Library support for research data management: a taxonomy of services

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Abstract. This exploratory paper surveys information science literature to propose a taxonomy of services to support research data management. It also intends to identify data management support services performed by the libraries. The identification of the articles reviewed was carried out through searches in databases, Google Scholar and cited references of the works analyzed. The articles were read, coded and categorized with the aid of the NVivo software, and categories were created based on the literature review. Three categories of services were obtained in the 165 articles analyzed: Infrastructure, Support and Educational. The paper concludes that the taxonomy proposed, altough preliminary, can serve as a guideline for institutions or professionals who wish to develop RDMSs or add services to those already developed in their institutions.

Keywords: Research data; Research data management; Libraries; Services.

1. Introduction

 The scientific article has been considered the final product of the research process and the major means of disseminating scientific knowledge (Coates, 2014). However, research data are increasingly viewed as a valuable product (Coates, 2014).

As research activities generate large amounts of data (Barbrow, Brush and 2017), the data in digital format is quite common in most if not all scientific disciplines (Pryor, 2014b). Research data should not only be processed and analyzed by researchers, but also managed throughout the life cycle (Barbrow, Brush and Goldman, 2017). This demand generates, in the institutions, the need to develop policies, infrastructures and services in order to assist researchers in

the creation, collection, manipulation, analysis, transport, storage and preservation of data sets (Pinfield, Cox and Smith, 2014).

In addition to the recognition of the potential and importance of research data, a number of external pressures have made research data management a growing concern in universities (Ashley, 2012) providing an opportunity for libraries to offer data management services (Kennan, Corrall and Afzal, 2014 and Kraft, 2015). Examples of sources of pressure are data reuse, requirements of funding agencies (Ashley, 2012), requirements of journal editors (Knuth, Johnson and Hauser, 2015), the recommendations for good research practices, the reputation of institutions (Ashley, 2012), as well as the growth and development of collaborative research and open research practices (Open Access, Open Science, Open Data) (Chiware and Becker, 2018).

Thus, research data management is currently a hot topic of the academic agenda for library and information services, providing a demand for libraries to redefine their role in supporting research and to develop closer relationships with their community (Corrall, 2012). This call provides libraries simultaneously an opportunity (Kennan, Corrall and Afzal, 2014 and Kraft, 2015) and also a great challenge (Pryor, 2014a).

Several terms were suggested in the literature to designate basically the same types of services, however a non-exhaustive research pointed out that "research data management services" and "research data services" were the most used ones.

What are research data management services (RDMSs)? The RDMSs are "[...] services that a library offers to researchers in relation to managing data..." (Tenopir, Birch and Allard, 2012, p. 7), covering the data life cycle, from the research process, through data collection, processing and analysis, publication and sharing, presentation to reuse of data (UK Data Service, 2018).

According to Tenopir, Hughes, Allard, Mike, Birch, Baird, Sandusky, Langseth and Lundeen (2015) research data management services have emerged in academic libraries in response to the growth of data-intensive research, along with changing roles in libraries and recognition of the need for data-driven search. Although Auckland (2012) claims that data management research services are still crawling and who should provide them are still debating questions, universities - and libraries - are beginning to discover how data management research should be supported in terms of consulting, training or infrastructure for data storage, sharing and curation (Cox and Pinfield, 2014). But what are the services that libraries can offer?

In recent years several articles have identified the various RDMSs developed and/or planned by the libraries in the United States and Europe (Si, Xing, Zhuang, Hua and Zhou, 2015; Tenopir, Pollock, Allard and Hughes, 2016;

Tenopir, Talja, Horstmann, Late, Hughes, Pollock, Schmidt, Baird, Sandusky and Allard, 2017; Tenopir, Birch and Allard, 2012 and Yoon and Schultz, 2017), as well as other works have presented the services developed in institutions (Akers, Sferdean, Nicholls and Green, 2014; Goldman, Kafel and Martin, 2015; Hiom, Fripp, Gray, Snow and Steer, 2015; Knuth, Johnson and Hauser, 2015; Perrier and Barnes, 2018; Searle, Wolski, Simons and Richardson, 2015; Sesartic and Töwe, 2016; Tenopir, Pollock, Allard and Hughes, 2016; Tenopir, Talja, Horstmann, Late, Hughes, Pollock, Schmidt, Baird, Sandusky and Allard, 2017 and Yoon and Schultz, 2017).

