The Influence of the National Institutes of Health Public-Access Policy on the Publishing Habits of Principal Investigators

A Dissertation Presented to the

Faculty of the Simmons College Graduate School of Library and Information Science

In partial fulfillment of the requirements for the Degree of Doctor of Philosophy

Dissertation Committee:

Robin Peek, PhD, Chair

Peter Suber, PhD

Lisa Hussey, PhD

By Athanasia Pontika

2011

The Influence of the National Institutes of Health Public-Access Policy

on the Publishing Habits of Principal Investigators

A Dissertation Presented to the

Faculty of the Simmons College Graduate School of Library and Information Science

In partial fulfillment of the requirements for the Degree of Doctor of Philosophy

By Athanasia Pontika, BA LIS

2011

Robin Peek, PhD, Chair — November 21, 2011 — Date

Peter Suber, PhD — 11/21/11 — Date

Lisa Hussey, PhD — 11/21/11 — Date

Στους γονείς μου

To my parents

Acknowledgements

First of all, I would like to thank my dissertation committee, Robin Peek, Peter Suber and Lisa Hussey for their guidance and support.

More specifically I would like to thank Robin Peek for her sincere help and mentoring through all my doctoral studies and Peter Suber for his irreplaceable guidance on the details of the open-access movement and mentoring. Our dinners at Harvard Square and the innumerous emails we exchanged have made these past four years challenging, enjoyable and memorable. You showed me not only how to think, develop arguments and conduct research, but more importantly you inspirited me to become a passionate open-access advocate- I sincerely thank you for that.

I would also like to thank for their input and help concerning this dissertation: Rong Tang, Associate Professor at the Graduate School of Library & Information Science, Simmons College; Scott Lapinksi, Digital Resources and Services Librarian at the Francis A. Countway Library at Harvard Medical School; and Donna Okubo, Community Outreach and Advocacy Manager, Public Library of Science.

Finally, I would like to thank my family in Greece for their constant psychological encouragement and financial support- I would have never made it without your help- and all my friends in Boston who treated me like family- the winters would have been unbearable without our happy hours.

Abstract

The mandatory NIH public-access policy, which became effective on April 7, 2008, requires the NIH-funded principal investigators (PIs) to self-archive to the National Library of Medicine subject repository PubMed Central a manuscript's electronic version immediately upon publication, which will then be available to the public free of cost the latest after a twelve-month embargo period. The Public Library of Science (PLoS), a non-profit open-access publisher in health sciences, publishes seven journals in the health sciences field (*PLoS ONE*, *PLoS Biology*, *PLoS Medicine*, *PLoS Computational Biology*, *PLoS Genetics*, *PLoS Pathogenes* and *PLoS Neglected Tropical Diseases*) and submits to PubMed Central all the published articles, irrespective of the funder of the research results. The PIs who had published in one of the PLoS journals were chosen based on the journals' established high impact factor immediately after their creation. The PIs' motivation to publish in one of the seven PLoS journals was unknown. Whether the NIH public-access policy has affected the PIs' publishing decisions was also unknown.

A random sample of NIH-funded PIs, who had published in one of the PLoS journals between the years 2005- 2009, was selected from the RePORTER database. During the period March-May 2011, forty-two PIs were interviewed using Skype™ software, and a semi-structured open-ended interview protocol was followed. The participants were divided into two groups; the pre-mandate PIs, who had published in one of the seven PLoS journals during the period 2005-2007 and the post-mandate, who had published in the PLoS journals the during period 2008-2009. The publishing habits of these two groups were compared, in order to reach an understanding about their publishing decisions.

Based on the findings, the NIH-funded PIs choose the PLoS journals due to their high impact factor, fast publication speed, fair peer-review system and the articles' open-access availability. Although the PIs agree with the premise that publicly funded research must be distributed for-free to everyone who has funded it, the steps required to comply with the policy were perceived to be time consuming. Since conformity with the policy is essential, the participants' goal is to ensure that the manuscripts will appear to PubMed Central, which either can be self-archived by the PIs, by an administrative assistant or by the journal.

The NIH public-access policy did not cause either an increase in the PIs' open-access awareness or a change in their publishing habits. The open-access advocates were supporters of the immediate free access to scientific information before the policy and provided their manuscripts free-of-cost before the policy's mandate. The non-open-access advocates choose their publications based on quality criteria such as the journal's prestige, impact factor, speed of publication and the attracted audience, while the article's open-access availability is considered to be a plus. Furthermore, since a large number of journals comply with the NIH-policy, the participants did not have to change their publishing habits.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction

On April 7th, 2008 the permanent National Institutes of Health (NIH) public-access policy was enacted, requiring that NIH-funded PIs must "submit or have submitted for them to the National Library of Medicine's PubMed Central an electronic version of their final, peer-reviewed manuscripts upon acceptance for publication, to be made publicly available no later than twelve months after the official date of publication" ("The Omnibus Appropriations," 2009). One of the goals of the NIH policy is to provide the wider population with free-of-cost public access of the research it funds and to promote the development of the field of health sciences. When an article is deposited to PubMed Central, it is also being indexed in the PubMed citations database, which is the primary resource collecting health sciences literature. The policy's main goal is to create a stable database for the results emerging from the NIH-funded research. In addition, since the manuscripts will be hosted in the same database, the same file formats and metadata will be applied, providing an easy searching interface for the articles' retrieval and their long-term preservation.

Although the policy has been implemented for two years, an examination needs to be conducted to determine how the NIH-funded PIs perceive open access and the mandatory policy. Is the mandatory NIH policy influencing the PIs publishing habits when they are about to decide where they would publish their papers? Are the terms of the policy an influential factor in the PIs decisions to provide their manuscripts through open access or in their decision to publish more of their articles in open-access journals? No other study has examined how the NIH-funded PIs perceive the premise that publicly funded research must become available free of cost upon publication through self-archiving, how the NIH policy shapes the PIs' publication preferences

and how compliance with the policy's conditions is managed. In this dissertation the NIH-funded PIs will be investigated to understand how they became aware of the public-access policy and to determine the reasoning behind their decision to publish in NIH-compliant open-access journals, and more specifically in the Public Library of Science (PLoS) journals, before and after the NIH policy. In addition, this research will explore how the PIs are educated about the NIH compliance, what kind of difficulties they experience in their effort to understand the policy's provisions and how they successfully manage to meet with the policy's compliance components.

The methodological framework of the study included a qualitative data-collection technique and sought to answer the following research questions:

(1) Which factors motivate the NIH-funded PIs to publish in the PLoS open-access journals?

(2) How do NIH-funded PIs perceive the NIH public-access policy?

(3) How does the NIH public-access policy influence the PIs' publishing behavior?

(4) How does the NIH public-access policy influence the PIs' decision to publish in open-access journals?

Forty-two NIH-funded PIs, who had published in one of the PLoS journals during the period 2005-2009, from thirty-two academic and research institutions around the United States were interviewed, using a semi-structured protocol, during the period from March to May 2010. The PIs were selected from the online publications' and patents' database RePORTER through a random sampling and the interviews were conducted using Skype™ software.

PLoS and the NIH policy

In 2003, the non-for-profit open-access publisher PLoS established its first journal in biology and year later a second journal in medicine. Until 2007, there were only seven journals publishing peer-reviewed articles in the subject fields of biology and health sciences. The Creative Commons Attribution License (CC-BY) of all the PLoS articles ensures that they can be reused, manipulated or translated by the readers. Additionally, this license allows authors to disseminate their articles without any copyright limitations, simultaneously protecting their rights from infringement (Sedwick, 2005). Michael Eisen, the PLoS co-founder, explains the reasoning behind this license: "We chose the attribution license because it ensures the optimal accessibility and usability while preserving the one thing that scientists value the most: attribution of their work" ("African sleeping sickness", §6). This open license enables PLoS to submit to PubMed Central all their articles and to offer them to anyone free of cost immediately upon publication, either from the journals' Website or through the PubMed links.

From their initial establishment the seven PLoS journals managed to compete with the prestigious and high-impact toll-access journals in health sciences. The journals entered the Thomson Reuters Web of Knowledge^{SM} database ranked among the first ten positions, with the journals *PLoS Biology* and *PLoS Pathology* occupying the first position from the moment they were listed ("Thomson Reuters- Science") (Chapter 2). The high-impact factor achieved by the PLoS journals in such a short period of time is one of the unique cases in the publishing industry, both in comparison to open-access and to toll-access journals.

The PLoS journals have been publishing NIH-funded articles since their establishment, even before the inception of the NIH public-access policy. In this dissertation the NIH-funded PIs are divided into two categories: the pre-mandate PIs, who published in one of the PLoS

journals before the mandatory policy (2005-2007), and the "post-mandate" PIs, who published for the first time in PLoS only after the mandatory policy. The reasons that prompted the pre-mandate PIs to publish with one of the PLoS journals were unknown, and whether the mandatory policy has influenced the post-mandate PIs' decision to publish in them also needs to be further investigated. Specifically, whether there are similarities and differences between the publication habits of the pre-mandate and the post-mandate population and how these two groups of PIs react to the mandatory policy must be determined.

The reasons authors choose to publish in the open-access journals are presented in previous studies (Chapter 2). The primary factors are the authors' personal belief that access to the research results should be free of cost (Morris & Thorn, 2009; Swan & Brown, 2004; Warlick, 2006; Xia, 2010), immediate article dissemination (Dallmeier-Tiessen et al., 2010), author retention of article copyright (Warlick & Vaughan, 2007), and journal reputation and speed of publication (Nariani & Fernandez, 2011). There are no previous studies that reveal the factors that influence the NIH-funded PIs' decisions about the choice of a journal in which to publish or if the mandatory policy is an important factor.

An exploration of the impact of the policy on the PIs' publication preferences can highlight the PIs' level of awareness concerning compliance with the policy and can assist with deliberation about the submission process. The free-of-cost public-access mandate of the NIH-policy with regard to the PLoS' articles indicates a new form of disseminating scholarly communication. What should be determined is whether the policy affects the PIs' publishing decisions and the level with which the PIs' publication preferences have been transformed in order to comply with the policy's mandatory terms. The discovery of a positive relationship will indicate that PIs are actively supporting an environment that increasingly encourages the free-of-

cost accessibility of the research results by providing their manuscripts open access, either through open-access journals or through self-archiving in repositories.

The NIH policy directs delayed public access, with a maximum twelve-month embargo period, while the open-access movement supports immediate access to the published material. However, further investigation is required to determine if the NIH-funded PIs choose to publish in these open-access journals because they want to offer the public their articles immediately with limited restrictions (libre access) (Appendix E) and to achieve easily compliance with the policy or if there are other reasons behind their decisions, which are not related to the policy but to the journals' characteristics, such as the journal's impact factor, peer-review system and speed of publication. It could be hypothesized that authors choose to publish in one of the PLoS journals because the NIH budget covers the open-access journals' publication costs and compliance can be achieved easily. Another hypothesis is that the PIs misunderstand the terms of the policy and believe that the mandate requests both the publication of the article in an open-access journal and self-archiving to PubMed Central. These are only propositions that need to be explored to identify the reasons the PIs choose to publish in one of the seven PLoS journals.

When this dissertation was written there were more than two hundred academic institutions and funding agencies that mandate self-archiving in repositories ("ROARMAP," 2010), and there are studies that provide instructions for the creation of such policies (Jantz & Wilson, 2008; Nguyen, 2008; Jones, 2007; Suber, 2009; Xia & Sun, 2007; Xia & Sun, 2006), but there are no studies that show how the NIH-funded PIs perceive the NIH mandatory self-archiving component of the policy. As previously mentioned, the policy serves the greater dissemination of publicly-funded research results through a subject repository, and it should be explored if the PIs share the policy's goals or if they view its mandatory character as an

additional burden to their administrative responsibilities, with which they must abide and cannot opt out since it is part of their agreement with their funding agency.

The current bibliography contains studies that explore the importance of self-archiving policies as a means to increase the open-access availability of research results (Swan, 2005; Suber, 2009- February; Suber, 2008a; Nguyen, 2008; Jones, 2007; Harnad & McGovern, 2009; Harnad, 2008; Crow, 2002a; Crow, 2002b; Buris, 2009; Harnad; 2006). Although the NIH policy mandates self-archiving it has not been investigated whether there is a relationship between self-archiving and publishing in open-access journals. The public-access policy imposes self-archiving in the PubMed Central subject repository, while the PLoS open-access journals also have a self-archiving component to them, since all the published papers are deposited immediately upon publication to PubMed Central. It is uncertain if the NIH-funded PIs are aware of the PLoS journals' self-archiving practices and it needs to be determined if the PIs who have chosen to publish with PLoS aim to comply with the policy using a journal that allows open-access and immediate release of the article and a submission to PubMed Central with no embargo periods.

Significance of the study

This dissertation is of significance to grant agencies, self-archiving policy makers, scholarly communication officers, and anyone who already has a grant from the NIH or wishes to apply for one in the future, as it extends the knowledge base that currently exists in the field, by gaining an understanding of how the PIs perceive public access and how their publishing behavior is transformed to ensure compliance. The concept of funding agencies mandating self-archiving is relatively new to the majority of the research investigators who apply for funding

and also to the scholarly communication officers, librarians and other administrative assistants, who collaborate with the researchers during their publishing activities. The PIs, who had to comply with the policy and implement it, have stories to share with the researcher and they can provide us with details related to the situation, and allow us to determine if they perceive compliance to be a smooth procedure or if it is frustrating and time-consuming.

This research explores the usefulness of the NIH mandate as perceived by the NIH grant awardees and will help to raise awareness of the topic among the PIs, administrative assistants, scholarly communication officers, and policy makers, who are unacquainted with its potential implications and benefits. To illustrate the potential of the NIH policy on the PIs' publication habits, this dissertation will investigate for the first time the NIH public-access policy and the efforts to comply with its terms from the PIs' point of view. This research attempts to serve as a stepping-stone to forthcoming funding agencies' policies on self-archiving and also to those who provide consulting services to PIs on policies institutionalized by funding agencies.

Open-access movement

Open access refers to scientific literature that is accessed via the Internet and whose users must be able to manipulate the published information (such as download, read, distribute, print, and search) and use the content for any legitimate cause, as long as they can connect to the World Wide Web. In addition, users of scholarly literature distributed through open-access must recognize the authors as owners of their work and provide appropriate attributions for content used. (Suber, 2004a).

Two main vehicles were proposed to deliver open-access content for scientific research: self-archiving through repositories and the open-access journals. With the first vehicle, authors

deposit their preprints or postprints in digital archives to support scientific research and create a scholarly archive, while the second vehicle calls for the creation of a new type of journal, which would not charge subscription costs and would distribute peer-reviewed articles. Since the main goal behind the establishment of these two vehicles is the broadest dissemination of the scientific work, the open access journals' publishers would not retain copyright of the published material, but alternative tools will be used to guarantee perpetual access. On the other hand, the digital archives should be compatible with interoperability standards, such as the Open Archives Initiative (OAI), so that search engines can retrieve them regardless of the hosting repository.

The Budapest Open Access Initiative (BOAI), which officially established the movement, was signed at a time when the flaws in the scholarly communication system became very obvious. The subscription prices of the scientific journals were highly inflated, and libraries struggled to allocate resources to renew journal subscriptions (Kyrilidou, 2004). For many years the research community's needs were underserved by libraries with limited increases or cut budgets. As a result of budget problems, the gap between the haves and have-nots was increasing and even the richest academic libraries were forced to eliminate subscriptions to scholarly journals they had maintained for many decades. With its first established initiative the open-access movement offered a promising solution, which proposed an alternative business model that would transfer the cost of production for scientific journals from the libraries and the single user to other factors, such as advertising, endowments and fundraising.

As defined in the BOAI open access can be delivered in two ways: through the open-access journals and the repositories. The latter are divided into two categories: disciplinary, which hosts articles in a specific field of interest, and institutional (Pinfield, 2009). PubMed Central, the most popular subject repository in health sciences, is maintained by the United

States National Library of Medicine (NLM), and the National Institutes of Health (NIH). On the other hand, the institutional repositories are hosted in academic or research institutions and have a two-fold purpose: to host the scientific products created within the institution and to operate as a medium for the preservation of this material. Neither of these repositories conducts peer review and they can host both refereed and non-refereed content (Suber, 2004a). Stevan Harnad and Paul Ginsparg, the two preeminent supporters of repositories and self-depositing, were the first to introduce the term "self-archiving" (Pinfield, 2004) to describe the activity whereby an author deposits an e-print, which is either a preprint (unrefereed manuscript) or a postprint (refereed manuscript) copy, in an open-access archive or repository (Swan, 2005; Suber, 2004b).

The crisis in the scholarly communication system (Chan, 2004; Case, 2002; Guédon, 2003; Okerson, 1989) resulted in an organized effort from the BOAI that stated that open access should be delivered not only through the repositories, but also through the open-access journals (Suber, 2004a). At the time BOAI was signed, its funders had already recognized that the open-access journals would upgrade the level of access to information. As a result, the Soros Foundation donated to BOAI a three-million-dollar grant to initiate the development of repositories and the foundation of prestigious open-access journals. At the same time, the Public Library of Science (PLoS) received a nine-million-dollar grant from the Gordon and Betty Moore Foundation for the same purpose (Anderson, 2004). Some open-access journals existed almost ten to fifteen years before the BOAI (Early OA journals, 2010), but individuals had founded them, and they were operating under limited budgets (Björk, 2004). The grant donated to PLoS aimed to increase the public awareness of the open-access journals, assist the development of prestigious open-access journals from distinguished publishers and institutions,

and hasten the progress and influence on the future of scientific journals and scholarly communication.

The purpose of the open-access journals is to offer prestigious scientific resources to libraries and users in various disciplines. In an effort to ensure quality control, the standards for open-access journals are consistent with those for peer review. Another factor that makes the open-access journals possible is the authors' willingness to submit their articles without requesting any royalties and the referees' desire to provide peer-review and editorial services to these journals for free (Suber, 2004a).

The open-access journals are digital and it is the Internet that made their development possible (Peek & Pomerantz, 1998). The migration of the academic journal from paper to digital form has not eliminated its main production costs, such as peer review, editorial services or typesetting, but shipping and storing costs do not apply anymore (Oppenheim, 2008). Since these production expenses remain for electronic journals, the open-access journals face publication expenses too. In recognition of these expenditures, the open-access journals attempt to find alternative means to cover the costs and remove them from the end user. For this reason, many different open-access journal business models have been developed and new models are constantly being tested (OA journal business models, 2010). The most controversial of the existing business models is the model that charges publication costs, a fee imposed by the publisher before the publication of the article (Björk, 2004). Opponents of this model, such as some toll-access publishers, argue that such a system will diminish the quality of scholarly communication, assuming that the publishers will print any article as long as the fee is covered, a belief that has not been proved so far (Oppenheim, 2008).

A paper by Laakso et al. (2011) discovered rapid growth in the development of the open-access journals during the period 1993-2009. The open-access journal continues to be considered a successful and trustworthy means of publishing scientific literature. During the investigated period, the development of the open-access journals can be divided into three stages. During the first stage, the Pioneering years (1993-1999), the open-access journals started their development and had their first supporters. The next period was the Innovation years (2000- 2004), during which the open-access journals were progressively expanding their impact and sustainability in the publishing world. In the last period, the Consolidation years (2005-2009), there was a rapid increase in the number of open-access articles, with the Directory of Open Access Journals (DOAJ) serving as the principal interface for searching open-access journals.

Chapter 2

Literature Review

Throughout scholarly communication history monographs and periodicals have been used to inform scholars about the advancement of sciences (Peek & Newby, 1996). The state and usefulness of these forms of scholarly communication were scrutinized for many decades, with a focus on journal publications and the way they function. Guédon (2003) defines the subscription journals run by for-profit publishers as "core journals." These core journals are indexed in the Thomson Reuters Web of Knowledge^{SM} (formerly ISI Web of Knowledge), where their impact factor is measured. Examples of such core journals are *Cell*, *Nature* and *Science.* When the journals reach the desirable impact factor in their field, they enter into the "core" category, a landmark that allows publishers to treat the journal as a high-profit venture. Although scientists have always been proud of their intellectual integrity and non-profit commitment to the public good, the "core journals" work in the reverse way, creating economic discrimination among readers (Yamey, 2008). When the PLoS journals were indexed in the Web of Knowledge^{SM} database their impact factor was high, competing with the traditional toll-access journals.

A journal develops a successful publication when the authors' publishing motives, such as high exposure of published articles, future promotion, solid peer-review and publication speed, are in accordance with the journal's established quality characteristics (Swan, 1999). The development of the open-access journals presupposes that, first, the authors are aware of their existence and, secondly, they choose to publish their manuscripts in them because their publishing demands are met by the journals' characteristics. The NIH-funded participants published in the PLoS journals before and after the mandatory character of the policy. Although the motives may not have been the same for both groups, these journals had acquired a level of

acceptability by the researchers' standards, and they had managed to develop a "core" status without charging a subscription fee to the readers and by providing their content free-of-cost to everyone.

Authors' awareness towards open-access journals

When authors examine the journals in which they will publish their articles, they have the option to choose from two main categories of journals: the open-access journals, which are distributed free of cost over the Internet (Suber, 2010a), and the traditional toll-access journals, which require a subscription cost. The latter have a longer tradition, since the first journals were published in 1665 (Peek, 1996) and some of them have managed to establish a high quality and reputation. Anderson (2004) compares the prestige of *Nature*, a journal that has existed for almost 150 years, and the PLoS journals, which have been established the past ten years, and he stresses that *Nature*, apart from its long history, is also greatly valued over PLoS due to the fact that it is in print, implying that readers are dubious when it comes to online publications, because of their skepticism over the quality of the information appearing on the Internet. Nicholas et al. (2005) also discovered similar authors' considerations about the online-only version of journals. Their data indicate that authors trust the information found in print versions more than in the electronic formats, and they are advised by colleagues and promotion committees not to choose the electronic-only journals to publish their research papers.

Studies conducted from the authors' perspectives on upcoming publishing production indicate that their level of awareness concerning open-access was relatively low (32%) (Rowlands, Nicholas, Huntingdon, 2004). In a comparative longitudinal study, Rowlands and Nicholas (2005) surveyed a new population sample of authors every twelve months for two consecutive years (2004-2005). For both years, these authors had to answer the same questions

indicating their familiarity with open-access. From the results it was discovered that, within a year, the number of authors who knew “a lot ” about open-access increased by 10%, while the number of authors who knew “nothing” decreased by 15%. In total, only the 30% of the authors consider themselves to be “extensively” or “less extensively” familiar with open access and the remaining participants either knew “little” about it or “nothing at all”. Generally, one out of ten authors had published in open-access journals, but more authors would have chosen to publish in them if they had been aware of their existence (Nicholas & Rowlands, 2005).

Swan and Brown (2004) surveyed researchers from a wide variety of fields, who published in toll-access journals and in open-access journals. All the authors from the second category were aware of open access, and more than half of the participants who had published in toll-access journals (60%) were familiar with the term open-access. What the results do not clarify is the exact level of awareness the participants had concerning open access. When authors who had published in open-access journals were asked to provide a time period when they were aware of open access, the most popular answer was for about two years (37%), with the second most popular being three years (34%). Only one-fifth of the authors were familiar with open access for more than three years, and only a tenth of them were familiar with the movement for less than a year. Of the authors who had not published using open-access, 26% were familiar with the open-access movement for two years and a little less than that (19%) were familiar with it in less than a year. The percentage of the authors who were familiar with open access for three years or more totaled 17%. The majority of the authors who were familiar with open access for two or three years were in the life sciences and health sciences fields. When authors were asked how many open-access journals they knew in their field, the majority stated one to three (38%). This indicates that one of the reasons authors who are familiar with the concept of open-access

may not be offering their articles open-access is because they are not familiar with open-access journal titles ("JISC/OSI journal authors survey", 2004).

The open-access publisher InTech investigated used an online survey and phone interviews to investigate the publication habits of open-access supporters (Kenneway, 2011). According to the results, the majority of the respondents (75%) indicated that the open availability of the articles is an important factor, supporting the belief that it upgrades access to information and has an impact on the wider distribution of the article. Authors raised concerns about publication fees, which to them are an essential component of the sustainability of the open-access journals, because if the cost is not affordable, then they will refrain from publishing in them. Although the authors trust the journal quality of the traditional toll-access journals, they commented that some of the open-access journals in which they have published, such as Hindawi, PLoS and BioMed Central, have demonstrated similar quality indicators.

Concerning the open-access awareness of the health sciences authors, Over et al. (2005) found that in life sciences and biology almost half of the respondents were aware of open access, which was the largest percentage of awareness compared to the other subject fields. Hess et al. (2007) discovered that, "within Information Systems, Medical Science and 'Others', between 90% and 91% of the respondents stated they have a positive or a very positive attitude" (p.5) toward open-access. Although this is a substantial percentage, only 23% of the respondents indicated that they had published using an open-access medium. Again, there is a pattern in which authors are in favor of the principle of free access to information and the open-access journals, but they do not publish in them as often as it would have been expected.

Schroter, Tite & Smith (2005) conducted semi-structured interviews with health sciences authors who had published in the British Medical Journal (BMJ). Almost 85% of the respondents

were aware of the term “open-access”, although some had the misunderstanding that the open-access journals do not perform peer-review and that this publishing model would cause uncontrolled dissemination of low quality papers over the Internet. Nonetheless, authors were able to describe benefits related to the open-access availability of their articles, such as ease of article retrieval, speed of article dissemination and decrease in subscription and interlibrary loan costs.

The authors’ awareness of the existing open-access initiatives and their propositions are also limited. When researchers listed open-access initiatives and attempted to rate the authors’ familiarity with them, they discovered that the authors did not know a lot about them. Among the responses, the most widely known initiatives are the Berlin Declaration and the Public Library of Science (PLoS) (Over et al., 2005). Apart from the Berlin declaration there are other initiatives that established the open-access movement (Bailey, 2006), but this research did not provide a commentary on why the authors were more aware of the PLoS declaration, which is not an initiative that established the movement. One possible interpretation could be the fact that PLoS established a series of widely read journals, and the participants heard about the initiative because of their knowledge about the journals.

Xia (2010) used statistical methods to compare the level of the authors’ awareness of open-access during 1990 to 2008. The results indicate that the gap in awareness closed and lately authors have become more aware of open access. Although the awareness rate for the years closer to 1990 was only 50%, for the years approaching 2008 this percentage dropped to only 15%. What is not known is the exact level of the authors’ awareness, but the data imply that more authors are aware of open access. Although this awareness has increased, the number of authors published in open-access journals has not increased at the same rate. Even though

authors are familiar with open-access and they agree with the premise of providing free access to information, in practice they do not publish widely in open-access journals.

Characteristics of the open-access journals

Nicholas, Huntington and Rowlands, prominent investigators of authors' publication preferences, surveyed 4,000 authors and asked them to describe open-access journals' characteristics. According to their responses, these journals offer their content for free, carry high quality articles and are distinguished for their indexing services. Approximately two thirds of the participants consider them to be inadequately indexed, but "the idea that OA publication was linked to ephemeral publishing was rejected" (p.507), and the authors disagreed with the statement that publishing in open-access journals impedes their career progress (Nicholas, Huntington, Rowlands, 2005).

Morris and Thorn (2009) discovered that some of their participants, who were members of the learned societies of the BioSciences Federation, had a clear idea of the open-access journals features, while others expressed more complicated answers believing that they operate under vague policies. Although the majority of the authors responded that the open-access journals are the ones that offer articles free of cost to their readership, the rest indicated that they only offer their electronic articles toll-free, implying that the journal itself is not free of cost. Almost 15% of the respondents concluded that these journals charge a publication fee and a small percentage (8%) indicated that these journals offer their articles free of cost only to their authors. The authors' fuzzy idea of the open-access journals' characteristics was obvious in another section in the research, when the authors were asked to name the open-access journals they have been reading. Although two thirds of the respondents answered that they read open-

access journals, in reality one third of them did not, since the journal titles they named were not open-access journals. From the list of the eight most highly read open-access journals mentioned by authors, five of them were PLoS journals, with three of them (*PLoS Biology*, *PLoS Medicine*, *PLoS ONE*) ranking in the first three places.

Dallmeier-Tiessen et al. (2010) conducted a larger study involving open access delivered by journals so far (N=40,000) and identified the facts that authors across a variety of disciplines believe about open-access publications. In this research the ratings for both self-archiving and open-access articles are merged. The majority of the authors believe that the open-access publications offer research produced with public assets for free. In this research it was discovered that the open-access papers are cited more frequently than the toll-access ones, which was not the case almost five years ago. Half of the respondents reported that the open-access publications offer high quality research, while less than 20% believed the opposite. This research proved that the online-only open-access publications are not negatively perceived by authors and that the solely electronic versions do not necessarily indicate low quality in publications.

Motivations and factors concerning where authors choose to publish

There are many motivations behind scholars' decisions to publish their research articles. They want to disseminate their findings to their colleagues; they anticipate that a quality publication will enable them to gain a promotion; and they aim to increase their prestige. Concerning monetary motivations, a small percentage of authors expects to receive a straightforward personal payment for their publications, but many of them believe that their previous publications will positively influence prospective funders to grant them resources for future research (Swan, 1999).

In an attempt to clarify which factors authors have in mind when they choose where to publish their articles, both for open-access and toll-access journals, various research projects have been implemented. The results revealed that there are many factors which repeatedly appear in all the research findings, though not all of them rank in the same position in every research study. In general, though, the main factors are the journal's reputation, its impact factor, the publication speed, the prestige of the editorial board, the readership it engages and the abstracting and indexing services. In addition, authors are interested in the journals' licensing terms, such as the pre-print or post-print self-archiving permissions. For the open-access supporters the copyright retention is also a decision-making factor (Rowlands & Nicholas, 2005; Rowlands, Nicholas & Huntington, 2004; Swan, 1999; Warlick & Vaughan, 2007).

Why authors choose to publish in open-access journals

Swan and Brown (2004) discovered that the most popular (92%) reason behind the authors' decision to publish open access is the "principle of free access for all readers" (p.220). The results of this study also support the Morris and Thorn (2009) results, in which a great number of authors indicated that the open-access journals have a greater publication speed and that they also attract a wider readership. These authors characterize the publication speed of the open-access journals as fast and their content as prestigious. Warlick (2006), who interviewed the biomedical faculty at the University of North Carolina at Chapel Hill, presented results, that supported the fact that the open-access journals are being published at a quick pace and that they have gained a quality reputation.

The principle of providing research articles open access dominates the authors' answers. In the JISC (2004) study, when authors were asked if they would still have submitted their article

to the same journal, even if it was not open-access, almost half of the authors (46%) answered that they would not have published in the same journal, while 31% indicated that they did not know whether they would have published in the same journal. The rest replied that they would have published in the same journal, even if it was not open access. These percentages indicate that the open-access movement has gained followers who believe in the premise of providing open-access to scientific knowledge and who would be willing to support their beliefs by offering their articles openly accessible to all. Xia (2010) discovered that in all cases authors choose to publish in open-access journals because they believe in the free availability of the articles and that the articles will reach a wide readership.

In the SOAP study (Dallmeier-Tiessen et al., 2010) authors indicated that publishing in open-access journals is advantageous. They support this position by stating that the articles' open availability contributes to the immediate dissemination of the research findings among scholarly communities and that it is a cost-effective means of disseminating research results both for individual users and for institutions and libraries. The open-access supporters express agreement with the principle that knowledge is and ought to be public, which is an advantage to those who cannot afford the expense of purchasing a subscription to the journals. Furthermore, when authors choose the open-access route, they believe that it benefits their careers, because their work becomes more widely disseminated and accessible and, in general, their research gains wider recognition.

Similar results were found in the Warlick & Vaughan (2011) research, where biomedical faculty members from the University of North Carolina Chapel Hill and Duke University were interviewed. An added advantage of open-access publishing is the authors' retention of copyrights, which appears to be a motivation for them to provide their articles open access. Some

participants in the survey mentioned that they infringed on the publisher's copyright in the past, while others, although they did not state it explicitly, implied that they had broken the journals' licensing agreement terms.

