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AN ECOSYSTEM FOR RESEARCH DATA MANAGEMENT (RDM) IN THE CONTEXT OF THE MEDICAL LIBRARIES

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Abstract:

Research Data Management (RDM) is a tool that is used in the management of research and development of data. RDM is widely used by organizations, institutions, governments, and libraries in the management of research data. The Library being an integral part of any academic, medical and special organization uses RDM in the management of data. It involves documentation, curation, analysis, preservation, and sharing of research outcomes to its users. The RDM Analyse data has long-term value and utility for further research, to continue further research it is necessary to have research funding agencies, organizations, PPP (Public Private Partnership), and lone researchers are examples of stakeholders. The university is the funding agency in a library in all respect have traditionally provided research services like traditional services and new ones integrating with RDM in the digital data growing market. The growth of data at a jet speed created another challenge in its management. The new hope of rays in the form of RDM appeared as solving of big data. A broader role for libraries and librarians in addition to these initiatives, including the incorporation of RDM into undergraduate instructions and in schools of library and information science, as well as influence and participation in the development of national policy. RDM services require the development, coordination, and synthesis of a range of library and medical institution services and programs.

Keywords: *RDM, Stakeholders, Medical Libraries, PPP, Big data, Ecosystem, Digital Data, Skills, Jobs*

Introduction:

Today, research organizations face a lot of challenges with Research Data Management (RDM). One of them is stakeholders, to shape their niche because of the multiple requirements, regulations, approaches, and instruments that make up the RDM ecosystem. Universities are currently producing enormous amounts of born-digital research data in a wide range of formats and at a rapid rate, leading to the so-called "volume," "variety," and "velocity" challenges of data. To help researchers create, gather, manipulate, analyze, transport, store, share, and preserve information, institutions must build policies, infrastructures, and services to handle data as a result of this "data flood." Despite its difficulties, it is becoming increasingly understood that sharing data widely can have advantages, including enabling the verification of research results, contributing to larger scientific activities involving the collection of data, and facilitating the reuse of data by others for upcoming research. Research

funders widely encourage and increasingly enforce – adherence to specific standards of data management and sharing because they are aware of the need to promote scientific good practice and to increase the value of the research they support. These specifications highlight the importance of proper research data management inside institutions. The design of research data services (RDS) and other RDM activities are now being significantly influenced by university libraries, medical libraries, etc. who have entered this field. To keep RDM librarians informed of recent advancements in RDM and prospects for collaboration, they must do regular environmental scans outside of the institution. Through continued instruction, training, and outreach, librarians can then communicate these developments to campus stakeholders. It is intended to give a thorough understanding of how librarians and library employees engaged in RDM think as they deal with the many difficulties that arise.

Review of Literature:

Academic librarians can provide pertinent leadership in RDM activities inside their universities or institutions because of their knowledge of research techniques and knowledge retention. Research libraries play a crucial coordination role in the development of an RDM program, even though institutional collaboration is important. The way RDM services are developed for their institution is something that campus stakeholder groups including university administrators, researchers, and research support units are all interested in. The library is in a particularly advantageous position to lead the RDM initiative since it is both a facility with people who are knowledgeable about many of the issues affecting RDM and a campus-wide service with relationships among these various stakeholder groups (Erway 2013; Shaffer 2013).

Academic libraries have a history of provisioning data for research use, giving many librarians a familiarity with the reuse requirements and concerns surrounding research data. (Humphrey, 2014) notes that data services librarians "often assist with locating data, interpreting data documentation, retrieving data files, and providing the data in a format that can be directly loaded into analytic software". Experience helping researchers use data sets can be leveraged in the provision of data management services. In addition, academic librarians are masterful at designing and delivering educational content tailored to the research practices of members of various disciplines, at varying levels of expertise. Their fluency and flexibility as instructors equip them to educate members of the university community on RDM issues.