This exploratory paper surveys information science literature to propose a taxonomy of services to support research data management. It also intends to identify data management services performed by the libraries.

2. Literature review

Recently, the perception emerged that the management of research data is the most challenging aspect for institutions (Pryor, 2014a). For libraries, data management represents an opportunity to play an even more active role in the research process. First, academic libraries can provide consulting services related to the management and conservation of research data. Second, libraries can provide the infrastructure for data storage and curation. Third, academic libraries can support librarians to become active members in research teams and grant proposals as consultants in data curation (Tenopir, Birch and Allard, 2012, p.41).

There are a variety of services that can be offered by libraries. According to Tenopir, Talja, Horstmann, Late, Hughes, Pollock, Schmidt, Baird, Sandusky and Allard (2017), the management of research data can take many forms. Thus, RDMSs range from providing tools for mining and visualization of data; training on data management activities; guidance on institutional policies; help in creating data management plans and in creating metadata standards; to creating and maintaining data repositories and assistance with intellectual property issues and data privacy.

For Swanson and Rinehart (2016) RDMSs may include education and technical capacity for various components of the data lifecycle and include planning for data management, assistance in collecting data from textual sources, advice on documentation of data and metadata usage, demonstration of the impact of dataset publishing, and provision of tools for discovery, access, and preservation of the data set.

The services mentioned above are just a few of those that libraries can offer. In addition to pointing out services, some authors propose levels, categories or classifications for RDMSs. Some of these groupings are shown below.

2.1 Classification of services

Tenopir, Birch and Allard (2012) state that the services can be classified as informational/consultative or technical services. Informational services include consulting on data management plans and metadata standards or reference support for finding and citing datasets, providing web guides, and help for data or data sets. Technical services include technical support for data repositories, preparing datasets for a repository, deactivating or deselecting the dataset from a repository, or creating metadata for a dataset (Tenopir, Birch and Allard, 2012). According to these authors, informational/ consultative services are the most commonly present in libraries.

Geraci, Humphrey and Jacobs (2012) propose the classification of services in three main levels: collection services - creation and maintenance of collections; data reference services or data curation; and computing services - storage, delivery, and data usage.

Reznik-Zellen, Adamick and McGinty (2012) propose three levels of service: 1) education – in a more basic level of services, libraries educate their community about data management; 2) query - support on a variety of issues relevant to the management of research data and 3) infrastructure - provision of infrastructure for management and data curation.

Hiom, Fripp, Gray, Snow and Steer (2015) classify services in: 1) data management assistance through advice and guidance for the creation, writing and review of data management plans (DMPs); 2) advocacy and training for all faculty, research facilities and other groups that support research within the university; 3) storage and support for data publishing; 4) web presence, social media, and metrics.

Si, Xing, Zhuang, Hua and Zhou (2015) divide the services into six aspects: 1) introduction to research data that seeks to explain the definition of research data, the reasons and values of management, preservation and sharing of research data, among others; 2) data management plan (DMPs) guidelines that provide information about writing DMPs that meet funder requirements. This service includes an introduction to DMPs, their components, documentation or creation of metadata, funding requirements, and templates or tools for creating DMPs; 3) data curation and storage services that ensure the management of active data, long-term preservation and access to research data; 4) data management training in the form of workshops, tutorials, lectures and online courses or included as part of information literacy education. These trainings help researchers address the challenges encountered with data management during the research process; 5) reference in data management, with reference librarian availability (via email, site, chat) in order to help the researcher in the process of managing and preserving their research data and; 6) recommendation and indications about data management resources, research data repositories and tools.

