

- Before a vaccine is tested in people, it goes through laboratory testing (in cells or tissues) as well as in animals (such as mice or monkeys, which in some tests are exposed to the targeted disease after vaccination). Depending on test results, researchers may alter aspects of the experimental vaccine or decide not to pursue human clinical trials.
- For a vaccine candidate to get tested in people, the Food and Drug Administration (FDA) must approve an Investigational New Drug Application. This application includes results from animal testing and suggests a design for human clinical trials.
- Clinical trials are designed in three phases to find out whether a vaccine is safe for people, what dose is most effective, and how the human immune system responds to the vaccine. These trials generally take several years, although the first COVID-19 vaccines were created and authorized in under a year.
 - ▶ Phase I trials usually test up to 100 people and are aimed primarily at assessing safety at various doses.
 - ▶ Phase II trials often enroll hundreds of people. Safety remains a focus, but these trials also aim to determine immune responses to the vaccine.
 - ▶ Phase III trials may test thousands or tens of thousands of people with the primary goal to determine if the vaccine works to prevent disease. These studies generally include volunteers randomly selected to receive an inactive placebo instead of the vaccine to help determine if evidence of protection—or any emerging safety issue—is attributable to the vaccine. These studies are larger and longer than the other trials and so can reveal rarer “adverse events” such as fever or a seizure following vaccination—and can help settle whether those issues are causally connected to the vaccine. Adverse events during a clinical trial may require a pause for assessment (the FDA may stop trials or request more research at any point in the approval process). In one example, the phase III trial for a COVID-19 vaccine candidate was temporarily paused in September 2020 when one subject came down with an illness after getting the vaccine. The trial resumed about a week later after analysis convinced regulators it was safe to do so.
- In considering whether to authorize or approve a vaccine for marketing, the FDA reviews safety and efficacy data from clinical trials along with other information—including the severity of the disease and whether other protective strategies or medical treatments are available—to determine whether the vaccine’s benefits outweigh its risks for those who will be deemed eligible to take it.

Is vaccine safety tracked after a vaccine is approved?

- As vaccines are produced at scale for marketing, samples are tested for purity and for batch-to-batch consistency.
- The U.S. Centers for Disease Control and Prevention (CDC) and the FDA monitor reports of adverse events, to identify any side effects that may not have been apparent during clinical trials.

6 tips for covering school vaccination requirements, vaccine exemptions and undervaccination

The Journalist's Resource asked health and communication researchers for advice to help journalists cover school vaccination requirements in the U.S. amid a rise in measles cases and a push by some lawmakers to let more unvaccinated students enroll.

by [Denise-Marie Ordway](#) | August 19, 2024

As kids in the U.S. head back to class this fall, school officials have been checking student shot records to make sure everyone meets school vaccination requirements. The task has taken on a greater sense of urgency as the [number of measles cases climbs](#) nationwide and many states allow more students to start school unvaccinated or missing doses of vaccines that protect against dangerous, highly contagious diseases.

We created this tip sheet to help journalists cover school vaccination requirements as well as the consequences of tightening or loosening them. It's a complement to our companion piece on [research-based strategies for boosting student vaccination rates](#).

1. Know the difference between “anti-vax” beliefs and vaccine hesitancy.

News stories often lump people who are nervous about vaccines together with ardent opponents and label them all “anti-vaxxers.” Not only is such coverage misleading, it also can be dangerous, says [Sarah Michels](#), an epidemiologist at the University of Montana's Center for Population Health Research.

Researchers and public health professionals tend to use the term “[vaccine hesitant](#)” to describe this highly heterogeneous group of people who are unsure about the safety, effectiveness or necessity of one or more vaccines. When journalists don't convey this spectrum of views, their stories make it seem as though opposition to vaccines is more common than it is, Michels says.

Even misconceptions about the prevalence of vaccine hesitancy can influence social norms — what people consider normal and acceptable — and discourage vaccination, researchers from the University of Colorado School of Medicine write in a [February 2024 essay](#) in The New England Journal of Medicine.

A [study published in 2022](#) estimates that 7% of U.S. adults hold anti-vax views and that 23% are vaccine hesitant. When a group of researchers surveyed a [nationally representative sample](#) of U.S. parents about vaccination, they learned 6.1% were vaccine hesitant about routine childhood immunizations, according to [a paper](#) the academic journal Pediatrics published in 2020.

2. Make clear that the overwhelming majority of U.S. students have received state-required vaccines, including many children in vaccine hesitant families.

U.S. states and the District of Columbia require kids to be immunized against certain diseases before they can attend school. While vaccination policies vary, they generally apply to both public and private schools. Some states require homeschooled children also to be vaccinated. Before they start kindergarten, kids must complete these four immunization series:

- ■ 2 doses of MMR, which protects against measles, mumps and rubella.
- ■ 5 doses of DTaP, which protects against diphtheria, tetanus and acellular pertussis.
- ■ 2 doses of VAR, which provides immunity against varicella, also known as chickenpox.
- ■ 4 doses of Polio, which helps prevent poliomyelitis, commonly referred to as polio.

Michels says school vaccination requirements ensure the vast majority of the U.S. students get immunized. About 93% of the [approximately 4 million children](#) in kindergarten in 2022-23 had received all doses of these four vaccines, according to [a report](#) the U.S. Centers for Disease Control and Prevention released in late 2023.

Another 2.5% of kindergarteners in 28 states were allowed to enroll while catching up on doses their families had accidentally or intentionally skipped.

3. Familiarize yourself with the range of reasons some people delay or refuse immunizations and have trouble completing a vaccine series.

Although [vaccine safety experts agree](#) that the MMR vaccine does not cause autism, fear of autism is the leading reason parents and caregivers give for wanting to skip it, according to a [review of 115 academic papers](#) written on the topic from 2000 to 2022.

The MMR vaccine has been widely studied because of its importance — the U.S. continues to have measles outbreaks — and because some parents still have reservations about it. In 2010, The Lancet medical journal [retracted a paper](#) that implied a link between the MMR and autism. Since then, [numerous studies](#) have confirmed there is no link between receiving vaccines and the developmental disability formally known as [autism spectrum disorder](#).

“This concern appeared repeatedly throughout the literature regardless of the type of study — suggesting how powerful and lasting false information can persist in parents’ minds despite MMR’s established safety and efficacy,” write the authors of the 2023 research review.

There are lots of other reasons some families have expressed concerns about inoculation. A [2017 study](#) in the academic journal PLOS ONE identified 72 factors associated with vaccine hesitancy, including people’s past experiences with health care, how much they trust mainstream medicine and how strongly they are influenced by their social networks.

Psychology scholar [Dolores Albarracín](#) urges journalists to examine the factors that drive undervaccination, or beginning a required vaccine series but not finishing it. She notes that families — lower-income families in particular — often skip or put off doses simply because it’s tough to get their children to their pediatrician’s office or a vaccination clinic.

Parents and other caregivers might have trouble taking time off work, paying for transportation, juggling the schedules of multiple children or finding a health care professional who offers immunizations for children at convenient hours, says Albarracín, director of the Communication Science Division at the [Annenberg Public Policy Center](#) at the University of Pennsylvania.

“A lot of it is really about access.”

“If you ran out of cash and you can’t take a bus or there’s no bus and you need to do it this week, a whole year or semester might go by before you find the opportunity,” she adds. “A lot of it is really about access.”

4. Report that school vaccination exemptions tend to reduce vaccination rates.

In all states and the District of Columbia, students who cannot receive vaccines because of a medical condition are exempt from school vaccination requirements, according to the [National Conference of State Legislatures](#). But the number of students who apply for and receive these exemptions is very small — 0.2% of kindergarteners nationwide in 2022-23, CDC data show.

A larger — and growing — share of students receive exemptions for religious, philosophical or other reasons. In 2022-23, about 3% of kindergarteners obtained exemptions, up slightly from 2.6% the prior year. Exemption rates varied considerably across states, from less than 0.1% in West Virginia to 12.1% in Idaho.

[As of August 2024](#), 30 states and the District of Columbia allow exemptions based on religious objections. Another 13 states allow exemptions for either religious or personal reasons.

Public health officials expect exemption rates to rise in Mississippi, where a federal judge last year [ordered the state to grant religious exemptions](#). Before that, Mississippi was one of a handful of states that only provide medical exemptions.

Journalists need to explain to their audiences that allowing exemptions reduces vaccination rates in local areas, Michels and Albarracín say. They worry declining vaccination rates will put students, their families and their communities at risk.

So far this year, 219 measles cases and 13 outbreaks were reported in the U.S., up from 59 cases and four outbreaks during all of 2023, [according to the CDC](#).

[Academic research](#) shows unvaccinated kids often live in the same areas or attend the same schools, creating population clusters where vaccination rates are not high enough to maintain [herd immunity](#). Studies also show that a new public policy can change social norms around vaccination, Albarracín adds.

A [study she coauthored](#), published in Nature's Scientific Reports, "provides robust evidence that policies can foster a culture of vaccination by signaling what constituents approve of and do," she notes in a [January 2024 article](#) published by the University of Pennsylvania.

5. Remind audiences that routine childhood vaccines are safe and effective.

[Christopher Clarke](#), director of the Science Communication Graduate Program at George Mason University, recommends journalists remind the public that vaccination is one of the best ways to protect kids against serious infectious diseases.

His research suggests that highlighting the [scientific consensus](#) on vaccine safety can improve people's knowledge and attitudes about immunization. In an experiment he and his colleagues conducted, 181 people read versions of a news article about vaccines, some of which contained a statement explaining that scientific studies have found no link between vaccines and autism and that scientists agree no link exists.

Participants who read an article that included such a statement "were less likely to believe that scientific evidence and opinion is unclear on whether vaccines cause autism," Clarke and his coauthors write in [their resulting paper](#), published in the Journal of Health Communication in 2015. They also found that after participants read the articles, those who were more sure that no link exists had a more positive attitude toward vaccines.

Journalists need to remind their audiences what the research shows, Clarke wrote to The Journalist's Resource.

"Childhood vaccines are safe, essential, and effective, and medical doctors and experts have known that for a very long time," he wrote.

6. Choose vaccination images that are medically accurate.

The American Academy of Pediatrics and SELF Magazine teamed up to create the [Immunization Image Gallery](#). The photos, free for anyone to use, portray people's experiences getting vaccinated more accurately than many photos that appear in news coverage, [Casey Gueren](#), a former executive editor at SELF, writes to explain why the project was created.

“The stock photography commonly used in stories about vaccines are often medically inaccurate in a range of ways, from showing the wrong syringes to showing shots being administered incorrectly,” [Gueren writes](#).

Health and science reporter [Tara Haelle](#) created a [tip sheet](#) in 2021 to help news outlets pick photos for vaccine stories. In it, she cautions against images featuring crying babies, worried mothers and oversized needles. She notes that many — if not most — vaccine stories “may not actually need a photo with a needle in it. A bandage on an arm, a person with a healthcare worker, a vial or similar images are often adequate.”

“While it’s not a journalist’s job to promote public health per se, we certainly need to avoid undermining it,” writes Haelle, the author of [Vaccination Investigation: The History and Science of Vaccines](#) and a health beat leader at the Association of Health Care Journalists.

Routine childhood vaccinations and changing school requirements

by [Denise-Marie Ordway](#) | August 13, 2024

For several years, the COVID-19 pandemic disrupted routine childhood vaccinations across the U.S., reducing the number of children entering kindergarten vaccinated against serious, highly contagious diseases such as the measles, diphtheria and polio, [an analysis](#) from the U.S. Centers for Disease Control and Prevention found.

The vast majority of America's [approximately 4 million kindergarteners](#) start school fully vaccinated, meaning they have received all doses of the vaccines their state requires. But the proportion dipped from 95% during the 2019-20 academic year to about 93% in 2022-23, the most recent year for which data was available, the CDC reports.

As childhood vaccination rates have dropped, outbreaks of measles — [declared eliminated in the U.S. in 2000](#) — have increased. So far this year, 211 measles cases and 13 outbreaks were reported in the U.S., up from 59 cases and four outbreaks during all of 2023, [according to the CDC](#).

In the coming months, education and public health leaders will likely discuss vaccination rates and ways to reverse the trend both nationally and in local communities. As schools prepare for the fall semester, administrators are checking children's shot records and working with families to help kids get up to date.

Researchers have spent decades studying strategies that encourage people to get vaccinated. Public health officials warn that communities do not have [herd immunity](#) against a disease until a high percentage of people become immune to it, usually through inoculation. The threshold for herd immunity against measles, for example, is quite high — [about 95%](#), according to the World Health Organization. In comparison, the threshold for polio is [about 80%](#).

Strategies for boosting childhood vaccinations

Last month, editors at the leading scientific journal Nature urged policymakers to consult academic research to determine which interventions work best at boosting vaccination rates.

"The burgeoning science of vaccine-uptake effectiveness is throwing up some unexpected results that could help public-health authorities to sharpen their policies — and save more lives," the editors write in [a July 9 editorial](#).

An example: In 2021, the White House [announced a new program](#) that offered free rides to vaccination sites to encourage Americans to get a COVID-19 booster shot. But [a study published in Nature](#) in June finds that providing a free round-trip Lyft ride to a CVS pharmacy "does not produce measurable benefits over and above reminding people to get vaccinated."

Studies published in recent years suggest these four strategies may help improve childhood vaccination rates. Detailed summaries of key papers that examine these interventions are located toward the bottom of this article.

- Offering inoculations at schools, libraries and other places children and their families frequent.
- Providing incentives such as financial rewards to families and to health care providers who administer vaccines to children.
- Eliminating exemptions to school vaccine requirements, except for students with medical conditions that prevent them from receiving vaccines.
- Reducing the number of kids admitted to school before they have received all doses of all required vaccines. Many schools allow students to enroll on a "provisional" or "conditional" basis while they catch up on their shots.

Vaccine exemptions

Psychology scholar [Dolores Albarracín](#) says schools send families mixed messages about the importance of childhood vaccinations when they allow a lot of kids to skip immunizations. In Idaho, for instance, families can request [vaccine exemptions for any reason](#). Schools there gave exemptions to 12.1% of kindergartners statewide in 2022-23, more than in any other state, [CDC data show](#). In Oregon and Utah, the rate exceeded 8%.

Nationwide, 3% of kindergartners — about 115,000 kids — obtained exemptions from state-required vaccinations in 2022-23. That's up from 2.6% the prior year.

Albarracín, who is director of the Communication Science Division at the University of Pennsylvania's [Annenberg Public Policy Center](#), has studied vaccination policies. A [paper she coauthored](#), published in Nature's Scientific Reports in December, suggests vaccination policies can alter social norms and change people's attitudes toward vaccines.

Like the [American Medical Association](#) and [American Academy of Pediatrics](#), Albarracín supports eliminating vaccine exemptions that are not directly tied to a student's medical condition.

"How can schools be trying to really ensure [vaccination] if, at the same time, they're allowing parents to not vaccinate kids for all these personal and religious reasons?" she asks.

School vaccination requirements

Children must be vaccinated against certain communicable diseases to attend school in the U.S. School vaccination mandates vary by state but generally apply to both public and private schools, including charter schools and parochial schools.

All states require kids to receive these four vaccines prior to enrolling in kindergarten:

- 2 doses of MMR, which protects against measles, mumps and rubella.
- 5 doses of DTaP, which protects against diphtheria, tetanus and acellular pertussis.
- 2 doses of VAR, which provides immunity against varicella, also known as chickenpox.
- 4 doses of Polio, which helps prevent poliomyelitis, commonly referred to as polio.

All states also allow exemptions to these requirements, according to the National Conference of State Legislatures, which tracks [student immunization policies](#). As of August 2023, every state provided exemptions to students for medical reasons such as having a weakened immune system or being allergic to a component of a required vaccine.

[Religious exemptions](#) are common, too. All but five states offer them. Fifteen states grant exemptions for children whose parents object to immunizations because of personal or moral beliefs or other reasons.

In 2015, California banned all exemptions that were not for medical reasons, becoming the first state in almost three decades to do so. At the time, only West Virginia and Mississippi prohibited non-medical exemptions.

In 2019, New York and Maine eliminated religious exemptions, followed by Connecticut in 2021.

Various groups have challenged such policies, however. Last year, a federal judge in Mississippi sided with several parents who argued that not being able to skip state-required vaccines on religious grounds violated their First Amendment rights. In April 2023, [the court ordered Mississippi, known for its high MMR vaccination rate](#) among kindergartners, to begin offering religious exemptions.

Early this year, the West Virginia legislature [passed a bill](#) that would have loosened school vaccine policies there, in part by letting private schools set their own standards. But Gov. Jim Justice [vetoed the measure](#) March 27.

Focusing on under-vaccinated kids

Epidemiologist [Sarah Michels](#) says states could boost vaccination rates quite a bit by focusing on children who have started a vaccine series but not yet finished it. Michels has conducted national studies of infants and toddlers and found that many are just one or a few doses away from being fully vaccinated.

This is relevant because most doses of the four vaccines schools require are administered to children before age 2, provided their families follow [the immunization schedule](#) the CDC recommends.

“Most families choose to vaccinate their infants and children, and what we saw is that more than 1 in 6 kids are missing doses,” explains Michels, an epidemiology specialist at the University of Montana’s [Center for Population Health Research](#).

A [study she led](#), published in *Pediatrics* last year, suggests the main reason more young children are not immunized is because of various barriers families face in accessing vaccines — not because they fear or object to vaccines. For lower-income families, it can be difficult to make time or afford transportation to vaccination clinics and medical offices.

“We found that moving across state lines, higher numbers of children in the household, lacking health insurance, lower household income, living in a rented home, and race and ethnicity were each associated with a 20% or greater risk of failure to complete multidose vaccine series in early childhood,” Michels and her colleagues [write in their paper](#).

Some 2.5% of U.S. kindergarteners were allowed to attend school without having received all doses of their required vaccines in 2022-23, [the CDC reports](#). The percentage of 5- and 6-year-olds who were provisionally or conditionally enrolled varied by state, reaching as high as 9.2% in Arkansas.

Growing opposition to vaccination mandates

Vaccines were a polarizing issue in the U.S. before the COVID-19 pandemic began. But [a 2022 analysis](#) from researchers at Baruch College and Fordham University finds that the political divide in attitudes toward vaccines has widened over the last decade.

“By 2015, a partisan split emerged across not only vaccine attitudes, but also in reported vaccination behavior.”

“By 2015, a partisan split emerged across not only vaccine attitudes, but also in reported vaccination behavior,” political scientists [David R. Jones](#) and [Monika L. McDermott](#) write in [the working paper](#). While Republicans “have become more vaccine skeptical,” they add, Democrats “have become more vaccine supportive.”

Vaccines have become a key issue in this year’s presidential election. Last month, former President Donald Trump [told supporters at a rally](#) in Minnesota that if he is reelected in November, he “will not give one penny to any school that has a vaccine mandate or a mask mandate.” Vice President Kamala Harris, on the other hand, has [spoken in favor](#) of vaccines broadly.

This year and last year, lawmakers in several states have pushed to make it easier for students to get vaccine exemptions and to ensure parents know what exemptions are available. For example, in Idaho, [a state law that took effect in July](#) allows students 18 years and older to request school vaccine exemptions for themselves. A [state law enacted in Louisiana](#) this year requires schools to include information about vaccine exemptions in all communications with parents about vaccine requirements.

A new Gallup poll quantifies changing attitudes toward childhood vaccinations. Americans are far less likely to say immunizations are important than they were before COVID-19 spread to the U.S. in early 2020, Gallup notes in an [Aug. 7 press announcement](#).

Today, 69% of U.S. adults think it's "very important" or "extremely important" that parents get their kids vaccinated. When Gallup conducted similar polls in 2015 and 2019, 84% of U.S. adults believed that.

Americans are also much less likely to believe the government should mandate vaccinations against contagious diseases such as measles. The Gallup survey, conducted in July with a [nationally representative sample](#) of 1,010 people, reveals that 45% of U.S. adults think the government "should stay out of" the issue.