In the study by Nariani & Fernandez (2011) the authors who had published with PLoS, Hindawi and BMC, the three major open-access publishers, were interviewed. According to the results, they chose to publish in specific open-access journals because "they had read articles in these journals or recognized familiar names on the editorial board" (p.7). Again, an important factor is the journal's reputation, which is composed of elements such as the journal's high impact factor, readership, speed of publication and the journal's indexing services.

Why authors choose not to publish in open-access journals

Research has also been conducted to clarify the reasons that drive authors away from publishing in open-access journals. Nicholas, Huntington, and Rowlands (2004) discovered that authors do not choose to publish in these journals because they consider that their articles do not gain adequate exposure to readers, are not highly cited and the publishing process is not fast ("JISC/OSI journal authors survey", 2004). What is interesting is that these negative comments from the open-access journals' opponents are the main positive factors that the open-access supporters believe make their publications advantageous. Swan and Brown (2004), in a research study published simultaneously with the previously mentioned study, discovered that the main reason authors do not publish in open-access journals is because they are not aware of them, since almost half of the respondents replied that they could not identify an open-access journal in their field. In addition, these authors consider that the open-access journals that are relevant to their research topic have little impact in the research community. The lack of familiarity with

open-access journals with high prestige and high impact factor also appears in the Warlick (2006) research results. Xia (2010) discovered that through the past ten years, authors did not publish in open-access journals because they were not familiar with them, though currently there is an increase in the level of their knowledge concerning the availability of open-access journal titles.

Publishing costs were investigated in the Dallmeier- Tiessen et al. (2010) research. The results revealed that the publication fee is the number one factor that prevents authors from submitting their work to open-access journals. The second factor is the journal quality, the third is the ease with which the article can be retrieved if searched, and fourth is the fact that authors are not aware of the open-access journals in their fields. For the first time, the authors' publishing habits were addressed as an important element that shapes publishing decisions. It was discovered that since the toll-access journals have a longer publishing tradition than the open-access ones, the authors' would choose toll-access journals due to their publishing habits. Very similar were the results from Warlick and Vaughan (2007). The cost of publication is again the most popular disincentive, and the low prestige of the journals appears to be the second most significant factor. The decreased impact factor of the open-access articles and the concerns for career advancement are listed as the fourth and fifth factors, respectively.

Research from both Morris and Thorn (2009) and Hess et al. (2007) discovered that authors consider the open-access publications to have low prestige and to negatively affect promotion and tenure. Hurrell and Meijer-Kline (2011), while examining the existing literature on author's publication preferences in relation to considerations of promotion and tenure concluded that researchers believe that their careers can be negatively influenced when they publish in open-access publications and positively when they choose the traditional publishing

format of toll-access journals. There is an impression that the latter have established better quality controls and an empowered peer-review system, which are requirements that the open-access journals seem to be missing.

Publication expenses and funding

One of the more controversial issues related to the open-access journals is the publications' expenditures and there are a couple of reasons that make this matter disputable. First, this business model has been established relatively recently and authors often misinterpret the way it works. More often authors believe that they will have to personally cover the expenses in order to publish their articles in an open-access journal. When Rowlands, Nicholas and Huntington (2004) asked their participants how much money they would be willing to pay to publish their article open access, they discovered that half of the respondents "would not accept this business model under any circumstances" (p.27). As a solution to the publication fees, Anderson (2004) suggests that authors limit themselves to self-archiving and not to publish in the open-access journals.

Even though there is the belief that all the open-access journals require publication fees, this is not always the case. Research studies revealed that there is an extensive number of open-access journals that do not charge this fee. Suber and Sutton (2007) examined both full open-access and hybrid journals from around the world and discovered that from the total number of 523 journals, only 17% charge publication fees. In 2006, Hooker (2007), examined the journals listed in the Directory of Open Access Journals (DOAJ) and found that 67% of them do not impose any author charges, while two years later, according to Shieber (2009), this percentage

was almost 71%. Morrison (2008) examined the open-access journals in the field of psychology and concluded that only a small number of them (10%) charge a publication fee.

When the publication expenses were examined from the authors' point of view, Swan & Brown (2004) showed that approximately 40% of the authors were not asked to meet such an expense and even when this charge existed it was waived for almost 20% of them due to the author's absence of funding that supported the research. Only 4% of the authors covered this expense using personal money, while the rest used resources derived either from their research grants or departmental and institutional grants. Similarly, the SOAP study (Dallmeier- Tiessen et al., 2010) discovered that half of the participants did not have to cover any expenses at all, and that almost one third of the ones who had this responsibility managed to cover it using resources from the research fund that was allocated for this purpose. A little more than 10% had to cover the expense themselves, while the rest of the authors had this amount covered either by their institution or their research funds.

It seems that in the past five to seven years, authors had a less clear idea about the costs related to publishing in the open-access journals. The reason could be that the newly created open-access journal model created a general distrust about this modern system of scholarly communication. Fry et al. (2011) discovered that authors in the health sciences associate publishing in open-access journals with a publishing fee. This can be explained by the fact that the PLoS journals, which are the most widely known open-access journals in the field, have publishing charges. On the other hand, although in the open-access initiatives it was discovered that the funding organizations would cover this expense, explaining that it is part of their responsibility to promote publishing in open-access journals, funding agencies' mandates were not as popular. In recent years, though, this situation has improved. As the SOAP study reveals,

although the number of authors who were self-financed did not decrease dramatically, for almost one third of the authors, a budget that covers publication expenses was established either by the funding institution or the academic institution with which the authors are affiliated. Depending on the journal, these expenses range in cost. A little less than half of the time when such an expense had to be covered, the mean amount of money spent was between $700-$1350. The lower scale fee started at $250 with the larger ranging from $1350 to $4100, but the authors rarely paid the last amount. Those who did were mainly in the fields of biological sciences, health sciences and earth sciences.

The publication charges not only apply for the open-access journals, but also for some of the toll-access ones that do not cover the expenses related to the articles. Morris and Thorn (2009) discovered that the amount of money authors have paid for publication charges was approximately the same for both the open-access and non-open-access journals. For the toll-access journals the authors who stated that they "sometimes" paid publication expenses was 42.03%, while for the open-access journals this percentage was only 12%. For the toll-access journals, 9.31% indicated that they "always" pay a publication fee, while for open-access journals this percentage was only 7.99%. When authors were asked how easy it was for them to obtain funding for their publication expenses, approximately 38% indicated that it was either "easy" or "fairly easy", while 43% said that it was either "difficult" or "very difficult". The information this research fails to provide is the reason that authors considered the process to be difficult.

Over (2005) found that 43% of the participants had to cover a publication expense and from this percentage 80% were authors in life sciences. The same article discovered that, in general, the number of authors who had to cover publication expenses for the open-access and

toll-access journals was approximately the same. What is also interesting in the findings is that the amount of money the toll-access journals asked authors to cover, when compared to the open-access journals, was roughly the same, even though the toll-access journals charge an additional subscription fee to the end user. When the authors were asked who they personally believe should be required to cover this expense, their first response was that it is the responsibility of the funding institution (71.5%); the second most popular answer was the institution with which they are affiliated (39.4%) and the third response was that the publication fee should be derived from the research grant (9%).

Peer-review

The quality of the peer-review process is an essential component that defines a publication as trustworthy and unambiguous. Nicholas et al. (2005) discovered that the vast majority of the authors consider the peer-review process to be an extremely important aspect that adds value to the journals. In general, authors expressed dissatisfaction with the peer-review process, addressing issues such as delays in the review process, lack of the reviewer's in depth attention or inadequate criteria for the articles' evaluation. Some others have argued that the reviewers have gained control over the' authors' careers, especially the ones who have a long tradition in reviewing.

Research results from authors originating from countries that do not dominate in the field of scholarly communication, such as South America, Eastern Europe and Africa, considered that there is an inequity in the peer-review treatment between their papers and the ones submitted from researchers originating from developed countries. This dissatisfaction may be one of the reasons that these countries are more aware of open-access and open-access journals than the

more developed countries. Another comment presented in the Nicholas et al. (2005) research was that research articles that do not present positive results have a tendency to be rejected, causing a false impression about the established theories that dominate in some research fields. Many authors also suggested that a blind peer-review system should exist not only for the referees, but also for the authors, as it is believed that some of the senior authors, who managed to create a reputable name in the past, are published more easily than the younger researchers.

Concerning the components of the peer-review process, authors indicated that the most important aspect for them as readers is to find articles that have been peer-reviewed. As an extra factor, authors want remarks from other colleagues after the article's publication, a practice that PLoS follows in its journals. Swan & Brown (2004) discovered that authors consider the quality of the peer-review comments in both the open-access and the toll-access journals to be similar, while a small number (13%) mentioned that the comments they received from open-access journals were greater in quantity; almost seven out of one hundred responses considered that there were fewer comments. Concerning the open-access journals peer-review process, a JISC report indicated that half of the respondents were "satisfied" with the peer-review process, and a little less than that percentage (45%) were "extremely satisfied". Only 5% of the responses showed "dissatisfaction" and none of the respondents were "extremely dissatisfied" ("JISC/OSI journal authors survey", 2004).

The Public Library of Science (PLoS) journals

Authors' preferences towards PLoS journals

The articles' open-access availability in relation to the liberal license terms ensures services for the users that the for-profit commercial journals fail to provide. The two previously

mentioned factors, open-access availability and CC-BY license, indicate that the PLoS's purpose is not to treat the published articles as profitable resources that would increase the journals' revenue, a characteristic of the journals originating from commercial publishers. By contrast, the popular and widely requested goal of the PLoS editors is to offer articles to the public, adding to the general movement of free-access to information with limited copyright restrictions and adding to the faster development and dissemination of the scholarly communication. For example, in a similar vein, mandates, such as the NIH public-access policy and others coming from various funding agencies around the world, demand public access to the scientific results they have funded through self-archiving (Sedwick, 2005). From the authors' point of view, Swan & Brown (2004) discovered that the authors' choice to publish in open-access journals stems from their willingness to offer their articles free of cost to anyone.

This public access is one of the factors that have enabled the PLoS journals to compete in such a short period of time with traditional commercial journals with a longer history (Tschider, 2006). Authors, who support the idea of openness to their research results, have chosen to publish their papers in one of the PLoS journals and have influenced others to act similarly. In an interview (Pharmboy, 2008, §17) Dr. Chris Patil states that he was introduced to PLoS and the idea of openness from his supervisor and other colleagues around the campus, who encouraged him to submit his article to one of the PLoS journals. In addition, for him the PLoS alternative model sounded like a good idea because "[he] had substantial objections to the business practices of certain large for-profit corporate entities in the science publishing field, and [he] knew [he] didn't want to be part of that system [anymore]".

PLoS fulfills the authors' needs concerning both the article production and the audience it reaches, two factors that determine a journal's quality (Dallmeier- Tiessen, 2010; Swan &

Brown, 2004; Warlick, 2006). Doctor Seyed Hasnain, Vice-Chancellor at the University of Hederabad in India, has published approximately six articles in PLoS, which currently makes him one of the most published authors in *PLoS ONE*. Doctor Hansnain insists on publishing with *PLoS ONE* because "…this journal, part of the prestigious PLoS family, transcends disciplines… Our work is of wide interest, therefore publishing in such a journal will attract a wider readership" (Zivkovic, 2009, §4). Dario Ringach from the University of California- Los Angeles states that, "it provided a venue in which to publish a controversial theory… PLoS would make these ideas widely accessible and also provid a forum for discussion" ("Interview with a PLoS ONE author", 2008, §4). Brian Fisher, of the California Academy of Sciences, highlighted the fact that, "by publishing in PLoS I have [put] biodiversity knowledge into the hands of interested participants everywhere" (Hawxhurst, 2009). These positive comments concerning the audience PLoS reaches are also followed with positive feedback about PLoS's immediacy of publication and editorial board — essential components for authors when they to choose a journal in which to publish their articles (Brown & Sherridan, 2004; Pharmboy, 2008; Warlick, 2006).

Studies prove that based on the authors' comments, in general, the most important components that indicate journal quality are the speed of publication, the journal's overall prestige and audience, the topic it covers and the colleagues' suggestions supporting or disapproving of a journal (Frank, 1994; Mabe, 2003; Regazzi & Aytac, 2008). Open-access supporters add another factor, which is the open-access availability of the articles. This ensures the benefit of providing access, not only to the scientific community, but also to anyone around the world, and also ensures the wide visibility of the articles (Brown & Sherridan, 2004; Dallmeier- Tiessen et al., 2011; Warlick, 2006).

In another comprehensive study, Schonfeld and Housewright (2010) discovered that between the years 2003 to 2009 the authors' decision about the journal in which they will publish their manuscripts is most affected by the journal's readership. For these authors the open-access availability does not seem to be an essential component, especially the last years (2006-2009). Although previous research indicates that the open accessibility of the articles increases their citation impact (Brody, 2004; Hajjen, Harnad & Gingras, 2005; Harnad and Brody, 2004), this research also concludes that the authors, even though they realize the need for change in the scholarly communication system, fail to act toward a change, and focus mostly on publishing in the venues approved by the committees of tenure and promotion.

In 2010, for a second consecutive year, the PLoS publishing house surveyed both accepted and non-accepted authors from all of its journals to estimate their satisfaction and to compare the results. Based on the findings, while in 2009 authors would discover the PLoS journals from their colleagues' recommendations, in 2010 authors indicated that they became familiar with PLoS because they had been reading PLoS articles. This change is due to the journals' growing number of published articles and the increase of their distribution. When authors were asked the reasons they chose to publish in PLoS during 2009 and 2010, the most popular answers were the publication speed, the peer-review process, its open accessibility, the journals' impact factor and the quality of the journal. In 2010, more authors considered the PLoS journals to be their first publication preference and they were willing to submit again to PLoS in the future, while almost half of the participants had published in PLoS more than once, a decision that stems from their satisfaction with the journals' high quality and positive publishing circumstances ("PLoS Author Research 2010", 2011).

PLoS journals prestige

The Thomson Reuters Web of Knowledge[SM] (formerly ISI Web of Knowledge), a database that indexes highly cited journals' articles, uses the following criteria when measuring journals: "citation data, journal standards and expert judgment" (Garlfield, 1990, p.185). For newly established journals, additional guidelines are taken into consideration. Each journal is required to meet its deadlines in the publishing periodicity; and the editors, editorial board members and the sponsoring society determine the journal's reputation, while the articles that appear in the journal, the concrete instructions by the editors, and the high-level experts who conduct the peer-review process add influential factors for the journal's positive evaluation (Garlfield, 1990).

The measurement of a journal's impact factor by Thomson Reuters has a long tradition. Although this database covers only a relatively small number of open-access journals, — approximately 4% due to their short period of existence (Mallikarjun, 2009) — the impact factors of the PLoS journals are indexed. Although the PLoS journals are relatively new in the publishing world, they have been receiving outstanding impact factors (Atsuko, 2006; Tschider, 2006).

In the Thomson Reuters archive, the impact factor of the first PLoS measured journal, *PLoS Biology*, dates back to 2004 where the journal's first impact factor was 13.868, placing it firmly in the first position among the journals in the subject category of biology. The journal presents the highest impact factor every year, and the past five years its factor, when compared to the second place ranked journal, was almost twice as high. Similarly, *PLoS Pathology*, since it first entered the Thomson Reuters list, has held the first position too. *PLoS Medicine*, during the time period 2005 to 2009, moves between the fifth and seventh position. *PLoS Genetics* was in

the tenth position both in 2008 and 2009 among the other journals in its field. Similarly, the impact factor of *PLoS ONE* for 2009 was classified tenth. The greatest change occurred with the journal *PLoS Computational Biology*. When it entered the list (2005), it held the 52nd position, but after only after a year it climbed to the eighth position and in 2009 it appeared in the seventh position.

For PLoS it was important to be able to indicate the impact of its articles rather than the journals as a whole, and for that reason a new metric system was created. This new non-proprietary system provides detailed data on the measurement of the articles' influence. The article level metrics, which provide partial data for the article usage statistics, were created in 2009 to count each article's usage, contrasting this method with the impact factor, which counts the journals' influence as a whole ("PLoS Author Research 2010", 2011). PLoS supports the idea that it is more beneficial for the readers to be able to determine how many times scholars have used a specific article, rather than have an understanding of the impact of the whole journal, which is extracted from only a small number of highly cited articles. The data for this metric system is generated from a variety of components, such as citations, online usage data, social bookmarks, comments, notes and blog posts about an article. When readers attempt to evaluate the usage of the PLoS articles, they have to take into consideration all these quality factors ("Article Level Metrics, 2009"; "PLoS ONE: Accelerating").

In the world of scholarly communication, the journal impact factor (JIF) is used as a quantitative standard to describe the frequency a journal is being cited. Based on their impact factor, all PLoS journals are classified within the top ten journals, with some of them holding a steady first position in the subject categories of medicine, biology, genetics, parasitology and biochemical research. According to Suber (2010) although the JIF provides only the counts for a

journal's published articles divided by the number of the citable items, it has falsely been equated with the journal quality. An article's quality, or a journal's as a whole, should not be estimated based on the journal's impact factor and there should not be confusion between these two. Instead, each one of them should count independently. Currently, the journals' impact factor alone is the most important criterion for the evaluation of the candidates' published work from committees of promotion and tenure, and authors make efforts to publish as many articles as possible in these journals. This behavior is explained mainly due to the false impression that every journal with a high impact factor also has high quality articles and that journals with lower impact factors fail to publish such superior articles.

A journal gains quality from the accomplishments of the published authors, the editorial board and the referees. Another factor that characterizes highly influential journals is prestige. A journal is considered a prestigious publication only when the community of published authors who get published in this journal and its readers distinguish it as such. Suber (2010) indicates that in some cases "quality feeds prestige" and vice versa; a highly prestigious journal receives more article proposals and has a large number of subscribers and readers, factors adding to the journals' quality. This type of quality, in turn, is the superiority the audience expects from the journal knowing that it will continue to publish outstanding articles and maintain its prestige. For relatively newly established journals, quality and prestige are not synonymous. Although they may have managed to gain some degree of quality, these journals, due to their short lives, cannot be called prestigious publications until such time as they establish themselves.

Currently the PLoS journals hold a steady position in the Thomson Reuter impact factor list. The number of articles published each year is increasing and the coverage of their publications has a wide range of subject fields that attracts authors from various disciplines

(Zivkovic, 2009). In addition, these journals had an increasing number of both first time authors and returning authors, and they are being highly recommended in conversations among scientists (Pharmboy, 2008). In general, the authors have a high level of satisfaction with the journals' peer-review process, the author feedback and the total production of the articles, and these are all elements that define a quality publication that increasingly gains a level of prestige ("PLoS author research, 2010", 2011). The PLoS journals have demonstrated that even though open-access journals have existed for a relatively short time, they have managed to compete with the toll-access journals and to brand themselves as such. The open-access availability, in combination with the journals' quality and growing prestige, proves the importance of the PLoS journals for the communication of experts, the exchange of information, and for the benefit of the community in need of this information, such as students, academic libraries and the general public, since highly cited articles can be disseminated without any copyright restrictions and fee barriers.

The NIH public-access policy

Brief policy history

Every year the National Institutes of Health (NIH) fund approximately $32 billion of health science research ("NIH budget requests," 2010) and provide almost $10 million for publishing costs. In 2004, the U.S. House Appropriations Committee concluded that, since the NIH uses public money to fund a large part of research every year, this research must become available to anyone who needs it, also serving the taxpayers' right to obtain the research results they have funded (Zerhouni, 2004; Peek, 2004).

The Appropriations Committee introduced a plan for the NIH to improve access to research

results and initiate cooperation for research among Americans and international health care investigators, adding to the advancement of the health level of the citizens of the United States. At this point, the U.S. House Appropriations Committee added fundamental rules that the NIH would have to include in the funding contract with its awardees. The basic direction was that NIH-funded research should become available free of cost via the National Medical Library's (NLM) repository PubMed Central (PMC), no later than six months after the original day of publication (Suber, 2004c; Quint, 2004; Peek, 2004).

On November 15th, 2005, the Public Access Working Group (PAWG), an advisory body for the NIH public policy, realized that the compliance rate was extremely low — only 3.8% (Kaiser, 2006; Kroth, Aspinall & Philips, 2006; "NIH Public Access," 2006; Suber, 2006a; Peek, 2006; English & Joseph, 2008) — and expressed their intention to make the policy robust, by changing its voluntary character into a mandatory one (Suber, 2005; Suber, 2006- March). The main incentive behind that proposal was initiated by two interest groups: the Alliance for Taxpayers Access (ATA) and the Scholarly Publishing and the Academic Resources Coalition (SPARC) (Suber, 2005; English & Joseph, 2008).

On July 19th, 2007 the Appropriations Committees approved the policy as mandatory, asking for immediate submission to PMC, delaying open access, and extending the embargo period to twelve months. At this point the policy was under an annual renewal. The submitted manuscript is the author's final peer-reviewed version, a term conforming to the copyright law, since a publisher retains the rights only of the published manuscript (Suber, 2007a). Under these conditions, on October 23rd, 2007 the Senate approved the policy (Suber, 2007b) and almost two months later President George W. Bush signed the spending bill, part of which included the

arrangement that the NIH must mandate open-access for its research results. The exact wording of the policy is:

> The Director of the National Institutes of Health shall require that all investigators funded by the NIH submit or have submitted for them to the National Library of Medicine's PubMed Central an electronic version of their final, peer-reviewed manuscripts upon acceptance for publication to be made publicly available no later than 12 months after the official date of publication: Provided, That the NIH shall implement the public access policy in a manner consistent with copyright law. ("National Institutes of Health," 2008, §1)

On March 12th, 2009, President Barak Obama signed the 2009 Consolidated Appropriations Act making the NIH public-access policy permanent, leaving aside the previous provision that was subject to annual renewal ("First U.S. Public," 2009). The final directive of the policy was that NIH-funded research should become available free of cost via the National Medical Library's (NLM) repository PubMed Central (PMC), no later than twelve months following the original day of publication.

PubMed Central was established in 1999 by the NIH Director, Dr. Harold Varmus, whose vision was to create a repository for health sciences manuscripts. From the moment the repository was founded it was united with PubMed, the citations database, implementing full searching services for researchers, publishers and the general public (Pope, 2001). PubMed Central was chosen to serve as the main repository for the NIH-funded research because it preserves the medical literature for 150 years and has a long history as an information retrieval database system in health sciences. As a result, the newly submitted articles would be described

with the same metadata structure and interoperability that would be established for the rest of the NIH databases (Zerhouni, 2004; Suber, 2004c; "National Institutes of Health", 2005).

Compliance requirements for authors

Compliance with the policy has three steps. First, the PIs have to understand the terms of the policy and second, they have to submit their articles to the NIH Manuscript Submission System (NIHMS) and receive a temporary identification number (NIHMSID#), which expires in ninety days. Within this time frame, the PIs have to proceed to the third step, which is confirming the submission process to finalize the deposit, and receiving a permanent PMC identification number (PMCID#). This whole procedure requires the PIs to use the NIH manuscript submission (NIHMS) database supported by the NIH (Joseph, 2008).

Copyrights

Compliance with the policy is ensured either when the principal investigators or someone else on their behalf, such as the publisher or an administrative assistant, submits (self-archives) into PMC the peer-reviewed version of their published article immediately upon publication, "provided, that the NIH shall implement the public access policy in a manner consistent with copyright law." ("Frequently Asked Questions", 2009, sec.218) The article will be provided at no cost through PubMed Central at the latest after a twelve-months embargo period, or sooner than that, if the publisher allows it. This condition is completely in accordance with the existing copyright law (Copyrights, 1976) according to which, an author is the copyright owner of his/her own tangible creations. Even with the first, voluntary, version of the NIH policy, it was requested that the PIs retain their copyrights to allow them to submit their published articles into

PubMed Central. Under this new system, the authors had to start screening and carefully sign their agreements in order to ensure compliance with the policy, while the publishers also made changes in their licensing contracts (Peek, 2008a).

What the NIH policy requests early in the funding process, through its contract with the PIs, is that they negotiate with the publishers and grant them only those rights they need to legally publish an article. As cited in the frequently asked questions of the NIH public-access policy Website "Authors, consistent with their employment arrangements, may assign these rights to journals (as is the current practice), subject to the limited right that must be retained by the funding recipient to post the works in accordance with the Policy, or the provision that the journal submits the works in accordance with the Policy on the author's behalf." ("Frequently Asked Questions", 2009, III, A. 1). When the PIs choose the journal that will submit their research results, they have to inform the publisher that their research was conducted under an NIH grant before they sign any licensing agreements. In cases where the publisher does not have any specific instructions for NIH-funded research in their licensing agreements, authors have to either search for another publisher or negotiate with them, by using an author addendum, a legal contract allowing the sustainability of the necessary rights for depositing to PubMed Central. According to Peter Suber (2008- October, § 23), by authors "retaining the key right", they serve a threefold purpose: (a) they do not commit to a completely restrictive agreement, (b) the article can be deposited to PMC and (c) they refrain from committing copyright infringement.

When the University of California at San Diego (UCSD) launched a strategy to provide information explaining the NIH-policy, there was an attempt to understand the difficulties authors face. As it was reported, one of the problems authors often face is how to discern if a publisher allows compliance with the policy and how they can communicate with the publishers

through the licensing agreements that the research was conducted using NIH-funds. Another confusing parameter in the process is whether the publisher will be submitting the manuscript to PubMed Central, or if the authors are responsible for implementing this step. For authors who often publish in more than one journal with divergent licensing agreements, these issues become even more frustrating as the component of transferring copyrights is added. In all these cases, if authors want to ensure compliance with the policy, they must thoroughly check the terms, and their language is often complicated (Stimson, 2009).

According to Banks & Persily (2010) research results, not all journals' licensing agreements are well structured and some prohibit authors from finding answers concerning compliance with the mandatory policy. In their research they described such examples, in which publishers' licensing agreements state that the authors must cover a publication fee to have their articles submitted to PubMed Central, giving them the false impression that this is the route they have to follow to comply with the policy. A similar example is noted by Peek (2008- August), where the American Psychological Association (APA) was charging authors $2,500 to have their articles submitted into PubMed Central.

The Banks & Persily (2010) research does not state how the authors manage their copyrights or to whom they address their questions. It could be hypothesized that the authors are accustomed to addressing copyright issues to their publishers, with whom they initially sign the article's licensing agreement, and not to the librarians, who have only recently begun to consult with the faculty and staff on scholarly communications issues, such as managing copyrights and assisting them with their publications. When the subjects were asked how the journals' licensing agreements affect their publication choices, half of the responders replied that their decision is

affected by the journal's open-access policies. The vast majority of the participants favor open access, recognizing the non-demanding access to information as an advantage.

Submission process

The submission process also seems to be perplexing. To begin with, authors often misunderstand the difference between the institutional repository PubMed Central and PubMed, which is the National Library of Medicine's (NLM) citations database. Even though both provide free-of-cost services, they clearly serve different purposes. Another component that frustrates authors is the procedure they have to follow to submit their articles to PMC using the NIH manuscript submission (NIHMS) tool, and the steps they have to take to finalize this process. There is a conflict in the literature on the submission tool, as it is generally considered to be a solid and easy to use tool (Peek, 2006; English & Joseph, 2008), though Stimson (2009) discovered that the PIs who have used it indicate that they are experiencing difficulties.

When the authors submit their manuscripts to PubMed Central, they usually seek help to track the identification number (PMCID#) that corresponds to their submitted paper, a unique number attached to every publication, which can be used to prove compliance with the policy. For example, the PIs have to use this number when they apply to the NIH for future funding or when they request renewal of funds in the progress reports and for some tracking this number can be frustrating and time-consuming. Fry et al. (2011) also discovered that the participants' perception was that "the deposit process was tedious, extremely time-consuming, and somehow discouraging" (p.51). According to the NIH ("Public Access Training"), the submission process lasts for ten minutes, and this time increases with the manuscript review before finalizing the posting. Nonetheless, when the PIs become familiar with the steps of the process, the time required for submission decreases.

Joseph (2008) suggests that repository managers can create a mechanized procedure, which the PIs can use to proceed to the PubMed Central submission through the system hosted in their affiliated institution. Harnad (2008) also described the same procedure, indicating its importance and usefulness especially in cases where the PIs are affiliated with institutions that have adopted a self-archiving policy as well. Under these circumstances, the NIH-funded PIs would have to perform the manuscript submission process twice: once in their affiliated institution repository and once in the PubMed Central. Since this practice cause a decreased submission rate, the institutional repositories must create a harvesting process that will automatically submit to PubMed Central.

Concerning the health sciences researchers' self-archiving practices, Fry et al. (2011) discovered that almost 82% of the participants had their manuscripts submitted to a subject repository, a finding indicating that the process of self-archiving is not only not well-known to the researchers, but that they are also not willing to take over this responsibility because they perceive that it is time consuming. Therefore, although a unified submission system, as suggested by Joseph (2008) and Harnad (2008), could increase the self-archiving rates, it is still unknown if the health sciences researchers would recognize the importance of self-archiving to the extent where they would spend their time to conduct the process themselves.

Assisting the NIH-funded PIs

Even though the NIH policy is a government decision, its relation to the libraries' goals is twofold. To begin with, it is the libraries' responsibility to provide access to information related to the policy, and since it is about access to peer-reviewed information, library science specialists should not only promote it, but also advocate in favor of similar existing or future policies

(Joseph, 2008). In addition, one of the academic libraries' missions is to facilitate the sharing of resources and information concerning policies to the institution's faculty, staff and students (Stimson, 2009). Since funding agencies' policies are a relatively new reality, this role can be complex and frustrating for the librarians, as the role of the libraries is not to decipher the policy, but to provide resources that would assist the NIH-funded authors to clarify the policy terms (Keener & Sarli, 2010). To overcome possible difficulties and gain an understanding of the terms of the policy, close long-term cooperation with the institution's legal department and the office that controls the institution's grants has to be initiated and maintained, to help clarify ambiguous terms and perplexing concepts in existing policies or to assist in developing future institutional policies in scholarly communication (Joseph, 2008; Keener & Sarli, 2010).

There is limited current bibliography presenting such projects, and it is unknown if indeed libraries failed to develop such strategies to assist their patrons, or if they have initiated them, but neglected to inform the community with a relevant publication. According to Keener and Sarli (2010), libraries should offer different types of assistance to authors, in order to clarify issues related to open access, copyrights, and the various publication trends in the current scholarly communication system. Since the authors' needs in some cases are complex, a successful plan of action should entail "in-house" cooperation between the authors, the institution's office that manages grants, and the library. In addition, collaboration between external stakeholders is required, such as other libraries that organize similar projects and the funding agency.

The relatively few articles that exist in the bibliography describe only the methods used by the libraries to assist the authors with NIH-policy compliance, but there is not an indication measuring, from the patrons' point of view, how helpful they are and if they successfully correspond to the patrons' needs. Banks & Persily (2010) discovered that although the NIH

Website offers information on how authors can comply with the policy, it is not well organized and it can be frustrating to users who cannot find the answers to what they are looking for, so they search for directions in other services. To overcome this problem, one of the most popular services libraries must offer is the creation of an institutional Website that contains on one page all the necessary information NIH-funded researchers need to know in order to comply with the mandate. Apart from that, toolkits must also be created, which provide answers to the most frequently asked questions, and other material relevant to copyright, which would explore the implications for agreement with the policy and provide the basic steps the researchers must take to ensure compliance. In general, studies support the fact that researchers meet difficulties when they attempt to submit their manuscripts into PubMed Central, so libraries must organize either one-on-one sessions or group workshops (Banks & Persily, 2010; Barnet & Keener, 2007; Stimson, 2009).

In their research, Banks & Persily (2010) studied the impact of the NIH policy on the University of California at San Francisco NIH-funded PIs. This research indicates that the institution's authors sometimes consider that it is the library's responsibility to assist them with the terms of the mandate, since the policy mentions that either the PIs or someone else, on their behalf, can proceed with the manuscript submission to PMC. The same research shows that a small number of PIs seek assistance with the policy, but of those who did the majority of them initially requested help from their publishers, then they addressed the issue to the institution's grant administration department, next they consulted an NIH staff member, with the library being their last option.

