Journal of eScience Librarianship
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Full-Length Paper

Assessment of Data Management Services at New England Region Resource Libraries

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Abstract

Objective: To understand how New England medical libraries are addressing scientific research data management and providing services to their communities.

Setting: The National Network of Libraries of Medicine, New England Region (NN/LM NER) contains 17 Resource Libraries. The University of Massachusetts Medical School serves as the New England Regional Medical Library (RML). Sixteen of the NER Resource Libraries completed this survey.

Methods: A 40-question online survey assessed libraries' services and programs for providing research data management education and support. Libraries shared their current plans and institutional challenges associated with developing data services.

Results: This study shows few NER Resource Libraries currently integrate scientific research data management into their services and programs, and highlights the region's use of resources provided by the NN/LM NER RML at the University of Massachusetts Medical School.

Conclusions: Understanding the types of data services being delivered at NER libraries helps to inform the NN/LM NER about the eScience learning needs of New England medical librarians and helps in the planning of professional development programs that foster effective biomedical research data services.

Introduction

Exponential growth of data collections is occurring around the world. With increased scientific research and data being produced, it raises questions of how to manage these outputs (DataONE 2012). Researchers are interested in storing, reusing, and possibly sharing their data; and with an increased risk of data loss, there need to be plans in place to ensure data protection and preservation. The emerging need for research data management has prompted libraries to plan for providing data services to their users (Tenopir et al. 2014).

Research data services (RDS) include "providing information, consulting, training or active involvement in: data management planning, data management guidance during research, research documentation and metadata, research data sharing and curation of completed projects and published data" (Fearon et al. 2013). Most data services are extensions of "traditional informational services," but expanding and creating discipline-specific services can be constrained by lack of knowledge and skill among library staff and their confidence in this area (Tenopir et al. 2014). Health and science librarians are interested in providing these types of services (Creamer et al. 2012), but have faced many barriers in funding personnel and institutional support.

There is a need to educate librarians, researchers, and students to understand, use, and manage science data (Carlson et al. 2011). In response to this need, the Lamar Soutter Library at the University of Massachusetts Medical School created the New England Collaborative Data Management Curriculum (NECDMC), in partnership with several libraries in the New England region. This curriculum aligns with the National Science Foundation's (NSF) data management plan (DMP) recommendations and addresses universal research data management challenges. The development of this resource shows that science and medical librarians are aware of funding agency mandates, and are actively providing data management services (Antell et al. 2014).

In addition to understanding scientific research data management, there are many other growing areas librarians must be knowledgeable about when discussing best practices with researchers. One area creating new approaches to scientific research is eScience, also defined as team science and networked science (Creamer et al. 2012; Soehner et al. 2010). Librarians are educating researchers about open access and open data policies to promote the accessibility and reuse of the raw data generated during the scientific discovery phase (Tananbaum 2013); copyright and intellectual property rights concerning data (Creamer et al. 2012); scholarly communication which is "the system research and other scholarly writings are created, evaluated for quality, disseminated to the scholarly community and preserved for future use" (Association of Research Libraries 2015); and specific data curation practices including appraisal and selection, representation, and organization of data for access and use (Heidorn 2014).

Large academic research libraries have been found to be leaders in providing eScience and RDS to their communities. Support systems for RDS at these institutions may be centralized, decentralized, a hybrid of both, or may involve multi-institutional collaborations (Raboin et al. 2012; Soehner et al. 2010). These academic institutions' libraries have been addressing the need for developing data management services (Reznik-Zellen et al. 2012) and are beginning to expand into other areas to support the data curation, access, and copyright needs of

researchers (Westra 2010).

However, as a new services area, research data management is an emerging area of focus in librarianship, and most librarians are still learning about RDS and how it relates to the services currently provided by their libraries or institutions. While the approach to creating and offering data services will differ based on institution size, research community, mission, and funding, environmental scans can build an understanding of how organizations and institutions with similar interests can engage in this area. Science and medical libraries will have an important role in providing needed data services to their communities in response to the increase in scientific research and the data management requirements of this research.

The focus of data management literature has been on programs at individual institutions and on higher-education initiatives as a whole (Reznik-Zellen et al. 2012). In contrast, this assessment distinctively surveys New England Region (NER) medical and biomedical libraries and their development of educational programs and appropriate services for research data management. Unique to this study, this group of special libraries shared their institution's status on offering data services, how their librarians are becoming educated on data management, and if their users are in need of these types of services. From this assessment, the NER will understand the current challenges and benefits of creating data services in the region to drive the future development and expansion of library support for scientific research.

Setting

The National Network of Libraries of Medicine (NN/LM) Regional Medical Libraries (RMLs) provide medical library support throughout the United States. Eight RMLs head the following regions: Greater Midwest, MidContinental, Middle Atlantic, New England, Pacific Northwest, Pacific Southwest, South Central, and the Southeastern/Atlantic. These RMLs support NN/LM member libraries in each region by providing document delivery, funding, outreach, and training. Specifically, they provide health professionals equal access to biomedical information and aim to improve the public's access to information (National Network of Libraries of Medicine 2015a).

The University of Massachusetts Medical School, Lamar Soutter Library serves as the head RML for the New England Region. Under contract by the National Library of Medicine, the Lamar Soutter Library leads and responds to the ongoing information needs of the NER diverse populations. Specifically, UMMS has lead the development of the following major initiatives: Focused Outreach, Knowledge Management, Public Health Information Access, Communities of Interest, and eScience (National Network of Libraries of Medicine 2015b).

