

We're all in this together: recommendations from the Society of Behavioral Medicine's Open Science Working Group

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INTRODUCTION

On April 14, 2019, the Society of Behavioral Medicine's (SBM's) President Michael Diefenbach requested that SBM's Board of Directors empanel a working group charged with considering how a perceived “drive for open science” in the broader research community might intersect with the professional interests of SBM members. Although the term “open science” may mean many things to many people—with lofty aspirations and preemptive caveats muddying the waters on many sides—there is a movement reinforced through funding decisions and legislative action that will continue to promote principles of transparency, data sharing, and participatory science at scale throughout the scientific community [1–3]. Understanding how this general movement may influence the work of SBM members will continue to be of high priority to SBM members, committees, and councils. The SBM President's request, approved by the Board, articulated a “call for action” with a charge to: (a) explore the likely implications of open science for behavioral scientists; (b) educate SBM members about open science; and (c) develop recommendations for the Board to consider adopting on behalf of the SBM membership.

After the presidential initiative was approved, a working group was formed with eight members selected from across the active SBM membership roster. Care was taken when forming the working group to: (a) represent diversity in gender and discipline, (b) collect input from scientists along the full continuum of career stage, and (c) to assemble individuals who are recognized thought leaders in the subject matter. Recommendations for “thought leaders” were solicited from selected members of the SBM Board and Wisdom Council (past presidents). The resulting working group was equally partitioned on gender (4 males, 4 females), with a broad span in professional tenure (2 senior-career, 4 mid-career, 2 early career), and a substantive collective contribution to the professional literature on the topic of open science as evidenced by citations included in the current report. In its kickoff meeting, the group partitioned the broad topic of open science into three relevant dimensions: (a) editorial policy, (b)

Implications

Practice: Open science initiatives often draw data, with consent, from interoperable data systems in healthcare, thus creating a platform for practice-based evidence.

Policy: Legislation and funding programs can change the incentive structures for opening up access to scientific data, resources, and publication while protecting participants' rights and liberties.

Research: Scientists must work together in deciding the rules of the road for open access publication, for sharing resources, and for welcoming the participation of citizens in an era of expanded capacity for collaborative research.

resource sharing, and (c) citizen science. This article offers a synthesis of the group's recommendations in each of these areas.

EDITORIAL POLICY: CONTEXT AND RECOMMENDATIONS

One of the most crucial responsibilities of a scientific professional society is to take stewardship over the curation and dissemination of its constituent knowledge base (i.e., behavioral medicine in its broadest sense). For SBM, this responsibility begins with oversight of policies and content for its flagship journals, *Annals of Behavioral Medicine (ABM)* and *Translational Behavioral Medicine (TBM)*; but can also extend to peer review and dissemination of programmatic content in its annual meeting; to articulation of perspective and policy in its online publication, *Outlook*; to the provision of educational content through its webinars; to the provision of health education material through its website; and can even extend to its advocacy efforts as encapsulated through policy briefs and official outreach.

One of the more controversial areas of discussion within the publication community is *open access*; that is, providing published content free of cost for the benefit of the larger community [4]. It can be

controversial because in many cases professional societies depend on the revenues generated by its publications. Alternative funding plans have been proposed, such as “Plan S” in Europe, that seek to protect professional societies from financial disruptions by diverting government funding to support open access publication [5]; though, as might be expected, the viability of those plans is still evolving [6]. Many high-impact publishing sources in the USA offer an author-based publication fee to support open access with some success; however, warnings have been issued not to confuse those legitimate practices with the “predatory practices” (i.e., aggressive recruitment of authors for the financial gain of the journal over substantive scientific review) of journals with dubious legitimacy [7].

In the USA, the Office of Science and Technology Policy (OSTP) concluded that research funded through taxpayer dollars should be made available through open access to all who could benefit from it. Consequently, a Presidential executive order was issued in 2013 directing Federal agencies with more than \$100 million in research and development (R&D) expenditures to develop plans for making the results of federally funded research freely available. Publishers pushed back on this demand, claiming that time was needed for them to extract market value from the products of their sponsored publication processes. A one-year allowance in complying with open access requirements was offered as a compromise. Starting in 2008, the National Institutes of Health (NIH), a primary funder for work done by SBM members, had begun implementing a requirement for open access publishing within 1 year following publication as a stipulation for grant award [8].

