

A Guide for Scientists to Identify and Address Misinformation



The National Academies of
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A Guide for Scientists to Identify and Address Misinformation

Committee on Addressing Inaccurate and Misleading Information about
Biological Threats through Scientific Collaboration and Communication

Board on Life Sciences

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About the Guide

Inaccurate and misleading information during infectious disease outbreaks has become commonplace, presenting challenges to effective outbreak control, seeding distrust among affected populations in foreign response activities, and eliciting questions among security experts about the true origins of outbreaks. Some false claims may be disproven through sound scientific analysis, suggesting a role for scientists to provide evidence-based, scientifically defensible information to refute such claims.

This how-to guide is for scientists to identify and address claims about infectious diseases and other biological threats that emerge from or are perpetuated by inaccurate and misleading information. This guide has been written to provide information to any scientist who is interested in addressing inaccurate and misleading information, regardless of whether they are part of the trusted network that has been recommended by the associated strategy report.¹ Although a few organizations, such as the World Health Organization, the United Nations Interregional Crime and Justice Research Institute, a few government agencies, and some scientific publishers, have developed programs to counter misinformation or provide informational materials about addressing misinformation, the resources often are tailored based on their missions, audiences, and broader stakeholders and the tools developed are evolving rapidly given the current landscape of false information (including the emergence and spread of this information). The how-to guide presented here focuses on scientists as the primary audience and provides practical steps that scientists can take to determine whether to address a claim, how to address it, and how and to whom to communicate corrective information. The guide builds on existing scholarship and practical experiences in addressing misinformation that is derived from or exaggerated by inaccurate and misleading information.

The main purpose of the study is to build capacity and capability among the scientific community in Southeast Asia to provide the knowledge that can be used by scientists and possibly other actors to counter false claims about emerging infectious diseases and other biothreats. Although no evidence exists demonstrating that Southeast Asia is more likely to develop or receive misinformation than any other geographic region, this region has witnessed the emergence of several infectious diseases that have spilled over into the human population, and regional growth of efforts around responsibility in the life sciences. Within the context of this study, false claims broadly refer to misleading information, disinformation, false claims about the purpose of pathogen research and scientific facilities, and poor-quality scientific information such as studies that have little statistical power, methods that do not match the conclusions drawn, or poor reporting of results. The goal of the study is to inform the development of how scientists with the requisite expertise (i.e., domain expertise) can work cooperatively to address false claims. The accompanying strategy for engaging scientists in a trusted network to address inaccurate and misleading claims by building a defensible and accurate scientific foundation is available online.² This strategy report also contains specific resources, cultural considerations, and resident expertise within Southeast Asia that may alter how regional scientists use the guide. A visualization of online platforms through which scientists continue to collaborate, share data and information, and crowdsource scientific analysis and peer review scientific information are available online.³

Given the complexity of mis- and disinformation, many stakeholders and a diverse range of efforts are necessary to prevent and counter these claims. This National Academies of Sciences, Engineering, and Medicine study focuses on one set of stakeholders—scientists—to help address mis- and disinformation claims, particularly within their areas of expertise. Furthermore, the

¹ See <https://www.nap.edu/catalog/26466>.

² See <https://www.nap.edu/catalog/26466>.

³ See <https://www.nap.edu/catalog/26466>.

landscape and risks associated with mis- and disinformation, though not new, are evolving rapidly because of the volume of information available, the availability of new online platforms (e.g., social media) and tools (e.g., artificial intelligence), and the changing pandemic and broader societal context. Therefore, critically analyzing all available (often new) resources for addressing mis- and disinformation for their effectiveness is not feasible. The outcomes of this study are intended to present current scholarship and practical knowledge about how to engage scientists in working collaboratively to address inaccurate and misleading scientific information and to provide broader audiences (e.g., policymakers, journalists, lay and religious leaders, and other members of the public) with evidence-supported, robust scientific information that effectively can counter mis- and disinformation.

