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Council On Governmental Relations

An Association of Research Institutions

COGR 2018 SURVEY REPORT ON INSTITUTIONAL RESOURCES FOR PROMOTING RESEARCH QUALITY

The Council on Governmental Relations (COGR) is an association of 188 leading research universities, affiliated medical centers and independent research institutes. Our member institutions play a major role in performing research on behalf of the federal government, conducting over $60 billion in research and development activities annually. In addition to its focus on the influence of federal regulations, policies and practices on the performance of research carried out at member institutions, COGR periodically assesses associated institutional policies and processes and provides guidance on effective practices.

At the October 2017 COGR Meeting in Washington DC, and subsequently in October 2018, we held a session on research quality and reproducibility and efforts by the National Institutes of Health (NIH) and research organizations and societies to improve rigor and reproducibility in the wake of unreliable pre-clinical findings and failed clinical trials. These efforts include improving experimental design, ensuring appropriate statistical power, attentiveness to bias, authentication of biological and chemical resources, and transparency in reporting of methods, materials, and results.

Beginning with a 2011 NINDS notice, workshop, and publication, and subsequent publication by the NIH Director, NIH has made a concerted effort to strengthen the rigor and reproducibility of the research the agency funds, providing resources and making this a component of review and evaluation of grant applications. Resources and requirements were addressed again in a December 13, 2018 NIH blog post.

The National Science Foundation (NSF) has also engaged in efforts to foster reproducibility, including through the establishment of an agreement with the National Academies to assess reproducibility and replicability in science. A committee held its first meeting in December 2017 and additional meetings have been held throughout 2018. A report is expected in March or April of 2019.

In support of these efforts, COGR developed a survey to identify what resources its member institutions provide to foster rigor and reproducibility, including computing, biostatistical/statistical support, data analysis, data management, mentoring, training, and other resources. Survey questions are included in Appendix A. The survey was fielded between March 9 and April 20, 2018. Sixty-four member institutions (34%) completed the survey, with 57 (31%) responding to all survey questions.

A response rate of approximately one-third of the membership could be attributed to the challenge of completing this survey. In response one question regarding how many offices were contacted in order to complete the survey, the majority of respondents (63%) indicated that 2-5 offices were contacted, 17% 6-10, and 4% more than 10. However, it is also possible that those institutions that responded are more likely to be providing resources to help ensure research rigor and reproducibility.

Appendix B highlights some of the links to resources provided by institutions. Summary results follow.

Resources Offered Centrally to Promote Research Quality

We asked what resources institutions provide centrally to promote research quality. (Appendix A, Question 2). There were 64 responses to this question. Institutional participants reported a wide array of resources available for improving research quality, 33% of which are provided free of charge and 67% either free or charged back. Responses can be found in Table 1.

Table 1. Resources Provided to Improve Research Quality

Resource	Percent Provided	Resource	Percent Provided
Computing	80%	Protocol Templates	59%
		Grant Proposal Development Support	95%
Biostatistical/statistical	78%	Lab Management Support	31%
Data Analysis	56%	Central Web Repository of Resources	36%
Data Management	72%	Library Resources	81%
Mentoring	61%	Software and Data Carpentry Workshops	41%
Training in Rigor and Reproducibility	45%	Other	16%

In terms of resources offered centrally to promote research quality, 100% of institutions responding indicated that they offer some form of central support. Of the 64 responses received, 80% of institutions reported providing computing resources, 78% biostatistical and statistical support, 56% resources for data analysis, and 72% for data management. Regarding resources for mentoring and training, 61% of institutions reported providing

mentoring resources, and 45% training in rigor and reproducibility, fundamental principles of rigorous research, or other areas related to research quality that are separate from responsible conduct of research (RCR), institutional review board (IRB), institutional animal care and use committee (IACUC), or other compliance training. It should be noted however that responses suggest that "reproducibility" is being interpreted differently across institutions.

Fifty-nine percent of institutions reported providing protocol templates, and 95% grant proposal development support, while 31% offered lab management support, such as resources to assist investigators with managing the research team, and 36% a central web repository of resources for enhancing research quality. Eighty-one percent of institutions reported providing support in the form of library resources on research data management, publishing services, and other areas, while 41% indicated that they provide software and data carpentry workshops (teaching core data skills for conducting research).