Yoon and Schultz (2017) examined websites of American academic libraries and classified their services in four areas: service, information, education, and network (links to external resources).

The review above demonstrates that the classification of services varies greatly, depending on the understanding of the authors who propose it.

3. Methodology

This is an exploratory research carried out by means of a survey of articles, published in scientific journals, on the support to the management of research data carried out in libraries. The articles were identified through searches in databases such as the Library and Information Science Abstracts (LISA), Library, Information Science & Technology Abstracts (LISTA), Information Science & Technology Abstracts (ISTA), Google Scholar and references cited in the works analysed.

The search in the databases used the terms below, present in the title, abstract and keywords fields of the articles:
- ("data management" AND librar*) OR ("research data servic*" OR "data management servic*" OR "research data support*" OR "data management support*" OR "research data management")

The selection of the articles obeyed the following criteria:
- Type of publication: scientific journals;
- Language: Portuguese, English or Spanish;
- Availability: full text;
- Relevance: support for the management of research data carried out in university libraries.

After the initial selection by type of publication, language and availability of full text, the articles went through a reading of the title and abstract in order to evaluate their relevance. A total of 203 articles were evaluated, of which 38 were discarded.

The 165 articles were imported into the qualitative research software NVivo, from QSR International and read in order to identify, systematize and propose a taxonomy of services.

The method of content analysis proposed by Bardin (1977) was used as a method for the treatment and interpretation of data. Content analysis is one of the methods used to analyze textual data (Elo and Kyngäs, 2008) and is defined as "[...] a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh and Shannon, 2005, p. 1278).

All material was coded and categorized. Initial categories and subcategories of services were created based on the literature reviewed, therefore using a deductive content analysis, an approach generally based on earlier works, such as theories, models, mental maps and literature reviews (Elo and Kyngäs, 2008 and Gibbs, 2009); and also using an inductive approach where categories are derived from the data or themes that emerged from the articles analyzed, an approach based data or open coding.

The categories and subcategories of services (nodes and sub-nodes) follow a hierarchical structure, where "codes that have similarity or refer to the same subject are grouped under the same branch of the hierarchy ..." (Gibbs, 2009, p. 98).

A comparison was made throughout the coding step allowing grouping of categories as well as category reduction. The grouping of categories was accomplished by identifying the distinct information and bringing together the similar or related information.

An initial categorization for the services and hierarchy of terms was proposed. After that, a rearrangement of the categories was done based on the literature, followed by the standardization of names and merging of categories with thematic affinities.

4. Discussion

The taxonomy of services was created from the full reading and categorization of 165 articles. The categorization and hierarchy of terms allowed to systematize and propose a taxonomy of services to support research data management, structured in three main themes - Infrastructure, Support and Educational as shown in Table 1.

Table1: Categories of services

Categories of services	Code
1 – INFRASTRUCTURE	INF
2 – SUPPORT	SUP
3 – EDUCATIONAL	EDU

The Infrastructure category includes tools, methods, software and platforms for the management and curation of research data, including data repositories, as well as other infrastructures such as institutional policies, social network analysis tools, productivity assistance and collaborative work, network infrastructures, among others.

The Support category is formed by the technical services (technical assistance) carried out by the libraries as documentation of data and metadata, data deposit,

preservation, guarantee of access, publication, among others, as well as support services that aim at information, advice and consulting, in person or online, on the most varied subjects related to the management and curation of data such as the preparation of data management plans, metadata standards, open access to data, best research practices, data policies, services offered and others.

The Educational category and educational services for training and data curation should be organized as advocacy, awareness-raising, data management, as well as awareness of library responses; events such as conferences, seminars, symposia, lectures and working groups, data and other resources offered; preparation and provision of guides, templates, tutorials or help for the management of data and projects of policies as well as technological, infrastructure or tools projects; trainings, workshops, courses, sets of classes and data curation programs, as well as other types of training on topics such as policies, services, technologies, infrastructure and tools offered.

