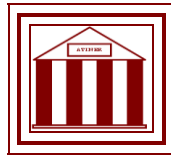


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**Specialized Information Sources in Health
Sciences: Analysis of Features and Proposed
Criteria for Evaluation**

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Specialized Information Sources in Health Sciences: Analysis of Features and Proposed Criteria for Evaluation

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Abstract

The manipulation of information has challenged professionals working as users within the healthcare field for many years. Even though the information technology has been collaborating with the new possibilities to store and to access information, their resources are not yet employed in a systematic wider way, insofar as much of that content does not reach its full potential of use because of the lack of training to retrieve it, the lack of mechanisms to process and to assure its availability in a proper format and in a proper moment with quality. Thus, we consider that it is essential and relevant to carry out studies with the aim to improve the understanding of the structure and the possibility of using information sources in healthcare. This situation, we believe, is a real challenge for the professionals, researchers and students working on the healthcare field, mainly for the users, which are going to use those sources for the first time. Within such context, we believe that it is crucial to analyze and describe the resources offered by the information sources in the healthcare field in order to make the clarification of the functional characteristics of those sources possible and to approach issues related to search these sources, as well as the several biases referring to the process of evaluation of information quality within the healthcare field. The proposal of the present research was developed within this context, identifying functional characteristics, structure and interrelations of information sources in the healthcare field, as well as the aspects related to the information quality of such sources. We choose to analyze these sorts of specialized information sources because of their relevance to the practice of information users within the healthcare field. This research opened the possibility of verifying the characteristics of the sources, its purposes, structures and covering, allowing the users to reach a comprehensive view of the real aim of each source approached. The analysis contributed to reduce the complexity involved in the informational process, collaborating to the effective use of information sources. In addition, the analysis allows us to emphasize aspects related to quality inhering in such sources. Based on this study, we hope that information users of the healthcare field are able to access an educational material that allows them to use the information sources effectively, then collaborating to the relevant use and proper application of the available information and fostering the practice in that field, either in a professional level and in a research level, eventually promoting the quality of life in our society.

Keywords: Database, Evaluation of sources of health information, Source of health information, Terminology System.

Introduction

Within the healthcare field, the handling of specialized information has challenged professionals while they act as information users. Despite of the fact that information technologies have been collaborating for the efficiency in information storing and accessing, the time spent in a search process should be taken in account in order for the processes involved to be improved. Indeed, the paradox of the affluence of information and the impossibility of its effective use is a key issue in the scope of information services (Lima 1989).

There is a large amount of information sources in the healthcare field, for example: scientific journals, technical reports controlled vocabularies, databases, medical records, information systems, ontologies, to mention a few. These instruments support professionals, educators and students in the medical field, thing which creates possibilities for consulting several information sources. However, the users of these kinds of information sources should have knowledge about what they are able to offer and how they can be consulted, as well as other issues that can support one in proper use of these sources.

The high degree of heterogeneity present in instruments currently used in the domain of healthcare demonstrates the need of management. Within this context, the analysis and description of the resources offered by digital information sources in the healthcare field is very important. Thus, one can observe the need of elucidating the functional characteristics of such sources by approaching the several different issues involved in information quality measures. In seeking better understanding of the use of information sources, one can improve their usefulness to researchers and healthcare professionals. This can also make it possible for these professionals to reach their goals and allow them to identify new opportunities for acting.

The present paper is based on the research conducted with the goal of investigating information sources in the healthcare field. In order to do so, we present their features, particularly, the information sources classified as terminological systems and databases, emphasizing their importance in the scientific, professional and educational contexts for supporting professionals and students. We seek to understand the evaluation of these sources according to criteria of quality established in line with guideline of topicality, authority, interactivity, and so forth.

Literature Review

Information Sources

Information sources are very important resources for the development of research in any knowledge field. Even more important is to know how to identify, learn about and promote access to information through the variety of existing sources. Among the several definitions found for information sources in the literature, we adopted in this work the definition posted by Pellizzon et al. (2003, p. 493), based on the Guide BVS 2003, which states that "an information source is any resource that meet the users demands, including products and services of information, people or a net of people, and computer programs".