The primary audience for this how-to guide is scientists and scientific institutions from Southeast Asia, as specified in the study's Statement of Task. Mis- and disinformation is an international problem, affecting all nations of the world. This guide, though developed as a resource for scientists in Southeast Asia, may be used by scientists in any part of the world. Scientists who are part of networks within their countries, regions, and throughout the world can use this guide to help counter inaccurate and misleading scientific information. For this guide, **“scientist” includes laboratory and field life scientists; clinicians (human and veterinary); public health scientists; social scientists; and scientists from a variety of other natural, physical, and computer sciences and organizations (academia, industry, nongovernmental organizations, government laboratories, and community or unconventional laboratories)**. Potential secondary audiences are policymakers, journalists, and members of the public (e.g., lay and religious leaders). Refuting claims in the broader public discourse (e.g., public messaging campaigns) is not the focus of this guide. However, if regional scientists do play roles in engaging with policymakers and other non-scientific stakeholders, expansion of those roles to include countering inaccurate and misleading claims is possible.

A Guide for Scientists to Identify and Address Misinformation



Whether you are a new or established scientist, you have an interest in promoting high-quality, accurate, and defensible scientific information. Generally, that means designing and conducting research and/or experimental methods to answer particular scientific questions or create a particular technology or product. But, increasingly, as the need for information and access to data increases, new platforms and venues have become go-to places for discussing and sharing scientific information without the same level of scrutiny as given to peer-reviewed publications, which have their own challenges. These platforms may provide new opportunities for scientists to discuss complex issues regardless of whether sufficient knowledge exists, communicate new research that has not been reviewed by scientific experts prior to publication, and/or engage in public discourse about a timely topic. Although some of the information communicated may be accurate and defensible, others may not, which may lead to the creation of propagation of mis- and disinformation.

The consequences of inaccurate, misleading, or even hyped scientific information include the loss of trust in the public health system and/or ineffective public health responses during epidemics, international conflict about the source and responsibility of epidemics, or the targeting of individual scientists and research institutions associated with particular claims. Although the scale and scope of consequences may vary by claim, actor, and situation, claims that are created from and/or propagated by scientific inaccuracies may become exaggerated as they prey on existing biases and beliefs.

So, how can you as a scientist address these claims? How do you know which claims should be addressed to reduce harm and which debunking efforts could inadvertently increase harm by amplifying falsehoods? How do you correct inaccurate information? With whom should you work to ensure that your efforts include the most appropriate scientific expertise for a particular claim? Do you have the time and resources available to counter inaccurate information effectively and thoroughly?

This guide provides a step-wise approach to determining whether to correct scientific inaccuracies that could lead to mis- and disinformation, correcting scientific inaccuracies, and communicating the correct information. The key steps for identifying and addressing claims are as follows:

STEP 1

Evaluate the claims to determine whether scientific inaccuracies should be addressed.

STEP 2

Identify expertise needed to correct scientific inaccuracies.

STEP 3

Define the methods for correcting scientific inaccuracies.

STEP 4

Communicate the correct information and uncertainties.

Strategies for conducting each step are outlined in this guide.

STEP 1: Evaluating the Claim

A critical aspect of identifying and addressing inaccurate and misleading scientific information that may contribute to misinformation claims is determining whether a particular claim needs to be addressed and could be addressed without inadvertently amplifying and propagating mis- and disinformation. Claims may be associated with particular scientists' work or institutions, or they might be more specific to a particular societal event, including outbreaks of emerging infectious diseases or other incidents involving biothreats. This decision-making process may be different for individuals who are the subject of, or intimately involved in, a particular claim. However, the initial set of questions to determine whether a claim should be addressed is the same (see Box 1).

BOX 1 KEY CONSIDERATIONS WHEN DETERMINING WHETHER TO ADDRESS A PARTICULAR FALSE CLAIM

CONSIDERATION 1

Could the claim cause significant harm or damage to public health, national security, or other social systems, either directly or indirectly through influencing individual behaviors?

CONSIDERATION 2

Can scientific knowledge or analysis counter a particular claim?

CONSIDERATION 3

Do scientific knowledge or data exist to provide accurate and defensible scientific information to counter a particular claim?

CONSIDERATION 4

Could addressing a particular claim amplify it, resulting in greater, rather than reduced, harm?

If the potential for harm or damage is high, the claim can be addressed through scientific knowledge or analysis, and if data exist, and scientific inaccuracies can be addressed without amplifying the claim, you can address the claim. Addressing the claim may involve the conduct of research, analysis, or peer review and often requires a cross-disciplinary group of experts from the life, social, and other scientific fields.