The three main categories (Infrastructure, Support and Educational) are subdivided into the subcategories "Management and data curation" and "Others" (Figure 1).

Figure 1: Categories and subcategories

Regardless of the hierarchical level, the subcategory "Management and data curation" is formed by the grouping of services arranged in 12 subdivisions. The "Others" subcategory consists of 13 types of services that do not fall under the previous subdivisions.

The subcategory "Management and data curation", regardless of the main category (Infrastructure, Support and Educational), is formed by services that address the following subjects (Figure 2):

Figure 2: Subcategory Data management and curation – subjects

000 Data management and curation – general
General subjects such as: Data management, including active data. Data curation. Preservation. Research data. Data life cycle. Data stewardship.

Data maintenance. Best management practices. Best practices for sharing. Strategies for managing and disseminating data. Data Science, eScience, eResearch.

001 Planning

Data management plan (DMP). Planning the creation, storage, and preservation of data. Preservation strategies. Research design. Funding. Compliance with the requirements from funding agencies and publishers.

002 Obtaining

Creation, collection or capture of data. Scanning. Data acquisition. Licensing/subscription of data. It also includes search, location or discovery and data. Data catalog.

003 Organization and format

Organization of files and folders (filenames and structuring of folders). Use of recommended data format and interchangeable patterns. Data standardization. Preservation formats. Conversion format. Migration. Data quality assurance (for data collection, data entry, scanning, transcription and verification). Version control. Validation. Packaging. Authenticity, reliability, comprehensibility of data. Cleaning of data.

004 Documentation of data and metadata

Data description (information that explains how the data was created, collected, acquired or scanned, what it means, its content and structure, and any manipulations that may have occurred). Standards for data description. Allocation of standardized and structured metadata (for description and for preservation). Automatic generation of metadata. Data dictionary. Description of the methodology.

005 Evaluation and selection

Evaluation and selection of data for preservation (deposit in repositories). Revaluation of data or set of data that must be preserved.

006 Storage

Short and long term storage. Archiving. Data repository. Repository services. Identification of repositories. Backup and data security (prevention of physical losses - accidental, hardware and software failures, disasters, human errors, data corruption, unauthorized access). Encryption. Mirroring and replication. Safely delete data. Data integrity. Sharing and data deposit. Dissemination of data. Move data. Data transfer. Ingestion. Redundancy of data.

007 Copyright, intellectual property and licensing

Data protection (copyright, intellectual property). Intellectual property rights. Authorship and ownership of data. Licensing for data. Conditions for obtaining a license. Access control. Embargo.

008 Ethical, legal and consent issues

Data privacy and confidentiality. Sensitive data. Anonymity. Ethical obligations with research. Consent for data sharing.

009 Publication and citation
Data publication. Data citation.

010 Use and reuse
Access guarantee. Permanent access. Open access. Persistent identifiers (DOI, ORCID). Link data set to documents. Record of data. Use and reuse of data. Availability of data. Ensuring appropriate underlying and supplementary data links for articles in institutional repositories.

011 Mining, analysis and visualization
Data Mining. Data analysis. Data visualization. Data processing. Data integration. Creating graphs and tables for numeric data. High performance computing - advanced analysis, simulation, modeling, artificial intelligence.ata Mining. Data analysis. Data visualization. Data processing. Data integration. Creating graphs and tables for numeric data. High performance computing - advanced analysis, simulation, modeling, artificial intelligence.

Likewise, the "Other" subcategory consists of services that address the following issues (Figure 3):

Figure 3: Subcategory Others – subjects

012 Social Networking Analysis
Tools and methods for analyzing social networks.

013 Productivity assistance and collaborative work
Tools and systems for productivity assistance and collaborative work.

014 Design and management of databases
Design and management of databases.

015 Development of guidelines, standards, services and infrastructures
Support (information, guidance, advice and consultancy) related to the development of policies, guidelines, standards, services and infrastructures.

016 Course or curriculum development
Participation in the development or the development of course or curriculum for the management and curation of data in librarianship schools. It also includes teaching management and data curation.

