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Open Science in eating disorders: Using current evidence to inspire a plan for increasing the transparency of our research

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Abstract

Objective: There is increasing consensus that open science practices improve the transparency and quality of clinical science. However, several barriers impede the implementation of these practices at the individual, institutional, and field levels; understanding and addressing these barriers is critical to promoting targeted efforts in increasing effective uptake of open science.

Methods: Within this research forum, we drew from publicly available online information sources to identify initial characterizations of researchers engaged in several types of open science practices in the field of eating disorders. We use these observations to discuss potential barriers and recommendations for next steps in the promotion of these practices.

Results: Data from online open science repositories suggest that individuals using these publishing approaches with pre-prints and articles with eating-disorderrelevant content are predominantly non-male gender identifying, early to mid-career stage, and are more likely to be European-, United States-, or Canada-based.

Discussion: We outline recommendations for tangible ways that the eating disorder field can support broad, increased uptake of open science practices, including supporting initiatives to increase knowledge and correct misconceptions; and prioritizing the development and accessibility of open science resources.

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AUTHOR CONTRIBUTIONS

Sasha Gorrell: Conceptualization; data curation; formal analysis; project administration; writing – original draft; writing – review and editing. **Shira Cohen:** Conceptualization; data curation; formal analysis; writing – review and editing. **Katherine schaumberg:** Conceptualization; writing – original draft; writing – review and editing. **Lisa Marie Anderson:** Conceptualization; writing – original draft; writing – review and editing. **Erin E. Reilly:** Conceptualization; writing – original draft; writing – review and editing.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Public Significance Statement: The use of open science practices has the potential to increase the transparency and quality of clinical science. This Forum uses publicly sourced online data to characterize researchers engaged in open science practices in the field of eating disorders. These observations provide an important framework from which to discuss potential barriers to open science and recommendations for next steps in the promotion of these practices.

Keywords

eating disorders; equity; gender; open science; pre-prints; pre-registration; projects; reproducibility; rigor

1 | INTRODUCTION

Over the past decade, increasing emphasis has been placed on the need for greater transparency in scientific conduct and reporting (Nelson et al., 2018). Although the concept of open science is not new, awareness of the approach and calls for adoption of open science practices in clinical science are now widespread (Tackett et al., 2019). In the United States, the federal Office of Science and Technology Policy issued a recent mandate to make publicly funded research freely available immediately after publication, guidance that will take effect by the end of 2025. Similarly, the Data Governance Act will take effect for the European Union in September 2023 (European Commission, 2022), part of a widespread plan launched by the European Commission to regulate and facilitate data sharing across Member States. As global shifts toward mandatory implementation of open science efforts appear imminent, some data have been published regarding the frequency of uptake in these practices (Larivière & Sugimoto, 2018), and the characteristics or attitudes of researchers engaging in open science (Abele-Brehm et al., 2019; Baždarić et al., 2021); however, up-to-date, we know little about open science activity in eating disorders (EDs) research. In this Research Forum, we provide a broad discussion, supplemented by preliminary observational data, of how the ED field can move forward in supporting adaptive open science engagement.

1.1 | Why focus on uptake of open science in eating disorders?

The ED field has compelling reasons to increase research transparency and share resources (Burke et al., 2021). EDs are among the deadliest of psychiatric illnesses (Chesney et al., 2014) and are not rare, estimated to affect 5.5 million United States adults, with health system and societal costs upwards of $60 billion in 2018–2019 (Streatfeild et al., 2021). High costs associated with EDs are also observed internationally; in 2012, estimated costs associated with EDs in Australia were around $69.7 billion (Deloitte Access Economics, 2012). In the United Kingdom, over $9 billion was attributed to ED care in 2021, which represents a significant portion of the funding allotted to the UK National Health Service (Hearts Minds and Genes Coalition, 2021). Yet, compared to other high-priority fields (e.g., infectious disease), the ED field has been particularly challenged in establishing sufficient research infrastructure and corresponding training resources that are commensurate with the field's clinical and educational demands (Austin, 2016). This is in part due to the fact that, although EDs are considered a major contributor to global disease burden (Erskine et al., 2016; Santomauro et al., 2021; Zipfel et al., 2022), grant funding devoted to the study of