Research library employees are in a good position to manage services like RDM services that are provided horizontally across the university since they already have contacts with researchers, other research support units, and university officials (Humphrey 2014). Libraries can coordinate services across disciplines as institution-wide resources, assisting researchers across various fields in adhering to best practices in data management. Given their own limited resources and the numerous demands on their time and energy, most researchers are open to receiving the expert advice of librarians on various issues of data management (McLure et al. 2014).

Academic librarians can also work with other institutions to design and test RDM solutions, sharing their experiences in professional forums and coordinating

RDM activities outside of their own university. The DLF E-Research Network, the Association of College and Research Libraries (ACRL) Data Management Working Group, the New England Collaborative Data Management Curriculum, and the Virginia Data Management Bootcamp, to name a few, have all helped to forge a number of cross-institutional alliances. The E-Science Institute (sponsored by the Association for Research Libraries [ARL], Digital Library Federation [DLF], and DuraSpace), the New England Collaborative Data Management Curriculum and the Virginia Data Management Bootcamp have As they build their RDM skills, librarians are utilizing these and other chances for international collaboration.

Promoting researchers as major stakeholders and data stewardship as a goal is a crucial component of the coordination work required to develop an RDM program. In order to plan for RDM services, university officials must be informed of the needs and requirements of researchers. At the same time, researchers and research support organizations must be informed of campus policies. The conversation of RDM needs to be initiated by librarians with all campus stakeholder groups, some of whom may already have RDM objectives in place. RDM aims are common to both library and IT strategies, according to an ARL analysis of a number of member institutions' strategic plans for their libraries, IT, and universities (ARL 2014).

Objectives:

1. Research data management environment
2. Activities supporting the development of RDM service
3. Building partnerships
4. Skills and Jobs in RDM fields
5. Identifying needs and developing policy
6. How might RDM services assist libraries in expanding their role

RDM Environment:

No matter how RDM development is viewed—at the organizational, institutional, governmental, or global levels—it depends on the cooperation and coordination of many active stakeholders. It is necessary to have a broad view of the current RDM ecosystem to understand the role of the academic library in activities at any of these levels. The ability to identify activities where the library is ideally positioned to facilitate and manage RDM development makes it possible to identify the numerous stakeholders involved in RDM activities and characterize their interests, roles, and responsibilities.

RDM Stakeholders:

The range of RDM stakeholders can be grouped into four major categories, although they have been variously defined in the literature (e.g., Erway 2013, 7; Pinfield et al. 2014, 4). This organization is meant to bring groups together based on shared roles, interests, and responsibilities in RDM rather than to indicate or mandate group isolation.

1. Governments & Funders:

1. Ensuring and upholding the integrity of the research
2. Fostering access to open research
3. Increasing investment return
4. Data sharing as a "public good"
5. Reusing data is encouraged

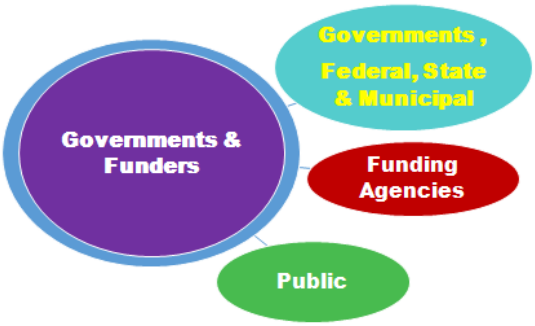

Figure-1

Governments and funding organizations have an interest in maximizing the return on their investments because they are the main sources of funding for academic research. Reusing well-managed and shared data in primary research, follow-up, and synthesis studies, as well as in transdisciplinary and data-intensive research, has the potential to produce a variety of advantages (Heidorn 2011, 662; Pryor 2012, 1). Funders encourage RDM activities to make sure that proper data stewardship and sharing are integrated into the research process, with varying degrees of success. This is done through one or a combination of high-level government recommendations, requirements for submitting RDM plans with grant proposals, and the sharing of research data products when appropriate and applicable.