When the mandatory policy became effective the NIH-funded PIs had to comply with it. Even though there is research that shows in general how authors are educated about copyright

and licensing agreements (Wirth & Chadwell, 2010; Corbett, 2009; Spivey, 2005), there is very limited research on how the NIH-funded PIs learned about the steps they have to take to submit their article to PubMed Central (Barnett & Keener, 2007; Stimson, 2009; Banks & Persily, 2010). Although their bibliography presents the strategies libraries develop to educate their patrons, it fails to mention whether or not the authors find it useful.

In general it is known (Banks & Persily, 2010) that the PIs learn about the NIH policy not through an information package they receive upon acceptance of funding, but because they ask for help from their publishers or the librarians of the institution with which they are affiliated. They also visit the NIH Website that contains instructions on the policy and they use other Website that provide similar information, such as the SPARC Website ("NIH policy implementation", 2010). Although these studies reveal some of the steps authors take to get educated on the policy, they have limitations, as the participants were self-selected and they are affiliated only with one academic institution, which limits the generalizability of the results. Research has proven that self-archiving takes place mostly by third parties, who archive on behalf of the authors (Carr & Harnad, 2005), but it needs to be further investigated whether the PIs are conducting this process themselves, or their assistants are usually responsible for the self-archiving. The current literature lacks relevant studies that provide specific details about both the submission process difficulties and the time required to complete the submission process.

Chapter 3

Methodology

This dissertation investigated forty-two NIH-funded PIs, who are affiliated with thirty-two academic institutions and research centers and have published in one of the PLoS journals during the period 2005-2009. The participants were selected from RePORTER, a publications and patents database maintained by the NIH. The interviews followed a semi-structured interview protocol, where the participants were asked thirteen open-ended questions related to their publishing practices and explained how these are being affected after the mandatory NIH public-access policy. This chapter analyzes in detail both the research methodology and the data coding and validation techniques.

Qualitative research strategy

Due to the lack of previously existing literature investigating the influence of the NIH public-access policy on the NIH-funded PIs, there was a need for an examination and understanding of the current situation concerning the influence of the NIH public-access policy on the authors' publication habits. An explanatory method was used, which is defined as the technique where the researcher conducts semi-structured interviews and, by asking open-ended questions, recognizes the nature of the participants' understanding in a specific situation, emerging mostly from their narrations (Creswell, 2003).

Based on the fact that these research questions are being explored for the first time and there is not any previous bibliography concerning those questions, the investigator applied open-ended descriptive research questions to reach a broader understanding of the current situation. According to Morse (1994) through this research method the researcher manages to construct an in-depth knowledge of the investigated topic. Morse explains that the open-ended interview

protocol allows the researcher to thoroughly investigate the research topics and clarify the participants' comments with follow-up questions enabling the explanation of the principles, opinions and procedures for the specific group. One of the main goals of the interview process was to extract narratives from the participants and, by listening their stories, to provide an understanding of their publishing habits and how these habits were shaped from the moment the mandatory NIH policy came into effect. Using this semi-structured interview protocol the researcher gained an understanding of the participants' perception through their personal anecdotes. According to Kvale (2007) this research method is considered to be the appropriate strategy to investigate the gap in the literature, as it allows the researcher to capture in detail the subjects' personal narratives.

The previously conducted studies mainly explore the authors' publication habits. These former studies have used primarily semi-qualitative and semi-quantitative research methodologies. This technique is used in surveys, where, with the use of both open and closed questions, the researcher gathers both qualitative and quantitative data. Studies that investigated the authors' publication habits and their relation to the open-access publishing methods were conducted with either large-scale surveys (Dallmeier- Tiessen, 2010; Rowlands, Nicholas & Huntington, 2004; Swan & Brown, 2004), or minimum-scale surveys (Hess et al., 2007; Morris and Thorn, 2009; Over et al., 2005). Some research methodologies have focused only on interviews (Nariani & Fernandez, 2011; Schroter, Tite & Smith, 2005; Warlick & Vaughan, 2007).

In this dissertation the methodology used was in-depth interviews because, based on Smith & Osborn (2008), this technique demonstrates an exegesis of the subjects' experiences and their understanding of an existing situation. It can be applied when there is not a previous

exploration of the topic and there is a lack of previous literature review analysis. The real-life examples provided by the participants, in combination with the collection of detailed data, enable the researcher to draw conclusions on the topic under investigation.

The purpose of this study is to describe the publication habits of the NIH-funded PIs, who have published in one of the seven PLoS open-access journals before and after the mandatory NIH public-access policy. The research questions this dissertation will attempt to answer are:

(1) Which factors motivate the NIH-funded PIs to publish in the PLoS open-access journals?

(2) How do NIH-funded PIs perceive the NIH public-access policy?

(3) How does the NIH public-access policy influence the PIs' publishing behavior?

(4) How does the NIH public-access policy influence PIs' behavior to publish in open-access journals?

Target Population and Sampling Strategies

Research subjects

The interviewed subjects were selected through purposive sampling. Although the mandatory NIH public-access policy affects all the NIH-funded PIs, irrespective of the journals they have chosen to publish their papers, this research examined only those PIs who had published in one of the seven PLoS journals during the period 2005-2009. The NIH-funded PIs were chosen as the most suitable population to be interviewed because, according to the public-access policy, they are responsible for the PubMed Central article submission process. Since an extremely wide number of participants could not be interviewed, the researcher chose a convenient sample. In the end, the researcher attempted to make the results fit into the wider

community and reveal new trends by broadening the research study results to the general population that receives research grants from funding organizations in health sciences. The purposive sampling procedure decreases the generalizability of findings. This study is not generalizable to all researchers publishing in all areas of scientific publishing, but only to health sciences authors who have a grant from a funding organization that had adopted self-archiving policies.

According to Morse (1994), a successful method to describe the way people from different cultures behave and allow important components to become more obvious is by comparing populations. In this research the forty-two participants who were interviewed were divided into two different populations: the "pre-mandate" population (18 participants) and the "post-mandate" (24 participants). One category of participants were the NIH-funded PIs who published in the PLoS open-access journals, when the NIH-policy had a voluntary character, during the period between 2005 to 2007. The other category is composed of NIH-funded authors, who published in open-access journals only after the NIH policy became mandatory, during the period 2008 to 2009. The characteristics of the "pre-mandate" group are authors who have published in one of the PLoS journals during the three-year period 2005 to 2007, but they also may have published in PLoS after that period. The "post-mandate" group are authors who have published in PLoS for the first time between the two-year period 2008 to 2009. The formulation of the two groups was used to reveal the factors that were influencing the two different categories of PIs to provide their papers open access through the PLoS journals before and after the mandatory NIH policy and how this policy has affected their publication preferences.

In an effort to decide how many subjects should be interviewed, the researcher considered two components: adequacy and exhaustion of information, as described by Seidman

(2006). The first implies that the variety of the participants interviewed must be such, so that the experiences and opinions expressed during the interviews match with the understanding of others who are not part of the interviews. The latter, exhaustion of information, refers to the level of the study where the interviewer realizes that during the interview process the information shared by the participants becomes repetitive and that the researcher does not extract new information from the interview process. It was considered that the researcher should interview an adequate number of participants so that the collected data would be rich, providing expanded and in-depth explanations of the situation. A large quantity of data contributes to the generalizability of the research results, while the collection of inadequate data makes the input analysis more difficult (Kvale 2007; Seidman, 2006).

The participants were also affiliated with various academic institutions, hospitals and research centres around the United States. A variety of institutions and organizations were chosen to reveal if there is a connection between the career advancement standards and the PIs publication habits. Researchers publish for promotion and tenure (Hurrel & Meijer-Klein, 2011) and an attempt was made to show how much the PIs' publication preferences are influenced by their affiliated institutions' promotion and tenure practices.

Research tool

The research participants were selected from the Research Portfolio Online Report Tool (RePORT), a database maintained by the United States Department of Health and Human Services ("NIH research portfolio," 2010). Although the same information could have been extracted from PubMed ("PubMed," 2010) or the Web of Knowledge ("ISI Web of," 2010), RePORT is considered a reliable resource as it provides easy searching abilities with high rates

of both recall and precision (Keener & Sarli, 2010). The RePORT Expenditures & Results (RePORTER) database provides a variety of available information ("NIH RePORTER," 2010): the contact information of the NIH-funded PIs, a full citation of the published research results emerging from an NIH fund and details of the awardee organization, such as the name of the academic institution or the research hospital conducting the research. In addition, the tool gives the title of all the articles published under the same grant number, provides the link from each publication to PubMed Central and also offers the full citation information of the original publication, which includes the journal title, year of publication, volume, number, and pages.

The RePORTER tool includes a downloading function, the ExPORTER ("ExPORTER," 2010), where files in XML or CSV form are available of all the publications that resulted from NIH funding during the period 1985 up to today. The CSV files were exported into Excel sheets that the researcher used to retrieve the following information:

(a) identify the PIs who had published in the PLoS journals before and after the NIH policy;

(b) identify the population that will be requested to be interviewed; and

(c) track the institutions the PIs are affiliated with and their contact information.

Participant recruitment

For the selection of participants the CSV files were downloaded and the final selection was conducted in five steps (Table 1):

Step one: The "RePORTER Publications released in calendar year" file was downloaded from the "Publications" tab. This file includes a list of all the published articles funded under the NIH each year. The files of the years 2005 through 2009 were downloaded and then the

researcher selected the articles that were published in one of the seven PLoS journals. A new spreadsheet was created, called “research participants”, where the researcher would copy for each year the information from the fields of “author list”, “journal title”, “PMC_ID”, “PMID”, “Publication year”, and “Publication title” from the folder “RePORTER Publications released in calendar year”.

Step two: At this step the researcher visited the research randomizer Website (“Research Randomizer,” 2010) and drew a sample of one thousand PMIDs, from all seven PLoS journals, approximately 140 PMIDs from each journal.

Step three: When the participants were selected, the researcher downloaded from the “Link Tables” tab of the RePORTER Website the corresponding “RePORTER Publications link tables”, which include two columns: the “PMID” and the “core project number”. In this step the PMID that was extracted from the “RePORTER Publications released in calendar year” was matched with the “core project number”, as it appeared in the “RePORTER Publications link tables”.

Step four: Under the “Projects” tab, the files “FY RePORTER Project Data” were downloaded for the years 2005 to 2009. In this step, the researcher matched the “core project number” of the “research participants” Excel file with the “full project number” field. After this match, the researcher copied the information from the columns of the “PI_ID” and the “PI _name”.

Step five: In this step the researcher went into the RePORTER Website and searched using the tool’s main interface, adding search terms in the “core project number” area and the PIs’ first and last name in the respective fields for the years 2005- 2009. In the results page, the researcher double-checked that the information which appeared in the RePORTER results page

matched with the information collected in the “research participants” spread sheet. Under the “Hit List” tab, the researcher clicked on the “Project Number” link and under the “Details” tab was able to retrieve the PIs’ email, which was used to contact the participants.

Table 1. ExPORTER collected data

Step	Website	File name	Columns added in the research participants spreadsheet					
1	ExPORTER: Publications Tab	RePORTER Publications released in calendar year	Author list	Journal title	PMC_ID	PMID	Publication year	Publication title
2	Randomizer.Org	1000 participants were selected from all the PLoS journals						
3	ExPORTER: Link tables tab	RePORTER Publications link tables	PMID	Core project number				
4	ExPORTER: Projects Tab	FY RePORTER Project data	Core project number	Full project number	PI_ID	PI_name		
5	Searched RePORTER interface to collect the participants email address							

The participants were recruited by email. During the whole recruitment process, each participant would generally receive two emails. The first email was sent in bulk, where the participants’ email addresses were added as a blind carbon copy (bcc). This email contained the

purpose of the research, the reasons the particular person was chosen to participate in the research and, finally, why the person was invited to volunteer as a participant in the research and, finally, the arrangements to set an appointment for the interview (Appendix B). After a week the participants who had not responded back to the researcher accepting or rejecting the call were contacted again through a second email. This email (Appendix C) was addressed to them personally, reminding them about the first call. Apart from the emails, the researcher requested that Donna Okubo, Community Outreach and Advocacy Manager at PLoS post the research on the PLoS social networking tool Twitter. The call for participants was twitted twice, on March 18th and April 18th, 2011 (Appendix D). In this case PLoS was used as an insider (King & Horrocks, 2010), since its reputation is accredited and respected in health sciences, and its supporting tweets added value to the research (Seidman, 2006).

Interview Instrument Development

Interview questions

Kvale (2007) suggests that the interview quality can be verified with two main components. First the interviewer should compose short well-constructed questions that will motivate the participants to provide long and explanatory answers with examples. During that process, the researcher should also pay close attention to the participants' answers, and enrich the conversation with follow up questions in order to explicate ambiguous answers. These two components will enable the participants to respond with spontaneous answers and realistically describe the various events and the meaning making of the different aspects under examination.

The participants were asked to answer thirteen open-ended questions (Appendix A). For each question, when necessary, the researcher posed follow-up clarification questions, which

allowed an in-depth understanding of the participants' opinions. In general, the PIs opinion was explored in relation to four topics:

(a) the authors' awareness of the open-access movement;

(b) their preferences to publish in the PLoS open-access journals;

(c) their understanding of the impact of the NIH public-access policy; and

(d) the influence of the public-access policy on their publication habits

Since these four factors are correlated in this dissertation, the interview questions explored how the PIs' publication habits have been shaped in relation to these four components, and how they managed to comply with the NIH policy.

The interviews followed an interview protocol, which consisted of the following components; (a) research title, (b) main research questions, (c) transition questions, which allowed the researcher to move from one set of similar questions to another set, and (d) additional investigation questions. During the interviews the researcher kept notes of the participants' answers and other reflective notes, following the rules outlined by Seidman (2006).

The interview protocol can be divided into four sections (Table 2). First, the researcher asked background questions to gather information about the participant's specialty and whether there is a tenure track in the academic institution, research center or hospital with which they are affiliated. The next set of questions was focused on experience and behavior, allowing the participants to describe their publishing actions and experiences (questions: 4, 6, 8, 9). These questions were necessary to extract information on how the subjects comply with the policy's requirements. In addition, opinion and value questions were asked (1, 5, 7, 10, 13), which enabled the researcher to extract information on how the participant relates his personal goals to the importance of the matter under investigation. For instance, the latter type of questions were

used to discover the subjects' perception of the quality of the PLoS journals, why they have published in PLoS or if they feel that the NIH policy meets their personal expectations and goals as researchers. Finally, knowledge questions (2, 3, 11, 12) were included. These questions were the ones that allowed the researcher to get an idea of how well informed the participants were about the available open-access publishing options, the NIH terms and the steps they had to follow to comply with the policy (King & Horrock, 2010).

Table 2. Interview protocol sections

Question Type	Questions
Background	Institutional affiliation
	Field of research
	Tenured/ non-tenured
Experience/ Behavior	(4) When you submitted your first couple of times your manuscript to Pub Med Central, how was the submitting procedure and the software interface?
	(6) In your effort to better understand these complicated parts, where did you go for help and how would you rate that help?
	(8) After your NIH grant did you had to negotiate with a publisher to retain the copyrights of the article so that you are able to submit your manuscript to PubMed Central? Can you please explain the negotiation steps?
	(9) The PLoS journals charge a publication fee. How were you able to

	cover this expense?
Opinion/ Value	(1) Tell me why did you choose to publish with PLoS?
	(5) Are there parts of the policy that you find complicated? Can you explain by giving examples why these parts are confusing?
	(7) Did you use to publish in open-access journals before you became subject to the NIH public-access policy? Yes or no and why?
	(10) How does the NIH policy affect your decision about which journal you publish your papers? Please give examples.
	(13) In what ways would you say that the mandatory NIH policy has affected your decision to publish in open-access journals?
Knowledge	(2) How familiar are you with open access?
	(3) How did you learn about the compliance terms of the NIH policy?
	(11) When you submitted your first work to a PLoS journal after your NIH funding, how did you understand the relationship between publishing in an open-access journal and complying with the NIH policy?
	(12) Would you say that your knowledge about available open-access publishing options changed after you became familiar with the NIH public-access policy? Please explain.

Interview process

All the interviews were conducted through the Skype™ software. A Skype™ account was created specifically for this research and was deleted at the end of the research. All the subjects' contact information was added only ten minutes before the interview and was deleted

right after the interview, along with the calls' history saved in the software. To ensure the participants' privacy the software's terms and conditions were investigated. According to the Skype™ policy terms, the company would only share any user information with a third party when the user is involved in an illegal activity. During the interview, the researcher recorded the conversation using the Ecamm software. According to the Ecamm software terms and policies the company does not keep any copies of the recorded information. In the end, the interviewer transcribed the interviews.

In the call for participants, the subjects were informed that the estimated time for the interview would be approximately 20 minutes. Before the interview the participants would read the online informed consent and after they had hit the "Accept" button, the interview would start. King and Horrocks (2010) mention that the researcher should pay extra attention to telephone interviews, as the participants may misinterpret this method and the type of communication. They comment that some participants may believe that a conversation via a telephone or through the Internet will have the form of a friendly discussion, while others may assume that during the process they will be asked to provide exceedingly specific information. To avoid a possible misunderstanding, in the beginning of the interview the researcher thoroughly explained the way the interview would be conducted and what is anticipated from the participants.

Pilot Study

A pilot study was conducted at the beginning of February 2011 in an effort to test the reliability of the questions and calculate the estimated time for the interviews. During the planning of the research, it was expected that the participants, NIH-funded PIs, would not have much time to devote to the interview. Thus, the first task that had to be tested in the pilot study

was to determine the appropriate length for the interview. The researcher wanted to achieve a balanced situation where the interview questions could extract detailed answers but at the same time, the interview process would be relatively brief. The first participants were contacted on February 15, 2011. Twenty PIs, four PIs for each year (2005- 2009), who had published in *PLoS Biology* were contacted. In the first call for participants the researcher estimated that the research would last for approximately twenty to thirty minutes. When the participants responded to this call, they mentioned that they were not able to participate, because thirty minutes is a long time, which they did not have. After a week, the researcher decided to email the same participants to inform them that the required time for the interview had been changed to approximately fifteen to twenty minutes. This change was also mentioned in the email heading. After this change, five participants responded positively to the call.

The initial email of the pilot study was sent on 14th of February and the follow up email a week later on the 21st. Between March 22nd and April 5th five interviews were scheduled. During the pilot study the researcher realized that the twelve questions that were initially chosen would suffice for an interview of about fifteen to twenty minutes. The researcher also learned how to manage the time to ensure that all the questions would be presented within this twenty-minute time frame.

Another issue that emerged during the interviews was the realization that a question referring to the PubMed Central submission software interface should be added as a standard follow-up question, since the participants had a lot of information to share about this process. This realization emerged because when the participants were asked if they had had any difficulties understanding the NIH public-access policy they were discussing issues about the submission process and not the wording of the policy or the compliance terms. The researcher

wanted to increase the feedback related to the policy and not limit the data to the wording of the policy and the compliance terms. Thus, it was decided this follow-up question would be added, which would interrogate the participants about the article submission process and the software interface into PubMed Central.

Validation

Reliability

In qualitative research, reliability is the process wherein the subject clearly expresses his/her understanding of the explored situation, which allows the construction of meaning expressed through the interview process. The variety of experiences collected during the interviews with the participants can be compared to ensure comprehension of the facts (Stenbacka, 2001).

According to Guba and Lincoln (1981) there are four standards that can produce accurate findings for qualitative research. These standards can be used in part or as a whole:

(a) credibility; where the interviewees evaluate the truthfulness of the research results;

(b) transferability; where, through an in-depth analysis of the research results, the outcomes can be used in similar contexts;

(c) dependability; which is composed of replicability, where it is questioned whether the research results would be the same in cases when the research was repeated by someone else; and trustworthiness, which is the level at which the constantly changing factors that emerge from the research results are presented throughout the interpretation of the research data; and

(d) confirmability; the level at which audits are conducted to inspect the biases and misinterpretations to verify the research results.

In this dissertation the credibility (a) and comfirmability (d) of the results did not apply. The standards of evaluation that were taken into consideration are the transferability (b) and dependability (c).

Validity

To guarantee the accuracy of findings the researcher applied various strategies following the Leedy & Ormrod (2005) guidelines. To begin with, the research questions controlled the variety of accumulated data and while these data were being collected, the researcher eliminated personal biases. Without personal expectations about the findings, the researcher coded and analyzed the data based solely on the participant's answers. In order to reach an understanding of the current situation, the researcher analyzed the data thoroughly, and analytically described the complexity of the matter in question. The investigator combined the different components of the research findings and interpreted them by demonstrating reasonable arguments and ranking the data according to their importance. The research concluded by providing informed and enhanced interpretations of the situation studied, suggesting solutions to the problems, and making assessments about the research questions.

To insure further validity, the researcher produced a "thick description" (King & Horrocks, 2010, p.194) of the research events and their setting. A thick description is the procedure in which the researcher provides detailed information about the coding, the description and interpretation analysis and justifies the assessment and logic for the development of the research results. Although this technique cannot serve as a quality measurement for the

evaluation and interpretation of the data, it is a way a researcher can use to elaborate on research details and its conditions, because it helps the audience understand the researcher's technique from the first steps — such as the coding and choice of themes — to the emergence of the conclusion. The researcher applied the thick description approach in all the sections of this chapter, by adding detailed information about the research methodology, selection and recruitment of participants, conduct of the interviews, coding practices and the pilot study. In addition, a thick description approach is also followed in Chapter 4 (Results), where the researcher summarizes the findings and supports them by presenting quotations from the participants' original comments.

Interview Data Collection

The subjects were enlisted to participate in the research with an email. The researcher divided the sample into groups of 100 participants and each week emailed one of the groups (Table 3). After a week, the participants received a reminder email (Appendix C). The total number of potential participants contacted was 900 in a period of nine weeks.

The response rate was relatively low (Table 4). From the 900 participants, sixty-eight responded positively saying that they would be willing to participate in the research, but only forty-two of them actually participated in the interview. Twenty-four of the participants belonged in the "pre-mandate" category and 18 in the "post-mandate". The remaining twenty-six participants, although they never asked to withdraw from the research, did not contact the researcher to schedule an appointment for the interview. From the participants who were contacted only 128 responded that they were not interested in participating in the research.

Table 3. Dates the participants were contacted

Group	Count	Year published in PLoS	First email	Reminder
1	100	2005	03/06	03/13
2	100	2006	03/13	03/20
3	100	2006 & 2007	03/20	03/27
4	100	2007	03/27	04/03
5	100	2008	04/03	04/10
6	100	2008	04/10	04/17
7	100	2008 & 2009	04/17	04/24
8	100	2009	04/24	05/01
9	100	2009	05/01	05/08

Table 4. Participants' response rate

Responded "Yes"	Interviewed	Responded "No"	No response	Total
68	42	128	804	1000

Participating institutions

The NIH-funded participants were affiliated with academic institutions, research institutions and hospitals. Some of the participants had more than one affiliation, thus they were both professors in academic institutions and also were practicing medicine in hospitals. Sometimes this professional distinction was not very clear, because some hospitals belonged in

academic institutions. In other cases the subjects were working both in research centers and teaching in academic institutions. To track the participants' affiliation, the research asked them about it in the beginning of the interview. Only eight of the participants were affiliated with both a hospital or research center and an academic institution. Ten of the participants were affiliated only with a research center and the remaining twenty-four participants were affiliated with academic institutions. These twenty-four participants were affiliated with twenty-two different academic institutions around the United States.

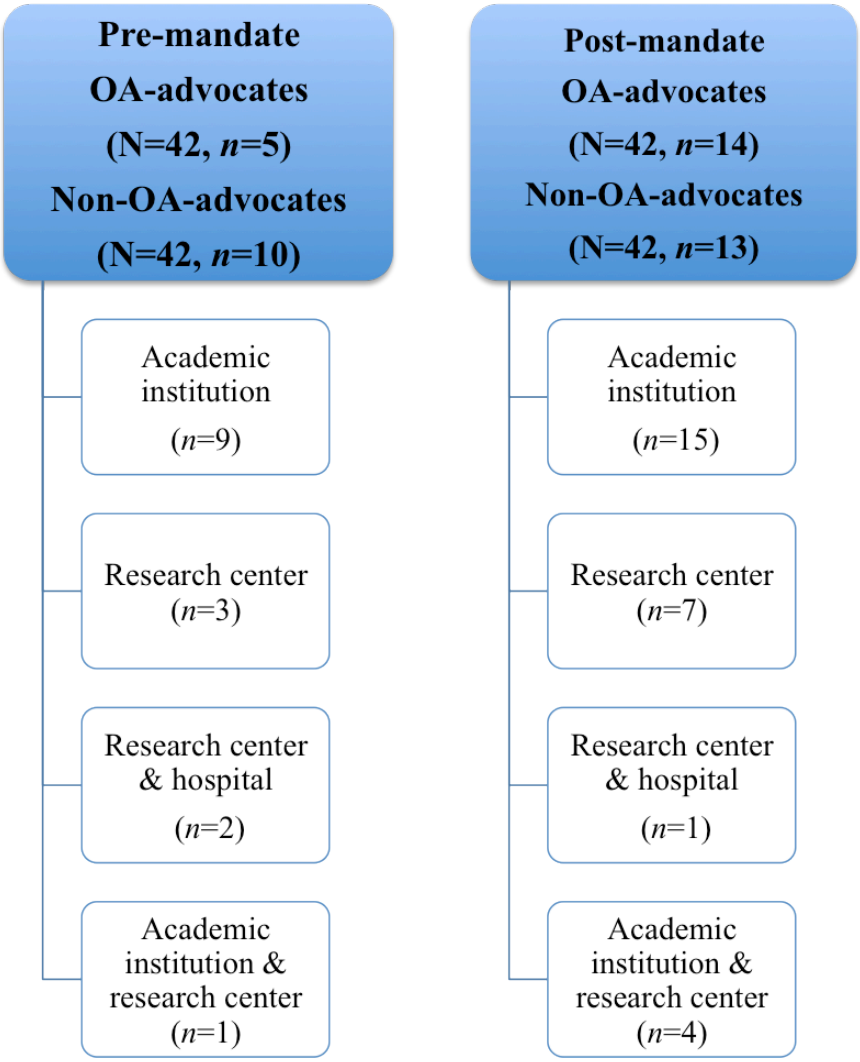
Table 5. Participants' affiliation

Participants' affiliation	Count
Research Center	10
Academic institution	24
A combination of a research center or hospital with an academic institution	8
Total	42

Participants' characteristics

Apart from the pre-existing differentiation of the participants as pre-mandate and post-mandate participants, during the interviews they were also self-characterized as open-access and non-open-access advocates. This characteristic was used as an additional category that would allow more comparisons to be made. From the pre-mandate participants, there were five open-access advocates and ten non-open-access advocates. The post-mandate category consists of fourteen open-access advocates and thirteen non-open-access advocates (Figure 1).

Figure 1. Participants' characteristics



Coding Scheme

In the participants' coding scheme, those PIs who belonged in the pre-mandate group were assigned the word "PRE" and the ones who belonged in the post-mandate group the word "POST". After the word that defined the group in which the participants belonged, a serial number was provided to each one of them, which was based on the order they were interviewed. For example, if the code scheme POST.45 is assigned for a participant, it indicates that the participant belongs in the post-mandate group, and that interview was the forty-fifth among the post-mandate participants. A separate count was used for the two groups.

Data collection and analysis

Kvale (2007) describes the analysis of the interviews in four steps. In the first step, the participants reflect on their understanding and report on their past experiences. During the second step, the participants become conscious of their background, allowing the researcher to develop an interpretation based on their narrations. Throughout the third step, the researcher improves access to details with follow-up questions. In the final step, the researcher transcribes the conversation and analyses the main themes. Even though text analysis could occur during the interviewing period, data examination is the concluding part, conducted only after the end of the interview process. Through the data examination procedure, the investigator records the initial knowledge acquired from the research and later interprets the significance of this knowledge to the research questions. By using the qualitative data analysis, an interpretation of the text data collected from the interviews is conducted. According to Creswell (2003) the researcher's first step is to manage the data by organizing the recordings and afterwards she has to extract a meaning out of the participant's words.

The researcher transcribed all the interviews. Afterwards, she read the transcribed text using two methods. In the beginning, each interview was read as a whole and the most important parts were highlighted. In the second step the researcher grouped the questions together and re-read the content identifying only the emerging key themes. The researcher looked through each file three times, with a two-day break after each time, so that she ad an opportunity to reflect on the data. The analysis of the content both across questions and across individuals was used to cross-check the highlighted parts and verify only the parts of the participants' wording that indicate the most critical information. When the interviews were read, one document was

created, where the repetitive themes and their corresponding text was added. The same practice was followed for the grouped questions. In the end, these two files were compared.

The repetitive ideas expressed among the interviews were characterized as themes. When the themes were singled out, the researcher organized them in a manner that demonstrated their association with each other and how they could form a theory. For example, the researcher singled out the main themes, and then grouped other concepts related to the main one under the main "umbrella" theme. This relationship proved what factors had caused specific behaviors and how concepts were related to each other (King & Horrocks, 2010). To illustrate the arrangement of the thematic system, a table was created, which depicted the organization of the main themes and the rest of the topics that underlie under that theme.

The main themes, as they emerged from the data are:

- Public access
- Open-access familiarity
- Publishing decision-making factors
- PLoS journals' characteristics
- Funding
- PubMed Central submission process
- NIH policy influence
- NIH awareness
- Assistance
- Copyrights

At that time, the researcher started a brief coding (Appendix F), which is the process of providing specific words that characterize parts of the text for the purposes of identifying their

meaning (Kvale, 2007). During the descriptive coding process, the researcher distinguished the emerging themes from the transcript sections, which were related to the research question. At this point, the transcripts were used to clarify the participants' interpretation of the general situation and how they developed their main understanding of the topic. After that, the researcher highlighted the main topics and determined the leading explanatory key words, by providing them with a single label, which was used for the second step analysis — the interpretative coding.

More specifically, for the analysis of the authors' preferences to publish with one of the PLoS journals, which is a "PLoS characteristics" main theme, the central topics that emerged were "high impact factor", "publication speed", "article open-access availability", and "peer-review process". Under each topic, other related corresponding themes were included. For instance, when the authors discussed the peer-review system of the PLoS journals, they mentioned that the peer-review system is fast, thus the term "fast" was added in the second level, under the term peer-review process. It was also mentioned that the peer-review system of PLoS is "democratic" and "scientific". For the main theme of "publication speed" the related concepts were "peer-review", "submission" and "acceptance". Thus, when authors mentioned their satisfaction with the PLoS "publication speed", it was determined that there could be a connection between the theme "publication speed" and the three aforementioned subthemes.

King & Horrocks (2010) specify instructions for the interpretive coding. Throughout this step, the researcher did not merely attempt to reveal the general ideas that emerged from the interviews, but attempted to interpret their significance. To do so, the ideas with a similar meaning, which emerged from the first step, were placed in categories. To reveal the interpretive codes correctly, the researcher focused both on the descriptive code and on the interviews, as the

first apply to more than one interpretation and the latter assist the researcher to correctly reveal their contextual relationship. In the third step, there was a comprehensive consideration of the main incorporated themes, which emerged from the topics of the second step of the analysis.

Descriptive analysis

After examining the qualitative data results, descriptive statistics were used to test the relationship or independence of the variables. Chi-square statistics were used to explore how the distributions of the categorical variables contrast with each other. Due to the low response rate and number of participants, the results are not representative of the whole population, but limited to the sample examined in this research.

In order to provide answers to the research questions, and more particularly to investigate motivations of publishing behaviors in relationship to the NIH public-access policy, a series of hypotheses were developed regarding the connections between independent variables and a dependent variable (Table 6). The relationships attempted to examine if there is a relationship between the pre-mandate and post-mandate group of authors and those authors who were self-characterized as open-access advocates or non-open-access advocates and their publication preferences.