In 2019, that number was 35%. Back in 1992, 14% of Americans felt that way, Gallup notes.

Reproductive health and abortion

July 11, 2024

The following is adapted from a SciLine media briefing, [part of a series of SciLine media briefings covering key issues in the 2024 election](#), that covered what the latest scientific research says about reproductive health and abortion.

Dr. Sarah Prager is an OB/GYN physician and a professor of obstetrics and gynecology at the University of Washington, and director of its family planning division, who spoke about what research says about the physical and the mental health implications of either having access to an abortion or not.

Dr. Amanda Stevenson is an assistant professor in sociology at the University of Colorado Boulder who shared information about current trends with abortion, including the demographics of who's getting abortions, when in their pregnancy they're doing so, and a comparison of some state-by-state abortion data from before and after the Dobbs decision that overturned Roe v. Wade.

Understanding abortion

SARAH PRAGER: I'm a professor of obstetrics and gynecology and also a subspecialist in complex family planning. So, talking and working with abortion and contraception and miscarriages is what I spend most of my time doing. What is an abortion? An abortion is the act of doing or taking something that ends a pregnancy, and that may sound obvious, but I think it's worth kind of talking about for a second what is and what is not an abortion. Generally when we talk about abortion, we are not also including ectopic pregnancy, which is a pregnancy outside of the uterus, or a spontaneous abortion, which is a miscarriage.

So, why do we say induced abortion sometimes? You'll probably have heard that mentioned as well, and we do that to differentiate from a spontaneous abortion. So, taking something that ends a pregnancy versus a pregnancy ending spontaneously, which is a miscarriage or a pregnancy loss. And generally speaking, we avoid the term elective abortion because that indicates some judgment that this is something that maybe doesn't need to happen, and all abortions are indicated for some reason.

I also just like to remind everybody that language does matter and how we talk about abortion has really wide implications. It can matter to our patients and to other individuals that they're associated with, both those who have abortions and those who may need one in the future. It also can really matter to people who perform abortions like I do and other colleagues of mine. It has huge implications on legislation and on regulation.

So, let's understand a little bit more. What is a medication abortion? Well, a medication abortion is taking a combination of medications, typically in the first 11 to 12 weeks, and that combination includes a mifepristone tablet that a patient swallows, followed usually in 24 to 72 hours by four misoprostol tablets that are administered by themselves at home. If the pregnancy is beyond nine weeks, then generally speaking the dose of misoprostol needs to be repeated at least one time. And the passing of the pregnancy also occurs at home. There are also some misoprostol-only regimens that are available. It typically requires more doses of the misoprostol to achieve a similar efficacy than if using pre-treatment with mifepristone, and there are more side effects.

We find in Washington State that it's been incredibly helpful to have this available, particularly for people who live rurally, and I'll explain that in just a minute. Mifepristone, the first medication of the medication abortion, is still really highly regulated through a system called the REMS, which stands for Risk Evaluation and Mitigation Strategies. This is an FDA system. This is applied typically to medications that are very dangerous or potentially life-affirming and is used to assess safety of use. And then typically, the REMS go away after safety has been confirmed. These REMS have been in place for well over a decade for mifepristone in spite of the fact that it's an incredibly safe medication. They include restrictions like mifepristone cannot be prescribed through a pharmacy like most other medications. There has to be a provider that is registered to be able to even receive mifepristone to dispense in a clinic. And if they want to prescribe through a pharmacy, both the provider and the pharmacy need to specifically register that

medication. Pharmacies also have to consent to carry mifepristone, and only one pharmacy in Washington State, for instance, currently carries mifepristone. It is possible now through some adjustments to the REMS that happened during and post-Dobbs that mifepristone can be mailed from a registered pharmacy to a patient, although that patient still needs to be living in the state where that medication is prescribed and mailed from. So, as I mentioned, mifepristone and misoprostol are incredibly safe medications. They're safer than ibuprofen. They're safer than Tylenol. And there was a recent analogy that was made that medication abortion is substantially safer than skydiving, which I think is an event that most of us would think of as being much more dangerous.

Procedural abortion in the first trimester is typically a uterine aspiration, and this can happen with a manual or a handheld vacuum aspirator or an electric vacuum aspirator. Most typically in the United States and around the globe, we use the manual aspirator for the first trimester, and it just looks like a big syringe. This is a procedure that takes under 5 minutes most of the time during this first-trimester time period. First-trimester abortion can also happen in a variety of settings. So, procedural abortion most typically happens in an outpatient clinic. That might be with or without various sedation type medications. However, it can also happen in an emergency department or in an operating room if patients do want or require more anesthesia or supervision. Medication abortion also can happen in outpatient clinics. It can happen through an emergency department, or an inpatient hospital unit if a patient is already admitted when they discover a need for medication abortion. As I mentioned, it could be mailed. And if a pharmacy is registered, it can be dispensed through a pharmacy.

Now, I'm going to switch to talking about abortion after 14 weeks, or after the first trimester. Procedural abortion is conducted using a dilation and evacuation or an intact D&E or D&X procedure. Medication abortion instead at these gestational ages looks very much like an induction of labor. We use the exact same medications and the exact same techniques as we would inducing labor at term, although sometimes we use the medications in slightly different doses. Location for abortion beyond 14 weeks can also vary, and the majority of abortions beyond 14 weeks procedurally also happen at outpatient clinics. These are often freestanding clinics like Planned Parenthoods or other independent abortion clinics. And typically, this is happening with anesthesia or sedation on site. They also can occur in an operating room, again particularly if there are medical concerns. Medication abortions beyond 14 weeks are typically going to be happening on labor and delivery wards, although in other countries there often are specific wards that are set aside for medication abortion management. Post-abortion care if the abortion is uncomplicated is pretty minimal in terms of what's required. We don't require patients to follow up, although we always offer a followup for our patients.

For patients who may live remotely and/or for whom a followup visit might be challenging, they're always welcome to take a home urine pregnancy test between two and four weeks after the abortion to confirm completion. And then, they can follow up if that test is still positive. Menstruation typically returns one or two months after the abortion, and most people feel able to resume their usual daily activities within just a few days of the abortion. If desired, contraception can start immediately. Complications are quite uncommon, generally less than 1% for all abortions. The mortality of procedural abortion is less than one in one million. The mortality for medication abortion is less than five in one million. And just to compare that to continuing pregnancy, the mortality of pregnancy is greater than one 100 out of 1 million. So, what you're looking at is really 20 to 100 times less safety continuing a pregnancy than having an abortion. If uncomplicated, an abortion also has no impact on future fertility regardless of how that abortion happens or at what gestational duration.

There are, however, complications of not getting an abortion, and there was a really pivotal study called the Turnaway Study that compared those who received a wanted abortion to those who were denied a wanted abortion, and all of those subjects were followed for 5 years. What the study found was that there were more life-threatening conditions like eclampsia, which is dangerously high blood pressure, and postpartum hemorrhage, for those who were denied their wanted abortions. There were more chronic headaches and migraines, more joint pain and high blood pressure compared to those who were denied an abortion. There are higher rates of household poverty, lower credit scores, and increased debt for those denied abortions, and also more negative outcomes for those children born after abortion denial as compared to people who were able to achieve their abortions and

then subsequently went on to have children. Those children actually did much better. So, bottom line of that is that child outcomes are much improved when it's a wanted pregnancy and a wanted birth.

“Abortion is safe and continuing a pregnancy oftentimes is not.”

We often hear about the risk of mental health implications of abortion, but having a wanted abortion is not associated with mental health harms. Compared to receiving an abortion, being denied a wanted abortion is associated with experiencing more symptoms of anxiety and low self-esteem one week after denial. Basically, prior history of a mental health condition is the strongest predictor of mental health conditions after an abortion. And laws that require women to be warned about negative psychological consequences of abortion are not based in evidence. Abortion is safe and continuing a pregnancy oftentimes is not.

Abortion statistics and demography

AMANDA STEVENSON: Defining abortion is always really important because there is so much misinformation about abortion contraception and pregnancy swirling around these days. So, I'm going to start by talking about the fact that most abortions happen very early in pregnancy. Almost half, 44% to 42% of abortions in the United States in recent years, have occurred at or before six weeks of pregnancy. So, this is four weeks or fewer since fertilization. So, these are very, very early abortions. We measure the gestational duration of the pregnancies that end in abortion from last menstrual period, which is important to note because so many early abortion bans are so early that those two weeks between the menstrual period and fertilization and ovulation are pretty important. The fact that abortions are occurring so early in pregnancy in the contemporary era is a pretty big contrast with the past and the more distant past. So, here, the disaggregation by gestational duration is slightly different.

So, in 2020, over three-quarters of abortions were at or before nine weeks, and we don't have the same disaggregation in different time periods, so the comparison is a little different in the earlier years, but you can see that about 1/3 of abortions at the time of *Roe v. Wade* were at or before eight weeks. And it's especially sort of notable that we have many more abortions at or before six weeks now than we had at or before eight weeks at the time of *Roe v. Wade*. So, abortions have been occurring earlier and earlier in pregnancy over time, and this is largely due to the fact that abortion can occur earlier because medication abortion enables the provision of this care at earlier gestational durations than were previously possible. Another change in abortion over time has been a very long-term multi-decade decline in the numbers and rates of abortion in the United States and then in recent years a pretty abrupt reversal. Now, these numbers come from four different sources. The incidence of abortion in the United States is not reliably available from the federal government because the CDC abortion surveillance is not mandatory. So, several large states do not report any abortion statistics to the federal government. And as a consequence, CDC statistics on abortion are always incomplete.

Surveys fielded by the Guttmacher Institute every few years provide a nationally representative estimate of the number of abortions annually in the entire United States. Since *Dobbs* and a little bit before *Dobbs*, two other sources of reliable data on abortion incidence have been introduced. Guttmacher has instituted a monthly abortion provision survey, and the Society of Family Planning has instituted a monthly survey called the We Count survey. What these data tell us is that abortion has reversed its multi-decade decline since 2020. We've seen a roughly 11% increase in the number of abortions in the U.S. from before *Dobbs* to after *Dobbs*. So, from 2020 to 2023. We don't know exactly why this increase has occurred. Another change since the *Dobbs* decision is that the type of abortion restrictions that we see implemented has radically changed. So, there were a lot of abortion restrictions implemented in the decade before *Dobbs*. But in the two years since *Dobbs*, we've seen much more severe abortion restrictions

enforced, total bans and near total bans on abortion in several U.S. states. Before Dobbs, the rate of abortion—so, this is the number of abortions per 1000 women of reproductive age—was highly variable across U.S. states. Some states had rates that were many times greater than others.

After Dobbs, we saw changes in the number of abortions and the rate of abortions that varied also across states, and these didn't always vary just according to the types of laws that changed. The changes we see in abortions after Dobbs are also the result of how the laws in the states around a state have changed. So, for example, we saw big increases in abortion in Florida because there were so many bans in other places in the South. These data are comparing April 2022—so, right before Dobbs—to April 2023. And since that time, Florida has changed its laws and would no longer have an increase. We would now see a decrease because of its six-week ban.

“CDC data on abortions are fundamentally incomplete.”

Data about who gets abortions in the United States are best sought from the Guttmacher Institute abortion patients survey because CDC data on abortions are fundamentally incomplete. So, all of California, for example, is excluded. Other states are also excluded. What we do know from the Guttmacher Institute abortion patient survey is that well over half of people getting abortions are in their 20s. Abortions for teenagers have been declining. They were declining before 2020, and they've declined since then as well, and they've been declining the most rapidly. They've been declining for everyone, but most rapidly for teenagers. People who are racialized are disproportionately represented among those who access abortion care, and this is the result of the confluence of variation in access to the means of controlling fertility before pregnancy, so variation in access to contraception, as well as differential ability to withstand the consequences of bringing an unplanned pregnancy to term. So, different people with different levels of resources may be more or less able to navigate that circumstance. So, people make decisions about pregnancy on the basis of their structural conditions.

Three-quarters of people who get abortions are classified as poor, and this is robust across various ways to measure poverty, but I'll note that both the data about age and the data about patient characteristics that are most reliable are most recently from 2014 because the Guttmacher abortion patient survey from 2021 and 2022, which is the most recent wave, was not nationally representative. So, this is sort of just indicative of the fact that studying abortion is challenging and describing abortion is also challenging. Most people who have abortions are already parents, about 60% or more. So, 59% in 2014 already have at least one child.

What is being done well in press coverage of these issues, and where is there room for improvement?

SARAH PRAGER: There is a huge amount of data around abortion safety and all of the different aspects of abortion. And when I see a lot of reporting, it strikes me that it is a bit similar to the way reporting happened for many, many years around climate change where there is a false equivalency set up between the very clear facts around abortion and other people's thoughts and feelings that are not fact-based. And I would personally like to see that reflected much more realistically in the reporting that I see so that how somebody feels about abortion and what the facts are about abortion are not being presented with the equivalent weight.

AMANDA STEVENSON: So, I think that the thing that is most notable to me about the coverage of abortion is how much it has improved in the past decade. Things are so much better now than they were 10 years ago, and I'm very, very grateful. A key difference between the way scientists talk about abortion and the way many journalists write about abortion is that we never use the phrase late-term or early-term abortion to describe abortions because term is a pregnancy that is ready to deliver. Term means something in pregnancy, and late-term and early-term are

not meaningful. So, instead, we say earlier or later abortions or we specify the gestational duration of the abortions that are at issue. Just precision like that though, it's really stuff around the edges in some ways compared to the kinds of issues we were seeing in the early 2010s.

Does traveling for abortion increase risks, in particular for those with complicated pregnancies?

SARAH PRAGER: So, delays in access in and of themselves can increase risk. So, abortion is safer earlier in pregnancy. It is safe throughout, safer throughout than continuing the pregnancy, but safer earlier in pregnancy. So, those delays can have safety impacts for patients. Being away from their support systems also increases the risk. And patients who are being denied access to abortion sometimes are already ill. And so, they are being forced potentially with a uterine infection or with ongoing bleeding or some other pregnancy complication to now seek care elsewhere because the providers in their state fear prosecution from proceeding with an abortion in a situation where there might still be a heartbeat, even though the pregnancy itself is no longer viable from a standpoint of survivability.

Are there any data on changes in gestational duration at abortion post-Dobbs?

AMANDA STEVENSON: There are no nationally representative survey data on gestational duration at all. So, we have to rely on the CDC data, which are fundamentally incomplete, to describe the distribution of abortions by gestational duration. And the most recent CDC abortion surveillance report is for 2021. So, the answer is no. What we can say, however, is that based on the #WeCount data from the Society of Family Planning survey, the fraction of abortions that are provided under shield laws and via telemedicine, which are all going to be medication abortions and therefore will be below the gestational duration thresholds applied by the providers. So, there's some inference that can be made on the basis of those data, but that's as close as you can get.

What has been the impact on the local medical industry, physicians, and patients in states that are surrounded by other states where abortion is banned?

SARAH PRAGER: My colleagues who are in no or low access states are really suffering because they are unable to provide evidence-based care to their patients and they are sometimes needing to refer their patients outside of state in order for them to get care. However, my colleagues like in Colorado or Nevada are also suffering to a certain extent because they are seeing increased volumes, some states more than others. And we are starting to hear that it is potentially creating some insurance problems as well because the states where abortion is accessible are taking on a significant increased cost of caring for people. Some states like California and Oregon and Washington have actually — their governors have set aside funds to help care for patients coming in from out of state. Other states may be doing this as well. I'm just aware of those three states. So, it is actually creating significant cost to local governments because we are now caring for patients coming in from out of state.

What types of news articles about abortion should be written more?

“Most abortions happen very, very early. They are not traumatic for patients unless they cannot get them.”

SARAH PRAGER: That is an interesting question. I partly want to answer it by saying we shouldn't need to talk about abortion anymore than we talk about an appendectomy. It is a routine health care procedure that improves health for the person and shouldn't be any more interesting than that to be honest with you. That is my feeling. I would also say I think a lot of the focus is on later duration pregnancies, even though that is the significant

minority of abortions that happen. And then even within that, there is more focus on very complicated pregnancies, which I think sound more interesting potentially, but also are not representative of the vast majority of abortions. Most abortions happen very, very early. They are not traumatic for patients unless they cannot get them, and they are extremely safe. And I feel that is not emphasized enough.

AMANDA STEVENSON: I really agree that we shouldn't have to talk about abortion so much. It is because it is so politicized that it's even so widely discussed already. The kinds of stories that I think are not being told as much that would be productive would be the description of the aims of those who would restrict abortion further because those aims are very public and they're pretty surprising I think to a lot of news consumers. So, because I also study that social movement, it does seem like it would be a useful thing to describe.

Are there safety differences between a medication abortion and a procedural abortion before 12 weeks?

SARAH PRAGER: There are some differences in the risks. We find slightly more pain, patient-reported pain, a little bit more nausea and vomiting, minor increases in minor medical concerns. And there was a fabulous study from almost 20 years ago now in 2005 that showed that patients who were able to choose between a medication abortion and a procedural abortion did report differences and side-effects. However, when they were asked about their satisfaction with the procedure, there was no difference. And so, if we can give patients the procedure that they want or the method that they want, they are much more satisfied with their care. So, the minor differences, though statistically significant for not concerning issues, isn't enough for most people that it's worth us saying you should choose one method over another. For an individual, there might be specific circumstances where a medication abortion or a procedural abortion might be preferred, but those would be relatively few.

Which states don't report abortion data to the CDC?

AMANDA STEVENSON: It changes over time, and that's part of why it's so bad. The data are so difficult to use—not bad, just difficult to use. The biggest state that doesn't report is California, and Maryland doesn't report. Some states report intermittently or report some things, but not others. And a key piece of the puzzle is that not all states themselves mandate reporting from providers. And so, the states with the most punitive laws requiring providers to report abortions to the state are the states that have now banned abortion. So, as states ban abortion that had the highest quality data in the CDC data, we're going to see a degradation in the quality of the data that the CDC has, even though it was already known to be incomplete. So, there's a list every year in the abortion surveillance reports.

Are there data on what motivates people to seek out an abortion?

AMANDA STEVENSON: Some states mandate that people receiving abortion care report on a state form their reason for having an abortion. So, yes, we have some data on this, but those state mandated reports are often categories of reasons that are somewhat coercive in nature. They're not based on good survey design. So, they're difficult to interpret. There is some older data that is nationally representative on reasons for people seeking abortions. And then, there are some smaller surveys. In general, people who are seeking abortion report more than one reason for needing an abortion, and some of the most common reasons are that they need to focus on the kids they already have—that's one of the most common—or that they don't have enough money to provide a stable household, that kind of answer. Those are the two very common ones. Or that they need to focus on their education among young people.

In a given state, does restricted access to abortion affect medical-residency program enrollment, and if so, what are the impacts for women's health care access in that state?

SARAH PRAGER: Great question. And these are data also that are a bit challenging to obtain because it means interviewing or surveying medical students who are applying to residency programs. And one of the big limitations for this will be that there is a limited total number of OB/GYN residency spots, and 54% I believe are in states where abortion is still accessible where they can train on that. So, if people were to be making decisions just on, "If I'm going to be an OB/GYN, I only want to go to a program in a state where I can learn how to do abortions," then half of all

medical students wanting to be OB/GYNs would be out of luck. Almost half. So, we don't see that to that extent. But when medical students are asked their preferences, they are ranking programs in states where they could learn to do abortions much more highly than they are ranking states where they will not be able to access that training in an easy fashion or at all.

Should the term “surgical abortion” be avoided?

SARAH PRAGER: Great question. Our medical community is moving towards the phrase procedural abortion as you heard me use as opposed to surgical abortion largely because the vast majority of these are done in an outpatient setting and surgery for most people connotes being in an operating room and having something that is much more complicated or dangerous than an abortion is. So, we do use that term procedural abortion, and that applies to whatever setting those abortions procedural are happening in. We also use the term now medication abortion, not medical abortion, because all of this is medical, but I think more clearly designates that we are using medication versus some other type of medical intervention.

