

HEALTH INFORMATION PUBLISHED ON MASS MEDIA AND ON BRAZILIAN HEALTH JOURNALS: an infometric and bibliometric study

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ABSTRACT

This work, based on a review of the literature on scientific communication, mass communication, the interaction between the two types of communication and their influence on society, has as goal to find out if the health information published on the mass medias is consistent with the research published on the Brazilian health journals. In order to do that, a bibliometric analysis of the most relevant topics being discussed on the Brazilian journals indexed in the *Web of Science* database was done, as well as an infometric analysis of the health information published on the mass medias focused on the propagation of scientific information, specifically on the magazines *Ciência Hoje*, *Galileu* and *Superinteressante*, from January of 2010 to December of 2012. The data collected shows that the more relevant topics discussed on the journals have their focus on analytical, therapeutic and diagnostic techniques, while the most popular topic on the mass medias is cancer, followed by other topics that appeal to the emotional side of their readers. The data has also shown that the most popular topics published in the scientific community are also published on the mass media publications, and that over half of the topics published by the mass medias are not amongst the most relevant topics in the scientific journals. In conclusion, even though some of the topics published on scientific journals are also published on the mass media publications, that does not happen according to the same trends.

Keywords: Health information. Mass communication. Scientific communication. Bibliometric studies. Infometric studies.

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I INTRODUCTION

Scientific communication ensures science advancement and gives it credibility arising from the scientific method. Since the emergence of scientific journals in the mid-seventeenth century, science has sought to improve the editorial process, in order to ensure

that the information published in scientific journals describe the concept accepted by the literature, and at the same time, ensure space for publishing new discoveries and theories. Their ultimate goal is the communication of science, especially among scientists.

As for the mass communication, it is aimed at disseminating information to a large number

of people who do not necessarily share the same interests and philosophies, as is the researchers' case. Therefore, the information conveyed in the mass media – popular magazines¹, daily newspapers (tabloids), radio, television and movies – is produced in a more general way than scientific information. It is more superficially written, in a colloquial language, which makes it accessible to a wider audience.

What is produced and published by researchers from different fields of knowledge is interpreted and rewritten in a colloquial language by the editors of the various mass media outlets. These then reproduce and provide this information – at a price – to the general population. This process of adapting the language of scientific information to the masses makes the information consumed by the general population to pass first through the editors' filter and only then it is consumed by individuals.

A survey conducted in 2010 by the Ministry of Science, Technology and Innovation (MCTI; Ministério da Ciência, Tecnologia e Inovação) of Brazil, which sought to survey the interest, level of information, attitudes, visions and knowledge that Brazilians have of Science and Technology, has shown that 58% of Brazilians believe that television (one of the mass medias) satisfactorily announces the new scientific and technological discoveries. The survey has also found that 43% of the population state that the professional who inspires trust and confidence as a source of information from various fields related to Science and Technology, is the physician, followed by journalists (42%), and scientists who work at universities (30%). Of survey respondents, 60% said they had much interest in information about Medicine and Health. Therefore, when looking at this data, it is clear that there is in the Brazilian society an interest on health information, and that the mass media plays an important role in disseminating this information.

Research conducted on health cause a tangible impact on society, since the methods and practices disclosed by the scientific community guide the development of activities in the general population's everyday life.

¹ The word *magazine* was chosen in this study to identify the mass publications. This word is widely used in different parts of the world to identify publications which focuses on the dissemination of information from different areas of knowledge, in colloquial language. They are the magazines of popular consumption.

2 MASS COMMUNICATION

The model of dialog consisting in the dissemination of standardized information to a large number of people is understood as mass communication. It dates back to the emergence of the press, as stated by Perles (2007, p. 7): "The emergence of the Gutenberg typographical system is considered the origin of mass communication due to constituting the first viable method for dissemination of ideas and information from a single source."

With the possibility of full-scale texts reproduction, different medias arose, such as pamphlets, newspapers and magazines. According to Perles (2007, p. 8), "The global association of newspapers accepts as true the evidence that the first newspaper in the world has been *Relationen*, produced by Johann Carolus in 1605."

As stated by De Fleur and Ball Rockeach (1993, p. 39):

The basic idea of a news media originated quite early in Europe, England and the New World. The American colonial press was established a few years before the United States would be constituted as a new nation. The colonial press would distribute small papers and pamphlets among the educated elite. Its content had [...] a level of refinement and taste above the ordinary citizens' capabilities. Nevertheless, they provided the basic format on which to create a new type of news [...]. When a way to finance a cheap newspaper for wide distribution was found, and techniques for fast printing and distribution were designed, the first true mass medium was born in the form of a "penny press newspaper". (BALL ROCKEACH, 1993, p.39)

Beltrão and Quirino (1986) state that industrialization and verticality are basic characteristics of the communication, i.e., mass communication aims to produce and distribute cultural products in the form of standardized messages and serially, created by a specific group of communicators and uniformly received by consumers (the masses) – all read the same message.

This idea is supported by Bernardi (2007, p. 41) when it is stated that:

In the capitalist society, the old means of social protection disappear; the individual is increasingly subjected to the logic of

the market, getting to be completely at its mercy. In the twentieth century, as a result of the Fordist/Taylorist paradigm, a mass society emerges and develops, in which standardization becomes the predominant concept. This form of organization, with regard to information, tries to reach the general public from informational packets, with simple content, that can be understood by the bottom of the social pyramid.