2. Research Support Units:

1. Cost Recovering
2. Commoditization of services
3. Getting customers to "buy-in" to items
4. Making use of scale's efficiencies
5. Creating adaptable and practical solutions

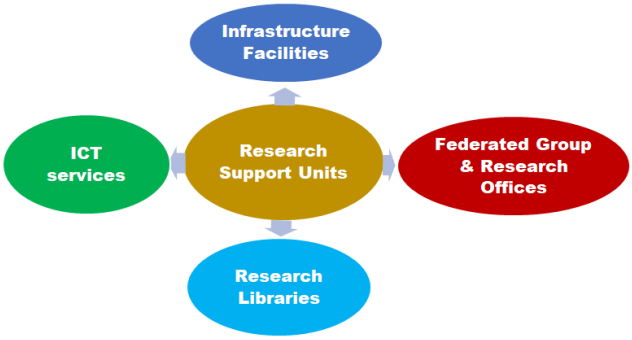

Figure-2

The RDM interests of university leadership, including Vice Chancellor, Professors, chief information officers, vice presidents of research, and university librarians, reflect their obligations to local governments, funding organizations, as well as to their institutional researchers, students, and community. These interests include promoting knowledge generation and preservation, tracking research output, and enhancing the reputation and prestige of the institution. Members of the university leadership team may also be researchers themselves, and as such, they may have a strong affinity for the research culture within their particular field.

3. University Leadership:

1. Monitoring the results and production of research
2. Knowledge advancement and preservation
3. Supporting highly influential research
4. Enhancing one's standing and reputation
5. Monitoring grant adherence
6. An increase in grant funds.

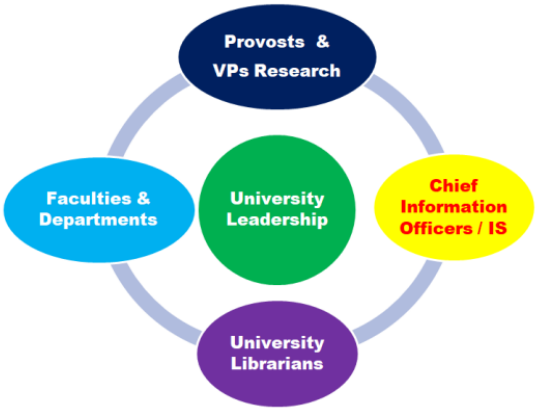

Figure-3

Figure-4

Researchers and their associated communities, departments, and faculties view RDM as a way to ensure compliance with funders, improve the effectiveness and caliber of their research, and advance knowledge in their field of study as the producers of data and disseminators of knowledge (Erway 2013, 10). The combined efforts of several research support units at the global level are necessary to address the varied interests and needs of the other RDM stakeholders. At the institutional level, RDM partners often comprise the library, IT services, and the office of research, in addition to other pertinent internal and outside service providers (Jones et al. 2013, 3; Pinfield et al. 2014, 4). At other levels, RDM involves cross-disciplinary and discipline-specific collaboration with infrastructure suppliers. These parties have an interest in developing effective RDM solutions and services that are highly used, scalable, and sustainable.

4. Researchers:

1. Guaranteeing grant compliance
2. High-impact research design
3. Increasing influence and recognition
4. Spreading and advancing knowledge
5. Enhancing the effectiveness and quality of research
6. Accessing information for reusing, confirming, and reviewing

Rudiments for RDM Coordination at Varying Levels:

RDM development occurs on a variety of levels, including initiatives within individual research groups, national and institutional policy formulation, and international cooperation. Despite playing a vital part in RDM development operations, each of the previously mentioned stakeholder groups has varying levels of interest, involvement, and contributions. Furthermore, the development of thorough, integrated data stewardship and sharing ecosystem is hampered by the disparate interests and levels of expertise among different parties. One or more of the partner groups must take on a coordinating and mediating role in RDM development where these discrepancies result in significant barriers to procedures or practices. Opportunities for groups to lead coordination efforts to grow due to the various stages of development, as well as the diverse circumstances and dynamics that exist there. For instance, both within and between countries, the development of RDM rules and standards by government funding agencies is inconsistent. All stakeholder groups are impacted by variations in these policies, which presents a crucial area for RDM collaboration on a variety of levels.

