Public Meeting of the

President's Council of Advisors on Science and Technology (PCAST)

March 24, 2022

Meeting Minutes

Meeting Participants

PCAST Members

1. Frances Arnold, Co-Chair
2. Francis Collins, Co-Chair
3. Maria T. Zuber, Co-Chair
4. Marvin Adams
5. Dan E. Arvizu
6. John Banovetz
7. Ash Carter
8. Frances Colón
9. Lisa A. Cooper
10. John O. Dabiri
11. William Dally
12. Sue Desmond-Hellmann
13. Inez Fung
14. Andrea Goldsmith
15. Laura H. Greene
16. Paula Hammond
17. Eric Horvitz
18. Joe Kiani
19. Jon Levin
20. Steve Pacala
21. Saul Perlmutter
22. William Press
23. Penny Pritzker
24. Jennifer Richeson
25. Vicki Sato
26. Lisa Su
27. Kathryn Sullivan
28. Terence Tao
29. Phil Venables
30. Catherine Woteki

PCAST Staff

1. Anne-Marie Mazza, Executive Director
2. Reba Bandyopadhyay, Deputy Executive Director
3. Sarah Domnitz, Deputy Executive Director and PCAST Designated Federal Officer
4. Kevin Johnstun, Research Analyst

Invited Speakers (in order of presentation)

1. Dustin Gardner, Ventura County Fire Department
2. Sean Triplett, National Interagency Fire Center
3. Deborah Sivas, Stanford University

4. Rod Linn, Los Alamos National Laboratory
5. Consuelo Wilkins, Vanderbilt University
6. Arthur (Skip) Lupia, University of Michigan
7. Jessica Hullman, Northeastern University
8. Kathleen Hall Jamieson, University of Pennsylvania

START DATE AND TIME: THURSDAY, MARCH 24, 2022, 1:00 P.M.

LOCATION: The National Academies, 2101 Constitution Avenue NW, Washington, D.C.

WELCOME

PCAST Co-chairs: Frances Arnold, Francis Collins, Maria Zuber

The PCAST co-chairs called the meeting to order – Frances Arnold, California Institute of Technology; Francis Collins, Acting Science Advisor to the President; and Maria Zuber, Massachusetts Institute of Technology. Arnold noted that the meeting was immediately preceded by a conversation with Vice President Harris and, in January, a meeting with President Biden. She introduced and welcomed Collins—the newest member to PCAST. He affirmed his support for PCAST and its clear goal to develop and articulate actionable recommendations to benefit the American public.

Detecting, Tracking, Mitigating, and Preventing Wildfires

Zuber opened the session by commenting that one of the many deleterious impacts of the changing climate is an increase in extreme events. Wildfires are one such example, and events in Australia, California, Colorado, and most recently in Texas, underscore that unplanned fires are becoming more frequent and more damaging. President Biden toured the aftermath of the devastating fire in December near Denver, CO that illustrated that fire season in many areas now occurs year-round rather than seasonally.

According to the U.S. drought monitor, 85 percent of the Western United States is suffering through drought conditions, and almost half of the region is in extreme or exceptional drought following years of dry, hot conditions aggravated by climate change. The Southwest is suffering through the driest period since the 1500s, according to a study published in *Science* last year. To address this problem, PCAST convened experts to inform them on the nature of the problem and what can be done.

Dustin Gardner, Ventura County Fire Department

Dustin Gardner described the current state of wildfires in the American Southwest as growing in number, frequency, and severity, and exacerbated by an increasingly hot climate, more frequent drought conditions, more damaging winds, and stronger and more frequent storms, including tornadoes. In the last decade, over 50,000 structures have been destroyed by fires in the west, hundreds of lives have been lost, and the financial impact has been in the hundreds of billions of dollars.

In California, eight of the largest fires since 1932—when records began to be kept—have occurred in the last four years.

Gardner suggested that PCAST could help by addressing three main needs:

1) Early detection of fires: Most fires that occur in the west begin during weather conditions that are hot, dry, and windy, and most fire devastation, death, and destruction occurs in the first 12 hours of a firefight. Thus, early detection is critical. A number of parties need information early, including firefighters, police, emergency medical personnel, emergency managers, policy makers, elected officials, and the public. In Southern California, the 10 million residents with cell phones helps speed detection, but detection is more challenging in remote areas, and science and technology may have a role to play in detection in these areas.

