

# Scientific rigor beyond open science: Faculty perspectives on research quality and evaluation

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## Abstract

In recent years, policy reforms and funding mandates have accelerated the adoption of open science practices. These practices are increasingly being promoted and mandated to enhance transparency and replicability. As such, they may serve as signals of the quality of a paper. However, transparency and replicability are only parts of what makes a study rigorous, and far less attention has been paid to how this emphasis on open science practices relates to the criteria researchers use to evaluate scientific rigor. Drawing on in-depth interviews with tenure-line faculty across disciplines, we examine how researchers understand scientific rigor and how they interpret the growing use of open science practices as signals of quality. Faculty consistently valued open science for improving transparency and accessibility but emphasized a broader set of criteria they consider equally important for rigorous research, including theoretical grounding, appropriate methods, accurate claims, and ethical considerations. Many noted that these dimensions of rigor are not always fully captured by open science frameworks or by journal badges that indicate adherence to open science practices. Faculty also expressed mixed views about the extent to which open science practices function as meaningful indicators of research quality across disciplines and methodologies. Our findings suggest that while open science can strengthen scientific rigor, evaluation systems that treat transparency and replicability as prominent evaluative signals may affect perceptions of what constitutes rigorous research. These findings have implications for the design and implementation of research evaluation frameworks that reflect the multidimensional and context-dependent nature of scientific rigor.

**Keywords** open science, scientific rigor, open science badges, evaluation signals, academic incentives

## 1. Introduction

Global research evaluation reforms increasingly position open science, which ‘aim[s] to make multilingual scientific knowledge openly available, accessible and reusable for everyone’ (UNESCO 2021), as a means of enhancing transparency, accountability, and trust in science. Practices of open science include open access (making research articles freely available to readers), open data (publicly publishing data used in a scientific study), open materials (publicly publishing materials such as code, instruments, and protocols), and preregistration (publicly publishing study methods, hypotheses, and analysis plans before the study is conducted), among others (Center for Open Science n.d.-b). Some funding mechanisms, like the U.S. National Institutes of Health, mandate open science practices for their funded projects (2024). Open science practices are also recommended or required by the European Commission (2025), UNESCO (2021), the U.S. Department of

Agriculture (n.d), the U.S. National Science Foundation (n.d), and non-governmental funders (Chan Zuckerberg Initiative n.d). Journals have begun awarding badges to studies that use certain open science practices (Grahe 2021; Schneider et al. 2022). Such requirements are largely motivated by the principle that research should be accessible to the public.

Some researchers, however, have raised concerns about how these policies may introduce their own issues. As these practices have become increasingly embedded in funding requirements and institutional evaluation systems, they are contributing to changes in how scientific quality is signaled and how researchers interpret and evaluate scientific rigor (Nelhans and Nolin 2022). It is therefore essential to examine open science practices empirically (Freiling et al. 2021; Nelhans and Nolin 2022; Suls et al. 2022; Brainard 2025).

Existing studies of open science have largely focused on disciplinary adoption rates, methodological feasibility, and technical

barriers (Ferguson et al. 2023; Greenspan et al. 2026). Less attention has been paid to how researchers perceive open science practices and their potential use as evaluative signals for scientific rigor. Tenure-line faculty members can be implementers and subjects of open science policies, thus occupying a crucial position in this transformation: their perceptions determine how evaluation instruments are interpreted, operationalized, and internalized in academic practice. This study contributes to the empirical evaluation of open science practices by examining tenure-line faculty members' perceptions of what is important for scientific rigor and the role open science plays in that, through in-depth interviews. We focus on tenure-line faculty across disciplines, as this allows for examining perceptions from researchers whose job focuses on research, meaning they might have the most nuanced perceptions of how open science fits with scientific rigor. Additionally, interviewing faculty across disciplines allows for examining varied perceptions of what constitutes scientific rigor and how open science may fit into that, including from disciplines that embrace open science more as well as those that might not see how it fits their work.

## 2. Scientific rigor: criteria and practices

The term 'scientific rigor' refers to the appropriate application of the scientific method to all stages of the research process, including study design, data collection and analysis, as well as reporting (National Institutes of Health 2024). Criteria that promote scientific rigor serve as benchmarks to evaluate the quality and trustworthiness of research across diverse methodologies (Mårtensson et al. 2016). Because the methods, approaches, and goals of scientific research vary widely across and sometimes even within disciplines, creating a comprehensive list of scientifically rigorous practices that all studies should implement is outside of the scope of this paper.