RDM Services:

Identifies the stakeholders involved with each offering, defines many of the services that can make up RDM offerings within an academic institution, medical, or government, and discusses actions libraries may take to coordinate these services. It will grow and alter as the RDM environment does. In consideration of the organizational and technological resources available, the suite of RDM services provided to a specific computing community should be adapted to the requirements of that community's researchers. Whether to offer an institutional data repository is a key concern as RDM teams build out their service portfolios on campus. Even though some libraries discover that data sets easily fit into the infrastructure of an already existing institutional repository, others explore developing or purchasing a standalone data repository for doing research on data sets created by the campus community. While some institutions have gone in this direction, survey data from the Digital Curation Centre (DCC) highlighted the preference of many institutions for working in partnership with other organizations to establish a research data repository **(Whyte, 2014).**

Institutional data repositories might be included in the RDM services provided on campus, but in our opinion, they should be primarily provided as a way to preserve and publish material that does not currently have a clear disciplinary home. Institutional repositories that concentrate on more conventional, the text-based scholarly output may strive to be comprehensive by compiling all papers produced by their institution's research community as well as librarians. However, they are unable to give researchers the functionality and exposure that disciplinary repositories with a focus on data sets for a particular audience can (e.g., tDAR & Archaeology Data Service for Archaeological data). Although a library may choose to make an institutional data repository available to a specific university community as a key RDM tool, it is not advisable to make that tool inclusive of all research data sets produced on campus.

With the variety of RDM - supporting technologies and services, academic libraries may opt to configure RDM services in a variety of ways. These days, the majority of university and college libraries are organised according to their academic departments. Libraries are faced with the same difficulty of creating RDM assistance that transcends their own organizational structure as many academics must adapt to new needs in order to continue supporting their research. They must collaborate widely across disciplinary and functional units as they establish partnerships to provide RDM services in coordination with other campus stakeholders, including offices of research, sponsored programs, information & communication technology service units, research compliance offices, and academic departments.

Development of RDM Service:

Many libraries are currently undergoing a budget cut due to the variety of potential and ongoing RDM operations. Libraries must carefully assess their role in developing and providing RDM services in order to provide services that will be truly helpful to the campus community. Numerous RDM teams carry out a variety of tasks to organise their service offerings. The sequence in which these structuring actions occur differs considerably between universities. While some may opt to finish

each of these tasks simultaneously, others may prefer to finish them all before introducing RDM services to the university community. Context alone can determine the "correct" strategy to integrate these structuring efforts with service offers, by considering the needs of researchers, readiness, and capabilities of on-campus partners, and available infrastructure on a particular campus.

In the process of creating RDM services, many library RDM teams frequently engage in a number of common activities. These activities are frequently iterative, with the team returning to them again. Creating alliances, conducting an environmental scan, determining rudiments, and formulating policies are some of these typical phases. While there are numerous tasks involved in creating and offering RDM services, there is no one, direct route.

Building Partnerships:

Many stakeholders on campus play significant roles in the planning of RDM services. Akers and colleagues note that RDM activities have been started by contacting many groups on campus, "with university research offices, advanced research computing facilities, and campus information technology departments being prominent library partners" in their discussion of eight research universities' approaches to RDM (2014, 184). Partners who help with the creation and submission of grant proposals include campus research departments like an office of sponsored programs. These collaborations are probably brand-new yet crucial connections for libraries developing RDM services. In order to build RDM services, collaborations with university information technology and high-performance computing centers are essential. These support units provide the data storage and computational capabilities required for data collection and analysis for research. Establishing methods for data sharing should be a joint effort between these groups and RDM librarians.

Identification of and building relationships with these and other stakeholders become increasingly important as libraries develop and provide RDM services. The ongoing roles of partners can range from advisory to participative and can include helping to create campus policy regarding the disposition of research data sets, advising the library's RDM team, setting up the computing infrastructure required for data management, reviewing DMPs, and becoming active team members supporting particular projects.

