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Public Communication about Science in 68 Countries: Global Evidence on How People Encounter and Engage with Information about Science

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Abstract

This 68-country survey ($n = 71,922$) examines science information diets and communication behavior, identifies cross-country differences, and tests how such differences are associated with sociopolitical and economic conditions. We find that social media are the most used sources of science information in most countries, except those with democratic-corporatist

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media systems where news media tend to be used more widely. People in collectivist societies are less outspoken about science in daily life, whereas lower education is associated with higher outspokenness. Limited access to digital media is correlated with participation in public protests on science matters. We discuss implications for future research, policy, and practice.

Keywords
science communication, public engagement with science, media use, social media, survey, comparative study, secondary data analysis

Introduction

Knowledge generated through scientific inquiry plays important roles in society. It can be vital for policy-making, economic development, technological innovation, and people's daily lives. The science-society nexus depends considerably on science communication, which we conceive broadly as the numerous forms of discourse about scientific knowledge, methods, and institutions (Schäfer et al., 2020). This includes not only public outreach by scientists and formal science education, but also communication about science-related issues in news media and among the public, for example, via social media platforms and messaging services. People may also engage with science in museums, zoos, and public lectures, or at protests such as the "March for Science" and the "Fridays for Future" rallies (Cologna et al.,

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2021). Fiction, such as films or comic books, are further ways through which science can enter into public discourse. The ability of science to facilitate individual and collective decision-making is therefore largely established and maintained through the "social conversation around science" in news media, social media, personal conversations, formal science communication, and fiction (Bucchi & Trench, 2021, p. 8). This conversation ensures that scientific knowledge circulates among the public so that people can make informed decisions on issues where this knowledge is instrumental, such as health, nutrition, and technology. Science communication can thus contribute to individual and collective well-being, especially during major societal and technological disruptions, including pandemic outbreaks and the rise of artificial intelligence (AI). Hence, it is crucial to gather robust evidence on how people inform themselves and communicate about science. This study provides such evidence on a global scale. It presents an analysis of the Trust in Science and Science-Related Populism (TISP) survey, which measured where and how 71,922 respondents in 68 countries encounter information and communicate about science (Mede, Cologna, et al., 2025).

Our analysis complements and expands existing research, as it includes countries beyond the "Global North," shows differences between countries and patterns across world regions, and identifies country-level factors related to such differences and patterns. It distinguishes two components of science communication: First, we analyze people's sources of science information, that is, their "science information diets" (RQ1). Second, we investigate how people communicate about science and engage in civic action on science-related issues (RQ2).

> ***Research Question 1 (RQ1)***: *Where do people across the world encounter information about science?*
> ***Research Question 2 (RQ2)***: *How do people across the world communicate about science with others?*

Exploring these questions allows for one of the most comprehensive empirical assessments of where people are exposed to science and how they engage with it to date. We offer representative evidence on more and less important forms of exposure and engagement and explain national differences using country-level indicators for economic and sociopolitical conditioning factors. Such evidence is vital for developing target group specific and culturally sensitive science communication strategies, education programs, and science policies around the world—including non-Western countries, which are typically understudied and prone to flawed inferences from the Western contexts (Guenther & Joubert, 2017). Therefore, our study facilitates a more inclusive and context-specific understanding about people's science information diets and communication behavior around the world.

Literature Review

What We Know About Where People Encounter Information About Science

Existing studies offer manifold insights into where people come across science for several geographical, topical, and temporal contexts. For example, surveys in Europe, Asia, and the United States show that people rely more and more—and now primarily—on digital media to obtain information about science and science-related topics such as climate, health, and technology (Ejaz et al., 2023; European Commission, 2025; Wellcome Trust, 2019). Social media platforms including Instagram, Facebook, X, YouTube, and TikTok have become places where people frequently encounter and engage with such information (Metag, 2020). Websites, online blogs, podcasts, and AI tools represent additional digital sources of science information (Schäfer et al., 2024). However, newspapers and magazines remain important information sources, especially in countries with strong news media markets like Sweden or Switzerland (Metag, 2020; Vetenskap & Allmänhet, 2024), and they are also often a primary source of much of the information that appears on digital channels (Al-Rawi, 2019). Other routes of exposure to science information include films, TV series, and books, as well as conversations with friends, coworkers, and doctors, for example (Funk et al., 2017). Qualitative research describes, for example, how people come across information about science in TV series and talk about it with peers (Brondi et al., 2021). Museums, zoos, and public lectures are other, less frequently used sources of information about science (European Commission, 2025). That said, science information is also disseminated through schools and universities (Roche et al., 2021).

While most research focuses on single countries, the Wellcome Global Monitor and the Eurobarometer surveys provide comparative insights into how people receive information about science. The Wellcome Monitor 2018 suggests that people from Scandinavian countries seek information about science more frequently than people from East Asian countries, including China, Japan, Taiwan, and South Korea (Wellcome Trust, 2019). The Special Eurobarometer 557 shows that social media are important sources of science information in many South European nations, and that newspapers have comparably high importance in the Benelux countries (European Commission, 2025).

What We Know about How People Communicate About Science

Scholarship on how people communicate about science with others in private life and public spaces has three prominent themes. First, a number of studies analyzed attitudinal factors making individuals more likely to discuss science with others. One of these factors is outspokenness, that is, people's tendency to share their opinions about science, regardless of potentially being isolated due to voicing controversial opinions (Kim, 2012; McKeever et al., 2017). Second, numerous studies explored the different forms of how people discuss science with others, including commenting on social media, chatting in messaging apps, and talking with friends, family, or coworkers in personal conversations (Habibi & Salim, 2021; Link et al., 2024). Third, several analyses investigated political communication about science-related matters, for example, by assessing how people articulate their views on climate change and political interference with academic freedom (Mede & Schroeder, 2024; Riesch et al., 2021). One form of such communication, among others, such as sending emails to politicians or engaging with them on social media, is participation in public protests, such as the March for Science, the Fridays for Future rallies, and protests against COVID-19 policies (Cologna et al., 2021). Further research shows that these factors depend on personal and contextual covariates. For instance, high formal education was found to be associated with higher willingness to talk with others about science, technology, engineering, or mathematics (Southwell & Torres, 2006).

This literature offers insights into how people engage with others about science. Yet, most research centers on specific contexts and provides little comparative evidence. That said, the Special Eurobarometer 557 indicates that people from several countries in Eastern and Southern Europe are less likely to discuss science and technology with peers, visit museums and public lectures, and join protests on science and technology matters (European Commission, 2025).