017 Research management and scientific communication
Research flows. Management of research information conducted at the institution. It also includes scholarly communication - survey results are evaluated, disseminated to the academic community and preserved for future use in both formal and informal communication media.

018 Identification of perceptions, practices and needs
Surveys, interviews and events to identify the needs of researchers in relation to data management.
019 Participation in project or research process
Participation of the library in a project or research process, acting more closely to the researcher.
020 Policies
Institutional policy for data management that includes creating a data management plan, sharing, accessing and supporting data, submitting data in repositories, licensing for reuse, embargo period, disciplinary rules in order to ensure integrity research and meeting the requirements of funding agencies. Policy development.
021 Impact Tracking
Impact of data usage. Statistical analysis on the use of data. Impact of data use and reuse. Impact of sharing.
022 Research reproducibility
Research reproducibility issues related to the proper management of research data, making them widely available.
023 Services
Services offered by libraries. Links to repositories, data centers, tools, data management services.
024 Technologies, infrastructures and tools
Technologies, infrastructures and tools for data management and curation offered to researchers. Includes: Survey tools. Tools for analysis of social networks. Tools for data analysis. Programming in Python. LaTeX. Bash scripting. Unix. Version control with GIT. Online survey. Networks. Mobile devices. Networks.

It is important to note that the subcategories - Data management and curation and Others - are present in all major categories, even if only partially. A view of the categories and their subdivisions is presented in figures 4 to 6.
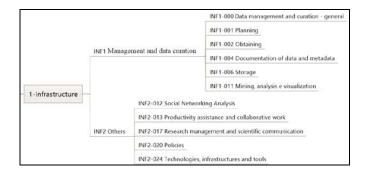
Figure 4: Infrastructure - subdivisions
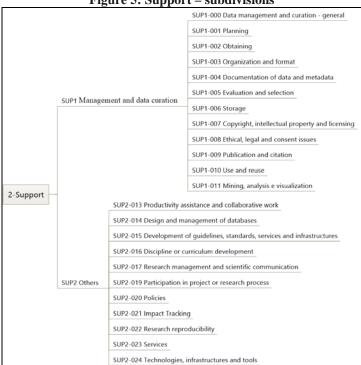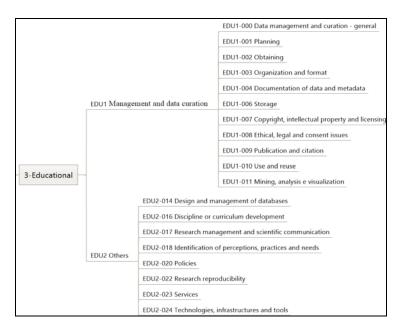
Figure 5: Support – subdivisions

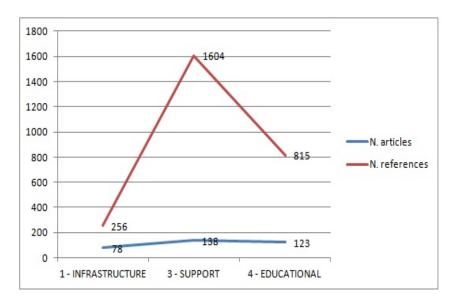**Figure 6: Educational – subdivisions**

Of the 165 articles analyzed, 78 present services classified in the category Infrastructure; 138 mention Support services and 123 articles deal with services in the Educational category. The same article can present services in more than one category at the same time (Table 2).

Table 2: Taxonomy of services: number of references

Levels	Articles (165)	References (2675)
1 – INFRASTRUCTURE	78	256
2 – SUPPORT	138	1604
3 – EDUCATIONAL	123	815

The services categorized as Support were the most present, with 1604 citations, corresponding to 59.96% of the references to services found in the 165 articles used to construct the taxonomy. Next, the services of the Educational category appear with 815 references, representing 30.47% of the citations and finally the services of the Infrastructure category with 256 references, representing 9.57% of the total citations to services found, as can be seen in the graph below (Figure 7).