2) Tracking resources: Despite the ability to easily order items on a cell phone and have them arrive on one's doorstep the next day, Gardner's fire department is using a resource ordering system that was designed in the 1940s mainly to move military equipment. It can take two days just to process the department's order for equipment. Improved tracking of firefighters is a serious need as well. This applies to tracking one's own team of firefighters and tracking firefighters in nearby teams. Gardner said that not knowing where one's firefighters are while fighting a fire can be unbearable, and this kind of tracking should be possible given the ubiquity of GPS.

3) Monitoring fires: Having the ability to monitor fires, forecast their growth, and then share that information with fire ground commanders, emergency responders, emergency managers, and the public would improve awareness, decision making, and help with moving people out of harm's way. Gardner noted the challenges of monitoring fast-moving fires, mentioning one fire that forced over 100,000 to flee as it traveled 14 miles in one night. Tracking that fire was hampered by high winds that grounded helicopters.

Sean Triplett, National Interagency Fire Center

Sean Triplett observed that for years there have been wildfires in Alaska, the Pacific Northwest, the Southwest, and even on the East Coast of the United States. The population in these areas continues to expand, however, and more homes are being built, many at the wildland–urban interface. Similar to Gardner's comments, Triplett mentioned that the environment has become drier and more subject to large fires. Triplett also noted that the traditional "fire season" lasting several months has expanded to a nearly continuous "fire year." Trying to respond to the increased need has stretched resources thin and exhausted professional firefighting personnel.

Detecting and tracking wildfires involves a system of surveillance that relies on government and commercial satellites and aircraft mapping the perimeters of active fires. There also are extensive networks of fixed cameras that provide multiple views of at-risk wildland to help identify new fires, as well as mobile systems that can travel with a fire as it moves. This information can be fed into a

firefighter's mobile device so the firefighter can track not only the fire movement but also nearby resources, weather developments, and potential escape routes.

Despite the large amount of data collected, development of effective means to provide firefighters on the ground with this information has not kept pace. In many places, the communications infrastructure is several decades old—mainly push-to-talk devices that do not have the bandwidth required to share information efficiently. Another part of the problem is that there are multiple agencies responding to fires so there are many different types of tracking devices, and they can't communicate with each other. So an immediate need is to build standards and integration capabilities for these devices.

Triplett commented that operationally the various agencies work very well together, but that does not carry over to the various jurisdictional parameters--budgets, data management practices, and agency policies and programs. Triplett stated that the National Wildfire Coordination Group's geospatial subcommittee created an online interchange standard for wildfire perimeter sharing which received over 3 billion hits in 2021 from the public and firefighting organizations for sharing and updating information about real time fire locations. He explained that a number of agencies are involved in supporting training and coordination across agencies to better understand the fire environment – NASA, NOAA, DOE, USGS, the National Guard through the FireGuard program, as well as partners in academia and the private sector. Ultimately, Triplett said, the goal is to have a nationally integrated system. For example, the Colorado Multi-Mission Aircraft program operates two video-equipped aircraft that can fly over fires to capture real-time information on the ground. These aircraft can monitor up to 300,000 acres, which is a relatively small footprint of the typical major wildfire, but it is still a useful tool. Ideally, the information collected from these aircraft would be integrated into a national system that could alert other systems, firefighters, and the public to improve situational awareness for all.

Triplett closed by saying that while a mature and robust fire detection and tracking system has been developed that can gather a lot of information that is important to share with decision makers, the information-sharing process needs to be improved through the development of standard data practices, better intelligence tools, and more usable forecasting techniques. Information must be formatted in digestible pieces that can be received and used by firefighters with mobile devices in the field or by emergency managers working in operations centers.

Deborah Sivas, Stanford University

Deborah Sivas discussed planning for the future of wildfires in terms of minimizing risks, reducing adverse outcomes, and gaining consensus on a long-term strategy. She described several areas where she said there already is consensus and areas where controversy remains.

Sivas said there are several issues pertaining to wildfires where there seems to be consensus. Forest management has been focused on suppression for the past 75 to 100 years, and there is general consensus that that approach has resulted in increased fuel loads in many forested areas. Over the years, the risks have increased also in part because the climate in the American West has become hotter and drier, and water has become more scarce. Smoke is also a major factor to keep in mind due to its deleterious effects on health. Many of the communities most affected by smoke are communities of color and low-income communities. Finally, there is consensus that the hardening of structures to resist

the effects of fire is a positive strategy, including building defensible space around structures, although this can be expensive and therefore difficult to implement.