UMMS has become a leader in eScience and data management initiatives by hosting conferences such as the Annual New England Area Librarian e-Science Symposium and New England Science Boot Camp for Librarians, as well as developing online resources, including the e-Science Portal for New England Librarians and NECDMC. Through this leadership, the Lamar Soutter Library seeks to demonstrate the need for and benefit of data management services and programs.

Seventeen Resource Libraries are members of the NN/LM NER. These Resource Libraries are larger libraries with complex operations and diverse user bases. Of the 17 libraries, 12 are

academic health sciences libraries: 10 are associated with Association of American Medical Colleges (AAMC) accredited medical schools, and two have long-established pharmaceutical programs and nursing programs. The remaining five are larger hospital libraries located within tertiary care institutions that serve multi-disciplinary health centers. Four of these five hospital libraries also have institutional affiliations with one of the medical schools within the region.

This group of medical, hospital and health sciences libraries was chosen for this study because they are in a prominent position to address the data needs of researchers and to educate students on best practices of scientific research data management. This survey assesses how the NER Resource Libraries are developing data services necessary to support one of the country's largest areas of hospitals, research centers, and learning institutes.

Methodology

To complete an environmental scan of this group of libraries, a 40-question survey was developed to discover what kinds of data management services are being provided and how well they do or do not work (complete survey in Appendix 1). The survey was created based on previous studies looking at data management in other library settings. Tenopir et al. (2014) surveyed Association of Research Libraries (ARL) and Association of College and Research Libraries (ACRL) members in the United States and Canada. Tenopir's study included questions concerning informational or consulting RDS and about technical/hands-on RDS. Both of these types of services are addressed in the current survey of the NER. Soehner et al. (2010) surveyed ARL libraries on their eScience and data support services. Soehner's survey instrument served as a starting point for defining eScience and for tailoring questions to focus on the education of students and medical professionals at these NER libraries.

For the purposes of this survey, data management was defined broadly as "the process of planning, controlling, and preserving the information generated during a research project. Data management services and programs include any guidance, education, and training offered in support of researchers, institutions, and agency goals" (e-Science Portal for New England Libraries 2014b). This definition was pulled from the e-Science Portal for New England Librarians website. This site provides tools and information to help information professionals effectively participate in networked science and to understand current eScience practices. With this definition provided, the authors assumed respondents would understand the parameters of the survey questions.

After receiving Institutional Review Board (IRB) exemption from the University of Massachusetts Medical School, the survey was distributed by SurveyMonkey®. Librarians at UMMS piloted the survey and provided feedback for revisions. The final survey was sent to the directors and contacts at the 17 NER Resource Libraries for completion. After two weeks, 16 libraries completed the survey; it was then closed for analysis, resulting in a 94% response rate and a sample size of 16 libraries.

Results

The results of this study revealed several common trends libraries are facing with data services, but highlighted specific challenges for medical and health sciences areas. Because this study focused on a small sample size, the results presented here cannot be generalized

outside this cohort. However, the findings do offer a starting point for further development of data management services at other RMLs and Resource Libraries.

Of the 16 libraries that completed the survey, five (31%) identified as a medical library at a medical school, four (25%) as academic health sciences libraries and four (25%) as hospital libraries. Three (19%) libraries identified as other: teaching hospital, science & health science library, and main campus library containing all science materials.

Data Services and Support

Two (12%) libraries responded as currently having formal plans in place, seven (44%) are currently in the process of developing a plan, and seven (44%) responded with no plans for creating data management programs (Figure 1). The nine libraries with plans in place or in the development stages described their program or planning process: working with other institutional departments, offering workshops and classes on research data management, and creating subject guides using the LibGuides platform from Springshare. Specifically, one library is piloting a workshop on using the DMPTool for creating data management plans; another is working to implement Mendeley as a tool for managing and sharing research papers; and one library is currently in discussions about how to integrate data management instruction into the graduate school's curriculum.