In places with restrictive abortion laws, are rates of uptake of contraception changing?

AMANDA STEVENSON: There's a strong association between restricting abortion and restricting contraception. So, this is difficult to answer because the places where abortion has been most severely restricted, there are pre-existing and also newly implemented restrictions on the provision of contraception. So, it would be difficult to answer even if we had perfect data, but we don't have perfect data. So, we don't know at the national level. We have some smaller clinical studies—so, that's a single clinic or a clinic system—which find that, yes, there has been increased uptake of long-acting reversible as well as permanent contraception in the wake of Dobbs. Whether that is stronger in places with bans is unknown and honestly probably unlikely because there's so many challenges accessing those most effective methods in those places that restrict abortion.

SARAH PRAGER: In my clinic personally in the first three to six months post Dobbs, we saw a tenfold increase in the number of patients coming in wanting permanent contraception, and that's in a state where abortion is highly accessible as are other long acting non-permanent methods of contraception. People were really scared that things would change also in Washington state or if they move out of state for work or school that they would lose this access. And generally speaking, we found that people are really terrified of being forced to have unwanted pregnancies, and that is resulting in patients at much earlier ages choosing to have permanent contraception so they never have an option of being faced with an unwanted pregnancy that they cannot abort. And as Amanda said, we can't really compare states where abortion and contraception are accessible to states abortion and contraception are less accessible. So, unfortunately, the patients living in those lower access states are also less able to prevent pregnancy if they would choose to. And frankly, we also just to go to the other side of that are seeing much more what we call obstetric deserts in states where abortion is inaccessible. So, people cannot prevent pregnancies. People who get pregnant cannot access abortion. And when forced to carry pregnancies to term, they cannot access safe obstetric care. So, it is terrible for a lot of people living in a lot of areas of the United States right now.

What is one key take-home message for reporters covering this topic?

SARAH PRAGER: I've already emphasized the safety of abortion, and I want to leave everybody again with that. And also, and this is my opinion, the fact that denying people health care is denying a basic human right and we are doing this to a very specific part of our population, namely women and other people who are pregnancy capable, and that is against any human right that I've ever heard of and frankly should be against our Constitution. It is in certain places. But because rights for women have never been codified in our Constitution, we're continuing to have to fight for this.

AMANDA STEVENSON: I would just say don't use the CDC data unless you have really, really good advice from somebody who really knows what they're talking about. And actually, be really circumspect about your state public health data, too.

Abortion pill mifepristone: An explainer and research roundup about its history, safety and future

by [Naseem S. Miller](#) | June 13, 2024

This piece was originally published in November 2023 and updated on June 13, 2024, to reflect a recent Supreme Court decision about access to mifepristone, and to highlight new research on medication abortion.

On June 13, the Supreme Court justices in a [unanimous decision](#) preserved access to mifepristone, a medication that's used for the safe termination of early pregnancy, writing that "federal courts are the wrong forum for addressing the plaintiffs' concerns about FDA's actions."

The legal future of mifepristone had hung in the balance for several months.

In August 2023, the [5th U.S. Circuit Court of Appeals ruled](#) that mifepristone should not be prescribed past the seventh week of pregnancy, prescribed via telemedicine, or shipped to patients through the mail. In September, the Justice Department asked the Supreme Court [to consider a challenge to that ruling](#).

On Dec. 13, 2023, the Supreme Court justices announced that they would take up the case on the availability of mifepristone. The American College of Obstetricians and Gynecologists [issued a statement](#) on the same day urging the court to rule in favor of keeping the pill on the market and available to patients. The justices heard oral arguments on March 26, 2024 before issuing the June 13 ruling.

Meanwhile, abortion is [on the ballot](#) in four states this year so far. Measures have also been proposed in several other states, with initiatives that aim to ban, restrict, or expand abortion rights. (State laws that ban abortion apply to both abortion medications and surgical procedures.)

It's important for journalists covering abortion to have a good understanding of medication abortion so that they can better inform their audiences. Below, we explain what medication abortion is, how individuals access it, and what research shows about its safety and effectiveness.

Medication abortion

[Medication abortion](#) is also known as abortion with pills or medical abortion. The Food and Drug Administration [has approved](#) medication abortion for up to 10 weeks of pregnancy and the World Health Organization [authorizes its use](#) for up to 12 weeks. It is endorsed by several organizations, including the [American College of Obstetricians & Gynecologists](#) and the [American Medical Association](#). Medication abortion can also be used beyond 12 weeks of pregnancy, according to several organizations including the [World Health Organization](#) and the [International Federation of Gynecology and Obstetrics](#).

Medication abortions accounted for 51% of all abortions in the U.S. in 2020, according to a 2022 [CDC report](#). Use of medication abortion has been on the rise in recent years, increasing by 154% from 2011 to 2020, and by 22% from 2019 to 2020.

In many parts of the world, including the U.S., a two-medication protocol is used for medication abortion: mifepristone followed by misoprostol. Mifepristone blocks the hormone that is required for the continuation of pregnancy, and misoprostol causes the uterus to cramp and expel the pregnancy tissue.

The current approved regimen for medication abortion is 200 mg of mifepristone, followed by 800 mcg of misoprostol within 24 to 48 hours. Individuals are advised to follow up with a health care provider seven to 14

days after taking mifepristone, [according to the FDA](#).

Studies have shown that both drugs are [safe and effective](#). In consultation with medical experts, The New York Times has curated and reviewed a [collection of 101 studies](#) on medication abortion, all of which conclude that the pills are safe.

History of mifepristone

[Mifepristone](#), or RU-486, is a drug that blocks progesterone, a hormone that's needed for a pregnancy to continue.

Developed by the now-defunct French pharmaceutical firm Roussel-Uclaf, the pill was first approved in France and China in 1988. As of May this year, 96 countries have approved it for medication abortion, according to the [Guttmacher Institute](#), a sexual and reproductive health research and policy organization that supports abortion rights.

The FDA [approved mifepristone](#) for medical termination of pregnancy in September 2000. Some 5.9 million women in the U.S. used mifepristone between September 2000 and December 2022, 32 of whom died, [according to the FDA](#), which notes in its report that “the fatal cases are included regardless of causal attribution to mifepristone.” Causes of death included infection, homicide, ruptured ectopic pregnancy, drug overdose, and suicide.

Danco Laboratories manufactures Mifeprex, the brand name for mifepristone. In 2019, the FDA approved a generic version of the drug, which is manufactured by GenBioPro. The drug is also manufactured by other companies around the globe.

When the FDA first approved the pill in 2000, the recommended dosage of mifepristone was higher, 600 mg, compared with the current 200 mg. Studies over time showed the lower dose is effective.

Initially, the FDA also required three doctor office visits, on days one, three, and 14 after taking the pill. Prescribers had to be licensed physicians and the drug had to be dispensed in person at a medical facility. The pill was approved to be prescribed within 49 days of gestation, or seven weeks.

By 2016, after evaluating safety data, the FDA modified prescribing requirements, extending the prescription period to up to 70 days of pregnancy, or 10 weeks. It reduced the number of required office visits to one, between seven and 14 days of taking the pill, and the prescriber no longer had to be a physician. Still, mifepristone was not available at brick-and-mortar pharmacies for patients who had a prescription, nor was it available via telemedicine.

But the onset of the COVID-19 pandemic in 2020, which closed many practices and limited in-office doctor visits, changed that.

Mifepristone prescription after COVID-19 and overturn of Roe v. Wade

In [December 2021](#), the FDA reviewed mifepristone's [long-standing safety data](#) and decided to remove the in-person dispensing requirements, expanding access to telehealth visits in states where [abortion isn't banned](#). The pill can also be mailed to patients since providers no longer have to dispense the pills in person.

It also allowed brick-and-mortar pharmacies that obtain certification from manufacturers to dispense the drug to people in person or through mail with a prescription.

So far, [18 independent brick-and-mortar pharmacies](#) are dispensing mifepristone, and larger drugstore chains may soon join their ranks.

It's important to note that since approving mifepristone, the FDA has required prescribers to be certified—which means they have to register with the drugmaker. Pharmacies too need to be certified. Advocates say this requirement further limits who can distribute the drug.

In June 2022, the U.S. Supreme Court overturned *Roe v. Wade*, striking down the constitutional right to abortion and allowing individual states to decide on access to abortion. Since the decision, [14 states have banned abortion](#) altogether. Those bans apply to both surgical and medication abortions.

Misoprostol and misoprostol-only abortions

The second pill used in the two-pill regimen for medication abortion is [misoprostol](#). The pill is approved by the FDA to prevent stomach ulcers in people at high risk of developing them. It was first approved in 1988.

Even though the FDA hasn't approved it for medication abortion, misoprostol is used off-label as part of the approved two-pill regimen for medication abortion.

[Off-label use means](#) health care providers prescribe a drug for diseases or conditions for which it's not approved by regulatory bodies such as the FDA. They do so when they deem its use is medically appropriate for the patient.

It is also used worldwide for medication abortion, medical management of miscarriage, induction of labor, and treatment of postpartum bleeding. The drug causes the uterus to cramp and expel pregnancy tissue.

The pill can be used alone for medication abortion.

The World Health Organization [has endorsed](#) the use of misoprostol-only for ending a pregnancy in parts of the world where mifepristone is not available. Studies have shown the regimen is [safe and effective](#), although it may have more side effects compared with the two-medication regimen.

A study [published in JAMA Network Open](#) in October 2023 finds that misoprostol alone is highly effective in self-managed medication abortions.

Abortion with misoprostol alone is rare in the U.S. but a legal ban on mifepristone could have made it the only option for some individuals, she says.

"What our study adds is that under the worst-case scenario in which mifepristone is removed, it doesn't mean that there's a ban on medication abortion," says [Ruvani Jayaweera](#), an epidemiologist and research scientist at Ibis Reproductive Health, a nonprofit organization that conducts social science research primarily on access to abortion and contraception around the world. "Our hope is that this study provides assurance to providers and people who are using misoprostol alone, whether it's in a clinic-based setting or a telehealth setting or a self-managed setting, about the effectiveness of this method."

Accessing abortion pills

Abortion pills are prescription medications in the U.S. Individuals in states where abortion is still legal can obtain them from licensed providers in person or via telehealth.

Abortion is currently [banned in 14 states](#). Eleven states have laws limiting abortion between six and 22 weeks. Twelve of the 36 states where abortion is available have restrictions on prescribing medication abortion via telehealth, according to the [Kaiser Family Foundation](#).

In response, activists have created networks of support to help individuals access abortion pills, explains [Carrie N. Baker](#), a contributing editor to [Ms. Magazine](#) and professor at Smith College who studies and teaches courses on gender, law and public policy.

"The mainstream press is not adequately paying attention to what's happening in the United States with regard to the underground network of abortion pill access," says Baker, who has a forthcoming book on the history and politics of abortion pills in the United States.

These networks have also existed to help individuals around the world.

Europe-based [Aid Access](#) mails the medication abortion regimen—mifepristone and misoprostol—to all 50 states, regardless of abortion restrictions. There are [other U.S.-based services](#), including [Plan C](#), which provides people with available options to get abortion pills based on the state they live in.

In a November 2022 research letter [published in JAMA](#), Aid Access reported that after the U.S. Supreme Court overturned *Roe v. Wade*, the average daily requests for telemedicine services for medication abortion increased from 82.6 to 231.7.

In the U.S., prescribing abortion medications via telehealth is nuanced based on state abortion laws.

For instance, U.S.-based virtual reproductive and sexual health clinic [Hey Jane](#) and online pharmacies like [Honeybee](#) can provide care and ship the pills to people in states where abortion is not banned. In all states, people may obtain medication abortion from alternative telemedicine services, online websites, or community networks, though the legal risk of each of these options may differ depending on the state. Services like [ReproLegal Helpline](#) help guide individuals on laws in their state, Jayaweera says.

Also, physicians in states that have passed [shield laws](#) can also prescribe medications via telemedicine to people in states where abortion is banned. So far, several states including Washington, Colorado, Massachusetts, Vermont, New York and California have passed telemedicine shield laws for health providers.

Abortion shield laws “seek to protect abortion providers, helpers, and seekers in states where abortion remains legal from legal attacks taken by antiabortion state actors,” according to a [review article](#) published in *The New England Journal of Medicine* in March 2023. Seven states so far have enacted a shield law since the overturn of *Roe v. Wade*.

But it's important to know and note that those laws don't protect individuals, Jayaweera says.

“One of the things to be especially sensitive to is with telemedicine or online models is that even if the risk is very much minimized for the provider, the legal risk falls on the individual in restricted states,” she says, underscoring the importance of educating individuals about those risks during counseling.

Self-managed abortion

Self-managed abortion is when individuals use medication abortion without medical supervision, ordering pills via telehealth, online pharmacies, mail or in-person.

Worldwide, most medication abortions are self-managed, Jayaweera says.

As a reminder, although the drugs are shown to be [safe and effective](#), the individuals who use self-managed abortion may face legal risks, explain Drs. Daniel Grossman and Nisha Verma in a [viewpoint published in JAMA](#) in November 2022.

“Resources like the [If/When/How legal helpline](#) may be useful for patients and clinicians who are trying to understand their legal risks related to self-managed abortion. Patients requesting emotional support could be connected with resources that provide free confidential talk lines,” the authors write.

Worldwide, 22 countries ban abortion altogether, according to the [Center for Reproductive Health](#), a global advocacy organization, and many others restrict it. This has given rise to safe abortion hotlines and “accompaniment groups” of people who have training in abortion counseling for individuals who are using medication abortion.

They also “provide a lot of empathetic counseling throughout the process and provide people with additional assurance and support and to help them understand if what they are experiencing is normal, or if they need to seek care,” says Jayaweera.

She was part of a [research team that found](#) the outcomes of self-managed abortions were comparable to the

ones performed under clinical supervision. The study, among others, contributed to the World Health Organization revising its guidelines last year to add [self-managed abortion in early pregnancy](#) to its abortion guidelines.

National organizations including the American Medical Association and the American College of Obstetricians and Gynecologists oppose the criminalization of self-managed abortion because it deters patients from seeking care when complications occur, write Dr. Lisa H. Harris and Daniel Grossman in a [review article published in the New England Journal of Medicine](#) in March 2020.

“The biggest danger to patients may be legal prosecution.”

“Given the safety of the combination of mifepristone and misoprostol for self-managed abortion, the biggest danger to patients may be legal prosecution,” the study authors add. “Doctors and health care institutions must develop strategies that favor effective, compassionate clinical care over legal investigation of patients.”

A note on abortion ‘reversal’ pills

On Oct. 30, a judge in Kansas [blocked a state law](#) that requires health care providers to tell patients that medication abortion can be reversed, despite a lack of scientific evidence. A few days earlier, in Colorado, a [federal judge ruled that](#) a Catholic medical center can’t be stopped from offering medication abortion “reversal” treatment.

So-called abortion medication “reversal” treatment involves taking a dose of the hormone progesterone in an attempt to stop the effects of mifepristone, but it’s important for journalists to inform their audiences that “reversal” of medication abortion [is not supported by science](#). (The Associated Press recommends using quotation marks in order to stress the lack of scientific evidence.) The American College of Obstetricians and Gynecologists has publicly stated that it does not support the treatment.

“Despite this, in states across the country, politicians are advancing legislation to require physicians to recite a script that a medication abortion can be ‘reversed’ with doses of progesterone, to cause confusion and perpetuate stigma, and to steer women to this unproven medical approach,” reads a statement on [ACOG’s website](#). “Unfounded legislative mandates like this one represent dangerous political interference and compromise patient care and safety.”

Between 2012 and 2021, 14 states had enacted abortion “reversal” laws, [according to a February article in the American Journal of Public Health](#).

“States largely use explicit language to describe reversal, require patients receive information during preabortion counseling, require physicians or physicians’ agents to inform patients, instruct patients to contact a health care provider or visit abortion pill reversal resources for more information, and require reversal information be posted on state-managed Web sites,” the authors write. “Reversal laws continue a dangerous precedent of using unsound science to justify laws regulating abortion access, intrude upon the patient•provider relationship, and may negatively affect the emotional and physical health of patients seeking [a medication abortion].”

[A 2020 randomized controlled study](#) of medication abortion reversal, involving 40 patients, ended early because of safety concerns for 12 participants. Some of the women in the study received 400 mg of progesterone after taking mifepristone to “reverse” the abortion. Others were given a placebo after taking mifepristone. Three patients – one had taken progesterone and two had received placebo – had severe hemorrhage and required ambulance transport to the hospital, the authors write.

“We could not estimate the efficacy of progesterone for mifepristone antagonization due to safety concerns when mifepristone is administered without subsequent prostaglandin analogue treatment. Patients in early pregnancy who use only mifepristone may be at high risk of significant hemorrhage,” [they write in the study](#).

A [March 2023 systematic review](#) of four studies finds, “based mostly on poor-quality data, it appears the ongoing pregnancy rate in individuals treated with progesterone after mifepristone is not significantly higher compared to that of individuals receiving mifepristone alone.”

A [2015 systematic review](#) of 11 studies on medication abortion reversal during the first trimester of pregnancy finds “evidence is insufficient to determine whether treatment with progesterone after mifepristone results in a higher proportion of continuing pregnancies compared to expectant management.”

How scientists estimate the role of climate change in specific weather events

by [SciLine and Climate Communication](#) | April 1, 2022

Extreme weather events such as life-threatening heat waves and record-breaking downpours are part of the natural climate system, but some kinds of extreme weather events have become more common in recent decades. Scientific advances are allowing researchers to determine the extent to which climate change contributed to some extreme weather events. This is the science of extreme event attribution.

- The most prevalent event-attribution technique involves calculating the “fraction of attributable risk” (FAR) for a specific weather event. This statistical approach has been long used by epidemiologists for public health studies (for example, “What is the risk of cancer that is attributable to cigarette smoking?”). In combination with well-established climate models, FAR allows scientists to assess the probability of an event happening in two different scenarios: a world without our history of greenhouse gas emissions related to human activities, and our world as it is now.
- Many of these studies have been compiled by the American Meteorological Society (AMS) in a series of reports called “Explaining Extreme Events of [year] from a Climate Perspective”.
- To minimize bias, studies are selected for inclusion in these reports solely based on the rigor of their designs. AMS publishes the results of all studies it has determined to be acceptably rigorous—whether they show a connection to climate change or not.

What factors complicate the study of climate attribution?

- Weather is inherently variable, so it takes an enormous amount of data over long periods of time to say with certainty that a specific extreme event was not simply a normal part of this variability.
- Human activities complicate the process of attributing extreme events to climate change.
 - ▶ For example, the frequency and severity of wildfires are affected not just by climate-change-related factors such as earlier spring and drought, but also by land management practices that affect the amount of available fuel.
 - ▶ Similarly, extensive surface paving in cities and suburbs has increased runoff and added to climate-related flooding.
- More data and improved computer models will increase the certainty with which scientists can determine the connections between extreme weather events and climate change. Still, some kinds of weather events are easier to model than others, and different studies will offer different degrees of certainty.

Is it fair to say climate change has “caused” any specific extreme weather events?

- Many factors contribute to every weather event; there is no “single cause” for any weather event.
- Scientists can, however, use climate attribution methods to determine the probability that a past weather event would have occurred if not for climate change. For example, scientists estimate that the record-breaking high temperature recorded in western Europe in May of 2020 was made 40 times more likely by human-caused climate change.
- In some instances, climate attribution methods have indicated that the odds of some past extreme events occurring would have been essentially zero if not for the “last straw” of climate change.
 - ▶ Climate change can arguably be said to have caused these extreme events—that is, made otherwise nominal events extreme—in that it enabled them to achieve an intensity that was otherwise effectively implausible.