Table 6. Independed variables and their correlated hypothesis

Independent variables	Hypothesis
Advocacy	Authors who were self-characterized as open-access advocates were publishing in open-access journals before the mandatory NIH public-access policy
	Authors who were not self-characterized as open-access advocates mentioned that their knowledge about available open-access options changed after they became familiar with the open-access policy
	Authors who were self-characterized as open-access advocates mentioned that the NIH policy would affect their decision about the journal in which they will publish their papers
Post-mandate authors	Authors who did not publish in open-access journals before the mandatory NIH public-access policy mentioned that their knowledge about available open-access options changed after they became familiar with the open-access policy
	Authors who did not publish in open-access journals before the mandatory NIH public-access policy mentioned that the NIH policy affected their decision about which journal they will publish their papers

Summary

A rich set of data was formulated after the completion of the forty-two interviews with the NIH-funded PIs who had published in one of the PLoS journals during the years 2005 to 2009. The open-ended questions prompted the participants to discuss their publishing preferences and explain how the NIH public-access policy shapes their decision when they consider in which journal they will publish their papers. The follow-up questions allowed the researcher to shed light on unclear information and proceed to a clear formulation of the main themes and the coding of the data. Finally, during the descriptive analysis the absence or presence of the connection between the variables was tested.

Chapter 4

Results

This chapter discusses the major findings of the study, addresses the connections of the discoveries, and explores how the four research questions are answered. The first and second questions are (1) which factors motivate the NIH-funded PIs to publish in the PLoS open-access journals and (2) how do the NIH-funded PIs perceive the NIH public-access policy? These questions investigate the authors' decision-making criteria for publishing their articles and what is their impression of the mandatory NIH public-access policy. Questions three and four are (3) how does the NIH public-access policy influence the PIs' publishing behavior and (4) does the NIH public-access policy influence PIs' behavior to publish in open-access journal? The two last questions investigate the impact of the NIH public-access policy on the authors' publishing behavior, their awareness of open-access and more particularly their decision to publish in open-access journals.

PLoS publication drive

Electronic content

The online nature of the open-access journals' articles is one factor that affects the PIs' decisions to publish with one of the PLoS journals. The online publications are characterized as an easy and recently developed practice for delivering content, which the PIs are inclined to adopt as their publishing culture. A PI affiliated with an academic institution mentioned, "[i]t is all online, it is relatively easy to do" (ID: POST.8). A post-mandate participant, affiliated with a large state academic institution, describes the popularity of the online open-access journals by presenting them as a new publishing trend: "So something that it is relatively new the people, the

editors, have different trends in what they are interested in publishing, so it is more like fashion, they are more interested in new things. So that was *PLoS Biology*." (ID: POST.18).

Accessing electronic content from a computer's desktop demonstrates for the participants a relatively new style of manipulating information, making its retrieval and use easier and faster. This new situation is in contrast to the print world, where the dissemination of information was slowed down by reprint requests, which the researchers fulfilled by mailing printed copies to their colleagues as soon as they received them. The flexibility of the articles' electronic format is described by a PI in pharmacology, who mentioned that the greatest advantage of the electronic articles, "which seems to be less obvious to people, is having full availability to the online text. You can do much more with it with the computer" (ID: PRE.3). One of the participants, who is a tenured professor in an academic institution, expressed in her comments that older research is not highly cited, not because the information is outdated, but because the researchers have abandoned the habit of physically visiting the library, where they would search for the copy of the article they are interested in, "having them available on people's desktops from a public library it makes it so much easier to do the work. You don't have to go over to the library, find a journal, look it up, xerox it. It is just wonderful." (ID: POST.17).

When the participants described how they search the existing literature, they mentioned that they not only focus primarily on those articles available in electronic form, but also on the ones that are free of cost. A pre-mandate participant explained that an added value with the online information occurs when access to the articles is not moderated behind a username and a password barrier, "so once we hit the digital world where access is only the cost of the Internet it was clear to me that it was time to change how we were going to provide the science that we do" (ID: PRE.4). Fry et al. (2011) discovered that researchers usually seek literature in Google

Scholar, and the affiliated institution's library is not the first searching option. The researchers in health sciences also go directly to PubMed Central. In this dissertation, when the PIs search the literature, their most common habit is the use of an online search engine interface and a database, where someone can search with the use of keywords. The vast majority of the PIs responded that their one-stop retrieval tool is PubMed, where they can seek literature fast, using subject keywords or the authors' names. Thirteen authors (31%) mentioned that when they find citations emerging from quality journals in an online search engine they prefer to read first the ones that are available free of cost, because there is only a one-click distance between the user and the article. According to the words of one of these participants:

> There is an additional concern and that is if you want to do a survey, you know, a review on a particular topic and you use PubMed for example to get their sources, then obviously you will, for practical reasons, you will focus on what is most easily available for expediency (ID: PRE.7).

These thirteen authors also mentioned that when the open-access articles fulfill their information need, then they would stop their search, without accessing the literature that requires a username and password type of access. When a retrieved article is under a subscription barrier, the authors have to log into their library's database and search for it. If the library does not subscribe to the specific journal, then the researchers have to make an extra step and request the article through the library's interlibrary loan system and wait until it arrives. These steps make the article acquisition process strenuous and time-consuming, and according to Fry et al. (2011) it is not a favorable method. The absence of a password barrier reduces the time required to retrieve an article. A participant affiliated with both a prestigious academic institution and a research center mentioned that he does not log into his affiliated institution's library Website, but

prefers to search for the open-access articles by visiting the journals' Websites directly, "I find this very convenient myself. When I have to find articles in the literature, rather than having to go to the library, I go directly to the journal to get access. I prefer to do that." (ID: POST.12). Fast access to information is considered to be an advantage, which the participants take advantage of since they can also trust the quality and prestige of the open-access journals.

Public-access premise

The articles' free-of-cost distribution is one of the main reasons the NIH-funded PIs have chosen to publish with one of the PLoS journals, a finding that agrees with the results of the Swan & Brown (2004) study. In this research, a little less than half of the PIs were self-characterized as open-access advocates (*n*=19, 46%), while the rest were not (*n*=23, 54%). Irrespective of the existence or absence of this distinction, the vast majority of the PIs agreed with the premise that publicly funded research should be disseminated for free to the whole community; the sponsors, the affiliated institution, the taxpayers and the public must have the right to access the research they have funded. This statement emerged as a popular topic throughout the interviews. "It is only fair to share the information with a quite an audience, not just people who happen to be subscribers and likewise, I don't think it is fair the public to pay the fee to download that information" (ID: PRE.7), noted a pre-mandate participant, who is affiliated with both a prestigious academic institution and hospital.

This sentiment is in accordance with the mandatory public-access policy, which concludes that since the NIH uses public money to fund a large part of research every year- almost $30 billion- this research must become available to anyone who needs it, also serving the taxpayers' right to obtain the research results they have funded (Zerhouni, 2004; Peek, 2004).

The PIs supported the benefit of openly accessible research with the argument that scientists around the world can freely access costly research, which contributes to the improvement of global health, a finding that was also mentioned in the Dallmeier-Tiessen et al. (2010) study. In addition, there were a few participants (*n*=5) who specified their desire to have their research results openly accessible, regardless of whether they are funded by the NIH, supporting the belief that open content is beneficial to the public, "to make sure that the papers were most easily accessible by the community" (ID:PRE.5), as a participant affiliated with a large state academic institution mentioned.

The seven PLoS journals submit all their articles into PubMed Central, regardless of whether they are supported by a NIH fund. Although more than half of the research participants (*n*=28, 67%) were not aware of that fact, they mentioned that they prefer to retrieve the PLoS journals' articles in their PubMed searches and that they could easily access the final published version of the article. The PIs appeared to be biased against the appearance of various versions of an article, such as a pre-print, or even the authors' final peer-reviewed version of the article. A pre-mandate participant affiliated with a large academic institution explained that, "the problem is that PubMed Central can have a different version deposited than the one that the journal actually publishes. So that is what to me is the problem" (ID: POST.1), and another participant added to this concept by saying how he has a strong preference reading the final published version of an article because, "it is like a house that has been painted" (ID: POST.24). Fry et al. (2011) indicate that the health sciences researchers read a great number of peer-reviewed articles per year, about 100, and in a search of the literature they want to retrieve and read the publisher's final version of the article.

Although the majority of the PIs (86%) mentioned that the open accessibility of the PLoS' articles is one factor determining their decision when choosing the most appropriate journal for their articles, a small number of authors (*n*=6) mentioned that the articles' open-access availability is not an influential component. "To be totally honest I have not given any thought when I was publishing to whether they are open-access or not" (ID: PRE.11), said a PI affiliated with a prestigious academic institution, conducting research in genetics. The profile of the participants, who decided to publish with the PLoS journals irrespective of their open accessibility, can be described as PIs who characterize themselves as "fairly" familiar with open access. They stated that they do not publish in open-access journals regularly, but they consider the open accessibility of their articles to be a plus.

A researcher in the biosciences field explained that the journal's quality and its peer-review system were the two influential factors that made him choose to publish in the journal *PLoS Biology*. "I will tell you the decision. It just had to do with [the fact that] it was a reasonably good journal and the review process was straightforward and easy" (ID: POST.6) and another participant from a large state academic institution gave a more analytical description of the thinking behind his decision to choose the journal in which he will publish his papers:

> "I choose to publish in the journals that I think are the best fit for the research that I do, so it is not that I sought to consciously publish in an open-access journal. I just thought of those who were in the readership and within the mission of that particular journal. [The article] would have the highest impact there and so, I guess I published in the PLoS journals [irrespective of whether] it is open access." (ID: POST.7).

Although the open-access availability of the articles is a publishing decision-making factor, for a small portion of the participants (17%) the status and quality of a journal are more important than the open-access component.

Impact factor

Although it is a highly appreciated count for scholars (Suber, 2010b) (Chapter 2), the journal impact factor (JIF), a number that measures the frequency a journal is being cited among scholars, has been inaccurately associated with a journal's quality. From the moment each of the seven PLoS journals were established they have held a steady impact factor in the Thomson Reuters list (Science, Thomson Reuters). The impact factor of the journals *PLoS Biology* and *PLoS Pathology* hold the first position in their corresponding fields, while the rest of the PLoS journals, *PLoS ONE*, *PLoS Medicine*, *PLoS Genetics* and *PLoS Computational Biology* are in the top-ten list every year.

Almost half of the NIH-funded PIs (*n*=22) answered that they have chosen to publish with the PLoS journals due to their high impact factor (Figure 2), which places them in the first rank among the open-access journals in the health sciences field. The positive descriptions about the quality of the PLoS journals were provided not only from the PIs who were open-access advocates, but also from the PIs who were not self-characterized as active supporters of the open-access movement. A pre-mandate open-access supporter and professor in immunology describes his belief about the PLoS journals' high quality, "I used the PLoS system because these journals are most highly rated among the open-access journals" (ID: PRE.8), while, a post-mandate PI conducting research in the same field at another institution who was a non-open-

access supporter describes the quality of another PLoS journal, "*PLoS Pathogenes* is a very prestigious journal in my field" (ID: POST.9).

Although there seemed to be homogeneity among the participants' opinions concerning the prestige of the PLoS journals, some comments that were expressed about *PLoS ONE*, a journal publishing peer-reviewed articles in any scientific discipline ("PLoS ONE: Accelerating"), were more controversial. A few of the authors (*n*=7, 16%) do not consider *PLoS ONE* to be a prestigious journal. A non-tenured professor in evolution stated the reasons why he published in *PLoS ONE*, "[t]he article in *PLoS ONE*, did not have very important results and this is why we chose this journal" (ID:POST.19) and another participant affiliated with a research center mentioned about the ranking of the same journal, "*PLoS ONE* is actually in the middle; it is not at the top, and it is not at the bottom" (ID:POST.6). The participants supported their statements by claiming that in this journal they have read a variety of low-quality and high-quality articles. Thus, the journal does not have the same level of topic specialization as the other PLoS journals and the peer-review system is not similar to the other journals. In the journal "*PLoS ONE*, they introduced this slightly different system of publication and peer review and I think that this model has significant problems because of the quality of the papers" (ID: PRE.8), mentioned a participant conducting research in immunology.

The issues that were described by some participants as disadvantages for the journal *PLoS ONE* appeared to be advantages to other participants. For a small number of PIs (*n*=4, 10%) the journal's non-specialization is not considered to be a negative aspect, "*PLoS ONE* is also a very reputable journal with a pretty high impact factor" (ID: POST.8), stated a professor in microbiology. Some participants had chosen to publish with *PLoS ONE* because the journal publishes a wider variety of broad-topic articles than the rest of the PLoS journals, "this is

something that I have sent to *PLoS ONE*. There are other PLoS journals that are more selective, trying to fit the general pattern of types of publications." (ID: POST.24), mentioned an oncologist affiliated with an academic institution. The participants who praised *PLoS ONE* shared stories in which they mentioned that they published articles in the journal that were not highly specialized scientific articles, but they were presenting either a new "project that aimed to gain international exposure" (ID: POST.14). Another researcher, who wanted to send a message to the scientific community that aimed to provide guidance and the best sanitary practices for the protection of public health says, "the article was about the spread of flu, influenza, internationally via airplanes" (ID: POST.13). In both cases the authors' attempt was to reach the widest readership as quickly as possible. It was suggested that all journals and all published articles do not always have to present high-quality scientific results. Often issues need to be explored and presented both to the scientific community and the general public, and *PLoS ONE* seemed to be the most suitable publication as the articles are published quickly and reach a wide readership.

Publication speed

Previous research conducted to measure the characteristics of the open-access journals indicated that the researchers who publish in them consider the publication speed of the articles to be fast (Morris & Thorn, 2009; Swan & Brown, 2004; Warlick, 2006). One PLoS author research study (2010) discovered that the primary reason the authors have chosen to publish with PLoS is the publication speed of the articles ("PLoS author research 2010", 2011). Similarly, in this research, sixteen participants indicated that one of the reasons they chose to publish in one of the PLoS journals is the fast-paced publication of the articles, which is among the top criteria

they consider to be beneficial in a publication, since it increases the impact of their discoveries (Figure 2). “It is more for expediency that anything else; expediency and good quality”, (ID: POST.8) stated one post-mandate PI, while another post-mandate participant mentioned, “I love the way they are so quickly distributed and are seen by everybody without subscription. I think it is wonderful” (ID: POST.17).

In cases where the participants used the term publication speed, they referred to the various steps of the publication process. They agreed that the PLoS journals have a rapid system concerning the article submission process, and also mentioned that the peer-review process was conducted with no delays. The authors felt that they had an on-time answer about the status of their articles, and knew relatively early if they had been accepted for publication or rejected. A PI affiliated with a research institution conducting research in radiology was in favor of the fast pace of both the submission and acceptance process of the articles, “[t]his is a very rapid turn and time is short. The time from submission to publication online is short. You do want your research to be known by other people as soon as possible” (ID: POST.11).

Expediency in the publication process was also described in cases when an article was not accepted in one of the PLoS journals and the journal’s editor suggested that the authors submit the article to another PLoS journal. Six authors (14%) mentioned that they were willing to accept this alternative offer, because the article formatting style among all PLoS journals is the same. Thus, the authors were able to re-submit the same article to another PLoS journal without needing to reformat their documents, a component that adds to the publication speed. A post-mandate PI described his preference in this situation, “*PLoS Pathogenes* is a prestigious journal and sometimes for expediency we submitted papers to *PLoS Pathogenes*, but they were not

accepted and they recommended that we submit to *PLoS ONE*, so that's part of the expediency as well" (ID: POST.8).

When the publication speed of the PLoS journals was discussed, a few interviewees (14%) compared this process with the most popular journals *Cell*, *Nature* and *Science*, expressing their annoyance with the delays in the article processing, which can last for up to six or twelve months. A post-mandate PI affiliated with an academic institution stated, "*Nature*, *Neuroscience* and *Neuron*, for my field, which is Neuroscience, are the top journals. Those can go on for years. The review process is notoriously long." (ID: POST.18). A participant working in a small research laboratory explained that a delay in publishing research results could be detrimental both to the research community and his career. He explains that large laboratories are well-funded, have large research departments, and as a result a large production of papers each year. In these cases, the authors are not highly affected by slow publications, but for small institutional laboratories, like the one in which he is working, the following situation exists, "people like me, we have to have productivity, we have to come up with a lot of papers and we don't have time" (ID: POST.24). Since the participants' promotion and professional development depends on the speed with which their articles will be published, a journal with a faster publication rate is a preferable publishing situation than another journal that may be more prestigious but slower.

Peer-review

The participants in the Nicholas et al. (2005) research "emphasized the positive effect of the peer-review process on the quality of publication" (p.213). In this dissertation the research participants offered positive feedback concerning the peer-review process of the PLoS journals

(Figure 2). “The reviews generally have a pretty rapid turnout” (ID: POST.8) was a PIs’ statement concerning *PLoS Pathogens*. Secondly, it was believed that the peer-reviewers of the PLoS journals are not professional peer-reviewers, but scientists. This situation was regarded as a complimentary aspect, because the participants felt that their article’s content was judged only by its significance and not by the popularity of the topic explored. A post-mandate participant in molecular biology affiliated with a prestigious academic institution favored all seven PLoS publications and said, “I like the PLoS journals, because the editorial board is made up of scientists and not professional editors and I think that this is a better system than having professional editors handling papers” (ID: POST.12).

In some cases (*n*=9, 21%) the peer-review system of the PLoS journals was compared to the peer-review system of the popular for-profit publishing houses, such as *Cell*, *Nature* and *Science*. It was considered that since these journals attempt to make the highest possible profit for their businesses, they are being more selective about the articles they publish. A participant from a state academic institution reports:

> I am too young, but older people, scientists, used to tell me the review criteria was, if actually this [the article] is well-done. Did [the researchers] actually do what they said, as opposed to, is this [article] the hottest thing as opposed to, you know, chicken soup? And therefore, there is a significance factor. I will just send it to *PLoS ONE*, because I don’t want to deal with people that are trying to say whether it is significant or not, which is subjective (ID: POST.18).

These participants believed that these toll-access journals have acquired a level of control, which is demonstrated through their peer-review process. In particular, there was a worry among PIs about the peer-review system as conducted by the traditional toll-access

journals, expressing a criticism on the criteria used to determine if an article will be accepted for publication or rejected. A pre-mandate PI and an open-access advocate expressed the following opinion about the toll-access journals:

> I also think that the for-profit journals…it is kind of…it is corrupting; it is pernicious. People think that in order to get ahead they have to, you know, publish in *Cell*, *Nature* and *Science* and the editors of these magazines, they really are magazines, have way too much, far too much influence about what gets published (ID: PRE.12).

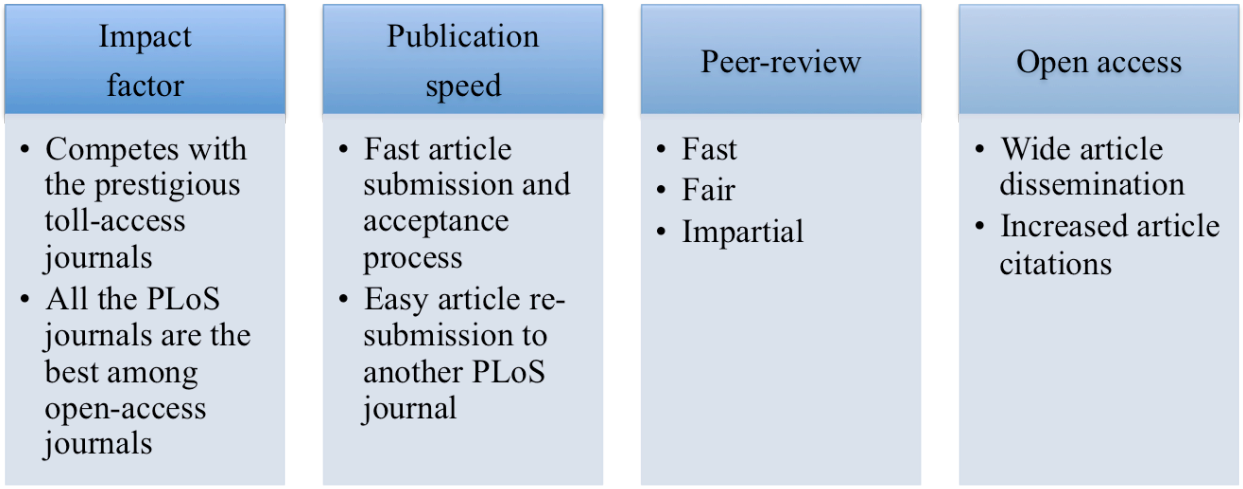
A post-mandate tenured professor in a medical college described his view of how the highly influential toll-access journals operate, which is mainly based on the commercialization of scientific research. He agreed that the motive behind the decision about whether an article will be published is based on whether an article fits into the journals' business model, which is based on the judgment of how profitable or how highly rated the published articles will be. A post-mandate PI researching in oncology explains:

> *Nature*'s income depends on advertising and subscriptions and the number of subscriptions and the number of pages of advertising they get are going to be directly related to the impact factor. So if they publish a lot of papers that nobody refers to, then the impact factor is going to go down. You know, it is like the Nielsen ratings for television, but it is who actually is reading the journal. I think that the open-access journals are a great alternative to a system that just got too much power (ID: POST.24).

In spite of the criticism for the peer-review practices of some of these journals, *Cell*, *Nature* and *Science* are considered by the participants to be the most successful and highly rated publications, where everyone has a strong desire to get published. In this research the PIs categorized the journals they were referring to in various tiers, based on the impact their

publications will have on their future careers. “There are three journals that are targeted and these are *Cell*, *Nature* and *Science*. These are the top three” (ID: POST.16) explains a cancer researcher who continues, “the open-access journals are more in the third category, with some exceptions” (ID: POST.16). The PLoS journals were not always considered to be in the third tier. They were also placed in the first category, as highly prestigious journals. “Basically they are considered top-tier high-impact journals” (ID: POST.27), as the head of an epidemiology department said. Irrespective of their tier, the PLoS publications were described as high-esteem journals that assist promotion, career and tenure purposes. A post-mandate tenured professor said that the promotion and tenure committees consist of people who are “pretty smart and they are subject to the same type of pressure that the people going up for tenure are and they understand the pressure so I don’t think that there is a bias [against the open-access journals].” (ID: POST.24). And the same participant continues by stating, “[t]he fact is that if you publish in *Nature* it is awesome. There is no way around that. But the fact is that if you publish in *PLoS Medicine*, that is darn good” (ID: POST.24). In order for the participants to be promoted in their careers they need to produce quality manuscripts. Although a publication in a prestigious toll-access journal can promote a researcher’s career, the participants believe that the same result can be accomplished when they publish their articles in the open-access journals, although their impact factor and prestige are not considered to be outstanding by everyone.

Figure 2. Reasons the participants chose the PLoS journals

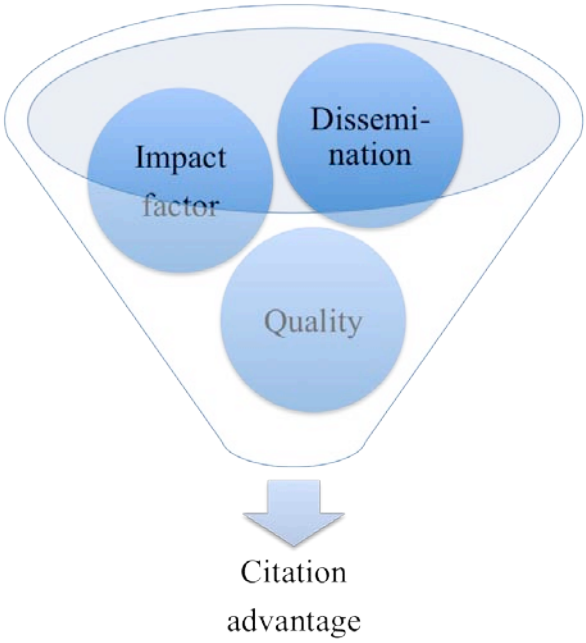


Citation impact

Seven of the NIH-funded PIs (17%) mentioned that one of the reasons they have published with the PLoS journals is the citation advantage, which results from the articles' open-access availability. A post-mandate participant specializing in entomology explains this relationship, "Well first of all because I support open-access. I used the PLoS systems because these journals are most highly rated" (ID: POST.3). The participants in this category were aware of the existing literature, which suggests that the articles' open-access availability increases the citation advantage (Brody, 2004; Hajjen, Harnad & Gingras, 2005; Harnad and Brody, 2004). This relationship — open accessibility and increased citation — emerged both from the data and it was also articulated by the participants. Related to the latter, a pre-mandate participant investigating environmental medicine in both a prestigious academic institution and research center commented, "there is some indication that research freely available by open access is more often cited than research that is not as easily available" (ID: PRE.7).

Apart from the relationship between the articles' open-access availability and the citation advantage, another connection related to the citation was also discovered. Based on the data, where the concept "citation advantage" was coded, the researcher screened the other coded concepts appearing around this key idea. In all the cases, the coded concepts that surrounded the words "citation advantage" were "quality", "impact factor" and "dissemination".

Figure 3. Citation advantage relationship



These words were used as codes by the researcher to indicate that an answer suggested that the PLoS journals have a high quality, that their impact factor is considered to be high and that they provide wide dissemination of the published articles. A participant conducting research in pediatrics explained why he published with PLoS, "[t]wo reasons: one is that several of them are high-quality journals and so they reach a broad audience of people and have good citations, so they make an impact in the field" (ID: PRE.1). A participant from the same institution

specializing in biochemistry stated that, "[o]pen access and impact factor and dissemination" (ID: PRE.13) are the reasons he publishes in PLoS journals. Thus, it could be concluded that some of the participants believe that the open availability of the published articles causes an increase in the citation advantage, and this increase is matched with the prominence of a prestigious publication, which has a high-impact factor and an outstanding quality (Figure 3).

Copyrights

All PLoS journals are distributed under a Creative Commons Attribution License (CC-BY), which accords limited copyright restrictions to the articles and allows their reuse, both by the authors and the readers (Sedwick, 2005). Although the researcher expected that the liberal CC-BY license of the PLoS journals would be a factor inciting the NIH-funded PIs to publish in these journals, it was discovered that it was not an issue the PIs consider. Throughout the research, there was a rather limited discussion on copyrights (*n*=7, 17%). The participants did not seem to thoroughly understand either the issues of copyrights related to their scientific publications or the terms of the licensing agreements they have been signing with the journals' publishers.

The interviewees, who commented on copyrights issues, either mentioned that they did not pay a lot of attention to them — "I don't worry about copyright issues, I just don't think about it" (ID: POST.23) as a professor in neurology explained — or they cared to the extent that they expressed their desire to hold their copyright at all times, although they understood that this is not what really happens, especially for the toll-access journals. A PI in molecular genetics affiliated with a large academic institution mentioned, "I think from our perspective, as researchers, it is obviously to our benefit to hold the copyright, but this meets some resistance"

(ID: POST.7). Another participant researching in the same field at a prestigious university mentioned, “I agree with the argument that authors should have the rights to their published works, their publication rights, the copyright and I like the idea that [a PLoS article] is readily accessible to everyone” (ID: POST.12).

The participants are interested in the journals’ licensing agreements only when they are about to implement the mandatory NIH public-access policy. Their primary concern was to publish their papers in a journal that would allow the article’s submission into PubMed Central and few of the participants (*n*=4) mentioned that they were not aware of how they could track these publishers. For example, a professor in microbiology affiliated with a state academic institution expressed the wish that, “there should be someplace where an author can look at a list of journals and know which ones submit for the authors automatically and which ones [require] the author to do it” (ID: POST.17). The participants, who were not aware that PubMed Central offers this service, were satisfied when the researcher revealed to them the Website with the list of these journals. The journals that submit the articles into PubMed Central on behalf of the authors are more popular, but even when they do not perform this service, the PIs would still publish in them, as long as they conform to the NIH policy’s terms, allowing self-archiving. When a journal does not submit the articles to PubMed Central on behalf of the PIs, then the PIs will have to complete the self-archiving. In this case, fifteen of the participants (35%) are not positive enough that they can always determine the version of the article to which they own the copyrights, before they proceed to the PubMed Central submission, “so you have to make the determination of the last un-copyrighted draft that has not been assigned and send that off to the PubMed Central. So that is a real pain actually. That is an awful [lot of] extra work.” (ID: POST.14), commented a researcher in genome ethics.

Two antithetical practices were revealed through the interviews that refer to the PIs self-archiving process to PubMed Central. There were two participants who mentioned that in an effort to comply with the policy they upload their manuscripts to PubMed Central without further discussing the issue with their publishers, "[n]o, nobody ever cared. And I don't care whether they care, I just do it anyway. I mean you have to wait until the article gets published, but I don't see how a journal can restrict us from following the NIH rules" (ID: POST.9), said a PI specializing in oceanography. In contrast to this opinion, where the participants cared more about complying with the policy than honoring the publishers' licensing agreement, a PI researching in nutrition and affiliated with a prestigious academic institution mentioned that initially she consults the publisher and then proceeds to the submission process:

> You got it backwards. I don't go to PubMed Central first, I go to my publisher first and my publisher, if it is NIH-funded, my publisher does the whole negotiation with PubMed Central in terms of copyright. The copyright is actually held by the journal (ID: POST.25).

The participants were asked to comment if, after the mandatory NIH public-access policy, they had to negotiate with a publisher to retain the copyrights of their article in order to proceed to the PubMed Central submission. Almost all of the authors mentioned that they have never proceeded to such an action. The majority of the participants mentioned that a large portion of the journals' publishers do not impose any difficulties complying with the policy, "every place that I have published has taken care of the compliance with that policy" (ID: PRE.10), stated a pre-mandate participant conducting research in biochemistry. Every time the PIs sign the licensing agreement they inform the publishers that the research is NIH-funded by filling in the part of the license form addressed to NIH-funded PIs. A professor from a large

academic institution said, “well in all the publishers’ copyright forms they do ask if the research was funded by the NIH, so I checked that and they put it in and then it was Web-accessible.” (ID: PRE.12). The largest number of the participants (*n*=29, 69%) mentioned that they only publish with journals that they know that comply with the policy, and this way they avoid further issues related to non-compliance, “any journal had to change their policies to go with the NIH policy. They had no choice, otherwise no one would have submitted to them and they would go out of business” (ID: PRE.5), as a pre-mandate PI in physiology explained.

During the interviews one of the participants revealed a unique point of view, which had not been revealed in other interviews. Although this interviewee was a NIH-funded PI, he was not conducting research in the health sciences field, but in “access to research results and intellectual property and copyright” (ID: POST.14) as he explained in the interview. As a result, this author was publishing a large number of articles in legal journals, rather than in health sciences journals. The author reported extensive negotiations with the publishers, due to two reasons. First, the legal journals do not include special instructions for NIH-funded PIs, since there are not many NIH-funded authors who publish in these journals, and second, the author due to his expertise on the topic, had an in-depth knowledge on the copyright issues and the negotiation process was not an unknown procedure to him, “some law school reviews, ironically, do not have the NIH-policy built in, because they are not used to publishing in research, which is funded by the NIH”. This author, found himself negotiating numerous times with journal publishers in order to proceed to the PubMed Central submission, “I have had, I don’t know 15-20 publications during the last year, and at least 2/3 or 3/4 of them entailed some set of negotiations with the publisher that were not in standard form” (ID: POST.14). The first step in the negotiations with the publishers is written correspondence, “[i]t often starts with an email and

sometimes it goes to letter" (ID: POST.14). When the participant was asked if he believes that he wins in the negotiations he replied:

> Here is my crack at it. I would say we lose in the sense that we have to. Our standard is pretty much open access, period. And that is what we want. We want our audience to reach our work. So anything less than complete open access is not up to our gold standard. So we fall short of that quite often. There had been some embargoed periods, you know the journal the one-year thing, sometimes it is six months. So sometimes we had to give that up, but I am happy with that, it is fine. People may not be able to use it immediately, but they get free access after that. (ID: POST.14)

Based on this participant's words, for some of the open-access advocates compromising with a publisher and accepting an embargo period is a loss for open-access. Nonetheless, the participants have to disseminate their publications and occasionally they have to accept the publishers' terms, even though the result is that the article will be closed to the public for some months.