Sivas also discussed several areas of controversy. For example, there can be local litigation on fuel management and the best way to reduce or eliminate the vegetation that serves as fuel for wildfires. If private companies are involved in thinning forest vegetation, management of merchantable timber also becomes an issue because it can mean removal of mature trees that keep the forest cooler and moister, while leaving intact the vegetation that fuels fires. Prescribed burning is also becoming more prevalent, which requires resources and personnel to ensure that the intentional fires do not burn out of control, so there can be differing opinions about how to implement this without threatening the safety of communities. There are also differing opinions about when to let a naturally-occurring fire burn versus managing it. Another area of controversy is post-fire salvage logging, which can result in litigation among stakeholders and commercial interests with various claims. Furthermore, there is lack of agreement about whether intensive post-fire logging reduces or increases fire risk.

Sivas said controversy also extends to construction. New construction typically has to meet rigid fire protection requirements, but millions of older structures don't meet those standards, and it is expensive to harden those structures. Finally, post-fire rebuilding presents additional controversy in terms of whether homes should be rebuilt in areas after they have burned.

Sivas offered three suggestions to PCAST: First, one size does not fit all needs. Different solutions will be needed for urban, wildland–urban interface, and back country areas. Second, as increased funding from federal- and state-level sources becomes available and decisions are made about how to allocate that funding, such as to firefighting resources and hardening homes, thought should also be given to allocating funding to protect vulnerable populations, such as children and underserved communities, from smoke inhalation. Third, regulatory reform should be reviewed to include consideration of prescribed burning and guidance on environmental review procedures.

Rod Linn, Los Alamos National Laboratory

Rod Linn said a significant body of research exists on fire and combustion characteristics, but wildfire modeling remains challenging. One reason for this is the large spatial and temporal range of the phenomena that drive wildfires, from ignition of individual fuel particles to changing weather. No single model can capture all of the characteristics; different models focus on different elements of the temporal and spatial spectrum. Furthermore, the environment is complex with a wide range of available fuels. Wildland fires are also quite variable, from relatively low risk fires that are easy to control, to intense fires with strong drivers such as high winds, difficult topography, and very dense and continuous fuels. And different parts of the same fire may exhibit different behaviors.

Linn explained that there are a number of models available. They range from empirically-derived, simple models, some of which are table-based or chart-based, to high-performance computing-based models. Some were developed as far back as the early 1970s, while some newer models have now been coupled to weather models so they can capture the movement of a frontal system or thunderstorm, which can change fire behavior. There are tradeoffs between the different types of models. For example, sometimes there will not be enough time to wait for a high-performance

computing model to run, while other times the detail of a high-performance model is needed. The next generation of fire prediction strategies will link models that forecast the behavior of fires with planning evacuations. Prescribed fires are another opportunity for advancements in wildfire modeling. Prescribed fires are not simply solitary fires that are lit and ignored but rather they involve planning for a complex ignition scheme that takes vegetation and topography into account along with smoke management and the risk of loss of control.

Linn closed with a list of issues demonstrating that wildland fire modeling is a multidisciplinary exercise involving various aspects of natural science, computer science, AI, machine learning, and smoke modeling. Advanced modeling will require advanced data sets, including an understanding of the three-dimensional structure of the vegetation. And finally, wildland fire science advancement must be done in cooperation with the wildland fire management community.

Zuber Moderated the Q&A and Discussion Between PCAST Members and Gardner, Triplett, Sivas, and Linn

Improving Scientific Communication

Collins introduced the session noting that despite significant scientific evidence supporting the acceptance of vaccines to prevent or ameliorate COVID-19 infection, over 50 million Americans have yet to receive a first vaccine dose out of concern about its safety and effectiveness. Collins indicated that PCAST might have a role to play in assisting the government in thinking about the most effective ways to communicate about scientific and health information.

Arthur Lupia, University of Michigan

Arthur Lupia commented that simply citing accurate scientific data as a means to educate a population is not sufficient. For example, Hurricane Ida was a powerful and damaging event in August 2021 that was accurately predicted by the National Oceanographic and Atmospheric Administration (NOAA) in terms of its strength and trajectory. When NOAA released a warning about the storm's danger, it was ignored by many people. As a result, it was much more deadly and damaging than it should have been. Similarly, the announcement of mRNA vaccines as an effective measure against COVID-19 met resistance by many in the public, thus prolonging the pandemic. Social media misinformation, some inaccurate press coverage, private individuals hyping unproven "cures," and conspiracy theorists negatively affected public perception. The federal government also was not consistently effective in communicating the science supporting the safety and efficacy of the vaccines.