Nowadays, one can visualize several kinds of specialized information sources, which promote the capacity and improvement of professionals, researchers and students. Within the healthcare field, some specialized information sources are very important, as for example: databases and terminological systems.

According to Cunha (1984), databases are computational information sources that can be surveyed in an interactive way using a computer. Lancaster (2004) emphasizes that in order to evaluate a bibliographical database one should observe some criteria, for example:

- Coverage: the content of the database has to be complete in a certain subject;
- Retrieval: the items of the database should be retrievable through a simple search strategy;
- Predictability: a document should be recognized as relevant from the information contained in the database;
- Topicality: new publications should be quickly included in the database.

Other kind of specialized information sources, which are very important within the healthcare field, are terminological systems. According to Keizer et al. (2000), a terminological system is a model of concepts and relations represented by terms. This system connects concepts of a domain, provides terms for those concepts and, in some cases, also provides definitions and codes. The advantage in using this system is that the terminological standardization allows the creation of a common language, which can provide better ways of exchanging information about a disease, its history, diagnosis, treatment and prevention.

The healthcare and life sciences field have a long tradition in the terminological systems. Lengthy terminologies, classifications, vocabularies, thesauri and ontologies have been developed throughout the years in several biomedical domains. The multiplicity and dynamics of such systems have required better understanding of their main characteristics. Table 1 depicts a summary of the basic elements of terminological systems.

Table 1. *An Overview about Kinds of Terminological Systems*

| Kind of System | Characteristics |
|-----------------------|---|
| Terminology | List of terms that refer to concepts in a specific domain. |
| Thesaurus | Terms are organized, for example, alphabetically. Concepts are described from the use of more than one term (synonyms). |
| Vocabulary | Concepts have definitions, which can be formal or informal in natural language. |
| Nomenclature | Set of composition rules that allow one to create new complex concepts or a terminological system as a result of that set of rules. |
| Classification | Concepts are organized from general relations (is_a). |
| Ontology | Logically organizes vocabulary that allows computational representations of a conceptualization. |

Source: Adapted from Cornet et al., 2006.

Quality of Information Sources

The lack of universal standards for publishing in the web environment, which could allow the publication of any content and then make possible the accumulation of no-relevant information, demonstrates the need of establishing criteria and methodologies for either filtering content or for creating estimate quality measures from the available information (Rieh and Danielson 2007). This phenomenon that occurs more widely in the web also attains healthcare information, since one can verify that information previously restricted to clinical offices in printed format can nowadays be easily accessed in websites.

Despite the inexistence of publishing standards, Silva (2013) emphasizes that in the medical environment some initiatives have already been taken by national and international

healthcare agencies, which are developing instruments that aim to establish quality certification for sites in the healthcare field. Among these agencies, it is worth citing the National Institutes of Health, the Health Summit Working Group and the Health On the Net (HON) Foundation. Since 1996, these agencies have developed and defined actions in order to create guidelines, which should be followed by the medical community.

As result of these efforts, instruments for quality regulation have been developed according to technical and ethical criteria. It is worth emphasizing that the websites following the posed criteria have the right of receiving a quality stamp, as for example, the HONCode of the Health On the Net (HON) Foundation. In Brazil, according to Lopes (2004), some organs as the Federal Council of Medicine (CFM), regional Councils Medicine of São Paulo and of Rio de Janeiro and the Brazilian Medical Association, as well as other institutions involved with educational and professional aspects in the healthcare field, have acted with the aim of establishing a regulation for information published on the web. A set of complex norms with the aim of evaluating the quality of the effectively retrieved information has arisen simultaneously to the attempts of establishing mechanisms of information quality control. One can find several works oriented to the evaluation of information sources adopting distinguished criteria. According to Lopes (2004), several information experts have participated in the creation of quality criteria for evaluating sites. Generally, these experts have as reference the categories presented by the Agency for Health Care Policy and Research (AHCPR), of the Health Information Technology Institute (HITI) and developed by the Health Summit Working Group (HSWG). The categorization proposed by the HSWG and its respective quality indicators include:

- Credibility: source, context, topicality, pertinence, usefulness, existence of editorial review;
- Content: accurateness, evidence hierarchy, precision of sources, institutional notifications, completeness;
- Presentation of the website: goals, profile;
- Links: selection, architecture, context, return links;
- Design: accessibility, navigability, internal search engine;
- Interactivity: mechanisms for returning information, discussion forum, explanation of algorithms;
- Anoucements: alerts.