Aside from the “public good” [1] arguments made by the OSTP, many scientific leaders have argued that greater transparency and openness would improve the conduct of research by: (a) combatting bias against the null hypothesis, (b) guarding against post-hoc analytic manipulation (“p-hacking”), (c) overcoming the “file drawer problem,” in which parts of the scientific record are hidden or lost (particularly results of studies with null findings), and (d) addressing the “replicability crisis” destroying public confidence in the scientific enterprise [1, 3, 9, 10]. To promote progress toward an open science ethos, the Center for Open Science published the Transparency and Openness Promotion (TOP) Guidelines with input from publishers, scientific associations, and funding organizations [11]. The guidelines were presented as a table with four levels of compliance (i.e., Not Implemented + Levels I – III of full implementation) across eight dimensions of implementation (i.e., citation standards, data transparency, analytic transparency, research materials transparency, design and analysis transparency, study preregistration, analysis plan pre-registration,

and replication). According to the Center’s website, over 5,000 journals and organizations have signed on to the TOP guidelines as an expression of scientific aspiration [12]. SBM’s two flagship journals were included.

Another argument for moving toward open access policies has to do with timeliness. The concern is especially prevalent in the life sciences for which delays may create unnecessary harm, and is the reason why many medical journals including SBM’s own journals (ABM and TBM) have created open access policies for studies with COVID-19 content [13–15]. However, peer-review processes take time, which has led to the use of preprint servers to garner early feedback on preliminary findings. Users of preprint servers can take advantage of crowd sourcing to obtain valuable feedback on their papers before, and in parallel, to submission for formalized peer review. Recognizing the value of preprint services, the National Institutes of Health published a policy Notice (NOT-OD-17-050) allowing investigators to cite Digital Object Identifiers (DOI’s) for preprints in their progress report forms pursuant to continuation of funding. It should be noted that although preprint servers are beginning to yield scientific value, the business plan for how to support these services is in flux, causing some of the international platforms serving users in developing economies to close down [16]. Others, including the preprint service offered through the Center for Open Science, are beginning to adopt fee structures to keep their services going. In addition, care should be exercised to ensure that preliminary findings are not confused with peer-reviewed findings of record in the public’s eye, an issue made apparent during the COVID-19 rush for information [14]. With these issues as background, the working group offered the following recommendations.

- **Recommendation:** SBM journals should adopt and formalize expectation of reaching a minimum of Level 1 from the Transparency and Openness Promotion (TOP) Guidelines (disclosure) without verification. Revisit in 5 years.
- **Recommendation:** Add Open Science Framework (OSF) badges to title pages for compliant articles to convey the Society’s value for transparency and openness.
- **Recommendation:** Explicitly permit and encourage prior publication on preprint servers not necessarily indexed by major search engines at time of submission. Following NIH guidelines, require citation of the digital object identifier when referencing preprints. In all cases, the SBM journal publication (Annals and TBM) will serve as the publication of record.
- **Recommendation:** Add sections for replication studies in both Annals and TBM. These articles would likely be published as brief reports and would complement the policy of TBM to publish null results.

- **Recommendation:** Investigate the feasibility of an option for two-stage peer review similar to procedures available through other biobehavioral journals (e.g., the *Journal of Experimental Social Psychology*). Stage 1 would allow reviewers to examine pre-registered hypothesis, protocol, and analytic plans before data collection begins. Stage 2 would allow for review of findings once the study has been completed. Report on feasibility within 2 years.

RESOURCE SHARING: CONTEXT AND RECOMMENDATIONS

Another facet of open science has to do with creating open-source platforms through which researchers can share data, protocols, computer code, and other materials to catalyze generativity and comparability in research. Research suggests that sharing resources through electronic platforms can boost productivity across an entire field, and can have a particularly accelerative benefit for scientists at under-resourced or geographically isolated campuses [17, 18]. Shared resources in the SBM realm may include data (e.g., shared public health data as a basis for modeling and discovery); data collection tools (e.g., data dictionaries/templates and measures for online survey platforms such as REDCap [19, 20] or Qualtrics), statistical code (e.g., code to score validated measures in SAS, SPSS, STATA, R, and other programs), intervention content (e.g., manuals, materials, message libraries), and digital health tools (e.g., apps, websites, program code). To promote cost-efficiency while expanding the breadth of research, funding agencies such as the National Science Foundation and the NIH have begun to require that investments in data collection made through taxpayer dollars yield collaborative dividends through data and resource sharing [21]. Current investments in shared repositories by the NIH include libraries for magnetic resonance imaging (MRI) scans as part of the “BRAIN” (Brain Research through Advancing Innovative Neurotechnologies®) initiative [22]; shared medical data from a large volunteer cohort under the “All of Us” initiative [23]; as well as a continued emphasis on sharing genomic data [24].