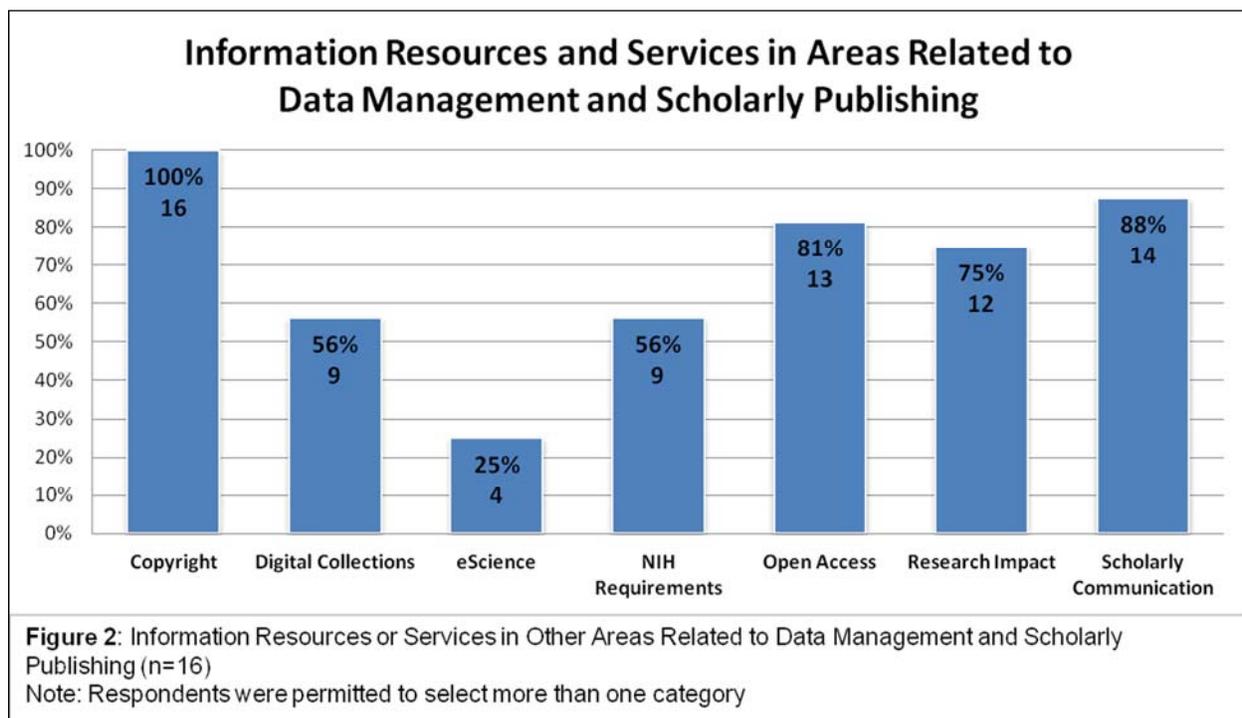**Figure 1**: Current Data Management Programs (n=16)
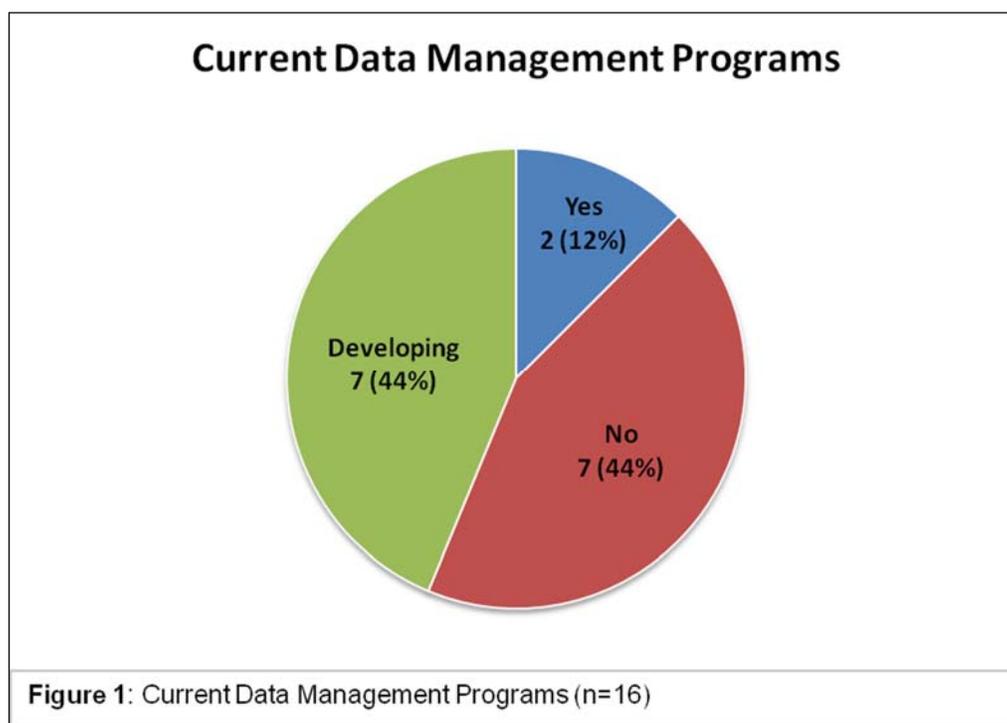
Librarians were asked to select the data reference and technical services they provide to their users. Eleven (85%) libraries are providing reference support for finding and citing data or data sets; 10 (77%) are discussing research data management with other libraries, people on campus or RDS professionals; nine (69%) are creating LibGuides and finding aids for data,