Following, we describe quality criteria of scientific rigor that are likely to be most applicable and important across disciplines: validity and reliability, reproducibility and replicability, transparency, generalizability, and ethics. *Validity* concerns how accurately an instrument captures the concept it is designed to measure, while *reliability* concerns the consistency of measures an instrument produces across researchers, time, populations of interest, among others (Bruton et al. 2000; Hayes 2005; Flake et al. 2022). *Reproducibility* refers to obtaining the same findings using the same data and analysis techniques, and *replicability* refers to obtaining similar findings with different data—either with the same instrument (direct replication) or a different instrument (conceptual replication) (Hicks 2023). *Transparency*—in documenting methods, analyses, and decision-making—enables others to assess and replicate the work (Prager et al. 2019), meaning transparency is necessary, but not sufficient for replicability and reproducibility. In qualitative and interpretive traditions, an important aspect of transparency is to disclose the researcher's positionality (e.g., worldview, social identities, and experiences), as that shapes how research is conducted and interpreted (Yadav 2022). *Generalizability* describes the extent to which findings can be applied beyond the specific context of the study (e.g., to the whole population) (Yom et al. 2022). *Ethical*

standards guide acceptable research practices, including research integrity, managing conflicts of interest, ensuring respect for participants, and consideration of the effect of research on society (Drolet et al. 2023; Lilja 2025). Together, these criteria offer a multifaceted framework for evaluating and strengthening the rigor of diverse types of research.

Scientifically rigorous practices support those criteria. For example, when researchers follow clear, pre-established protocols, this can contribute to higher reliability, replicability, and reproducibility (Mårtensson et al. 2016). More generally, a fundamental practice of scientifically rigorous research is creating a robust research design, which includes articulating clear research questions, formulating hypotheses or questions that are grounded in theory, and selecting methodological approaches that appropriately address the research problem (Abbott and McKinney 2013; Kelly and Lesh 2012). Once a study design has been selected, researchers must select appropriate measurement tools, sampling and data collection techniques, and analysis methods (Bowling and Ebrahim 2005; Mishra et al. 2019; Lakens 2022) to get valid, reliable, replicable, and generalizable results. Along with transparent reporting of procedures and findings, this helps researchers to replicate or reproduce previous studies' results. Ethical practices include, for instance, minimizing risks and maximizing benefits for participants in human subjects research or not to cherry-pick significant results in a dataset to write a paper about.

## 3. The open science movement and scientific rigor

Given the variety of criteria and practices of scientific rigor, how are open science practices positioned within contemporary policy and evaluation frameworks? An important goal of open science is making science more replicable (Hicks 2023). The adoption of open science has been spurred by a so-called 'replicability crisis' (Nosek and Errington 2017) in fields like psychology. Yet, even Brian Nosek, Open Science Framework (OSF) founder, noted that we do not know whether this crisis has affected various disciplines in the same way or to the same degree (NASEM 2019). Open science is frequently promoted as a way to aid replicability by making adherence to certain scientific principles more visible (Dienlin et al. 2021; Wentzel 2021), although the efficacy of its practices in this area is also debated (Dudda et al. 2025). The idea is that open data and open materials may, for example, counter questionable research practices (QRPs) such as selective reporting of outcomes (Bakker et al. 2021), since they might make QRPs more visible. Open data and materials may also foster collaboration among the scientific community (Arthur and Hearn 2021). The practice of preregistering studies could, for instance, reduce bias, increase transparency, and mitigate QRPs associated with data manipulation to try to find significant results (i.e., *p*-hacking) and hypothesizing after the results are known (i.e., HARKing) (Grahe 2021). All of this could then increase trust within the scientific community and among the public (Grand et al. 2012).

Yet despite the increased usage of open science practices spurred by policy measures, research shows that replication remains an elusive goal (Laurinavichyute et al. 2022; Crüwell et al. 2023; Dudda et al. 2025). One reason for this is that open science

practices focus on specific components of scientific rigor (e.g., transparency), but do not specifically address others (e.g., sample sizes or sample representativeness) (Hicks 2023). This means that, in some contexts, practices associated with openness may be treated as an indicator of replicability, even though openness itself does not guarantee it (Morrison 2022). Emphasizing specific open science practices as markers of quality criteria of scientific rigor might thus come at the expense of other criteria and practices that are at least just as relevant (Freiling et al. 2021). The concern here is not that open science practices are misguided or unnecessary, but that their increasing use as evaluative and signaling mechanisms may narrow how scientific rigor is perceived (Freiling et al. 2021). Indeed, prior research highlights how research assessment systems can be ‘gamed’ (Rijcke et al. 2016) by researchers and institutions strategically adapting behavior to improve performance on assessment indicators rather than enhancing research quality. Additionally, some studies, particularly qualitative ones, are context-specific and may be impossible to replicate (Pratt et al. 2020). However, when replicability-oriented practices are foregrounded as indicators of rigor, the standards by which such work is evaluated may be misaligned with its epistemic goals (Hengel et al. 2024).

Additional goals of open science include increased quality and integrity, collective benefit, equity and fairness, and diversity and inclusion (UNESCO 2022). Many of these goals reflect a broader vision of science as a public good: that it should be transparent, inclusive, and accessible to researchers and communities across the globe. However, the extent to which policy-driven open science initiatives achieve these goals is debated; the infrastructure and labor required to engage in open science practices—such as data curation or publication in open-access journals—may disproportionately burden researchers with fewer institutional support or from under-resourced regions (Fecher and Friesike 2014; Bahlai et al. 2019; Guzzo et al. 2022; Simm and Eigi-Watkin 2024). Thus, while the values underpinning open science are widely endorsed, their practical implementation continues to prompt critical reflection and ongoing debate (Bahlai et al. 2019; Freiling et al. 2021; Guzzo et al. 2022).