3 SCIENTIFIC COMMUNICATION

According to Le Coadic (1994), scientific communication takes place through two processes: written (formal) and oral (informal). Oral communication comprises public forms of communication, such as conferences and seminars, as well as private forms, such as correspondence and conversations among researchers. Written communication comprises the primary publications (articles, papers, etc.), secondary ones (indexes, thesauri, abstracts), and tertiary ones (bibliographies), which has as its ultimate goal the dissemination of scientific information to all their community.

Originally, communication among researchers would take place by means of exchanging private correspondence and publication of books that were produced by hand and on a small scale, which made scientific communication a slow process. Therefore, according to Hillesheim and Fachin (2006), when realizing the need for improvements in communication among researchers, a group of French scientists founded *Académie Royale des Sciences* (The French Academy of Sciences) in 1662 in Paris, and in the year 1665 was published the first issue of *Journal des Sçavans*. In England, in the year 1660 was created the *Royal Society of London*, which published in the year 1665 the *Philosophical Transactions*, its journal.

These two publications served as a model for universities, European scientific academies, associations and societies that created their own publications.

Le Coadic shows that:

Scientific communication formalization dates back over three hundred years. It occurred in response to the communication needs of research results among researchers whose numbers were growing. Science was changing situations: from a private activity it

was becoming [...] a social activity. (LE COADIC, 1994, p. 34)

As pointed out by:

The final process of change for the new science recording and communication media was only completed in the last century, when magazines obtained credibility to even replace books. Articles up to that time were considered as temporary forms of communication, and the monographic form of printed books was always the favorite one for the definitive record of science. The view that each observation or experiment form a unit by themselves only began to have acceptance in the eighteenth century. (STUMPTF, 1996, p.2)

Once accepted as a scientific communication medium, the journal itself became an object of study, and different definitions of what it actually is can be found in the literature.

The Brazilian National Standards Organization (ABNT – Associação Brasileira de Normas Técnicas) defines a scientific journal as:

One of the types of serial publications, which is presented in the form of magazine, newsletter, yearbook, etc., indefinitely published in fascicles with numerical and/or chronological designations in preset intervals (periodicity), in general with the collaboration of many people, dealing with various issues, within a defined editorial policy, and that is object of an ISSN (International Standard Serial Number). (ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS, 2002, p. 3)

Fachin and Hillesheim (2006) present the following definition:

Scientific journals are any or all types of publications issued in numbers or independent booklets, regardless of their form of editing, i.e., their physical support [...], but having a sequential and chronological chain, being preferably and indefinitely issued at regular intervals, meeting the basic normalizations of a bibliographic control. (FACHIN; HILLESHEIM, 2006 p. 28)

In this context, Mueller (2006, p. 27) states that it is the process of peer review that has en-

sured the scientific journals the preferred channel status for the dissemination of scientific knowledge. It is peer review that has the authority to confirm that the information submitted to journals is the result of a scientific discovery, and that the research is not the result of plagiarism.

The *International Committee of Medical Journal Editors* (ICMJE) defines the peer review process as:

A critical assessment of manuscripts submitted to journals by experts who are not part of their editorial boards. Since a critical evaluation, independent, and non-biased is an intrinsic part of all scholarly work, including scientific research, peer review is an important extension of the scientific process. (INTERNATIONAL COMITTEE OF MEDICAL JOURNAL EDITORS, 2013, our translation)

With all this in mind, the scientific journal is presented as the scientific communication preferred vehicle. Currently it has the facilities brought by the ICTs (Information and Communication Technologies), which has led to the transition of journals, which were conveyed in print, to electronic media.

As is explained by Mueller:

When arising and gaining innovative ways from the 1990s on, the electronic scientific publications aroused hopes in many researchers of a radical change in the traditional system of scientific communication. Just like the Renaissance Utopians, some dreamed of a new communication system in which access to all scientific knowledge would become universal and without barriers. Especially in countries furthest from the main production centers came the hope not only of access to what was produced abroad, but also that local production would have greater visibility and international penetration. (MUELLER, 2006, p. 27)

It is in this context of information retrieval facility in the electronic media that the Open Access movement arises.

3.1 Open access

Already in the 1980s, with the transformation of scientific knowledge in capital by periodical publishers big business, libraries and other

institutions that need access to scientific production found themselves facing a crisis: the demand for scientific information grew, and this made that the prices charged by the major publishers would make it difficult to meet the demand.

The emergence of the possibility of ensuring scientific information access, produced by electronic means and Open Access, proved as a possible solution to the crisis. As Mueller illustrates:

The Open Access electronic journals began to appear in the early 1990s. They are, for the most part and as the vast majority of electronic journals by subscription, very similar in appearance to the traditional model of journal, with the major difference being that they are accessible without payment. (MUELLER, 2006, p. 32)

The appearance of this model took place thanks to the Budapest Open Access Initiative, as explained by:

In February 2002, a unique initiative took place in Budapest, Hungary: the availability of research results on the Internet, systematized in academic and scientific journals, freely and without restrictions for scientists, researchers, scholars, academics, students, and the general public. In contemporary times, "Open Access" is the name given to this new paradigm related to the fast and free dissemination, discussion and reflection of the engendering results of science and technology that has revolutionized the world academia and academics. (ROCHA, 2009, p.3)

According to John Willinsky (2006), the Open Access Principle can be defined as follows: "A commitment to the research value and quality brings with it a responsibility to extend the circulation of this work as far as possible and ideally to all who are interested in it and everyone who can benefit from it." (WILLISNKY, 2006, p. 5, our translation).