datasets, and repositories; and nine (69%) are providing research data management classes. Additionally, some librarians are doing outreach and collaboration with faculty, staff, and students on data management plans and data standards, and are directly participating with researchers as a team member on a project.
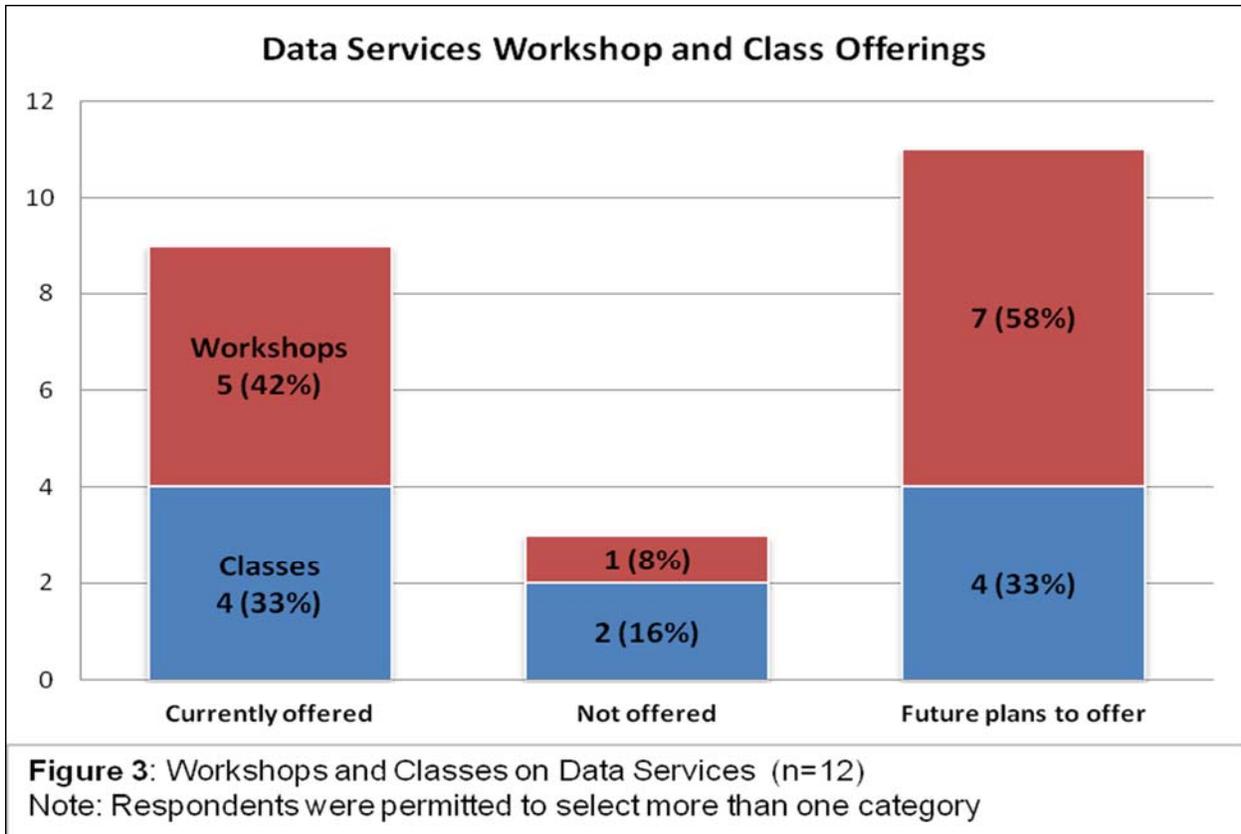
In terms of processing services, six (86%) libraries work on preparing data and datasets for deposit into a repository (either supported by the library or institution, or a repository service outside of the institution), and five (71%) libraries are identifying data or datasets for repositories, creating or transforming the metadata for these datasets and then ingesting the data or datasets into repositories. Fewer librarians are providing technical support for research data management systems and appraising datasets for curation and preservation.

Libraries are providing consultation in many areas related to data management (Figure 2): all 16 (100%) responding libraries provide copyright services, 14 (88%) provide scholarly communication, 13 (81%) provide open access services, and four (25%) provide eScience (team science, networked science or new approaches to scientific research) support. Further service areas that were described by libraries included: digital collections, citation management, data management plan support, consulting for sharing and publishing, research impact, gene set enrichment analysis or data analysis, National Institutes of Health (NIH) requirements, National Science Foundation (NSF) grant writing, and ingestion of data into institutional repositories.

Figure 2: Information Resources or Services in Other Areas Related to Data Management and Scholarly Publishing (n=16)
Note: Respondents were permitted to select more than one category

To understand the format in which libraries are providing data service topics, the survey asked about libraries' data services workshops and classes (Figure 3). For this survey, workshops were defined as including one or a series of meetings over a short period of time involving
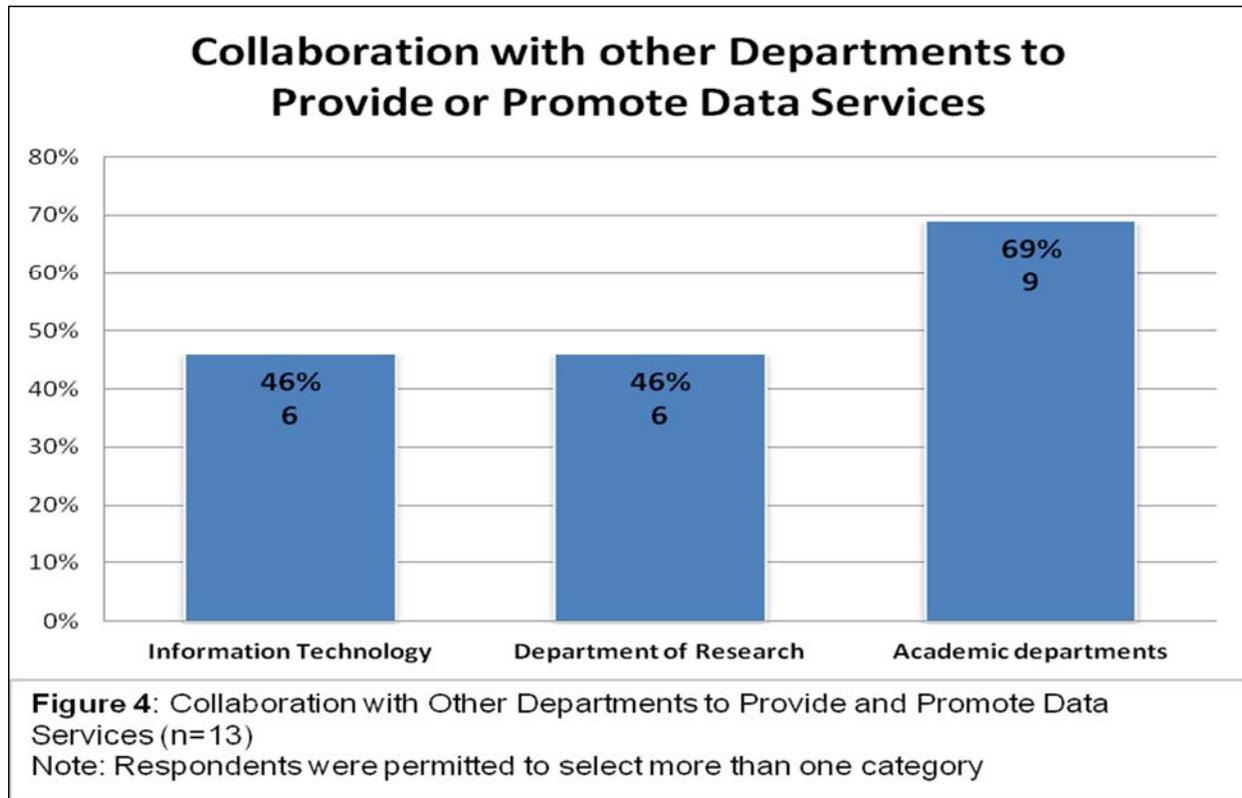
instruction on a specific topic or skill — usually involving specific assignments during the course of the workshop session. These types of workshops were identified by 12 (83%) of the responding libraries (with five currently running workshops and seven with future plans for workshops), and are strongly geared toward graduate students. Classes or courses were defined as a series of meetings over an extended period of time in which students are taught a particular subject; usually including assignments to be completed outside of the meeting times. Of the eight libraries that currently offer or have plans for these types of classes, five (83%) courses are for professional development, two (33%) offer a for-credit course, and one (17%) library gives a semester for-credit course.