That there may be disproportionate emphasis on ‘openness’ both within the scientific community and, as part of the funding and publication processes, on those parts of scientific rigor that overlap with open science practices is illustrated by the fact that more than 100 journals across disciplines now offer open science badges (Center for Open Science n.d.-a). These badges signal authors’ compliance with specific open science practices such as open data, open materials, and preregistration through the awarding of colorful icons that make those studies visually stand out (Center for Open Science n.d.-a; Schweitzer and Schulz 2018).

Following the need for empirical evaluation of open science practices (Freiling et al. 2021; Nelhans and Nolin 2022; Suls et al. 2022; Brainard 2025), this study focuses on how open science may impact perceptions of scientific rigor. Specifically, we use interviews with tenure-line faculty about the criteria they use to design and evaluate scientifically rigorous studies as well as what criteria they view as most important in their work. Previous research on perspectives of open science practices has focused primarily on fields whose methods allow for relatively frictionless adoption of open science practices (e.g., Ferguson et al. 2023; Greenspan et al. 2026). This study takes a broader

approach by interviewing tenure-line faculty from across disciplines to evaluate perspectives from faculty members using diverse approaches in their research. Additionally, we examine whether specific open science practices are, in some contexts, interpreted by faculty as markers of quality (Pourret et al. 2022; Suls et al. 2022), especially when some scholars and journals clearly mention the potential of open science practices to signal quality (Schweitzer and Schulz 2018; Freiling et al. 2021).

RQ1a: What criteria and/or practices do tenure-line faculty across disciplines perceive as important for conducting quality scientific research?

RQ1b: What quality criteria and/or practices for scientific rigor do tenure-line faculty across disciplines rank as the most important?

RQ2: How do open science practices fit into tenure-line faculty’s perceptions of scientific rigor across disciplines?

RQ3: What are tenure-line faculty’s perceptions regarding the awarding of open science badges in terms of signaling rigor across disciplines?

## 4. Method

To answer these questions, we interviewed 28 tenure-line faculty across disciplines at a large R1 university in the United States in a semi-structured format about criteria of scientific rigor and their perceptions and use of open science practices. All study procedures were approved by the authors’ university’s Institutional Review Board (IRB; IRB 00177204) before any work with human subjects started.

We used random stratified sampling with a sampling frame that we created of all (including medical) tenure-line faculty listed on the university’s departmental websites. We chose to conduct interviews exclusively with tenure-line faculty, since these faculty are research-focused. Because faculty are both subjects and implementers of institutional, professional associational, and national open science policies—through their compliance with university policies, publication norms, and funder mandates—interviewing them provides a valuable lens into the practical effects of science policy reforms on research culture. The sampling frame sorted faculty into one of four different strata (biological, physical, or social sciences, and arts/humanities) based on their home department or school. In cases of faculty whose research fell between or among these strata, we used the U.S. National Science Foundation’s (2023) Survey of Earned Doctorates to assist in classification. We interviewed faculty from a range of disciplines to capture diverse perspectives. In this qualitative study, we did not seek representativeness or generalizability; instead, we focused on conceptual and analytical depth appropriate to the phenomenon under study. Accordingly, this study should be viewed as an exploratory starting point for further investigation.

Following IRB guidelines, sampled faculty were contacted via email from a department contact rather than the authors. Interested faculty then scheduled an approximately one hour-long interview about their perspectives on scientific rigor with one of the researchers. To receive unbiased open-ended

responses from faculty about their perspectives on scientific rigor, interviewees were not informed in advance of the interview that they would also be asked to share their thoughts about open science. We sampled and contacted the same number of faculty in each stratum and stopped conducting interviews when we reached theoretical saturation (i.e., when no interviewees were mentioning new perspectives anymore). This process yielded 9 faculty members from biological sciences, 4 from arts and humanities, 7 from physical sciences, and 8 from social sciences.

The interviews were conducted as part of a larger study to gather faculty perceptions of open science and scientific rigor. In this paper, we focus on the analysis of the answers faculty provided regarding criteria for scientific rigor and how they view open science as relating to scientific rigor, along with faculty perceptions of open science badges, as these signal the use of open science practices.

Two of the authors conducted the interviews, with one interviewer per interview. After faculty provided written and verbal informed consent for participation, the interviewer used a semi-structured interview script (see [Supplementary Material](#)) of questions on scientific rigor, the quality criteria faculty associate with scientifically rigorous research in their own studies and when evaluating others' work. Interviewees were asked to rank the criteria they mentioned per their importance, meaning we did not provide them with a pre-determined list. Then, faculty were asked whether they had heard of or engaged in any practices related to open science (which was defined for them; see [Supplementary Material](#) for the definition). We also asked faculty about their perceptions of open science and to revisit their ranking of quality criteria for scientific rigor with open science practices in mind. Finally, faculty were asked about their perspectives of two specific open science practices: preprints and open science badges. As part of this, we explained the use of open science badges to faculty who were not familiar with them and displayed icons of the commonly used 'Open Data', 'Open Materials', and 'Preregistered' badges to all faculty (provided in [Supplementary Material](#)).