Costa (2008, p. 219) defines Open Access as "access to literature that is digital, online, free of cost and of unnecessary copyright restrictions and use licenses. Open Access in this sense must remove both price barriers as permission (to use)."

But for Willinsky (2006) the definition of an Open Access unique model is not consistent with the practices currently performed, and

therefore describes Open Access in ten different “flavors”: Home pages, e-print file, fee for authors, subsidized, dual mode, delayed, partial, per capita, indexing and cooperative: Institutions such as libraries and scientific associations contribute to support free access to magazines and the development of publishing resources.

Another separation that is made of the Open Access modes is explained as follows:

Currently there are two paths pointed to the so-called Open Access, with some variations. The first one is known as the “golden” path for free access, where journals make their articles freely accessible at the time of publication [...]. The second path is free access for automatic filing, also known as “green” path. In this model the authors, after sending a copy to a repository of articles accepted for publication or already published, make these materials accessible for free. (PIMENTEL SOBRINHO, 2011, p.s)

In addition to the several definitions assigned to Open Access, another challenge facing the movement is the lack of interest from the major publishers of periodicals to the adoption of this scientific communication publishing model. As is explained by:

Regarding the role of commercial publishers in the process, such publishers are powerful companies, not only financially but also politically, because, to the extent in which they own the newspapers and the copyrights of the works that these journals publish, they control, in fact, the scholarly communication system. In addition, most reputable publishers still derive power precisely from this prestige assigned to them by the community. The publishers discourse, by not allowing free access, is that they protect the author and the text integrity. (MUELLER, 2006, p. 34)

Therefore, in order to tackle the problem of copyright, the Creative Commons organization was founded in 2001, and in 2002 it published a set of free copyright licenses, and as defined by the organization’s website in Brazil, the

copyright licenses are easy to use and give the author a simple, standardized way to grant permission for people to use their intellectual work (which can

be anything from an artistic expression to an academic study), always in accordance with the conditions the author chooses. [...] Creative Commons does not record works and is not an alternative to copyright. Creative Commons licenses are based on the legal system of intellectual property and then allow the author to choose the terms that best please them, without any cost. (CREATIVE COMMONS, 2013)

Another challenge faced by the publications in Open Access, as highlighted by Schweitzer, Rodrigues and Rados (2011), is visibility. Simply because they are available online, access to publications is not guaranteed; it requires that publications be indexed in databases, portals and repositories of publications in Open Access.

4 MASS COMMUNICATION AND ITS RELATIONSHIP TO SCIENTIFIC COMMUNICATION

As the scientific communication goal is to ensure the advancement of science, respecting the scientific method, resulting in advances in various areas of everyday life, it is important to understand how the interaction between the mass media and scientific communication happens.

Bizzo (2002, p. 310) highlights that a “major challenge of science is to be widely spread, with no loss of accuracy; but the scientific rigor need not be synonymous with hermeticism in spreading science because the scientific jargon makes it virtually impossible to laymen to decode a scientific text.”

It is towards this formal language used in scientific circles that mass media outlets began to work with the dissemination of scientific information with more informal characteristics. Flores and Silveira explain that:

The elements of scientific text taken by the discursive formulation of journalism serve to purposes other than those considered as belonging to the scientific discourse. In addition to producing effects of credibility, they also serve to produce dramatization of effects and capture the reader, an intrinsic characteristic of the journalistic discourse. (FLORES; SILVEIRA, 2010, p. 148)

According to Le Coadic (1994), the scientific communication model can be represented as a system in which the production or construction, communication and the use of information follow each other and feed each other, while the mass communication takes place in a simpler way that limits communication to a bilateral relationship in which information is sent by the informant and received by the informed.

After the Second World War and the advent of ICTs, information has become more valued, and the general population (the masses) also went on to note that valuation. The science that was confined in laboratories and universities is the same science that created the nuclear bomb and went on to influence in a more tangible way the lives of ordinary people.

Inserted in this context, science is turned into news; and research, even if still in formulation or hypothesis processes, is quickly released. However, it is usually reported as discovery, creation already finished or as the beginning of a discovery that will achieve its purpose. The receiver, without knowing it, becomes a consumer of this information which, transformed into news, becomes an everyday phenomenon and is consumed as other news. And so, as such, scientific information will not have depth, theoretical and conceptual details which will prevent a deeper understanding of the information received [...].(PECHULA, 2007, p. 217)

It is a context shared by the health information: academic research and its dissemination in the mass media outlets.

4.1 Health information and communication and society

As highlighted by Lima et al (2012, p. 39):

The research work must go beyond the stage of publishing its results in scientific journals. It requires that the whole society be affected by the consequences of its results. For this, it requires from the researcher, the funding agencies and the scientific community a parallel work of socialization of these results, through unscientific communication channels, in addition to a public awareness work to generate interest in the realization of that production.

In this sense, seeking to bring health information to the ordinary citizen's reality, Targino (2009, p. 54) says that "it is essential to understand health as a basic feature of any society and therefore health information is critical to the decision-making process at the heart of public policies, aiming to raise the people's quality of life."