If the potential for harm or damage is not high, the claim cannot be addressed adequately through scientific knowledge or analysis, and/or if sufficient data do not exist, and/or the claim has a high likelihood of amplification, you should *not* address the claim.

Figure 1 presents this common evaluation framework for determining whether a claim is addressable.

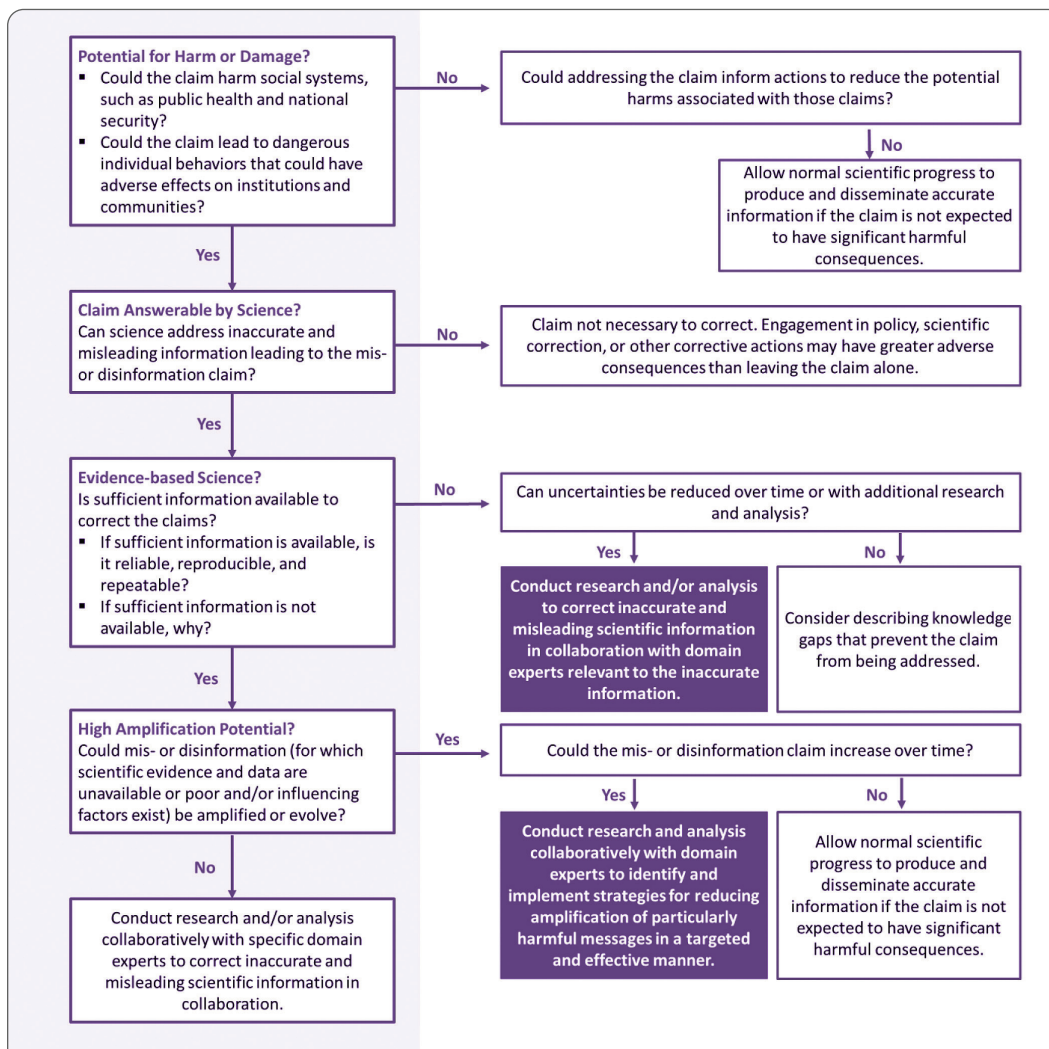


FIGURE 1 Decision-making framework for determining whether a claim should and can be addressed through scientific analysis, peer review, and/or communication. Ideally, scientists would evaluate whether to counter claims by discussing the claim with a trusted group of qualified scientists across the life, social, and computer sciences. These groups may be part of an established or newly created network, or an ad hoc set of experts. SOURCE: Adapted from Krause et al., 2022.