EDs has not reached parity with other disorders with which it shares comparable costs (e.g., schizophrenia) (Striegel-Moore et al., 2000). In addition, global clinical research centers for EDs remain relatively siloed; as a result, small samples contribute to the insufficient rigor and reproducibility of our findings (Hübel et al., 2018). To aid in addressing some resource challenges and isolation that ED researchers face, Burke et al. (2021) recently proposed that one effective strategy may be greater engagement in open science practices.

Less is known, however, about whether engagement in open science practices is helpful in mitigating field-related challenges and providing benefit to researchers. One way to quantify the value that open science practices bring to research visibility and investigator career development is via citation counts, which may be reflected in a Hirsch-index (i.e., the maximum value of h such that a given author has published at least h papers that have each been cited at least h times). H-index values can be crucial for career advancement; for example, a national habilitation procedure in Italy has been adopted whereby promotion to associate or full professor is directly linked to publications and number of citations (Marini, 2017; Seeber et al., 2019), and there is some evidence that citations may also be particularly important for securing grant funding (Rezek et al., 2011; Zhu et al., 2017). Recent review of rigor and reproducibility in the *International Journal of Eating Disorders* (IJED), a leading specialty journal that encourages open science practices, found a positive linear trend in rigor and reproducibility over the past decade, but this association had no relationship to citation metrics (Susanin et al., 2022). These findings suggest a lack of incentive structure to support increased transparency; however, this conclusion is speculative. Less is known about who is engaging in open science practices within the ED field; this knowledge may be useful in informing future actionable steps for update of open science and policy development across the academy. With this Research Forum, we discuss barriers to open science uptake, using preliminary data to highlight specific gaps and potential areas of need for open science adoption in the field, and provide specific suggestions for increasing use of open science within ED research. To advance the field and support the adaptive use of these practices, we must first consider the myriad factors that may impact equity (in the ability to adaptively engage in open science practices with equitably-distributed effort and burden) and the uptake of open science moving forward.

1.2 | Factors that impact open science uptake in eating disorders

Concerns have been raised about the potential for engagement in open science practices to create burden for researchers, an onus that may fall unequally and vary relative to both extrinsic (i.e., systemic) and investigator-specific factors (Pownall et al., 2021). Issues related to lack of equity in access to the resources necessary for open science implementation are likely not unique to EDs; however, inequities may fall unevenly within the field of EDs given its relative size and academic culture. We anchor this possibility with data drawn from publicly available resources, using methods which we detail below and in Appendix S1. In short, we searched open-publishing repositories to examine trends in open science activity on ED-related research relative to individual (e.g., gender, lead authorship, career stage, and h-factor) and extrinsic factors (e.g., type of institution, geographical location). We also include data specific to IJED, given its emphasis on supporting open science practices (e.g., offering “badges” to indicate author engagement). Evaluating field-

level behavior has the potential to inform where our effort and resources for increasing adaptive open science uptake might best be devoted moving forward. Although it remains unknown who, within the ED field, is not engaging in open science practices, clarifying characteristics of those who *do* engage in open science research could point toward potential gaps in uptake and inform recommendations for intervention, support, and policy.

2 | METHODS

To source publicly available data, we examined the use of open-access platforms for four types of open science engagement from January 2015 to November 2021: open access articles (manuscripts freely available online), pre-prints (i.e., complete manuscript for sharing early-stage results with a larger community for immediate feedback prior to peer review; retains the right to publish in a scholarly journal at a later date), registrations (i.e., description of planned work; often a protocol for a research study), and projects (i.e., flexible category that can include anything with contributing members and files). Search terms for each of the four online sources were: *ED, anorexia nervosa, bulimia nervosa, binge eating disorder, OSFED, ARFID,* and *eating pathology*.