Thus, it is important to highlight that, when circulating in different media, health information is consumed by different audiences and with different purposes. These groups range from politicians, professionals from other fields of knowledge, students and the general population of the different economic sectors.

although the asymmetries of all kinds that characterize the unequal Brazilian society - in health, communication and noticeably in the media - are not underestimated, this does not lead to disregard that every individual, group or institution move between the sending and receiving positions, besides acting in the social movement of speeches. (ARAÚJO, 2009, p.s)

With the emergence of the scientific health journals in Open Access, a new source of health information appears. Thus states Targino (2009, p. 70): "Regardless of these scientific content publications, researchers in health can not lose sight of the possibility of the public meeting their informational needs in cyberspace." This demonstrates that a greater concern with the spread of their research to society must be developed by the researchers.

5 METHODOLOGY

With the goal of identifying whether the issues disclosed by the mass medias and the issues disclosed by researchers in scientific journals are similar, a bibliometric survey to identify the most popular themes among Brazilian researchers and an infometric survey of themes published in mass medias were carried out. Data were collected in the multidisciplinary database *Web of Science*, specifically in the Open Access of Brazilian journals indexed by the database in the period from January 2010 to December 2012.

The infometric data relating to mass media were collected on Brazilian magazines Galileu,

Superinteressante and Ciência Hoje (published by three different publishing houses) for being publications aimed at disseminating scientific information to the masses, in the publications concerning the same time interval.

The method adopted to develop this work is based on the concepts of metric studies of information: Bibliometrics and Infometrics.

Bibliometrics is the informational quantification through frequency, distribution and percentage of scientific citations, while Infometrics is the degree of relevance, recall and retrieval of information, quantitatively treating all types of information, whether it be scientific or not (BUFREM; PRATES, 2005).

Therefore, it is characterized as literature review, for it uses publications already existing and reported in magazines and in the database; and features aimed at quantitative and qualitative research, for it lists and describes the themes published in both communication channels.

The techniques used for data collection are made up of:

- a) Survey of subjects in the Open Access scientific journals indexed in the *Web of Science* by means of the analysis of the keywords assigned to articles;
- b) Survey of the subjects of articles published in magazines, by means of a consultation

to publications and attributing keywords for the articles.

The magazines articles keywords definition was done by means of consulting the publications, determined in accordance with the article titles and the words that stood out in each article, since it is not a common practice for magazines to tag keywords in the content that is published in these medias.

The processing of data was as follows: among the keywords raised in *WoS*, keywords of articles in scientific journals were selected - all that were repeated over twenty (20) times². Then those keywords were divided in themes that were determined having as reference the hierarchy of Health Sciences Descriptors (DeCS) of the controlled vocabulary of the Virtual Health Library (VHL).

The keywords assigned to the magazines articles were standardized according to the DeCS and then divided into themes just as the scientific articles keywords.

6 RESULTS

10,959 articles were recovered on the *WoS* database and 17,172 keywords assigned to them were identified.

Figure 1 - Frequent keyword in the articles indexed in the *Web of Science*



Source: research data (2016).

2 The Zipf's law states that: $ab^2 = k$, where: a represents the number of words that occur h times, b is the number of occurrences of each word and k is the constant. (KIBEIRO, 1974)

The keywords identified as the most frequent were Nursing (349 times), followed by Brazil (279 times), Quality of life (252 times), Epidemiology (250 times), risk factors (250 times), rats (213 times). This indicates that the most frequent keywords of the articles published in Open Access journals have the role of field

characterization (i.e., nursing) and objects of study (i.e., Brazil).

These 266 keywords were divided into 69 themes, which were attributed to the keywords according to the hierarchy of terms in the DeCS, and these themes were represented in a Word Cloud that can be seen in Figure 2:

Figure 2 - More frequent themes of articles indexed in the *Web of Science*



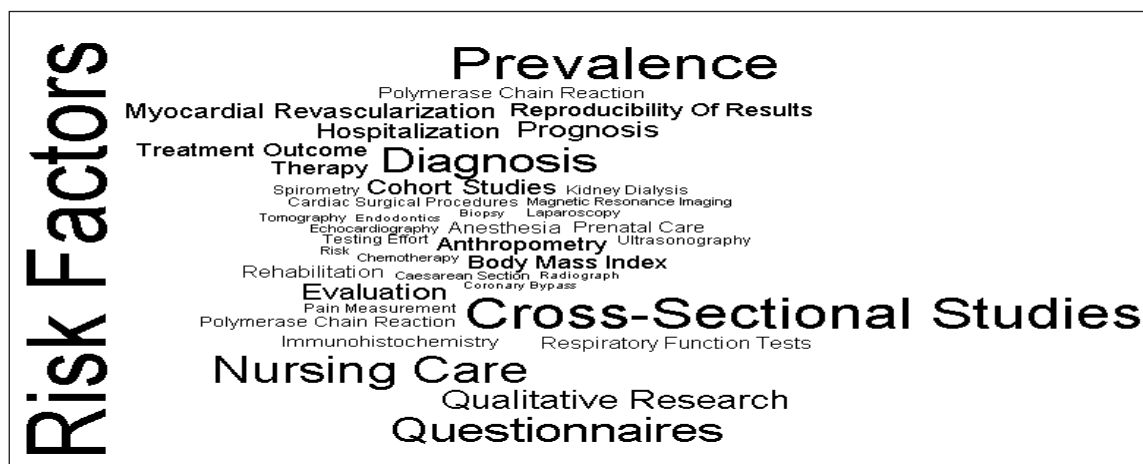
Source: research data (2016).