Publication fees

Every time a NIH-funded investigator applies for NIH funding or renews existing funding, he/she retains the right to include in the budget proposal a detailed estimation of the money that will be allocated for publication expenses, "we pay increasing attention to page charges and publication fees and try to budget for it." (ID: POST.1). In the past these expenses covered page charges and the cost for reprints, while currently, according to the policy's terms, expenses are not limited to printed-journals costs, but also include charges for electronic

publications and more specifically the open-access journals fees, “in the old days [expenses] would be for reprints but now it is for open-access or page charge[s].” (ID: PRE.7).

When the participants were asked how they cover the publication charges when publishing in the PLoS open-access journals, all authors answered that payments were made possible through the NIH fund. For the bulk of the authors, the NIH resources are the only monetary assistance they have available for their publication charges — “[p]rimarily NIH grant funding.” (ID: POST.2), mentioned a participant from a state academic institution. Only a couple of participants suggested that if they do not have enough NIH resources, then they could request money from their affiliated institution’s department. A physiology professor affiliated with a large private university reported, “Funding comes out of grants. Officially we don’t have assigned money. If I cannot afford to publish this paper I can beg my chairman for the money. But basically it is grants” (ID: PRE.5). Only a couple of authors mentioned that apart from the NIH grant and the institutional resources, they have other financial resources, which can be used for their publications. A researcher affiliated with one of the largest private cancer research centers explained, “[w]e pull out money from some of our grants. We have [funds] specified for publications [in] some of our grants, but when they are not in the grants we use philanthropic money for that.” (ID: POST.4).

A few participants (*n*=6) said that the publication fees charged by the open-access journal publishers are relatively high and unjustifiable, because online publications do not have the same level of expenses that the printed publications do. As a PI from an academic institution puts it:

> “One [journal] that comes to mind is clearly an open-access journal [that journal is *PLoS ONE*], but I was shocked to see that they wanted $1500 to publish a paper there. So my view is that they are not publishing something other than these online things and I don’t

know why they would want so much money. I guess because they can't sell anything. I guess if you can't sell a paper bound journal to a library to pay for it, you have to charge the authors for publishing the paper online. So I don't care much for that." (ID: POST.9).

The expense of the publication fee seems to be one reason prohibiting authors from publishing in open-access journals (*n*=8). Although the public-access policy ensures coverage of publication expenses, allowing the NIH-funded PIs to include in their budgets allocation of funds for publication costs, for a pre-mandate participant affiliated with a large academic institution the policy is an "unfunded mandate" (ID: PRE.12). He understands that the policy's goal aims to ensure the articles' open accessibility, but he believes that providing this openness by publishing in open-access journals is not possible due to the budget restraints, "if they mandate I have to publish in open-access journals they have to approve my budgets to allow me to do that. When I write a budget I write a hefty line for publications but it is never enough." (ID: PRE.12).

A participant from a large university specializing in cell biology said that since the academic institution and library subscribe to the journals he needs, he chooses not to publish in open-access journals and he explains, "[s]o since I am an academic institution I get free access because of the institutional subscriptions. I find this much easier than paying the $2,000 publication cost." (ID: POST.1). Researchers consistently said that currently all types of publications, both open-access and toll-access, are high-priced, "all publications these days are expensive, I think overall expensive" (ID: POST.8). A professor from an academic institution says that scientists must adjust to the new reality and keep distributing the information they produce to the public, "[y]ou don't have a choice, you have to do it. You can't generate information and not tell anyone about it." (ID: POST.8). The dissemination of the research results are an essential component for the development of all sciences, and the publications'

expenses are considered to be a necessary expense, "[i]t is expensive, but I think it is appropriate, an appropriate expense" (ID: POST.12), a professor from a prestigious and well-funded academic institution explained.

When the participants were asked if the money they receive for their publication expenses from the NIH is enough, the answers were both positive and negative. Almost half the participants, who were affiliated with various academic institutions and research centers, believed that their funding is adequate, since they received the same amount they requested in their budget proposals, "[y]ou have to budget for it. If you budget it appropriately then there is enough money." (ID: POST.12). The other half felt that the money they receive from the NIH is never enough, and that lately, due to the global financial crisis, there are cutbacks in the proposed budgets. A participant from a large medical academic institution reported, "[t]hey don't give me as much money as I would like to have. I submitted a budget which would cover all my publication costs and all my supply costs and then they just cut the budget." (ID: PRE.12) and another participant from another large academic institution added, "for any grant that you get now the amount is administratively cut anyway, so there isn't a lot of money to go around for anything." (ID: POST.26). The participants commented that in the past years the NIH has been conservative in spending for publication expenses. Although in the past an author could justify future publication expenses by providing the number of published articles and the amount spent in the previous year, it is believed that the NIH does not accept high budget allocations for publication expenses as often as it used to. A professor in genetics affiliated with a prestigious academic institution, who publishes a large number of articles every year mentioned, "[t]he NIH will say, no, nobody gets ten thousand dollars, twelve thousand per year for publication. So we

end up re-budgeting, which is unfortunate, but it is one of the things that one has to do." (ID: PRE.11).

All the participants (*n*=13) who were asked the follow-up question of whether they could afford to provide all their articles open access answered that this option seemed to be rather difficult, due to the high cost, "if I was to publish with nothing other than open access, it might be difficult, because then [the money] may not be enough. But certainly for the occasional publications and the occasional page charges it has not been an issue" (ID: POST.23), explained a professor in neural control. Another PI who runs a laboratory in a prestigious university said that, although it is highly desirable, they cannot afford to publish all their articles in open-access journals, "[i]t is enough only if we publish a small fraction of our papers in open-access journals. (ID: POST.27).

For four authors the publication cost is high enough to prevent them from publishing in open-access journals. A pre-mandate PI conducting research in biochemistry mentioned the reason he does not prefer to publish an article in an open-access journal, "[b]ecause it is always more expensive to publish in open-access journals, or choose an open-access option that not" (ID: PRE.10). The same PI explains that this extra added cost related to the open-access publications does not exist in the case of the subscription journals, thus he assumes that researchers prefer to publish in the latter more. "So that would be my guess for people who really back up, you know there is a monetary consideration that you don't necessarily have in other journals, although many journals have some page charges" (ID: POST.10). On the other hand, a couple of PIs mentioned that the open-access journals' publications fees are not expensive, "[b]ut in most cases the publication fee is too low. So we are talking about a few hundred dollars at the most." (ID: POST.16). Another author commented specifically on the low cost of the PLoS

publication charges, "[s]ome journals ask for a tremendous amount of money in order to make the paper open access and this is a lot of money. But the cost for the most PLoS journals is very competitive" (ID: PRE.13). Although the latter two participants do not consider the publication charges imposed by open-access journals to be high, it is worth mentioning that both of them are affiliated with prestigious academic institutions that are considered to be well-funded by the NIH.

Nine participants (21%) mentioned that there were cases where the toll-access journals charged the same amount of money for publication charges as the open-access journals. A PI in physiology stated, "I look at a journal and I look at how much it costs to publish a paper in this journal, for example a biophysical journal and then I see that it costs as much as an open-access journal" (ID: POST.23) and in such cases, there is a preference among the PIs to publish the articles in the open-access journals, "I suggest that we don't publish there. I mean if we are going to pay $1500 for a paper, we should only do it if it is an open access journal, because this is how much it costs to publish in an open-access journal." (ID: PRE.5). This participant views the publication costs as money he is spending to receive something back in exchange, and in this case, the author expects that a high publication fee is worth being spent only when an open-access option is negotiated, "in other words it makes me expect to get something from my money. So if I am paying a lot of money to publish it then I expect to get open access." (ID: PRE.5).

The interviews took place between April and May 2011, a period close to the progress reports and the budget renewals. During the interviews a pre-mandate and an open-access supporter said that at that time he had articles ready for publication that he had wished to make them open-access but could not afford the expense, "it is tough. The problem I am facing right

now is that I am three months before this grant renews and I am really tight and the problem is that I have published, oh God I have one, two, three, four, five papers recently and I just don't have the budget to do open access." (ID: PRE.12). The same PI continued by saying that the publication charges to publish all his articles open-access every academic year would be more than $20,000, which is approximately the amount of money they would spend if they had hired a graduate laboratory assistant for the academic year.

NIH public-access policy

Open-access familiarity

In the current literature Over et al. (2005) conclude that the level of open-access journals awareness by the health sciences authors is ranked highly compared to the authors in other subject fields, and Hess et al. (2007) discovered that their investigated population, who were health sciences researchers, tends to greatly favor the open-access publications. In this current research the participants mentioned a familiarity with open-access, which they gained when they were following the debates and the public conversations on the topic, but also when they were discussing it with their colleagues and publishers. All the comments the authors provided concerning their open-access awareness, though, involved the open-access journals. Although the NIH public-access policy is about self-archiving into PubMed Central, none of the authors articulated the relationship between open-access and the self-archiving practice during the interviews. All the participants, when they were discussing their open-access awareness, were referring to the open-access journals. Five participants stated that they are extremely familiar with the open-access journals because they serve on an open-access journal editorial board and

the rest of the respondents had either published in them, or they have been reading open-access articles.

When the participants were asked to express their familiarity with open access, the more general answers were that they are familiar with the open-access theories. “I am familiar with the concept” (ID: POST.20), said a PI affiliated with a large academic institution conducting research in biochemistry, and another academic focusing on molecular biology mentioned the open-access journals business models, “I am familiar with all the different models for funding journals” (ID: PRE.6). Two participants mentioned that to them open access means that the articles require no access fee. Two PIs affiliated with academic institutions stated, “[t]o me open access just means that you don’t have to have subscription to get access to the journal’s content” (ID: POST.8) and that everyone can access the content, “[t]o me it means that you can, you know, everyone can download the journal and the article” (ID: POST.18). Three post-mandate PIs from research centers mentioned that open-access relates to the retention of copyright, “[s]o I am very aware of the issues of having something downloadable and yet copyrighted” (ID: POST.13), said one participant while another mentioned that open-access refers to immediate access to information, “[o]pen access [means] that it is available as soon as it is published online” (ID: POST.11).

Almost half of the post-mandate participants associated with either academic institutions or research centers, in an effort to show their level of interest towards open access, stressed that they have been following the debates related to the topic. One participant said, “I have read the literature about it, when there was a lot of discussion a few years ago, about starting the PLoS library journals” (ID: POST.12) and another stated, “[w]hen the whole idea of the open-access journals was first pushed by Harold Varmous and *PLoS Biology* was funded there was an active

debate about the importance of such journals in the literature" (ID: PRE.11). One pre-mandate participant and open-access advocate not only followed the arguments about open-access but also actively participated in promoting the open-access publishing as an author, "I publish a great deal [in open-access journals]" (ID: PRE.13) and a post-mandate participant, who was also self-characterized as an open-access advocate participated on open access as a reviewer, "I have both reviewed for open-access journals and I have published in open-access journals" (ID: POST.17).

Of the forty-two participants, five of them were journal editors; three of them were editors in open-access journals and two of them in toll-access society journals. All of them mentioned that they are aware of open access because of their affiliated titles either as editors — "I am one of the scientific editors" (ID: POST.16) — or because they were serving in societies that were interested in the topic — "I was a president of a scientific society journal when this debate was going on." (ID: POST.25). The participants who were editors in open-access journals felt they had a more in-depth knowledge on the topic, "I am on the editorial board of the [X] open-access journal, so I am pretty familiar" (ID: PRE.13), while another one stated, "for several years I was the editor of a journal in open access" (ID: PRE.7).

NIH-policy familiarity

As explained in Chapter 2, the NIH public-access policy has a long history; the planning started in private discussions, where the researchers envisioned a system for the open distribution of the publicly-funded research, while in the end it was established with the government's support. To accomplish its purpose, the policy entails terms and conditions, with which the NIH-funded PIs have to comply ("First U.S. Public," 2009). This dissertation attempted to define how

well-informed the NIH-funded PIs are in relation to the policy's terms and how they manage to comply with the policy's specifications.

In an effort to investigate the level of accuracy of information the PIs are receiving on the policy, they were asked to define where they had first heard about it. Almost half the participants did not clearly recollect where exactly they had learnt about the terms of the policy. A few examples of their responses are, "I am not sure actually" (ID: PRE.11), "I am not sure how I learned about that" (ID: POST.10), "I don't remember" (ID: POST.18), "Oh boy- I am not even sure if I remember how I first heard about it." (ID: PRE.1) and "I don't know" (ID: PRE.4). Based on these quotes it is obvious that the policy has a long history and many participants could not easily provide a definitive answer.

Almost all of the participants recollected that they had read about the final terms of the NIH public-access policy through the NIH by an email, "I heard from several people and finally I got emails, more official emails from the NIH. But the rumor was spreading before we got the official notice" (ID: POST.16) commented a participant originating from a large academic institution, while two others affiliated with smaller universities said, "I think the NIH wrote me a letter, or an email and said you have to submit to Pub Med Central. I really don't remember the answer to that question." (ID: POST.8) and "I learned because NIH sent letters to NIH-funded investigators about this compliance, so there was direct mailing from NIH." (ID: PRE.8).

Before the final compulsory NIH public-access policy in 2008, the NIH had regulated similar voluntary versions of the policy, starting in 2004 (Chapter 2). The NIH-funded-PIs recollect reading and discussing the policy throughout these years. During the time between the two periods for the voluntary policy and the mandatory policy, the terms related to them were being extensively discussed, adding constant exposure. "It was very well publicized. I don't

know if I saw it first directly from the NIH, because I am a NIH grantee, or if I saw it first in journals and in the news. It was widespread" (ID: PRE.10), mentioned a pre-mandate and non-advocate PI, while another PI gathered information using a different medium, "[w]hen it first came out, first of all we were following the amendments in the appropriations process" (ID: POST.14).

Apart from receiving the NIH emails the PIs remember reading other NIH materials too, such as the institution's bulletins and Websites, "I am in E-commons, so I think that some stuff came from there" (ID: PRE.2), as a researcher in genetics mentioned. The institutions, with which the authors were affiliated, were also involved in the dissemination of the details of the policy. The main information technique was through emails — "many emails from my hospital's administrators" (ID: POST.4), said a post-mandate PI affiliated with both an academic institution and a hospital. These emails mainly originated from the grant departments and the institution's administration, "[t]hey came out from the office of research" (ID: PRE.9), reports another PI who works in a research center conducting research in molecular biology. The PIs, who run large laboratories, usually have one or more administrative assistants and project managers and they would be informed about the details of the compliance terms from them. Those assistants would conduct research on the topic and inform both the PIs and the laboratory members, "the specific details involved with complying… I learned about that by communicating with my program officer." (ID: PRE.5), said a PI who runs a large laboratory team. The participants also mention discussing the issue extensively with their colleagues. A PI from an academic institution recollects, "I have talked to a lot of people about this topic for quite a long time" (ID: POST.3).

Although the PIs stated that they read about the policy through the NIH email or the various NIH electronic resources, they actually learned about the policy while they were

completing the application forms and the progress reports, where they had to pay close attention to the terms, and understand the details in order to sign and comply. A PI from a large academic institution recollects, "when I actually tried to understand what it is, and I still don't understand what it is, but when I tried to understand it, I was looking at the instructions for grants." (ID: POST.18). A pre-mandate PI referred to a similar situation, by describing how he collected the information concerning the implementation of the reports:

> [t]he existence of the new program I learned about in some kind of email… but then in terms of the specific details … which have to do specifically with how progress reports have to be written and how grant renewals have to be written … I learned about that while I was writing them in part by reading the policy online and also communicating with my program officer. (ID: PRE.5)

It is obvious that the participants mentally distinguished the two steps concerning the NIH public-access policy. The first step was familiarity with the mandate and its terms, and the second step, which seemed to be the most important and most difficult, is the implementation of the policy and the reassurance that all the necessary steps are taken, which will ensure further funding from the NIH.

Complicated policy

The implementation of the NIH-public access policy has various steps. As discussed in Chapter 2, for the PIs to comply with the policy they have to read the text and understand how to adjust the copyright arrangements, self-archive their published material into PubMed Central, define the embargo period and receive a PubMed Central identification number (PMCID#) (Joseph, 2008). An attempt was made to determine how well-informed the PIs are in relation to

the policy, and if they have had any difficulties understanding its terms. Based on the PIs answers, three categories were established (Figure 4). The first one is composed of the PIs who mentioned that they had no difficulties understanding the policy (*n*=13, 31%) and felt confident complying with it, describing both the policy and the process as being "self-explanatory" (ID: POST.11). The second category consisted of the PIs who mentioned that they had never conducted the submission process themselves (*n*=15, 36%), because someone else was responsible for the whole process. Fourteen of the participants (33%), the third category, mentioned that they have had encountered difficulties during the submission process.

Figure 4. Understanding and complying with the policy

The NIH public-access policy is easy to understand and comply	N=42, *n*=13, 31%
The NIH public-access policy is difficult to understand and comply	N=42, *n*=15, 36%
The PI's have assistants who are responsible for the submission and could not express an opinion	N=42, *n*=14, 33%

These PIs were asked to report the parts of the policy they found complicated. Their answers can be divided into three categories: the (a) policy's wording, (b) licensing agreements, and the (c) submission process.

Policy wording

Almost one third of the participants characterized the wording of the policy as unclear and difficult to understand. What is worth mentioning is that virtually all of the PIs responded

that they had never read the whole text of the policy. Although such a response could have been expected mostly from the PIs who were not responsible for the submission process, because someone else is conducting it on their behalf, this response was also popular in the group that controlled the submission process themselves. Almost half of the participants who have not read the policy and do not conduct the submission process mentioned that they consider the policy to be clear, because their assistants have never complained about it, "[y]ou know, I didn't do that myself but no one complained to me" (ID: POST.24), said an oncologist from an academic institution. The other half of the participants who do not conduct the submission process assumed that the policy is perplexing. This assumption is based on the fact that since their institutions have hired an administrative assistant, whose job is to deal with the policy and its requirements, then to them this implies that the policy must have unclear parts, "that is why we need specialists, because it is complicated. We need specialists so we can understand it and we can handle it… It is confusing enough that we have people that are dedicated to doing it." (ID: POST.4), mentioned a PI working in a research center. Under these circumstances, the NIH funded PIs have simplified the policy's terms and taken into consideration the most important part of it, which is the submission of the article into PubMed Central. A participant affiliated with a large and prestigious academic institution explains that "the information is really difficult to understand, so I don't know where I would… what it means other than they kind of want things accessible online, you know that every citizen could get the article." (ID: POST.18).

Concerning the ambiguity of the policy's language, what is not clear to the PIs is the type of papers that should be submitted to PubMed Central, and their versions. Although there is an understanding that publicly funded primary research, such as research articles, have to conform to the policy's terms, what the PIs do not understand is the status of the review articles or

commentaries, and they cannot decide whether they should proceed with a submission to PubMed Central or not. A post-mandate PI specializing in anatomy and affiliated with an academic institution stated which parts of the policy are unclear to him, “I am quite sure of the status of review articles and commentaries. I understand the status for primary research, but I am not sure about the status for publicly supported review articles. I guess this may reflect my ignorance.” (ID: POST.2). Another participant employed in a research center discussed another confusing part, “[a] journal article is [subject to the rule], but what is a journal article and what is a book chapter is not always completely clear and we had to figure that out” (ID: POST.14). As it turns out sometimes the PIs have difficulty determining specifically when a piece of writing is considered to be a book chapter and or an article, especially nowadays, when the electronic publishing has altered the traditional nature of a book chapter or a journal article. During the self-archiving procedure, a PI affiliated with a research center was not confident about the version of the submitted paper, “it had to do something with formatting, or size of manuscript, or whether we had to put supplementary material through it” (ID: POST.9) and he could not discern where exactly in the policy there were specific instructions for formatting issues.

Licensing agreement

The policy’s terms, when they are examined in relation to the journals’ copyright agreements, seem to be frustrating to the PIs. In general, the participants do not seem to pay close attention to the publishers’ licensing agreements and they do not follow specific strategies to manage the copyrights of their articles. On the other hand, when the policy was first implemented the journals had not yet defined specific guidelines related to its terms, but the participants mentioned that lately some of the licensing agreements have shifted to serve the

needs of the NIH-funded PIs. A participant affiliated with a large academic institution mentioned that he had published an article in a journal that did not have specific guidelines about NIH-funded authors and the status of this paper had been unclear for a long time after its original publication, “I got a note from NIH that they didn’t receive this paper, it hasn’t been deposited to this PMC system” (ID: PRE.8). The author explains that this process is confusing, and continues, “that’s where the problem comes, because I don’t have any way to do that, if the journal has this arrangement with the NIH and the authors are not empowered to do it” (ID: PRE.8).

The shift in the journals’ licensing agreements towards compliance with the policy was characterized as inevitable in order for the journals to sustain their publications. A PI affiliated with a research center who mentioned that he publishes mainly in the same society journal noted, “[the journal] had to change their policies to go with the NIH policy. They had no choice, otherwise no one would have submitted to them and they would go out of business” (ID: PRE.4). Although changes have occurred, there are still problems concerning the licensing agreements, since they vary with each journal. A participant affiliated with a large academic institution explained, “it is not exactly clear to me whether the journals do that, or if I am doing that. What happens then? That is not really clear to me.” (ID: POST.18). And he continues by saying that when authors submit an article to a journal, they are informed about the publisher’s policies only after the article has been accepted for publication, “[a]fter, if at all.” (ID: POST.18). It is at that time that the publisher would inform the NIH-funded PIs not to proceed with the submission of the article, but in some cases the embargo period still remains unknown to them:

> Maybe some journals deposited after twelve months and maybe the twelve months have not expired yet, I don’t know I am not sure about that, but I have noticed that other

journals have deposited much faster, at least they have not waited until the last moment." (ID: PRE.8).

As a result, the confusion the PIs experience when the journal is responsible for the manuscript submission to PubMed Central has two issues. The PIs seem to have an unclear understanding of the status of the journals that are submitted immediately on their behalf, and, also, there is a growing confusion regarding the embargo period of each journal.

Those PIs who publish the majority of their articles in the same journals are less frustrated with the status of their articles, but those who publish many articles every year in various journals are not always aware about the details of the licensing agreements of each publisher. Some of them publish approximately twenty to forty articles, while others produce an even larger number of papers, around seventy to eighty. Every year they usually publish their papers in various journals, but when they have to submit the progress reports or the budget renewal applications, they are not aware of the status of all of their papers, "some of them [papers], it is because there is a one year embargo, and it is not always the case, so I am at a loss. I don't know what is going on with them" (ID: POST.23) a PI from a prestigious and well-funded academic institution conducting research in genetics explained. Tracking the status of the journals' licensing agreements and the conditions for all these articles is an onerous job, "[m]y only concern is that I don't know if all my papers will end up there… for other journals [toll-access] it is difficult for me to monitor the process" (ID: PRE.13) stated another PI from the same institution, who conducts research on infectious diseases.

One advantage of the PLoS journals is the fact that they submit the published articles to PubMed Central, a beneficial practice for the authors since they will not have to take any further action to comply with the terms of the policy. The immediate submission of all the PLoS articles

to PubMed Central, irrespective of the funding institution, was not known to the PIs. More than half of the PIs (60%) reported that they were ignorant about this relationship, and a relatively small number (*n*=5, 12%) mentioned that after their article was published they uploaded it themselves into PubMed Central, the same way they used to do for the rest of their publications, which were not in open-access journals. What the PIs seem to favor most about the PLoS journals, is the fact that the journals upload the final published version of the articles to PubMed Central immediately upon publication. This preference was widely expressed by participants who were affiliated with either academic institutions, or research centers and hospitals: "It is open access. You don't have to go to PubMed and the article is in the definitive version in *PLoS Biology*." (ID: POST.2), or "since PLoS is by nature an open-access journal, what happens is that users are able to see the final full version of the article" (ID: POST.3). A pre-mandate researcher in genetics stated, "if you have a paper that *PLoS Genetics* has published, you will see the paper in its actual formatted form when you go to *PLoS Genetics*" (ID: PRE.2).

By contrast, some of the toll-access journals follow a different practice, where the PIs have to upload their own final version of the paper to PubMed Central. This results in the existence of two different, available versions of a paper, one that is the final publisher's version of the article and another one, the authors' final version, which exists in PubMed Central. The latter is "a separately formatted paper, which looks very different and it is cited very differently, so it is a little confusing because now there are two versions of your paper out there" (ID: PRE.2) said the PI in genetics, and this practice is not always supported by the PIs, "PubMed Central can have a different version deposited than the one that the journal actually publishes. So this is what is the problem to me. It seems to me sort of redundant and a nuisance" (ID: POST.1), a PI affiliated with an academic institution said. Another PI working in a large and prestigious

academic institution stated, “different journals have different policies so that it is somewhat confusing about what can be submitted and what cannot be submitted to Pub Med Central. What version of the article is acceptable to upload?” (ID: POST.12).

In spite of the frustration, the participants stated that they understand how the policy benefits the research community. A PI employed in a large and prestigious academic institution supports the idea that there is a “knowledge transfer” (ID: PRE.3) to the general public and although the policy is, perhaps, perplexing, they are willing to adjust and comply with it. A participant from an academic institution investigating in molecular biology considered himself “old” and not familiar at all with the current technology, a situation that creates problems:

> So every time I have to go to a Website and fill out some form, whether it is PubMed Central or whatever, it is probably going to aggravate me, because [computers] are not intuitive to me and I don’t know how to make them intuitive. Sometimes, I will be trying to fill out a form, and I can’t even say what you are asking me here, what do you want. (ID: POST.8)

The same participant, though, understands the benefit behind the public-access policy and he adds, “I get aggravated with new things to do. I am just a scientist. But I support all this and I am trying to be patient” (ID: POST.8). Another participant, who is affiliated with both an academic institution and a research center specializing in oceanography mentioned, “I completely understand the reason and I agree with the reason. It is just that there are cases when I don’t have any time left to go chase these numbers around” (ID: POST.9).

The majority of the authors concluded that overall they are trying to comply with the policy by ensuring that all their manuscripts will be uploaded to PubMed Central, either by the journal or someone else. To them having the article appear as assigned by the terms of the policy

repository is the basic requirement they have to fulfill in order to comply with the policy and assure further NIH funding. A participant from a large academic institution researching evolution stated, “I don’t know the details, only that I have to have this article submitted to PMC so that it is available to the public. I don’t worry about the details.” (ID: POST.19). For that reason, when 11% of the participants upload their papers to PubMed Central, they do not even inform their publishers about the submission. “I don’t even know that they know, because I do it and you know, I don’t announce it to them, I just do it.” (ID: POST.23) a PI from a prestigious and well-funded academic university said. Although these PIs anticipated that at some point the publishers would have contacted them for breaking their license agreement with the publisher, by submitting the article to PubMed Central, they mentioned that the publishers have never bothered them, thus, they continue submitting the articles to PubMed Central without asking for permission.

Submission process

The majority of the NIH-funded PIs (*n*=30, 71%) find that compliance with the policy takes extra effort, which makes it time-consuming and an administrative burden, a finding that agrees with the results of Fry et al. (2011). The participants feel frustrated because they are not familiar with the details of the policy, and the procedure of listing, submitting, reviewing and approving publications seems to be too complicated (Figure 5). To them the fact that many academic and research institutions have created administrative positions to assist the NIH-funded PIs with the policy’s terms is a factor proving that the policy is complicated. It was mentioned that if the policy was not so complicated, “there would not have been the need to have an assigned staff member to conduct this job”. A post-mandate PI characterizes the access policy as

"administrative burden" (ID: POST.9), and a pre-mandate PI characterizes it as an "unnecessary nuisance" (ID: PRE.11) that adds to the existing administrative responsibilities, which are not related to their role as scientists. A post-mandate participant affiliated with a research institution mentioned:

> [The policy] is confusing enough that we have people that are dedicated to doing it. It is not onerous, but you know there are rules that you have to follow. You know this paperwork is clerical work, and this clerical work we like people who know the details to take care [of it]." (ID: POST.4)

Along with the belief that the policy is considered to be an administrative burden it was also mentioned that it is a "low priority" (ID: POST.9) and "time consuming" (ID: POST.17) since multiple steps are required to ensure compliance, such as tracking the license agreements for each published article, conducting the PubMed Central submission process, and adding the corresponding PubMed Central identification numbers to resumes, progress reports and the applications for funding. A PI conducting research in genetics for a large academic institution reports, "[t]hey are asking us to do things, they are enforcing it rather strongly and you cannot, if you apply for a new grant, and you submit your CV every single paper in your CV has to be uploaded." (ID: POST.26).

On some occasions spending time to comply with the policy seems to be useless. The policy allows an extended embargo period and researchers who conduct competitive research and wish to be constantly updated with the most recent developments in the field will not benefit from it as a participant affiliated with a large and prestigious academic institution mentioned, "I wonder if it is really necessary. I don't understand the utility for a serious researcher, you know, leaders in the field, people who already know what is going on in the field who are getting the

information from the journals." (ID: POST.16). A PI affiliated with an academic institution conducting research in nutrition considered that the policy does not successfully complete its objective, "I don't think that it actually accomplishes the goal, which it was intended to accomplish and it creates all kind of outworked effects that are not to anyone's advantage." (ID: POST.25). When this researcher was asked to elaborate on what she meant by the statement that the policy does not "accomplish the goal", she continued:

> Well the goal that I understand it intended to accomplish is to make the findings of the scientific literature available to the public. But it misses the point that the public is not educated enough to read scientific articles. We are scientists and write our papers to talk to other scientists and not to talk to the public. So even if they can look at the paper they will not necessarily be able to understand what this means. A better policy would have been to require us to provide lay abstracts on our paper and make the lay abstracts available, or an extended lay abstract (ID: POST.25).

It is important to take into consideration these participants' commentaries, as they refer to the two most important terms of the policy: the public access to research results and the allowance of an embargo period. The policy can be characterized as being successful only if it is in accordance with the participants' beliefs, since they are the ones who have to take the extra steps and comply with it. If the participants do not trust the policy and its benefits, then the chances increase that the policy will be less powerful.

Concerning the process of submitting a manuscript to PubMed Central, three different types of answers were provided. Thirteen (31%) of the participants mentioned that they experienced no problems, while fourteen (33%) were not in a position to express an opinion because someone else was responsible for the submission — an administrative assistant, a

graduate student, or a designated librarian. A third of the respondents (36%) mentioned that they have experienced difficulties in their effort to submit their articles to PubMed Central. The first category of authors mentioned that the process was relatively easy and fast and that they did not have any comments for improvement. Two post-mandate researchers explained, “I actually didn’t have a problem with it. I actually thought that it was a very easy thing to utilize, and for me it was quite seamless” (ID: POST.7) and “[t]he procedure was relatively straightforward and the software was good. There were no problems.” (ID: POST.6). Also, during the first submission another participant explains how he had small difficulties, “[m]aybe the first time or two it took a little bit longer. Now I do it more quickly. It takes me one or two minutes to upload the manuscript.” (ID: POST.16).

In the second category belonged authors who had never been involved in the process. For example, a pre-mandate researcher in molecular biology said, “I haven’t personally submitted, so I think that I would personally not answer that question.” (ID: PRE.9). These participants either had either assistance from their affiliated institution — “my secretary does all that” (ID: PRE.6) — or were always publishing in journals that submitted on their behalf. According to the statement of a PI conducting research in tropical medicine, “I publish in the journals that have an arrangement with PubMed Central to automatically deposit papers there, so I don’t have to do something myself.” (ID: PRE.8). Based on the wording of the policy the PIs must self-archive the manuscripts to PubMed Central, or someone else can complete the submission on their behalf (“First U.S. public”, 2009). When the journals submit the articles to PubMed Central the procedure becomes easier for the PIs. In this case the PIs do not have to log into the databases and upload the manuscript and any complementary files. They only have to take care of the last step of the submission, which is the inspection of the manuscripts uploaded by the publisher and

the acceptance of the final submission (Chapter 1). To them, being responsible only for the last step of the process makes the policy less time-consuming. This journal practice is popular among the PIs and when one of them, who is affiliated with a research center, was asked if he would consider submitting an article in a journal that does not submit, he mentioned:

> I would be much less inclined to publish in that journal because that would be a lot more work for me. So I think it is an important factor in my decision about which journal to publish in. All the journals that I have published in have that policy, so I didn't have to make that decision yet" (ID: POST.11).