Figure 7: Number of references to services by category

Therefore, educational and support services are the most frequent, representing an extension of services already carried out by the libraries, enlarged to work with scientific data.

Although it is not possible to list all the research data management services performed by the libraries, we can highlight that in the Infrastructure category, (which consist of services such as the availability of tools, software and platforms, including data repositories, as well as other infrastructures important for the operation of RDMs, as institutional policies) the services of the Infrastructure category, subcategory Data management and curation, "INF1-006 Storage" are to provide or develop:

- Tools for publishing data or data set.
- Data repositories, specific or multidisciplinary - infrastructure that supports the archiving, sharing, preservation and reuse of data.
- Repository services such as statistics and reports, data preservation, and assistance with intellectual property and copyrights.
- Exchange and data sharing platform.
- Data backup tools or services.

In the Infrastructure category, the subcategory "Others" the INF2 020 Policies subcategory stands out, represented by services such as the provision of:
- Institutional policies for data management.
- Policies for access to data submitted in the repository, licensing for data reuse and embargo period.

The Support category is constituted by the technical services or assistance performed by the libraries, where the library itself performs a series of activities

such as data documentation and metadata, data deposit, the provision of unique identifiers, etc .; in addition to the actual support activities such as information, orientation, advice and consulting. In the subcategory "Management and data curation" the subcategory SUP1-006 Storage stands out which consists of services such as the provision of support, guidance, assistance, advice, recommendations and advice to:

- Storage/archiving/repository of data or dataset in repository.
- Data repository implementation.
- Use of data repositories.
- Data storage in internal and external repository.
- Identification of appropriate repositories to deposit data.
- Sharing of data.
- Determination of the best repository for a given dataset.
- Technical support for data repositories.

In the Support category, subcategory "Other", the subcategory SUP2-024 Technologies, infrastructures and tools stands out, consisting of services such as technical support, assistance, guidance or advice for use:

- Geographic Information System (GIS).
- Nvivo software.
- Statistical software.
- Tools for data manipulation.
- Research data management systems.
- Online survey.
- Mobile devices.
- Other technologies, infrastructures and tools available.

Finally, the Educational category is formed by services such as advocacy; holding of events such as seminars, workshops, symposia; trainings; workshops; provision of tutorials, guides, etc. In the subcategory "Management and data curation", the subcategory EDU1-001 Planning stands out, consisting of services such as offering of trainings, workshops, courses, seminars, conferences, classes in:

- Data management planning.
- Data management plan - creation/writing of plans.
- Use DMPTool to create data management plans.
- Funders' requirements for data management and DMP.
- Development of guides, models, support materials:
- Data management plan - creation / writing of plans.
- Advocacy:
- Data management plan.

In the Educational category, subcategory "Others" stands out the subcategory in EDU2-024 Technologies, tools and infrastructures, formed by services such as the offering of trainings, workshops, courses, seminars, conferences, classes:

- Tools for data analysis.
- Tools for data management.
- Use of statistical software.
- Analysis of social networks.
- Nvivo software.
- Geographic Information System (GIS).
- Statistical methods.
- Introduction to R.
- Using LaTeX.
- SQL.
- Python programming.
- Version control with GIT.
- Bash scripting.
- Unix.
- REDCap (data capture).
- Use of a particular interface.
- EndNote.
- Web application development.

5. Conclusions

This paper proposes a taxonomy of research data management services for libraries consisting of three main categories (Infrastructure, Support and Educational) which are subdivided into the subcategories "Management and data curation" and "Others" (Figure 1). Each one of the subcategories have further subdivisions which are replicated in each for the three categories. For Management and data curation, these are: 000 Data management and curation – general, 001 Planning; 002 Obtaining; 003 Organization and format; 004 Documentation of data and metadata; 005 Evaluation and selection; 006 Storage; 007 Copyright, intellectual property and licensing; 008 Ethical, legal and consent issues; 009 Publication and citation; 010 Use and reuse and 011 Mining, analysis and visualization. For "Others" the subcategories proposed are: 012 Social Networking Analysis; 013 Productivity assistance and collaborative work; 014 Design and management of databases; 015 Development of guidelines, standards, services and infrastructures; 016 Discipline or curriculum development; 017 Research management and scientific communication; 018 Identification of perceptions, practices and needs; 019 Participation in project or research process; 020 Policies; 021 Impact Tracking; 022 Research reproducibility; 023 Services; 024 Technologies, infrastructures and tools.