Lupia went on to describe a communications scheme he called "Fidelity First," which is an approach the government could follow in crafting credible and effective public communications strategies. Fidelity First builds on scientific findings about how people learn, and it builds on President Biden's memorandum, "Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking."

Human attention capacity is limited, according to Lupia, and the competition for an individual's attention is intense. To gain the public's attention, scientific information should have immediate

relevance to a person's core concerns. Second, the information must be consistent with the person's values. Third, it should be actionable so as to motivate individuals to remember more about the information. In addition to securing people's attention, information must have credibility, which is bestowed by those receiving the information. Credibility is not inherent - it is the outcome of an assessment made by the person who is receiving the information whether or not to pay attention. What really affects the credibility of a source is perceived common interest multiplied by perceived relative expertise. The key word is "perceived," because perceptions carry the day.

An example of damage to the credibility of government science is "Sharpiegate," in which Hurricane Dorian's forecasted track shown on a poster board was altered with a Sharpie pen to suggest that Alabama would be affected, which reduced scientific fidelity and impacted credibility. One way to build or repair credibility is to develop evidence-based policy. Evidence informs but is not sufficient for developing policy. Policy reflects individual values and preferences, morals and ethics, politics, perceptions of freedom and responsibility, competing interests, and more. Making policy without considering these factors would fail to achieve what the nation needs to address its challenges and seize opportunities.

A problem with some scientific communication, including from the government, is that it often presents science combined with advocacy that has moral/ethical or other dimensions, and does so in a way that does not clearly delineate what part of the communication is rooted specifically in the science. This can mislead people about the true meaning of a scientific study and lead to distrust. Therefore, Lupia suggested that the federal government needs a science communication policy that would assure every American that when a government agency makes a scientific claim, it always puts "Fidelity First." He proposed this "Fidelity First" principle: "All USG science-related communications that include references to scientific content must meet high standards of fidelity to the underlying empirical and theoretical corpus." Each agency could develop its own template for meeting this principle.

Lupia provided a template for how the government could use the "Fidelity First" principle to convey scientific information more effectively:

- For claims that are about scientific research and not its policy implications, statements should be in the form "Study A produced Finding B."
- For claims that include scientific content but are not solely based upon scientific research, statements should be in the form: "Our values are X. Research shows Y. Based on X and Y, we recommend Z."

Consuelo Wilkins, Vanderbilt University

Consuelo Wilkins discussed the COVID-19 Health Equity Workstream at Vanderbilt University, beginning with the key objectives of the program. First, effective communications, especially to those on the front line of health care, including workers beyond those providing clinical care. These include front-line workers who delivered food and nutrition, environmental services, and general information about how to protect against the COVID-19 virus. To be effective in communicating with diverse populations, it was

important at the outset to disaggregate data by race, ethnicity, preferred language, and socio-economic factors.

To illustrate the differences in experience of various populations within one zip code, Wilkins mentioned Nashville, Tennessee, where in an area called Antioch, the population is mainly African American, Hispanic, or Latino; more likely to speak a language other than English in the home; more likely to have been born outside the United States; and more likely to be working, albeit earning less than others. This population, which was most impacted by COVID-19, had different demographics than the overall population of the Nashville metropolitan area. To get information about health care to this group, the message had to be presented differently, and needed to take into consideration the cultural and structural barriers associated with accessing health care and accepting health information, especially when the science did not appear to represent or reflect their community.

The Health Equity Workstream contacted organizations with whom they had long-standing relationships and asked how best to communicate ideas for improving and protecting health and, in the virtual climate, how best to present the information outside of a healthcare setting. The Workstream went directly to the communities and asked how they could help support those communities with information and tools. Early on, the effort was relatively successful in delivering this content using Facebook live events, including discussions/Q&A in languages other than English that were preferred by the community. Frequently asked questions (FAQs), brochures, etc. were developed. The Workstream leveraged local voices in this effort, and offered resources to these organizations at a time when local funding had been reduced or eliminated. Further, the Workstream offered some financial resources to support dissemination of information to local communities.