To source data on researcher career stage, h-index, gender pronouns, institution type, and geographical location, we searched publicly available online resources for the first author of each article or pre-print or owner of the registration or project. In an attempt to capture the greatest likelihood of direct engagement in open science, we focused much of our examination on first authors of either pre-prints or articles ($n = 108$). To confirm trends across different types of engagement in open science practices, we also examined gender pronouns of lead contributors of registrations ($n = 103$). Finally, we examined patterns of open science engagement relative to gender and academic degree over the past year in IJED, given the stature of this journal and the emphasis it has placed on open science (Burke et al., 2021). Further detail on all methods, including data extraction and how we determined and delineated gender, degree, and institution type is available in Appendix S1.

3 | RESULTS

3.1 | Career stage

Total counts of the four types of engagement are available in Table 1: pre-prints, open-access articles, projects, and registrations; pre-prints and open-access articles are combined into one category. Average participation ranged between one and five engagements across types of engagement and career stage. In pre-prints/articles and projects, scholars in early to mid-career stages evidenced slightly higher participation than those in senior positions (e.g., average pre-prints/articles for early career = 1.21; mid- and late-career = 1), although the practical significance of this difference is unclear.

3.2 | Hirsch-index

Data on those who had at least one first author article or pre-print ($n = 108$) are presented in Table 2, including mean h-index values. In a recent systematic review of h-indices in academic medicine, these values increased relative to rise in academic rank (Zaorsky et al., 2020); contextualizing our sample relative to this review, the sample's average h-index

reflects someone with a rank between an assistant or associate professor (i.e., early to mid-career).

3.3 | Gender with career stage, and academic degree

For those for whom gender was specified in our search ($n = 95$), a majority (64%) identified as women. For those for whom both gender and career stage were specified ($n = 88$), 50% of first authors were women and early in their career (i.e., 0–9 years from degree); the next most represented were early career men (28%). Trends relative to the type of academic degree suggest that, among those with one or more first author pre-print or articles, most individuals (63%) held PhD degrees, with about a quarter who held a Masters' degree or a degree in progress.

3.4 | Institution type and geographical location

A majority of open science pre-prints and articles appear to be associated with non-medical institutions (e.g., R1-R3 research institutions, liberal arts institutions, non-medical research centers) (76%). Shown in Figure 1, geographical representation of first authors of open science pre-prints or articles centers primarily in Europe (53%), or in North America (36%), which here is represented only by the United States and Canada. Africa was included in possible counts but had no representation.

3.5 | Trends in the International Journal of Eating Disorders

Descriptive characteristics regarding lead authors of empirical articles in IJED in 2021 are presented in Table 3. We delineate articles that were "Free to Read" or "Free Access" in this table, but do not include them in further counts of open publications. These are categories representing articles that may be read without a paywall, but this access is a decision determined by the journal, rather than by the author. More specifically, Free to Read refers to the status of the first issue of the year, a decision made by a central team at the publisher, representing a standard for all journals they publish. Full Free Access status is chosen either at the journal level or by the publisher, driven by a wish to promote that article temporarily; neither of these categories reflects deliberate action taken by a given author to make their work publicly available.

Only about 20% of 2021 IJED content was "open" (Table 3). There was a considerable amount of missing gender data; nonetheless, the elevated proportion of women/nonbinary+ first authors compared to male first authors representation is notable. This was the case among first authors of the total papers published (65.3% women/nonbinary+ vs. 15% men) as well as in the open subsample (45.5% women/nonbinary+ vs. 9.1% men).

Geographical representation in the IJED sample differed relative to open vs. non-open status (Figure 2); in the open category, most open publications were published by first authors affiliated with European institutions.