Comparing Science Information Diets and Communication Behavior Globally

A growing body of scholarship demonstrates that the ways in which people come across information about science and communicate about it differ across countries (e.g., European Commission, 2025). These differences depend on cultural, sociopolitical, and economic factors (Bauer et al., 2019; Gascoigne et al., 2020). For example, the Wellcome Global Monitor found that across all inhabited continents, internet access is strongly related to whether people seek information about science (Wellcome Trust, 2019). However, science communication researchers have not yet tested further factors empirically but often rely on findings from related fields, such as research on public opinion about science and political communication (Noy & O'Brien, 2019; Shehata & Strömbäck, 2011). This research indicates that national levels of (a) education, (b) freedom of academic exchange and dissemination, (c), access to digital media, (d) the gross domestic product (GDP), (e) press freedom, (f) freedom of speech, and (g) democratic deliberation are associated with where people encounter information about relevant matters and how they discuss them with peers (Altay et al., 2025; Mede, 2022; Nisbet & Stoycheff, 2013). For example, the Programme for International Student Assessment (PISA) surveys show that national levels of reading literacy are positively associated with recreational social media use (Hu & Yu, 2021) but negatively associated with online chatting (Luyten, 2024). The GDP was found to correlate positively with information sources, such that people in affluent societies use daily newspapers, radio and TV, printed magazines, books, online sources, and conversations with others more frequently to learn what is going on in their country and the world (Khosrowjerdi et al., 2020). Oppression of academic exchange and dissemination may affect how often scientists are featured in news media and where citizens can find reliable information about scientific issues (Roberts Lyer et al., 2022). Press freedom and the extent to which governments allow democratic deliberation predict participation in political protests (Ahmed & Cho, 2019).

Most comparative research on sociopolitical predictors of people's information diets and communication behavior centers on *politics and current matters*. Yet, there is no systematic research on country-level factors explaining how people encounter information and communicate about *science*, which often involves other information channels, attitudes, and country-level factors than political information diets and communication behavior. Science communication scholars and practitioners are thus often forced to fall back on comparing individual studies from specific countries when making assumptions on how science information diets and communication behavior vary across countries. Such comparisons have limited validity because of substantial methodological variations across studies, manifested in the variety of measures (different granularity and wording), data collection procedures (online, telephone surveys, etc.), sampling strategies (representative, nonprobability, quota sampling), sample compositions (different sociopolitical views across samples), or survey periods (before, during, or after events like the COVID-19 pandemic). Most conclusions on how people encounter information and communicate about science with others are therefore limited to specific regional, temporal, and topical contexts. This, for example, reduces the capacity of global organizations to design and manage effective international science communication and education initiatives.

A further limitation of research on public communication about science is its bias toward the "Global North," while African, Latin American, Arab, and (to some extent) East and South East Asian countries remain understudied (Guenther & Joubert, 2017). We thus know little about science information diets and communication behavior in non-Western societies. Decision-makers in science education, science communication, and policy-making from the "Global South" may therefore draw flawed inferences from Western countries to their local contexts. For example, Western data shows that the importance of radio as a news source is declining, albeit the opposite applies to many African countries (Nkoala et al., 2024). Similarly, research from Global North countries suggests a conflict between trust in science and religiosity, whereas faith in science and God may go hand in hand in countries like Nigeria (Falade & Bauer, 2018). Ignoring disparities like these may result in ineffective science communication strategies, public resistance against education programs, and useless government expenditures, similar to when the Structural Adjustment Programs of World Bank and International Monetary Fund imposed Western neoliberal economic theories on Latin American and African socioeconomic realities in the 1980s–1990s. What is needed is an analysis of people's sources of science information and communication behavior across the world, including country-level indicators for relevant covariates. Our analysis addresses this need.

Materials and Methods

Data

To test the research questions, we used the TISP dataset (Mede, Cologna, et al., 2025). It contains post hoc weighted survey data on individual perceptions of science and science communication behavior of $n = 71{,}922$ respondents in $k = 68$ countries on all inhabited continents. The data were collected between November 2022 and August 2023 in a preregistered online survey with 88 samples, using balanced quotas for age and gender (doi: 10.17605/osf.io/5C3qd). Almost all samples included at least $n = 500$ respondents, and many contained 1,000 and more (see Table 1 in Mede, Cologna, et al., 2025 for an overview).

The survey received ethical approval from the Area Committee on the Use of Human Subjects at Harvard University in August 2022, which declared it exempt from full IRB review (protocol #IRB22-1046). Participants gave written informed consent before taking the survey. Mede, Cologna, et al. (2025) provide detailed information on the data collection and pre-processing, including survey instruments, additional IRB review at national partner institutions, and weighting procedures. They also present overviews of sample sizes and sociodemographic characteristics across countries.

Measures

The survey included 17 pretested questions on where and how often people come across information about science (RQ1) and communicate about it with others (RQ2). The authors of the TISP project adopted them from established national population surveys on public opinion and communication about science, such as the Science and Engineering Indicators (National Science Board, 2022). Many questions were validated in previous studies (e.g., Metag, 2020). To ensure that respondents have a common understanding of the term "science" despite semantic variations across translations and cultures, the survey included a description at the beginning of the survey based on the Wellcome Global Monitor[1] (Wellcome Trust, 2019). To give respondents a better idea of "science-related issues," the questionnaire mentioned climate change, vaccination, nutrition, and new technologies as examples.

Individual-Level Measures: Sources of Science Information (RQ1). We operationalized RQ1 along five common dimensions of where people encounter information about science, that is, (a) news media, (b) fiction, (c) social media, (d) conversations, and (e) formal science communication. For each of these dimensions, respondents were asked how often in the past 12 months they "have come across information about science" (a) in newspapers or magazines, in news shows on TV or radio, on news websites or in apps, in news videos or podcasts, (b) in films or series, (c) on social media, (d) in instant messaging conversations and conversations outside the internet, and (e) in museums, zoos, and public talks (1 = *never*, 2 = *once or twice a year*, 3 = *several times a year*, 4 = *once or twice a month*, 5 = *once or twice a week*, 6 = *almost every day*, 7 = *once or more per day*). In our analyses, we treated response data as quasi-continuous in order to facilitate statistical modeling and to follow common practice for handling non-equidistant scales (e.g., Cacciatore et al., 2018). Supplementary Table S1 includes question and item wordings, *M* and *SD*, as well as α and ω reliability estimates, all of which were acceptable, good, or very good. See Supplementary Table S2 for means and standard deviations of the RQ1 measures across countries.

Individual-Level Measures: Communicating About Science With Others (RQ2). Following three prominent themes of scholarship on how people communicate about science in private and public settings, we distinguished an attitudinal, a conversational, and a political dimension of science communication behavior. First, we investigated an attitudinal dimension with a three-item scale capturing people's *outspokenness about science*. This scale was adopted from McKeever et al. (2017) and measured to what extent respondents agree that they will share their opinions about scientific issues regardless of what others think of them (rescaled for all analyses: 1 = *strongly disagree*, 7 = *strongly agree*). Second, we analyzed a conversational dimension with three items measuring different forms of *discussing science with others*. They asked respondents how often in the past 12 months they had conversations with friends, family, or coworkers, chatted in messaging apps, and shared or commented on social media posts "about scientific issues" such as "climate change, vaccination, nutrition, new technologies" (1 = *never*, 7 = *once or more per day*). Third, we examined a political dimension of people's science communication behavior. We focused on one important aspect of this dimension, that is, *participation in public protests on science-related issues*, because the TISP dataset did not provide measures for other aspects, such as reaching out to politicians via email. The item we used for this asked respondents how often in the past 12 months they attended public rallies or protests related to scientific issues, such as COVID-19 protests, "Fridays for Future" demonstrations, and a "March for Science" (1 = *never*, 7 = *once or more per day*). See Supplementary Table S3 for *Ms* and *SDs* of the RQ2 measures across countries.