This framework allows scientists and/or institutions to conduct an informal threat assessment to determine the need for and consequences of addressing particular inaccurate or misleading information and particular mis- or disinformation. You can follow the steps of the framework below. Box 2 provides critical questions for evaluating the potential for harm.

The threshold for what scale and type of consequences would elicit a response may differ by sector and individual and may be interdependent, thus increasing potential costs. If you and your trusted colleagues think the costs and consequences could be significant, you can proceed to determine whether the claims are addressable through science. Box 3 presents the second set of questions to ask.

Even if scientists or scientific information are not mentioned in the mis- or disinformation, the claims may be addressable through robust science or science communication. Box 4 presents a third set of questions to consider.

BOX 2 EVALUATING THE POTENTIAL FOR HARM

QUESTION 1

What are the consequences of the claim to society? Example questions:

- Could the claim present challenges to public health responses during outbreaks (e.g., promoting distrust of international aid workers, vaccines and medicines, or other public health measures)?
- Could the claim cause challenges to national security (e.g., preventing an effective response to infectious disease, instigating conflict, or exacerbating tensions between countries)?
- Could the claim cause challenges to economies (e.g., preventing ineffective response to incidents, slowing or stopping supply chain, or causing unauthorized knowledge or data transfer)?
- Could the claim cause harm to the environment or to particularly vulnerable populations?

QUESTION 2

Are the effects of the consequences significant?

Significant consequences can be measured by illness and death, environmental costs, economic costs, costs to national security, or other costs. Estimation of these risks may be qualitative rather than quantitative. Current methods for biological risk assessment could help in assessing the consequences of the claims (WHO, 2010).

BOX 3 DETERMINING WHETHER CLAIMS ARE ADDRESSABLE THROUGH SCIENCE

QUESTION 1

Does the claim reference scientific information, processes, or experts?

QUESTION 2

Could accurate, defensible science counter specific claims or rationale underpinning the claim?

QUESTION 3

Does scientific consensus already exist?

Addressing these questions goes beyond simply identifying available scientific information and data to also determine whether existing information and data demonstrate a high degree of accuracy and use of solid experimental and/or analytical methodology. As a scientist, your experience with peer review and analytical assessment of scientific literature will be needed for assessing the quality of the existing information and data. Depending on the topic, you may need to work with scientists with other relevant disciplinary expertise to assess the quality of existing information and data. Box 5 presents the fourth set of questions to ask before determining whether to address a specific claim.

BOX 4 EVALUATING WHETHER SCIENTIFIC INFORMATION AND/OR DATA EXIST TO ADDRESS A CLAIM

QUESTION 1

Are scientific data and/or information, either published or unpublished, available to quickly and easily correct claims?

- Are the data and/or information highly technical or more generalized and easier to understand?
- Are the data and/or information appropriately contextualized?
- Have the data and/or information been peer reviewed or verified?
- Can the data and/or information not be released due to a journal's embargo, intellectual property concerns, or other reasons?

QUESTION 2

Are there other existing resources in the public domain that can be leveraged to address a claim?

BOX 5 DETERMINING POTENTIAL FOR AMPLIFICATION OF CLAIMS

QUESTION 1

Is the claim being shared widely and through various social media, media, and other means?

QUESTION 2

Do shared claims connect to prevalent themes or topics in the public debate, which suggests that the claim may be amplified?

QUESTION 3

Is the claim not shared widely, but might reach or otherwise influence key policymakers or audiences?

QUESTION 4

Could addressing the claim cause it to be shared and believed more widely or have a long-lasting lifespan?

Critical parts of assessing the potential for amplification are understanding the audience of the particular claims and ultimately also the corrective messages, and the degree to which the claim already has spread widely—reaching more audiences that can be corrected effectively. But amplification is possible for claims that could gain algorithmic traction (e.g., through AI algorithms) within subsets of online audiences. If the claims align with established biases or belief

systems in various audiences and have been disseminated widely, correcting the claims may present significant challenges by either making those efforts ineffective or reinforcing the false claims. However, if the claims are not widely distributed and/or the audience is reachable through effective science communication, correcting the claims may be feasible.

If you, a colleague, or your research institution are the subject of a claim, you can follow the framework described above to determine whether to address the claim, recognizing the investment of human and financial resources needed to do so.