The interviews ranged from 30 min to slightly over an hour, with most nearing the hour mark. We audio recorded the interviews and had them transcribed by a professional transcription service. The transcripts were de-identified, with each participant being referred to by an assigned number from P1 to P28. The two researchers who conducted the interviews analyzed the faculty's responses using a deductive-inductive coding process using MAXQDA version 24. Deductive codes based on the authors' literature review included replicability and reproducibility, research design, ethical standards, generalizability, qualitative and quantitative methods, and transparency, among others. Inductive codes were identified during the coding process and included perceptions of open science and scientific rigor, fraud and trustworthiness, types of data, and decisions about research. The coders discussed inductive codes as they came up, and new codes were added based on their consensus. Previously coded material was then recoded for newly emerged codes.

For the ranking of quality criteria of scientific rigor, not everyone provided the same number of criteria, and some viewed them all as equally important. We grouped similar criteria and practices that can help meet the criteria into broader criteria of scientific rigor to allow for the creation of a rough overall ranking. We call this a rough ranking as some faculty's ranked criteria

would be merged into a broader criterion in our grouping process. This process yielded 12 criteria, which we further merged into the three high-level categories described in our findings.

## 5. Faculty perceptions of quality criteria and practices of scientific rigor

To answer RQ1a, we examined the criteria and practices of scientific rigor that faculty mentioned as being important. Since faculty were asked to identify these criteria before being made aware of our additional intention to ask about open science practices, these findings represent their thoughts on criteria of scientific rigor and practices that support those criteria cleanly. Many of their responses are in line with open science principles and practices, but our findings indicate that faculty conceptualizations of scientific rigor extend beyond the aspects most commonly highlighted in discussions of open science. At a very high level of abstraction, the criteria can be classified into the categories of sound study design, transparency, and following ethical standards.

### 5.1 Sound study design

Sound study design encompasses many criteria and practices, and faculty across disciplines, using a variety of research methods, mentioned this as essential for scientific rigor. Key components cited by faculty were (1) grounding research in theory, (2) aligning methods and data with research questions/hypotheses/theory, and (3) making accurate claims.

#### 5.1.1 Grounding research in theory

Interviewees stated that grounding research in theory and referencing appropriate literature are critical when designing studies, interpreting results, and evaluating others' work. 'Sometimes I find that [...] some key existing literature has been missed for the study has been put out, so people will make claims that aren't really true. Certainly, that's true for myself' (P6). Going back to theory is also critical for faculty when they find data that do not align with their expectations: '[I make] sure that I'm rigorous in looking at every little tick of every single data point to make sure that we've got an explanation for why a current theory or model doesn't explain the data' (P17).

#### 5.1.2 Aligning methods and data with research questions/hypotheses/theory

Interviewees emphasized that the research questions should inform decisions about the chosen method and data collection and analysis. Several faculty stated that it is not generally possible to capture every piece of data about a trial, interaction, or participant, so researchers must decide which data are important to collect and which data they can leave out. After collecting the data, researchers may also need to decide how to clean their data. Then, they need to decide how to prepare the data for analysis and which variables to include in the analysis. All these decisions need to align with the respective theories or hypotheses and research questions.

[A]s far as just the design of the research, [it should be] done in a way that it's based on either hypotheses or research questions. It [should be] designed to be a big enough sample size to answer the question you want to answer, all the statistical power, appropriate statistical techniques. (P22)

A key component of this alignment among research questions, methods, and data is maintaining high validity, which means that the instrument is measuring what it is designed to measure (Higgins and Straub 2006; Flake et al. 2022). Of course, there is no validity without reliability (Higgins and Straub 2006), so that played a role in the alignment as well.

Scientific rigor, to me, means that studies are conducted in a way where you believe that the results and the findings are reliable and valid, and that they've been conducted in high-quality ways that use the field's best standard practices of how we determine what an evidence-based practice is. (P24)

As illustrated in the above quote, for many interviewees, aiming for high validity (and reliability) meant using appropriate measurement tools and data analysis methods.

### 5.1.3 Making accurate claims

Accurately stating claims, or not overclaiming what the data can actually show, was a vital component of sound study design for many faculty: 'I guess on the other side of things would be just not overstepping what the data show in a conclusion type of sentence or the take-homes from the research' (P6). Several faculty expressed that overstated discussion and conclusion sections are a problem even in published journal articles:

They overstate. They misquote. [...] Then you have this myth, this misconception that just goes and it goes, and it goes, because then people quote that article saying, "It is this." (P10)

[I]f you look at the data, what is it that that set of data shows you? If you look at the data that somebody cites that supported a theory, then does that really support the theory? (P11).

The latter further illustrates that we need to ensure that researchers report other data accurately in the literature review as well.

