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Letter to the Editor

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In Layman's Terms: The Power and Problem of Science Communication

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Abstract

Improved policies for science communication are needed to ensure scientific progress in coming decades. The COVID-19 pandemic illustrated massive gaps in science communication, ranging from masking and social distancing mandates to vaccination requirements. These obstacles compounded the pandemic's tremendous inherent clinical and public health challenges. Although science made immense progress in understanding the virus and designing infection control solutions, society still remains within the pandemic due to flawed understanding, low responsiveness, and widespread misinformation on behalf of the public. Flawed communication plagues national responses not only to the pandemic, but also other long-standing issues such as climate change or nutrition. This Letter proposes a new protocol and framework for effective science communication, designed to educate experts in evidence-based communication, improve public partnership through relatability and modern relevance, and increase empathy and trustworthiness to increase public cooperation. A defined protocol for science communication can ensure that evolving knowledge can tangibly benefit society.

The COVID-19 pandemic exposed a pressing need for improved science communication by illustrating how easily information can be misinterpreted to create confusion or spread misinformation. Science communication can make or break outbreak responses, yet only 1/3 of Americans believe scientists communicate effectively, and the population holds profoundly different views on science-based topics including climate change, evolution, nutrition and yes, vaccinations.[1]

Scientists have mastered communication amongst peers through proposals, publications, and conferences. Discussions within the medical community come easily, as scientists expect colleagues to speak the same language; however, conversing with the public can pose unique difficulties. The advantage of a shared knowledge base disappears as translating complex scientific information into laymen terms is challenging. When they fail to address this gap, scientists appear disconnected and condescending.

The pandemic highlighted countless examples of poor scientific communication, beginning with the masking debate and escalating with vaccine alarmism. Officials initially advised against masking based on incomplete knowledge on the virus and how masks would affect transmission. As more data was generated, public health guidance changed accordingly. However, some people questioned subsequent mask mandates. This illustrates the vitality of teaching the public - including elected officials - about the scientific process and its constant evolution. Guidance changes not because initial recommendations were false, but because experts learned and adapted.

Similarly, poor communication directly impeded the national pandemic response by preventing the prioritization of a national testing strategy incorporating rapid antigen tests. Only recently, 18 months after the lockdown, did federal officials announce a rapid testing initiative. An early focus on PCR-based tests, trusted due to their high individual diagnostic sensitivity, clouded advocacy by experts including Mina *et al.* who argued rapid testing would provide a high-sensitivity national-level public health tool.[2] Experts failed to impress the utility of rapid testing regardless of low individual sensitivity upon the public or governing officials.

Compounded by pre-existing doubts about vaccines based on misleading associations with autism and long-term health detriments, suspicion of government tracking devices, and unacceptable historical racism, alarmism severely interrupted America's quest towards mass immunity. Previous vaccination campaigns demonstrated the value of community-level approaches in enhancing vaccine uptake, yet this approach was not initially taken. When the vaccine was originally released, a third of the American population expressed concern.[3] While some simply stated 'if others get it, I don't need to,' others expressed deep fears - some were understandable and founded in reality while others were based on misinformation, and still other sets of people doubted the safety of a vaccine developed at such a rapid pace. These opinions were intensified

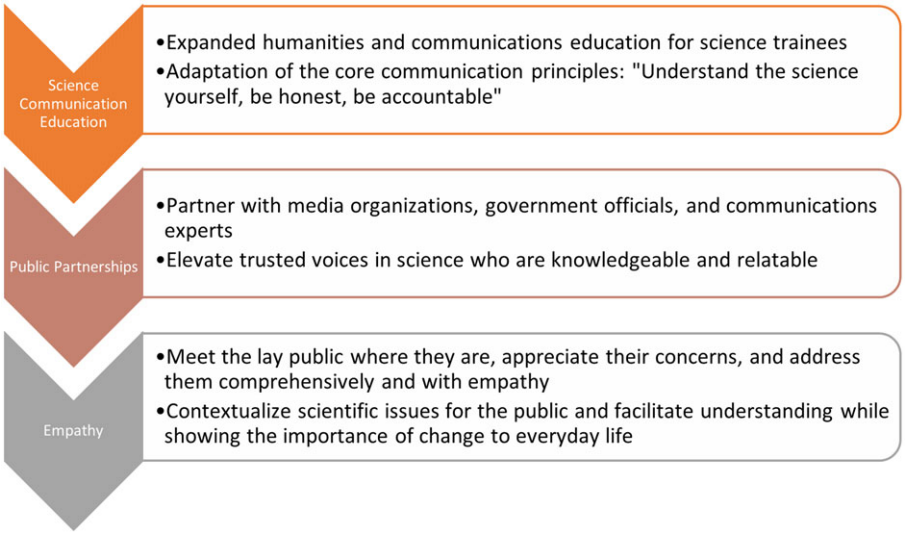

Figure 1. A 3-step framework to improving scientific communication and increasing public responsiveness to scientific knowledge.

in under-represented communities as individuals found it difficult to believe distant authorities asking for blind trust.