Consulting with your institution, communications networks, and other experts, your assessment of the consequences may be more personal, specifically focusing on you and your family’s safety or reputation, and your institution’s reputation and security. Although these consequences are not at the community, national, or international levels, the immediacy of the consequences may be significant, particularly if they present a specific danger to you, your family, and your organization. Figure 2 describes examples of situations and informal assessments that have occurred.

EXAMPLES	<p>A scientist receives an email with inappropriate, somewhat threatening, language about experiments they supposedly did according to a blog the email sender referenced.</p>	<p>An internationally well-known media outlet runs a story about research conducted in your laboratory and misquotes a spokesperson from your institution making your research appear inappropriate.</p>	<p>A reporter contacts a scientist for a story they are working on in the scientist’s area of expertise. By the general description of the story in the email, the scientist fears that the reporter already has their mind made up and is looking for a quote for a story that most likely will contain misinformation.</p>
ACTIONS BY THE SCIENTIST	<p>This scientist should contact their institutional communication experts and work with them to determine the best course of action based upon the assessment of the risks posed by the blog.</p> <p>The scientist also may contact law enforcement depending on language used in the email and whether they feel their personal safety might be at immediate risk. Law enforcement agencies may be able to work with other intelligence agencies to contact the individual that wrote the email and/or runs the blog.</p>	<p>The scientists should contact their institutional communication experts and work with them to determine the best course of action to correct the information, which could be an email or letter to the editor describing the errors, a written piece or frequently asked questions on an institutional website, or some other form of rebuttal.</p> <p>The information is in the public domain and unless the media outlet corrects or recants the story, the scientists and institution will have to do their best to refute continuously the claims as quickly as possible.</p>	<p>The scientist should work with their institutional communications experts to respond as soon as possible asking the reporter what is the arc of their story and their deadline.</p>
RESULT OF DECISION	<p>In this instance, the blog is not a credible source, has limited reach, and does not appear to be referenced by other sources. Drawing greater attention to the blog could potentially raise the profile of the individuals behind it and increase readership. Unless the blog develops greater reach or readership, debunking it is not worth the resources.</p>	<p>The reach of the media outlet is wide and influential in this example, and the inaccurate information and misinformation runs a high risk of being repeatedly cited as fact. The claim persists regardless of whether corrected information is released.</p>	<p>This is an opportunity to potentially correct misinformation before it reaches the public domain. The scientist should make every attempt to speak with the reporter before their deadline because they potentially could change the arc of the story and influence the sharing of correct scientific information.</p>

FIGURE 2 Examples of situations and informal assessments.

STEP 2: Identifying the Expertise

Although some scientific inaccuracies may be addressed by experts from a single field or discipline, more likely, you will need to identify scientists from other disciplines (referred to as “domain experts”) who have knowledge and expertise in addressing one or more aspects of the inaccuracies being circulated. Identifying domain experts needed to address these claims is a critical step in defining the approach for correcting inaccuracies, hype, or misleading scientific information, and in developing the messages for communicating correct information and associated uncertainties. Box 6 highlights questions for determining the scientific expertise needed to correct claims. Scientific experts may be drawn from national, regional, or international institutions and networks.

BOX 6 IDENTIFYING DOMAIN EXPERTS

QUESTION 1

What scientific information is needed to address misinformation claims?

- What scientific information is needed to correct inaccuracies relevant to the misinformation claims?
- What scientific information is needed to produce accurate, defensible knowledge to counter the misinformation claims?

QUESTION 2

What life, social, and computer science skills and expertise are needed to address scientific inaccuracies and counter associated misinformation claims?

- What specific expertise is needed if the primary audience is scientists?
- What specific expertise is needed if the audience includes non-scientists, such as members of the public, policymakers, and journalists?

The exact types of expertise needed depends on the content of the claim, though a combination of domain experts and science communications experts likely would be most effective. For example, if the claim is about a specific area of infectious disease research, a scientist or institution would want to form a team that includes experts in the scientific discipline (e.g., virology, microbiology, public health, computational biology, medicine), laboratory biosafety and biosecurity, science communication research, and possibly law and research policy.

Once you have determined the specific expertise and skills needed to address a particular claim or scientific inaccuracy, you need to identify and evaluate the credentials of the domain experts. Box 7 highlights questions to ask when assessing the knowledge and expertise of scientists.

When working in teams, you should promote inclusivity and diversity of scientists by including experts from a range of backgrounds, relevant scientific disciplines, genders, career stages, and countries.