Some expressed that the skill to make accurate claims is tied to the skill to design the study well and that peer review should ideally identify instances where the findings are overstated because of a mismatch between study design and claims:

I think as a reviewer, oftentimes what we say is, "You did this experiment and it shows this, and it may be right, but you also need to do this other thing." This other thing in combination is what people in the field typically do. You've done one thing, but the standard is higher than that. [...] If that basically turns out to be supportive, then I believe what you said. (P1)

Rigorous science thus involves not only drawing appropriate conclusions but also exercising restraint in claims, especially when the evidence is limited or preliminary.

## 5.2 Transparency

Many interviewees mentioned transparency, which includes the careful documentation and sharing of the research process from beginning to end, as a crucial criterion for scientific rigor. They stressed repeatedly that researchers must communicate all their assumptions, decisions, and processes: 'Just describe things for what they are. That makes sense, right? Just be aware of the limitations' (P11). Or:

I think, for me, the most important way that I encounter the concept of scientific rigor day to day in my life here as a PI [principal investigator] is being very forthright about the decisions that we're making and our motivations. (P19)

Transparency is essential for ensuring that other criteria for scientific rigor are in place:

The first [criterion] is, can you clearly communicate what you did so that another scientist could reproduce your study based on the way that you're describing it. It is common that we get so familiar with the way we do our science that—scientific writing is challenging, and so sometimes it's even hard to tell the study design or important things about the study just in the way that it's written. (P6)

By thoroughly documenting and communicating their research decisions, assumptions, and limitations, faculty in our study make their work more interpretable, trustworthy, and usable by others.

Transparency was often, but not always, linked to reproducibility and replicability. Note, although there is a difference between reproducibility and replicability, most interviewees did not adhere strictly to the definitions of these terms (in terms of what differs between them; instead, some used the terms interchangeably). We have, therefore, combined them in this analysis. One interviewee explained the importance of reproducibility and replicability this way: 'Things can look really exciting and then not hold up to further scrutiny' (P22). Another cited the importance of verification to ensure that this criterion is being met, stating, '[studies should] not simply [be] reproducible by that same person who shows you the data but reproducible in general by an expert in the field who's independent' (P2).

## 5.3 Ethics

Ethics was repeatedly mentioned as necessary for scientific rigor. A key component of ensuring ethical research is academic honesty, which 'means doing your best to get the answer right' (P8) by acknowledging limitations and checking results: '[W]hen-ever my name [or the name of my lab] is on something [...] [is] really carefully vetted for rigor' (P8). Another interviewee stressed that accurate and thoughtful analysis is critical to minimize bias:

I think people sometimes, when they have their data and they analyze it, they aren't truthful about it, and they aren't rigorous about it. [...] [As researchers, we should do] things in a methodologically rigorous fashion that can ultimately be reproduced and [try] to be as unbiased as possible about your own findings. (P10)

In research involving human participants, respect for their privacy, confidentiality, and autonomy are also required for conducting ethical research. One interviewee stated that the following criteria related to researchers' relationships with participants should be considered key components of rigorous research: 'Cognitive empathy, heterogeneity, palpability, follow-up, and self-awareness' (P28). Other faculty stated that researchers have an obligation to ensure participants understand how their data will be used and shared:

We usually make that clear on how we are going to use that data. We have procedures where the identity of the person is not disclosed in any sense. [...] We explain that to patients. Sometimes, yes, identification is required, but then we let them know and update their consent. (P9)

## 6. Faculty ranking of criteria of scientific rigor

Answering RQ1b, the rough ranking we compiled of the most important criteria of scientific rigor for faculty in our study is as follows, with the first being the most important: (1) study design, (2) making accurate claims, (3) reproducibility and replicability, (4) aligning methods with research questions and claims/validity and reliability, (5) grounding research in theory, (6) data sharing, (7) ethics, (8), transparency, (9) clarity of techniques, (10) acknowledging limitations, (11) respect for and relationship to participants, and (12) honesty. It should be noted that while a criterion like honesty was ranked lowest, this does not mean faculty viewed it as not important. In fact, it being on this list means it is still viewed as important—otherwise, faculty would not have mentioned it in response to our question about important quality criteria of scientific rigor. We sorted these criteria into the high-level categories of sound study design (1, 2, 4, 5), transparency (3, 6, 9, 10), and ethics (7, 11, 12). These categories should not be taken as exclusive—reproducibility and replicability, for example, also rely on sound study design (Prager et al. 2019).