The COVID-19 research community was working in high gear and producing science, including effective vaccines, at record speeds. The question then arose: how to share this evolving information with the community so that there is community buy-in and trust? The Pfizer and Moderna vaccines had been shown to be about 95% effective. But in a population that had been historically abused and marginalized, left out of clinical treatment opportunities, and denied access to care, credibility had been damaged. In many parts of the community, a positive response to the vaccines' 95% effectiveness did not occur and uptake of the vaccines was lukewarm. To counter this discouraging outcome, the Workstream created a new tool to measure trust in research, specifically intended to assess levels of trust of individuals who had been marginalized historically. Well-educated individuals respond to honesty, fidelity, and the level of competency and credentials in the information provider's CV. Marginalized groups often receive information differently and are influenced by other factors such as whether there is or appears to be a profit motive driving the information, whether there are hidden agendas, or whether there are adequate privacy protections in place.

The Workstream offered two measures: a trust subscale (participants enjoy full and honest disclosure and minimization of risk) and a distrust subscale (researchers lie to induce patient participation, release personal information, and may secretly infect minority research participants). Black, Hispanic and Latinx populations were more likely to believe the latter claim than white participants.

Wilkins closed by recommending a recognition that historical injustices validate the fact that marginalized people have valid reasons to question information. One-size-fits-all approaches to scientific communication do not work, and may widen inequities. Diverse research teams and

mechanisms for funding trusted community messengers (faith leaders, community health providers) are needed. Scientists should be trained in effective communication and cultural humility, present scientific information in a way that considers context and lived experiences, and use multiple modes and languages.

Jessica Hullman, Northwestern University

Jessica Hullman noted that current practice in many government organizations is to present data-driven science that suppresses uncertainty in favor of point estimates, a practice she termed "conventional certitude." She felt that the practice puts public trust in science at risk. As an example, she described the U.S. Census Bureau's 2020 decision to adopt a new disclosure avoidance system based on a technique called differential privacy. Previous methods for protecting private identity information were insufficient as analysis science advanced. Privacy researchers identified a stronger approach to reduce that risk by adding calibrated amounts of noise to data. However, they did not expect what happened – that there was strong pushback from stakeholders who objected to "adding noise to their data." Yet the net effect on the usefulness of the data of employing this new methodology was negligible.

For years, the Census Bureau had implied that the census data was precise even though the data is compiled through a complex pipeline that is subject to many uncertainties and results in population estimates that are reduced to a single digit (point estimates). Members of the public believe that government estimates and estimates from scientific research are more precise than they really are. This is not unique to Census data as is the case for other government reports (e.g., on the budget, jobs, gross domestic product [GDP]) that are presented without efforts to quantify what are often significant uncertainties. The Centers for Disease Control and Prevention (CDC) has proffered point estimates for new COVID-19 infections and deaths when it was known that the input data were of very poor quality. There was massive selection bias for who was getting tested, for example. "Conventional certitude" arises from a perception that uncertainty is too complex for the average person to understand. As trust in science has become politicized, there is a fear that uncertainty will be "weaponized." Yet conveying uncertainty sets up an implicit contract of trust that the information being provided by the agency (or entity) is complete. For example, a forecast of probability of rain contributes to better decision making even if the forecaster is wrong. Hullman's first recommendation was that the government should express uncertainty with all point estimates.

Hullman contended that if perceptions of conventional certitude are changed, there should be a concomitant investment in the strategic communication of uncertainty. From research on uncertainty, it has been concluded that not all formats are equally effective. Saying something is very likely or, on the other hand, doubtful, seems simple and straightforward, but without some quantifiable measure may be too ambiguous to be useful for decision-making. One approach to improving the outcome is to visualize uncertainty, for example as a distribution in place of or along with point estimates. One technique promoted by cognitive psychologists is "frequency framing." A base rate must be combined with information on true positives and false positives and then presented in visual formats, such as an icon array, which allow people to grasp both the absolute and relative aspects of the data being reported. Providing curated stories or scenarios can also help to convey distribution.

It should also be acknowledged that for conveying information and uncertainty, one size does not fit all. It is critical to acknowledge that uncertainty must be integrated at all levels and in targeted presentations for various stakeholders. Not all users are alike in their information needs and aptitude, so information should be provided at different levels of granularity with different emphasis. Data journalists can provide a useful example, as they have modified the way data is presented to help readers internalize that a given point estimate is not "the truth," that there is uncertainty in the numbers. Even so, we should expect that users will tend to suppress uncertainty information.

Hullman suggested several improvements to the presentation of data including explicitly acknowledging transitory uncertainty so that consumers would know that at times they can expect less than complete information. Data could be labeled with a qualitative score to denote how experts judge the value or completeness of certain data sets. It would also be helpful if information providers would publish prior prediction error and calibration information in forecasts. In addition, providers of data have to acknowledge that assumptions are being made, and that often those providing the data cannot quantify how uncertain these assumptions are. Therefore, Hullman recommended that forecasts be labeled as "hypothetical experiment results." Agencies should be forthright in reporting and/or acknowledging all expected forms of error (e.g., non-response and other non-sampling error), not just one type.