We asked what resources, other than those listed in question two, were made available centrally to help ensure research quality. Institutions noted sample processes and procedures for data management; a research study infrastructure template; data repositories; methods descriptions; visualization support and consulting, and Geographic Information Systems, RedCap (data capture), and R language workshops and support. Additional resources included mock reviews; peer review of faculty research specific aims; recognition/awards for high quality research; web resources (e.g., myIDP reporting system); mentoring; and training.

It is important to note that although resources may be available centrally, several respondents indicated that researchers may not be aware of these resources. Many resources are available at the college or department level, and the variety, availability, and robustness of resources offered can also differ substantially. Seven respondents indicated that either all or the majority of resources are available on a school/college/department level. Respondents also reported that some resources, such as mentoring, are often provided informally and therefore difficult to track.

Resources to Meet NIH's Rigor and Reproducibility Requirements

We asked whether institutions offered resources to assist researchers in meeting NIH's Rigor and Reproducibility Proposal Requirements. Of the 64 responses to this question, 58% indicated that their institution does offer such resources, 28% that they do not, and 14% were unsure (Appendix A, Question 4).

In terms of the types of resources offered, 22 institutions providing feedback indicated that they offer grant writing resources that address rigor and reproducibility; assistance with study design evaluation; cell line authentication; annual stipends to faculty to run pilot tests and visit sites; assistance with methods descriptions and validation of key reagents; consultations on biostatistics; experimental design, and administrative and data management; a reproducibility of research guide; and, specific, online resources (some in the form of programs and courses). Columbia University has developed the ReaDI Program (Research

and Data Integrity), which provides resources, outreach, and consultation services to investigators across the research life cycle, and by discipline, to improve data management and research integrity.

The University of Michigan Medical School has developed a website on rigor and reproducibility with several links to presentations on reproducibility standards, applicable agency notices, journal articles, and events and workshops. The University of Southern California Academic Senate adopted principles on research rigor and reproducibility in 2016 that "endorses a rigorous and transparent approach to research" (see Box 1). The University of Pittsburgh has also developed publicly posted guidance for researchers outlining the importance of rigor and included 'tips' from university colleagues. Harvard University has developed resource material on Research Rigor & Reproducibility Training for Harvard Medical School Postdoctoral Fellows. In addition, several respondents indicated that they provide formalized graduate courses, and routinely provide seminars and workshops for researchers. Links to a sampling of additional web and other resources are provided in Appendix B.

Box 1: Rigor and Transparency in the Conduct of Research at the University of Southern California (USC)

In this 2016 paper the USC University Research Committee highlights factors that can undermine rigor and lead to irreproducible results and offers recommendations to foster rigorous and transparent research. Recommendations include:

Promoting Transparency – make data storage and sharing sites available for researchers to readily share data; encourage researchers to pre-register all research projects; and consider a broader collaboration with a data sharing partner.
Encouraging Good Institutional Practices – offer training programs and courses in rigorous experimental design, research standards, statistics, meta-analyses, and objective evaluation of data; support compliance with research standards, including data sharing; and pursue a method for systematic data collection such as electronic laboratory notebooks.
Consideration in Merit Review and Promotion – consider strategies that further encourage robustness of research design, data and code sharing, and high-quality mentoring in the evaluation of merit and promotion; incentivize personal efforts and successes in achieving transparency and rigor; provide a system for including metrics of research work not published in the traditional research format; and assign value to projects designed to systematically validate or reproduce original research.
Participating on Reproducibility Work – encourage researchers to both participate in reproducibility efforts and to report and share efforts to reproduce research by providing incentives, including in merit evaluations and consideration for promotion; facilitate authentication efforts; and encourage external funding sources to support the validation of others' research.