Twenty-nine participants (69%) are in favor of the journals that conduct the submission process on behalf of the authors, while the rest are willing to submit an article to a journal that does not offer this service. A pre-mandate PI who belonged in the latter category answered, "that wouldn't necessarily be a problem", justifying his attitude by saying that, "[t]o me the primary motivation for the choice of a journal is the caliber of the journal and the audience that it serves, and an issue like this I see as minor." (ID: PRE.10).

For the article submission process to PubMed Central thirteen of the PIs mentioned that they have administrative staff designated to assist them with the NIH policy, "we hired and assigned somebody to do that" (ID: POST.4) as an oncologist affiliated with a research center mentioned. One of the participants, who is affiliated with a large research center that is part of an academic institution, stated that they have a full-time person responsible for the submission process, "we have a research assistant assigned to this function, so there are about 25 or 30 people working in our biggest grant" (ID: POST.14). Other NIH-funded PIs have their manuscripts submitted by their "personal secretary" (ID: PRE.6), "project manager" (ID: POST.3) or "students or post-docs" (ID: PRE.1). Only a couple of authors mentioned that their

institution has an organized office in the library that handles this type of communication, "[y]es, there are good assistants at the library and it is a dedicated job" (ID: POST.4), and library specialists are responsible for the submission process. This department of the library, apart from working with authors and ensuring that they comply with the policy, also "works with these journals in terms of making sure that we have complied with all the requirements in that regard" (ID: POST.4). In general, although it was expected that the libraries would be committed to assisting the PIs with the submission process at a greater level, it was discovered that they are not very involved with the procedure.

The participants who run large laboratories or were affiliated with large academic institutions that receive significant funding had their assistants investigate the policy's details and inform them about its technicalities. These PIs felt that they were more informed about the policy than the rest of the participants, who lacked such assistantship, and they also had a more positive attitude towards the policy. The portion of the authors, who did not have assistants dedicated to this task, had a greater level of frustration concerning the policy and more negative feelings about the tracking process and believed that it is time-consuming and frustrating:

> We only have a certain number of hours in the day, so we can either do research with that time, or you know, spend the time submitting information to the NIH Websites. And you know, some people have administrative help to do that. Others don't. So it is an added administrative burden." (ID: POST.9).

This participant is affiliated with a state academic institution and did not have an administrative assistant helping him with the policy. In general, the participant mentioned that he feels that he has plenty of administrative responsibilities on a daily basis, which are taking much of the time that he could invest in conducting research.

The third category of authors characterized the submitting procedure and the software interface as being either “terrible” (ID: POST.1; ID: POST.15; ID: POST.22; ID: PRE.11) or “clumsy” (ID: POST.1; ID: POST.17) to use the participants’ words. A participant affiliated with both a research and an academic institution expressed a general dissatisfaction by mentioning, “[s]o most people, you know, consider that process to be somewhat a weird, awkward pain” (ID: POST.9). The uploading of manuscripts to the PubMed Central interface was considered to be a complicated process, even for authors who considered themselves to be advanced technology users. A post-mandate participant affiliated with a large academic institution said, “And I mean I am a pretty computer savvy guy and I think that the system is still pretty clunky.” (ID: POST.22).

Many themes emerged from the interviews concerning the submission process. One of the main emerging themes was that the authors conducted the submission procedure more than once, because they thought that their previous efforts had failed, and ended up having the same article uploaded more than once. Other themes involved the multiple log-in screens that exist throughout the whole process, the various databases where the authors have to submit their articles, and the different identification numbers assigned to a document during the whole procedure. The authors are puzzled by the inconsistency of the identification numbers, both when they are about to request funding through the NIH applications and when they want to include them in their resumes. Unfortunately, the authors could not recall in detail specific examples about the frustrating parts of the submission process and although follow-up questions were asked, the researcher was not able to select in-depth information that showed the specific steps that were considered to be the most complicated parts of the submission process.

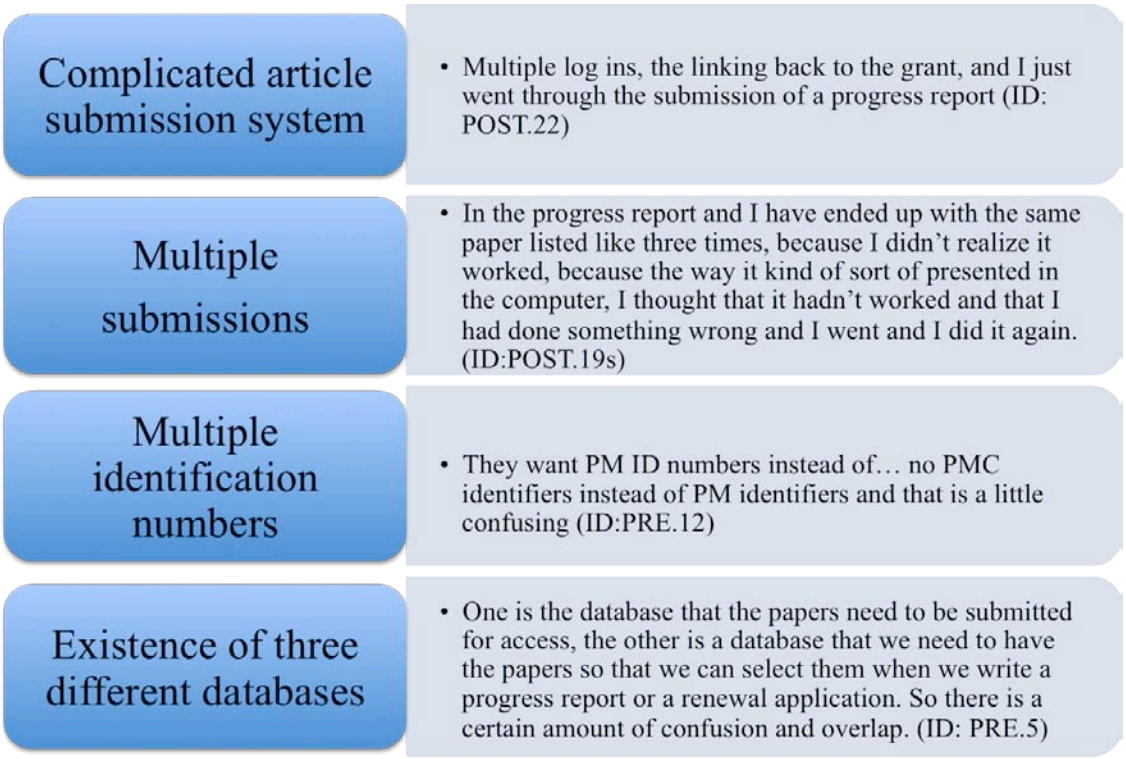
For the majority of the time, the PIs were not sure that they had completed the article submission correctly. It was mentioned that the submission process requires accessing more than one password protected site, which makes the procedure fuzzy. A participant affiliated with a large institution conducting research in medicine explained that, "[t]he multiple log ins, the linking back to the grant, and also the linking of the papers to PubMed Central for the progress reports" (ID: POST.22), are perplexing procedures that demand many steps at one time. Apart from multiple log-ins, the PIs said that they had to navigate through multiple screens before they completed the whole submission process, "there seems to be some redundancy with what they have done already and I have to scroll through a lot of screens to see what is already there versus what isn't". (ID: POST.16), recollects a participant from a large and prestigious academic institution. At the end of the process, there is an uncertainty about whether or not the procedure has been completed correctly, "in the progress report I have ended up with the same paper listed like three times, because I didn't realize it worked, because the way it was presented in the computer." (ID: POST.8), recalls a participant specializing in immunology, who attempted to submit his manuscript to PubMed Central.

Another example presented was the complexity during the submission process due to the existence of different databases. A PI affiliated with an academic institution who was not provided with an assistant explains, "[t]here are three databases. One is the database that the papers need to be submitted to for access, the other is a database that we need to have the papers so that we can select them when we write a progress report or a renewal application. So there is a certain amount of confusion and overlap in the system." (ID: PRE.5). When the researcher asked the participant to name the third database, the participant responded, "I don't remember the name. That is part of the problem. I cannot keep track of these things, so it is still very confusing

to write a progress report" (ID: PRE.5). It is clear from the participant's words that this process not only seems to be confusing, but it is also time-consuming. Another participant with no administrative help, who is affiliated with an academic institution, said: "Let me think about it… I don't remember exactly what it was. We struggled [with the co-authors] with it maybe six months ago and there were issues where it wouldn't work." (ID: POST.9)

During the submission process, an article is assigned two different identification numbers (Chapter 2). The first number, called NIH manuscript submission reference number (NIHMSID), is temporary, and the second number, called PubMed Central reference number (PMCID), is permanent. The first number can be used only for a short period of time, until the second permanent number is assigned to the manuscript. In addition, from the moment an article enters the PubMed citations database, a third PubMed reference number (PMID) is assigned to it ("Include PMCID in citations"). Although the PMCID and the PMID are not related, their existence is frustrating, "they want PMID numbers instead of… no PMC identifiers instead of PM identifiers and that is a little confusing." (ID: PRE.12) comments a pre-mandate participant conducting research in cell biology. Two others affiliated with academic institutions had the same frustration, "our papers have three ID numbers. One is the PubMed ID, assigned by the NLM, one is called the PMC number and there is another number as well, but none of these numbers are the same number" (ID: POST.1) and "making sense of the difference between the different PMCID and the PMID numbers, it seemed like it was a little bit convoluted. It is nice to have a system where there is a single identification number." (ID: PRE.1).

Figure 5. Complicated submission process



Although some negative feelings were expressed about the implementation of the policy, none of the authors mentioned that they were against the policy's goals. What they would prefer, though, is another way of ensuring compliance. By recognizing the flaws in the current submission procedure, the authors suggested an alternative system, which would be less time-consuming. A participant affiliated with a large and prestigious academic university said, "[m]aking the authors the ones responsible for access, is the most regressive and inefficient way of achieving the policy. And it is a terrible policy from people who don't seem to understand and care about researchers' time and convenience." (ID: POST.16). The most popular idea that was proposed by the participants is explained very well by a PI affiliated with a prestigious academic institution. It was suggested that the NIH should have made a direct negotiation with the publishers and not with the NIH-funded PIs as it is currently. "It would be nice if it was set up so

that when you did something to the journal, it automatically went there [PubMed Central] and that was the end of it." (ID: PRE.11). The current agreement is characterized as a block in the system that adds more work to the existing heavy schedule of the PIs, who feel that the existing situation decreases the importance of their role, which is to make science and not spend their time uploading articles and tracking their status. Instead, it was suggested that an agreement between the NIH and the journals' publishers would have the same results, but would require less time from the PIs.

Seeking help

A large portion (*n*=31, 75%) of the participants mentioned that even though they recognized the arduousness of both the wording of the policy and the article submission procedure to PubMed Central, they had never sought assistance. Nine of the participants indicated that they managed to solve the problems themselves, although they realized that they might not have completed the task correctly. "I just figured out what I could figure out" (ID: PRE.10) stated a participant affiliated with an academic institution. As it has already been mentioned the submission process is considered time-consuming and for that reason a PI affiliated with a prestigious academic institution and his laboratory team felt that they were too busy to initiate any type of facilitating process, "I would say lack of time, because you know, if I knew it would be presumably something that can be dealt with" (ID: POST.18). Apart from the lack of time there was also a lack of belief in the purpose of the policy, which was recorded when a PI affiliated with a research center mentioned that he considered the submission process to be a misuse of his time and instead of seeking assistance, he preferred to assign the project to someone else "I didn't go for help, so to me, I am biased, to me it was a total waste of time. I

didn't go for help. I just had someone else to do it." (ID: POST.1). Although the vast majority of these authors did not ask for help, they mentioned that if they had actually decided to seek help then they would probably visit the NIH Website or they could have contacted the NIH staff directly, "I guess I would snoop around the Pub Med Plus site. It would be a logical thing to do" (ID: POST.2). A PI affiliated with a research center mentioned that although parts of the policy are not clear to him, he has never requested help, and when someone else would ask for his help then he would not mind sharing his own explanation, "I usually tell them my interpretation of the answer. I don't send them anywhere. I give them my interpretation". (ID: POST.13).

The smaller portion of the participants (25%) asked for help and addressed their questions to a variety of people and online guides. A couple mentioned that their working environment is beneficial, because some of their colleagues are more intuitive when it comes to answering these questions. A PI affiliated with an academic institution who runs a large laboratory team explained, "one advantage of my profession is all the people I am associated with daily are young people, my students and the people in my lab… I go down in my lab and I get one of the smart people" (ID: POST.9). Three participants affiliated with academic institutions stated that they asked their colleagues to assist them, "I went to someone else who had already submitted it once" (ID: PRE.11). Another resource was affiliated with the institution's program officers. A participant from a research center explains his experience, "I was communicating with my program officer" (ID: POST.1). Those who had personal assistants would assign the task to them, as a participant working in an academic institution specializing in pediatrics noted:

> This administrator, who is really good at figuring things out; so I send them off to figure it out and help me with it, so she came back and she gave me whole reports and actually I don't know what resources she accessed to do that" (ID: PRE.1).

The forty-two participants were affiliated with thirty-five different institutions. Only two interviewees, who were affiliated with the same prestigious academic institution, mentioned that their academic library was proactive and introduced workshops, educating their faculty about the best compliance practices, "Well the [X] library had their workshop on open-access and you know the NIH rules and the specific copyright forms" (ID: PRE.7). These authors responded that even from the beginning, when the mandatory policy was first introduced, their library cooperated closely both with them and the grants department and organized workshops, where the policy's compliance terms and the copyrights issues were analyzed. It is understood from the data that the libraries' involvement in the participants' training on the mandatory NIH public-access policy is minimal. It was not possible to cross-check whether all the participants were aware of the available workshops organized by their institutions, but the consensus from the data indicates that either these workshops were rather limited or if they existed, they were not well advertised and the PIs were not aware of them. The absence of the library's role in the implementation of this policy did not seem to have surprised the participants. As it was revealed, authors did not expect the libraries to be in a position to assist them with the issue. When a frustrated author was asked, if he had contacted the library to receive help regarding one of the complicated parts of the policy, he replied, "Ha, ha, ha, well not really" (ID: POST.23).

There were only six participants who reported that some type of assistance was provided through the institution in general. Three participants affiliated with large state universities mentioned that this assistance came through "faculty meetings" (ID: POST.7), the office and

research administration — “I had an email from them and my institution required me to have training in it” (ID: POST.15) — or the grants department — “we had a couple of workshops, and there was a period when we had them come down and meet with all of our investigators” (ID: POST.14). Even though some academic institutions organized some sort of assistantship for the NIH-funded PIs, the participants commented that this assistance came rather late, as it was provided long after the actual policy was implemented, at a point when the authors had already been familiar with its terms and their responsibilities, “I mean the institution came around with recommendations after I already knew what I need to know about it, so it was late” (ID: PRE.8) a PI affiliated with an academic institution said.

The participants were asked to evaluate the quality of the assistance they received, especially during the workshops. The results indicate that there have been workshops which were informative and explanatory regarding the details of the policy, “so we have the knowledge that we can gain from it, the pros and cons from it” (ID: POST.7), as a participant conducting research in genetics recollected. On the other hand, there were negative commentaries on the quality of the workshops, which were not characterized as improving the PIs’ understanding of the topic, but rather that they were presenting the issue in a complicated way. In particular, there was one occasion when a participant affiliated with a highly prestigious academic center considered that the workshop was, “terrible. It was not clear at all and it was not particularly helpful” (ID: POST.15).

Apart from the workshops and the human assistance, the PIs sought other resources to get informed about the mandatory NIH public-access policy. Some collection of information occurred from the news, “I heard about it through the news, one of these channels. My ears were always to the ground listening about these kind of things” (ID: PRE.5), said a participant

affiliated with a research institution. Two of the participants, who were self-characterized as open-access advocates, reported that they followed the Congressional news extensively during the period when the policy's mandatory character was reconsidered in the Congress, "first of all we were following the amendments in the appropriations process" (ID: POST.14). When the mandatory policy was passed, the participants reported that there was extensive exposure on the topic in the journals' editorials and mentioned that virtually all journals they were reading at that time had at least one editorial article devoted to the policy — "so I followed the news, and mostly some correspondence and the editorials published in scientific journals." (ID: PRE.8). The information presented in the journals' editorials was a resource where authors would search to find answers to their questions, "I have read some of the editorials and things that have been written about it and the concepts behind it" (ID: PRE.1), stated a participant in pediatrics.

Searching information on the Internet was another tactic followed by the authors. The policy was greatly promoted in many Websites, where the compliance terms and the submission process were presented. A participant conducting research in pharmacology and affiliated with an academic institution said that he was mainly searching on, "Wikipedia, which I would say is really good, Creative Commons and then, you know, the SPARC, which I look at very often" (ID: PRE.3). Apart from the general Websites, the participants also retrieved information from the NIH Website, but the general conclusion, as revealed from the data, is that this information was not useful and practical. The previously mentioned PI in pediatrics said, "[w]hether it was me or the Website I am not quite sure, but in a general way I recollect that I had some difficulties trying to understand the system" (ID: PRE.1). Another participant affiliated with an academic institution expressed his disappointment regarding the lack of information at the NIH Website, "I really went through the NIH Websites and they are not terribly helpful." (ID: PRE.12). Although

it was also expected that the participants would have closer communication with their publishers to ensure compliance, the number of participants who addressed questions to the publishers was limited. Only three mentioned that when they had specific queries about the journals' policies in relation to the NIH-funded PIs, they visited the journals' Websites, "I just look at the journals' Website and, you know, it becomes apparent. I mean, this is not extremely complicated." (ID: PRE.10).

Public-access policy and open-access awareness

This dissertation attempted to understand the authors' knowledge of the terms of the NIH public-access policy, how their awareness on the policy's terms has increased their knowledge on the available publishing models and ultimately how it has influenced their publishing behavior. The gist of the mandatory NIH policy is to return back to the taxpayers the publicly funded research and ensure that its results will be available to anyone with no additional fee ("First U.S. Public," 2009). The cost-free component is, also, one of the basic arguments behind the reasoning of the open-access movement (Suber, 2010). Although these two components have similarities, until the time this research was conducted it was unknown whether the mandatory NIH public-access policy initiated a new level of open-access awareness among the PIs and increased the PIs' understanding about the various types of publishing options, which are available for their future publications.

Policy does not increase open-access awareness

Based on the data two categories of participants were established: the ones who mentioned that their knowledge and publishing behavior was affected because of the NIH

mandatory open-access policy (*n*=7) and those who mentioned that they did not see any changes either in the level of comprehension about their publishing decisions or in the way they publish their research articles (*n*=35) (Figure 6). The latter category can be divided into two groups. The the first group is composed of the participants who were self-characterized as open-access advocates (*n*=15, 36%). These people explained that their knowledge has not changed because, as open-access supporters, they have been acquainted with the topic of providing free-of-cost access to research results, "I was pretty much familiar with it because I was following the whole movement from the beginning" (ID: POST.10) mentioned a post-mandate PI affiliated with a research center and another pre-mandate PI adds that he was aware of all the alternative choices before the mandate, "I don't think it has changed. I am aware of the options that are out there, and I had been, so I don't think that the policy changed that." (ID: PRE.13).

During the interview discussions, it was mentioned that the NIH policy was implemented long after the established open-access policy, and that the NIH terms did not generate any changes to the scenery of the open-access movement. "No, I think it is slow and generally only minimally successful to change the climate for open access" (ID: POST.2), expressed an oncologist from an academic institution. The goals that the policy attempted to accomplish were already being practiced by the PLoS journals, which were both offering their articles free of cost and were also submitting them to PubMed Central. A post-mandate and open-access advocate PI, who is affiliated with an academic institution, described this relationship, "I felt that the NIH public-access policy was intended to catch up with what the *PLoS ONE* journals had done with the PMC" (ID: POST.24).

So far it has been revealed that journal quality is the most significant factor that shapes the authors' decisions when choosing where to publish their papers. The PIs mentioned that they

were motivated to publish with the PLoS journals either when its impact factor was increased or when they read articles in these journals whose quality met their expectations. When a journal achieves these two characteristics, then it is considered an appropriate publication for the authors to submit their articles. The non-open-access advocates (*n*=12) said that they were not affected by the public-access policy, because to them the open availability of the articles was not a decision-making factor in their publishing choices. Although these authors were not against the free-of-cost access premise, their choice of the best journal for their articles is based on other quality criteria and the open-access availability is only considered to be a plus, "No, we publish in the most appropriate journal for our work and that is the criteria that we use." (ID: POST.4), mentioned an oncologist affiliated with a research center. A small portion of authors (*n*=5, 12%) mentioned that they publish the vast majority of their articles only in a couple of society journals. These participants mentioned that they were not affected by the policy mainly because even after its mandatory character, they keep submitting their articles to the same journals they used to. A participant affiliated with both an academic and research institution explained, "we publish more routinely in the American Society journals. They handle all the submissions, so nothing has bothered me about how we publish and open access doesn't really matter a lot to me." (ID: POST.9).

Two of the participants mentioned that they are not interested in the policy and they do not believe they have gained extra knowledge about the available open-access publishing options from the NIH public-access mandate, because either they are not aware of the policy's details or they are not particularly interested in the topic. A pre-mandate and open-access advocate said, "I am not someone who cares a lot about it, so I haven't paid a lot of attention trying to figure it out" (ID: PRE.11). This participant mentioned that he publishes all his articles in open-access

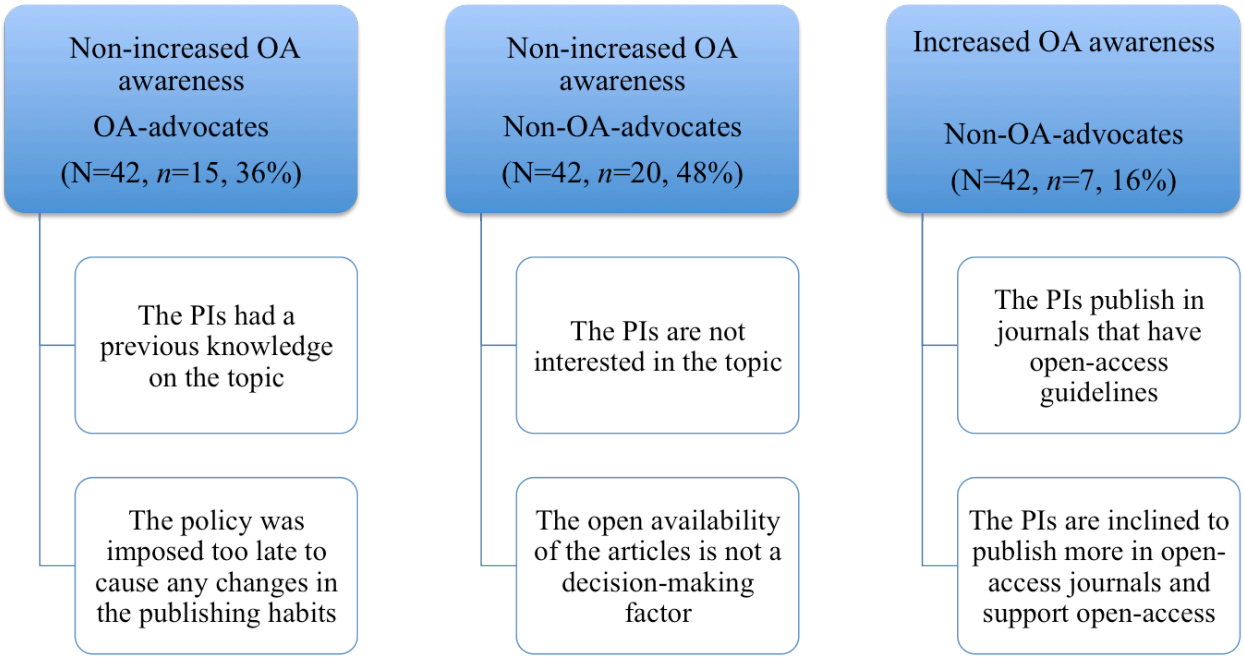
journals even before the implementation of the policy, thus the policy has not any effect. On the other hand, a post-mandate participant affiliated with an academic institution mentioned that he did not comprehend the policy from the beginning. “No I would say that I never really completely understood [the NIH public-access policy] in the first place.” (ID: POST.1). To this participant the policy and more specifically the submission process is unnecessary, because he has to proceed to extra steps in order to submit the article to PubMed Central, an action he believes should not be the PI’s responsibility, but the journal’s, “any NIH published article in a journal, that version, should also be placed by the journal into PubMed” (ID: POST.1)

Policy increases open-access awareness

A rather small portion of participants (*n*=7) felt that there was a change in their level of knowledge on the available open-access publishing options, which was caused by their relationship with the NIH public-access policy. The participants realized that lately they have been exposed to a variety of new situations that made them more aware of the available open-access publishing options causing a change in their publishing behavior. One of these situations is the development and exposure of the open-access movement. In the past years there were many public discussions related to open access, introducing a better common understanding about the available open-access publishing options and benefits among the PIs. “Well it has changed in recent years. Nobody talked about open access not that many years ago. So of course it has changed. So whether it changed because of the NIH policy, well it would have to.” (ID: POST.8), mentioned a participant from an academic institution conducting research in molecular biology. The same author continues by stating that the open-access movement will progress further as long as the system is organized so that the dissemination of the NIH-funded

information would be more feasible through the open-access publishing options, "[t]here will always be some steps to take but they will make it easy. NIH should do that and the journals should do that. And if they don't in the future it will not impact." (ID: POST.8).

Figure 6. Open-access awareness towards the NIH policy



A couple of authors mentioned that they recognized both an increase in their knowledge on the topic and also a change in their publishing behavior, because currently they are paying more attention to the journals' licensing agreements and how these comply with the policy's terms. A pre-mandate participant affiliated with a highly prestigious academic institution explained that before deciding on the journal to which he will submit his papers, he explores and takes into serious consideration whether the journal automatically submits to PubMed Central on the authors' behalf, "I review a list of journals that I am interested in and if they don't provide that feature they are out of the list" (ID: PRE.12). In the search of the most suitable journal, another pre-mandate participant moves a step further and also investigates whether the journal

offers open-access guidelines, “I pay substantially more attention to whether individual journals have open-access policies or not.” (ID: PRE.9). Apart from a change in his personal publishing habits, the same participant added that lately he has noticed an increase in the knowledge about the available open-access options by other NIH-funded PIs, “[i]n our laboratory, the graduate students and the post-docs have a lot of responsibilities for the manuscript submission and selecting the journals and I think we spend more time, talking about the policy, the issues and outcomes.” (ID: PRE.9).

Three post-mandate participants, two affiliated with academic institutions and one with a research center, mentioned that apart from the fact that they recognize the open-access options, they are also inclined to pay closer attention to the open-access benefits and publish more in the open-access journals, “I am a little bit more inclined to use this open-access system … it has certain advantages …. So it could be that the policy itself just stimulated me to use this open-access system” (ID: POST.17). Another participant believes that the policy has shifted his thinking regarding his future publications, and that he is more likely to support more widely the open-access status of his articles:

> Right now, with this NIH policy it has changed. My main target is first to look for the open-access journals and then look for the impact factor. If it is reasonable I go there, not to the other big journals that have a closed policy. (ID: POST.11).

For two other post-mandate participants affiliated with academic institutions, even though the policy has exposed them to the available open-access options and has made them think more about these possibilities, it has not affected their publishing decisions at all, “[i]t certainly started me thinking about it more, but it hasn’t changed my understanding of anything” (ID: POST.23). This participant favors the NIH public-access policy and believes that it

managed to reach an audience and raise awareness even among those academics who have never heard the discussions about the public-access premise. He implied that the academics do not usually examine certain issues, which are peripheral to their work — "[i]n the university we are sheltered and we like it that way" — unless there is a reason to be interested in a topic that convinces them it will be beneficial to their research and careers, "[w]e really don't have to think about something unless we want to. There are some people who worry about copyright because they may have issues of patents that they are concerned about." (ID: POST.23).

Four pre-mandate and open-access advocates mentioned that there was not a specific change in their understanding and knowledge concerning open-access, because they already knew the details, but they felt that there has definitely been a change in the way others view the movement, "this is now becoming a more general phenomenon …stimulating the worldwide interest in open-access publishing" (ID: PRE.7), as a pre-mandate and open-access advocate mentioned. Another participant affiliated with a research center indicated that due to the NIH public-access policy he feels that there is a broader understanding of the available open-access publishing options by others, which makes it easier for him to convince the co-authors of his articles to pursue publication in an open-access journal, "I feel like the NIH public-access policy for me was… my group had committed to putting a work in an open access form. It was easy for me to communicate within my peer group and with my institution." (ID: PRE.4). Apart from the increase in the discussions about the topic, academic institutions assist in the increase of both the exposure and the discussions about the available open-access options, with the adaptation of institutional open-access policies, "[s]o I am still learning as I go, because our institution is thinking now about archiving our articles for open access, so I would say yes, because now there

is this new consideration" (ID: POST.7), explained a participant affiliated with a large academic institution.

The workshops that were scheduled to assist the PIs with the policy's terms also seemed to have worked to the benefit of open-access awareness. Two post-mandate participants affiliated with research institutions explained that when the policy started to be implemented, there was a need for the authors to understand the specifics of its terms and learn how to comply with its requirements, "certainly when the policy went into affect we had to learn the specifics of the policy." (ID: POST.14). And since the policy has common issues with open-access, the workshops' presentations explored issues and educated participants on both topics, "[t]he specifics of having to put the information into PubMed Central… and the fact that you are finding yourself referring to those open-access journals" (ID: POST.13).

Although the participants in this dissertation mentioned a change, which is reflected in their level of open-access awareness and publication habits, it is not clear if these changes occurred due to the introduction of the NIH public-access policy or to the rapid development of the open-access movement, since both took place simultaneously, or if this synchronization was coincidental. A pre-mandate and open-access advocate participant affiliated with an academic institution describes the way he understood the development of the situation, "The NIH policy was implemented at a time when the open-access journals were becoming more visible and more popular, so it is hard to say whether the knowledge of one affected the knowledge of the other." (ID: PRE.5).

Another author mentioned that there is a change in the level of knowledge, not because of the NIH, but because of the changes in the dynamics of publishing:

> So it was not because of the NIH, it was because of floating, of publishing as a real dynamic, I mean now, it always was to some extent, but not to the extent it is now — you know, online publishing and open access and so forth — so I guess it wasn't because of the NIH policy, but because as a researcher I am becoming aware of the new dynamics, the changes in publishing, options and policies and that sort of thing. So in that sense, yes, I think about open access certainly much more than I did a few years ago. But it wasn't because of the NIH policy. It was because of the changes that are occurring in scientific publishing." (ID: POST.3).

With the emergence of technology the publishing industry shifted to online publications. Authors gradually adopted online publishing and also realized that they can decide if they want to offer their articles open access or closed access to the public. It was mentioned that in health sciences the increase in the awareness of the available open-access options was initiated with the development of the BioMed Central open-access journals and later on with the PLoS journals, which added to the open-access journals the same quality criteria assigned to the toll-access journals. Since there was a "much higher quality in the articles that were published in these journals, there was a bigger trend toward publishing in open-access journals." (ID: PRE.2). The changes in scientific publishing reflect the reality that the highly prestigious open-access journals empower the authors to offer their articles free of cost.