Hurricanes and climate change

by [SciLine and Climate Communication](#) | October 26, 2023

Evidence continues to mount that human-induced climate change is causing hurricanes to grow stronger and more destructive. Hurricanes are producing heavier rain, their storm surges are riding atop higher sea levels, and in many cases they are lingering longer over land, causing increased flooding and infrastructure destruction.

Facts for Any Story

- Tropical cyclones, which include hurricanes, have been by far the costliest and deadliest kind of weather or climate disaster in the United States since 1980, costing over \$1.3 trillion and causing nearly 7,000 deaths. As of the summer of 2023, the five costliest U.S. Earth-system disasters (including earthquakes, volcanic eruptions, fires, and all kinds of extreme weather, adjusted for inflation) since 1980 have all been hurricanes, and all five have occurred within the past 20 years: Katrina (2005), Harvey (2017), Ian (2022), Maria (2017), and Sandy (2012).
- Globally, recent decades have seen a disproportionate increase in especially strong hurricanes, which pose the greatest threat to lives and property. Scientists compared hurricane intensities from 1979 to 1998 and again from 1999 to 2017 and found a statistically significant increase in the fraction of hurricanes in categories 3, 4 and 5 (those with the highest wind speeds) during the second of those two 18-year periods. The observed trends are consistent with those projected by models of hurricane activity in a warming world.
- Hurricanes get their energy from ocean heat; the warmer the water is, the stronger a hurricane can get. More than 90% of the excess heat trapped in the climate system due to human-caused global warming has gone into the oceans, providing the added energy driving recent hurricanes' extreme wind intensities and the increased evaporation that has resulted in associated torrential rainfall.
- Both heavy rain and storm surge—water pushed ashore by heavy winds—contribute to flooding, which causes the vast majority of hurricane-related deaths and financial losses. The amount of rain falling in some recent hurricanes was substantially increased due to human-caused climate change, including in Harvey (by 20 to 38%), Ian (18%),⁸ Katrina, Irma, and Maria.⁹ Modeling suggests this increase in precipitation led to a 14% to 18% larger area flooded in greater Houston during Harvey, and one study estimated that the cost of flooding attributable to human-caused warming alone was \$13 billion. Hurricanes are also producing higher storm surges due to sea level rise.
- Analysis of Hurricane Harvey's damages in Harris County, Texas, estimates that around one-third to one-half of the flooded properties would not have flooded without human-caused climate change, and that low-income Hispanic or Latino households were disproportionately affected.
- Climate-change-related perturbations in atmospheric winds like the jet stream appear to be contributing to a trend in which hurricanes are moving more slowly over the United States (slowing by 17% over the past century), and are increasingly likely to "stall" near the coast, potentially leading to catastrophic local rainfall and flooding.
- There has been a significant increase in how quickly hurricanes intensify in the Atlantic basin in recent decades, an expected symptom of global warming.¹⁶ In fact, hurricanes in the Atlantic affecting the U.S. East Coast are now more than twice as likely to rapidly intensify from a weak storm to a Category 3 or greater storm than they were in the 1970s and '80s. Hurricanes that intensify rapidly are difficult to forecast accurately and prepare for, especially when this occurs close to the coast, and cause a disproportionate amount of human and financial losses.
- On average, the development of the first named hurricane in the Atlantic now occurs about a month-and-a-half earlier than it did 40 years ago, with most of that due to increasing warmth of Atlantic waters.
- Globally, hurricanes are reaching their maximum intensities further from the tropics, shifting toward temperate, heavily populated coastal regions that have not historically experienced them. Northern Hemisphere hurricane peak intensities have shifted northward by 100 miles in the past 30 years.

- Recent projections suggest that the U.S. Southeast and Gulf Coasts will face increased hurricane risk due to the effects of continued global warming on steering currents and wind shear.

Pitfalls to Avoid

Avoid asking whether climate change “caused” a particular hurricane to slow, intensify rapidly, etc., as there are always many contributors to any weather event. Instead, ask whether climate change contributed to the intensity of a hurricane or the likelihood of its especially damaging behavior (such as stalling over a coastline)—questions that scientists can increasingly answer with confidence given recent advances in attribution science.

Heat waves and climate change

by [SciLine and Climate Communication](#) | February 8, 2023

Human-caused global warming has increased the frequency, size, intensity, and duration of extreme heat events. What were once very rare events are becoming common.

Facts for Any Story

- Extreme heat is the deadliest form of extreme weather in the United States, causing more deaths than hurricanes and floods combined; over twice as many deaths as tornadoes; and more than four times as many as from extreme cold.
- Heat waves are occurring three times more often than they did in the 1960s—about six per year compared to two per year. Some recent evidence suggests the increase has been even greater.
- The average number of days between May and September with at least one large heat wave in the northern mid- to high latitudes doubled between the 1980s and the 2010s, from 73 to 152. By the 2010s, all but 10 days during those five months had two or more simultaneous heat waves within those latitudes—a seven-fold increase in such days since the 1980s and noteworthy since simultaneous heat waves severely increase stresses on ecosystems, agriculture, and utilities. During the same period, the geographic expanse of coinciding heat waves grew by 46% and the hottest day of the year with coinciding heat waves became 17% hotter.
- The heat wave that struck the Pacific Northwest in the last week of June 2021 broke heat records in dozens of places. In Quillayute, Washington, the temperature hit 110 degrees F, exceeding the previous record by 11 degrees. According to one analysis, that heat wave would have been virtually impossible in the absence of human-caused global warming.
- Globally, there has been a 90-fold increase in the frequency of monthly heat extremes in 2011-2020 compared to 1951-1980: Extreme heat events that deviate strongly from the norm in a given region (so-called 3-sigma events) now affect about 9% of all land area at any time, on average. In the last decade, record-breaking hot months occurred eight times more often than would be expected without global warming. With continued climate change, the frequency of these intense heat events is likely to increase further, with particular risks for some important food-producing regions.
- Summer nights have warmed at nearly twice the rate of summer days in the United States—a shift that exacerbates health impacts because hot nights reduce the body's ability to recover from hot days. The percentage of the U.S. continental land area experiencing abnormally hot nighttime temperatures increased from 5 percent to 40 percent over the four decades between 1970 and 2010.
- In addition to more extreme heat, humidity is also rising in some regions like the eastern United States. This takes an extra toll on health because humidity interferes with the body's ability to cool itself through the evaporation of sweat. A temperature of 90 degrees F with 80 percent humidity feels like 113 degrees F.
- Those most vulnerable to heat-related illness and death include young children, the elderly, those with chronic illnesses, student athletes who practice outside, outdoor workers, city dwellers, and those without air conditioning (or who lose it during power outages).
- Recent evidence suggests that climate change is altering atmospheric circulation, such as the jet stream, causing persistent weather patterns to get stuck in place, increasing the duration and damaging effects of heat waves.

Pitfalls to Avoid

It's no longer true that "no single extreme weather event can be attributed to human-caused climate change"—a common refrain in past coverage of heat waves and other weather extremes. With more than 200 peer-reviewed studies published to date, attribution science—which can indicate the contribution of human-caused climate change to individual heat waves and other extremes—is increasingly credible and deserving of careful coverage.

Cold snaps and climate change

by [SciLine and Climate Communication](#) | February 23, 2023

Periodic bouts of extreme cold do not invalidate or weaken the overwhelming scientific evidence that human activities are warming the Earth to dangerous levels. Evidence even suggests that human-induced global warming may be a driving force behind some winter cold snaps, and that Arctic warming in particular may be increasing the frequency and persistence of U.S. winter cold snaps.

Facts for Any Story

- There is a clear scientific consensus that human activities — primarily the burning of fossil fuels — are causing the Earth to warm, and that the Arctic has warmed two to four times faster than the rest of the world over the past four decades, a phenomenon known as Arctic amplification.
- This overarching warming trend has been punctuated periodically by episodes of unusually cold winter weather (“cold snaps”) in northern temperate regions, including North America and Eurasia.

Most cold snaps are not setting new records for coldness. In fact, the vast majority of temperature records broken in recent decades have involved record-breaking heat. Nonetheless, some severe cold snaps bring temperatures significantly colder than average for the time of year, and they can have serious impacts on human health, transportation systems, infrastructure, and energy consumption.

- Global warming is leading to later freeze-up of the Great Lakes and higher lake water temperatures. This increases lake-effect snowfall, which occurs when frigid air blows across relatively warm, ice-free water. Global warming is thus paradoxically leading to heavier snowfalls in regions bordering the Great Lakes, such as western New York State.
- Global warming also has increased the amount of water vapor in the atmosphere via additional evaporation, which may be augmenting snowfall in sufficiently cold regions.
- Mounting evidence from observations and computer simulations suggests that Arctic warming is linked to U.S. cold snaps.
 - ▶ Disproportionate Arctic warming has reduced the temperature difference between the Arctic and temperate latitudes, which is thought to favor a “wavier” jet stream — the high-altitude current of wind that circles the Northern Hemisphere and that creates and steers weather systems from west to east. A wavier jet stream tends to swing northward and southward as it moves eastward, allowing pools of cold, polar air to penetrate as far south as Texas and elsewhere in the U.S. South while also sending tropical air far northward, sometimes even creating winter “heat waves.”
 - ▶ In general, when the jet stream has large meanders, its temperature waves also travel east more slowly, which can make these cold plunges (and concomitant northward warm surges into polar regions) more persistent.
 - ▶ In addition, uneven Arctic sea ice melt and related heating in the Arctic have increased disruptions of the polar vortex, a persistent, very-high altitude swirl of cold air in the northern polar stratosphere, causing it to stretch and elongate, like a rubber band, or even split into separate swirls. This can cause the jet stream to meander and exacerbate the southward flow of cold air into temperate regions including the United States, and the flow of warm air into far northern regions.
 - ▶ Strong Arctic warming and the associated loss of sea ice combined with La Nina conditions (cool ocean temperatures in the Tropical Pacific Ocean) were found to be factors in the February 2021 extreme cold snap that caused huge societal disruption in Texas and the southern Great Plains.

- ▶ Computer simulations that complement high-resolution meteorological observations predict that as the Arctic continues to warm, we can expect an increase in the frequency and persistence of cold snaps in northern temperate regions including the United States for some years ahead, albeit with weaker intensity.

Pitfalls to Avoid

- Avoid amplifying the misconception that cold snaps somehow undermine the clear evidence of human-caused global warming—or that any single weather event is representative of what is happening with the climate. In the United States, long-term observations show that high-temperature records are being broken more often than cold records and the same is true globally.
- The severity of a cold snap may not be its most disruptive attribute. Even if temperatures are not record-breaking, a long-duration cold spell may have a greater impact than a short, intense one. And when cold penetrates farther southward than normal, communities unfamiliar and unprepared for abnormal cold can be severely disrupted.
- The jet stream exists all year and resides in the atmosphere (about 5-7 miles high, at altitudes where jets fly). It is responsible for creating and steering most of the weather systems experienced in temperate latitudes, including North America and Eurasia. The polar vortex, by contrast, exists only during winter and resides in the stratosphere (about 30 miles over the North Pole); its relationship to weather is less well defined and understood than the jet stream's. Because the polar vortex typically stays close to the North Pole (and it is the winds associated with the polar vortex that expand southward across the United States), it is best to avoid saying “the polar vortex is coming to X location.”

Wildfires and climate change

by [SciLine and Climate Communication](#) | January 19, 2023

Human-caused climate change is a significant contributor to the increasing size, intensity, and damage of western U.S. wildfires, and to a lengthening of U.S. fire seasons.

Facts for Any Story

- U.S. wildfires are being fueled by southwestern North America's driest 22-year period in at least 1,200 years, based on soil water content. Human-caused climate change was responsible for 42% of that soil dryness.
- In the western United States human-caused climate change caused more than half the increase in forest fuel aridity (how dry and flammable vegetation is) since the 1970s and has approximately doubled the cumulative area burned in forest fires since 1984.
- Climate change-related declines in western spring snowpack, and increased evaporation from higher temperatures in spring, summer, and fall, have in the decades since the early 1980s reduced moisture and contributed to a marked increase in the frequency of large fires and the total area burned by western wildfires. A study of western U.S. ponderosa pine and Douglas fir forests concluded that climate change-related moisture deficits are undermining post-wildfire forest regeneration and recovery there.
- Fires in 2020 alone contributed 44% of the total area burned in the central Rocky Mountains from 1984 to 2020. Since 2000, high-elevation forests in this area have been burning at rates higher than at any point in the past 2,000 years.
- From 1972 to 2018, there was an eight-fold increase in the annual area burned in California's summertime forest fires. Evidence suggests that this dramatic increase was caused primarily by unusually dry air linked to human-caused climate change.
- Earlier spring snowmelt and other factors related to human-caused climate change have contributed to a substantial increase in fire season length in forests throughout the western United States. Western U.S. fire seasons in 2003–2012 averaged more than 84 days longer than in 1973–1982. The average burn time of the largest wildfires also increased during this period, from nearly six days to more than 50 days.
- Many factors contribute to wildfire risk, including some that may be unexpected and far flung. For example, Arctic sea ice loss — due primarily to human-caused warming — and resulting shifts of warm air in the atmosphere may be contributing to wildfire-conducive weather in the western United States.
- Similarly, some of the effects of wildfires can be far flung as well. One computer modeling study found evidence that heat and smoke released from wildfires in the western United States can lead to more intense rainfall and more large hailstones in U.S. central states.
- Nights have warmed significantly — even more than days — during the U.S. fire season.⁹ That added heat has lowered the overnight relative humidity that once gave firefighters some of their best opportunities to gain control over wildfires.
- The frequency and intensity of wildfires in Alaska have been greater in the past few decades than for any period in the past 10,000 years.
- Some populations are disproportionately at risk from wildfires. U.S. census tracts populated primarily by Black, Hispanic, or Native American people have roughly 50% more wildfire risk than do other census tracts.
- More and bigger wildfires means more toxic smoke exposures. Computer models have estimated that, over the past decade, the number of people experiencing at least one day of wildfire smoke levels deemed unhealthy for all age groups increased 27-fold, with nearly 25 million Americans so exposed in 2020 alone. Other

analyses have suggested that wildfire smoke may have a bigger impact on health and lead to more respiratory hospitalizations than smoke with similar particle sizes from other sources.

Pitfalls to Avoid

Many factors contribute to wildfire occurrences, and human activities are by far the leading source of wildfire ignitions even as climate change has contributed significantly to wildfire size and intensity. (From 1992 to 2012 in the United States, humans ignited 84 percent of wildfires.¹⁵) Instead of asking whether climate change “caused” a wildfire, it’s better to ask:

- How is climate change influencing the likelihood of wildfires such as these?
- To what extent was this wildfire larger and/or more intense because of climate change?
- How has climate change made the U.S. more vulnerable to large fires like this one?

Drought and climate change

by [SciLine and Climate Communication](#) | June 6, 2024

Human-caused global warming is increasing drought risk across much of the United States as rising temperatures accelerate evaporation, increase water uptake by heat-parched plants, and reduce the amount of winter snowpack available to refresh regions during dry summer months.

Facts for Any Story

- There have always been droughts—temporary periods when the supply of moisture fails to meet human and environmental demands. But much of the U.S. West is now experiencing something different: a long-term drying, or “aridification,” driven primarily by rising temperatures and changing precipitation patterns that have their roots in human-caused global warming.
- Droughts are increasing in frequency and intensity as climate change leads to more water-cycle extremes in which, for example, large amounts of rain fall all at once, followed by long periods of no rain at all. Other examples of water cycle changes include less snow and more rain in winter, earlier snowmelt and runoff leading to earlier green-up, and more plant water use because of longer, warmer growing seasons.
- Droughts are among the costliest weather and climate-related disasters in the United States, exceeded in costs only by hurricanes and severe storms over the past four decades.
- Since the 1950s, climate change-fueled changes in the water cycle have caused droughts to develop faster, increasing the frequency of “flash droughts”—those that appear suddenly, with little warning. As increased heat drives evaporation, flash droughts rapidly reduce soil moisture, with potentially severe impacts on agriculture and ecosystems.
- As temperatures go up, drought risk goes up, even in areas where rainfall has remained close to normal, because of increased evaporation and water uptake by plants. From 2000 to 2010, for example, high temperatures in the upper Missouri River Basin—the United States’ largest river basin—significantly contributed to a decade-long drought that by some measures (e.g., river-flow decline) was more severe than the Dust Bowl and could not be accounted for by the modest decreases in precipitation alone.
- Warming has caused snowpack declines in many U.S. areas over recent decades, increasing drought risk, as the western United States relies heavily on snowmelt for water supply. Springtime heat waves, like those that drove record snow melt in the U.S. West in 2021, can hasten melting and intensify resulting droughts. Dry air during heat waves can also increase sublimation, reducing runoff even in years with normal snowpack levels.
- Wildfires have increased in size and intensity in the western United States and the fire season has grown longer (see Quick Facts on Wildfires and Climate Change). Drought plays a role as it combines with hot, dry, and windy fire weather to increase wildfire risk—conditions that are increasing across the U.S. West. Human-caused global warming is likely to be the primary driver of these changes. Wildfire increases, in turn, speed snowpack melt, and intensify drought in some areas.
- Human-caused global warming was responsible for over 40% of the severity of the dry spell that parched the U.S. Southwest from 2000 to 2021, changing what would have been a moderately arid stretch into the driest 22-year period since at least the year 800.
- Droughts reduce availability of water for hydropower generation and heat waves increase demand for electricity, causing greater dependence on fossil fuel-burning power plants and increasing air pollution. One simulation based on California data suggests that human health impacts would be highest in hot, dry years, with people of color disproportionately affected.
- Drought doesn’t just weaken and kill plants; it prevents new ones from growing. A decades-long period of

hot and dry weather that affected many parts of the Rocky Mountains from the 1980s through about 2010 resulted in significant decreases in tree regeneration and forest resilience.

Pitfalls to Avoid

Don't assume that drought is just about the amount of precipitation. Though it may seem counterintuitive, even places that see increases in precipitation can face a heightened drought risk because the temperature-related increase in evaporation and water demand by plants can outpace the increase in precipitation.

Torrential rain, flooding, and climate change

by [SciLine and Climate Communication](#) | April 12, 2024

A growing percentage of U.S. precipitation now comes in the form of extreme events, with human-caused climate change directly responsible for much of this increase. Heavy rain contributes to flooding that is damaging buildings and roads, eroding soil, flushing pollutants into waterways in many parts of the United States, and straining the nation's aging dam network.

Facts for Any Story

- Extreme precipitation events are increasing in frequency, duration, and extent as the globe warms.
- Rising air temperatures, caused primarily by the build-up of heat-trapping gases due to fossil fuel burning and land use change, are increasing evaporation from soil, plants, lakes, and oceans. Warm air holds more moisture than cooler air, creating a greater atmospheric reservoir of water vapor for release during rain and snow storms. For every 1°C (1.8°F) increase in atmospheric temperature, the air holds 6% to 7% more water vapor, causing downpour intensity to increase.
- Heavy rains are getting heavier. Looking at the top 1% of rainfall events, as measured by the amount of rain that fell within a 24-hour period, the amount of precipitation falling in these heavy events has increased substantially across the United States since the 1950s—by 60% in the Northeast, 45% in the Midwest, 37% in the Southeast, 24% in the Northern Great Plains, 21% in the Southern Great Plains, 17% in the Southwest, and 1% in the Northwest.
- Heavy rains are also getting more frequent in many parts of the United States, especially in the Northeast, and covering greater areas of land. The prevalence of record-breaking rainfall events and the amount of land they drenched was constant for most of the 20th century, but has doubled since the 1970s.
- Heavy rains now often last longer, too. There is growing evidence that climate change-related atmospheric conditions, including a wavier jet stream, are causing storms to get “stuck” in place. When they linger longer over a given region, it drives an increase in extreme rainfall that can lead to flooding.
- Climate change-related increases in heavy rain intensity and frequency, and the lingering persistence of these weather events over affected areas, have exacerbated flooding across the United States, especially in the Midwest, increasing the number of cities and expanses of land now at high risk. In coastal areas, rainfall-related flooding is exacerbating the documented doubling in the frequency of high-tide-flooding caused by sea level rise over the past 30 years.
- From 1988 to 2017, the increase in precipitation due in part to human-caused climate change was responsible for about one-third of the cumulative cost of U.S. flood damage, with an impact totaling an estimated \$73 billion.
- Atmospheric rivers (ribbons of atmosphere with high water vapor concentrations) are the primary drivers of flood damage in the U.S. West, with damage increasing about 10-fold with each one-step increase in the AR scale (a measure of atmospheric river intensity and duration) from 1978 to 2017. The Oroville Dam crisis of 2017 in northern California, which forced the evacuation of more than 180,000 people, is one example of damage caused by atmospheric river precipitation intensified by human-caused warming, according to simulations.