These findings are consistent with the characteristics of the scientific publications: the focus is on research, the results demonstration and its analysis. It is by means of this type of publication that the peers can recreate and

replicate the published studies, ensuring the scientific method application.

The keywords grouped under the three most common themes can be seen in Figures 3, 4 and 5 below:

Figure 3 - Keywords grouped under the theme “Analytical, Diagnostic and Therapeutic Techniques and Equipment”

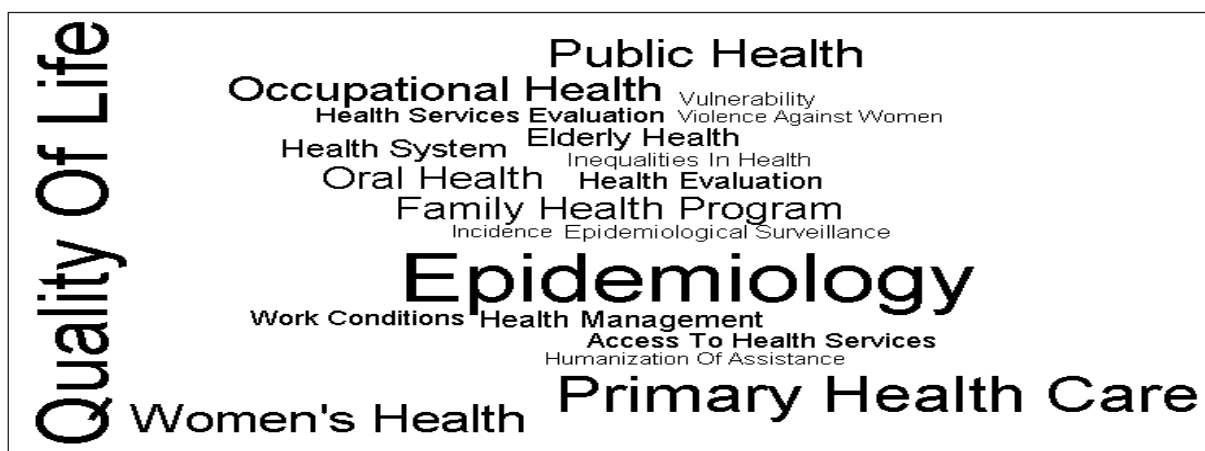


Source: research data (2016).

The most frequent subject of the studies indexed by WoS concerns the “Analytical, Diagnostic and Therapeutic Techniques and Equipment” (Figure 5), which includes keywords such as: Risk factors (repeated 250 times) Prevalence (repeated 144 times), Cross-sectional studies (repeated 136 times), Nursing care (repeated 117 times), Diagnosis (repeated 110 times) Questionnaires (repeated 109 times), Qualitative research (re-

peated 75 times), Evaluation (repeated 61 times), Prognosis (repeated 61 times) and Cohort studies (repeated 56 times), which makes it possible to identify that the most common theme among health care scientists covers mainly aspects of health research and study, focusing on data analysis (keywords such as Risk factors) and search strategies (keywords such as Questionnaires, Qualitative research).

Figure 4 - Keywords grouped under the “Public Health” theme



Source: research data (2016).

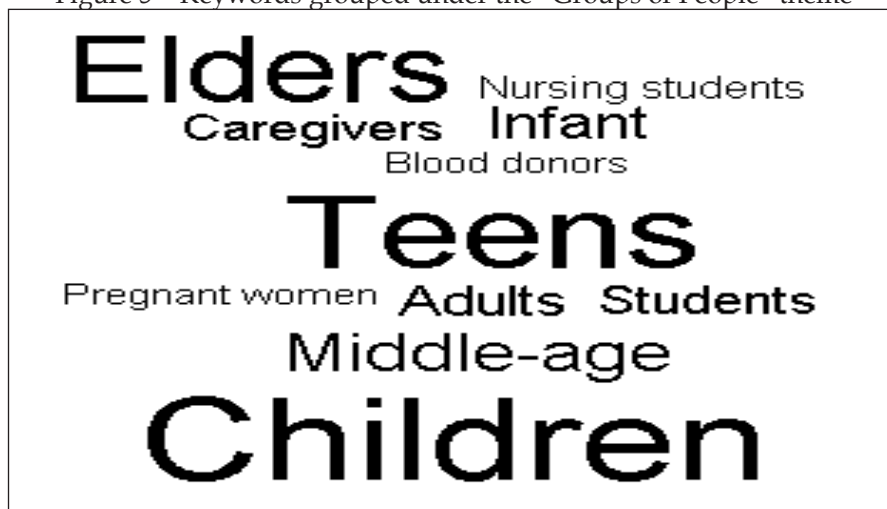
With the creation of the Unified Health System (SUS) in Brazil came a new demand for research on the Brazilian health care scenario, which consequently meant the publication of a large number of articles on this area. By reason of this great number of publications, the theme “Public Health” was created in the DeCS, which refers to those publications that deal with issues related to the population care by the State, such as the Brazilian Unified Health System (SUS), for example. The highlight that this category has in Brazil’s health literature depicts the research regional focus.