4 | DISCUSSION

With this Forum, we provide preliminary data on open science engagement in the ED field to provide a foundation for proposing next steps to advance open science practices. Our intent was to leverage openly available information to inform efforts to increase open science uptake across all researchers in the field. We found that a majority of open science engagement is being conducted by early to mid-career researchers who identify as females/nonbinary+; hold PhD degrees; are most commonly those with an h-index reflecting status at the assistant or associate professor level; and are based predominantly in Europe, followed by North America.

The finding that female early to mid-career researchers are more represented may simply reflect the demographic nature of clinical psychology as a whole (Gruber et al., 2021). Additionally, it appears that many early to mid-career women are engaging in open science practices; however, the labor of open science and the distribution of necessary resources to fulfill engagement may fall unevenly. Early career researchers, who typically have fewer resources and less funding and are also more likely to be female-identifying relative to those at later career stages (American Psychological Association, report by the Committee on Women in Psychology, 2017), may contribute more of the invisible labor necessary for producing reproducible and replicable work (e.g., checking code and cleaning data; curation of online repositories; development of resource sharing plans; mentoring others in open science), which may go unrecognized in current academic incentive systems (Pownall et al., 2021). While early career researchers have been heavily involved in the broad push towards open science and may be eager to adopt these practices in the ED field, countervailing forces (e.g., limited resources, required invisible labor, incentive structures which rely on rapid publication for career advancement) may also create tension between enthusiasm for and practice of open science (Pownall et al., 2021).

From an institutional and geographical perspective, our findings suggest that most open science engagement is occurring in non-medical research centers in Europe and North America. These regions did appear to be over-represented on the whole for their contributions to publishing compared to other regions (including within non-open publications in IJED). Thus, these data trends may reflect open science engagement in the broader scientific community; this pattern could also reflect a lack of incentive structure in medical center settings, a possibility which warrants further research.

Our data are preliminary and primarily function to generate discussion of potential gaps and areas of need that may benefit from future consideration as the ED field moves to increase engagement in open science practices. As we consider the suggested trends from our data relative to gender, career stage, and academic environment, it is important that as a field, we consciously avoid placing extraneous burden on women and other historically marginalized groups in STEM, and promote the justice, equity, diversity and inclusion of open science participation.

4.1 | Moving forward: Promoting adaptive open science engagement in eating disorders

Promoting and maintaining equitable open science practices in the ED field will require focused effort that is dedicated both to (a) increasing comfort and competency, and (b) addressing challenges to adopting open science practices that arise in the face of limited resources, and the existing academic climate.

4.1.1 | Increasing researchers' comfort with and competency in engaging with open science

Increasing the ease of implementing open science practices and training is critical to expanding its effective use. Although our preliminary data suggest that uptake is greatest among early to mid-career researchers, it is important to minimize the burden of self-taught knowledge. This can be effectively facilitated in at least three ways: first, training in common open science skills should be incorporated into higher education ED programs (e.g., clinical psychology PhD programs with a dedicated focus on EDs) that might be required to do so to meet accreditation standards. Second, it is important that freely available or low-cost educational and hands-on experiences in open science be prioritized at ED conferences, within ED professional organizations, and in training programs that attract early career researchers in EDs (e.g., T32 postdoctoral positions). Finally, ED researchers who are qualified to do so must take an active role in developing novel tools (e.g., data sharing code) and providing applied examples of how to use them with ED-specific samples. This may include fostering collaborative relationships with others both within and outside the field who have complementary skillsets.