Country-Level Measures. We retrieved seven country-level indicators for sociopolitical and economic factors from external databases and added them to the dataset, as they may be associated with people's science information diets (RQ1) and science communication behavior (RQ2). The indicators covered the following aspects:

- *Education*, measured with harmonized test scores from major international student achievement testing programs, including the Trends in International Mathematics and Science Study and the PISA surveys (provided by the World Bank).
- *Freedom of academic exchange and dissemination*, measured with a component of the Academic Freedom Index that indicates the degree to which scholars are free to communicate among each other and with nonacademic audiences through media engagement and public lectures (provided by V-Dem).

- *Access to digital media*, measured with national internet adoption rates that indicate the share of the population who used the internet in the last 3 months (provided by the International Telecommunication Union).
- *Gross domestic product (GDP) per capita*, adjusted for inflation and for differences in the cost of living between countries (provided by the World Bank).
- *Press freedom*, measured with the World Press Freedom Index,[2] which indicates the extent to which the production of news and information relies on pluralist, independent, safe, and transparent infrastructures and goes beyond print media to include audio and audiovisual news media (provided by Reporters Sans Frontières).
- *Freedom of speech*, measured with the Civil Liberties Score, which indicates the degree to which citizens enjoy freedom of expression and association, the rule of law, and personal autonomy (provided by Freedom House).
- *Democratic deliberation*, measured with the Engaged Society Index, which indicates the extent to which people discuss political matters among themselves, in the media, associations, or public life (provided by V-Dem).

Supplementary Table S4 presents a detailed overview of these indicators, the data sources, and possible pre-processing procedures. We selected the indicators based on previous research suggesting that they influence media use, communication behavior, and political participation (see above). The selection of indicators was also based on practical considerations.[3]

Analyses

We conducted (a) *univariate analyses* of where respondents are exposed to information about science-related issues and communicate about science with others, (b) *multivariate analyses* of country-level factors that may be associated with science information exposure and communication behavior, and (c) *bivariate analyses* of these associations at the country level. The TISP dataset includes post-stratification weights, which we used for all analyses in order to obtain point estimates that are nationally representative for age, gender, and education, and have correct standard errors (Mede, Cologna, et al., 2025). All analyses are reproducible with the data and code we share at: https://osf.io/gvcfe/

Univariate Analyses. The univariate analyses investigated different sources of science information (e.g., news, social media; RQ1) and three components of how people communicate about science with others in private and public spaces (outspokenness about science, discussing science with others, participation in public protests; RQ2). We inspected weighted national average values and standard deviations of the information sources and components.[4,5]

Multivariate Analyses at the Global Level. We fitted Bayesian linear regression models[6] to analyze the extent to which sociopolitical and economic conditions explain cross-national variance in public communication about science. The models included seven country-level factors that have been shown to be associated with people's sources of science information (RQ1) and the ways in which they communicate about science with others, for example, education, freedom of academic exchange and dissemination, freedom of speech[7] (RQ2). The RQ1 models predicted weighted national average values of exposure to the five sources of science information. The RQ2 models predicted weighted national average values of science-related outspokenness, discussing science with others, and participation in political protests on science-related issues ($n = 68$ for all models). These models used the same weighting procedure as the univariate analyses.

Bivariate Analyses at the Country Level. The multivariate analyses are able to identify how people's science information diets and communication behavior relate to sociopolitical conditions at the global level. To investigate these relationships at the country level, we probed four relationships that have been frequently discussed in the literature but have not yet been tested empirically at a global scale. These analyses included bivariate distributions of science information exposure in news media and press freedom, information exposure in museums, zoos, or public talks and freedom of academic exchange and dissemination, outspokenness about science and national levels of democratic deliberation, and participation in public protests and freedom of speech.

Results

Sources of Information About Science (RQ1)

Social Media Are the Most Important Information Source in Most Countries, but Traditional News Media Remain Relevant Particularly in Northwestern Europe. The univariate analyses show that people in 53 out of 68 countries tend to encounter science information more frequently on social media platforms such as Facebook, YouTube, TikTok, and Instagram (68-country

$M = 3.81$, $SD = 1.96$) than through newspapers and news websites or apps ($M = 3.65$, $SD = 1.45$), conversations and messaging services ($M = 3.18$, $SD = 1.67$), fiction ($M = 2.96$, $SD = 1.53$), and museums, zoos, or public talks ($M = 2.38$, $SD = 1.53$; see Figure 1).

However, we find cross-country differences and patterns. Populations of several countries in South East Asia and Africa have higher overall exposure to science information regardless of the way of exposure. Baseline exposure seems considerably lower in many European countries as well as Japan, Canada, and New Zealand, for example, where most people report encountering science information only on a monthly basis or less often via social media, news media, conversations, fiction, and in museums, zoos, or public talks. Correspondingly, we find that respondents in many South East Asian countries come across science information particularly often on social media—more than once or twice a week in Bangladesh, India, Indonesia, and the Philippines, for example. Several African countries, including Egypt, Ethiopia, Kenya, Nigeria, and Uganda, show similarly high exposure rates. Yet, people in most Western countries encounter science information comparably less often on social media. For example, respondents in the United States and Australia say they come across science-related social media content less often than once a month, and Sweden and the Netherlands report even less exposure.

News media remain relevant sources of science information across the world. In several North and West European countries as well as Russia, newspapers and magazines, news shows on TV or radio, news websites and apps, and news videos and podcasts seem to outrank social media. Respondents in Finland, for example, report encountering science-related information once or twice a month in news media, but only several times a year on social media.

Conversations with friends or family, both online and offline, are also relevant for exposure to science information—particularly in East Asia, where people report exposure about once or twice a month. In South Korea, Indonesia, and Taiwan, for example, conversations tend to be even more important than news media. This is mainly driven by high exposure through instant messaging services rather than offline conversations in these countries.

Fictional films, series, books, or comics are less important ways to encounter information about science. However, people in some sub-Saharan African countries, such as Kenya, Ethiopia, Nigeria, Uganda, and Botswana, report exposure to science information through fiction about science once or twice a month. Formal science communication is clearly less common in people's