## 7. How do faculty view open science practices fitting into criteria of scientific rigor?

It is evident from our findings so far that many faculty are thinking about issues related to open science, specifically in regard to the topics of transparency and replicability/reliability, even when we did not prompt them to (yet). This is true even as our later questions about open science directly revealed

that faculty members varied in their adoption of and comfort with open science practices. For example, some of faculty reported not having heard of the term 'open science' before, and many of the faculty who had heard of open science expressed some level of uncertainty regarding its exact definition. That is not to say that either the faculty who had not heard of the term or those who were uncertain about its practices were not engaging in open science practices. In fact, most of the faculty interviewees reported using some form of data sharing practice, and most of those openly shared data as a part of the publication process. Those who practiced open data and data sharing sometimes spoke of its importance to scientific rigor:

I actually think the better way to know whether the study is right is that if they also just publish the data alongside with the publication, so that if I want to check I can check. Just because the reviewer checked the paper, if the reviewer doesn't have access with data, I also don't know if the paper is right. (P15)

In addition to transparency, open data could allow fields to progress faster:

[I]t allows a level of transparency that holds researchers accountable for ensuring that the work that they do is accurate, high quality, all of those kinds of things [...] there's [also] probably a lot of additional investigations that could be done with all of the data that exists currently that has been not investigated, simply because it fell outside of that particular researcher's area of interest. (P24)

Faculty thus recognized that making data publicly available not only strengthens the credibility of individual studies but also contributes to the cumulative advancement of scientific knowledge.

Relatedly, the practice of open materials was also cited by those who engaged in it as being important for scientific rigor. Some wished that the practice of open materials would go further to include more details to avoid researchers having to run the same studies again:

That's very frustrating that [the measurements and code were] not shared because then what that makes me do is I have to go back, and I have to run [a basic experiment again]. I just have to run these experiments again just because they didn't include a 10-kilobyte file of all of the tabulated data. (P17)

Other faculty did not see open science practices fitting seamlessly into their work since they cannot share all their data openly to safeguard participants' privacy and confidentiality:

I do think that [sharing data] is valuable, but [...] There are so many variables in play with qualitative work—protecting confidentiality. [...] I post my interview guides, and so that's one step that I want to take in terms of transparency, and that can help future researchers or in similar fields to use that and use that to inform their studies. (P28)

This same interviewee also expressed that some participants may be reluctant to participate in research if their data would be shared openly. This faculty member also stated that reproduction/replication is not usually a primary goal of qualitative research in their field:

I think it's [replication] a little more complex with qualitative research because [...] Me conducting interviews with someone or observations might be different from someone else in a different social position conducting that. [...] I think that you can certainly have studies that complement other ethnographies either by studying the same field site at a different point in time. I think those can be valuable, but I wouldn't call it replication. I think it would be impossible to "find" the exact same thing through replication. (P28)

Very few faculty in our sample used preregistrations, and some even felt this practice may pose a risk to scientific rigor:

I would find a [preregistered] design that I had to walk in that early in the game, incredibly restrictive. Every new subject you have, every new study you run changes your knowledge base. You have to be free to say, "Oh, we got to change the study. We got to add in some other metrics." Somebody decides, "Okay, the histology's important." If your study doesn't include histology and you've locked it down, you can't do histology. (P3)

Another interviewee perceived preregistrations as only useful in specific statistical circumstances: 'With what I do, preregistration would be wrong. That's for psychologists and their [small] *N*s' (P23).

Overall, faculty in our study shared mixed views about the importance of open science in relation to scientific rigor. Some faculty viewed open science practices as being near the top of their ranking of criteria for scientific rigor:

I suppose some of the tenets of open science [...] would be very high on the ranking list. [I]f I had [another researcher's] dataset and their statistical code alongside it, and I could run it and say, "Yes, I get the same answer," that would be huge for me in terms of scientific rigor [...] Components of open science would really facilitate that because culturally I'm not used to looking for that sort of thing. Somebody who publishes a paper without open science, which is pretty much everything that I read, I don't dock them points for that, but boy, I would sure elevate that thing that's most important to me. (P6)

However, there were also faculty who viewed open science practices as being important for scientific rigor, but ranked them near the bottom of their list of important practices:

I think [open data and open materials] would be definitely toward the bottom, but it's just—it needs to be a part of that publication. People need to go and use it. I'm not saying it's not important. I'm just saying that it's part of that. It's a required dissemination of results. (P21)

Another faculty member viewed open science practices as simply a part of the publication process and stated that they do not factor into their ranking of important criteria for scientific rigor:

I have a difficult time fitting [open science practices] in here. We've talked about open-access publishing or at least making your data available. I guess I'm seeing what we've talked about is fitting in other categories that we go beyond this [...] If you don't publish or share your work, then, of course, others don't know about them. (P7)

Answering RQ2, faculty varied in their perception of how necessary the specific practices of open science are for ensuring scientific rigor. Most faculty viewed the practices of open data and open materials as key parts of the research process, although some data cannot be shared fully due to protecting participants' privacy. Other practices, such as preregistration, were mostly viewed as peripheral, discipline-specific, or even restrictive to exploratory research.

## 8. Open science badges in perceptions of scientific rigor

Some faculty members had noticed open science badges before. Others mentioned badges that were more field-specific and not associated with the open science movement. However, most interviewees had not encountered open science badges before.