Other initiatives have been conducted by several authors – as for example Molineux and Williams (1999), Kahn et al. (1997), Mostafa and Terra (1998), to mention a few – with the aim of establishing quality parameters for both the certification of sources and for determining ethical codes related to the available informational content.

Description and Research Corpus

Our research analyzed two types of information sources within the healthcare field, which can be classified as terminological systems and databases. These sources are available on the internet and we made use of information collected there that approaches:

- professionals that participate in the Blood Project (physicians of the Center of Hematology and Blood Transfusion of the State of Minas Gerais, Brazil)

- professors, researchers and graduate students of the Nucleus of Education in Collective Health;
- reference librarians that act in the health field and perform bibliographical research and work in the library of the Health Campus of Federal University of Minas Gerais;

We also perform surveys in 21 papers published in 13 journals of the healthcare field in 2012, with the aim of verifying which information sources were mostly cited. The selected journals were mostly used by the sample group, and their titles are: Electronic Journal of Communication, Information & Innovation in Healthcare (*Revista Eletrônica de Comunicação, Informação & Inovação em Saúde*); Journal of Public Healthcare (*Revista de Saúde Pública*); Notebooks of Public Healthcare (*Cadernos de Saúde Pública*); Brazilian Journal of Epidemiology (*Revista Brasileira de Epidemiologia*); Academic Medicine; Bulletin of the Medical Library Association; Clinical Anatomy; Journal of Data and Information Quality; Journal of Traumatic Stress; International Journal Of Medical Informatics; Electronic Journal of Health Informatics; The Open Medical Informatics Journal.

According to our findings based on the journals and the results of the surveys obtained through the interviews, we could delimit the corpus for the research. The following information sources were selected:

a) Terminological systems:

- Systematized Nomenclature of Medicine – Clinical Terms (SNOMED – CT);
- Medical Subject Headings (MeSH);
- Unified Medical Language System (UMLS);
- Foundational Model of Anatomy (FMA);
- International Classification of Diseases (ICD-10)

b) Database:

- Virtual Library of Healthcare - BVS¹;
- Cumulative Index to Nursing & Allied Health Literature – CINAHL;
- Medical Literature Analysis and Retrieval System Online – MEDLINE;
- Primal Pictures Interactive Anatomy;
- EMBASE.

Consolidation of Characteristics of Information Sources

Using the analysis of the characteristics of both terminological systems and databases we created a comparative structure in which we listed items able to generally represent the particularities of the specialized information sources. This structure (Table 2) depicts a wide overview of sources, which allow users to identify aspects as coverage and purpose. These aspects can aid to guide the searches to sources that contain information that meets the informational demands of users.

¹ VHL is a portal through which are arranged several databases.