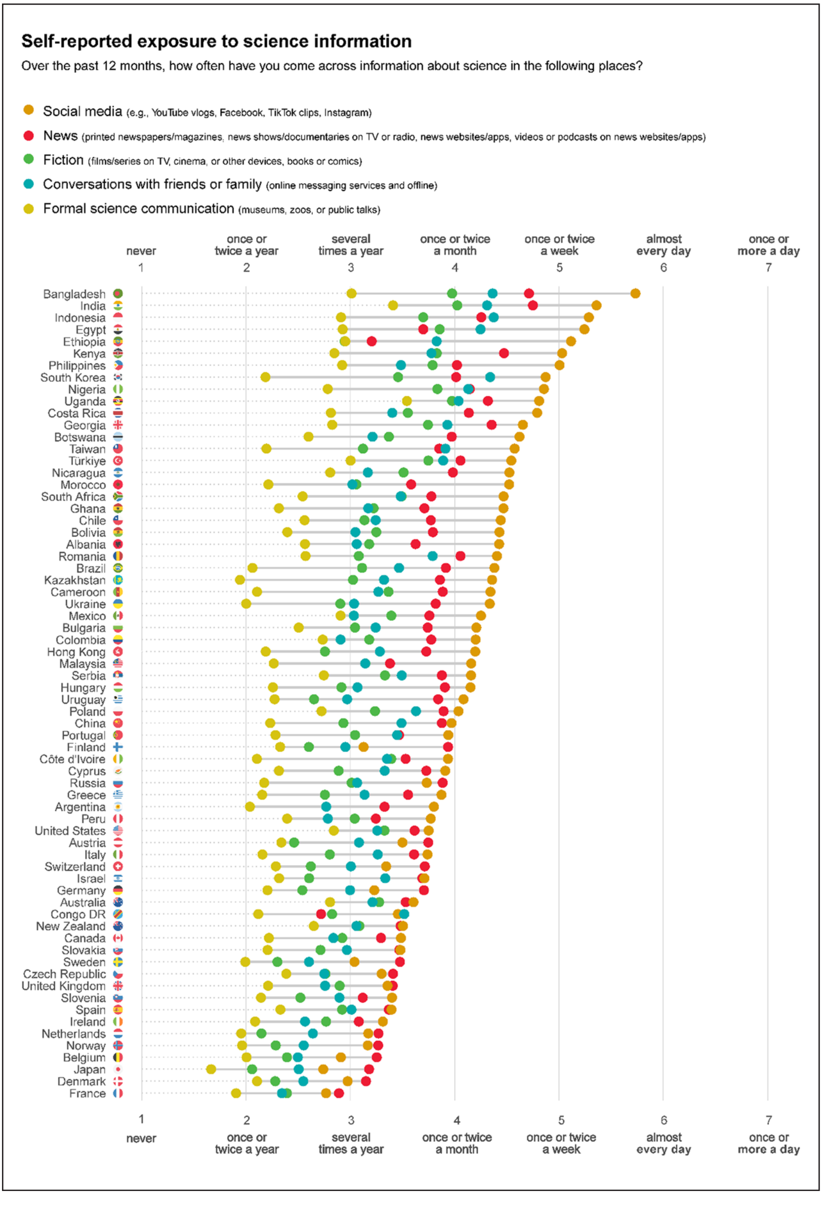

Figure 1. Average Reported Frequency of Exposure to Science Information.

science information diets. Across the world, most people report visiting museums, zoos, and public talks only once or twice a year on average.

Higher Social Media Exposure in Low-GDP Countries; Limited Access to Digital Media Associated with Visits of Museums, Zoos, and Public Talks. We find that GDP per capita and access to digital media are the two most informative factors explaining why science information diets differ across countries. People in countries with higher GDP are less likely to encounter science-related information on social media ($b = -0.28$; 89% credible interval (CI) = [−0.47, −0.08]; partial $\eta^2 = 0.09$) and in the news ($b = -0.20$; 89% CI = [-0.35, −0.06]; partial $\eta^2 = 0.08$) than people in low-GDP countries (see Supplementary Table S5).[8] Engagement with science in museums, zoos, and public talks is more likely in countries with less access to digital media ($b = -0.18$; 89% CI = [−0.29, −0.07]; partial $\eta^2 = 0.10$).

We did not find substantive evidence that further country-level factors are associated with people's science information diets. However, 80% CIs—a less conservative threshold for Bayesian inference—suggest that social media are a slightly more important route of exposure to science information in countries with low national levels of education ($b = -0.15$; 80% CI = [-0.30, −0.01]; partial $\eta^2 = 0.47$), whereas visiting public lectures and other ways of formal science communication are marginally less common in countries with restrictions to freedom of speech, for example ($b = 0.17$; 80% CI = [0.03, 0.33]; partial $\eta^2 = 0.02$).

Limited Freedom of Journalists and Academics Does Not Fully Prevent Engagement With Science. Bivariate distributions of people's science information diets and country levels of press freedom show that respondents in some countries with less freedom—for example, Kenya, Uganda, and Nigeria, as well as Bangladesh and India—still say they frequently come across science through news media (Supplementary Figure S1). The Democratic Republic of the Congo is an exception, where a low press freedom scores correlates with less exposure to science information in news media. Limitations to the freedom of academics to disseminate and discuss scientific knowledge among the public could be an additional barrier to science communication in the Democratic Republic of the Congo, where we find less public engagement with science in museums, zoos, and public talks (Figure 2). The same applies to several East Asian countries with low scores for freedom of academic exchange and dissemination, including China, Hong Kong, and Malaysia, as well as Russia and former Soviet republics such as Kazakhstan and Ukraine, albeit this may be partly due to low numbers and limited accessibility of museums or zoos in some of these countries. However, scholars in Egypt, Türkiye, India, and

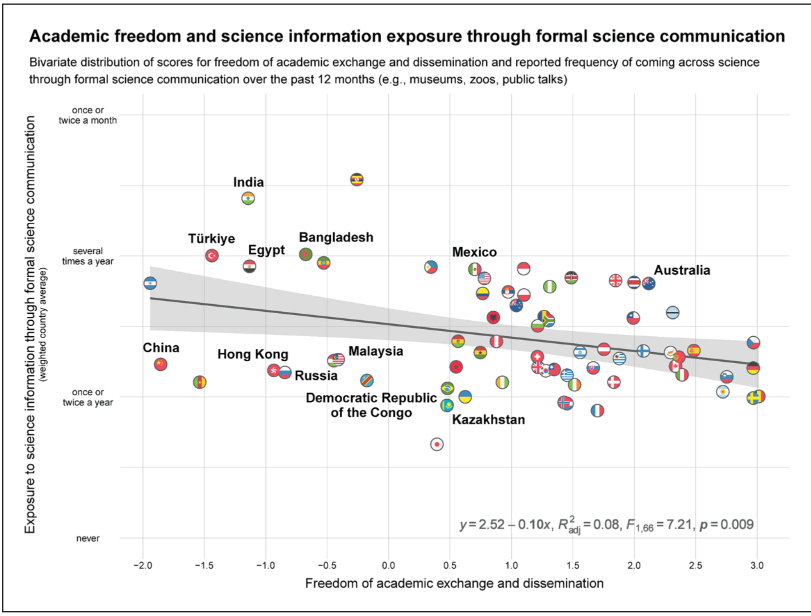

Figure 2. *Bivariate Distribution of Freedom of Academic Exchange and Dissemination and Reported Exposure to Science Information in Museums, Zoos, and Public Talks.*
Note. Exposure was measured on 7-point Likert-type scale with response options 1 = *never*, 2 = *once or twice a year*, 3 = *several times a year*, 4 = *once or twice a month*, 5 = *once or twice a week*, 6 = *almost every day*, 7 = *once or more per day*. The trend line shows a linear regression line predicting country-level means of exposure with freedom of academic exchange and dissemination. The gray band indicates the 95% confidence interval.

Bangladesh still seem to reach the broader public via museums, zoos, and lectures despite local limitations to free academic dissemination and exchange.

Communicating About Science with Others in Private and Public Spaces (RQ2)

Context Factors of Outspokenness, Discussions, and Participation in Protests About Science-Related Matters. We investigated attitudinal, conversational, and political aspects of people's science communication behavior. Results show that individual outspokenness about science—an attitudinal component—is generally high, as respondents in almost all countries tend to confirm that they share opinions about science regardless of what others think (68-country

$M = 5.30$, $SD = 1.47$). Yet, we find characteristic differences between world regions (see Figure 3). People in many sub-Saharan African countries are more outspoken about science (e.g., Kenya, Uganda, Cameroon, Ghana, Nigeria, Côte d'Ivoire), whereas people in collectivist cultures with Confucian value systems report lower levels of outspokenness (e.g., South Korea, Hong Kong, Japan, Taiwan).