Conducting an Environmental Scan:

An environmental scan that supports RDM services may be conducted both inside and outside the institution and is frequently an ongoing procedure. Multiple purposes are served by an internal environmental scan of the resources used and accessible on campus to assist RDM in various departments. It can also be used to map current and potential RDM - related services and resources on campus, as well as possible partners throughout the university that are already contemplating or supporting RDM to a subset of people on campus. An external environmental scan aids RDM service providers in staying up to date on the subject, learning from peers by reading the literature on data management taking part in online discussion forums and attending conferences dedicated to the topic.

Identifying Needs & Developing Policy:

Numerous universities have conducted needs assessments to inform

RDM librarians about how campus constituents manage research data management and how RDM services might be helpful. These assessments have primarily been conducted through surveys and interviews with researchers on campus. RDM service developers can gather information through interviews with researchers about the data sets they produce and the resources they currently use to manage them using resources like the DCC's Data Asset Framework and the Data Curation Profiles Toolkit developed at Purdue University. Researchers' understanding of DMPs is shown via RDM assessment surveys, which also pinpoint personal and group data preservation, sharing, and documenting procedures. Interviews and surveys may also indicate campus departments or disciplines that could collaborate on an RDM pilot project, frequently due to specific data support needs that were identified during the needs assessment process (e.g., Nicholls et al. 2014).

Although policy formation is a cross-institutional process, libraries may guarantee that they have a voice in the discussion by starting the discourse regarding RDM policy (Erway 2013). Although many RDM providers believe that top-down policy formulation must involve the university leadership, they also recognise that bottom-up participation is crucial to gaining support from stakeholders. Libraries are in a strong position to assist in managing and representing stakeholder concerns to a policy development committee because of their cross-institutional linkages on campus. According to the qualitative analysis done by Pinfield and colleagues (2014), the policy formulation process frequently entails engagement with RDM stakeholders from throughout the institution, is iterative in character, and is frequently modified by policymakers to suit their own needs.

How Might RDM Services Assist Libraries In Expanding Their Role:

Academic libraries are increasingly able to support academics as they do and distribute research by offering services throughout the various stages of the research life cycle. RDM is one such area, along with digital humanities, project support, and other areas. We think that RDM gives libraries a chance to redefine their function inside the university. By fostering communication between researchers, improving understanding of the data life cycle, providing disciplinary and institutional resources, and emphasizing the importance of documentation of data sharing, libraries that provide RDM services can have a significant impact on the campus communities where they are located (McLure et al. 2014, 158).

Many libraries and related organizations work both inside and outside the institution to unite the various RDM stakeholder groups in order to develop cooperative & collaborative solutions (Tenopir et al. 2012).

Beyond the institution, libraries actively contribute to the formation of regional, national, and international federated RDM support groups that share scale-up efficiencies and promote data stewardship. National organizations like the Australian National Data Service and the DCC in the UK work to support and improve their respective countries' national research data environments by offering a variety of tools, services, and resources that make it easier to collect, connect, discover, and reuse data. On a global scale, organizations like the Committee on Data for Science and Technology and the

recently established Research Data Alliance work to increase the reliability and usability of data for science across all fields of study and across countries, respectively. The library is unquestionably in a prime position to play a significant role in data management, curation, and preservation. Because active curation of research data is required by best practices in RDM, not only storage or backup, librarians are well-positioned to instruct and support researchers in long-term data curation.

RDM Trends in Medical Libraries:

Most medical colleges and universities of applied sciences for health professions receive their information and material from university libraries, usually in the form of a medical branch library, while in some cases there is only a subject liaison librarian. Additionally, smaller departmental libraries, resources for continuing education, and/or patient libraries are frequently offered by university hospitals. Similar heterogeneity exists in hospitals that are not affiliated with universities. Medical libraries may be found in larger hospitals in particular; some hospitals offer library services to both doctors and patients, while others solely have patient libraries.