Figure 3: Workshops and Classes on Data Services (n=12)
Note: Respondents were permitted to select more than one category

Collaboration and Outreach

Four (25%) of the responding resource libraries are currently working on collaborations with libraries (branch or main) at the same institution, and three (18%) have plans to collaborate with libraries at other institutions. Thirteen libraries are collaborating with other departments on campus (Figure 4). Nine (69%) libraries are teaming up with different academic departments, and provide and promote services in mainly science departments such as: medicine, nursing, biomedical, biology, genetics, and molecular biology. These nine libraries shared their current, past, and future collaboration projects related to data services: implementing institutional repositories (IRs), working research data management into curriculum and educational materials, starting digital curation projects, providing Information Technology (IT) support in workshops, accessing software and data analysis, and teaming up with the Office of the Vice

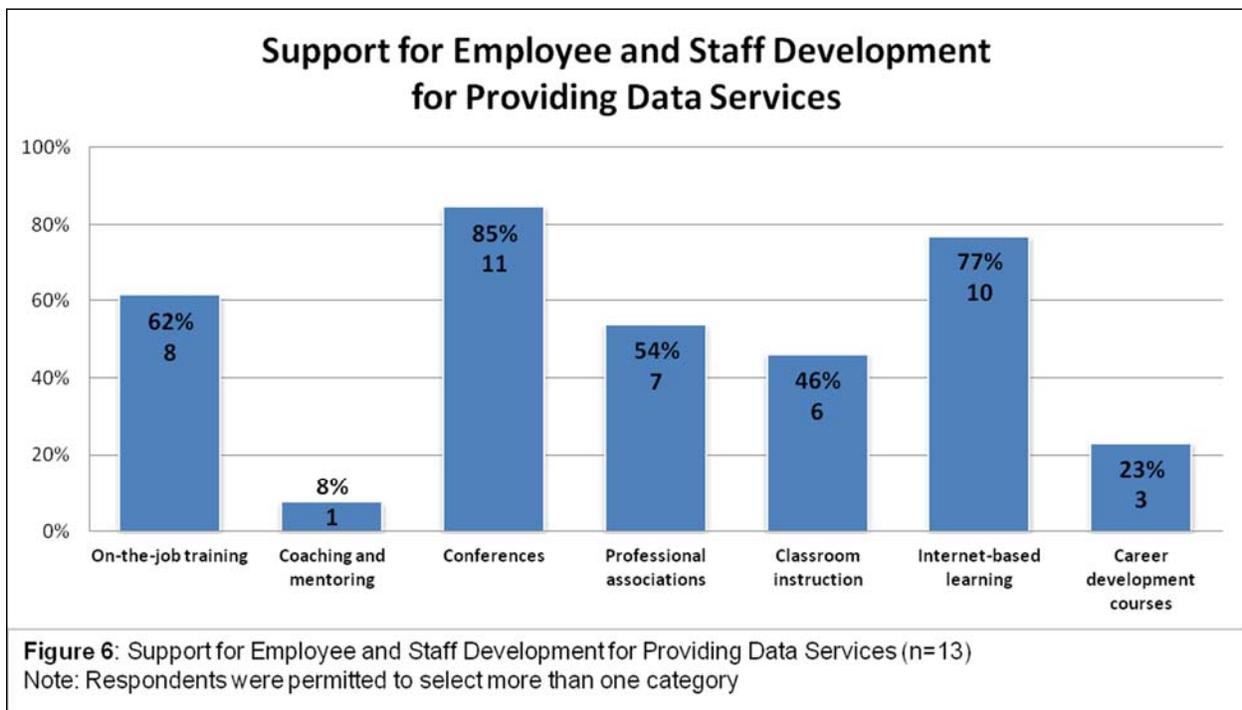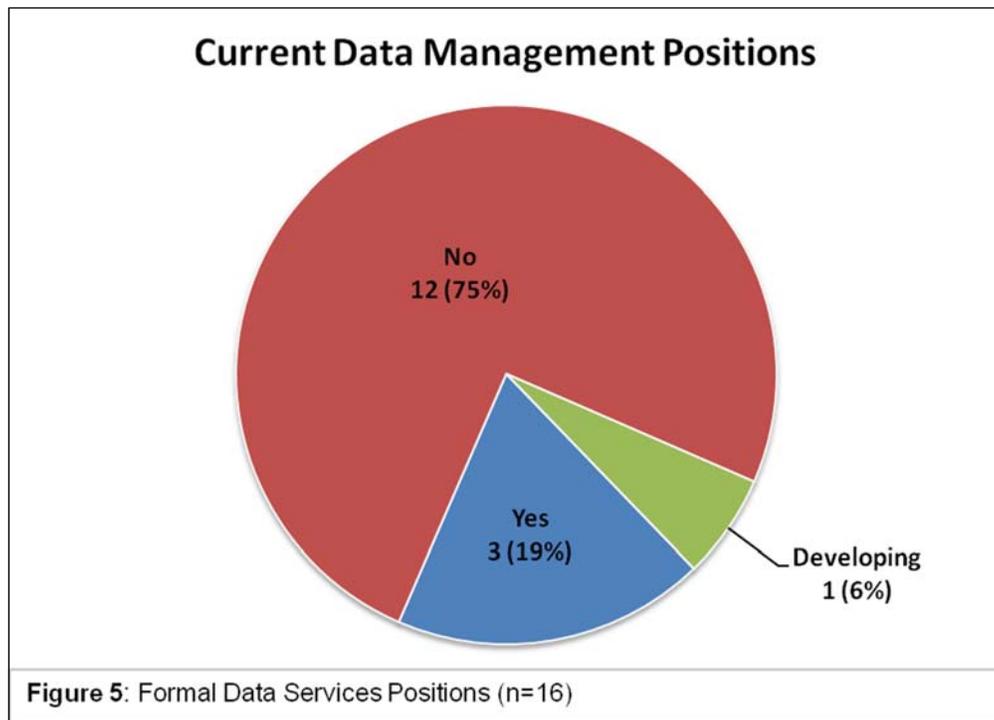Provost for Research (VPR) for Responsible Conduct of Research (RCR) training.