4.1.2 | Addressing organizational or systemic challenges to adopting open science practices

Uptake of open science practices may further be challenged by barriers to its adoption, but also facilitated by incentive structures. In academia more broadly, incentive structures may soon begin to incentivize open science engagement within institutions (e.g., for promotion and tenure) which will shift behavior. Of note, a growing number of institutions now contract with given publishing companies; this coordination draws upon institutions and governments who may subsidize the publishing process. For example, "transitional agreements" between Wiley (publisher of IJED) allow for some researchers from certain institutions or countries to provide their content in a freely available format. The rapid increase in the number of these contracts, and the evolving nature of payment for open-access publishing will likely continue to shift behavior–including the geographical distribution of open science activity. Redistributing monetary burden certainly shifts behavior related to access of published material, but we note here that publisher agreements do not alleviate the hidden costs of time, skill, and labor that many open science practices, specifically those involving development of reproducible data and analytic materials, require.

Here, we shift to consider how within the subfield of EDs, there are several small efforts that could have a large impact on our collective climate. For example, we might prioritize harmonization of assessment measures across research sites (made possible by open science adoption), which will facilitate data sharing, and improved rigor in our sample sizes. Outside

of academic settings, application-based scholarships might be established by ED-specific sponsorship (e.g., the Academy of EDs) to specifically support open science efforts within the ED field, across career stage.

When resources are minimal (as they are particularly in a small sub-field), allocation of funding and support for open science should focus on those groups for whom uptake has been comparatively slower and/or more challenging. Our data suggest that individuals in later career stages, those who are male-identifying, and individuals conducting research outside of Europe, the United States, and Canada may have the greatest latency in open science uptake. To address this issue among those in later career stages and in less-resourced geographical locations, efforts mentioned just above (e.g., increasing skills via accessible resources provided at international ED conferences) may be beneficial.

Closing the gender gap around open science may be more nuanced than a problem of skill acquisition, particularly given that female early career researchers may need even more resources to counteract existing systemic barriers to open science in STEM than male-identifying peers (Abele-Brehm et al., 2019; Pownall et al., 2021). Broader uptake of open science may depend on closing knowledge gaps and misconceptions about open science itself. Specifically, barriers to uptake that might be exponentiated in resource-poor environments might derive from a fear of “being scooped.” In ED training environments, a shift in prevailing norms should be made to increase awareness, and clarify misconceptions about open science (e.g., engaging in research transparency does not uniformly lead to sharing close-kept ideas) and to adopt a cultural standard whereby we minimize unnecessary hypercriticism in the context of peer review.

5 | CONCLUSIONS

Preliminary evidence suggests that open science practices in the ED field are predominantly currently engaged by female early or midcareer scientists who are more likely to have a PhD degree, and to reside in Europe or North America. Here, we provide guidance to increase and maintain equity, and minimize the burden of open science practices moving forward. Research priorities include inquiry that can determine where the burden of time and cost of open science practices falls, and what barriers might exist to the acceptance and adoption of adaptive open science practices in the ED field.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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DATA AVAILABILITY STATEMENT

Data Availability Statement: The data that support the findings of this study are openly available in Open Science Foundation (OSF) at https://osf.io/9ygpb/.