RDM Skills and Competencies for Librarians:

The data life cycle and research life cycle serve as the foundation for the curricula at library and information science schools that have data curation programs, and many of these schools also demand practical field experience to help students become involved in the research process. The essential data management and preservation issues that could be necessary at each of these processes are outlined in Corral and Higgins' (2012) data life cycle. By coordinating database architecture and knowledge mapping, health sciences librarians embedded inside research teams assist in managing and preserving project data from the outset. Librarians must enhance their foundational knowledge of information science and broaden it to include expertise in technology, informatics, and outreach. Traditional librarian skill sets include specific abilities including database management, database design, information searching, research techniques, and digital preservation. Some qualities that librarians may be less familiar with are data literacy, the ability to communicate and solve problems, an entrepreneurial spirit, a willingness to take risks, confidence, and teamwork.

Job Postings for Librarians Involved In RDM:

Sample job titles include director of research data management, scientific data curator, data services manager, and associate director for data science and data analytics.

Among the responsibilities of this position are:

1. Serving as the campus community's primary data management consultant.
2. Developing library services and policies to support scientific research.
3. Representing the library in the development of institutional policies and
4. Facilitating the collection, preservation, and access to scientific data.

Librarian RDM Tools and Resources:

1. The Data Interview
2. The Data Curation Profiles
3. The DMP Tool
4. RDM Professional Development Resources

New Library Services in Medical Libraries:

Some medical libraries' offerings in terms of services. Regarding the current level of collaborative services to support education, research, and clinical practice, the replies provide a contrasting picture. They indicate a profession in flux when used in conjunction with other advancements. The majority of libraries from academic or research institutions offer a range of consulting and support services for their target groups in addition to lectures, courses, or seminars that are part of the medical curriculum and optional training sessions. Full mediated searches for researchers working on systematic reviews, clinical guidelines, and similar publications are less prevalent, however, most do help in the creation of search techniques (Spencer & Eldredge, 2018).

Research Data Management:

German university libraries have recently developed research data management (RDM) services on par with advancements made at universities all around the world. Typically, libraries develop regional collaboration networks with university computing centers and central research departments. According to a survey, nearly 60% of libraries at organizations that do medical or health research said that they provide RDM consultations or other support for RDM. The RDM support is given in half of these instances by the medical library team. In comparison to other services, this percentage is smaller. This may be because the field is complex and changing quickly. Medical libraries do have numerous opportunities to participate in RDM, meanwhile. It will be crucial to provide these services to regional researchers and students in the coming years when a national research data infrastructure (NFDI) is established.

Conclusions:

The role of RDM in medical and health sciences librarianship will grow over time. A variety of digital technologies are used in today's healthcare delivery and research environments to track measures of patient health indicators and save clinical data. EHRs, patient monitoring devices, automated lab equipment, and cell phones have all developed into extremely useful resources for locating and gathering healthcare data. The unheard-of amount of clinical and scientific data is expanding quickly. These data need to be properly handled, saved, conserved and share so that researchers, doctors, and patients may access them. Researchers, physicians, lab assistants, ICT workers, statisticians, funding agencies, and health sciences librarians must coordinate their efforts to effectively manage the research data. Several new RDM roles for health sciences librarians have been highlighted in this paper, including writing RDM tools, teaching RDM best practices, showcasing RDM resources, providing RDM consulting and assistance with DMPs, building and managing collections of research data, and embedding within clinical research teams. By institution and librarian, the RDM services available differ. They are based on the number of employees, the amount of time, money, and resources available, as well as the individual experience, knowledge, and abilities of the librarian. The role of health sciences librarians in providing RDM services is still developing. While no single health sciences librarian can provide all data services, they may nevertheless share courses, collaborate, and learn from one another while also observing best practices. Being retrained and upskilled is crucial because few libraries have the resources to hire more staff. These responsibilities call for continuing administrative assistance and professional development for the health sciences librarians who are performing them.

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