Figure 4: Collaboration with Other Departments to Provide and Promote Data Services (n=13)
Note: Respondents were permitted to select more than one category

Data Positions and Staff Development

Libraries were asked about their formal staff positions and the type of librarians performing data services. Only three (19%) of the libraries currently have data management-related library staff positions (Figure 5). These position titles include metadata archivist, metadata librarian, data librarian, science data management librarian, and repository manager.
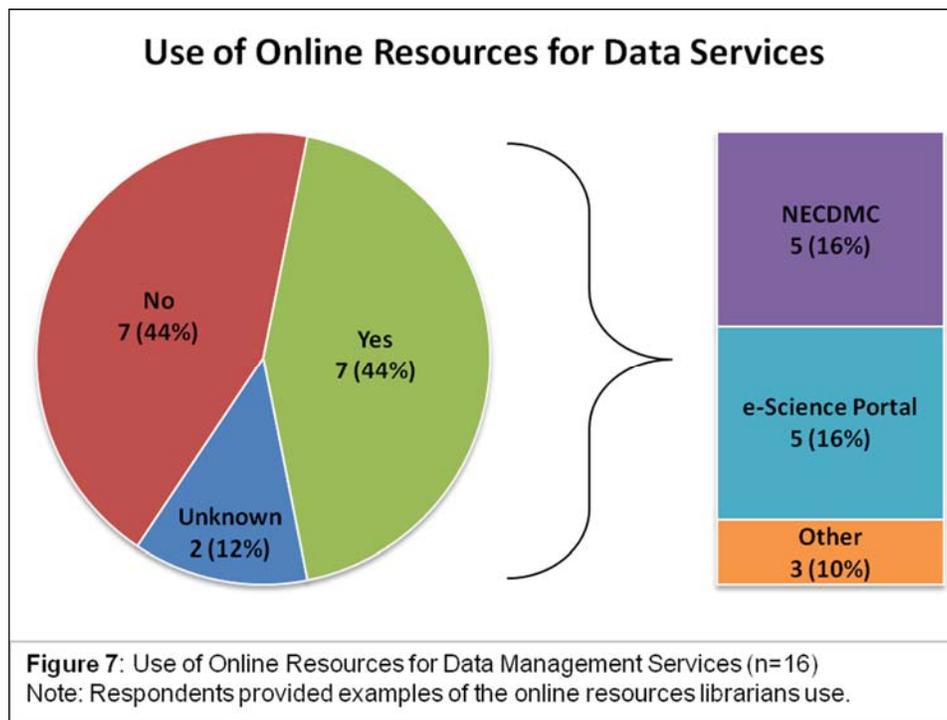
Due to the fact that many of these libraries do not have specialized personnel to field data questions, libraries responded that reference, instruction, or subject librarians are performing or providing data services. In addition to their regular tasks, technical services and embedded research librarians may also be called upon to provide data services.

Only 13 libraries responded to the question asking how staff develop and acquire the needed skills and knowledge for providing data services (Figure 6). Eleven (85%) libraries identified conferences, 10 (77%) utilize internet-based learning, and eight (62%) provide on-the job training/learning as the primary preparation for librarians to provide data services. There is less of a focus put on classroom instruction (six, 46%) or attending career development courses (three, 23%).

Figure 5: Formal Data Services Positions (n=16)

Figure 6: Support for Employee and Staff Development for Providing Data Services (n=13)
Note: Respondents were permitted to select more than one category

Digital Data Services

One section focused on the library's use of online resources when providing or learning about data services. Of the 16 NER libraries participating in the survey, only seven (44%) librarians consult online resources for assistance with inquiries (Figure 7). The most heavily used resources named by these seven libraries are the e-Science Portal for New England Librarians and The New England Collaborative Data Management Curriculum (NECDMC). These librarians are also consulting RDM websites at Minnesota, Purdue, UK Data Archive, MANTRA, DMPTool, and other online resources through California Digital Library (CDL) and Association of Research Libraries (ARL).