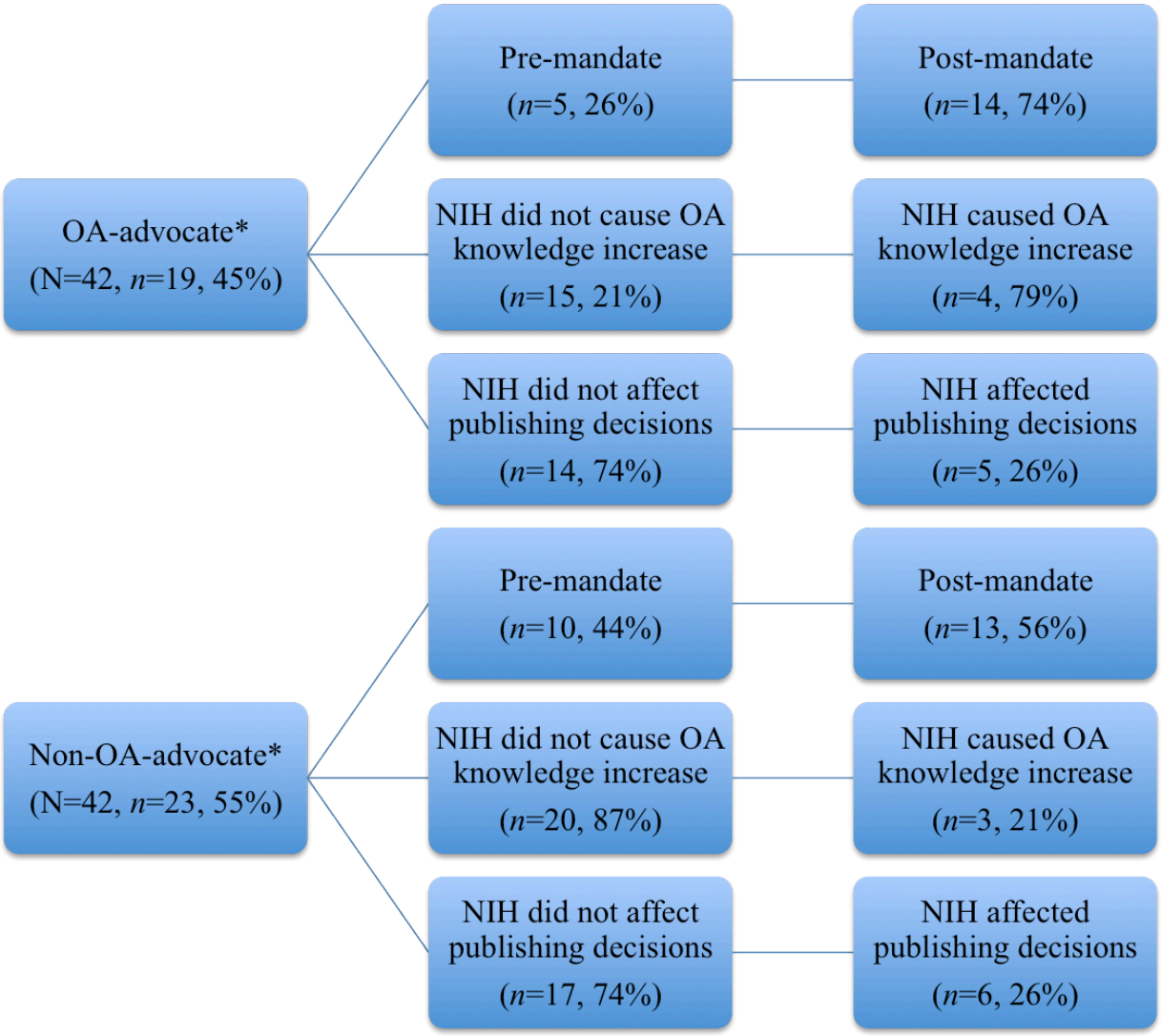
Public-access policy and publication behavior

One of the NIH public-access policy requirements, with which the PIs must comply, is to have the published articles deposited into PubMed Central ("First U.S. public", 2009). The easiest method authors can use to comply with the policy is to choose to publish in an open-

access journal, as they do not have to negotiate about the copyrights and the final published peer-reviewed version of the article will appear in PubMed Central immediately upon the article's publication. When the mandatory policy came into effect, whether the authors would view the policy as an influential factor in their publishing' habits could not be predicted. The existence or absence of this relationship had never been examined, and it has been unknown whether the mandatory policy, which originates from one of the greatest funding institutions not only in the United States but in the world, would shift the authors' publishing preferences and introduce a new type of thinking about the quality criteria that the participants are seeking.

When the PIs were asked if their decision to publish in open-access journals was affected by the mandatory NIH policy, two categories were established (Figure 7). The group with the lower number of participants (*n*=11, 26%) mentioned that they are affected by the policy, while the other category, which consists of almost two thirds of the participants (*n*=31, 74%), stated that their publishing behavior is not affected by to the policy. The participants in the first group supported the open-access movement more than the actual policy. These participants were self-characterized as promoters of the movement that allows immediate access to information and does not impose embargoes, as the NIH-policy does. The other group felt that since the vast majority of the publishers' licensing agreements include NIH implementation conditions for the authors and they allow the manuscripts to be submitted into PubMed Central, then the policy is not restricting their publishing choices and it is not a basic decision-making factor about where they will publish their papers.

Figure 7. Open-access and NIH public-access relationships



*

Open access and NIH public-access policy relationship

The participants were asked to comment on how they viewed the relationship between publishing in an open-access journal, such as PLoS, and complying with the requirements of the

* OA advocates are the participants who were self-characterized in the interviews as open access supporters, while the Non-OA advocates did not use this characterization.

NIH public-access policy. On many occasions, when this question was asked, the researcher was asked either to repeat or reword the question, “I don’t know how to explain. I mean frankly I don’t even know what that means” (ID: POST.9), said a participant affiliated with a state academic institution. It cannot be safely stated whether the confusion was caused by the choice of the words that composed this question (When you submitted your first work to a PLoS journal after your NIH funding, how did you understand the relationship between publishing in an open-access journal and complying with the NIH policy?) (Appendix A) or because the PIs had never thought of this relationship. Based on the participants’ responses the latter case seems to be the prevailing one. The majority of the authors who asked for the question to be reworded later mentioned that they had not thought of this relationship beforehand. A participant affiliated with a large state academic university conducting research in molecular genetics mentioned, “I have to say that I was quite naïve about this, and actually didn’t give much regard to that relationship” (ID: POST.7).

A little less than half of the participants (*n*=18, 43%) reported that they did not realize the relationship between publishing in an open-access journal and complying with the policy. A post-mandate participant affiliated with a large academic institution reported, “I actually did not. Is that, maybe you can explain it to me, is it automatic?” (ID: POST.3). A pre-mandate participant affiliated with an academic institution also mentioned that he does not understand the relationship, and whenever he is about to publish an article he only tries to provide his published content open-access, irrespective of the policy, “I don’t really understand it, I just try to publish in open access as often as possible.” (ID: PRE.12). In only one case was it mentioned that there is no significance between the two components of compliance with the policy and publishing in PLoS. This participant said that he treats all the articles the same by submitting them to PubMed

Central, even if they are published in open-access or in toll-access journals, “I saw no distinction, I just put it on the Web the way that I would have done with the other articles.” (ID: POST.23), revealed this participant who is affiliated with a state academic institution conducting research in neural control.

The other participants mentioned that compliance with the terms of the NIH public-access policy is ensured irrespective of the open or closed status of the published article. A pre-mandate PI affiliated with an academic institution said, “Oh no, I don’t think that you have to publish with PLoS to comply with the policy. Most of the journals comply with the policy.” (ID: PRE.6), while a post-mandate PI affiliated with a prestigious academic institution added, “I think by the time the NIH rules came out … we already expected that this would be the case, that we would be submitting and all journals would be in compliance with the NIH-policy” (ID: PRE.27). The only relationship a pre-mandate participant affiliated with the same academic institution could discern between these two concepts, is the common reasoning behind the public-access policy and the open-access movement, “I don’t see these two being linked. The relationship is, and the linkage is, they both are trying to achieve the same thing, they both have the same philosophy behind them.” (ID: PRE.11).

The other portion of participants (*n*=24) had realized that publishing with the PLoS journals entails compliance with the NIH public-access policy, “[p]ublishing in an open-access journal automatically complies with the NIH public-access policy” (ID: POST.5) reported a post-mandate participant affiliated with the same prestigious academic institution. Two PIs mentioned that although they never thought of this relationship, they knew that the PLoS journals comply. “I knew that it was complying, but I didn’t really think about it that much” (ID: POST.22), noted a post-mandate participant affiliated with both an academic institution and a research center. A

pre-mandate participant affiliated with a large research center mentioned that he was aware of the compliance because "open access is part of the NIH [policy]. It is a NIH requirement and publishing in a PLoS journal is open access." (ID: PRE.9). Similar were the words of a post-mandate participant, affiliated with a prestigious academic institution, "[w]ell the point is that the NIH wants it accessible you know to taxpaying citizens and since anyone can get into PMC and download a PLoS article it should be automatic" (ID: POST.18). As a result, some of the participants understood that there is a relationship between the open-access journals and the policy, since the latter mandates public accessibility, and this concept is common both in open-access journals and in the terms of the mandatory NIH-public access policy.

NIH does not increase publishing in open-access journals

Open-access advocates and publishing.

The largest portion of the participants (*n*=31) responded that they are not affected by the policy in the selection of the most suitable journal for their papers. Two different categories of participants were established after the analysis of these negative responses. The first category is composed of participants who are self-characterized as open-access advocates (*n*=14). These participants published in open-access journals before the policy was implemented as a matter of principle and they continue to do so, irrespective of the existence of the NIH public-access policy, "[t]he NIH policy really doesn't affect where I publish at all. Because I was already doing much more of the NIH policy before it was instituted." (ID: PRE.6), stated a participant from an academic university. This population criticized the mandatory policy, indicating that it came into effect late in comparison with the longer history of the open-access movement and that it ensures delayed access and not immediate access, which is the primary focus of the open-access journals.

It was also stated that the primary influence that shapes the open-access advocate's publication habits is the open-access policy, and that the mandatory NIH-policy has a minimum affect, "[i]t is not the NIH policy, it is the open-access policy. I prefer when it is appropriate to publish in an open access journal" (ID: POST.12) explained a participant affiliated with both a prestigious academic institution and a research center. Another post-mandate PI affiliated with a less prestigious academic institution argued that the NIH policy came into effect slowly, "I think the NIH has been late and slow because of the Congressional restrictions and what they could accomplish " (ID: POST.2). Although the NIH policy ensures public access, it allows an embargo period, and these participants advocated immediate open-access, "the NIH policy only deals with what happens after twelve months, and when I talk about open access I mean from the publication day, from day one not after twelve months" (ID: PRE.7), explained a pre-mandate and open-access advocate participant affiliated with a prestigious academic institution. Another critic of the policy, who is affiliated with both an academic institution and a research center and belongs in the post-mandate category stated:

> "[t]he whole PubMed Central manuscript submission thing is a little bit artificial. It basically represents a political compromise between the journals and the people who would say that when the public pays for something, the public should not have to pay to read the results." (ID: POST.22)

What this participant meant is that the policy is not innovative, but rather attempted to draw a golden line that would make the public feel entitled to exercise its rights to acquire access to the research results.

Non-open-access advocates and publishing.

The largest portion of the participants (*n*=31, 74%) declared that their publication habits have remained unchanged and that the NIH policy does not affect their decisions. The second category of participants, the non open-access advocates (*n*=17) suggested that the NIH public-access policy does not affect their publishing decisions and does not prompt them to publish in open-access journals. A participant affiliated with a highly prestigious academic institution mentioned, "[the policy] really doesn't affect our decision" (ID: POST.27). A post-mandate participant affiliated with both an academic institution and a hospital conducting research in oncology stated that the policy not only does not affect his publishing choices, but also it makes it unnecessary for him to publish in open-access journals, since eventually the article will be accessible to the public free of cost through the PubMed Central repository, "I guess it would have encouraged me to send it to a journal that is expensive. You know if it is not an open-access journal and people can read it, access it from PubMed Central, I guess this is a good thing**.**" (ID: POST.24).

The policy is insignificant to the decision to publish in open-access journals for a participant affiliated with an academic institution conducting research in anatomy, "if anything PubMed Central makes that less important" (ID: POST.2), because the open accessibility of the articles is ensured through the PubMed Central submission, "[i]t might make me less interested in publishing in open-access journals since essentially it is converting a paper that is going to a closed-access journal into an open-access publication" (ID: POST.2). A similar opinion is presented by another participant, who is affiliated with both an academic institution and a research center, "[i]f anything the policy has made me less prone to publish in open-access

journals, because I know that after a year [the article] will become freely available, no matter where I publish it" (ID: POST.22).

When an author publishes in a toll-access journal, the articles' open accessibility is ensured with the submission of the article to PubMed Central, where the article will be provided open access immediately or after an embargo period which ranges from three to twelve months, depending on the licensing contracts of the journal publisher, "I can go either way. Most of the journals I publish in have open access after six months and it seems to me that that it is adequate" (ID: POST.1), stated a post-mandate participant affiliated with a large state university. This embargo period does not seem to affect the authors' decisions to publish in toll-access journals, as they understand that there has to be a balance between the public's right to have access to information and the publishers' right to make a profit that will allow them to sustain their publications, "I mean, wouldn't it be nice to have it immediately? I am not sure if this is a big deal. I am sure that publishers have to make money too." (ID: POST.1).

A pre-mandate participant views the relationship between the NIH public-access policy and its influence on publishing in the open-access journals differently. This author published in open-access journals in the past and mentioned that the policy does not affect his decision, even though it allows an embargo period keeping the article from the public view, which to him is a long period of time, "the NIH policy is only in regard to what happens after twelve months… I still believe that the twelve-month interval is too long" (ID: PRE.7). Another pre-mandate participant suggests that he is not affected by the policy because he would rather support open-access than the public-access policy. He mentions that his desire is to keep publishing in open-access journals as he used to, "[f]or me [there is] very little [effect] because I would pretty much

always publish in open-access journal or at least a journal that offers an open-access option" (ID: PRE.3).

The participants understand that compliance with the policy can be achieved in more than one way: though the open-access journals, but also through the toll-access journals that either deposit the articles to PubMed Central or they the PIs to self-archive their manuscripts. "To comply with the NIH… I mean there are different ways to comply with [NIH], besides open access so that wasn't really a consideration. " (ID: POST.3), a post-mandate participant affiliated with an academic institution noted. As a participant affiliated with a large academic institution explained, "regardless of whether I publish in an open access journal or not, there is open access to the work, so I don't really concern myself about that" (ID: POST.7). When a journal submits the articles to PubMed Central, then compliance with the policy is assured, even though this journal is not an open-access journal.

Publishing habits and promotion.

A factor that seems to greatly influence the authors' publication decision is the effect a publication will have on their career, and more specifically on their promotion and tenure. Mann et al. (2009) discovered that a large portion of authors believe that publishing in open-access journals can be detrimental to their future promotion and career, while Cronin and Overfelt (1995) discovered that committees for promotion and tenure evaluate faculty based on the quality of their articles rather than the quantity. Thus, when a publication in a toll-access journal is crucial to a first-time authors' career, the author would choose to publish in a journal that would advance his career. Although there were no doubts that the PLoS publications promote career advancement and benefit public access to research results, the vast majority of the

participants mentioned that a publication in one of the major journals in health sciences, such as *Cell*, *Nature* and *Science* is always more beneficial, than publishing in any other journal.

The PIs, who were self-characterized as open-access advocates (*n*=19, 45%), indicated that they publish the vast majority of their articles open access, "I would pretty much always publish in open-access journals or at least a journal that offers an open-access option." (ID: PRE.3) stated a pre-mandate and open-access advocate PI. Nonetheless, the same person claimed that, when a publication is vital to a first-time author's future career, then the open-access option is not the principal decision-making factor, "I am the head of a lab that I govern, but if one of my students says: "*I really really want to publish in this journal"*, and it was a closed-access journal their wishes would come first" (ID: PRE.3). Career impact has always been a primary factor in the authors' selection of the most appropriate journal for their research publications, and this decision is crucial in particular to younger researchers, "[m]y decision whether to publish in an open access rather than a closed-access journal is mostly determined by what I regard as the career impact on my junior associates" (ID: POST.2), mentioned a participant affiliated with a research center.

The impact of a prestigious publication to the advancement of someone's career and the positive effect on further funding are two of the most important factors influencing someone's choice for their prospective publications, "if I have a student or a faculty member, whose career depends on impact factor and things like that, we may go to *Science* and *Nature*, which are not completely open access" (ID: POST.14) a post-mandate participant conducting research in biostatistics stated. In addition the participants believe that when their articles present outstanding results they need to submit them to the highly rated journals, even though this means that they will sacrifice the free accessibility of the article, "we can submit it either to *Science*, or

Nature or *PLoS Biology*. What do you think is in our best interest? The answer is a *Science* or *Nature* paper. But what is in the best interests of the research community? I would argue that *PLoS Biology* is." (ID: POST.2). Although there is a conflict between the public good and the participants' promotion, the participants in most cases publish their articles in the journals that will benefit their career development.

Publishing quality criteria.

All the participants listed some quality criteria they have in mind when they decide about the most appropriate journal in which to publish their articles, and the "quality of the journal" (ID: POST.20) is the most popular answer. The reputable publications are favored, especially the ones that meet a set of criteria that have been mentioned earlier in this chapter, such as, "the relevance, the readership and the impact and importance of the work" (ID: POST.21) as a post-mandate participant affiliated with a large academic university summarized.

The level of quality authors seek for their publications is not determined by the type of the journal, whether it is an open-access or closed access journal and is not related to the NIH public-access policy. A pre-mandate participant affiliated with a prestigious academic institution and a research center mentioned that he is in favor of reputable publications and that the NIH policy is irrelevant in his decision:

> "It hasn't [affected me]. Still, I send some of my good articles to *PLoS Pathogens* and I will continue to do so and this is not dependent on the NIH-policy, but on the prestige of the journal. So although I respect the policy, it hasn't changed my ranking of journals to submit to." (ID: PRE.13).

Another participant affiliated with a large academic institution also mentioned that he would respect the policy and try to publish in open-access journals as long as, "the journal has a high impact, it will bring high visibility of my work, which is important for funding, and other things and that it's the content is appropriate" (ID: POST.25).

The PIs care mostly about the journal's impact factor, mainly because it boosts their career development. As a pre-mandate PI affiliated with a large academic university, who specializes in pharmacology mentioned, "it is all about career reward. [Publishing in *Cell, Nature* and *Science*] is where the maximum reward comes from with respect to open access". (ID: PRE.3). Usually the PIs conceptualize their own lists of the journals related to their fields and when they are about to choose which of these journals will publish their papers they primarily choose the one with the highest impact factor. A pre-mandate participant from an academic institution conducting research in cell biology explained, "if I have a paper I go first to the *Journal of Virology* because they have an open-access option. And if it doesn't get accepted I will go to the next one down in the impact-factor listing" (ID: PRE.12).

For the majority of the participants the choice of the most suitable publication is determined only by considering the journals' quality criteria and it is not affected at all by the NIH public-access policy or the status of the journal in which the article will be published or "whether it is open access or not" (ID: PRE.8). The PIs choose the journals to which they will submit their articles based on their quality and the caliber of the published work. "I think that I would still feel that I have to go where the best journal is for the work that I have to publish." (ID: POST.17) noted a post-mandate participant affiliated with an academic institution. These quality criteria are met by both the toll-access and open-access journals, "[I]t just happens that

some open-access journals are also top rated and are [the] best reviewed and read journals in the field" (ID: PRE.8).

When the policy was first introduced the participants experienced difficulties with the journals' licensing agreements, because some of them had not created specific instructions for the NIH-funded PIs and important directions concerning compliance with the policy were missing (Banks & Persily, 2010; Peek, 2008b, Stimson, 2009)(Chapter 2). A pre-mandate participant affiliated with a research institution mentioned that he will publish with the journals that comply and he added that, "there are plenty of journals with high prestige that comply." (ID: PRE.2). In cases where the authors could not easily determine a journals' intention to comply with the policy, they would contact the journal editor. The previously mentioned participant continues:

> "Cell Press has a new journal and we are very interested in publishing, because they publish good papers. Before we actually submitted our paper we sent an inquiry to the editor, asking them how they would ensure that we comply with the NIH policy" (ID: PRE.2).

When this research was conducted the mandatory policy had been implemented for approximately three years and the participants claimed that the majority of the journals currently comply. A participant affiliated with a research institution stated, "I think they all understood fairly quickly that they will not have any business unless they get on board with what everybody is doing, so I think that currently [compliance] is not an issue." (ID: PRE.5)

The toll-access journals, in their effort to be in accordance with the policy's terms have changed their policy agreements and made compliance easier. A pre-mandate participant affiliated with an academic institution explained, "the policy did not really affected me, simply

because the journals realizing that this is a requirement and the old journals have changed their requirements to go together and meet this policy" (ID: PRE.8). Since the journals have changed their licensing agreements, the majority of the authors were not affected at all by the policy and their publishing choices have not shifted, by submitting to the same journals they used to in the past, "[i]t actually hasn't affected me at all. I think that I publish in exactly the same places that I always have" (ID: PRE.6), said a PI from an academic institution. A post-mandate participant affiliated with an academic institution conducting research in microbiology mentioned that in cases where a journal would not comply with the policy's terms, he would be reluctant to consider publishing in it, "I would think double about it, because it is a hassle to do it and remember how to do it," (ID: POST.17). In general, the PIs avoid publishing in journals that ignore the policy and are careful about compliance with the policy, "we are just very careful to do all the things that the policy requires" (ID: PRE.6), said a participant affiliated with an academic institution, who mentioned that the laboratory he runs publishes approximately 25 articles per year.

Based on the research results it was clear that the authors generally attempted to comply with the policy by submitting their articles to PubMed Central and if there is one factor authors consider extremely important that is related to compliance, it is the article submission. Since the vast majority of the journals submit the articles to PubMed Central, for more than half of the participants (n=31) the policy is not an issue under consideration and it is not a factor motivating them to publish more often in open-access journals, "the requirements are really a non-issue now. They just don't exist because the journals take care of everything." (ID: PRE.5), a pre-mandate participant stated, while another one expressed similar thinking, "[i]t is an irrelevant issue for me, because all the journals that I submit to are NIH compliant" (ID: PRE.4). For the

same author, the effects of the policy have an impact only when it is time to provide NIH with the details of the work conducted during the past year through the progress reports, where the PubMed Central submission identification numbers are used as proof of the research articles publication, “In your progress report you claim these papers. You have to have these papers in a specific way in the database that allows you to assign them with a specific protocol” (ID: PRE.5).

A limited number of authors (*n*=4, 9.5%) expressed the fear that the policy could alter the publishing setting and create problems for the for-profit toll-access journals by reducing their subscriptions and consequently their revenues. It was mentioned that in some areas in health sciences there are formal discussion forums where authors submit articles that negotiate valuable information and new discoveries for public review, which eliminates the role and importance of the publisher in the article production. A participant affiliated with a prestigious academic institution mentioned, “I think that if [the implementation of the policy] done seriously it will create a damage for journals, and maybe this policy will change dramatically things and maybe for the best.” (ID: POST.16). With the dominance of electronic publishing and the change in the way scientific information is being distributed, in some fields a peer-reviewed article is not considered to be the only type of trustworthy publication:

> Often scientists don’t understand the utility at these days to publish in journals. There are fields where you publish neuron results in neuron Websites … and then the scientific community will judge you by repeating your experiments, or confirming them or showing that your results are somehow wrong (ID: POST.16).

This new trend is increasing gradually in some fields, making this participant wonder about the forthcoming influences in his research area, “[s]o there are fields that work this way,

but our field does not, for a number of reasons. But many of us wonder if it is the time to make some dramatic changes there." (ID: POST.16).

NIH increases publishing in open-access journals

The conceptual premise of the public-access mandate is to provide citizens with access to the research they have funded. One pre-mandate participant affiliated with a research center commented on the relationship between the public and the policy, "NIH is being funded by taxpayers, and I like the argument that we are making science and the research available to the people who are ultimately paying for it." (ID: PRE.2), mentioned a pre-mandate PI and an open-access advocate affiliated with a research center. This participant indicated that he is an open-access advocate, who published in open-access journals in the past, but currently, the mandatory policy initiated the introduction and support of the open-access concept, creating an atmosphere of positive attitudes toward the open-access journals among his colleagues, "[n]ow that the NIH policy is in place, it is easier for me to convince them to go to a very good open-access journal, rather than going to any journal without any [thought of] open-access." (ID: PRE.2), while another pre-mandate participant affiliated with a prestigious academic institution adds that due to the policy the open-access concept is highly valued, "the NIH has helped to make this an important issue in regard to publishing so that my colleagues are now more aware of this and therefore this is becoming more commonly appreciated" (ID: PRE.7).

A relatively small number of authors (*n*=8, 19%) mentioned that they are affected by the NIH public-access policy when it comes to making a decision about where they will publish their research articles. A post-mandate participant responded that the policy has made him consider the available open-access options more often. "I am much more positive about publishing with

journals that have at least partially open-access policies" (ID: POST.6). The PIs commented that at the moment they agree to accept the NIH funding, they have to comply with their funder's terms, "scientists still have the choice of the journal they will go, but the NIH says that we encourage you to go to open access and we have this compliance policy about going to open-access" (ID: PRE.2). Although the policy promotes public access and it does not suggest that the articles should be published in a specific type of journal, open-access or toll-access, another participant also interprets the policy's wording as a prompt from the NIH to publish in open-access journals, "it encourages us to publish in them" (ID: PRE.1). Although this author was familiar with the open-access concept, because he was self-characterized as an open-access advocate, he indicates that the policy has made the NIH-funded PIs more receptive to the idea of openness, which is through publishing in the open-access journals, "I think it makes it more real to think of it more. You are really forced to confront it anytime you send an article or something, so you are just forced to think about it." (ID: PRE.1).

One of the authors suggested that the reason the policy affects his decision to publish in open-access journals, derives from his title, which is "a NIH-funded PI" (ID: POST.8). He feels that he has to conform to the NIH-policy's requirements, which indicate that his articles have to be published in journals that comply with the policy, so that they appear in PubMed Central. "The mandatory policy means that I don't have a choice" (ID: POST.8), and he adds that he will attempt to comply by using a journal where he will not have to make any extra effort, "I will look at the ones that make it the easiest for me to do" (ID: POST.8). The same concept of ease of compliance is expressed by another post-mandate participant affiliated with a research center, "we were inclined to go to journals were you don't have all the hassle." (ID: POST.14). The previous PI though, expressed his willingness to keep publishing his articles in prestigious

publications; “I am still not going to sacrifice quality if I can help to do that.” (ID: POST.8). Therefore, the participants are seeking journals that will allow the article’s submission into PubMed Central, and the open-access journals are a good solution, as long as they have high quality, since they permit the submission of the article’s final version without embargo periods.

When they mentioned that the NIH public-access policy made them increase their publishing in open-access journals, what a few of the participants actually meant is that their goal is to publish only with those journals that will allow their articles to be submitted into PubMed Central. These participants had the erroneous perception that the toll-access journals that allow the manuscripts’ archiving to PubMed Central are the same as the open-access journals. A pre-mandate respondent described how the policy influences his publishing decisions:

> “So I think it does affect- for instance there are journals that still do not deposit into PubMed Central and they are available in PubMed and you know as scientists we want our work to be fully visible, so now that the NIH policy is in place, there is not motivation to submit into a journal that does not comply with the NIH policy and I would say quite strongly that I have no plans submitting a paper because that wouldn’t be in accordance with the current policy.” (ID: PRE.2)

Another participant affiliated with an academic institution explained the same decision, “I had decided that we were only going to publish in journals that did the work for us.” (ID: PRE.5). This PI was not motivated to publish in journals that would not comply with the policy and he communicated this preference to his colleagues in the research laboratory he runs.

A descriptive method (chi-square test) was used to test various relationships between the open-access advocates and the non-advocates and the pre-mandate and post-mandate authors (Chapter 3, Table 6). The only results that revealed some interest is that the publication patterns

for the advocates during the pre- and post-mandate periods are significantly different from those of non-advocates c2 (df=1, n-42) = 3.88, p=.049. Apart from that, no further relationships could be found for the investigated population.

Summary

This dissertation attempted to provide a deeper understanding of the factors that define the PIs' publication habits, and in some cases the mandatory NIH public-access policy is one of them, while in other cases it does not at all control their publication habits. The major findings in this dissertation are that the NIH-funded PIs choose one of the PLoS journals for their publications based on four main criteria: the (a) journals' impact factor, (b) publication speed, (c) peer-review system and (d) articles' open-access availability (Figure 2). The participants did not spend a lot of time reading and getting familiar with the terms of the mandatory NIH public-access policy and failed to ask for help for the complicated parts mainly due to lack to time. Almost one third of the participants are not responsible for the submission process; another third conducts the submission personally and finds it an easy process, while the rest of the participants experience difficulties. For the vast majority of the PIs the NIH public-access policy neither increased their awareness of the available open-access publishing options, nor caused an effect in their publishing behavior (Figure 7). The PIs either support stronger the open-access movement than the policy mandates, since open-access publications allow immediate access to manuscripts, or they publish in journals that ensure compliance with the policy, allowing an embargo period

Chapter 5

Conclusions

This final chapter summarizes the results of the four research questions addressed in this dissertation, discusses the findings and provides recommendations for future research. The main questions this dissertation attempted to answer are:

(1) Which factors motivate the NIH-funded PIs to publish in the PLoS open-access journals?

(2) How do NIH-funded PIs perceive the NIH public-access policy?

(3) How does the NIH public-access policy influence the PIs' publishing behavior?

(4) How does the NIH public-access policy influence the PIs' decision to publish in open-access journals?

The major findings of this dissertation are related to the components that have an effect in determining the participants' publishing options, how the participants manage to comply with the mandatory terms of the NIH public-access policy, and how the policy has an influence on their open-access awareness and publishing behavior.

Discussion

Factors influencing publishing decisions

The general direction in which the scientific publications are moving is toward the online environment, which is characterized by the ease of article retrieval and manipulation of information. The participants' primary reference searching tool is PubMed, the online citations database, which retrieves results from both toll-access and open-access journals. When the

retrieved articles are hosted in the latter, the participants search the journals' content directly by visiting the journals' Websites. When the quality criteria of the PLoS journals were examined, the participants noted that there are four factors that affect their publishing decisions: the (a) impact factor, (b) publication speed, (c) peer-review and (d) articles' citation advantage. Although the PLoS journals are not always perceived as the most prestigious publications, such as *Cell*, *Nature* and *Science*, they have nonetheless demonstrated a high quality that attracts the participants.

The publication-speed of the PLoS articles stems from three factors: (a) the effortless initial article submission, (a) fast peer-review process, and (b) ease of article re-submission. The speed of the dissemination of information is considered to be an advantage, and for this reason, the journals that delay the publication process were criticized. Another benefit of the PLoS journals is their peer-review process, through which an article is judged only by its significance, in contrast to *Cell*, *Nature* and *Science*, where it was reported that they sometimes commercialize the scientific research results. Finally, since the PLoS journals maintain the same instructions for the preparation of manuscripts, resubmission to another PLoS journal does not require extra time and effort.

To ensure compliance with the NIH public-access policy, the PIs have to manage their articles' copyrights and ensure that they own the rights to submit their articles to PubMed Central (Joseph, 2008). Although the researcher expected that the participants would manage their copyrights, it was discovered that the PIs do not perform any extra actions to retain their copyrights mainly for three reasons. First, some of the toll-access journals in which the PIs publish sometimes submit the articles to PubMed Central on their behalf, and no further action for copyright management is required by the PIs. Second, the PIs occasionally publish in open-

access journals, which may not have limited restrictions and copyright management is not necessary, and third they ignore the copyright limitations imposed by the journals' licensing agreements and proceed with the article submission themselves, ignoring any possible infringement of the law. There were only five (12%) participants who belong in the latter category.