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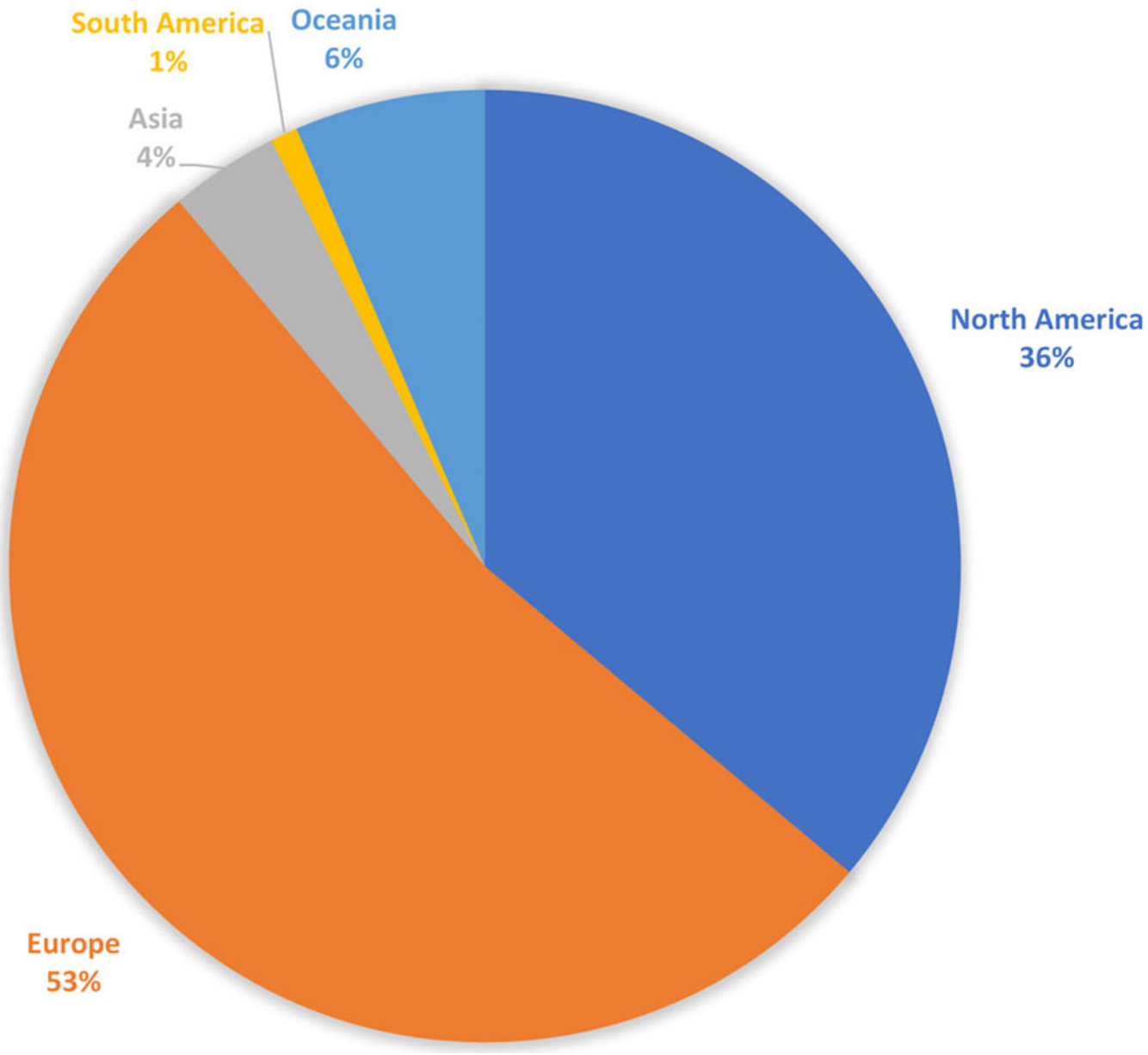

FIGURE 1.

Geographical representation of first authors of open science platform pre-prints or articles (2015–2021). *N* = 108 authors with at least one first author pre-print or article. Open science platform publication refers to the following: articles and preprints were drawn from the PsychArchives site, as well as from the OSF site which included OSF sources themselves, along with papers from bioRxiv and PsyArXiv. Our search time frame was from January 1, 2015 through October 11, 2021. Included publication material is defined as: Pre-prints (i.e., complete manuscript for sharing early-stage results with a larger community for immediate feedback prior to peer review; retains the right to publish in a scholarly journal at a later date); Articles (i.e., manuscripts that are freely available online. In this sample, North

America is represented only by the United States and Canada. Africa was included in possible counts but had no representation. OSF, Open Science Foundation