In answering RQ3, faculty were, overall, mixed in their perceptions of the usefulness of open science badges as signals of scientific rigor. Some faculty said that open science badges could be beneficial in determining the scientific credibility of the research: 'Yes. I would think that it would add more credibility for me' (P2). One interviewee, for instance, said that they would perceive badges as a marker of quality because, in their opinion, highly funded, large-scale research studies are more likely to engage in open science practices (tying ascribed scientific rigor to a study being funded with large amounts of money):

[M]y first assumption would be that this was probably funded research [...] I already would be thinking [...], "Well, it's probably already of higher scientific rigor than, perhaps, studies that weren't awarded this." Not necessarily because it's a badge on it, but because you're going to read the study and [see], "Oh, wow, this was a large-scale RCT [randomized controlled trial]. They had some funding to do this." (P24)

Another faculty member mentioned that badges could be useful in teaching, as badges could help locate studies that would be possible for students to replicate because of the provided data and code: 'I want [students] to [present about] a paper that has [open materials] specifically because the best way to learn a paper is to rerun it—rerun the code' (P18).

Others thought awarding open science badges was problematic, as illustrated by this interviewee questioning who determines adherence to the standard or not: 'I think some people might see a badge and think that that adds credibility to the

study [...] That's bad. That's really bad. Who confers these badges?' (P23). Or: 'I would have more of the question of who decides the criteria and whether it passes that scientific rigor to get the badge' (P16). Others questioned the need for badges, highlighting that transparency is something that many researchers strive for anyway: 'Seriously. Who cares? I don't see the point. People have been doing open-ish things for a long time' (P22).

Another interviewee raised concerns about the badges being used as markers of quality when certain types of studies cannot adhere to those specific practices: 'If we want to do this—badges for scientific rigor—we need to account for different methods and the different ways that we evaluate different types of methods' (P28). This view, therefore, links back to the findings we described in response to our previous research questions.

## 9. Discussion

The open science movement has evolved into a major pillar of global science policy, reflecting growing expectations that publicly funded research should be transparent, reproducible, and accessible (e.g., [National Institutes of Health 2024](#)). Our interviews provide insight into how faculty interpret these practices in relation to scientific rigor, which may inform evaluative judgments in certain contexts. Faculty in our study defined scientific rigor with a multifaceted set of criteria and practices that span disciplines and methodologies rather than a checklist. While criteria emphasized by open science ambitions, including reproducibility/replicability, transparency, and collaboration, were viewed as important criteria of scientific rigor, faculty also mentioned they rely on other criteria that may receive less focus in funding and publication requirements. Study design, including data collection, data analysis, validity, and reliability, and ethics were equally, if not more, important criteria for many. Faculty also expressed mixed views on how open science practices relate to scientific rigor. Taken together, these findings suggest that while open science practices as they are currently enacted in practice contribute to important aspects of scientific rigor, they do not encompass its full range. Evaluation contexts relying heavily on open science indicators could contribute to conflating procedural openness with epistemic quality ([Araujo et al. 2026](#)).

Before discussing the findings in more detail, there are some points to consider about our study. The sample used in this study consists of relatively fewer faculty members from the arts and humanities than from the biological, physical, and social sciences. This may be because our recruitment email emphasized that the interviews are about 'scientific rigor.' It is possible that this term did not resonate with faculty in the arts and humanities stratum of our sampling frame. We have some evidence pointing in that direction, as one participant from a humanities discipline—after receiving our recruitment email—inquired whether it would be appropriate for them to be interviewed (of course, it was). Nonetheless, we had four participants from the arts and humanities and reached theoretical saturation for that stratum as well, so the distribution of faculty across strata is unlikely to limit our findings. Additionally, the faculty we interviewed were all from the same R1 university in the

United States, and, as such, their opinions may not reflect the full diversity of viewpoints on these subjects among researchers from different backgrounds and cultural contexts. We intentionally included faculty from different disciplines; however, because this was a qualitative study, we did not aim for representativeness or generalizability. Despite this, we did review our data for patterns but did not observe clear or consistent differences in perspectives across disciplines. We encourage future work to build on our findings by investigating how perspectives may differ both across disciplines and within specific disciplinary contexts through experimental and survey research.

With these considerations in mind, our findings suggest that the issue is not whether open science practices contribute to scientific rigor—a point with which faculty broadly agreed—but how prominently these practices are positioned within research evaluation. While the goals of open science, such as transparency and accessibility ([UNESCO 2022](#)), are widely supported and align with many dimensions of scientific rigor, our findings highlight nuances in how these goals are translated into practice. Faculty expressed concern that when open science practices are emphasized as policy requirements or evaluative signals, they may be interpreted as proxies for rigor, even though they represent only one subset of the practices faculty rely on to enact rigorous research. Thus, the growing focus on open science may inadvertently draw attention away from other foundational dimensions of rigor that are less easily standardized or signaled ([Hengel et al. 2024](#)). Faculty in our study repeatedly pointed out that well-reasoned decisions and clear communication of all processes, preconditions, assumptions, methods, limitations, and researcher positionalities are vital to carrying out and evaluating scientifically rigorous work. While open science practices certainly support the communication of these elements, they do not necessarily ensure the quality of the underlying decisions themselves. For example, a study can be transparent about the chosen method, yet the method may be inappropriate for the study's research question, or the measurements may not meaningfully capture the constructs of interest. Moreover, many of our faculty expressed that while open science practices are currently implemented and signaled, they do not always require that these dimensions be fully articulated. This was further emphasized in answering RQ1b, since criteria related to sound study design all ranked within the top five of our rough ranking, with 'study design' ranking first on its own. These and other criteria also do not seem to be addressed adequately by common open science practices, as data that is neither reliable nor valid can still be shared openly ([Freiling et al. 2021](#)). Open science practices, especially open data and open materials, may make up part of a scientifically rigorous study, but they are only that: a part.