The cross-cultural patterns of outspokenness largely replicate for a conversational component of science communication, that is, how often people actively discuss science with others. The zero-order correlation of outspokenness and science discussions was $r(66) = 0.63$, $p < .001$. This demonstrates how latent attitudes are linked to (self-reported) communication behavior (Matthes et al., 2012). For example, respondents in Kenya, Uganda, and Nigeria—three countries ranking high on outspokenness—talk about science with their peers, discuss it via messaging apps, and share or comment science-related social media posts about once or twice a month, but many people in Japan report doing so only once or twice a year (see Figure 3). They score clearly below the full sample, which reports discussing science approximately several times a year (68-country $M = 3.11$, $SD = 1.44$). However, we identify countries where the attitudinal and conversational components are less closely linked. For example, in Albania, Nicaragua, and Denmark, we find relatively large discrepancies between outspokenness and frequency of discussing science with others. People in these countries may still discuss science with like-minded others in their families or on social media but seem more hesitant to voice potentially controversial opinions about science in public.

A political aspect of public engagement with science—people's participation in public protests on science-related issues in the 12 months before data collection in 2022/2023—shows somewhat idiosyncratic variation. In Russia, China, Kazakhstan, and Nicaragua, where civic engagement is subject to state oppression, most people say they never attend such protests (68-country $M = 1.66$, $SD = 1.37$; see Figure 4). However, people in Türkiye, Egypt, and Indonesia, for example, report participation in protests on science-related matters several times during the year despite local restrictions. Yet, freedom to initiate public protests is not an imperative for actually speaking out: While some liberal countries such as the United States, Australia, and New Zealand do show much public protest on science-related issues, others do not: People in Sweden and the Netherlands, for example, report attending such protests considerably less often.

Less Educated Populations Tend to Discuss Science More Frequently With Others. National levels of education are a robust country-level predictor of

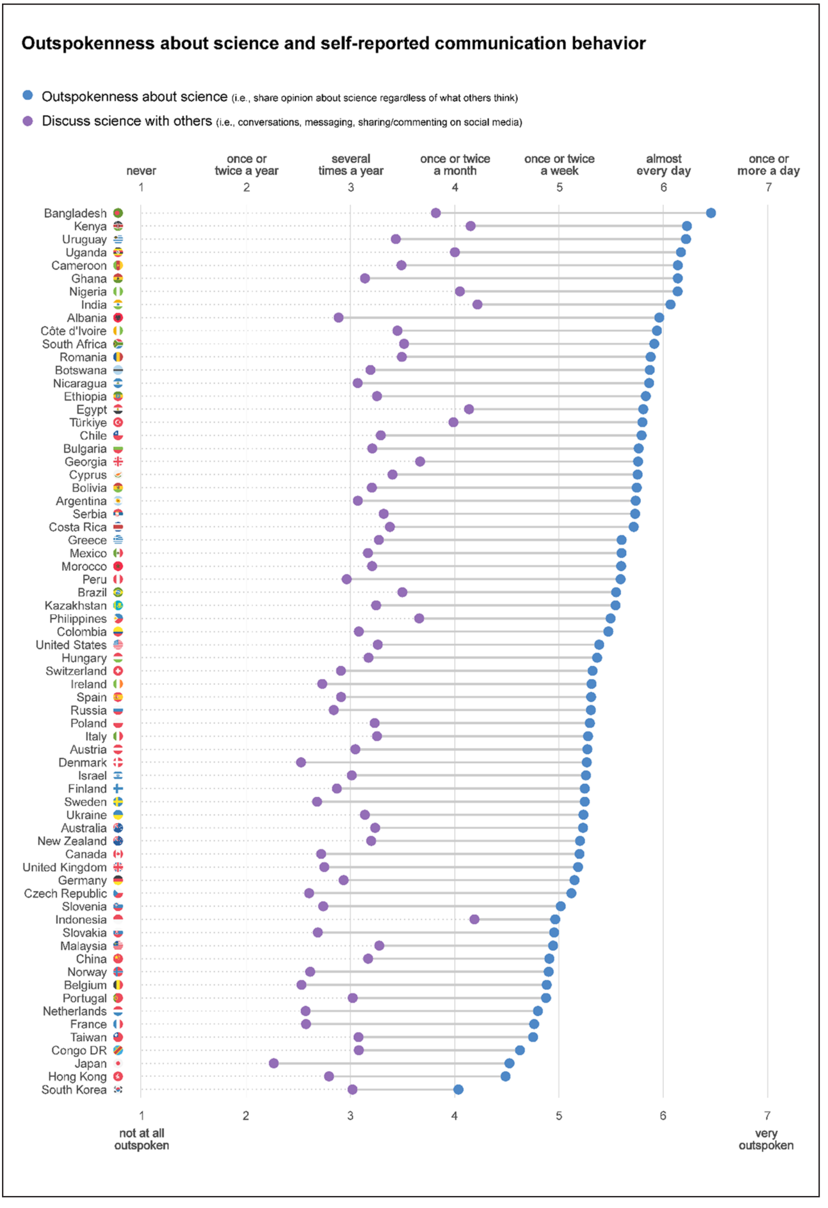

Figure 3. Average Outspokenness and Reported Frequency of Discussing Science With Others.