BOX 7 IDENTIFYING AND EVALUATING DOMAIN EXPERTS

QUESTION 1

Do the domain experts within your trusted scientific network have the appropriate skills and expertise to address the inaccurate information?

QUESTION 2

What domain expertise exists outside of your network but is needed to address the inaccurate information?

QUESTION 3

Do the identified experts have strong scientific credentials (e.g., publication record, scientific expertise, reputation, scientific excellence awards, and leadership positions)?

QUESTION 4

Are scientists from all relevant disciplines and sectors involved in your collaborative team for addressing the inaccurate information?

A diverse team of experts proactively and reactively can develop various messages such as talking points, frequently asked questions, and press releases to lead or redirect the narrative. Usually, proactive science communication requires fewer resources than reactive science communication and has the ability to add appropriate context about the information being shared. Additional examples of proactive communications include live or recorded radio broadcasts, blogs or video interviews, tours of research facilities, articles and editorials in mainstream media outlets, presentations at conferences and symposia, and communication and collaborations between scientists. All of these approaches can integrate accessible and relatable concepts, prevalent public discourse, and language for the specified audiences.

Step 3: Defining The Methods

Once you have identified the appropriate expertise, the next step is to work with your team to define your approach for understanding and addressing scientific inaccuracies. Box 8 highlights questions for determining the claim and its source.

BOX 8 CHARACTERIZING THE CLAIM AND ITS SOURCE

QUESTION 1

What is the source of the inaccurate and misleading information or resulting misinformation claim?

QUESTION 2

What is the credibility of the source of the inaccurate and misleading information or resulting misinformation claim?

QUESTION 3

What is the reach of that source?

QUESTION 4

Has the inaccurate and misleading claim been referenced in other sources?

QUESTION 5

Has the claim been repeated elsewhere?

Understanding the source of mis- and disinformation can provide initial insight about their origin and purpose, which can reveal biases and perspectives of the primary audiences. This information can provide insight about whether new scientific information perpetuates or further exaggerates false claims being circulated. Understanding the source and origins of scientific inaccuracies can help to identify how to address those inaccuracies and to whom to communicate the correct information. Box 9 provides critical questions to consider when determining how the claim should be addressed.

BOX 9 DEFINING THE APPROACH

QUESTION 1

**What scientific inaccuracies and associated claims already are being addressed?
What still needs to be addressed?**

QUESTION 2

What approach will you use to correct scientific inaccuracies?

QUESTION 3

What resources are needed to correct scientific inaccuracies or build the scientific foundation to counter particular misinformation claims?

Your team of scientists should identify where and how to address the scientific inaccuracies, including deciding whether to conduct empirical analyses (online via crowdsourced or collaboration platforms or in the laboratory); provide detailed peer review of publicly available documents containing inaccuracies and/or claims; and/or compile, evaluate, analyze, and share existing accurate, defensible scientific information. The specific approach depends on where the inaccurate information is accessible and which data and methods are available to the team. Once the team determines its approach, it should evaluate the type and level of resources needed to correct the scientific inaccuracy and/or counter the misleading claim and proceed with the development of accurate, defensible scientific information.

STEP 4: Communicating Correct Scientific Information

Communicating the correct information accurately and effectively is as important as producing accurate, defensible information. Several key considerations exist, including understanding the informational needs of your audience and identifying your goals and communication approaches before developing and communicating corrective information. Institutions often have communications and public affairs offices to support scientists' efforts in reaching audiences beyond the scientific community, especially policymakers, journalists, and lay and religious leaders in the broader public. If your institution or network has this type of office, you should work with it to determine how to communicate corrective information. Regardless, training in science communication and public engagement and/or collaboration with professional science communicators will help to ensure that the corrective message has the intended effect. For countering misinformation that has not yet spread widely but still could be damaging,

communicating corrective information while referencing the false claim allows the audience to focus on the corrective statement and disregard the inaccurate statement as false (Thorson 2016). Box 10 provides questions to guide communication, especially in communicating the corrected information and associated scientific uncertainty.

BOX 10 IDENTIFYING THE NEEDS FOR ADDRESSING THE CLAIMS

QUESTION 1

Who are the primary and secondary audiences?

QUESTION 2

Have you been working with a science communication expert on your team?