Pitfalls to Avoid

- Flooding is the result of many factors, including the amount of precipitation falling during a particular time interval and the kinds of surfaces (e.g., impervious roads and parking lots) on which it falls. Overstating the extent to which any single flood is attributable solely to climate change or heavy rain can unduly narrow the range of mitigation or resilience strategies considered, such as urban rain gardens.

- Climate change is affecting flood trends differently in different regions, with a tendency for increases in wetter areas and decreases in drier ones. Avoid averaging such changes across regions, as increases and decreases can cancel each other out, falsely implying little or no change.
- Be careful when using the term “100-year” storms or related short-cut constructions of probability. Define them carefully when you use them, or come up with your own explanatory language—for example: “By historical standards, storms of this intensity have only a 1% chance of happening in any given year, yet three have occurred in the past 12 months.”

Sea level change and climate change

by [SciLine and Climate Communication](#) | September 9, 2021

Earth's seas are rising at an accelerating rate, a direct result of human-caused climate change. Ocean temperatures are going up, causing ocean water to expand. And as land-based glaciers and ice sheets melt, they add water to the oceans. Differences in coastline geography, ocean currents, land subsidence, and other factors are causing some areas—including the U.S. East and Gulf Coasts—to experience greater sea level rise than others.

Facts for Any Story

- **Observations** | The average global sea level has risen by about 20 centimeters (7-8 inches) since 1900, with about half of that occurring since 1993. Human-caused climate change has made a substantial contribution to this rise, resulting in a rate of rise greater than during any preceding century in at least 2,800 years.
- **Causes** | Global sea level rise is primarily a result of two factors: first, an influx of new water to the ocean due to the melting of land-based ice from mountain glaciers and the Antarctic and Greenland ice sheets in response to the warming atmosphere and ocean; second, an increase in existing ocean water volume due to thermal expansion—water in the ocean expands as oceans absorb the heat trapped in Earth's atmosphere.

In the 1970s and '80s, thermal expansion caused the largest share of sea level rise, but since the 1990s, melting land ice has caused about half the rise. The fraction of sea level rise caused by melting land ice is anticipated to increase over this century.

- **Rates** | The rate of global sea level rise is increasing due to the accelerated melting of ice sheets and mountain glaciers: It has more than doubled from approximately 1.5 mm per year throughout most of the 20th century to 3.3 mm per year from 1993 to 2020.
 - ▶ Mountain glaciers contributed around 0.70 mm per year to global sea level rise from 1900 to 2018. The Greenland and Antarctic Ice Sheets' contribution to global sea level rise from 1900 to 2020 was 0.44 and 0.08 mm per year, respectively. But their mass loss has increased substantially in recent decades. From 2002 to 2020, the Greenland Ice Sheet has contributed about 0.78 mm per year and Antarctica has contributed 0.41 mm per year.
- **Locality** | Sea level rise is not equal around the globe. It varies along coastlines due to changes in Earth's gravitational field resulting from melting of land ice, changes in ocean circulation, the vertical rising or sinking of continents (geologic "uplift" or "subsidence"), and other factors.
 - ▶ The U.S. Northeast has been experiencing a faster-than-global increase in sea level since the 1970s. Research suggests that warming surface waters and an influx of fresh water from the melting Greenland Ice Sheet—consequences of global warming—are reducing the density of surface waters near Greenland, lessening their ability to sink and drive the overturning circulation. This reduces the northward tug of Atlantic waters, allowing water to build up along the U.S. East Coast.
 - ▶ The western Gulf of Mexico and parts of the U.S. East Coast are currently experiencing additional relative sea level rise caused by the withdrawal of groundwater and fossil fuels, which causes the land to sink. The amount varies widely by location—negligible in some areas but quite significant in others, such as Galveston, TX, which has experienced a relative sea level rise of 3.5 mm per year since 1983 and is projected to experience a further two-meter (6.5 feet) rise by 2100 as a combined result of rising seas and land subsidence. Continuation of extractive practices will further amplify relative sea level rise in these locations.
- **Flooding** | As sea levels have risen, the annual number of high tide floods (sometimes referred to as "sunny day floods") has increased 5- to 10-fold since the 1960s in some U.S. coastal cities including Charleston, SC; Honolulu; Philadelphia; and San Diego. Projections indicate that tidal flooding will continue to increase in depth, frequency, and extent throughout this century due to climate change.

- Impacts | Nearly 40% of the U.S. population lives in densely populated coastal areas, where sea-level-rise-related increases in flooding, shoreline erosion, and storm surge threaten infrastructure critical to local jobs and regional industries, such as water and sewer systems, roads, and power plants. Disadvantaged communities, indigenous peoples, and coastal ecosystems are especially vulnerable to sea level rise impacts.
- Future | As global temperatures continue to increase, sea level will continue to rise. The rates of future heat-trapping greenhouse gas emissions and hence global warming will determine how much and how fast it will rise.³ Limiting global warming to 1.5 degrees C (2.7 degrees F) above pre-industrial levels would roughly halve sea level rise by 2100 compared to that resulting from 3 degrees C warming.
 - ▶ Global average sea level is very likely to rise by 9 cm to 18 cm (3.6 inches to 7.2 inches) by 2030, compared to global mean sea level in 2000; by 15 cm to 38 cm (6 inches to 1.2 feet) by 2050; and by 30 cm to 1.3 meters (1 foot to 4 feet) total by 2100. Emerging science regarding Antarctic ice sheet instability suggests that, for higher greenhouse gas emission scenarios, a rise exceeding 6 feet by 2100 is physically possible, although the likelihood of that outcome remains uncertain.
 - ▶ Research suggests that because of rising sea level, the odds of extreme coastal flooding will double approximately every 5 years for most U.S. coastal locations. That means that by 2050, today's 'once- or twice-in-a-lifetime' coastal floods will occur every year for 70% of the U.S. coast, and will occur daily for 90% of the U.S. coast by 2100.¹⁷
 - ▶ Many U.S. cities, such as Miami, will experience greater sea level rise than the global average. In the short term, South Florida is projected to experience a rise of 25.3 cm to 53.3 cm (10 inches to 1.75 feet) above the local mean sea level from the year 2000 by 2040, and a rise of 53.3 cm to 1.4 meters (1.75 feet to 4.5 feet) from that 2000 baseline by 2070.¹⁸
 - ▶ Policies matter. Climate model projections show that if countries follow the emission reduction paths they have committed to under the Paris Agreement, the Earth's average temperature would rise about 3 degrees C (5.4 degrees F) by 2100, compared to pre-industrial levels. This warming would very likely induce about 24.4 cm (9.6 inches) of global sea level rise above 2015 levels. But if policies are implemented to limit global warming to 1.5 degrees C (2.7 degrees F), then global average sea level rise would be half that, about 12.2 cm (4.8 inches) by 2100. However, if instabilities in the Antarctic ice sheet are triggered this century then these projections will be significantly higher.

Pitfalls to Avoid

- When reporting findings related to melting glaciers and ice sheets, don't forget to mention that global warming also causes thermal expansion (as ocean temperatures rise, the water expands), which also causes substantial sea level rise.
- High-tide floods are sometimes referred to as "nuisance floods," but this is a poorly chosen term to include in your reporting because these floods are much more than a nuisance. They are dangerous, damaging, and costly flooding events.

Immigrants in U.S. communities

July 16, 2024

The following is adapted from a SciLine media briefing, [part of a series of SciLine media briefings covering key issues in the 2024 election](#), that covered what the latest scientific research says about:

- Current U.S. racial, cultural, gender, and wealth demographics, and how these have changed in recent decades due to immigration;
- Where immigrants are migrating from and where in the U.S. various immigrant groups have settled;
- Whether and how immigrants affect the labor market and productivity within various economic sectors;
- How immigrant wages compare to non-immigrant wages;
- Differences between how unauthorized and authorized immigrant groups affect various sectors of society, including labor markets, businesses, and public safety.

Dr. Nancy Foner is a professor of sociology at CUNY Hunter College who provided a snapshot of current U.S. immigrant demographics, including where immigrants have been coming from and where they're settling. And how those factors have changed over the last several decades, along with some implications of those changes.

Dr. Pia Orrenius, a labor economist serving as vice president and senior economist at the Federal Reserve Bank of Dallas, focused specifically on immigrant impacts on the U.S. labor force and economy.

NANCY FONER: If we look at contemporary immigration to the U.S., I think the most extraordinary astonishing thing really is the numbers. They are truly astonishing:

- After five decades of extraordinarily high immigration, 46 million immigrants now live in the U.S.. That's the highest number since Census records have been kept.
- This includes 11 million undocumented immigrants. They're really 1 out of 4 immigrants in the nation.
- And you add on to the 46 million, their children, it's 90 million. And to give some perspective, this is actually more than the population of Germany.
- If we look at percentages, not absolute numbers, about 14% of U.S. residents are foreign-born. And that's a huge jump from 1970 when the 10 million immigrants were a little under 5% of the population.

It's also where the immigrants are coming from that is new. And this has led to very dramatic transformations in the racial order in the U.S. In 1960, and I say 1960 because this is five years before the federal legislation, the 1965 immigration act, really opened the door to massive immigration in the U.S. by abolishing the national origins quotas that had been in place since the 1920s. So in 1960, 75% of immigrants in the U.S. were from Europe. Today it's 10%. Now, many of those who came from Europe, by the way, had come earlier in the 20th century. But you can see the huge change in where immigrants are coming from. And this has had a very dramatic effect on the race and ethnicity of the U.S. population.

- Non-Hispanic whites were 85% of the population in 1960. They are now just under 60%.
- Hispanics were 3.5% of the population of the U.S. in 1960. In 2021, 19% due to immigration, also to births.
- Asians in 1960 were less than 1% of the population. Asians are now 6.1% of the population, and most are foreign-born.
- Blacks in the United States in 1960 were 11% of the population, now around just a little under 14%. And what's interesting about the Black population and immigration is the growing number of Black immigrants in the U.S. — 12% now, are foreign-born. And if you add on the children, it's about a fifth.

In education, never before has such a large proportion of immigrants in the U.S. been so highly skilled and educated.

- In 2022, 35% of immigrants over 25 had a bachelor's degree or more, and that was almost exactly the same as US-born adults.

- 80% of adult Indian immigrants have a BA degree or higher.
- Among Nigerians, another 65% have a BA or higher.
- Chinese and Koreans are above 50%.

Immigrants today are living everywhere. They're not just in traditional gateways like New York or Chicago. That was true, you know, in the last great wave of immigration at the turn of the 20th century. They're in rural areas, they're in urban areas, they're in suburbs. There are more immigrants living in suburbs than in central cities. And just to give you an idea of some of the changes, I just wanted to point out what we could call three new immigrant meccas:

- One is Dallas-Fort Worth, which went from 34,000 immigrants in 1970 to 1.4 million in 2014.
- Phoenix, in the same years, went from 87,000 to 650,000.
- And the Las Vegas area, 35,000 to 460,000.

Immigrants are living now in the far west. They're living in the South, which never had large immigrant populations. They're all over the Midwest. They're in cities, as I said, suburbs and rural areas, all throughout the country.

Immigrants are also integrating into America, something very important, because this is a big issue in the U.S., and it's important. Over time, immigrants and their children are becoming more like the native-born. This is very clear from the National Academy of Sciences report on immigrants and their integration to America. And what's clear is that in educational attainment, in income, and occupational distribution, living above the poverty line, residential integration and English language ability, immigrants and their children are becoming more like the native-born over time.

I also just wanted to mention two myths, and there are many myths about immigration, but these, I thought, are the ones that perhaps stand out the most.

One is that immigrants are not learning English the way earlier Europeans did, and that is false. Immigrants who arrive without English (and of course many today do come with English already, which is unlike the past) are acquiring English as rapidly, and actually, some studies show even faster, than European immigrants did in the early 20th century. And by the third generation, that's the grandchildren of immigrants. The third generation is, to a large extent, monolingual in English, leading some social sciences to actually say that the U.S. is the graveyard of languages. Maybe I wouldn't go quite that far. But we should not worry that immigrants and their children and grandchildren are not learning English.

Another myth is that immigrants commit more crimes than the native-born. And that, again, is false. The foreign-born, in fact, are much less likely than the native-born to commit violent crimes. And in fact, cities and neighborhoods with greater concentrations of immigrants have much lower crime and violence than comparable non-immigrant neighborhoods. Again, leading a well-known sociologist to say, "If you want to be safe, move to an immigrant neighborhood."

And then there are some immigrant contributions. Now I could go on forever on this, but let me just mention a few. One is that immigrants have fueled population growth in cities, suburbs, towns, and revived deteriorating urban neighborhoods. Even in rural areas, they have staunched in many cases population loss, and even in some places led the population to grow. Many cases of deteriorating urban neighborhoods that have been quite saved by immigrants moving in. One in my own city of New York, Brighton Beach, which was really very much in decline, immigrants from the former Soviet Union have been a major factor in reviving the neighborhood. Little Village in Chicago, again, an area where the ethnic whites moved out to the suburbs in the Sunbelt, and Mexican immigrants have let this become a thriving commercial center.

Immigrant impacts on the U.S. labor force and economy

PIA ORRENIUS: We've had a record volume of migration since 2022. Official data has been slow to catch up to the surging inflows along the southwest border. With this latest migration surge, just like earlier migration, the effects of the economy are pretty straightforward. Migration boosts economic growth because it's population growth and it's

labor force growth, and with little impact on inflation. There are effects on natives and prior immigrants. So, the net economic effect on natives is positive. But, of course, there are winners and losers. And wages may take some time to adjust to rapid influxes of immigrants. And we need to note that the fiscal impact of immigration, it can be negative at state and local level if immigrants have low wages and income. So that's another consideration we should bear in mind.

Immigrants in the U.S. labor market make up about 19% of the workforce and about half of U.S. job growth since 2010. Even if you go back further, you'll see a similar statistic. So what this means, even though they're a smaller share of the workforce, they have a very important contribution to growth. The share of growth that we can attribute to immigrants will increase as the U.S. labor force growth slows, which it will, which it already is, and that's due to aging and low birth rates. It's important to note that immigrants have higher labor force participation rates than natives, although they do have slightly lower income on average, and they have a similar unemployment rate to natives. Sometimes, some years, they have lower unemployment rates than natives, in fact. Among other benefits of immigration, they complement native workers at high and low ends of the skill distribution.

So in terms of education, we've had more high-skilled immigration now in recent decades than we've ever had before, but there's still a really important contribution at the low ends of the education distribution. They also tend to fill jobs that natives typically shun. They're more innovative — we measure that through patenting — than the natives. And that's also partly an artifact of the fact that we bring in so many high-skilled immigrants on STEM visas that we get a lot of STEM workers, and they're typically in research and development, and they also start businesses at a higher rate. So these are a number of the benefits that have been shown in the research over and over again.

The foreign-born share of the labor force is very, very high for the low-skilled workers and also disproportionate at workers with Ph.D.s, for example. There's just a lot of contributions here in healthcare and in science and technology, engineering. Where you see the least immigrants is typically jobs that require cultural or linguistic sensitivities. Like lawyers and judges, it's hard if your English is not your first language, and those occupations are more difficult to access than others.

So the labor force grows with immigration, that means that the output in the economy rises. We call the output of the economy the gross domestic product, or GDP. Again, immigrants account for about half of labor force growth. Some of that rise in GDP accrues to natives. But the important thing to remember is the "immigration surplus" is not shared equally. So what happens, you have more workers, wages initially fall. But the return to capital, the return to land, rises. So owners of capital and land benefit a little bit more when you first have a rise in immigration. But then you have an adjustment in business investment and that's really important because that will put the economy back to where it was before, and wages rise again. This again is the theory around immigration and the economic impact. One question that we ask in economics is we need the business investment to adjust to the increase in the labor supply, and so how long does that take? And so that's kind of an argument or a debate in economics. But in tight labor markets like we've had here in the last three years with rampant labor shortages, these negative labor market effects of immigration are not going to be widespread or easily detected.

So we've had in the pandemic and the recovery from the pandemic, say, two vacant jobs for every unemployed worker. We've had record wage growth in immigrant-intensive occupations and industries. Under these conditions, you're not going to be able to see, for the most part, any negative impact on the labor market of immigration when you're looking at native workers that are competing with immigrants.

The fiscal impact of immigration is another topic. We have a lot more information on that now than we used to. What is the fiscal impact? It's what, you know, an individual or household contributes in taxes minus what they consume in publicly-provided goods and services. What we find is that high-skilled immigrants have very large positive fiscal impact, as do high-skilled, high-income natives. A National Academy of Sciences study found that these high-skilled immigrants contribute something like \$850,000 each to the net fiscal balance over their lifetime. So it's a significant fiscal boon.

But, of course, low-skilled immigrants, if they have low incomes and especially if they have large families, they'll have a negative fiscal impact, and that's also documented in the National Academy's study that was conducted on this issue. Interestingly for that class of immigrants, that negative impact is concentrated at the state and local level. It mostly comes from education. So K-12 is expensive. It's — depending on where you live, \$10,000 to \$15,000 per student per year. And so you can see how that can quickly add up. Now, of course what I remind people, when you're writing about the fiscal impact, remember that the spending on education is an investment that's going to pay back over time. So if you look at the lifetime fiscal impact, those investments in education are going to pay back many times what's invested.

U.S. immigration policy is interesting. There are few alternative pathways for unauthorized immigration, which is the reason that we have systematic unauthorized immigration into the U.S. Another thing we should note, we've had a lot of humanitarian migration here in the last couple of years. Many of those will not qualify for asylum. And so that's setting us up for a situation that has to be resolved here in the next 5 to 10 years. In general, our work-based visa quotas are very insufficient to accommodate immigration. They've been fixed for decades in many cases, and also temporary visas are completely inconsistent with the number of permanent visas that are available. So many, many immigrants have to actually return to their countries because they will not get a green card. And skilled workers typically face long queues if they want to stay permanently. And there's country quotas that prevent permanent migration of particularly people from places like India and China. This is just a picture of the family-based immigration system, which is currently our system. So you can just see how much is based on family, much less is employment, and then of course we have the humanitarian categories.

“there are net economic benefits to immigration, which means it's in the country's interest to have immigration.”

So there are net economic benefits to immigration, which means it's in the country's interest to have immigration, obviously. But some natives and prior immigrants may lose from immigration in the short run if they're competing head-to-head with immigrant workers. It's important because business investment and capital adjustment really is the magic that makes the economy adjust to higher labor supply. So that's really the answer to integrating large amounts of immigrants. Low-skilled immigration does have a negative fiscal impact. That can also be addressed with more high-skilled immigration, which has a very large positive fiscal impact, and it also can be addressed by transferring funds from federal government to state and local governments because even low-skilled immigrants have a positive impact on average at the federal level. It's just state and local where it's negative for certain households, and that's, again, mostly related to education.