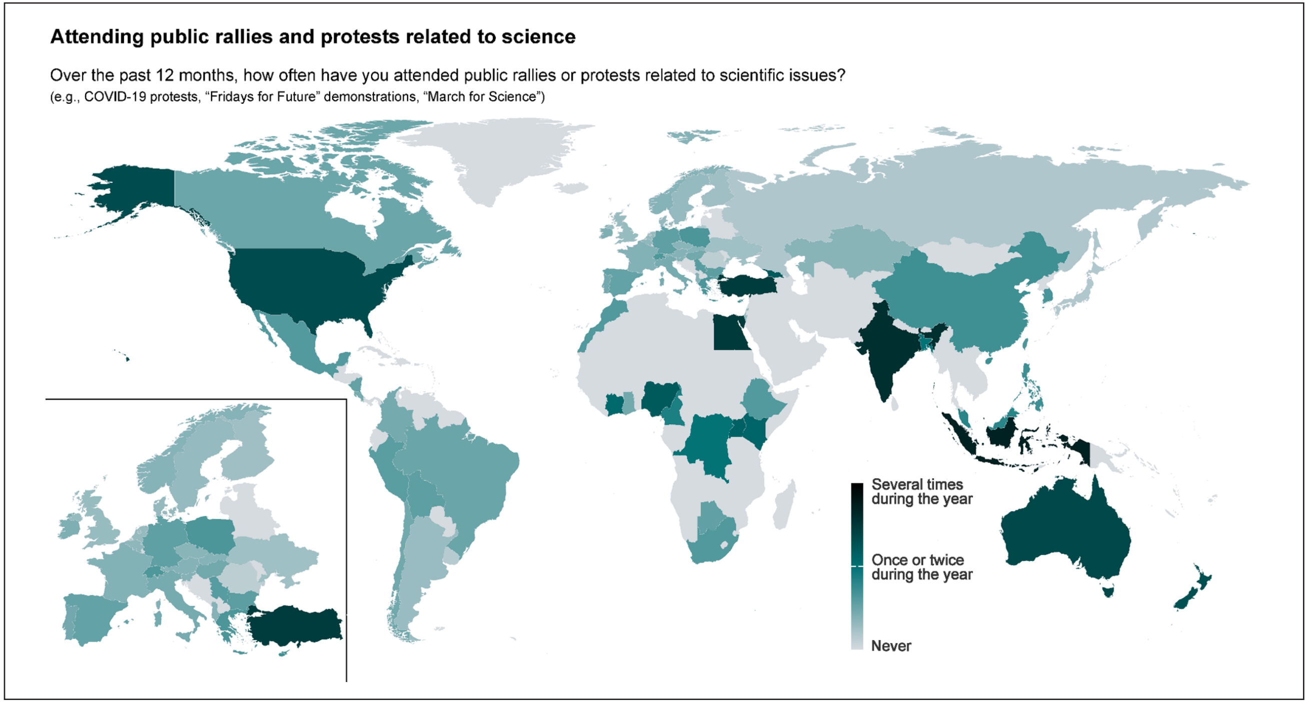

Figure 4. Reported Frequency of Attending Public Rallies and Protests Related to Science.
Note. Light gray indicates countries where no data were collected. Response options: 1 = *never*, 2 = *once or twice a year*, 3 = *several times a year*, 4 = *once or twice a month*, 5 = *once or twice a week*, 6 = *almost every day*, 7 = *once or more per day*.

outspokenness, with less educated people being clearly more outspoken about science-related issues ($b = -0.28$; 89% CI = [-0.42, −0.13]; partial $\eta^2 = 0.41$; Supplementary Table S6). Less conservative Bayesian inference criteria suggest that less educated populations are also slightly more likely to discuss science with others in conversations, messaging apps, or on social media ($b = -0.11$; 80% CI = [-0.22, −0.02]; partial $\eta^2 = 0.40$). People with less access to digital media, as indicated by national internet adoption rates, are more likely to attend public protests and rallies related to science ($b = -0.12$; 89% CI = [−0.23, −0.01]; partial $\eta^2 = 0.07$).

Limits to Democratic Deliberation and Freedom of Speech do not Necessarily Decrease Willingness to Speak Out on Science-Related Issues. None of the country-level indicators for the freedom of individuals, journalists, and academics to voice their opinions freely are associated with national levels of outspokenness, discussing science with others, and participation in public protests in the full 68-country sample (regression estimates range between 0.00 and 0.09 and all lie within CIs that include zero; see Supplementary Table S6). National levels of democratic deliberation are also not related to the attitudinal, conversational, and political components of science communication behavior that we distinguish in this study (regression estimates range between 0.05 and 0.08). Regional patterns seem to outweigh each other at the global level. For example, several Latin American countries whose populations score high on the democratic deliberation score—including Uruguay, Chile, Costa Rica, and Argentina—show high science-related outspokenness (Supplementary Figure S2). However, some East Asian and European nations with similarly high levels of democratic deliberation, such as South Korea, Japan, France, and the Netherlands, have lower outspokenness levels. Similarly, public participation in protests is positively associated with whether people enjoy the liberty to do so in only some countries (e.g., the United States), as bivariate distributions of speech freedom and country-level averages of the reported frequency of attending public protests on science-related issues illustrate (see Supplementary Figure S3).

Discussion

For science to inform individual and collective decision-making, it is essential that people have access to science-related information and opportunities to participate in public discussions on science-related matters in private and public life. Whether, to what extent, and how this is achieved has implications for policymakers, science communicators, and educators. Our study provides nationally representative, comparative evidence on where 71,922 respondents in 68 countries encounter science-related information, how outspoken they are about science, how they discuss it with others, and how often they participate in public protests on science-related issues. This evidence presents rich opportunities for discussing several lines of explanations and theoretical reflections on how and why people around the world *encounter science information on social media and beyond* and *communicate about science in private and public spaces*.

Encountering Science Information on Social Media and Beyond: Global Patterns and Implications for Science and Society

People in most countries come across science-related information most frequently through social media. This conforms with research showing that social media are the most used source of information about several issues, including politics and current matters, in various countries worldwide (Newman et al., 2024). Social media are particularly important for how people encounter science information in many South East Asian countries, where respondents report encounters on multiple days a week. This may be because media diets in these countries are more strongly geared toward digital platforms (Mukerjee, 2024). Respondents in several African countries show comparably high social media exposure to science information, potentially because social media platforms substitute for expensive or barely available alternative information sources, such as science journalism in newspapers and museums or zoos. These high exposure rates suggest that social media can be a useful tool for South East Asian and African science communication professionals: Platforms such as Instagram and TikTok allow them to interact with considerable parts of the public on a weekly or daily basis, which is crucial for sustainable outreach and engagement strategies (National Academies of Sciences, Engineering, and Medicine [NASEM], 2017). Yet, strategies tailored toward social media may reach only specific groups of the public, as social media use varies across sociodemographic characteristics (Gottfried, 2024). After all, practitioners need to consider cross-platform differences: The potentials and limitations of social media for public engagement with science differ considerably depending on user characteristics, regulation of access, potential government censorship, and platform affordances, that is, whether platforms allow the use of visuals, meaningful dialogue, and monitoring harmful content, for example (Qian et al., 2024).

Yet, despite the increasing importance of social media for science communication, traditional news media tend to be used more frequently than social media in all Scandinavian and German-speaking countries as well as

Belgium and the Netherlands. All these countries have democratic-corporatist media systems (Hallin & Mancini, 2004). Such systems are characterized by high degrees of pluralism and professionalization, extensive press subsidies, high newspaper circulation, and strong public-service broadcasting (Humprecht et al., 2022). As such, they offer favorable conditions for the production of science-related news and, as our results suggest, for its reach among the public. More recent analyses of media systems also map well onto our findings, as we find news media to be the most relevant source of science information in all countries that Brüggemann et al. (2014) sorted into the Northern and Central clusters of media systems. These results are further evidence that media use is conditioned by media systems (Wallner, 2022).

People also encounter science information in conversations with friends and family, both in personal conversations outside the internet and, especially in some East Asian countries, in online messaging services. This is plausible given that messaging platforms such as Line and WhatsApp rank among the most important news sources in Taiwan and Indonesia, for example (Newman et al., 2024). Museums, zoos, and public talks provide meaningful ways to encounter science, but people across the world use them clearly less often than other information sources. However, in some countries where admission to many museums and exhibitions is free, such as Australia and Mexico, formal science communication does not rank far behind other forms of exposure to science information. This suggests that government and philanthropic subsidies for museums can effectively benefit their ability to foster public engagement with science.

Notably, we find that several South East Asian and African populations report comparably frequent exposure to science information across all information sources, whereas overall exposure is lower in most Western countries. This conforms with global surveys on news exposure, such as the Reuters Digital News Report, which also indicates the highest exposure rates for India, Kenya, the Philippines, and Türkiye and the lowest rates for Denmark and Japan across several online and offline news sources (Newman et al., 2024). This pattern may also be marginally affected by global variations in acquiescence bias, which has been shown to be stronger in cultures that value collectivism, deference, and conformity—for example, in East Asia and sub-Saharan Africa—because respondents tend to prefer indicating compliance with socially accepted behaviors, such as being well informed about science (Krautz & Hoffmann, 2019; Lechner et al., 2019; see also Rammstedt et al., 2017). However, the impact of cultural variations of acquiescence on our results is likely very limited, because global patterns of acquiescence bias do not map well onto global patterns of exposure to science information. For example, several Latin American countries, which were also found to score high on acquiescence (Lechner et al., 2019), do not rank among the countries with highest exposure rates (see Figure 1). After all, research has found that any such impact is strongly confounded by other predictors of acquiescence, including age, gender, and education (He et al., 2014).