Figure 7: Use of Online Resources for Data Management Services (n=16)
Note: Respondents provided examples of the online resources librarians use.

Libraries were asked about the presence of digital repositories at their institutions. Of the 16 responding libraries, 13 (81%) have a repository at their institution or library. Of these 13 libraries, 12 (86%) have an institutional repository, four (28%) institutions have research or data repositories, and one (7%) library identified having a disciplinary repository. In terms of what is accepted into these repositories, libraries manage mostly local research outputs. Three (25%) libraries accept data or datasets to their institutional repository, with six (50%) others planning to make this feature available in the future.

New England Region Environmental Scans

Of the responding libraries, six (38%) have completed an environmental scan. Their major findings included: community need for data storage and preservation; assistance with creating data management plans; being educated about best practices and tools; more outreach and visibility of projects and policies; use of electronic lab notebooks in research labs; the best

ways for handling confidential data; and focusing research data management education for graduate students.

To address these needs and areas lacking in data education, libraries have created strategic agendas to include providing more instruction, making local- and third-party resources available and easily accessible, structuring institutional repositories as sharing platforms, and developing educational and training materials and courses for students.

Challenges of Library Data Services

The final section of the survey was made up of open-ended questions asking libraries to identify the challenges their institutions have encountered to provide data services, or why their institution does not provide data services. The challenges encountered by the two (12%) libraries currently offering data services included: a lack of data management policies at the institution; difficulty in raising awareness of library services due to other departments on campus also providing data services; and the need for better collaboration between departments and with researchers across campus.

Seven (44%) libraries responding to this survey are currently in the development stages of creating data services and programs. The challenges they identified during the planning process include: confusion surrounding the definition of "data services;" requiring stakeholder support and time; raising awareness of data management issues; changes in staff and administration; varying patron types with different needs; lack of staff time and expertise; unclear if someone else at the institution is already doing data management; ineffective promotion of the library's role; and researchers who are not willing to share their work or data.

There are also seven (44%) NER libraries not offering data services and are not currently planning programs to address data management. These institutions identified the need for more personnel in terms of staff size and specialization, and lack of requests or need for data management help. Other major issues cited were the focus of the institution (teaching versus research university, or academic versus hospital library) and decentralized organization adding challenges to working with others at the institution in order to develop data services.

Discussion

This survey resulted in mixed responses about strategies the New England Regional Resources Libraries are using to develop and provide data services to their communities. There are few libraries with fully developed services and have an understanding about the data needs and challenges at their institutions.

Understanding the vocabulary used in data management and related subject areas is key to providing applicable and sufficient services. Libraries indicated there is still ambiguity surrounding research data management terminology, and also about whom at the institution are providing data services. The e-Science Portal for New England Librarians serves as a starting place for librarians to find tools and resources for data services. The portal features a Thesaurus containing terminologies and concepts on a variety of eScience-related topics. Users are able to electronically submit new vocabulary and records to the Thesaurus, thus preserving it as a current go-to eScience resource for librarians (Read et al. 2013).

Although this assessment used a definition of data management generally accepted by the eScience and medical community and is cited from the e-Science Portal Thesaurus, there is no standard definition of what data management services include. Therefore, the survey questions may have been interpreted differently among participating libraries and resulted in some librarians being unable to answer certain questions. This was also seen in a 2013 study of Regional Medical Library-sponsored activities addressing eScience (Abad 2013). Abad's study of all the RMLs reflected a vague understanding of eScience and additionally found that the activities of regional libraries strongly reflect the interests of that region.

Understanding the institutional mission is key to providing data services. One participating library commented that their institution "campus libraries are focused on educational support" and therefore do not have a need to provide data services. Another library stated that as a "teaching university there has been little need." Based on these statements, the institutions within the New England Region have different focuses and data management needs. NER libraries are serving various types of larger institutions, including hospitals, medical schools, health sciences programs, and so must tailor their services to the needs of that community. Understanding why teaching hospitals and academic campus libraries are not addressing data management services would involve a deeper look into specific institution organization within the NER.

Librarians can build professional skills to provide data services by using available resources and participating in development opportunities. Similar to previous assessments, this survey confirmed that libraries lack personnel with the technical skills needed for management and curation of data, and there is a need for continuing education programs emphasizing best practices for RDS. Online tools such as the UMMS-developed e-Science Portal and NECDMC, help practicing librarians gain the necessary skills for providing data services. From this survey, only seven libraries consult online resources, but NECDMC and the e-Science Portal were listed as the most used sites. It is encouraging to see that libraries in the New England Region are taking advantage of resources created by their colleagues at the University of Massachusetts Medical School and other New England institutions. This shows the impact UMMS is making to address data management needs in the NER and that the UMMS resources are helping librarians address scientific research data management needs at their own institutions.

However, the lack of qualified personnel must be addressed, as well as the need for formal training. Currently only three of the NER libraries have titled data positions, and existing librarians are expected to learn necessary skills and knowledge on the job. Internet-based learning and on-the-job training can support employee development and continued education, but conferences and formal classroom training can provide the hands-on work and experience new data librarians need.