The most frequent keywords were: Quality of life (repeated 252 times), Epidemiology

(repeated 250 times), Primary health care (repeated 171 times), Women’s health (repeated 119 times), Public Health (repeated 119 times), Worker health (repeated 97 times), Oral health (repeated 84 times), Family health program (repeated 82 times), the Brazilian Unified Health System (repeated 56 times), Health of the elderly (repeated 54 times).

This data allows to note that there is a large number of publications targeted to government programs aimed at protecting the citizens’ health (such as the Brazilian Unified Health System and the Family health program), as well as concern for the population’s quality of life.

Figure 5 – Keywords grouped under the “Groups of People” theme



Source: research data (2016).

The “Groups of People” theme stood out as one of the most popular because in health care research it is important that the articles indexing identifies the group that was studied, as each group of people has specific characteristics, and the findings that apply to one of these groups

does not necessarily mean that it be applicable to another group.

As for the data on the magazines publications, 265 articles were surveyed, to which 293 keywords were assigned, which are represented in Figure 8 according to their frequency.

Figure 6 – Keywords of the articles published in the magazines



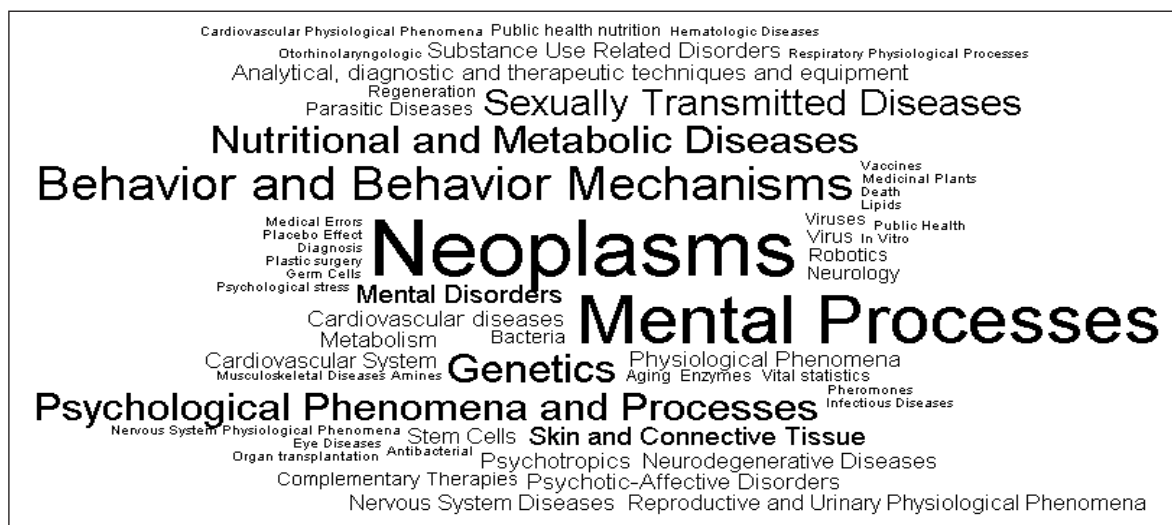
Source: research data (2016).

The most frequent keywords were Cancer, which was repeated 27 times, followed by Memory (17 times), Genetics (15 times), Obesity (13 times), AIDS (6 times), Pain (6 times), Depression (6 times), Diagnostics (5 times), Stem cells (5 times), and Metabolism (4 times). These data allow us to note that the magazines articles deal more frequently with diseases or specific health conditions.

The results are consistent with the publications characteristics in magazines and other mass media outlets: they are done focusing on what is tangible to the reader, their feelings and experiences. Issues such as cancer or memory are common to all citizens, being independent of social group or level of education.

The 293 keywords identified were divided into 51 themes, which are shown in Figure 7:

Figure 7 - Themes of the articles published in the magazines



Source: research data (2016).

The most common themes are Neoplasms, which was repeated 32 times, followed by Mental Processes (27 times), Behavior and behavioral mechanisms (24 times), Analytical, diagnostic and therapeutic techniques and equipment (19 times), Genetics (18 times), Nutritional and metabolic diseases (14 times), Psychological Phenomena and Processes (14 times), Sexually transmitted diseases (11 times), Reproductive and urinary physiological phenomena (9 times), Affective psychotic disorders (8 times).

Under the theme “Neoplasms” are grouped the different types of cancer. It is the most popular theme among the magazines. According to WHO data, an average of 1,655,1 people die of cancer every

year in Brazil (ORGANIZAÇÃO MUNDIAL DA SAÚDE, 2013). This makes that the number of people whose lives are impacted because of the disease be very high, and consequently the number of people looking for more information on cancer be also very high.

The “Mental Processes” theme includes the conceptual functions or human thought. The keywords grouped under this theme were: memory, creativity, cognition, self-perception, dreams and learning. Studies done in this area involve the areas of psychology, psychiatry and neurology, for example.

The keywords grouped under the “Behavior and behavioral mechanisms” theme can be seen in Figure 8:

Figure 6 – Keywords grouped under the “Behavior and behavioral mechanisms” theme



Source: research data (2016).

The “Behavior and behavioral mechanisms” theme comprises studies of human behavior. Behavior is defined in the DeCS as the observable response to a situation and the unconscious processes underlying it. These are issues that are part of everyday life for all, and generally they assist in improvements in interpersonal relationships. Therefore it is possible to understand this type of publication appeal.