The use of resource-sharing platforms is unevenly distributed in behavioral medicine. Previous surveys of SBM members have shown slow adoption relative to other disciplines [3]. Resource sharing platforms, such as “Open Digital Health” (opendigitalhealth.org) are new and just now coming online. Behavioral ontologies (i.e., semantically interoperable vocabularies) have been slow to evolve [25], while the academic incentives for data sharing are nonexistent or in their infancy. Nevertheless, some tools and policies are beginning to emerge in similarly situated professional societies that could be appropriated by SBM. For example, the Association of American Medical Colleges, the Multi-Regional Clinical Trials Center at Brigham and Women’s Hospital and

Harvard Medical School, and with the New England *Journal of Medicine* are working to leverage existing initiatives and infrastructure to give journal credit to researchers who deposit data within existing repositories through a virtuous cycle of data deposition, assigning a Personal ID (PID), encouraging data reuse with citation, and ultimately generating professional credit for data stewardship [26]. Similarly, the American Psychological Association has initiated a relationship with the Center for Open Science to ensure that data from the behavioral sciences are Findable, Accessible, Interoperable, and Reusable following the F.A.I.R. [27, 28] standards [29]. With this context as background, we make the following recommendations:

- **Recommendation:** Build awareness of current data and resource sharing opportunities through the SBM Webinar Series, through programming sessions of the annual meeting, through informative resources placed more enduringly on the SBM website, and/or through SBM’s online newsletter Outlook. Invite an NIH representative to contribute an explanatory paper on government incentives for data/resource sharing through TBM’s “News from the NIH” series.
- **Recommendation:** Nurture efforts by SBM members to seek funding for external data and resource sharing platforms. Advocate for the development of resource sharing platforms, such as Open Digital Health, consistent with the SBM mission.
- **Recommendation:** Integrate policies and tools to ease the burden of data and resource sharing as they become available. We encourage SBM’s journal editors to reinforce the inclusion of PIDs for data publication as citable resources as part of the virtuous cycle in medicine and the behavioral sciences. Educational content for how authors could describe their data-sharing activities, and how to list PIDs in their Curricula Vitae, would make a nice addition in SBM’s Outlook. In addition, as other resources become available for sharing (e.g., data collection tools, statistical code, intervention content, and digital health tools), building mechanisms for enabling citation of those artifacts should also be advanced.

CITIZEN SCIENCE: CONTEXT AND RECOMMENDATIONS

In addition to lending support for cooperation between scientists, open science frameworks can be adopted to facilitate greater participation between researchers and the public in an approach referred to by some as “citizen science” [30–32]. One philosophical argument for creating greater participative discourse between professionals and the public was articulated by the Scottish philosopher David Hume (1711–1776) in an argument referred to as the “is / ought” challenge [33]. Scientific discourse, Hume reasoned, can often focus on facts or what is technologically feasible in the present; that is, it focuses on “what is,” and not on “what ought to be.” Figuring

out where priorities lie for the research questions that we collectively answer must require a broader conversation across multiple layers of social discourse, including discussions that explicitly bring in values, principles and aspirations for desired future states (i.e., what “ought” to be). Pragmatically, the National Academies of Sciences, Engineering, and Medicine has embraced greater openness and public inclusiveness as a way of rebuilding public trust in the scientific enterprise [34]. Indeed, recent efforts such as the “March for Science” campaign seem to have turned the tide on skepticism as reported from national polls conducted by the Pew Foundation [35]. Aligning scientific prowess with public values builds mutual trust [36].

There are also methodological reasons for broadening participation between scientific experts and nonexperts [34, 37]. The government website “citizenscience.gov” reports on hundreds of projects (448 as of March 13, 2020) that have benefitted from “crowdsourcing” [38] capabilities of volunteers submitting data on locally observed events [39]. The ways in which citizens participate in science can vary, according to King and colleagues [31]. These authors made a distinction between approaches that represent research “for the people” (i.e., promoting data altruism with a one-way flow of personal data into the laboratory), “with the people” (i.e., crowdsourcing data collection with community members as volunteer collection specialists), and “by the people” (i.e., blending the active agenda-setting of community-based participatory research with the rigorous data collection tools endemic to citizen science methods). This latter approach, of conducting science “by the people,” should be a particularly valuable tool for advancing population health through the co-creation of knowledge applicable to the local context and to the “local” needs of people with shared experiences [31, 40, 41].

Another instantiation of citizen science is in an area some have called “personal science” [42]. Personal science involves individuals using scientific methods and practices to answer personal questions. For example, people can use N-of-1 methods to answer questions about foods that might trigger irritable bowel syndrome [43] symptoms or use of behavioral science theories, coupled with self-tracking to devise and test personalized plans to improve one’s sleep [44]. The Society of Behavioral Medicine’s expertise in both the appropriate types of methods for this type of work (e.g., N-of-1 study designs [45]) and also our domain expertise in behavioral health affords an opportunity to play a leadership role in providing education, training, and support to individuals interested in using scientific methods to gain personal knowledge for improving their own health. As with other types of novel designs, there are multiple methodological issues that can and

should be addressed to extract maximum value from the approach [45–47]. Still, it is a particularly unique pathway for the behavioral medicine community to both rebuild trust of the public in science and also advance “last-mile” solutions to local problems, via not just supporting citizen scientists but to turn the phrase, foster scientific citizens. Following are recommendations in the area of citizen science relevant to the SBM.