Table 2. Comparative Analysis of Terminological Systems and Databases

| Criteria Information Sources | Type | Modality | Domain | Property | Coverage | Purpose | Structure | Possibility of survey | Updated |
|------------------------------|-----------------------|-----------------------|------------------------|---|---|---|--|--|------------------------------------|
| Snomed CT | Terminological system | Terminology | Healthcare Sciences | IHTSDO | Procedures, observable entities, body structure , organism, drugs / biological products, specimen, physical strength, ect | Acquisition of information to healthcare units | Concepts, descriptions and relations organized in hierarchies with distinguishes levels of granularity | Snomed-CT Browser | Twice a year |
| CID-10 | Terminological system | Classification | Healthcare Sciences | OMS | Diseases, lesions and extrinsic causes to health problems | Make possible the achievement of a disease nomenclature in a unique language | Categories are listed up to five levels if compared with the is_a relation | Interface web, PESQCID program and program in help for Windows format | Annual |
| MeSH | Terminological system | Controlled Vocabulary | Healthcare Sciences | National Library of Medicine | Medicine, Nursery, Odontology, Veterinary, Healthcare systems, Pre-clinical sciences | Indexing of papers published in biomedical journal present in the database Medline and PubMed | Heading organized in multiple hierarchies with just one identifier for each heading | MeSH Browser | Dinamically |
| FMA | Terminological system | Ontology | Anatomy | <i>Structural Informatics Group (SIG) da University of Washington</i> | Anatomy, clinical medicine, electronic health record. | Encode anatomical knowledge, which can be reused by any application | Contains anatomical classes and relationships necessary to model the structure of the whole body | Access through the Foundational Model Explorer (FME); by UMLS and the OQAFMA system. | Weekly |
| UMLS | Terminological system | Terminological system | Biomedicine and Health | <i>National Lybrary of Medicine</i> | Biomedicine and health | Integrate information from various incompatible terminology resources facilitating the development of computer systems that understand biomedical language. | Its structure includes names of concepts, their identifiers and the main characteristics of these concepts and their relationships. | Terminology services UMLS (UTS) | Undefined |
| BVS | Database | Database | Healthcare Sciences | Latin American and Caribbean Center on Health Sciences Information (BIREME) | Health Sciences | Meet the needs of technical and scientific information professionals, researchers and students in the health field | Basis of national and international bibliographic data, institutions directories, events, health courses and projects, numerical databases, chemicals and information sources to support education and decision-making | Interface developed by BIREME called IAH - Interface for health information access | Vary with the bases which are held |
| Medline | Database | Database | Healthcare Sciences | <i>National Library of Medicine</i> | Medicine, biomedicine, nursing, dentistry, veterinary medicine, | Providing technology products and services in | Referential database with summaries, full texts and | Via Portal CAPES | Weekly |

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|---------------|----------|----------|-------------------------------|-------------------------|--|---|--|--|-------------------------------|
| | | | | | public health, physical education and sports, nutrition, public health, speech therapy, physiotherapy and occupational therapy, preclinical and related sciences. | health and contribute to the medical and hospital care. | books. | (EBSCOhost) PubMed VHL | |
| Cinahl | Database | Database | Healthcare Sciences | <i>EBSCO Industries</i> | Nursing, biomedicine, the health science library, alternative medicine, information for patients, health related disciplines. | Meet the informational needs of professionals, researchers and students in the field of health sciences. | Basic reference data summaries, full texts and books. | EBSCO system called EBSCOhost (Via Portal Capes) | Weekly |
| Primal | Database | Database | Anatomy | Ovid Technologies | Anatomy, medical, surgical medicine, orthopedics, medical radiology, nuclear medicine, diagnostic imaging, rheumatology, physiatry, physical medicine, rehabilitation, pathological anatomy and clinical pathology, laboratory medicine, nursing, physiotherapy and occupational therapy, physical education and sports. | Provide educators, students, medical professionals a range of features aimed at improving the knowledge in anatomy. | Audiovisual database of three-dimensional images of human anatomy that contains photos, videos, text, magnetic resonance imaging, among many other features. | Available for research in the CAPES Journals Portal | Undefined |
| Embase | Database | Database | Biomedicine and Pharmaceutics | Elsevier | Drugs and clinical; adverse drug reactions; emphasis on evidence-based medicine; systematic reviews | Allow recovery of information needed to meet the demands of information of biomedicine and pharmacology areas. | Bibliographic database with full text | It is currently available in the Health Portal page Evidence-Based | Daily with huge rising taxes. |

Source: Prepared by authors, 2013.