It is noticed that the most frequent themes in the magazines have features appealing to their readers’ emotional aspects. They are themes related to the readers’ needs, habits and problems.

6.1 Comparison between the two media outlets

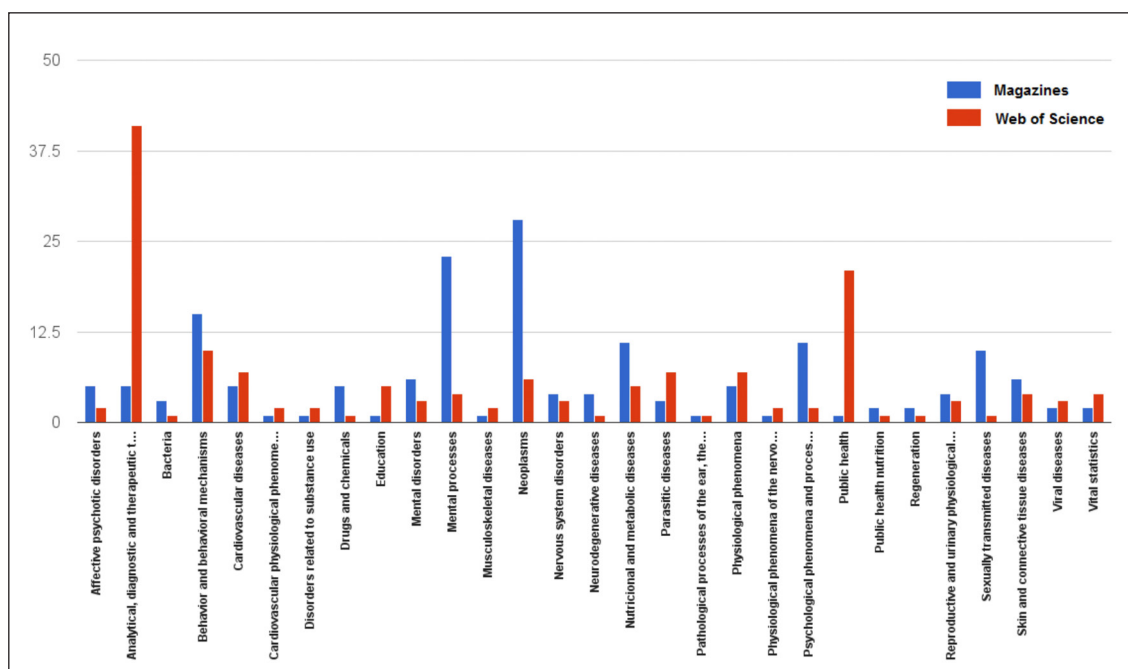
By comparing the themes addressed by the two communication channels it is possible to observe the following situations:

Twenty-nine themes are common to magazines and *Web of Science*. They are: (1)

Physiological phenomena; (2) Regeneration; (3) Neoplasms; (4) Bacteria; (5) Affective psychotic disorders; (6) Behavior and behavioral mechanisms; (7) Physiological phenomena of the nervous system; (8) Chemical compounds and drugs; (9) Otorhinolaryngological manifestations; (10) Cardiovascular diseases; (11) Analytical, diagnostic and therapeutic techniques and equipment; (12) Skin and connective tissue diseases; (13) Psychological phenomena and processes; (14) Nervous system disorders; (15) Viruses; (16) Musculoskeletal diseases; (17) Reproductive and urinary physiological phenomena; (18) Neurodegenerative diseases; (19) Nutrition in public health; (20) Nutritional and metabolic diseases; (21) Mental processes; (22) Parasitic diseases; (23) Public health; (24) Sexually transmitted diseases; (25) Mental disorders; (26) Education; (27) Disorders related to substance use; (28) Vital statistics, and; (29) Cardiovascular physiological phenomena.

The frequency with which these themes appear in both medias can be seen in Table 1:

Table 1 – Frequency of themes common to scientific journals and magazines



Source: research data (2016).

It can be noted that there are frequency differences in the publication of themes that are common to both vehicles. Those that stand out most in the scientific community (Analytical, diagnostic and therapeutic techniques and equipment, and public health) appear less frequently in the magazines, while the themes that appear more often in the magazines (Neoplasms, Mental processes, and Behavior and behavioral mechanisms) appear less frequently in scientific publications.

From the themes identified in the *WoS*, thirty-nine (39) do not appear in the magazines. The themes and the frequency with which they appear were:

- Groups of people (12 times)
- Health facilities, human resources, and services (9 times)
- Social sciences (8 times)
- Nursing (6 times)
- Population characteristics, Musculoskeletal physiological phenomena (5 times)
- Animals, Bacterial infections and mycosis (4 times)
- Health care administration, Physical phenomena, Pathological processes (3 times)

- Human activities, Information science, Humanities, Stomatognathic diseases, respiratory diseases, Surgical specialties, Cardiovascular physiological phenomena, Proteins, Type of publication (2 times)
- Accidents, Pharmaceutical administration, Disease attributes, Publishing features, Inorganic compounds, Dermatology, Disciplines of natural sciences, Digestive system diseases, Hematological diseases, Epidemiological factors, Cell physiological phenomena, Physiological phenomena of nutrition, Eye physiological phenomena, Geographical locations, Biomedical and dental materials, Pediatrics, Skin, Rehabilitation, Urogenital system (1 time)

From the issues addressed by the magazines, 21 do not appear among the most popular themes of *WoS*. They are: Genetics (repeated 18 times); Psychotropic substances (6 times); Stem cells (5 times); Metabolism, Vascular system, Additional therapies (4 times); Neurology, Viruses (3 times); Enzymes, Ophthalmopathies (2 times); Plastic surgery, Blood disorders, Placebo effect, Cardiovascular physiological phenomena, Respiratory

physiological phenomena, Pheromones, Lipids, Death, Medicinal plants, Respiratory physiological processes, Organ transplantation (1 time).