Xenophobia, racism, and health in immigrant communities

August 27, 2020

The following is adapted from a SciLine media briefing. Research shows that people who experience xenophobia —prejudice against those who are, or are perceived to be, foreign or outsiders— can suffer lasting harmful health effects as a result. SciLine's media briefing, the second in a series focused on racism, covered the latest science on how xenophobia-driven discrimination in the United States impacts the health and wellbeing of: Latinx immigrant communities; Muslim immigrants from the Middle East and North Africa; and Asian American populations, particularly during the COVID-19 pandemic.

Dr. Georgiana Bostean, a sociologist and associate professor of environment, health and policy at Chapman University, focused on the health of Latino and immigrant populations.

Dr. Gilbert Gee, who is a professor in the department of community health sciences at UCLA's Fielding School of Public Health, focused on the social determinants of health inequities in minority populations, focusing primarily today on Asian-American populations.

Dr. Goleen Samari, an assistant professor and public health demographer at Columbia University's Mailman School of Public Health, described what science is learning about how xenophobia and migration-based discrimination can impact health, with a particular focus on communities from the Middle East and North Africa.

Population health in Latinx and Immigrant Communities

GEORGIANA BOSTEAN: I'll be talking a bit about population health disparities and the role of the environment on health and health behaviors and how that ultimately translates into racial and ethnic health disparities. I am trained as a demographer and sociologist. So you'll sense that bias throughout my presentation.

So I'll start with asking you to think about what contributes to differences in health and longevity between different racial and ethnic groups in the U.S. So if we had to assign a slice of the pie to genes and biology, where might you put that? So the CDC estimates that a very small proportion is actually due to genes and biology. Health behaviors are often also smaller than what people think. Medical care – also a little bit smaller than what people tend to think. And the total ecology and social and societal context actually makes up over 55%, approximately, of population health differences. And this can come as a surprise to folks when they think about health. And we in America especially tend to think about health as largely about personal choices and health behaviors. But really, health starts where we are born and work and live and age.

One component of our surroundings is the built environment. And in the built environment, we can think of things such as which retailers and services are available in different neighborhoods. And it probably doesn't surprise you that we know that there is a greater density of unhealthy retailers, such as alcohol and tobacco retailers and fast-food retailers, in predominantly minority neighborhoods and lower socioeconomic status neighborhoods. And that tends to be the trend.

So does this actually impact health behaviors? Well, there is a large literature that suggests that, yes, the surroundings and the built environment do impact individual health behaviors.

And one of the studies that I like to point to is actually a Google study within their offices. They teamed up with academics and changed the types of foods that were available and snacks that were available in the office. So they took M&M's and put them in dark jars and further out of reach. And they took healthy snacks and put those further up front in clear jars. And they were able to change the office consumption patterns to increase healthy food intake and to decrease unhealthy food intake. This also translates, then, on our neighborhood level as well.

So given the really strong and well-established literature showing that lower socioeconomic status is associated with poorer health, people are often surprised to hear about what's called the Latino health paradox—that Latinos,

despite having lower-average socioeconomic status, tend to have longer life expectancy than native-born populations. But this advantage decreases among immigrants with time in the U.S.

Some immigrant groups have among the longest life expectancy. However, they don't necessarily have longer, healthier lives. So they may live longer but spend more years in morbidity and functional disability. So much of this Latino health paradox is thought to be due to smoking and to selective migration patterns. And so colleagues and I have thought about how this might dissipate as we see changes in smoking. So smoking really has declined in all groups over the last decades. And so we are not sure whether this life expectancy advantage will be maintained. On the other hand, we also have vaping, which has become an issue among particularly youth. And uptake among Latino youth has also been pretty strong, with approximately 15% of Latino high schoolers having vaped in the last 30 days. So it's unclear how these counteracting forces are going to work out. And as we have fewer immigrants to the United States and see more second-generation Latinos, we may see some of this advantage dissipate as well. And then finally, the counteracting force of obesity-related mortality—we see higher rates of diabetes-related mortality, for example, in these groups.

So one of the things that I am excited to tell journalists about is the fact that the choice of words matter. The word racism is highly politicized, even though we know there is this large evidence base that, in fact, it is racism causing some of these health disparities. But I want to point to a Robert Wood Johnson Foundation study from a few years ago of over 3,000 Americans across the political spectrum—and it was a multipronged study with surveys and focus groups. They found that even when messages are true—so saying things like America's not in the top 25 countries in life expectancy—even though that is a true message, people are less likely to believe what comes after that because they have this adverse reaction to that initial message. So leading with something that Americans tend to already believe is value-based—something like Americans lead the world in medical research and medical care—they're more likely to believe everything that follows. And these are the exact phrases that they tested out.

So they came up with at least three things that we can do when talking about these social determinants and social factors in health, and that is framing it around how disparities affect everyone. And there are some studies that show that greater inequality affects not only the groups that are disadvantaged, but even advantaged groups compared to other countries with lower inequality. The second thing is that presenting just the problems tends to turn people off—so thinking about the types of solutions that we can implement to address these. And one of those that's been widely accepted is a health in all policies approach, thinking about how all sorts of different policies affect individual choices. And then, finally, using language that is colloquial and priming, using values that we already believe in—for example, the personal choice—that, yes, health is both about personal choice, but let's think about how those personal choices are affected by the context in which we live.

So I want to leave you with this thought about the role of journalism in shaping the public's understanding of health. The most commonly noted cause of health mentioned is behavioral. And so—and then the second most common is social. But what I'd like to argue is that we should always talk about behavioral in the context of social differences. For example, with smoking, we can't just talk about the personal decision to smoke, but rather, this—how does the retail environment affect those decisions? How does receipt of coupons affect these decisions? Because we have large established literatures on that. So the takeaway is that we'd love to see the whole story of how health is patterned.

Racism and the health of Asian American populations

GILBERT GEE: Today, I'll first talk about how racism makes people sick. And secondly, I'll throw out a second angle that you might want to consider that I think deserves some more reporting.

So let's begin with the big picture. We know that health is determined in part by your genetics and also by your health behaviors—things like diet and exercise. But it's also about health care.

So health is behaviors, genetics. It's also access to care. It's also whether you live in supportive social networks. But

it's also where you live, work and play. It's also your position in society. We know that people with more education and more income tend to be healthier than people with fewer privileges. And this is a pattern we see across many societies, including the United States. And of course, we have national, state policies and the political economy and so forth that all determine our health. So the main point here is that health isn't simply about your behaviors and your health care, but it's also what the research has called social determinants. All these upstream factors play an important role in our health and well-being. And unfortunately, prejudice, racism, discrimination are part of these social determinants. Racism has many different ways that can affect our health and well-being. But today, I'm going to focus on one, which is stress.

“The thing about stress is that it contributes to wear and tear on our body.”

We know that microaggressions, making assumptions about people, as well as major hate crimes, are stressful. And the thing about stress is that it contributes to wear and tear on our body, resulting in something that scientists call allostatic load. This can have effects in terms of weakening your immune system, causing failure of target organs and things like that. And stress, we know, is associated with things like even increasing your probability of catching the common cold. Research on this specific to Asian Americans (shows that) more reporting of discrimination is associated with more illness. And this isn't controlling for things like gender, age and so forth. But it's not just that outcome. We see this dose-response relationship for other things like major depressive disorder, heart disease, pain, respiratory problems and so forth.

My research joins a much broader conversation that's been happening in science for many, many years, including reports published by the National Academies of Science, the National Institute of Health, the surgeon general and so forth. So the point here is that science is taking racism very seriously as not only an equity issue, but a health one as well. And certainly, COVID has amplified our attention on discrimination amongst Asian Americans. As you've probably seen in many reports, Asian Americans are being targeted for hate crimes in relation to this pandemic. Now, you know, the past couple of decades of research has shown that general experiences of racial discrimination amongst Asian Americans is associated with illness. So it seems logical to anticipate that COVID-related discrimination, anti-Asian discrimination, would also be associated with illness. And research is just starting to emerge to show that very point. A study that was just published where they looked at Korean immigrants in the U.S. found that discrimination was, in their analysis, a more important predictor of distress than even income.

So now let me pivot just a little bit and talk about another angle related to the same topic. And it's on something I call race adjustments, and I want to talk about it from two points of view. So the first is, think of this issue of judicial awards. So in other words, imagine a child is struck by a car, and now the judge has to decide how much to pay out to the parents. And the way they calculate the payout is basically anticipating, what are the anticipated future earnings of that child using actuarial science? And so let's say we presume that the payout is a million dollars, right? But we also know that women make 75 cents to the dollar. And we know that Black women, for example, make around 65 cents to the dollar. So it's very – it's happened in the past where the judicial awards to a white male child is far greater than the award to – and I mean to the parents of, say, a Black child, right? And so this is one way where seemingly neutral decisions using mathematics and seemingly objective science can reap major discriminatory effects not only to families, but across generations.

Now, let me take another example of this same idea. So three years ago, a study was published using kids from the Bay Area. And the researchers had to wrestle with what to do with biracial children. And they decided to create a rule whereby if a child was Black and Asian, the child was reclassified as Black only. If the child was Hispanic and Asian, they were reclassified as Hispanic, and so forth. And so the consequences of this were to essentially, in the research, make Asian Americans invisible. And not surprisingly, later in the same paper they admitted that the

study overrepresents the Black and Hispanic community and underrepresents the Asian community. And so these are two examples of how researchers can make decisions that are seemingly neutral but nonetheless can have racialized impact and contribute to inequalities in that way. So to close, what this all means is that issues of race, racism, health and research are all intricately intertwined together.

Islamophobia as a public health issue

GOLEEN SAMARI: I'm going to conceptualize and discuss why Islamophobia is a public health issue as sort of a lens into one specific community that experiences racism and xenophobia. And it's important to note that this work really builds on the legacy of anti-Black racism and health research that has been done in the field of public health for many decades.

So first, I think it's important to set the context a bit. Hate crimes are clearly a dimension of health that result in fear, injury and death. (After an) increase in anti-Muslim hate crimes after 9/11, the rates were fairly stable until about 2015, when the rhetoric of the 2016 presidential election started. The Council on American-Islamic Relations has now recorded over 10,000 anti-Muslim bias incidents from June of 2014 to June of 2019, with the highest recorded in 2017.

“hateful events towards one community often beget hateful events towards another community.”

I also want to point out while we're here that discrimination on the basis of religion is only second to race for source of bias in discriminatory acts. So anti-Semitism is often at the forefront of the types of incidents that we see recorded. So the highest number of incidents are usually anti-Semitic in the religious categories. But these things trend together, so hateful events towards one community often beget hateful events towards another community. So whenever you see a rise in anti-Semitic or anti-Black racism, you also see a rise in Islamophobia.

Let me define Islamophobia a little bit. Islamophobia is social stigma towards Islam and Muslims, dislike of Muslims as a political force and a distinct construct referring to xenophobia and racism towards Muslims or those perceived to be Muslim. So parts of this definition are really important because Islamophobia affects several different groups of people. So first, you have Muslims, right? But then you have this assumption about who is a Muslim based on how people look. So we call that category of people those who are racialized to be Muslim because of stereotypes and assumptions about racial identity. So Islamophobia, similar to other stigmatized identities, is really rife with stereotypes of Muslim Americans and Americans who look Muslim-like. Really, that's equating a lot of populations who are from the Middle East or North Africa to being Muslim when there's a lot of heterogeneity of religion within those groups. So in the U.S. Muslim population, there's about 3.5 million Muslims, and over half of them are immigrants. But again, there's a long history of Muslim migration to the U.S., and you have second- and third-generation Muslims in the population. So worldwide, the population of Muslims is really growing. And by 2050, you expect about 8.1 million Muslims, or 2.1% of the U.S. population. Importantly, though, this is a really racially diverse group of individuals. So in the U.K., you have Muslims primarily from the South Asian region. And then in the U.S., you have a really interesting mix of sort of white, Black, Asian—primarily South Asian—and Latino Muslims.

So a lot of who is in that white category or—is what we consider to be sort of an invisible minority, which is the Middle Eastern and North African immigrants, because they are categorized as white because there is no other sort of census-defined racial ethnic category that captures immigrants from the Middle East. In the way that we collect

data, that's one group that often disappears because they're categorized as white.

Research on Islamophobia and health to date shows some interesting findings. So in 2018, myself and my colleagues did a systematic search, and we looked at evidence based on Islamophobia and health. In total, we found 53 studies—only 53. So this is clearly an area where there is more research needed, and ongoing research efforts are encouraged. But there were consistent relationships between experiences of discrimination and poor mental health among Muslims and Muslim-like populations. Findings of worse mental health were really consistent across outcomes of psychological distress, paranoia, depression and anxiety. For physical health, the research was a little bit more limited, but there were some findings on coronary heart disease or poor self-rated health, which is correlated with poor physical health. And then a study on birth outcomes after 9/11 that showed that women with Arabic names in California were more likely to have preterm birth compared to women without those names. So there's some physical health evidence.

There's also a lot of evidence on barriers to access and utilization of health care. So as you would expect, discrimination on the basis of your identity prevents you from seeking and getting health care. So in a recent study sort of unpacking this Muslim-like population, my colleagues and I used seven years of National Health Interview Survey data and looked at the population of Middle Eastern immigrants in the U.S. And we found that among Middle Eastern immigrants, white respondents had 66% lower odds of delaying care and 84% lower odds of being rejected by a doctor as a new patient compared to nonwhite respondents. And similar to other studies of immigrant groups, we found that U.S. citizens had a 76% higher odds of visiting the doctor. So basically, identifying as nonwhite was very prohibitive of getting care.

These are some of the pathways (in) which racism and Islamophobia affect health. So you have your individual pathways of stress. You have interpersonal pathways, interactions with providers and the health care system, other mechanisms—like these communities tend to socially isolate when they experience discrimination. Structural pathways are basically discriminatory ideologies and the structural features of institutions, policies and the media that can reinforce health disparities. Examples of these policies include immigration policy that contributes to structural inequity. We saw this really pretty clearly with the implementation of the Muslim ban in 2017. We've also seen this over the years with patterns of racial and religious profiling in the naturalization process to block citizenship of individuals from Muslim-majority countries.

The media can also shape the structural social environment in ways that affect Muslim American and immigrant community health. Negative media coverage of Muslims plays an active role in the social understanding of Muslims as, quote-unquote, “the enemy” and in perpetuating Islamophobia. The Media Portrayals of Minorities Project at Middlebury College published a report in 2019 that found that Muslims were disproportionately by far the most negatively portrayed minority in America today. They've looked at close to 3,000 news articles and they basically found that coverage of Muslims heavily focuses on foreign conflict, terrorism, law and order. And this means that stories centering on Muslims basically tend to reinforce the perception that there's a correlation between Islam and violence. So it's important to think about the fact that this coverage not only influences our political debates, but it also impacts how we perceive people of different demographic backgrounds when we encounter them in everyday lives. And it ultimately impacts their health and well-being and the health of these communities.

So as reporters, I would really encourage people to challenge prejudice and debunk outright lies. Be careful who you give a platform to, and provide context for the events that you cover. Improve your understanding of Islam and all its diversity, and really cultivate relationships with members of the community. And lastly, I just want to say you have to choose your words carefully. When you use phrases like Islamic terrorism, you're implicitly conflating two concepts and further perpetuating Islamophobia.

Latin American immigrant experience

July 24, 2024

Unusually high numbers of immigrants from Latin America have recently arrived in Denver, New York and other U.S. cities, where they face financial, legal, and personal barriers to becoming part of these communities. SciLine interviewed [Dr. Edelina Burciaga](#), an assistant professor of sociology at the University of Colorado, Denver, whose research looks at the role of legal status shapes the transition through adulthood for undocumented immigrant young adults.

What factors affect educational opportunities of recent Latino/a immigrants?

I think when thinking about educational opportunities for Latina and Latino immigrants, it's important to understand that legal status really plays a role in the opportunities that people who come here as immigrants have. And so, my research looks at undocumented immigrant young people. And in 1984, the Supreme Court held that immigrants—no matter what their legal status is—can access public education through 12th grade. So, when children are coming and joining our schools, I think it's really important for them to enter schools that have robust English language learner programs, infrastructure to build strong homeschool partnerships, and abilities to communicate with their parents in their own languages. However, once immigrant young people graduate from high school—particularly for undocumented young people—we find that there's more challenges navigating the road to college. They're not eligible for federal financial aid. Dependent upon where they live, they may or may not be able to pay in-state tuition at colleges and universities. So, it gets a bit harder after elementary school for immigrant children.

How do federal policies influence the employment trajectories of recent Latino/a immigrants?

This is an area where legal status really plays an important role. You know, how you come to the United States determines whether or not, when you arrive here, if you have access to a work permit or not. And by that I mean, if you come with a refugee status or as an asylee—so, with some kind of legal status—there's typically a way for you to get a work permit while you're here. If you come without legal permission, then you're undocumented, and there's no way for you to really work with legal permission. So, federal policy really governs how immigrants come. And that shapes their, you know, the ways that they're able to work, not necessarily whether or not they are working, because I think, I'm sure as we're all aware, we know many undocumented immigrants are part of our labor force. And I think one point that's really important for people to understand is that regardless of someone who's working with or without legal permission, it's pretty typical for undocumented immigrants to still file taxes using an individual tax identification number. So, they are often still filing and paying taxes on the wages that they earned. So, I think it really makes a big difference how you come, and that impacts your employment trajectory.

How do state and local policies affect the employment trajectories of recent Latino/a immigrants?

State policies do play an important role in the employment trajectories of immigrants. Again, this is an area where legal status matters. And I think one development that has happened in states like California and like here in Colorado—where I do some of my research—is the expansion of accessibility to professional licenses. Now, some might think, “Oh, this is—how important is it to get a professional license?” But there's several occupations that require that individuals be licensed. And we can think of some of the more common ones, like lawyers or doctors, and I think there's even some more uncommon ones, like hair stylists or estheticians—people that take care of your skin—child care workers, for example. And so, states like Colorado have expanded the ability for undocumented immigrants to get professional licenses so that they can use their education and training in service of their community. So, I think in that way, state and local policies really play an important role in facilitating entry into the labor market for particularly undocumented immigrants.

What aspects of a U.S. community shape Latino/a immigrants' sense of belonging there?

Belonging is such an interesting and exciting concept. I think it's something we can all identify with as a feeling of being a part of, or wanting to be welcome and accepted. And for immigrants, I like to think of it as sort of the

emotional aspect of immigrant integration—how are we including immigrants in our community? And so, I do think that because law and policy is such an important aspect of the immigrant experience, laws and policies that are welcoming, I think, really signal, you know, inclusion, which can lead to feelings of belonging amongst immigrants. I was doing interviews in 2017 and 2018. And I was doing interviews with undocumented immigrant young people. And at the time, the Denver State Capitol had put up a sign that said, we heart immigrants, and more than one interviewee—an undocumented young person—mentioned how that sign, although symbolic in a lot of ways, really sent an important message to them about their place in the Denver metro area and in the community in the Colorado community. So, I think that symbolic actions like that—actions that carry a lot of symbolic meaning—and then actionable items like laws and policies, can really signal to immigrants that they're welcome and that they belong.

Are there policy or other solutions that improve the experiences of Latino/a immigrants, based on research?

In my own research, I've looked at the impact of the Deferred Action for Childhood Arrivals program, which was introduced in 2012. And that program had significant benefits, I mean, research at the national level, but my own research here in Colorado, showed that undocumented young people felt a greater sense of belonging and, you know, got jobs in the areas for which they were trained to study. High school teachers, who've gone on to be lawyers, have gone on to be childcare workers. It gave them a real sense of agency in their futures. And as they transition through adulthood, and so pilot programs like that, I think, really kind of acknowledged the reality of many of the undocumented immigrants currently living in the United States, which is they've been here for 10 or more years and have really built lives here. There's other policy steps that states have taken on a state-by-state basis. And one that has shown my research has shown time and time again, to be really crucial is access to driver's licenses. So, here in Colorado, undocumented immigrants can get driver's licenses. And that's made a huge difference in navigating the city. We live in a place where you need a car. Many places are places where you need a car, and to be able to drive with legal permission has made such a huge difference. I think other ways that other policies that have been important are, you know, access to different types of health care whether that's for reproductive health. And though I think those types of policies also can be really important for Latina and Latino immigrants.