The research allowed the identification and systematization of the main services developed by the libraries. Thus, the work can serve as a guideline for

institutions or professionals who wish to develop RDMSs or add services to those already developed in their institutions.

In this article, due to space limitations, it was not possible to provide an exhaustive list all research data management services carried out by libraries. Nevertheless, it is interesting to notice that the services categorized as Support were the most present. Next, the services of the Educational category appear, and finally the services of the Infrastructure category.

The data also show that the services most mentioned by the articles analyzed in the Infrastructure, Support and Educational categories are those belonging to the subcategory 006 Storage, mainly the support with the data repositories, followed by the services of the subcategories 001 Planning (with more importance the data management plans) and 004 Documentation of data and metadata, with emphasis on the support for the description of data or datasets and support with the standards and metadata schemes, for the identification, creation or application of the standards.

In is important to point out that this work is part of a research still in progress, presenting preliminary results, therefore, susceptible of alterations, especially with respect to the proposed categories, since every process of categorization is a process of choices and is highly subjective.

References

Akers, K. G., Sferdean, F. C., Nicholls, N. H. and Green, J. A. (2014) 'Building Support for Research Data Management: Biographies of Eight Research Universities', International Journal of Digital Curation, 9(2), pp. 171–191.

Ashley, K. (2012) 'Research data and libraries: who does what', Insights: the UKSG journal, 25(2), pp. 155–157.

Auckland, M. (2012) Re-Skilling for Research: An Investigation into the Role and Skills of Subject and Liaison Librarians Required to Effectively Support the Evolving Information Needs of Researchers. London: Research Libraries UK.

Barbrow, S., Brush, D. and Goldman, J. (2017) 'Research data management and services: Resources for novice data librarians', College & Research Libraries News, 78(5), p. 274.

Bardin, L. (1977) Análise de conteúdo. Lisboa: Edições 70.

Chiware, E. R. T. and Becker, D. A. (2018) 'Research Data Management Services in Southern Africa: a Readiness Survey of Academic and Research Libraries', African Journal of Library, Archives and Information Science, 28(1), pp. 1–16.

Coates, H. (2014) 'Building Data Services From the Ground Up: Strategies and Resources', Journal of eScience Librarianship, 3(1), pp. 52–59.

Corrall, S. (2012) 'Roles and Responsibilities- libraries, librarians, and data', in Pryor, G. (ed.) Managing Research Data. London: Facet Publishing, pp. 105–133.

Cox, A. M. and Pinfield, S. (2014) 'Research data management and libraries: current activities and future priorities', Journal of Librarianship and Information Science, 46(4), pp. 299–316.

Elo, S. and Kyngäs, H. (2008) 'The qualitative content analysis process', Journal of Advanced Nursing, 62(1), pp. 107–115.

Geraci, D., Humphrey, C. and Jacobs, J. (2012) Data basics: an introdutory text. Ann

Arbor: Inter-university Consortium for Political and Social Research (ICPSR).

Gibbs, G. (2009) Análise de dados qualitativos. Porto Alegre: Artmed.

Goldman, J., Kafel, D. and Martin, E. (2015) 'Assessment of Data Management Services at New England Region Resource Libraries', Journal of eScience Librarianship, 4(1), p. e1068.

Hiom, D., Fripp, D., Gray, S., Snow, K. and Steer, D. (2015) 'Research data management at the University of Bristol', Program: electronic library and information systems. Edited by D. Andrew Cox, 49(4), pp. 475–493.