Overall, vaccine hesitancy hindered America's recovery. Vaccinations plummeted after 50% of Americans were fully immunized.[4] Recently, there was a massive Delta variant-associated case surge precipitated by the large unvaccinated population. Again, communication collapsed, with mixed messages such as respites of masking and social distancing followed by quick reinstatements.

The importance of science communication was similarly highlighted with the Johnson & Johnson vaccine. Accustomed to seeing '95% effectiveness' on the nightly news regarding the Pfizer-BioNTech and Moderna vaccines, many quickly determined that the JNJ vaccine, which was reported as 'only' 70% effective, was inferior. Prominently, Detroit's mayor refused to accept a JNJ shipment. This could have been avoided by thoughtful communication.[4] Although scientists are trained to express uncertainty when sharing formal results, the lay public needs a clear, contextualized message to avoid confusion and encourage action.

Similarly, the Astra-Zeneca vaccine was suspended by numerous countries after reports of clotting. The US similarly paused administration of the JNJ vaccine following 6 clotting cases - or 1 in 1 million vaccine recipients. Studies demonstrated that clots occurred at the same rates in recipients and the regular population, but prominent reporting of isolated incidents understandably generated fear. Although studies indicated the vaccines' safety, this temporary pause and inconsistent communication produced intangible harm. Even if adverse effects are rare, salient stories lacking context unquestionably remain in people's memories, increasing hesitancy for the vaccines in question, and perhaps any vaccines at all.

Although each of these situations created public health dilemmas, scientists had not necessarily acted improperly. They simply followed a conservative approach accounting for the existing facts. We can therefore ask ourselves: What are some solutions to improve science communication without sacrificing accuracy?

Education

First, scientists should receive more comprehensive education on communication strategies. This requires expertise in not only life science, but also social science and humanities (Figure 1).

Additionally, paralleling the CDC's scientific mantra of 'be first, be right, be credible,' this education should center around core principles: understand the science yourself, be honest, be accountable.

Paradoxically, effective communication is far more difficult for 'experts' than novices. Expertise engenders isolation from the public's collective knowledge, making it difficult to evaluate a reasonable baseline of information.

Additionally, communications research is vital to creating an evidence-based understanding of people's responses to various communication methods. Understanding the science behind scientific communication can help address wide-ranging problems from climate change to preventing the next pandemic- issues where the objective science is known, yet society has failed to create policy progress for decades.

Partnership

Second, scientists must partner with the media to elevate educated, yet relatable voices. The traditional approach to publicizing scientific breakthroughs has been paternalistic. Experts dictate recommendations for people's lives. This discourages public accountability and self-investment. Transitioning science from labs to communities requires collaboration with media, government, and public figures. In today's age, social media outreach is equally important. People don't like being told what to do; instead, platforms like Twitter allow experts to share thoughts in a relatable, personal manner - if approached correctly with evidence-based communication strategies.

Modern science communication should prioritize engagement, as seen when the masking debate was modified to incorporate themes of social responsibility and selflessness. Later in the pandemic, experts increasingly focused on providing context to the public. For example, to reduce vaccine hesitancy, experts educated people on FDA testing and approval processes. They highlighted activities one could enjoy post-vaccination and contextualized the rate of adverse effects to reduce availability bias. For example, by comparing clotting rates after vaccination with those of contraceptives, reports of vaccine-related clotting and death appeared less scary. Contextualization improves compliance and trust. Looking ahead, this approach can facilitate social progress on key societal

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issues. Increased trust will inherently lead to public investment in research funding.[5]

Empathy

Third, scientists must bring empathy into communication. Medical school emphasizes listening and empathy. Empathy in communication improves an audience's reception of a message. Experts must meet the audience where they are, with credibility and compassion- whether their concerns are economic for climate change, physical for vaccination, religious for evolution, or social for masking.

Throughout the pandemic, it has been established that effective communication is vital to generating a shared level of understanding. Masks were not a revolutionary invention, yet they remain the best infection-control tool, only if their importance is understood. Science is powerless without effective communication. It does no good to learn a complicated concept if society cannot apply it towards the public good.

COVID-19 offers scientists a pivotal opportunity to address problematic aspects of science communication as interest in public health has increased, opening direct lines of communication between researchers and the public. Science must harness this opportunity, fortifying this new channel through increased engagement, and trust-building.

In order to realize the full benefits of scientific discovery and medical knowledge, gaining the public's trust and interest is vital. Scientists must start with a stronger foundational education in the humanities, particularly in communication science. This education should be founded in the following 3 core principles, which the authors previously proposed in an analysis for the Harvard Kennedy School, Belfer Center for Science and International Affairs: 'Understand the science yourself, be honest, be accountable.' All science communicators must abide by this mantra to facilitate public buy-in. Experts in the field should partner with communications specialists and policy professionals to share their knowledge effectively. Science experts should work to gain the public's trust while ensuring that they remain relatable and recognizable of the layperson's experience. Finally, the core medical principle of empathy must be employed in meeting audiences where they are, acknowledging their concerns, and contextualizing scientific knowledge within everyday life.

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