Increasing Visibility of the Topic of Reproducibility – incorporate reproducibility in research into the broader curriculum; encourage a focus on transparency and rigor in research practices; include the topic of reproducibility in speaker and lecture series and debates; foster a collaborative approach to addressing reproducibility.
Authenticating Key Resources – encourage and support efforts to authenticate key research resources; building infrastructure for authenticating cell lines and other biological and chemical resources upon arrival at the university; periodic calibration and testing of research tools; provide funding for authentication where not available through sponsored agreements; and consider closed electronic digital notebooks as a medium for recording these practices as well as more open and public reporting structures.

Biostatistical or Other Statistical Support

We asked whether institutions have a specialized biostatistical or other statistical support group or unit on their campus (Appendix A, Question 5). Of the 64 institutions that responded, 80% indicated that they do offer statistical support, 11% that they do not, and 9% were unsure. Of those that responded affirmatively, 33% were through the Clinical and Translational Science Awards (CTSA) Program and 67% through a unit serving the entire campus.

We asked how many biostatistical or other statistical consults were completed in the last year. Six institutions indicated that they were unsure. Of the 24 institutions that provided approximate numbers, six indicated 150 or fewer consults (25-119), eleven 150-350, five 350 – 550, and the remaining institutions 750, over 1,000 and over 3,100.

Thirty-two institutions provided information on what resources are offered and when these services are provided. The most common resources offered were assistance with study design and protocol development, data collection and analysis, preparing grant applications, IRB applications, and statistical assistance. Of the institutions that commented on when these services are made available to researchers, most indicated that services are available from development, through proposal, and award stages at the request of researchers.

Data Repositories for Public Access Requirements/Open Data

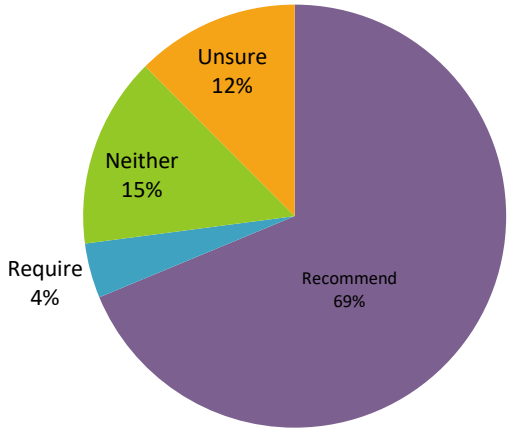


Figure 1

We asked institutions if they maintain a repository or repositories where researchers can deposit data in response to public access requirements or a desire to make data openly available, and whether use of these repositories is recommended or required (Appendix A, Question 6). The majority of respondents, 76%, indicated that their institution maintains a repository. Among those institutions only 4% require use (See Figure 1.). Most institutions with repositories manage them through their libraries. One institution indicated that Google Drive and Box (document archive and collaboration platforms) are utilized. Of the 15% of institutions that indicated that they neither require nor recommend use of an institutional repository, the majority leave the decision on whether to utilize the repository to the researcher and/or specific granting agency requirements.

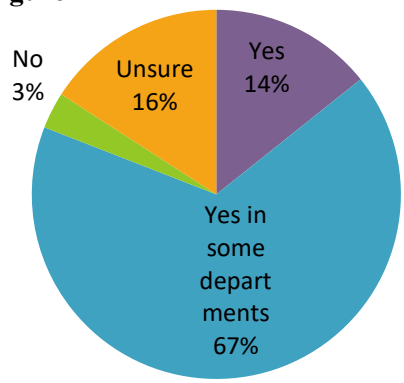
Incentivizing Reproducibility and Transparency Efforts for Research Projects

We asked whether institutions incentivize reproducibility and transparency efforts for research projects through means such as special funding, promotions, badges, or other efforts (Appendix A, Question 7). Seventy-three percent of respondents indicated that their institutions do not provide explicit incentives. Several institutions that answered "no" expressed support for doing so or indicated they were in the planning stages of developing a process for providing incentives. Of the 11% of institutions that do provide incentives, one indicated that they come in the form of training certificates, and another "Open Science Badges" from the Center of Open Science (COS). The badges, often included in publications, indicate a commitment to openness and accessibility. According to COS, use of the badges "dramatically increases the rate of data sharing." Other institutions indicated that they provide specific incentives in planning stages; and one institution that they provide an open access fund which assists researchers in paying journal fees. Sixteen percent of institutions that responded were unsure of whether their institution provided incentives.