Are there policies or other solutions that don't work to improve the experiences of this group?

I would say that in order to really understand—to answer this question—we need to look to the 1990s and 2000s, when there were various laws passed in states across the United States. The one that got the most attention was Arizona's SB 1070, or your "Show Me Your Papers" law. And what research has shown is that these types of policies really make it difficult for immigrants—Latina/Latino immigrants, whether they are documented or undocumented—makes it difficult for them to navigate daily life. In the wake of the passage of laws like that, we see school attendance go down significantly for young children. We hear about people not leaving their homes for fear of something happening to them or a family member. And this can also become an important public safety issue in terms of immigrants not wanting or feeling comfortable cooperating with local police. So I think those types of laws that really highlight one's undocumented status or even kind of lead into racial profiling can be harmful to Latina/Latino immigrants, but also the Latino/Latino community writ large, regardless of immigration status. I think we also have to be mindful of the ways that we're talking about immigrants, and undocumented immigrants in particular, that can lead to fear and anxiety, which my research shows that heightened rhetoric around this causes significant stress and anxiety for undocumented young people. So, I think that type of rhetoric can—anti-immigrant rhetoric—can have very real consequences for folks.

Here are the answers to 15 common questions about fluoride in drinking water

We scoured decades of published academic research to address questions about water fluoridation, including what it is, who makes decisions about it, and how safe and effective it is.

by [Naseem S. Miller](#) | December 17, 2024

A decades-old debate about fluoride has gained new momentum since early November, when Robert F. Kennedy Jr., President-elect Trump's nominee for secretary of the Department of Health and Human Services, [called it](#) an "industrial waste," and said the administration would advise water systems across the country to remove it once Trump takes office.

Florida Surgeon General Joseph Ladapo followed suit, [issuing an advisory](#) for Florida communities to stop fluoridating their water supplies, citing controversial studies that link fluoride with a range of conditions, even though research findings about these associations are far from conclusive as we explain in this research-based piece.

Since then towns and cities [across the nation](#), and at least [one in Canada](#), are considering the removal of fluoride from their waters.

Meanwhile, advocacy groups like the [Fluoride Action Network](#), which lobbies against water fluoridation, have had some success with their efforts. In September, a federal judge in California [ordered](#) the Environmental Protection Agency to strengthen the regulations for fluoride in drinking water, siding with advocacy groups that had raised concerns about the effects of the mineral on children's health.

But many public health officials say that years of research show that low levels of fluoride are safe and help prevent dental cavities, particularly in children.

Major health organizations recommend water fluoridation as a way to prevent dental cavities and find it safe. The [American Dental Association](#) has reaffirmed its staunch support of water fluoridation. So has the [Florida Chapter of the American Academy of Pediatrics](#). The [International Association for Dental Research](#) also supports water fluoridation and finds it safe, as does the [U.S. Centers for Disease Control and Prevention](#).

"The U.S. Public Health Service; the United Kingdom's National Institute for Health Research, Centre for Reviews and Dissemination, at the University of York; and the National Health and Medical Research Council, Australia have all conducted scientific reviews by expert panels and concluded that community water fluoridation is a safe and effective way to promote good oral health and prevent decay," according to a [May 2024 CDC Scientific Statement on Community Water Fluoridation](#).

To be sure, the prevalence of dental cavities has decreased in recent decades, thanks to the widespread use of fluoride toothpaste and fluoride mouthwash since the 1970s. As a result, the benefits of water fluoridation may be less pronounced than they were when the programs were implemented in 1945.

But despite arguments to remove fluoride from community water supplies, studies also haven't found that low levels of fluoride in water are harmful, or that the practice of water fluoridation should be stopped.

To help inform news stories and conversations about this topic, we scoured dozens of research studies and articles and organized them as answers to 15 commonly asked questions.

We're including hyperlinks to the journal articles we cite. Some of the journals may be behind a paywall, so be

sure to check out our [2023 tip sheet](#) on how to access academic research for free.

This piece is a companion to a research roundup.

1. What is fluoride?

Fluoride is a naturally occurring mineral found in soil and water, generally in low concentrations. It is a compound of fluorine, one of the elements on the [periodic table](#).

2. How does fluoride work on teeth?

The outer layer of the tooth is called the enamel. It is made up of mineral crystals, including calcium and phosphate.

Fluoride prevents tooth decay [in three ways](#): It prevents the loss of minerals from tooth enamel; it improves remineralization, a natural process in which minerals like calcium and phosphate are added back into the tooth enamel with the help of saliva; and it prevents bacterial activity, such as metabolism of bacteria and acid production, in dental plaque. (Dental plaque is a soft, sticky, colorless film of bacteria and other microorganisms that forms on the surfaces of teeth, gums and mouth tissue.)

“The science is simple: Fluoride strengthens tooth enamel, the protective outer layer of teeth, by promoting remineralization,” writes Dr. Amal Noureldin, clinical professor of cariology at Texas A&M University, in a [December 2024 article](#) in The Conversation. “It also makes teeth more resistant to the acids produced by bacteria in the mouth. This helps prevent cavities, a problem that remains widespread even in modern societies.”

3. What is water fluoridation?

Almost all water contains some fluoride naturally, but the amount is typically too low to prevent cavities.

Almost all water contains some fluoride naturally, but the amount is typically too low to prevent cavities.

Community water fluoridation is the process of adjusting the amount of fluoride in drinking water to the recommended national level of [0.7 milligrams of fluoride per liter of water](#), according to the U.S. Centers for Disease Control and Prevention. That’s equivalent to about three drops of water in a 55-gallon barrel, [the CDC says](#).

In 1999, the CDC named fluoridation of drinking water as one of [10 great public health interventions of the 20th century](#), because of the dramatic decline in dental cavities since the process was implemented in 1945.

Increasing the proportion of people whose water systems have the recommended amount of fluoride is one of the health policy objectives of [Healthy People 2030](#). Healthy People is a federal initiative that provides 10-year public health goals.

4. What’s the typical fluoride intake in the U.S.?

Among children aged 6 months to 14 years, drinking water accounts for 40% to 70% of total fluoride intake, according to a [2015 federal study](#) published in the journal Public Health Reports. For adults, drinking water provides 60% of total fluoride intake. Accidentally swallowing toothpaste accounts for about 20% of total fluoride intake in

very young children 1 to 3 years old. Other major contributors to total daily fluoride intake are commercial beverages and solid foods.

Most kinds of toothpaste sold in the U.S. contain fluoride in the form of sodium fluoride or monofluorophosphate, at about 1,100 to 1,100 mg/L, or 1.3 mg in a quarter teaspoon, [according to](#) the NIH's Office of Dietary Supplements.

Fluoridated water keeps a low level of fluoride (0.7 mg/L) in the mouth all day. Fluoride toothpaste provides a much higher concentration at important times of day such as bedtime, [according to the CDC](#). The [agency recommends](#) small amounts of fluoride toothpaste for children younger than 6 and advises parents to talk to their doctor or dentist.

Other [types of fluoride products](#) include mouthwash, varnish, gel and supplements. Gels used by dentists are typically applied one to four times a year and [can lead to ingestions](#) of 1.3 to 31.2 mg of fluoride each time.

The National Institutes of Health's Office of Dietary Supplements has a [fact sheet for recommended fluoride intake](#) by age. The American Dental Association reviews [topical and systemic fluoride](#) supplements on its website.

It's difficult to assess people's dietary fluoride intake globally because fluoride concentrations in water vary across regions and countries, as noted in a [2024 Cochrane review](#).

5. What is the history of water fluoridation in the U.S.?

Dr. Frederick S. McKay, a dentist in Colorado Springs, Colorado, was [the first](#) person to link fluoride in public water with fewer cavities in 1901. He had noticed an unusual permanent dark stain, or "mottled enamel," on many of his patients' teeth. He also noticed that these patients seemed less susceptible to tooth decay.

In 1931, the Dental Hygiene Unit at the National Institutes of Health was established and the primary responsibility of its director, Dr. H. Trendley Dean, was to investigate the association between fluoride and "mottled enamel." Dean replaced the term "mottled enamel" with "[fluorosis](#)," a term that continues to be used today.

In 1942, after extensive observational surveys, Dean created the Fluorosis Index to classify the condition, ranging from very mild to severe, depending on how much of the tooth was covered by the stains and the color of the stains.

Dean also compared the prevalence of fluorosis with the prevalence of dental cavities among children in 26 states and noticed that children with fluorosis had fewer cavities. Indeed, children who lived in cities with more fluoride in community water supplies had fewer dental cavities.

The next step was to determine what level of fluoride in the water supply was optimal so that enough fluoride could be added to community water supplies to help prevent cavities.

In 1945, several cities in Michigan, New York, Illinois, and Ontario, Canada, began testing the effect of negligible levels of fluoride in community water supply. The amount ranged from 1 to 1.2 milligrams per liter. Grand Rapids, Michigan, was the first city in the world to implement water fluoridation.

The [study of this initial fluoridation went on for 15 years](#), showing that dental cavities were reduced by 50% to 70% among children who lived in communities with fluoridated water.

In 1962, federal health officials in the U.S. [created the optimum range](#) of fluoride concentration in the water supply, from 0.7 to 1.2 mg/L, with the lower concentration recommended for warmer climates, where water consumption is higher, and higher concentration for colder climates.

In 2015, the U.S. Public Health Service—a collection of agencies within the Department of Health and Human Services—[updated the recommendation](#), setting 0.7 mg/L as the optimal fluoride concentration in community water supplies.

Here's the [CDC's visual timeline](#) of water fluoridation in the U.S.

6. Who makes decisions about water fluoridation?

A community water system supplies water to the same population year-round and serves at least 25 people at their homes or at least 15 homes, such as mobile homes and subdivisions, [according to the CDC](#).

Community water fluoridation is not enforced at the federal level. The decision of whether and how much to fluoridate public drinking water is made by state and local officials.

The federal government has set two different levels for fluoride in the water. One is the maximum allowable amount to prevent toxicity, and the other is the optimal level, to help prevent dental cavities.

The [Environmental Protection Agency regulates](#) drinking water contaminants, including fluoride, which can occur naturally at toxic levels. In 1986, the agency set the maximum allowable amount of fluoride in drinking water at 4 milligrams of fluoride per liter of water.

Community water systems that exceed the 4 mg/L level [must notify](#) people who are served by that system as soon as possible, but no later than 30 days after the [violation](#).

EPA also has a non-enforceable secondary standard for fluoride of 2.0 mg/L, which is recommended to protect children against tooth discoloration or pitting.

Meanwhile, the Department of Health and Human Services recommends optimal water fluoridation levels to help prevent dental cavities. This level is 0.7 mg/L.

The recommended level of 0.7 mg/L is not an enforceable standard.

State and local governments decide whether to implement water fluoridation. [Some states](#) have laws that require public water systems of a certain size to provide fluoridated water, [according to the CDC](#).

The [CDC provides](#) funding to support infrastructure in states for water fluoridation, monitoring and quality of fluoridation and to develop resources for training and public awareness. The agency also provides technical assistance to state fluoridation programs.

A Nov. 13, 2024, [KFF piece delves deeper](#) into the federal role in water fluoridation. The Washington Post has created an [interactive map](#) of states that mandate fluoride in drinking water.

7. What about private wells?

Private wells are not regulated by the federal government or most state governments. More than 23 million households in the U.S. rely on private wells as a source of drinking water, according to the [Environmental Protection Agency](#).

A [2009 study](#) of well water by the U.S. Geological Survey finds that one in five wells had contaminants at concentrations above the benchmarks for drinking water.

Here's an [interactive map](#) of private wells in the U.S.

8. How effective is water fluoridation?

Years of research have found that water fluoridation prevents dental cavities.

In the decades following the implementation of water fluoridation, the reduction of cavities in children was significant. However, recent studies show that the effect of water fluoridation has lessened since the mid-1970s with the widespread use of fluoride toothpaste and fluoridated mouthwash.

An [October 2024 review](#) of 157 studies, published in the Cochrane Database of Systematic Reviews, finds that water fluoridation leads to only a slight improvement — [3 to 4 percentation points](#) — in the proportion of children without cavities. Another large study in England, [published in January 2024](#), also finds “very small positive health effects” to water fluoridation.

In comparison, older studies show a greater benefit.

A [2015 Cochrane review](#) of 155 studies finds water fluoridation reduced the average number of decayed, missing, or filled children’s primary teeth by 35%. It reduced the average number of decayed, missing or filled permanent teeth by 26%.

A [2018 study](#), published in the Journal of Dental Research finds that children who lived in counties where 75% or more of the water supplies were fluoridated had 39% fewer cavities in their baby teeth than those who lived in less fluoridated communities. Older children had 12% fewer cavities in their permanent teeth.

A [1990 study](#) published in the Journal of Dental Research, which looked at trends between 1979 and 1987, finds that children’s dental cavities decreased by 36% over the same period. And by 1987, about half of the children didn’t have any cavities in their permanent teeth.

The [study also finds](#) that children who had always been exposed to fluoridated community water had 18% fewer cavities than those who had never lived in fluoridated communities.

Water fluoridation has also been associated with a 20% to 40% reduction of enamel cavities in adults, according to a [1989 review](#) published in the Journal of Public Health Dentistry.

A [2007 meta-analysis](#) of 20 studies finds water fluoridation was linked with a 27% reduction in dental cavities among adults.

It’s important to note the studies don’t draw a cause-and-effect conclusion between the reduction in cavities and water fluoridation. However, they emphasize that water fluoridation has played a role in the decline.

“At present, there are many unanswered questions regarding the reasons for the continued downward trends in dental caries in U.S. children, but there can be little doubt that for this decline to be maintained, fluoride-based prevention must be continued,” write the authors of the [1990 study](#).

In 2015, on the 70th anniversary of U.S. community water fluoridation, U.S. Surgeon General Vivek Murthy wrote in the journal [Public Health Reports](#), “Community water fluoridation is one of the most practical, cost-effective, equitable, and safe measures communities can take to prevent tooth decay and improve oral health.”

9. How many people have access to fluoridated water?

By 1969, 44% of the U.S. population was receiving fluoridated water or about 88,475,684 people.

By 1985, this percentage increased to 55%, or 130,172,334 people. By 2000, this percentage was 57%, or 161,924,080 people, according to a [2015 study](#) published in the journal Public Health Reports.

According to the [latest available data](#) from the CDC, in 2022, more than 209 million people, or 72.3% of the U.S. population served by public water supplies, had access to water with fluoride levels that prevent tooth decay.

The CDC’s [Water Fluoridation Statistics](#) page also breaks down the numbers by state. You can find [historical fluoridation statistics here](#).

Although the proportion of the U.S. population drinking fluoridated water increased rapidly between 1945 and the 1970s, the rate has slowed down since.

The authors of a [1999 article](#) in the CDC’s Morbidity & Mortality Weekly Report attribute the trend to several factors.

The public, some scientists and policymakers no longer view dental cavities as a public health problem or don't believe that fluoridation is necessary or effective.

Also, as evident today, nearly 25 years since the MMWR article was published, adopting water fluoridation can require a political process, which can make implementing public health measures difficult.

Other factors include unsubstantiated claims about adverse health effects of fluoridation, and cost, especially in small communities with limited budgets, according to the 1999 study.

10. How much fluoride is in my community's water?

The CDC's [My Water's Fluoride](#) is a great source of information to find out whether a community water system in the U.S. is fluorinated. It also includes information about community fluoride levels. In cases where that information is not provided, you can check with your local government.

The site also includes [State Fluoridation Reports](#), which include average fluoride levels by month.

A [2023 study](#), published in the Journal of Exposure Science & Environmental Epidemiology, finds that between 2006 and 2011 about 4.5% of community water systems in the U.S. had an average fluoride concentration exceeding 1.5 mg/L, while 15.4% had levels higher than 0.7 mg/L. These trends were especially true for water systems that served semi-urban Hispanic communities and communities in the Southwest U.S., researchers find.

11. Is water fluoridation cost-effective?

Water fluoridation can save individuals and communities money by preventing tooth decay, older studies have shown.

For communities of 1,000 or more people, the return on investment is \$20 for every dollar spent on water fluoridation, according to a [2016 study](#) published in the journal Health Affairs. The return on investment increases and the community size increases, the study finds.

A [2005 study](#) of community water fluoridation programs in Colorado, including 172 public water systems that served 1,000 people or more, finds that one year of exposure to fluoridated water resulted in average savings of \$60 per person.

A [2015 federal study](#) finds that the annual per-person cost varied by the size of the water system ranging from \$0.50 in communities of \$20,000 to \$3.70 for communities of 5,000, updated to 2010 dollars using the Consumer Price Index — only a fraction of the cost of one dental filling.

Tooth decay is one of the most common chronic diseases among children in the U.S. About a quarter of children living below the federal poverty level have untreated tooth decay, [according to the CDC](#).

Nearly half of children between ages two and 19 had untreated or treated dental cavities in one or more of their primary or permanent teeth, according to the CDC's [National Center for Health Statistics](#).

12. How does fluoridation help address health disparities?

Children living in families with low incomes were twice as likely to have decay in their primary teeth compared with children in families with high incomes, according to the CDC's [Oral Health in America](#) report, published in 2021. In addition, Black and Mexican-American children are more likely to have tooth decay compared with their white counterparts, [according to the report](#).

Some studies suggest the potential for water fluoridation to reduce inequalities, while more recent studies have found the impact to be [inconclusive](#).

A [1999 study](#) on 5-year-old children in England, published in the International Journal of Epidemiology, finds that

water fluoridation not only reduced dental cavities but also lessened social inequalities in dental health.

A February [2020 study](#) of 2,075 adolescents in North Carolina, published in the International Journal of Environmental Research and Public Health, finds no effect of community water fluoridation on racial disparities. However, researchers find that in communities that had no water fluoridation, the parents' education made a difference. Children whose parents had lower education levels had a higher risk of dental cavities.

A [2017 study](#), published in the Journal of Public Health Dentistry, finds that income-based disparities in dental cavities among U.S. children and adolescents remained largely unchanged between 1988 and 2014, reflecting the limited impact of public health initiatives targeting these inequalities.

In addition to the lack of research on the impact of fluoridation on dental disparities, “there have been other note-worthy changes during the period that may have exacerbated disparities in dental caries, such as the increased prevalence of obesity, greater consumption of bottled water and increasing public mistrust in the safety of tap water,” the [authors write](#).

13. What happens when fluoride is removed from the water supply?

Only a few studies have explored the after-effects of fluoride removal, and they show an increase in the number of cavities among children once water fluoridation stops. Meanwhile, there is no definitive data from Oregon, which is the [third-least-fluoridated state](#) in the U.S.

Calgary, Canada, which took out fluoride from the city water in 2011, is putting it back in, following a [rise in dental cavities](#) among children, [reported The Sunday Times](#) in early December.

In Juneau, Alaska's capital city, which removed fluoride in 2007, the prevalence of dental cavity procedures increased, according to a [2018 study](#) published in BMC Oral Health. For instance, children younger than 7 who lived in areas without fluoridated water needed about 34% more dental procedures than children in areas with fluoridated water. That's the difference of 2.68 dental procedures versus 2.01 procedures.

A [1989 review](#) of research, published in the Journal of Public Health Dentistry, aims to find out whether water fluoridation is still effective or necessary given the continued decline of dental cavities in children.

The review highlights the case of Antigo, Wisconsin, which began water fluoridation in 1949 and stopped in 1960, only to start again in 1965.

The prevalence of cavities “increased remarkably (about 100 percent) between 1960 and 1966,” according to [the review](#). “Similarly, in Wick, Scotland, which started water fluoridation in 1969 but stopped it in 1979, the caries prevalence in 5- to 6-year-old children increased by 27 percent between 1979 and 1984, despite a national decline in caries and increased availability of” dental products like toothpaste with fluoride.