During the data collection it was observed that, although the majority of magazines articles does not mention directly the sources consulted - usually is mentioned only "an article by Dutch researchers" or "... in an article published in the journal *Nature* this past month" -, most of the items mentioned by *Superinteressante* and *Galileu* magazines are based on studies published in foreign journals, or developed by foreign researchers. As for *Ciência Hoje* magazine, it has a special section that includes only Brazilian research, but does not identify the sources consulted either.

7 CONCLUSION

This study has revealed that 42% of the most popular topics in the scientific community are published by mass media outlets and 56% of the subjects treated by the mass media are not among the most relevant issues to the scientific community.

The most publicized theme by the scientific community refers to the **Analytical, diagnostic and therapeutic techniques and equipment**.

As for the magazines, the themes that have the more prominence refer to **neoplasms** (cancers), **mental processes** (involving articles on memory and cognition, for example) and **behavior**, that is, topics that have greater emotional appeal to the reader.

It was observed that the magazines do not clearly mention the consulted sources of information when disseminating research findings and other scientific studies. They mention the places of origin of the researchers or the title of the magazines where the study was sought, but the situations in which the article title is mentioned, for example, are rare.

It is also noted that most of the studies reported by the magazines are of foreign origin, although the Brazilian production in the health area is large and in Open Access to reporters and editors of these magazines.

Having all this in mind, it can be said that the mass media outlets are reporting thematic

studies relevant to health, but in a way that is inconsistent with trends in the field.

Of the difficulties in developing the work it is possible to highlight that:

- a) In magazines, in general, identification of information sources of the reports dealing with the dissemination of scientific studies on health is not done;
- b) Magazines *Galileu* and *Superinteressante* publish extensive articles about health but they are, in large numbers, interviews with researchers or health care professionals on topics receiving prominence in the magazines fascicles and tend to relate to more tangible problems at certain times of year, such as, for example, interviews about influenza at the beginning of winter, or obesity in periods next to the summer season.

Given the current configuration of society and the way ICTs are embedded in much of the population's routine, it is pertinent that research on the dissemination of science information in social media continue, as they are largely widespread tools used by society.

This work has dealt with information released by major publishers and companies industrially working with information, but it is important to highlight that currently individuals do not depend exclusively on products provided by these publishers to have access to scientific information.

In addition to online Open Access to scientific journals, where the query in full of documents published by scientists is possible, it is also possible to access blogs and websites of people who are dedicated to disseminating news from the world of science, who are doing the same process of adaptation from technical language to colloquial language, but without the financial interests that evidently motivate the mass media publications.

It is important to highlight that this work is a portrait of the subjects published in the Open Access scientific journals; therefore it does not represent the totality of the scientific production on health by Brazilian researchers, since it does not take into account the publications done by Brazilian researchers in national or international scientific journals with restricted access.

In this sense, it is relevant that analyses of these new sources of information be done (blogs, for example), both from the infometric point of view and from the perspective of the communicators' motivations, as well as an

investigation of health information disclosure practices adopted by researchers and by health professionals to society, since the task of disseminating information is also up to them.

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INFORMAÇÃO SOBRE SAÚDE PUBLICADA EM MASS MEDIA E SOBRE A REVISTA BRASILEIRA DE SAÚDE: um estudo Infométrico e Bibliométrico

RESUMO

Este trabalho, baseado na revisão da literatura sobre comunicação científica, comunicação de massa, interação entre os dois tipos de comunicação e sua influência na sociedade, tem como objetivo verificar se as informações de saúde divulgadas nos meios de comunicação de massa são consistentes com a pesquisa publicada nas revistas brasileiras de saúde. Para tanto, foi realizada uma análise bibliométrica dos temas mais relevantes discutidos nas revistas brasileiras indexadas na base de dados da Web de Ciências, bem como uma análise infométrica das informações de saúde publicadas nos mass media focadas na propagação de Informação científica, especificamente sobre as revistas Ciência Hoje, Galileu e Superinteressante, de janeiro de 2010 a dezembro de 2012. Os dados coletados mostram que os tópicos mais relevantes discutidos nas revistas têm foco nas técnicas analíticas, terapêuticas e diagnósticas, enquanto que o tópico mais popular nos mass media é o câncer, seguido por outros tópicos que atraem o lado emocional de seus leitores. Os dados também mostraram que os temas mais populares publicados na comunidade científica também são publicados nas publicações de massa, e que mais da metade dos temas publicados pelos meios de comunicação de massa não estão entre os temas mais relevantes nas revistas científicas. Em conclusão, embora alguns dos tópicos publicados em revistas científicas sejam também publicados nas publicações de massa, isso não acontece de acordo com as mesmas tendências.

Palavras-chave: Informação em saúde. Comunicação em massa. Comunicação científica. Estudos bibliométricos. Estudos de Infometria.

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