In addition to creating online resources for librarians, UMMS also supports activities to provide them with exposure to scientific research data and experience working with researchers. The Annual University of Massachusetts and New England Area Librarian e-Science Symposium serves as an educational opportunity for librarians to learn about eScience resources and discuss current library roles for engaging research communities and supporting networked science (eScholarship@UMMS 2015). Similarly, UMMS sponsors the New England Science Boot Camp for Librarians, which helps to provide librarians with context and terminologies of

science disciplines that will enable them to better engage with faculty and researchers to provide research services (e-Science Portal for New England Librarians 2015).

UMMS has also addressed the need for formal RDS education among librarians by teaching a class at Simmons College in Boston aimed to present the NECDMC in a more collaborative and face-to-face setting. Designed as a train-the-trainer course, librarians (students and professionals) examine data practices of scientific research and explore strategies to provide data services to researchers.

For training the next generation of researchers, workshops can be a great way to instill best practice for residents or students to take back to their lab and to pass on their knowledge. In general, workshops and other training opportunities are the "bread-and butter" (Raboin et al. 2012) of research data services. According to this survey, more libraries are offering data workshops than classes, and these workshops are strongly geared toward graduate students. It is encouraging to see that graduate students have the resources and opportunities at their institutions' libraries to learn data management practices which can then be applied to their studies and research. However, it would be beneficial to examine these workshops further to understand their individual components and goals. In a study of University of Massachusetts Amherst Libraries, graduate students expressed the desire for more discipline-specific information during workshops (Adamick et al. 2012). Libraries who want to offer data management services to the student body must to evaluate the needs of the students, and then attempt to provide services to meet those needs. Therefore, data management workshops may have many focuses: broad-based overview of data management best practices, and/or discipline-specific sessions focusing on specific tools for specific types of research.

Digital datasets are another form of digital information librarians and archivists can handle in their repository programs. One principle goal of data management and data curation is to provide readily available data to researchers (Creamer et al. 2012). Institutional repositories have become the "catch all" for a variety of scholarly and research output (Walters 2009). Antell et al. (2014) noted that many institutions have already developed robust institutional repositories and data repositories. This is reflected in this study, as 13 (81%) respondents identified some type of repository at their library or institution. At these institutions there is a range of repository platforms: some libraries have developed their own repositories, while others are using outside platforms such as Bepress Digital Commons and Islandora. For these repositories, most institutions are accepting papers and works — published by students and faculty — with plans to accept datasets in the future. This is a feature libraries can assist researchers with as they become more aware of sharing not only their work, but the importance of research data and metadata to back-up their results.

This study, however, did not ask respondents for details about the types of data being deposited into these institutional repositories. These institutions are creating and handling a large amount of health and patient data. Due to issues surrounding patient privacy and Institutional Review Board constraints related to human subject research, it would be beneficial to understand how these institutions manage this type of data and if they have repositories suited for addressing data privacy issues. Therefore, future studies should examine New England Region's Resource Libraries' institutional repositories for the types of data that is accepted and deposited.

Conclusion

This assessment helps New England medical and biomedical libraries understand the growing need for the implementation of data services and what types of services other New England libraries are providing. By comparing NER medical, hospital, and health-sciences libraries, the results of this study show there is little being done to address the data needs of students and researchers, but also highlights the region's use of resources provided by the NN/LM NER Regional Medical Library at UMMS.

Data management is important for science students and professionals to understand as requirements for grants and funding are growing to include proper data management plans and policies for sharing and preservation of data. Libraries can provide services in these areas and teach best practices to ensure research integrity at their institutions. As found in this study, New England Resource Libraries are beginning to formulate ways to incorporate this education into graduate-student curriculum, and offering workshops to faculty for further career development. However, these workshops and courses cannot be uniform across institutions or libraries. Therefore librarians must work to understand the needs and challenges of their users, and tailor individual programs to those needs.

Workshops, courses, and online resources are important elements in spreading the knowledge of data services. Librarians can utilize these tools to understand research data management, and then teach and implement services at their institutions. However, there are challenges and barriers to providing such services. While many libraries are able to hire additional personnel to specialize in data management or create a team of librarians to work with students, faculty, and researchers, other libraries do not have the funding or means to create these new positions. Therefore, in smaller medical and hospital libraries, it falls on the current staff members to take on providing additional services and understanding a subject area that is unfamiliar to them. Negative implications of this situation include librarians spending their time learning additional material, not focusing on their priority tasks, and therefore becoming overwhelmed with work.

Results from this survey also confirms these NER libraries serve a specialized community but have similar issues libraries in general are facing with the new area of data management and what exactly "data services" include. By sharing these findings with the wider scientific community, medical and health science libraries can understand what areas these libraries are focusing on, and what additional services they need to incorporate and expand. This and recent studies encourage discussion of formal data services, and from this survey in particular, the use of the e-Science Thesaurus within the e-Science Portal in order to move toward a consensus of the definitions used in the field.

As noted in Abad's survey of eScience initiatives at Regional Medical Libraries throughout the United States, further research should be done to investigate data management services and programs in each National Network of Medical Libraries region. It is important to understand what kinds of activities best serve individual regions and how RMLs can serve the Resource Libraries and their network members. These medical, hospital and health sciences libraries are in a unique position because they can address the data needs of researchers and students on best practices of research data management before these students engage in scientific research themselves. Understanding the types of data services that are being delivered at

NER libraries helps to inform the NN/LM NER about the eScience learning needs of New England medical librarians and helps in the planning of professional development programs.

Supplemental Content

Appendix 1: Survey Questionnaire
An online supplement to this article can be found at http://dx.doi.org/10.7191/jeslib.2015.1068 under "Additional Files".

Acknowledgement

Funding Statement

Disclosure

The authors report no conflict of interest.

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