Hullman concluded her comments by reiterating the contention made at the outset of her talk that the government should transition to releasing most government data, including Census data, as noisy measurements. This is already detailed in the Census Bureau's unpublished "noisy measurements file," a more forthright depiction of what the Census actually knows. She recommends that "noisy counts" should be released for the benefit of the public for the purpose of normalizing error and in public recognition of error uncertainty. To engender trust in data-driven estimates, science, and the legitimacy of government institutions, government communication must convey sources of uncertainty.

Kathleen Hall Jamieson, University of Pennsylvania

Kathleen Hall Jamieson stated that as part of a panel study of four battleground states conducted in 2020, questions were asked to try to predict the likelihood that those who were initially vaccination-hesitant would ultimately agree to vaccination. The result was that there was a high predictive power for factors that were not specifically related to the COVID-19 vaccine but to other issues; for example, if immunization could be achieved just by contracting the disease, if vaccines contained toxins such as antifreeze, or whether the CDC vaccination schedule was appropriate. That is, basic information about vaccination was more powerful as a predictor for whether an individual would ultimately accept a COVID-19 vaccination than COVID-specific factors.

Jamieson asserted that there is some foundational knowledge that scientific agencies should find ways to communicate, while minimizing public susceptibility to misinformation in relationship to this fundamental knowledge. She provided several recommendations to this end, and noted that similar recommendations also would be applicable to other scientific topics, such as climate change. First, she recommended establishment of a misconception monitoring, prevalence assessment, and response system for health agencies that would build on some existing programs. Second, she proposed making all monitoring, prevalence assessment, and response data available to scholars in real time. Third, she suggested using direct contact with the public to communicate foundational knowledge and bolster

trust. Finally, she recommended auditing the language of public-facing materials from health agencies to flag and fix instances that increase public susceptibility to misconceptions.

Jamieson provided a number of illustrative examples of health agency communication about COVID-19 vaccines to the public, which varied significantly in accessibility and level of detail. She proposed that the monitoring and response system across the agencies could be harmonized and coordinated. The NIH/CEAL iHeard St. Louis project website provides a good model for how to do this. There are numerous opportunities to directly inform the public, for example in the 15-minute post-vaccination observation period, positive, clear, understandable information could be disseminated, focusing on the benefits of vaccination while not over-emphasizing the lower probability adverse outcomes. People need to know vaccines are safe and effective. Jamieson emphasized the importance of using clear and straightforward language that is well-organized and presented in an accessible format.

The language used in public communications should be audited to flag and fix instances that increase public susceptibility to misconceptions, particularly around uncertainty, to avoid misinterpretation of categorical statements like "masks help." A more nuanced and accurate statement would have been "well fitted, high quality masks that are properly used help." The same goes for "vaccines are safe" because when an exception occurs and there is a rare adverse event, it puts all vaccines in question. Similarly, the name of the Vaccine Adverse Event Reporting System (VAERS) implies that events reported are caused by the vaccine and that the causal relationship has been confirmed, rather than as a "sentinel" or an "alert" system that provides "unconfirmed" or "raw" data. In particular, categorical claims should be reviewed, because when there are events that contradict the categorical claim (e.g., a person wearing a mask contracts COVID-19), the public may believe the agencies/scientists were being untruthful, incompetent, or politically-influenced when making those statements.

Collins Moderated the Q&A and Discussion Between PCAST Members and Wilkins, Lupia, Hullman, and Jamieson.

PUBLIC COMMENT

Claude Massot of the Initiative Physique Heuristique Inductive et Déterministe provided two minutes of public comment.

CLOSING COMMENTS

Zuber and Collins provided brief closing comments that emphasized the importance of identifying specific issues brought up during the meeting to which PCAST could uniquely contribute expertise.

MEETING ADJOURNED: 4:30 P.M. Eastern Time

I hereby certify that, to the best of my knowledge, the foregoing minutes are accurate and complete.

Frances Arnold, Ph.D.
Co-Chair
President's Council of Advisors on Science and Technology

Francis Collins, M.D., Ph.D.
Co-Chair
President's Council of Advisors on Science and Technology

Maria Zuber, Ph.D.
Co-Chair
President's Council of Advisors on Science and Technology