QUESTION 3

Is your approach to communication based on mental models? (Knowledge deficit models have been shown to be ineffective at communicating science to various audiences.)

QUESTION 4

What are your communication goals?

QUESTION 5

What uncertainty is associated with the correct information? How is uncertainty described for information for which little or no scientific consensus exists? How has uncertainty been captured in the corrective message?

Defining your audience and understanding its informational needs are the first steps in developing effective communications. Different audiences have different expectations, perspectives, biases, foundational scientific knowledge, and preferred means of communication. For example, the general public may want to know how scientists' corrective messages and scientific content affect their lives and their societies. Policymakers may seek to understand how these corrective messages affect existing and future policies in their fields. Peers may be interested in determining whether corrective messages may provide an opportunity for future scientific collaboration. Religious communities may want to know if corrective messages will resonate with their beliefs. Approach each audience differently and tailor communication to each based on the group's unique interests (an approach called audience segmentation) (Detenber et al. 2016). Therefore, developing corrective messages (i.e., accurate information that corrects inaccurate or misleading information) that specifically reach the intended audiences and engage these audiences in dialogue (as opposed to one-way or push communications) is more effective at countering mis- and disinformation than providing information via a one-way (or didactic) approach. Two-way communication between scientists and their intended audiences provides more meaningful and effective engagement (Besley 2014; Ho et al. 2020; Kreimer et al. 2011; Peters 2013).

Once you have defined and characterized your audience(s), the next step is to **identify the goals of communication and the optimal communication approach**. This step builds on the process of understanding the specified audience to determine the goals and objectives of communication. In cases such as public meetings, one or more communication goals may exist: education, advocacy, awareness raising, trust building, policy or research influence, encouragement of change, or inclusion in a dialogue. Because the public has more trust in traditional media than social media in Southeast Asian countries (Ho et al. 2019), scientists will need to be sensitive to the type of communication platforms that they use to communicate corrective messages to the public.

The final step in communicating information involves **preferentially communicating the most critical information first**. The public, the media, and business stakeholders want the key findings first, the reasons for why the findings matter (the “so what?”), and, lastly, the supporting details that led to the correction of misinformation (see Box 11).

These strategies can be used to contextualize information meaningfully for audiences, which may increase the efficacy of the science communication, particularly to non-technical individuals (NASEM 2017; Price and Tewksbury 1997; Scheufele 2014). Box 12 provides guiding practices for communicating science. The strategy report provides additional details about science communication.

BOX 11 CHARACTERISTICS OF COMMUNICATING SCIENCE

CHARACTERISTIC 1

When developing your message, avoid jargon. Effective science communication stays away from jargon or unfamiliar words and uses terms that make sense to a broader audience. If scientific terminology must be used, explain it in more commonly understood terms.

CHARACTERISTIC 2

When creating your message, use framing messages to connect scientific information to cognitive schemas that matter to your target audience.

CHARACTERISTIC 3

When developing corrective messages, use charts, graphs, images, and other visuals to avoid jargon and make an audience comfortable with a topic.

CHARACTERISTIC 4

When developing messages for non-technical audiences, highlight the correct information rather than the misinformation.

CHARACTERISTIC 5

When developing the message, discuss the broader contextual impact of the misinformation claim and corrective message, which may help audiences understand why addressing the claim is important even if they may not understand the scientific processes behind the counter-argument.

BOX 12 BEST PRACTICES FOR SCIENCE COMMUNICATION

Actions that enhance science communication

- Employing evidence-based strategies for effective, tailored messaging in collaboration with life, social (including science communication), and computer scientists
- Referring audiences to trustworthy sources for defensible, accurate information
- Promoting collaboration between domain experts and science communicators
- Preparing information in formats accessible to the audience
- Using simple, clear, and concise language when explaining the science to lay audiences
- Being patient, empathetic, and sympathetic

Actions that reduce effectiveness of communicating science

- Overstating your expertise
- Using jargon, formulae, or complicated scientific terminology except with domain experts
- Telling people what to do without elaborating the advantages
- Overwhelming people with information
- Repeating misinformation by retweeting or sharing
- Challenging or ridiculing personal and religious beliefs that might promote motivated reasoning
- Insulting, belittling, shaming, or embarrassing people when they have shared or believed misinformation

SOURCE: Wettstadt and Shuttleworth 2020.

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