Faculty in our study were overall supportive of the open science goals of transparency and accessibility but did not always agree on how open science practices fit within scientific rigor, particularly how they support important criteria of scientific rigor, such as study design. Transparency, in other words, is not a proxy for rigor. Once again, this points to potential issues surrounding the implementation of open science, both as a funding requirement and as a marker of quality. Additionally, open science practices cannot guarantee reproducibility and

replicability (Dudda et al. 2025), and as mentioned by several interviewees, reproducibility and replicability are also not always a goal of every study. Researchers have also pointed out that replicability does not equate to ‘truth’: a study may replicate yet be untrue due to shared errors in assumptions, measurement, or analysis (Rubin 2023). This point is important to evaluate further, as our interviewees noted a range of criteria that could benefit science more broadly, especially when the published science does not fully showcase the ‘truth.’ Additionally, implementing open science practices—even if they are generally seen as useful—is also not value-neutral, and serious consideration needs to be taken before requiring these practices for publishing or advancement purposes (Hostler 2023). Preregistering studies, publishing datasets and code, managing data, etc. all take time and resources that divert attention at best and make publication inaccessible at worst since not all researchers have the funding or institutional support needed to implement these practices (Bahlai et al. 2019; Borgerud and Borglund 2020; Wentzel 2021; Guzzo et al. 2022).

As noted earlier, open science policy changes do have other stated aims beyond reproducibility/replicability, including the ethical concerns of access, integrity, equity, fairness, diversity, and inclusion (UNESCO 2022). Our faculty cited ethics as an important criterion of scientific rigor. While this alignment between open science goals and faculty concerns is notable, interviewees also pointed to dimensions of ethical and community-engaged research that extend beyond what is typically emphasized in current open science practices. In practice, open science emphasizes forms of sharing such as open access publications, data, and materials which can support transparency and accessibility for community members. However, these forms of openness do not necessarily address more participatory aspects of research, such as engaging participants in the research process or fostering community involvement (Drolet et al. 2023; Emmons et al. 2023). In fact, some faculty in our study noted that considerations such as privacy, identity, and researcher-participant relationships can shape how research involving human subjects is conducted, including what forms of openness are appropriate (Tamminen et al. 2021). Prior work highlights the importance of implementing such practices ethically as a part of openness (Davies et al. 2021; Simm and Eigi-Watkin 2024; Lilja 2025).

Regarding open science badges, faculty highlighted their function as evaluative signals. Some interviewees said that such markers would be useful in helping to locate studies that are potentially replicable. More, however, expressed concerns about badges. These interviewees stated that badges may indicate a level of credibility or rigor that is not borne out by the study itself. These interviewees also questioned who awards the badges. As reported by these faculty, when open science badges are treated as indicators of rigorous work, they may influence how studies are evaluated by drawing extra attention to studies that display such signals. When these signals are used as heuristic cues without close attention to other criteria of scientific rigor, there is a possibility that aspects of rigor such as validity and accuracy of claims could receive less scrutiny. Some faculty also associated open science badges with funded research, which they, in turn, associated with indicators of research

quality. As noted in the introduction, public and private funding organizations often require adherence to certain open science practices, but that does not mean that every aspect of the resulting study is scientifically rigorous, as some of our interviewees presumed. Study design and methodological decisions, for example, continue to develop after funding is awarded. Additionally, studies that have not received funding can be rigorous, whether or not they align with certain open science practices.

Based on the varying perspectives identified in this study, additional research is needed on the implications of adopting open science practices as policy. This study gathered faculty perspectives on how open science practices are interpreted in relation to conducting and evaluating research. Having identified those perspectives, they can serve as categories in large-scale surveys of scientists, which can quantify those perceptions and potentially even compare them for researchers from different institutional backgrounds or from different countries. Given concerns about public trust in science and the hope that some researchers and policy organizations have of open science practices increasing trust in science (Besançon et al. 2021; Cole et al. 2024; National Institutes of Health 2025), future research could also build on the findings from this study by testing how the general public responds to research that highlights other criteria of scientific rigor than open science-related ones as well.

## Supplementary material

Supplementary material is available at *Research Evaluation Journal* online.

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## Ethical approval

All study procedures were approved by the University of Utah’s Institutional Review Board (IRB; IRB 00177204) before any work with human subjects started.

## Data availability

The data underlying this work cannot be shared publicly as participants did not consent to having their full transcripts published. However, partial answers are included throughout the manuscript, and the interview script is included in the [supplementary materials](#).

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