Sociopolitical and cultural conditions shape how people encounter information about science and communicate about it. We tested this with our data and found that low-GDP countries show substantially higher rates of exposure to science-related information on social media. This suggests that low economic prosperity does not undermine access to science-related information. It may fuel the use of less expensive information sources such as social networking sites, both because of lower purchasing power on the audience side and because of less supply on the news production side. Little availability of digital media does not seem to prevent exposure to science-related information either, as people with limited internet access engage more frequently with science in museums, zoos, and public talks. This indicates that people in less digitalized societies are still connected to public discourses about science (see Lakew & Olausson, 2019). We can also not confirm concerns that societies with lower literacy, limitations to free academic exchange and dissemination, and oppression of journalists disengage from science (Losi, 2023).

We do not find a general association of people's science information diets and national levels of press and academic freedom, but we do find regional patterns. For example, people from some sub-Saharan African countries, including Uganda and Kenya, continue to encounter science information via news coverage despite comparably low press freedom. Limited independence, pluralism, and transparency of news media may thus not fully prevent people in these countries from encountering science in the news (Losi, 2025). This is similar in Bangladesh and India, which have two of the biggest news audiences worldwide (Newman et al., 2024).

In the Democratic Republic of the Congo, however, a limited ability of journalists to work freely is associated with less public exposure to science through news media. Limitations to academic exchange and dissemination seem to have similar repercussions in some East Asian countries as well as Russia and a few former Soviet republics, where these limitations coincide with less public engagement with science in museums, zoos, and lectures. These dynamics are concerning as they may challenge free access to science information and thus undermine the human right to science (Chapman & Wyndham, 2013). They require action by communication professionals to defend science journalism and public engagement efforts against oppression. Scholars and journalists who still reach the public despite limited press and academic freedom—for example, in India and Bangladesh—need ongoing structural support as well, so that they remain capable of facilitating informed decision-making and public engagement with science.

Communicating About Science in Private and Public Spaces: Cultural Differences and Sociopolitical Conditions

We show how cultural, societal, and political conditions are intertwined with public and private communication about science. For example, people in countries with collectivist value systems seem to be less outspoken about science. This conforms with scholarship on cultural differences in human and mediated communication in general and may thus not be specific to outspokenness about science (Mooij, 2014). Despite legitimate criticism of binary classifications into collectivist vs. individualist cultures (Schwartz, 1990), these classifications seem to serve as useful heuristics for interrogating the relationship of cultural conditions and people's propensity to communicate about science with others. However, further research needs to test this pattern empirically, which was not possible for us, because existing country-level data on cultural values (e.g., Hofstede et al., 2010) cover only a subset of the 68 countries in the TISP study. More generally, future work may also want to explore further ways to utilize our country-level measures for categorizing the data, going beyond simplifying distinctions of Global North versus South or collectivist versus individualist societies. For example, one could distinguish between different types of cultures of civic participation (Theocharis & van Deth, 2018).

Engaging in political protests on science-related issues like COVID-19 or climate change seems to be contingent upon political regulations in only some countries. It is also associated with whether people are socialized to hold civic engagement in high regard, as in several Latin American and English-speaking countries (Dudley & Gitelson, 2002). The United States, Australia, and New Zealand, for example, seem to have some sort of a science-related "protest culture" (Klandermans et al., 2014). However, the 2024–2025 protests against budget cuts in Dutch academia—which rose after the TISP data collection—illustrate that protest attendance may increase quickly once a salient issue emerges, as the Special Eurobarometer 557 indicates (European Commission, 2025). This shows that demanding political action on science-related issues hinges on socialized values and political conditions: Participants of protests on science-related issues may not only—or not at all—aim to articulate their position toward scientists but toward political decision-makers, especially for highly politicized issues like the COVID-19 pandemic. This, then, illustrates the importance of conceiving "science communication as political communication" (Scheufele, 2014, p. 13585) and accounting for national levels of politicization of those issues that the TISP survey mentioned as examples, that is, climate change, COVID-19, and the March for Science.

Another important correlate of how people communicate about science with others is education, such that populations with lower education show higher levels of outspokenness about science and higher willingness to discuss science with others. This corresponds with research on Dunning–Kruger effects, which suggests that people who are less educated about science-related issues and are unaware of this deficit—that is, have a lack of metacognitive knowledge—are more likely to share their opinion on science-related issues such as climate change and COVID-19 (Mede, Kobilke, et al., 2025; Mede, Rauchfleisch, et al., 2024). Global science discourse may thus be populated, to some degree, by individuals with limited understanding of science. This bears the risk that inaccurate claims or superficial knowledge spread more easily, which may impede truthful, evidence-based science communication (West & Bergstrom, 2021).

Furthermore, we find that people in less digitalized countries participate in political protests on science-related matters more frequently. Limitations to online political action may thus cause people to speak out in public spaces. This conforms with Hassanpour (2014), who suggests that shutdowns of the internet and cellular communications during the Arab Spring in Egypt motivated people to take protests to the streets. Overall, our findings illustrate how public engagement with science is embedded in a complex array of sociopolitical, cultural, economic, and legislative conditions.

Conclusion

Our study suggests several future directions for how to understand the potential, challenges, and cross-cultural differences of people's science information diets and communication behavior. We highlight three of these directions, that is, (a) implications for science policy, communication, and education; (b) the primacy of social media and the urgency of addressing misinformation and miseducation; and (c) further theory-driven research on global patterns and differences.

First, our results are relevant for science-related policy-making, funding initiatives, education, and science communication practice. For example, they provide context-specific evidence for political decisions on where to allocate expenditures for education and public engagement efforts: Policymakers and funders may want to invest more resources into museums in countries where these are visited less frequently, such as Japan, where several museums have been in precarious financial situations (Mainichi Shimbun, 2023), because subsidies for museums seem to be linked to be higher visitor numbers as the case of Australia suggests.

The results can also inform the design of school curricula so as to include interventions promoting "science media literacy," which helps students to retrieve reliable science information from social media—particularly in Indonesia and Malaysia, where social media clearly dominate people's science information diets (Mede, Howell, et al., 2025, p. 2). This corresponds with recommendations of a country-specific analysis of the Irish subset of the TISP data, which concludes that "science education programmes should prioritize [. . .] the ability to navigate misinformation and evaluate evidence" (Roche et al., 2025, p. 13).

Our data may also motivate public and private funding for science journalism: In Ethiopia, for example, quality science coverage by news media seems unable to reach large parts of the population (see Figure 1). Local decision-makers may want to address this deficit by subsidizing science journalism at federal and private TV stations, for example, which rank among the most trustworthy news sources (Wolde & Woldearegay, 2024). Our data also legitimize such subsidies in Finland, Germany, Sweden, and Switzerland, where science journalism is underfinanced but—according to our findings—an important source of science information. Science communication practitioners, then, may use our data to identify potentials for collaborations with further stakeholders: In countries where people encounter information about science primarily on social media, effective science communication strategies may recruit online influencers, for example, whereas close collaborations of scientific institutions and professional journalists may be more useful in countries that show high exposure to science through news media. Overall, our study helps science communicators, policymakers, and education professionals to derive implications for their work based on country-specific insights and thus avoid generalization of large survey datasets, which is a common concern in the social sciences (e.g., see Vaidis et al., 2024).