Hsieh, H.-F. and Shannon, S. E. (2005) 'Three Approaches to Qualitative Content Analysis', Qualitative Health Research, 15(9), pp. 1277–1288.

Kennan, M. A., Corrall, S. and Afzal, W. (2014) '"Making space" in practice and education: research support services in academic libraries', Library Management, 35(8/9), pp. 666–683.

Knuth, S. L., Johnson, A. M. and Hauser, T. (2015) 'Research Data Services at the University of Colorado Boulder', Bulletin of the Association for Information Science and Technology, 41(6), pp. 35–38.

Kraft, A. (2015) 'RADAR - A repository for long tail data', in Proceedings of the 36th Annual IATUL Conference. Hanover, DE: IATUL.

Perrier, L. and Barnes, L. (2018) 'Developing research data management services and support for researchers: a mixed methods study', Partnership: The Canadian Journal of Library and Information Practice and Research, 13(1), pp. 1–24.

Pinfield, S., Cox, A. M. and Smith, J. (2014) 'Research Data Management and Libraries: Relationships, Activities, Drivers and Influences', PLoS ONE. Edited by P. Launois, 9(12), p. e114734.

Pryor, G. (2014a) 'A patchwork of change', in Pryor, G., Jones, S., and Whyte, A. (eds) Delivering research data management services: fundamentals of good practice. London: Facet Publishing, pp. 1–19.

Pryor, G. (2014b) 'Preface', in Pryor, G., Jones, S., and Whyte, A. (eds) Delivering research data management services: fundamentals of good practice. London: Facet Publishing, pp. vii–viii.

Reznik-Zellen, R., Adamick, J. and McGinty, S. (2012) 'Tiers of Research Data Support Services', Journal of eScience Librarianship, 1(1), pp. 27–35.

Searle, S., Wolski, M., Simons, N. and Richardson, J. (2015) 'Librarians as partners in research data service development at Griffith University', Program: electronic library and information systems. Edited by D. Andrew Cox, 49(4), pp. 440–460.

Sesartic, A. and Töwe, M. (2016) 'Research Data Services at ETH-Bibliothek', IFLA Journal, 42(4), pp. 284–291.

Si, L., Xing, W., Zhuang, X., Hua, X. and Zhou, L. (2015) 'Investigation and analysis of research data services in university libraries', The Electronic Library, 33(3), pp. 417–449.

Swanson, J. and Rinehart, A. K. (2016) 'Data in context: Using case studies to generate a common understanding of data in academic libraries', The Journal of Academic Librarianship. Elsevier Inc., 42(1), pp. 97–101.

Tenopir, C., Birch, B. and Allard, S. (2012) Academic Libraries and Research Data Services: Current Practices and Plans for the Future. sl.: Association of College & Research Libraries (ACRL) (Whipe Paper).

Tenopir, C., Hughes, D., Allard, S., Mike, F., Birch, B., Baird, L., Sandusky, R., Langseth, M. and Lundeen, A. (2015) 'Research Data Services in Academic Libraries : Data Intensive Roles for the Future?', Journal of eScience Librarianship. Worcester, 4(2), p. e1085.1-21.

Tenopir, C., Pollock, D., Allard, S. and Hughes, D. (2016) 'Research data services in

european and north american libraries: Current offerings and plans for the future', Proceedings of the Association for Information Science and Technology, 53(1), pp. 1–6.

Tenopir, C., Talja, S., Horstmann, W., Late, E., Hughes, D., Pollock, D., Schmidt, B., Baird, L., Sandusky, R. J. and Allard, S. (2017) 'Research Data Services in European Academic Research Libraries', LIBER QUARTERLY, 27(1), pp. 23–44.

UK Data Service (2018) Research data lifecycle. Available at: https://www.ukdataservice.ac.uk/manage-data/lifecycle (Accessed: 27 July 2018).

Yoon, A. and Schultz, T. (2017) 'Research Data Management Services in Academic Libraries in the US: A Content Analysis of Libraries' Websites', College & Research Libraries, 78(7), pp. 1–19.