Information Quality Analysis

Considering the aspects related to the quality of information, this research sought to establish some hypothesis that could help users in their analysis of the adequacy of specialized information sources. Thus, to establish a core of health information quality criteria, a few basic categories considered in the evaluation of a source of information were selected, they were based on specifications identified in the specialized literature, referenced in the study of Lopes (2004), in which we could identify consensus on certain topics. The purpose of this research is to point out quality criteria in the description of specialized sources aimed to establish a network of specific parameters in contrast to the broad criteria that many institutions use to endorse the sources. Some extensive studies, as pointed out by Lopes (2004), point out roughly 50 evaluative criteria, which ultimately serve researchers and scholars of information sources, but does not cover the gap related to the user from sources that need specific criteria to legitimize their choice for a specific source of information in a simple, direct and objective way. Hence, the categories established in this research – based on the referenced authors to evaluate the item "Quality of specialized information sources" – make up ten items, are presented as follows:

- Update: refers to the frequency of updates of the source, which shows the occurrence of constant revisions and proves the timeliness of information;
- Authority: refers to the person responsible for providing the source of information, which ensures reputation to information when they come from the organizations or institutions referenced;
- Purpose: refers to the authors' motivation in the creation of source and encompasses the clear specification of objectives and trends;
- Reliability: refers to the relationship between the Authority's area of operation and the information content available in source; as identifying the intellectual responsibility of the content and the relationship between the specificity of the institution responsible for the source and our content is a way to ensure the credibility of the source;
- Coverage: refers to the depth of the approach of content, addressing aspects such as range, accuracy, completeness, generic or specific content;
- Organization: refers to friendliness of the interface and the ability to access different levels (easy, intermediate, advanced);
- Support: refers to support users to solve problems and answer questions that arise when the font is used, also comprising help links;
- Design: refers to attributes such as sharpness, font size, clear identification of images, beauty, page color, ease of use, originality of sounds and images and stability of the layout;
- Navigability: refers to ease of orientation of users inside and outside the source, including mechanisms of access, ease of handling and use of the software with hyperlinks to related information; links to drive which refer to sites that complement the information available, as well as of clarity in navigation processes (like: start, restart, exit, return, forward)

- **Accessibility:** refers to the existence of resources to assist people with disabilities in the use of sources, and query options in other languages.

To make possible the evaluation of the quality of information sources object of this research, evaluation criteria were established, aiming at creating scales to qualify each stated dimension. The criteria to value the items are detailed in Table 3.

Table 3. Criteria to Value Quality of Information Items

| Items | Evaluation criteria |
|----------------------|--|
| Update | 5 - daily; 4 - weekly; 3 - monthly; 2 - semiannual; 1 - annual; 0 - undefined. |
| Authority | 5 - healthcare research institutions 5 - publishers with publications in the field of health 1 - bodies or institutions outside the health field 1 - publishers who have no publications in the field of health 0 - unidentified |
| Purpose | 2 - clear objectives about the purpose of the source 1 - inferred goals on the purpose of the source 0 - controversial goals or no goals |
| Reliability | 3 - information content related to the area of authority 2 - contents partly related to the area of authority 1 - information content unrelated to the area of authority, but related to health 0 - informational content not related to the area of authority and not related to health |
| Coverage | 3 - specific content 2 - generic content 1 - content superficially related to the topic of source 0 - diffuse content unrelated to health |
| Organization | 5 - friendly interface allowing the possibility of different levels of research 4 - different levels of research are possible 3 - friendly interface 2 - just one level of search 1 - complex interface 0 - disorganized use alternatives without a logical pattern |
| Support | 5 - online help available; tutorials, manuals, FAQs, help links 4 - availability of tutorials and manuals, FAQs and help links 3 - help links on the search screen available 2 - textbooks available 1 - FAQ available 0 - there is no alternatives to support or aid the user |
| Design | 5 - ease of use, layout stability, beauty, clarity of fonts and images 4 - layout stability and ease of use 3 - beauty, clarity of fonts and images 2 - simple aesthetic that promotes ease of use 1 - design without attractive, purely functional 0 - failure to comply to aesthetic aspects |
| Navigability | 4 - clarity in navigation processes and links to move between sites; ease of use; 3 - clarity in navigation processes and software's ease of use; 2 - clarity in navigation processes and links to move between sites 1 - links to move between sites 0 - confusing navigation options without menus or indicative links |
| Accessibility | 3 - other languages' options and available access for the disabled 2 - available access to disabled 1 - other languages' options 0 - does not meet the accessibility criteria |

Source: Prepared by authors, 2013.