Second, the primacy of social media as a source of science information suggests the importance of implementing measures to ensure that the information is true, and that false and misleading information is countered to the extent possible. This may require (coordinated) efforts of different stakeholders. For example, scientists and science communicators will need to actively promote true and combat false information on issues within their expertise through effective interventions (Kozyreva et al., 2024). Social media platforms may introduce more fact-checking tools and automated disinformation detection. Decision-makers might need to legally oblige platforms to do so, but they must be aware of the ethical boundaries of platform governance and risks of regulating public discourse (Bechmann, 2020). They will also need to be aware that less educated populations tend to be more outspoken about scientific issues (see Supplementary Table S6), which bears the risk that misleading claims spread more easily. To address that, teachers may want to focus more on those components of education that can safeguard against ill-informed outspokenness, such as metacognitive skills helping individuals to reflect on the limits of their own (science) knowledge when communicating with others about science (see Roberts, 2015).

Third, our findings are also useful for future scholarship, which may want to explore further country-level factors and incorporate individual-level variables that are associated with people's science information diets and communication behavior, such as the volume of press coverage on science or public trust in science (Guenther et al., 2024; Schäfer, 2012). Importantly, we recommend that future scholarship develops theoretical frameworks that organize country-level and individual-level factors and relate them to each other. This would facilitate informed post hoc explanations and a priori assumptions on how people's science communication behavior varies within and across individuals and macro contexts.

Further research also needs to address limitations of our analysis, most of which are typical for survey research and are, to some degree, determined by the methodological approach of the TISP project. These limitations include the cross-sectional design (which complicates causal inferences), the somewhat limited sample representativity (e.g., in terms of urban/rural place of residence), and the use of online samples (which probably have a preference for online sources of science-related information). Another limitation is the low granularity of key measures in the TISP survey, which did not allow us to explore potentially consequential differences between social media platforms, news brands, and forms of political engagement with science-related issues. For example, we focused on participation in public protests on science-related matters, which is a very tangible form of political engagement, but we could not investigate other forms of engagement, such as voting or donations. However, our analysis is still a good proxy for these other forms, because protest behavior is strongly related to people's political participation repertoires in general (Oser, 2022).

In addition, we relied on self-report measures, which are prone to overreporting and may therefore result in overestimating actual exposure to science information and communication behavior (Parry et al., 2021). Future research may want to use longitudinal and experimental study designs to test causal assumptions, more fine-grained questions, and survey modes that do not require respondents to be online-savvy and fluent in writing, for example telephone or face-to-face interviews. Further analyses could also apply other data handling procedures to achieve approximate equidistance of response data for the individual-level measures, e.g., by mapping the seven discrete response options (1 = *never* to 7 = *once or more per day*) onto a 365-day continuum. Follow-up studies may then interrogate how people's sources of science information are associated with the way they communicate about science with others, test how cultural conditions affect this association, and retrieve more meaningful indicators of cultural norms than the individualism-collectivism distinction.

Importantly, future studies should analyze not only the quantity but also the quality of people's science information diets and communication behavior. Information diets often contain false, deceiving, or polarizing content, and communication behavior may articulate skepticism, distrust, denial, and populism toward science (Ecker, 2023; Mede, Schäfer, & Metag, 2024). Respondents of the TISP study may have included such content and behavior in their answers to questions about how often they come across information "about science" and communicate "about scientific issues." High exposure and engagement, such as in Bangladesh and Kenya, should thus not be a goal in itself; it also suggests a mandate of decision-makers to monitor and perhaps regulate science communication especially in those countries (Bitta, 2022).

Our research, then, offers a highly instrumental basis for further follow-up studies. It considerably expands current knowledge about where and how people around the world engage with science and may thus foster a culturally sensitive approach to science communication scholarship and practice.

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Data and Code Availability

All data and code underlying this study as well as additional materials (e.g., pre-computed models, figures in high resolution) are available at the Open Science Framework: https://osf.io/gvcfe/. Raw data and survey instruments are publicly available at: https://osf.io/5c3qd/

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Ethical Approval

The survey received ethical approval from the Area Committee on the Use of Human Subjects at Harvard University in August 2022, which declared it exempt from full IRB review (protocol #IRB22-1046).

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Informed Consent

Participants gave written informed consent before taking the survey.

Supplemental Material

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Notes

1. The description is: "When we say 'science,' we mean the understanding we have about the world from observation and testing. When we say 'scientists,' we mean people who study nature, medicine, physics, economics, history, and psychology, among other things."
2. We inverted the index so that higher values indicate more freedom.
3. We decided against using indicators that are only available for a few countries included in the TISP dataset. For example, we did not include sociocultural indicators such as those from Hofstede et al. (2010), because this would have led to the exclusion of several countries and reduced the robustness and cross-cultural scope of our analysis.
4. The weights compensated for deviations between population and sample distributions of age, gender, and education for each country and accounted for unequal sample sizes across countries. They were provided by the authors of the TISP dataset, who employed an iterative procedure called raking (see Mede, Cologna, et al., 2025, for more details). We successfully replicated this procedure for this study.
5. We did not conduct significance tests of differences between countries, as the large amount of pairwise comparisons would have exceeded the scope of this

study and would not have aligned well with our ambition to explore broad regional patterns instead of individual country differences. However, we encourage future research to test for significant differences at the country level to add further depth to our results.

6. The multivariate analyses included only 68 cases, that is, one for each country. In these scenarios, Bayesian regression gives more robust results than frequentist regression, provided that the researcher chooses a sufficiently high number of model estimation iterations. Therefore, we preferred Bayesian modeling to frequentist modeling and set a high number of 10,000 model iterations. This limits the risk of estimating unreasonably high regression coefficients, ensures more reliable standard errors, and thus produces more robust credible intervals (CIs), which can be described as the Bayesian counterpart to frequentist confidence intervals. A key advantage of Bayesian CIs over frequentist confidence intervals—apart from being more stable in scenarios with small datasets—is that CIs allow intuitive probability statements about parameters (for 89% CIs: "there is a 89% chance that the population value lies within the interval"), whereas the interpretation of confidence intervals is less straightforward (for 89% confidence intervals: "if we repeated the study infinitely many times, 89% of the intervals would contain the population parameter"). However, our Bayesian models used non-informative priors (i.e., a priori assumptions on the distributions of model parameters) as there are to our knowledge no studies that would meaningfully inform priors. In these cases, performance differences between Bayesian and frequentist modeling are relatively small (see McElreath, 2020, for detailed explanations).
7. Variance inflation factors (VIFs) were below common thresholds (O'Brien, 2007), but the speech freedom indicator showed minor multicollinearity (VIF = 7.89). We retained it in the models, as they used non-informative priors, which can handle multicollinearity better than frequentist regression modeling.
8. CIs are highest density intervals (HDIs). We report 89% CIs following common practice in Bayesian modeling (McElreath, 2020) and scholars suggesting that 89% CIs are more stable than 90% or 95% CIs (Kruschke, 2015).

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