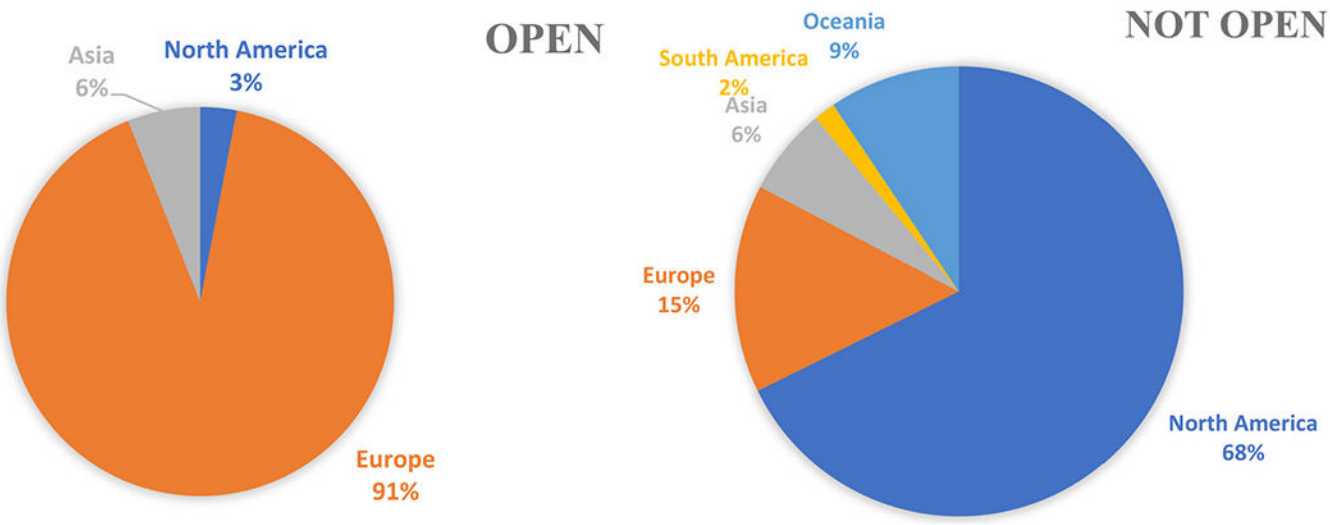

FIGURE 2.

Geographical representation of first authors of open and non-open IJED empirical publications (2021). Empirical publications refer to Original Articles, Brief Reports, and Registered Reports Stage 1. Percentages represent proportion within open publications (left panel, $n = 33$) and non-open publications (right panel, $n = 126$). Open refers to open access status (with no fee required to read), that was determined by authors (i.e., requiring a fee to publish). Non-open publications refer to those that require a fee to read, or affiliation with an institution for which the paywall is waived. Non-open does not include open access publications (i.e., status that was determined by authors, requiring a fee to publish). Neither open nor non-open include publications that were determined by the journal to be "Free to Read" or "Free Access." IJED, International Journal of Eating Disorders. Continents included in possible counts but with no representation include for open: Oceania, Africa, and South America and for non-open: Africa

TABLE 1

Open science platform publication counts per person across career stage (2015–2021)

		Counts		
	Career stage	**Authors with at least one first author pre-print or open access article**	**Project**	**Registration**
Range	Early	1–4	1–5	1–4
	Mid	1	1–2	1–3
	Late	1	1–2	1–3
Mean	Early	1.21	1.27	1.38
	Mid	1	1.13	1.25
	Late	1	1.18	1.36

Note: N = 108 authors with at least one first author pre-print or article; counts for projects and registrations are within this subsample. Open science platform publication refers to the following: articles and preprints were drawn from the PsychArchives site, as well as from the OSF site which included OSF sources themselves, along with papers from bioRxiv and PsyArXiv. We drew registrations and projects from OSF. Our search time frame was from January 1, 2015 through October 11, 2021 for preprints and articles and through November 8, 2021 for registrations and projects. Included publication material is defined as: Pre-prints (i.e., complete manuscript for sharing early-stage results with a larger community for immediate feedback prior to peer review; retains the right to publish in a scholarly journal at a later date); Open access Articles (i.e., manuscripts that are freely available online); Projects (i.e., flexible category that can include anything that has contributing members and files or explanatory texts or images), and Registrations (i.e., description of planned work; often a protocol for a research study, with specific details on, e.g., data collection methods or analytic plans). Career stage early = 0–9 years from degree; mid = 10–19 years from degree; late = 20+ years from degree.