- **Recommendation:** Support, develop, and improve a diversity of methods that could fit within citizen science, such as extensions of community-based work and also personal science practices. Ways in which the SBM can support an evolution of citizen methods can include: (a) hosting webinars on the topic by researchers and citizen scientists; (b) providing links through the SBM website to consent forms and templates that will protect citizen participation; (c) encouraging publication in SBM journals of papers illustrating the utility of citizen science methods and offering practices that enable safe, ethical, rigorous use of these methods; and (d) providing relevant scientific expertise to advance both the dissemination and implementation of effective citizen science programs and practices in behavioral medicine and related fields.
- **Recommendation:** Develop respected pathways for incorporating insights from “citizen scientists” at whatever capacity to bring their voice into the scientific conversation. Ways to accomplish this may include (a) building out a public-facing forum on the SBM website, (b) hosting “twitter chats” between SBM scientists and patient advocacy groups (e.g., SBM Twitter Chat: “Health Policy Advocacy: Lessons from a Mom who Took on the Tanning Industry,” May 29, 2018), (c) presenting on the contributions of citizen science in behavioral medicine to external audiences (i.e., leading the narrative on participant involvement in medical research), (d) developing robust pathways for non-traditional scientific citizens to meaningfully participate, contribute, and benefit from our professional meetings and events; and (e) building pathways for citizen scientists and scientific citizens to meaningfully contribute within our scientific discourse as authors and principal investigators of scientific efforts, when appropriate.
- **Recommendation:** Find ways to bridge the “is” and “ought” arguments in the behavioral medicine dialectic so that evidence generation interacts effectively with broader social values. The Working Group endorsed efforts by the professional society to be inclusive of community voices when establishing scientific priorities, while encouraging individual researchers to maintain an open, bilateral communication channel with the constituencies and stakeholders benefiting from the work. The implication is for individual researchers to assume direct responsibility for communicating their results to lay audiences (either directly or jointly through intermediaries), and to “design for

dissemination” [48] in an effort to foster scalable translation of research results [34, 49].

- **Recommendation:** As best practices, methods, and approaches emerge for new methods and strategies for bridging is/ought discussions, SBM could advocate for additional resources and pathways for this type of work to occur across society. For example, new study sections and FOAs at NIH and other funding agencies for these alternative methods and practices could be advocated to ensure these approaches not only are recognized as legitimate but also receive the resources and appropriate peer review mechanisms to enable the work to be enacted and flourish in a safe, ethical, and rigorous fashion.

THE WAY FORWARD

The Working Group’s discussions culminated in the recommendations summarized above. These recommendations are an important starting point but likely not sufficient for advancing the interests of the field and members of the Society. Promoting transparency and openness will also require a culture change in behavioral medicine. Culture change will take time. Some of the recommendations in this report will facilitate that culture change but developing a comprehensive strategy to accelerate it was beyond the scope of the Working Group’s charge. If culture change is desired, the Board should engage experts and leaders in the Society to develop strategies to accelerate that process.

As the SBM membership considers these recommendations, it should also consider the advantages and disadvantages of centralizing infrastructure for sharing preprints, code, materials, and data. The Society’s publishing partner, Oxford University Press, offers some tools for authors whose work is published in the journal. There are also a number of public repositories for disseminating these resources outside of the Society’s publications mechanisms. End users—be they scientists, policy makers, business people, or citizens—need to know where to look for these resources. Creating a centralized repository—or a collection of repositories for different types of materials—could be a valuable contribution for the field. That said, this also raises the potential of creating “open silos” whereby resources that are relevant to researchers from multiple disciplines are shared in a fractured way that would be counter to the aspirations of effective sharing [50]. Therefore, a central next step would be to not merely build something alone but, instead, work in collaboration with other professional societies to advance effective strategies for sharing ideas, materials, and resources across disciplines. Creating infrastructure requires a financial investment. The Working Group believes that the Society should consider that investment because it will create a common good but it was beyond our scope to do a financial analysis.

The Working Group was not myopic about open science. There are risks to moving down this path. For example, there are financial implications to standing up public repositories. Sharing information can attenuate competitive advantages. It may change the value of the memberships, annual meeting attendance, or the Society’s publishing partnership. Furthermore, opening our doors to the public to achieve equitable participation, contribution, and benefit from our sciences will be disruptive and, indeed, unwelcome among some areas of our membership and science. Yet the risks are greater if we maintain the status quo and opt not to set a proactive agenda for open science. The greatest risk may be existential because closing our work off from each other and those outside our community will limit its potential impact. Whatever approach we take, it should be in coordination. After all, to quote one of the lessons of the COVID-19 crisis, “we’re all in this together” [51].

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Compliance with Ethical Standards

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