Substantive Reviews of Research Proposals for Quality of Design Prior to Submission

We asked if individual departments at institutions provide substantive reviews of research proposals for quality of design prior to submission for funding (Appendix A, Question 8). Of the 63 responses received, 81% indicated that some or all departments provide substantive reviews (see Figure 2). Among those that responded 'yes' one institution indicated that each school has its own process and that some are very robust, one that they provide mock study sections and speed grant reviews, and another suggested that most support occurs through statistical consulting, internal peer review, or external grant writing consultants. One respondent indicated that their institution provides a Grants Central proposal development function and an Academy of Research Mentors; another provides departments assistance with experimental design and other resources.

Figure 2



Graduate Training in Rigor

We asked whether graduate students in the sciences or social sciences are offered training in the fundamental principles of rigorous research and if that training is required (Appendix A, Question 9). The survey noted that this would not include responsible conduct of research training. Of the 61 responses received, 59% of respondents indicated that graduate students are offered this type of training, while 10% indicated it was not offered, and 31% were unsure. Several that responded 'yes' mentioned that the training is often incorporated as part of the curriculum within the student's field of study.

The somewhat high level of uncertainty to this question may suggest that the central office is not always aware of the training being offered. However, most universities that answered 'yes' pointed to specific course offerings or training in research methods and responsible conduct of research. Other offerings include free workshops and online training. Pennsylvania State University offers free workshops twice per year that address research quality. Brown University has piloted and implemented a Rigor and Transparency Program focused on design, variables and variation, big data, and other topics. Cornell offers several graduate courses and workshops on topics such as research methods in social sciences, research design, practice and policies, and quantitative research methods. The majority of these programs are managed at the school or department level and offered primarily at the graduate level or beyond. Thirty-nine percent of respondents indicated that the training was required.

Raising Awareness of Rigorous Approaches to Research

Sixty-two institutions responded to our survey question regarding whether there are efforts at their institution to raise awareness of rigorous approaches to research such as randomization of subjects, blinding of data analysis, sample size estimation, and replication of experiments

(Appendix A, Question 10). Sixty-one percent of respondents indicated that there are efforts to raise awareness, while 16% indicated that there are not, and 23% were unsure.

Those responding affirmatively commented that this education is provided through responsible conduct of research training and other courses (e.g., design of clinical trials; outreach by the Office of Research Integrity in relation to animal and human subjects requirements; and through workshops, seminars and symposia where case studies are discussed, including research design and the importance of rigor in study design and the conduct of research. Institutions described raising awareness through graduate student seminar courses (including "survival courses"), other training sessions for both graduate students and faculty, and departmental and lab meetings; 1:1 consultations through a research development unit and biostatistics core; or indicated that core facilities provide this training to users.

Box 2: Efforts to Raise Awareness of Rigorous Approaches to Research

The University of Utah described a series of efforts led and sponsored by the Health Sciences Library, the Vice President for Research, and the Center for Clinical and Translational Science to raise awareness of rigorous approaches to research. These include Grand Rounds Research Reproducibility, a weekly interdisciplinary lecture, and discussion on reproducibility topics in all disciplines. Lectures are recorded and made available to the public on YouTube.

Other resources at the university include the Research Reproducibility Coalition, an interdisciplinary group of faculty, staff, and students who meet to discuss institutional approaches to improving research reproducibility, connect with researchers of similar interest, and help guide the development of the Research Reproducibility Conference; and the Research Reproducibility in the Sciences Workshop. The workshop is a two-credit course to preface the Research Reproducibility Conference, a week-long course to boost awareness and teach practical skills. The course is also offered for Continuing Medical Education and Medical Library Association credit. The annual Research Reproducibility Conference, most recently held on June 15, 2018, is the second Research Reproducibility conference held by the institution and brings people together nationally to discuss research reproducibility topics.