Abbreviation: OSF, Open Science Foundation.

TABLE 2

Characteristics for those with at least one first author pre-print or article published on an open science platform (2015–2021)

Variable	Mean (SD)	Range
h-index	13.18 (13.66)	0–84

	Men	Woman/non-binary+	
Gender pronouns[a] *n* (%)	34 (35.8)	61 (64.2)	*n* = 13 missing

	PhD	MD	Other
Degree type *n* (%)	65 (63.1)	11 (10.7)	27 (26.2)

	Medical Research Institute/Medical Center	Other
Institution type *n* (%)	26 (24.1)	82 (75.9)

	Men first author (*n*)	Woman/non-binary+ first author (*n*)
Career stage	*n* = 4 missing	*n* = 3 missing
Early	25	44
Mid	2	6
Late	3	8

Note: *N* = 108; excluding missing gender data, *n* = 95. Open science platform refers to publication as per the following: articles and preprints were drawn from the PsychArchives site, as well as from the Open Science Foundation (OSF) site which included OSF sources themselves, along with papers from bioRxiv and PsyArXiv.

[a]Of those for whom gender pronouns were publicly available information, no individuals were identified within this subsample (i.e., first authors of preprints/articles) as using only they/them pronouns. For Degree type, PhD includes PhD, PsyD, D.Sc., PhD/ClinD; MD includes MD and MD/PhD; Other includes degree in progress (undergraduate or graduate) and MA. Medical Research Institute/Medical Center includes those institutions determined to be and foremost a medical institution (e.g., academic medical center, hospital system, school of medicine); in contrast, those institutions indicated by “Other” include R1-R3 research institutions, liberal arts institutions, non-medical and research centers. Career stage early = 0–9 years from degree; mid = 10–19 years from degree; late = 20+ years from degree.

TABLE 3

Characteristics of IJED empirical publications in 2021

Type of article	Frequency (valid % of total with known gender) *N* = 173
Open	33 (19.1%)
Not open	126 (72.8%)
Free to read	9 (5.2%)
Free access	5 (2.9%)

Gender pronouns[a]	Within open (*N* = 33)	Of total (*N* = 173)
Male	3 (9.1%)	26 (15%)
Female/nonbinary+	15 (45.5%)	113 (65.3%)
Unknown	15 (45.5%)	34 (19.7%)
Degree	**Within open (*N* = 33)**	**Of total (*N* = 173)**
PhD	12 (36.3%)	84 (48.6%)
MD	11 (33.3%)	30 (17.3%)
Other	7 (21.2%)	54 (31.2%)
Missing	3 (9.0%)	5 (2.9%)

Note: Empirical publications refer to Original Articles, Brief Reports, and Registered Reports Stage 1. Open refers to open access status (with no fee required to read), that was determined by authors (i.e., requiring a fee to publish), and does not include publications that were determined by the journal to be “Free to Read” or “Free Access.” “Free to Read” and “Free Access” are status determinations made by the journal, designating publications that do not require a fee to read. We do not include “Free to Read” or “Free Access” as “Open” within the “Gender Pronouns” or “Degree” counts.

Abbreviation: IJED, International Journal of Eating Disorders.

[a]Those who identified with they/them pronouns, or those for whom there were multiple pronouns (e.g., she/ they) are included in female/ nonbinary+. For Degree type, PhD includes PhD, PsyD, D.Sc., PhD/ClinD; MD includes MD and MD/PhD; Other includes degree in progress (undergraduate or graduate) and MA.