The information sources were evaluated based on categories and established criteria (Table 4). The classification of these sources followed attributes of quality depicted in Table 5.

Table 4. Evaluation of Information Sources Based in Quality Criteria

| | Snomed | CID-10 | MeSH | FMA | UMLS | BVS | MedLine | Cinahl | Primal | Embase |
|----------------------|--------|--------|-------|-----|-------|-------|---------|--------|--------|--------|
| Update | 2 | 1 | (***) | 4 | (***) | 4 (*) | 3 | 4 | (***) | 5 |
| Authority | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Purpose | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| Reliability | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Coverage | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| Organization | 3 | 3 | 4 | 2 | 3 | 5 | 5 | 5 | 5 | 5 |
| Support | 2 | 2 | 2 | 3 | 3 | 4 | 3 | 4 | 4 | 4 |
| Design | 2 | 2 | 2 | 1 | (**) | 5 | 5 | 5 | 5 | 4 |
| Navigability | 2 | 2 | 3 | 2 | (**) | 4 | 4 | 3 | 4 | 4 |
| Accessibility | 0 | 0 | 0 | 0 | (**) | 0 | 0 | 0 | 0 | 0 |

Source: Prepared by authors, 2013.

(*) The mean of 3 databases ratings.

(**) We cannot access the interface as it is paid.

(***) The information was not found on website and manuals.

Table 5. Classification of Information Sources Based on Quality Criteria

| | Points | Ranking |
|------------------|--------|---------|
| Embase | 35 | 1° |
| BVS | 33 | 2° |
| Cinahl | 33 | 2° |
| Medline | 31 | 3° |
| Primal | 29 | 4° |
| FMA | 25 | 5° |
| CID-10 | 23 | 6° |
| MeSH | 23 | 6° |
| Snomed CT | 22 | 7° |
| UMLS | 18 | 8° |

Source: Prepared by authors, 2013.

Considerations

Providing continuous, sustainable and reliable information on health has not been an easy task, especially for issues related to the exponential increase in the volume of information and the heterogeneity of standardization of medical vocabulary that itself has a wide range of expert sources. Despite the efforts made by the various tools available it is still difficult to achieve a satisfactory outcome when the issue is related to the effective use of information sources in health, due to its dynamic context.

The proposal to highlight the main points in the terminology systems and databases aimed at providing demand optimization of the use of these information resources that, due to the wide scope and lack of user manuals, are

frequently underutilized. This purpose has found support in the McGarry (1984, p. 84) statement, "making information available means to remove any barriers to their diffusion and transfer".

In addition to the brief description of its elements and its basic characteristics, this research sought to link the description of items of information sources to the quality attributes listed by various authors (Silva, 2013; Tomael et al, 2001; Luz et al, 2007; Lopes, 2004), seeking to integrate some concepts previously treated in a segmented way. Based on these criteria and associations, we considered that the sources analyzed meet the quality requisites for health information since these characteristics were observed in their scope, with little missing points that can be verified in the summary tables of each analyzed source. It should be clarified that the establishment of a ranking from the compilation of the analysis aims to demonstrate the fulfillment of relevant items that are considered mandatory to the sources of information, rather than disqualify the information contained in their scope or undermining its credibility.

In this sense, the proposed criteria and the quality assessment presented in this paper are tools to synthetically compose a way to the qualification of sources of information in order to ratify to the user of these tools basic requirements expected to be present in all sources. We note that this research did not seek to carry out an exhaustive description; rather to offer helping criteria. The selected information sources contain a large detail of structure and the purpose of the study was to present a brief description, so that users can get a quick overview of them in order to direct their demand to sources that address their information needs precisely.

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