“The data reviewed here and elsewhere (5,872) document both the past and present effectiveness of water fluoridation in consistently lowering the level of caries prevalence,” the [review concludes](#).

There's not enough evidence to decide what happens if communities stop fluoridating their water.

The [October 2024](#) study finds that the benefits of fluoridated water may be smaller than it was before the widespread use of fluoride toothpaste. At the same time, there's not enough evidence to decide what happens if communities stop fluoridating their water supply or how it could affect disparities. The review found no reliable studies on whether fluoridation had an impact on adult dental cavities.

14. What happens if you consume too much fluoride?

Excessive fluoride intake [typically occurs](#) through drinking groundwater that has high levels of fluoride, and when high-fluoride water is used in cooking or irrigation of crops.

Excessive fluoride intake has been associated with [dental fluorosis](#), which leaves white streaks or spots on teeth in its mild form. In severe form, dental fluorosis can cause brown or gray discoloration of teeth.

It can also lead to a bone disease called [skeletal fluorosis](#). Consuming high levels of fluoride can lead to its accumulation in bones over time, changing the structure and density of the bones.

Excessive levels of fluoride have also been associated with lower IQ in children in some studies, although this association [warrants additional research](#).

The [odds of developing dental fluorosis](#) with a water fluoride concentration of 0.7 mg/L is about 12%. Those odds increase by 2.9% as fluoride levels increase by 1 mg/L. The odds of developing dental fluorosis is 72% when the water fluoride concentration is 4 mg/L.

15. Is fluoride in water safe?

Since the 1950s, opponents of water fluoridation have shared unsubstantiated claims linking it with an increased risk for cancer, Down syndrome, heart disease, bone loss, low IQ, Alzheimer's disease, and allergic reactions, among others.

There's yet to be [any credible evidence](#) to support an association between fluoridation and these conditions.

The main documented risk of community water fluoridation is [dental fluorosis](#), a cosmetic change in dental enamel, mostly in the form of visible white markings on teeth.

As Dr. Katelyn Jetelina, an epidemiologist and the author of the popular Substack [Your Local Epidemiologist](#), puts it: "The dose makes the poison."

"Very high levels of fluoride can be dangerous," [she writes](#). "Fluoride toxicity first impacts the skeletal bones, beginning at an exposure of 5 mg/kg of body weight per day. If we do the math, the average child (40 kg) must drink 286 liters of fluoridated water daily to reach toxicity. At that point, they would die from water overconsumption."

Here's what research says about the link between fluoride and various conditions:

Thyroid function: [Jetelina points](#) to a [meta-analysis of 27 studies](#), published in the journal Environmental Research, that finds thyroid hormone levels began to increase when water fluoride levels were about 3.5 times higher than the 0.7 mg/L that's added to water systems.

Children's IQ: Exposure to high levels of fluoride over a long period of time [has been linked](#) to lower IQ scores in children, according to research mostly conducted outside the U.S.

A systematic review and meta-analysis of 74 studies, published in [January 2025 in JAMA](#), finds a drop in children's IQ points as exposure to fluoride increases. The authors write that "There were limited data and uncertainty in the dose-response association between fluoride exposure and children's IQ when fluoride exposure was estimated by drinking water alone at concentrations less than 1.5 mg/L." They call for additional research. All studies included in

the systematic review were conducted outside the U.S.

An August 2024 [systematic review](#) of published scientific literature from non-U.S. countries, including Canada, China, India, Iran, Pakistan and Mexico, finds that higher levels of fluoride exposure, including water containing more than 1.5 milligram of fluoride per liter of water, are associated with lower IQ in children. The 1.5 mg/L is more than twice the optimal 0.7 mg/L standard in the U.S.

A report by the U.S. HHS' [National Toxicology Program](#) notes there wasn't enough data to show if the 0.7 mg/L level of fluoride has a negative effect on children's IQ.

"An association indicates a connection between fluoride and lower IQ; it does not prove a cause and effect," according to [the report](#). "Many substances are healthy and beneficial when taken in small doses but may cause harm at high doses. More research is needed to better understand if there are health risks associated with low fluoride exposures."

A [2023 meta-analysis](#) published in the journal Public Health finds that community water fluoridation at the current recommended levels does not negatively impact children's IQ. However, further research is needed to better understand fluoride's effects in areas with high exposure levels and to address methodological weaknesses in existing studies, according to the authors.

A [2022 long-term study](#) of 15,793 Australian schoolchildren, published in the Journal of Dental Research, finds that fluoridated water doesn't affect the emotional and behavioral development of the children. The study was conducted between 2012 and 2014 at baseline. Its follow-up was from 2019 to 2020.

A 2019 [study of 161 children](#) in Mexico between May and December 2017 also finds no evidence that fluoridated water affects children's IQ.

But a California judge [ruled in September](#) that the current optimal level of fluoride in drinking water — 0.7 milligrams of fluoride per liter of water — "poses an unreasonable risk of reduced IQ in children."

"Unless EPA appeals the ruling, it must initiate a rule-making to further evaluate the risk," according to an [E&E News](#) by POLITICO article written by Miranda Willson on Nov. 18. The article adds that a nationwide push to get rid of fluoride through EPA policies would probably take more than four years.

In response to the California district court ruling, the American Dental Association [issued a statement](#), noting that the ruling "provides no scientific basis for the ADA to change its endorsement of community water fluoridation as safe and beneficial to oral health."

The association also [urged](#) its members and the public "to be cautious of 'pseudo-scientific information.' This information is not always based on research conducted according to impartial and evidence-based scientific methodology; and the conclusions drawn from research are not always scientifically justifiable or without bias."

Pregnant women: A study published in [May 2024](#) in JAMA Network Open, has linked the consumption of fluoride by pregnant moms to neurological conditions in their children by age 3 or 4. Another study in Canada, [published in 2019](#), also shows an association; however, that study has [received criticism](#) for its methodology.

Dr. Christine Till, the author of the 2019 study, is among the researchers who maintain that there's enough evidence to suggest that pregnant women should try to limit their fluoride intake, according to a [recent article](#) in The New York Times.

Meanwhile, a [scoping review of 95 studies](#) published in February 2023 in the journal Advances in Nutrition, which looks at the relationship between iodine and fluoride in pregnancy and maternal thyroid function and a child's neurodevelopment, draws no specific conclusion and recommends more research to develop future recommendations for iodine intake and fluoride exposure for pregnant women.

Chronic kidney disease: A [2007 review](#), published in the journal Nephrology Dialysis Transplantation, finds no association between water fluoridation and chronic kidney disease.

“The poor evidence quality and deficient methodological rigor of the identified studies means that no definitive conclusions regarding the association between consumption of optimally fluoridated community water and CKD can be made,” the authors write.

Cancer: The [American Cancer Society provides](#) a comprehensive review of research on the link between fluoride and cancer, which together show “that there is no strong evidence of a link between water fluoridation and cancer,” according to the organization. “However, several of the reviews noted that further studies are needed to help clarify the possible link.”

A [systematic review of 14 studies](#), published in the journal Bone in November 2024, finds no clear link between fluoride and primary bone cancers. The authors note that most of the studies, however, were low quality and there’s a need for more robust studies.

A [2000 systematic review](#) of 214 studies, published in the BMJ, also found no clear evidence of potential negative effects of water fluoridation, aside from dental fluorosis.

“As always, the dose makes the poison, and the benefits of adding the small, recommended amount of fluoride to public water supplies have been shown to far outweigh any risks at the community level,” writes [Dr. Katrine Wallace](#), an epidemiologist and adjunct assistant professor at the University of Illinois Chicago, in a [MedPage Today opinion](#) piece. “The challenge ahead will be quieting the disinformation and encouraging continued use of a proven public health measure.”

Fluoride in water: A research roundup and reporting tip sheet

To help journalists with their reporting, we read through dozens of published research papers and unpacked several recent studies about fluoride in water.

by [Naseem S. Miller](#) | December 17, 2024

Several U.S. [communities](#) are debating whether to remove fluoride from their water supplies in the wake of comments by President-elect Trump's Health and Human Services nominee Robert F. Kennedy Jr., who [called the mineral](#) an "industrial waste," looking to remove it from water systems across the nation once Trump takes office.

Local journalists who may find themselves covering this topic will likely hear arguments from both sides. A good question to ask to inform your reporting is, "What does the research say?"

To be sure, there are still unanswered questions about water fluoridation in modern times and many researchers have called for better studies. At the same time, there's little evidence that fluoride is harmful at low levels.

We have unpacked five recent studies, including systematic reviews, followed by a list of additional research.

Before selecting these studies, we read through dozens of published research papers, which paint a complex and evolving picture of the water fluoridation debate. Here are some of the main takeaways from recent studies:

The prevalence of dental cavities has decreased in recent decades, thanks to the widespread use of fluoride toothpaste and mouthwash, so the benefit of water fluoridation may be less pronounced today than it was in years after the programs were implemented in 1945.

Evidence for the benefits of water fluoridation is largely based on older studies, many of which were conducted before the widespread use of fluoride toothpaste. But this doesn't mean that fluoride is harmful or should be removed from water supplies, researchers note. The per-person cost of fluoridating a water system is a fraction of the cost of one dental filling.

Water fluoridation leads to reductions in dental cavities, especially in children, both in baby and permanent teeth, research finds, especially in earlier studies. But evidence for adults is limited.

The main negative effect of fluoride in water is [dental fluorosis](#), where white streaks appear on teeth.

Some studies show an association between fluoride and harmful health effects, but most of those studies are conducted in areas of the world with exceptionally high fluoride levels, which is not relevant to the U.S., where the fluoride levels in community water supplies are generally low.

Long-term exposure to very high levels of fluoride can lead to adverse health effects, including noticeable discoloration and pitting of teeth, and skeletal fluorosis, a condition that affects bones and joints. Some studies have also shown an association between high fluoride levels with lower IQ in children.

Water fluoridation may reduce dental health disparities, especially for children in lower-income households, although more recent studies have been inconclusive.

The studies consistently identify the consumption of sugary foods and drinks as a leading cause of dental cavities. They highlight how frequent and excessive sugar intake creates an environment in the mouth that favors the growth of bacteria responsible for tooth decay.

There is a need for more, high-quality research on the cost-effectiveness of water fluoridation and the

limitations of previous research to produce more robust evidence for policymakers.

This is a companion piece to [15 common questions about fluoride in drinking water](#).

Some of the journals may be behind a paywall, so be sure to check out our [2023 tip sheet](#) on how to access academic research for free.

Research Roundup

[Water Fluoridation For the Prevention of Dental Caries](#)

Zipporah Iheozor-Ejiogor, et al. Cochrane Database of Systematic Reviews, October 2024.

The study: This paper reviews 157 studies from 1946 to 2023, to evaluate the effectiveness of water fluoridation in preventing dental cavities in people of all ages. To be included, the studies' baseline of fluoridation levels had to be comparable and the studies had to report at least two time points to assess the impact of fluoridation.

The findings:

- The few studies conducted after 1975 show that water fluoridation was associated with a [4 percentage point](#) improvement in the proportion of children without cavities in primary teeth and a 3 percentage point improvement in permanent teeth compared to non-fluoridated areas. (Note that the data is not presented in terms of reduction in cavities.)
- At 0.7 mg/L, the [optimal fluoride level](#) in the water, about 12% of people in the included studies showed dental fluorosis.
- There is not enough information to determine if water fluoridation reduces socioeconomic disparities in tooth decay.
- There's not enough information to understand how stopping water fluoridation affects tooth decay levels.
- No studies on the effectiveness of fluoridation for preventing adult cavities made the researchers' inclusion criteria.

The takeaway: More studies evaluating the effectiveness of water fluoridation for the prevention of cavities are needed, the authors note.

"The implementation or cessation of community water fluoridation requires careful consideration of the current evidence alongside the broader context of a population's oral health, oral health behaviors, diet and consumption of tap water, movement or migration, and the availability and uptake of other caries prevention strategies," they write. "In addition, factors such as acceptability, cost-effectiveness and the feasibility of the implementation and monitoring of a community water fluoridation program should be taken into account."

[2015 United States Public Health Service Optimal Fluoride Level Adherence and Operation Among Adjusting Water Systems in 40 States: 2016–2021](#)

Theresa J. Boehmer, et al. AWWA Water Science, October 2024.

The study: This study evaluates how well U.S. water systems adhere to the 2015 U.S. Public Health Service [recommendation](#) for optimal fluoride levels in drinking water of 0.7 mg/L. Using data from the [Water Fluoridation Reporting System](#), the study examines adherence, data quality and the precision of fluoride level maintenance across 40 states, from 2016 to 2021. The U.S. Public Health Service is part of the Department of Health and Human Services.

The findings:

- Most water systems operated near the USPHS target of 0.7 mg/L, with a mean monthly fluoride level of 0.71 mg/L.
- About 76% of fluoride readings fell within ± 0.1 mg/L of the target.

- Larger water systems serving over 200,000 people showed less fluctuation, with average fluoride levels closer to the target and with fewer deviations. Smaller systems serving 25 to 3,300 people had greater variability, with
- 29.8% of readings exceeding the upper limit of 0.8 mg/L.
- About 16% of reported readings were below the recommended 0.6 mg/L, potentially compromising dental health benefits.

The takeaway: “These findings demonstrate that adjusting water systems are operating consistently and at a greater accuracy,” the authors write. “Water fluoridation recommendations are reviewed as additional research becomes available, particularly on minimum therapeutic dose, balance of benefits and potential harms, user acceptance and satisfaction, and cost-effectiveness.”

[How Effective and Cost-Effective is Water Fluoridation for Adults and Adolescents? The LOTUS 10-Year Retrospective Cohort Study](#)

Deborah Moore, et al. Community Dentistry and Oral Epidemiology, August 2024.

The study: The LOTUS study investigates the effectiveness and financial costs of community water fluoridation in preventing dental treatments and improving oral health among adults and adolescents 12 years and older in England. The research spans 2010 to 2020 and examines outcomes like fillings and extractions; decayed, missing or filled teeth; and treatment costs.

The findings:

- Invasive dental treatments were 3% lower in the optimally fluoridated group (0.7 mg/L) compared with the non-optimally fluoridated group.
- Decayed, missing or filled teeth were 2% lower in the fluoridated group.
- The National Health Service dental treatment costs were 5.5% lower for fluoridated individuals. (NHS is the publicly funded health care system of the U.K.)
- Reductions in dental treatments varied minimally across socioeconomic groups, with no meaningful impact on reducing health inequalities.
- The takeaway: “Receipt of optimal water fluoridation 2010–2020 resulted in very small positive health effects which may not be meaningful for individuals,” the authors write. “Our results support the hypothesis that water fluoridation appears to be producing less dramatic impacts on oral health in contemporary UK populations than in historical studies.”

They add: “The discovery of water fluoridation made an unparalleled contribution to oral health in the 20th century. In the 21st century, greater impact may be achieved by advocating for upstream, policy-level action to address the commercial determinants of health and create supportive food environments.”

Related commentary: [Investigating the Effectiveness of Water Fluoridation](#)

Darshini Ramasubbu, Jonathan Lewney and Brett Duane. Dental Public Health, July 2024.

[Community Water Fluoridation Levels To Promote Effectiveness and Safety in Oral Health—United States, 2016—2021](#)

Theresa J. Boehmer, Srdjan Lesaja, Lorena Espinoza and Chandresh N. Ladva. Morbidity and Mortality Weekly Report, June 2023.

The study: This study examines trends in community water fluoridation levels across the U.S. from 2016 to 2021. It evaluates how fluoridation levels align with federal recommendations of 0.7 mg/L to prevent cavities while ensuring safety.

The findings:

- More than 70% of the U.S. population served by public water systems had access to optimally fluoridated water

during this period. A total of 4,080 community water systems safely fluoridated water 99.99% of the time with levels below the [secondary safety standard](#) of 2.0 mg/L, a level set by the Environmental Protection Agency to protect public health. Meanwhile, suboptimal water systems in which fluoride concentrations are below 0.6 mg/L are ineffective in supporting the oral health of their communities.

- Fluoridation levels varied by state and region, with some states achieving significantly higher rates than others.
- Many communities maintained fluoride concentrations consistent with the federal recommendation of 0.7 mg/L for balancing effectiveness and safety in preventing tooth decay.

The takeaway: Community water fluoridation remains a widely adopted and effective public health strategy for preventing tooth decay.

[Evaluation of Water Fluoridation Scheme in Cumbria: the CATFISH Prospective Longitudinal Cohort Study](#)

Michaela Goodwin, et al. Public Health Research, Nov. 2022.

The study: This study evaluates the impact of reintroducing water fluoridation in Cumbria, England, on children's dental health, and its cost-effectiveness. Researchers followed two cohorts: Children born between 2014 and 2015, who were exposed to fluoridated water from birth until age 5. And children who were 5 years old in 2013 and 2014 and were followed until they were 11 years old.

The children were either in a control group or an intervention group. The control group included children who lived in East Cumbria and did not receive fluoridated water. The intervention group included children who lived in West Cumbria and received fluoridated water through their water treatment plants.

The findings:

- Among the birth cohort, 17.4% of children in fluoridated areas had tooth decay compared with 21.4% in non-fluoridated areas, indicating a modest benefit.
- For the older cohort, decay rates were slightly lower in fluoridated areas — 19.1% vs. 21.9%.
- Fluoridation is likely cost-effective because it decreases the need for expensive dental treatments.
- There were no significant differences in the effect of fluoridation observed across socioeconomic groups.
- The takeaway: “We suggest that, where prevalence is low, consideration should be given to targeted approaches that may be as or more effective, as this may attract less criticism from those who believe that [water fluoridation] is an inappropriate intervention,” the authors write. “Such targeted approaches may include modification of known risk factors, such as sugar consumption, rather than relying on the biopharmaceutical effect of fluoride alone.”

They add: “The ‘silver bullet’ approach that was effective in the 1950s is failing to address dental caries in the most deprived populations and, hence, a hybrid approach with behavioral elements should be considered.”

Additional reading

[A Systematic Review of Fluoride Contamination in Water Resources of Iran from 2016 to 2023: Spatial Distribution and Probabilistic Risk Assessment](#)

Danial Nayeri, Hadis Elyasi, Ali Jafari and Mohammad Rezvani Ghalhari. Biological Trace Element Research, October 2024.

[Association Between Fluoride Intake From Drinking Water and Severity of Dental Fluorosis in Northern and Western Mexico: Systematic Review and Meta-Analysis](#)

José Gamarra, et al. BMC Oral Health, June 2024.

[Oral Health of Women and Children: Progress, Challenges, and Priorities](#)

Jayanth Kumar, James J. Crall and Katrina Holt. Maternal and Child Health Journal, July 2023.

[The Fluoride Debate: The Pros and Cons of Fluoridation](#)

Antoine Aoun, Farah Darwiche, Sibelle Al Hayek and Jacqueline Doumit. Preventive Nutrition and Food Science, September 2018.

[Debater Water Fluoridation Before Dr. Strangelove](#)

Catherine Carstairs. American Journal of Public Health, August 2015.

[Dental Caries \(Cavities\): Community Water Fluoridation. Systematic Review](#)

The Community Preventive Services Task Force, April 2013.

[Effectiveness of Fluoride in Preventing Caries in Adults](#)

S. O. Griffin, E. Regnier, P. M. Griffin and V. Huntley. Journal of Dental Research, May 2007.

[Dental Caries and Dental Fluorosis at Varying Water Fluoride Concentrations](#)

Keith E. Heller, Stephen A. Eklund, Brian A. Burt. Journal of Public Health Dentistry, April 2007.

[Systematic Review of Water Fluoridation](#)

Marian S. McDonagh, et al. The BMJ, October 2000.

[Achievements in Public Health, 1900-1999: Fluoridation of Drinking Water to Prevent Dental Caries](#)

MMWR, October 1999.