In addition to these efforts, the Health Sciences Library faculty give regular lectures, perform outreach, and teach courses on reproducibility topics and tools. Other efforts include a Research Administration Training Series with classes on reproducibility topics, including an introduction to reproducibility, data management, electronic lab notebooks, and other areas. Columbia University also held a symposium in late 2016, Promoting Credibility, Reproducibility and Integrity in Research, and will hold a second symposium in March 2019.

Actions Taken to Promote Transparency in Reporting Scientific Outcomes

We asked respondents what actions their institution has taken to promote transparency in reporting scientific outcomes, including reporting of blinding, randomization, inclusion and exclusion criteria, how outliers are handled, and other methodological details necessary to assess and reproduce published findings (Appendix A, Question 11). Of the forty-seven institutions that responded to this question, 26% indicated that their institutions have not acted on this, or that they were unaware of specific actions taken, and suggested that these actions may be taken at the departmental level.

Of the remaining 74%, institutions pointed to courses, workshops, seminars, training and education programs, newsletters, reporting guidelines, guest speakers, and mentoring and mentoring plans as vehicles for promoting transparency. One institution indicated that they have Open Science Ambassadors and templates for pre-registration, and another promotion and training on open datasets and open protocols, use of the Open Science Framework, and other tools for transparency. The University of Washington noted that its eScience Institute offers intellectual support for creating reproducible computational workflows across research disciplines. UW-Madison has faculty and staff at the forefront of their disciplines play a role in outlining and promoting best-practices for rigor and reporting. Researchers are supported by mentors, courses, workshops and other professional development opportunities.

Harvard noted that research programs emphasize these concepts to program participants. As an example, the Harvard Chan Bioinformatics Core makes their code as reproducible as possible and publicly available on GitHub. They also include some of these concepts in trainings, e.g. keeping track of data analysis parameters and version control. The ICCB-Longwood Screening Facility encourages users to publish well-annotated compound screening data and methods in the NIH PubChem data repository. The Harvard Medical School Library of Integrated Network-based Cellular Signatures Program (HMS LINCS) (funded by NIH) has developed its own database to share publicly the datasets produced by HMS LINCS investigators. Software Carpentry courses that promote best practices for software/data analysis documentation and code sharing are hosted on the HMS campus at least annually.

Specific Training, Resources, or Other Support

We asked whether institutions offer training, resources or other support on issues that may affect the rigor and reproducibility of research in three areas, including the impact of biological variables such as sex, age, weight, and health status of animals in studies and publications; authentication of key resources such as cell culture lines, antibodies, and genotype of transgenic animals; and, identification and tagging of key resources in manuscripts and grants (Appendix A, Question 12). In terms of addressing the impact of biological variables such as sex, age, weight, and health status of animals in research and

publications (Question 12a), 54% of respondents indicated they offer training or other support, while 14% indicated that their institution does not offer this support, and 32% were unsure. Regarding support in the form of authentication of key resources such as cell culture lines, antibodies, and genotyping of transgenic animals, 51% provide this support, while 16% indicated that their institution does not, and 33% were unsure. Thirty-seven percent of institutions that responded offer support in identification and tagging of key resources in manuscripts and grants, while 25% do not. Thirty-nine percent were unsure.

Conclusions

The results of our survey indicate that universities are providing resources to help ensure research rigor and reproducibility but that the depth and breadth of resources provided varies considerably both between and within institutions and is often not tracked centrally. Additionally, responses suggest that researchers may not be aware of the institutional resources available to them.

Institutions may benefit from fully assessing and making transparent resources currently offered to facilitate rigorous approaches to research; assessing use and identifying barriers and possible incentives to improve use. Efforts to raise awareness of institutional resources and those offered by other institutions, professional societies, and the federal government, would provide substantial benefits with respect to strengthening rigor and reproducibility. We also note that institutional attention to these issues appears to be increasing, and since the survey, some institutions may have already taken steps to increase awareness and provide additional resources such as electronic lab notebooks and other resources for their researchers. As an organization, COGR will take steps to direct institutions to available resources and consider other means of facilitating reproducibility, including further consideration of barriers and incentives.