One factor that caused extensive discussions was the cost of publications. The participants mentioned that they have paid publication fees in some of the toll-access and some of the open-access journals, but there was not a consensus for the rate of these charges, which is considered an expected finding, since the journals have different publication charges. Although the open-access journals have higher charges than the toll-access journals, they provide their content free of cost to everyone in the world, while the toll-access journals, apart from the publication charges, also have a fee for the subscribers. Due to this distinction two main groups of opinions were expressed. One group mentioned that the open-access journals fees are not extremely high (*n*=18), given that the article will be open access. The second group believed that since the article would be free of cost to the public through PubMed Central, the fee for publishing in an open-access journal is an unnecessary expense (*n*=7). Three participants, who were affiliated with prestigious and well-funded academic institutions and/or research centers, mentioned that the open-access journals' publication fees are not high and that they could afford publishing almost all their articles in open-access journals.

Implementation of the NIH public-access policy

All the participants expressed a familiarity with open-access, which they have gained mainly by reading or discussing the debates about the movement. Although open-access can be

delivered in two ways — through the open-access journals, such as the PLoS journals, and the open repositories, such as PubMed Central — the participants' comments during the interviews focused only on the open-access journals. It can be hypothesized that the PIs probably did not mention the open repositories and the self-archiving process because before the policy this process was not a dominant practice in their publishing culture. The results of the PEER Behavioral Research final report (Fry et al., 2011) indicate that the participants, who were from a variety of disciplines, including medicine, were not familiar with the term repository. Specifically for the health sciences, less than half of the participants were aware of a medical repository in the health sciences, including PubMed Central, which is the most prominent repository in the field.

The participants' familiarity with the NIH public-access policy came through notification emails from the NIH. Due to the policy's long history, which started as voluntary and ended as mandatory, the participants were not able to recollect where exactly they had heard about it, but they commented that they had never read the whole text. According to the policy's terms, the submission process has to be conducted either by a PI or by someone else on behalf of the PI ("First U.S. Public," 2009). Almost one third of the participants mentioned that they conduct the submission process themselves and that they find both the policy and the submission process relatively easy. Another third mentioned that they are not responsible for the submission process, because they have some type of assistance: personal administrator, librarian or a grants department administrator. The final third of the participants mentioned that they are responsible for the submission process and that they find both the policy and the process complicated. The frustrating parts of the policy can be divided into three sections: the (a) policy wording, (b) licensing agreements and (c) submission process.

When the policy was first introduced the journals had to rewrite their licensing agreements and adjust their terms to ensure compliance for the NIH-funded research articles, an action the participants found to be inevitable for the journals in order for them to sustain their publications. Although the majority of the journals introduced new licensing terms, these terms differ, mainly about who is responsible for the submission process to PubMed Central, the author or the journal, and the establishment of the embargo period. Some journals submit the manuscripts to PubMed Central on behalf of the PIs, while others do not and the PIs have to proceed with the submission process. When the PIs self-archive their manuscripts they can personally set an embargo period, but when the journals control the submission process, then this period ranges from three to twelve months. Since the PIs tend to publish a high volume of articles yearly, from 20 to 50, tracking the embargo period for each article can be frustrating and time-consuming.

One third of the participants who conduct the submission process themselves characterized it as a procedure that requires a lot of time, which they could have used to conduct research instead. Two reasons make this process time-consuming; the variety of the existing databases the PIs have to log in, and the different identification numbers assigned to each manuscript throughout the whole submission process. The process from the first step, which is the upload of a manuscript to PubMed Central, until the last step, the approval of the application, is unclear to them. The participants who had some type of help from an administrative assistant both with the submission into PubMed Central and the further control of their manuscripts had more positive feelings about the policy and the submission process, than the ones who lacked this help. The participants who had a permanent personal assistant who dealt with the policy's

compliance terms were affiliated with either prestigious and highly funded academic institutions or research centers.

Those who felt frustrated with both the policy's language and the submission process did not seek help due to lack of time. Concerning the confusing parts, they either gave their own interpretation or conducted all the required steps in the submission process, hoping that they were following the procedure correctly. Although it was expected that the libraries would have been more involved in informing the PIs of their scholarly communications options and assisting them with the terms of the policy, it was discovered that their involvement was minimal. When general assistance was provided, it was in the form of workshops, organized mainly by the institution's grants program in cooperation with the library.

Public-access and open-access insight

The NIH public-access policy had a rather limited influence on the PIs awareness of the open-access publishing options. There were only three participants (21%) who mentioned that their awareness of open-access increased and they were not self-characterized as open-access advocates. These three noted that they seek to publish in journals that have open-access policies, such as the hybrid journals that allow immediate open-access to their articles by imposing an extra publication fee, or that they are willing to consider publishing more often in open-access journals than they used to.

A rather small portion (n=4, 10%) of the open-access advocates, who had taken advantage of the open-access publishing options for a longer time before the implementation of the policy, stated that their level of knowledge did not change. Nonetheless, they observed an increase in the level of knowledge of their colleagues and students on the open-access topics,

which in practice means that they can communicate more easily with them about open-access ideas and have their approval to publish their articles in open-access journals more often than in the past.

The non-open access advocates (*n*=20, 87%) did not perceive an increase in their knowledge as a result of the NIH-public access policy because they were not paying a lot attention to the policy. For them the journals' impact factor and prestige are more important than the article's immediate open-access availability. In addition, since the journals comply with the policy, their choice of journals in which to publish their papers is based on the quality criteria and not on the open-access movement factors.

Publishing behaviour after the NIH public-access policy

The policy also did not cause the participants to publish more in open-access journals. For the participants who were self-characterized as open-access advocates (*n*=14, 74%) the policy did not increase their awareness of open access or their awareness of the free-of-cost distribution of the research articles. The policy was implemented a long time after the establishment of the open-access movement and the open-access journals, and since it allows an embargo period, for all of them it does not serve the same purposes as the open-access movement, because it does not ensure immediate access to research results.

When the participants who were not self-characterized as open-access advocates decide on the journal to publish their papers, they have in mind the journal's impact factor, quality of published papers and speed of publication. For them the open-access availability is desired when feasible, but it is not the number one deciding factor. According to the policy's terms, the NIH-funded manuscripts must be submitted to PubMed Central and become available free of cost no

later than following a twelve-months embargo period and this time is not considered to be a long wait time. The participants suggested that compliance with the policy is achieved both when publishing in open-access and toll-access journals, and the choice of the kind of the journal depends on the journal's quality criteria.

The PIs' desire is to prove their commitment to the NIH by complying with the policy. The terms of the policy are stated in the contract the PIs sign with their funder and the presentation of the research results in the form of an article is the product of the research conducted using the NIH funds. Therefore, the participants feel that they have to comply with their funder, whose contract they initially sign.

The relationship between publishing in an open-access journal and complying with the policy was not clear to the participants. A small number of them (n=3) mentioned that the policy affects in their decision about which journal will publish their papers, but they did not express the willingness to increase their open-access publishing options. What they actually meant is that their goal is to have their manuscripts appear in PubMed Central and to comply with the policy's rule.

Directions for future research

Although the establishment of the open-access journals predates the NIH public-access policy, this dissertation discovered that the participants believe that the NIH public-access policy was introduced at the same time as the wide development of the open-access journals. It cannot be determined, though, if the policy has caused the growth of the open-access journals' prestige, or if there is no relationship between these two components. Although this dissertation investigated whether the NIH public-access policy caused an increase in the participants'

awareness of the open-access publishing options, a further investigation is necessary to determine whether the open-access journals' success was caused by the public-access policy.

An unexpected finding was that participants (*n*=13, 31%) visit the PubMed citations database searching for literature in their fields. In their results list, the participants have access to citations that link to closed-access articles and to citations that link to open-access articles, which are hosted either in the PubMed Central database or in open-access journals. When the results are free of cost and retrievable through PubMed Central and have a satisfactory level of quality, they avoid visiting their affiliated institutions' library databases for expediency sake. Additional research needs to be conducted to examine the role of PubMed in the PIs literature searching habits and how the open-access articles retrieved from PubMed Central meet the PIs need for quality, adequacy and accuracy of scientific information.

It was discovered that the manuscript submission process to PubMed Central was considered to be complicated. The participants who were not conducting the submission process themselves, but had dedicated assistants to take care of this process, had more positive feelings about the policy than the participants who conducted the submission process themselves and described it as perplexing. Due to this situation, two different types of research can be conducted. The first should examine the degree to which the manuscript submission process is a barrier to the PIs compliance with the policy and their appreciation of the goals of the policy. The second type of research should focus on the PIs' assistants, who are responsible for the submission process. The PIs noted that implementation of the policy is time-consuming and an administrative burden, which deprives them of the valuable time they could have allocated to conduct research. What must be examined is whether the PIs' administrators, whose profession is to deploy administrative projects, consider that the wording of the NIH public-access policy is

difficult to understand and interpret and if the submission process is considered to be perplexing and difficult by this group of people.

The participants in this research were funded by the NIH, the world's most prestigious and largest funding organization in health sciences. These participants mentioned that they publish a great number of articles every year, ranging from twenty to fifty, a count that proves their high productivity and the importance of their research results. The toll-access journals *Cell*, *Nature* and *Science* were criticized for their powerful peer-review system and the fact that the article acceptance process is slow. Since this finding was not anticipated, it must be further investigated how the authors who publish in one of these journals, regardless of whether or not they have an NIH funding, feel about the journals to which they submit their manuscripts, because of their strong prestige factors.

Conclusion

The research participants were forty-two NIH-funded PIs who had published one or more articles in one of the PLoS journals during the years 2005 to 2009 and were affiliated with thirty-two academic or research institutions, practicing research in various fields in the health sciences. Although the results of this dissertation cannot be generalized to the whole health sciences population, the findings allow us to draw some conclusions.

Apart from the journals' impact factor and publication speed, which constitute the two components authors would take into consideration when deciding on the most suitable publication (Rowlands & Nicholas, 2005; Rowlands, Nicholas & Huntington, 2004; Swan, 1999; Warlick & Vaughan, 2007), there is an increased tendency to support the premise of free-of-cost access to publicly-funded research. What is not known, is if this premise became part of the

scientists publishing behavior due to the development of the prestige of the open-access journals and the mandatory NIH public-access policy, or if it is just a new shift they feel they must endorse in order to meet their funding institutions' expectations and follow the popular new trend that requires the free-of-cost distribution of publicly funded research results.

The issues that emerged during the implementation of the policy focused more on the submission process than anything else. Compliance with the policy is a more important factor than understanding the terms of the policy itself, since it ensures further funding. The participants' primary concern is to verify that their article will appear into PubMed Central. They do not spend much time with the details of the policy, such as seeking help and managing their copyrights due to limited time. It is obvious that the participants favor any type of assistance, and the ones who have assistance on a permanent basis expressed a more positive stance towards the policy.

All of the open-access and the toll-access journals comply with the policy. The NIH public-access policy did not cause any changes in the participants' publishing behavior, because they keep publishing in the same journals they did before the policy, since the submission of the manuscript to PubMed Central is allowed. Some toll-access journals permit the authors to conduct the deposit themselves, and some others execute it on behalf of the authors. The latter, although they seem to be offering a service to the PIs, in reality control both the manuscript's copyright and embargo period. An impressive finding was that the participants never considered the limitations caused in that case. In fact, they favor the journals that conduct the submission process on their behalf, and some of them only publish in the ones that operate this way.

The NIH public-access policy affected only a limited number of the PIs and caused changes in their awareness of the available open-access options and in their publishing behavior

by making them publish more in open-access journals or in toll-access journals that provide open-access options. The participants were unaffected by the policy because: (a) the journals allow the manuscript submission to PubMed Central, a component that ensures compliance with the policy and further NIH-funding and (b) the policy allows a maximum twelve-month embargo period, which contradicts the open-access advocates' belief (*n*=11) that in open-access the research results must be delivered immediately.

The research methodology used in this dissertation was qualitative, where interviews with open-ended questions were conducted. The benefit of this method was that the researcher gained a deep understanding of the PIs opinions about the mandatory NIH public-access policy and how this shapes their publishing behavior. A future quantitative study, surveying a larger number of PIs, can be conducted using this study, which will allow the generalizability of the results to a larger population. Since currently we have become aware of the important issues related to the research questions, a quantitative research study will give us the ability to infer statements and draw conclusions applied to a broader group of the NIH-funded PIs.

Bibliography

African sleeping sickness test [Web log message]. Retrieved on February, 2011 from http://wiki.creativecommons.org/Case_Studies/African_Sleeping_http://wiki.creativecommons.org/Case_Studies/African_Sleeping_Sickness_TestSickness_Test

Anderson, B. (2004). Open access and institutional repositories. *Behavioral & Social Sciences Librarian*, 23(1), 97-101. doi: 10.1300/J103v23n01_05

Anderson, R. (2004). Author disincentives and open access. *Serials Review*, 30(4), 288-291

Antelman, K. (2004). Do open-access articles have a greater research impact? *College & Research Libraries*, 65(5), 372-382.

Atsuko, M. (2006). Situation and spread of open-access publishing in the Journal Citation Reports. *Journal of the Japan Medical Library Association*, 53(1), 41-47

Bailey, C. (2006). *What is open access?* Retrieved on March 2011, from http://www.digital-scholarship.org/cwb/WhatIsOA.htm

Banks, M.A.& Persily, G.L. (2010). Campus perspective on the National Institutes of Health public access policy: University of California, San Francisco, library experience. *Journal of the Medical Library Association*, 98(3), 256- 259. doi:10.3163/1536-5050.98.3.015

Barnett, M.C. & Keener, M.W. (2007). Expanding library support in response to the National Institutes of Health access policy. *Journal of the Medical Library Association*, 95(4), 450- 453.

Björk, B. C. (2004). Open access to scientific publications- an analysis of the barriers to change? *Informationresearch*, 9(2).

Brody, T. (2004). *Citation analysis in the open access world*. Southampton, UK: University of Southampton, School of Electronics and Computer Science. Retrieved February 13, 2008 from http://eprints.ecs.soton.ac.uk/10000/

Carr, L. & Harnad, S. (2005). *Keystroke economy: A study of the time and effort involved in self-archiving*. Technical Report, ECS, University of Southampton. (Unpublished) Retrieved on November 15, 2010 from http://eprints.ecs.soton.ac.uk/10688/

Case, M. M. (2002). *Igniting change in the scholarly communication: SPARC, its past, present and future.* Retrieved from SPARC website: http://www.arl.org/sparc/bm~doc/SPARC_advances.pdf

Chan, L. (2004). Supporting and enhancing scholarship in the digital age: The role of open access institutional repositories. *Canadian Journal of Communication*, (29)3. Retrieved from http://cjc-online.ca/index.php/journal/article/viewArticle/1455/1579

Chaudhuri, J. & Thohira, M. (2010). Usage of open-access journals: Findings from eleven top science and medical journals. *Serials Librarian*, 58, 97-105. doi: 10.1080/03615261003623070

Copyrights, 17 U.S.C. § 201, 1976

Corbett, H. (2009). The crisis in scholarly communication, Part I: Understanding the issues and engaging your faculty. *Technical Services Quarterly*, 26, 125- 134. doi: 10.1080/07317130802268522

Creswell, J.W. (2003*). Research design: Qualitative, quantitative and mixed methods approaches* (2nd ed.). London: Sage Publications

Cronin, B. & Overfelt, K. (1995). E-journals and tenure. *Journal of the American Society*

of Information Science, 46(9), 700-703

Dallmeier- Tiessen, S., Darby, R., Goerner, B., Hyppoelae, J., Igo-Kemenes, P., Kahn, D. … Van der Stelt, W. (2010). *Highlights from the SOAP project survey: What scientists think about open access publishing*. Retrieved on February 2011, from http://arxiv.org/abs/1101.5260

English, R. & Joseph, H. (2008- February). The NIH mandate: An open access landmark. *College & Research Libraries News*, 82- 85.

ExPORTER. (2010). Retrieved on September 2010 from http://projectreporter.nih.gov/exporter

Frank, E. (1994). Authors' criteria for selecting journals. *Journal of the American Medical Association* 272, 163-4. Retieved on February 2011, from http://dx.doi.org/10.1001/jama.272.2.163

First U.S. public access policy made permanent. 2009 consolidated appropriations act ensures NIH public-access policy will persist (2009, March 12). Retrieved on October 29, 2010 from https://mx2.arl.org/Lists/SPARC-OAForum/Message/4849.html

Foshmire, M. & Yu, S. (2000- Summer). Free scholarly electronic journals: How good are they? *Issues in Science & Technology Librarianship*. Retrieved on November 11, 2010 from http://www.library.ucsb.edu/istl/00-summer/refereed.html

Frequently Asked Questions- Public Access (2009, December). Retrieved on October 15, 2011 from http://publicaccess.nih.gov/FAQ.htm#

Fry, J., Probets, S., Creaser, C., Greenwood, H., Spezi, V., White, S. (2011). PEER Behavioural Research: Authors and users vis-à-vis journals and repositories (Final Report). Retrieved on August 2011, from

http://www.peerproject.eu/fileadmin/media/reports/Final_revision_-_behavioural_baseline_report_-_20_01_10.pdf

Garlfield, E. (1990). How ISI selects journals for coverage: quantitative and qualitative considerations. *Essays of an Information Scientist*, 13(22), 185- 193

Guba, E.G. & Lincoln, Y.S. (1981). *Effective evaluation: improving the usefulness of evaluation results through responsive and naturalistic approaches*. San Francisco: Jossey- Bass.

Guédon, J.C. (2003, January 16- 18). *Creating scientific value with open access: A background paper for the Budapest meeting*. Retrieved from http://www.soros.org/openaccess/pdf/background_paper.pdf

Hajjen, C., Harnad, S. & Gingras, Y. (2005). Ten-year cross-disciplinary comparison of the growth of open access and how it increases research citation impact. *Bulletin of the Technical Committee on Data Engineering* (IEEE Computer Society), 28(4), 39-46.

Harnad, S. (2003). Open access to peer-reviewed research through author/institution self-archiving: Maximizing research impact by maximizing online access. In Law, Derek & Judith Andrews, Eds. *Digital Libraries: Policy Planning and Practice.* Ashgate Publishing 2003. Retrieved from http://users.ecs.soton.ac.uk/harnad/Temp/digital-libraries.htm

Harnad, S. (2004). Comparing the impact of open access (oa) vs. non-oa articles in the same journals. *D-Lib Magazine*, 10(6). Retrieved on November 11, 2010 from http://www.dlib.org/dlib/june04/harnad/06harnad.html

Harnad, S. (2008, March 2). *How to integrate university and funder open access mandates*

[Electronic mailing list message]. Retrieved on October 2011, from http://openaccess.eprints.org/index.php?/archives/369-How-to-Integrate-University-and-Funder-Open-Access-Mandates.html

Harnard, S., & Brody, T. (2004). Comparing the impact of OA vs Non OA articles in the same journals. *D- Lib Magazine*, 10(6). Retrieved February 2011, from http://www.dlib.org/dlib/june04/harnad/06harnad.html

Harnad, S., Brody, T., Vallières, F., Carr, L., Hitchcock, S., Gingras, Y., … Hilf, E. (2004). The access/impact problem and the green and gold roads to open access. *Serials Review*, 30(4), 310- 314. doi: 10.1016/j.serrev.2004.09.013

Hartman, J.M., Forsen, J.W., Wallace, M.S., Neely, J.G. (2002). Tutorials in clinical research: Part IV: Recognizing and controlling bias. *Laryngoscope*, 112, 23-31

Hawxhurst, A. (2009, September 8). *Ant research in PLoS ONE* [Web log message]. Retrieved on January, 20011 from http://blogs.plos.org/everyone/2009/09/08/ant-research-in-plos-one/

Hedlung, T., Gustafsson, T. & Björk, B.C. (2004). The open access scientific journal: an empirical study. *Learned Publishing*, 17(3), 199- 209.

Hess, T., Wigand, R., Mann, F., von Walter, B. (2007). *Open access and science publishing*. (Management Report 1/2007). Germany: Ludwig-Maximilians-Universität Munich. Retrieved on February 2011, from http://openaccess-study.com/Hess_Wigand_Mann_Walter_2007_Open_Access_Management_Report.pdf

Hooker, B. (2007, December). *If it won't sink in, maybe we can pound it in… Open Reading Frame*. Retrieved on March, 2011 from http://www.sennoma.net/main/archives/2007/12/if_it_wont_sink_in_maybe_we_ca.php

Hurrell, C. & Meijer-Kline, K. (2011). *Open access up for review: academic attitudes towards open access publishing in relation to tenure and promotion*. Retrieved on June 25, 2011 from http://tsc.library.ubc.ca/index.php/journal4/article/viewFile/104/pdf_10

Impact of open access journals: a citation study from Tompson ISI. (2004). The Thompson Cooperation. USA, Ohio: Thompson. Retrieved February 19, 2008 from http://scientific.thomson.com/media/presentrep/acropdf/impact-oa-journals.pdf

Include PMCID in citations (n.d.). Retrieved on September 12, 2011 from http://publicaccess.nih.gov/citation_methods.htm

Interview with a PLoS ONE author [Web log message]. (20, October 2008). Retrieved on January, 2011 from http://blogs.plos.org/plos/2008/10/interview-with-a-plos-one-author/

ISI Web of Knowledge. (2010). Retrieved from http://www.isiwebofknowledge.com/

Jantz, R. & Wilson, M. (2008). Institutional repositories: Faculty deposits, marketing, and the reform of scholarly communication. *Journal of Academic Librarianship*, 34(3), 186-195.

JISC/OSI journal authors survey: Report. (2004). UK: Key Perspectives Ltd. Retrieved on February 2011, from http://www.jisc.ac.uk/uploaded_documents/JISCOAreport1.pdf

Jones, C. (2007). *Institutional Repositories: content and culture in an open access environment*. Oxford, UK: Chantos Publishing.

Joseph, H. (2008). From advocacy to implementation: the NIH public access policy and its impact. *Journal of Library Administration*, 48(2), 207- 217. doi:10.1080/01930820802231435

Kaiser, J. (2006). Bill would require free public access to research papers. *Science*,

312(5775), 828.

Keener, M. & Sarli, C. (2010, November). Public access policy support programs at libraries: A roadmap for success. *College & Research Libraries News,* 539- 542

Kenneway, M. (2011). *Author attitudes towards open access publishing*. UK: TBI Communications Ltd. Retrieved on June 25, 2011, from http://www.intechweb.org/public_files/Intech_OA_Apr11.pdf

King, N. & Horrocks, C. (2010). Interviews in qualitative research. Los Angeles: Sage.

Kroth, P.J., Aspinall, E.E., & Philips, H.E. (2006). The National Institutes of Health (NIH) policy on enhancing public access: Tracking institutional contribution rates. *Journal of the Medical Library Association,* 94(3), 279- 283

Kyrillidou, M. (2004, June). Serials trends in the ARL statistics 2002- 2003. *ARL: A Biomonthly Report*, 234. Retrieved on October 2010, from http://www.arl.org/resources/pubs/br/br234/br234serials.shtml

Kvale, S. (2007). Doing interviews. Los Angeles: Sage.

Laakso, M., Welling, P., Bukvova, H., Nyman, L, Bjork, B-C., Hedlung, T. (2011). The development of open access journal publishing from 1993 to 2009. *PLoS ONE,* 6(6). Article retrieved on June 2011, from http://www.plosone.org/article/info:doi/10.1371/journal.pone.0020961

Leedy, P.D. & Ormrod, J.E. (2005). *Practice research: Planning and design* (8th ed.). Columbus, OH: Pearson Education Inc.

Mabe, M. A. (2003) *What Do Authors Care About*? Fiesole Digital Collection Retreat.

Oxford. Retrieved on February 2011, from digital.casalini.it/retreat/2003_docs/Mabe.ppt

Mallikarjun, D. (2009). *Almost 500 open access titles indexed in ISI Web of Science*. [Web log message] http://mallikarjundora.wordpress.com/2009/12/05/almost-500-open-access-titles-indexed-in-isi-web-of-science/

McVeigh, M. E. (2004). *Open access journals in the ISI citation databases: Analysis of impact factors and citation patterns. A citation study from Thomson Scientific*. Retrieved on November 11, 2010 from science.thomsonreuters.com/m/pdfs/openaccesscitations2.pdf

Miller, J. (2009). "Publishers did not take the bait": A forgotten precursor to the NIH public access policy. *College & Research Libraries,* 123- 132

Morris, S. & Thorn, S. (2009). Learned society members and open access. *Learned Publishing*, 22(3), 221- 239. doi: 10.1087/2009308

Morrison, H. (2008, March). Less than 10% of open-access journals in psychology charge a publication fee. *The Imaginary Journal of Poetic Economics*. Retrieved on March, 2011, from http://poeticeconomics.blogspot.com/2008/03/less-than-10-of-open-access-journals-in.html

Morse, J. M. (1994). Designing funded qualitative research. In N.K. Denzin & Y.S. Lincoln (Eds.), *Handbook of qualitative research* (pp.220- 235). London: Sage Publications.

Mukherjee, B. (2007). Evaluating e-contents beyond impact factor- a pilot study selected open access journals in library and information science. *Journal of Electronic Publishing*, 10(2), Retrieved from http://tc.eserver.org/29568.html

Nariani, R. & Fernandez, L. (2011). Open access publishing: what authors want. *College*

and Research Libraries, March 2012. Retrieved on June 25, 2011 from http://crl.acrl.org/content/early/2011/06/10/crl-203.abstract

National Institutes of Health (NIH), (2005). *Policy on enhancing public access to archived publications resulting from NIH-funded research* (NOT-OD-05-022). Washington, DC: National Institutes of Health (NIH). Retrieved on October 29, 2010 from http://grants.nih.gov/grants/guide/notice-files/not-od-05-022.html

National Institutes of Health (NIH), (2008). *Revised policy on enhancing public access to archived publications resulting from nih-funded research* (NOT-OD-08-033). Washington, DC: Retrieved from http://grants.nih.gov/grants/guide/notice-files/NOT-OD-08-033.html

Nguyen, T. (2008). *Open doors and open minds: what faculty authors can do to ensure open access to their work through their institution*. Retrieved from SPARC website: http://www.arl.org/sparc/bm~doc/opendoors_v1.pdf

Nicholas, D., Huntington, P, & Jamali, H.R. (2007). The impact of open access publishing (and other access initiatives) on use and users of digital contents. *Learned Publishing*, 20(1), 11-25.

Nicholas, D., Huntington, P., Rowlands, I. (2004). Open access journal publishing: the views of some of the world's senior authors. *Journal of Documentation*, 61(4), 497- 519. doi: 10.1108/00220410510607499

Nicholas, D., Jamali, H., Huntington, P. et al. (2005). In their very own words: authors and scholarly publishing journals. *Learned Publishing*, 18(3), 212-220.

Nicholas, D. & Rowlands, I. (2005). Guest Editorial: Open access publishing: evidence from the authors. *The Journal of Academic Librarianship*, 31(3), 179- 181.

N*IH budget requests*. (2010, June 17). Retrieved on October 29, 2010 from http://www.nih.gov/about/director/budgetrequest/index.htm

NIH policy implementation (SPARC). (2010). Retrieved November 15, 2010 from http://www.arl.org/sparc/advocacy/nih/index.shtml

NIH Public Access Working Group (2006, November 15). *Meeting Summary*. Retrieved on October 31, 2010 from http://www.nlm.nih.gov/od/bor/PublicAccessWG-11-15-05.pdf

NIH RePORTER. (2010). Retrieved on September 2011 from http://projectreporter.nih.gov/reporter.cfm

NIH research portfolio online. (2010). Retrieved on September 2011, from http://report.nih.gov/

Okerson, A, (1989). Of making many Books There is No End: Report on serial prices for the Association of Research Libraries. In *Report of the ARL Series Crisis Project.* Washington, DC: Association of Research Libraries. Retrieved from http://www.library.yale.edu/~okerson/making/manybooks.html

Omnibus Appropriations Act of 2009 makes the NIH Public Access Policy Permanent. (2009, March 19). Retrieved on October 2010, from http://grants.nih.gov/grants/guide/notice-files/NOT-OD-09-071.html

Oppenheim, C. (2008). Electronic scholarly publishing and open access. *Journal of Information Science*, 34(4), 577-590. doi: 10.1177/0165551508092268

Over, A., Maiworm, F., Schelewsky, A. (2005). *Publishing strategies in transformation? Results of a study on publishing habits and information acquisition with regard to open access*. Germany: Deutsche Forschungsgemeinschaft Information Management (IM).

Retrieved on February 2011, from http://www.dfg.de/download/pdf/dfg_im_profil/evaluation_statistik/programm_evaluation/studie_publikationsstrategien_bericht_en.pdf

Patterson, M. (2003). *PLoS — Public Library of Science. 2003 Round Table on Developing Countries Access to Scientific Knowledge*, The Abdus Salam ICTP. Trieste, Italy. Retrieved on February, 2011 from http://www.ejds.org/meeting2003/ictp/papers/Patterson.pdf

Peek, R. & Newby, G. (1996). *Scholarly Publishing: The electronic Frontier*. Cambridge, MA: MIT.

Peek, R. (2004). The politics of publishing. *Information Today,* 21(11), 17- 18.

Peek, R. (2006). NIH public access update. *Information Today,* 23(4), 17- 18.

Peek, R. (2008a). A busy year for the NIH. *Information Today*, 25(3), 17- 18.

Peek, R. (2008b). Public input on NIH public access. *Information Today*, 25(7), 13- 14.

Peek, R. & Pomerantz, J.P. (1998). Electronic scholarly journal publishing. In M.E. Williams (Ed.) *Annual Review of Information Science and Technology*, 33, 321-356. Medford, NJ: Information Today, Inc.

Pharmboy, A. (2008, December 2). *Chris Patil (ouroboros) on the Campisi lab's new PLoS Biology paper: cellular senescence, protein secretion, and the aging/cancer paradox* [Web log message]. Retrieved on January, 2011 from http://scienceblogs.com/terrasig/2008/12/chris_patil_ourboros_on_the_ca.php

Pinfield, S. (2004). Self-archiving publications. In G.E. Gorman & Rowland Fytton

(eds.). *International yearbook of library and information management 2004- 2005: Scholarly publishing in an electronic era*. London: Facet pp. 118- 145.

Pinfield, S. (2009). Journals and repositories: An evolving relationship. *Learned Publishing,* 22(3), 165- 175. doi: 10.1087/2009302

PLoS Author Research 2010. (2011, January). Retrieved on February 2011, from http://www.slideshare.net/MarkPatterson/p-lo-s-author-research-2010-6638756

PLoS ONE: Accelerating the publication of peer-reviewed science. (n.d.). Retrieved on January, 2011 from http://www.plosone.org/static/almInfo.action

Pope, L. (2001). PubMed Central: A barrier-free repository for health sciences. *Series Librarian,* 40(1/2), 183-190

Public Access Training/ Communications. (n.d). Retrieved on September 2011, from http://publicaccess.nih.gov/communications.htm

PubMed. (2010). Retrieved on September 2010 from http://www.ncbi.nlm.nih.gov/pubmed/

Quint, B. (2004). Upfront with Barbara Quint: Future of the NIH open access policy. *Information Today*, 21(9). Retrieved November 20, 2010 from http://www.infotoday.com/it/oct04/quint.shtml

Regazzi, J.J. & Aytac, S. (2008). Author perceptions of journal quality. *Learned Publishing,* 21(3), 225- 235. doi: 10.1087/095315108X288938

Research randomizer: free random sampling and random assignment. (2010). Retrieved on December 2010 from http://www.randomizer.org/

Rowlands, I. & Nicholas, D. (2005). *Scholarly communication in the digital environment: The 2005 survey of journal author behavior and attitudes*. Aslib Proceedings, 57(6), 481-497.

Rowlands, I., Nicholas, D., Huntington, P. (2004). *Scholarly communication in the digital environment: What do authors want? Findings from an international survey on author opinion: project report*. London: Center for Information Behavior and Evaluation of Research Department of Information Science, City University. Retrieved February, 2011 from http://www.ucl.ac.uk/ciber/ciber-pa-report.pdf

ROARMAP. (n.d.) Retrieved on September 4, 2010 from http://roarmap.eprints.org/

Schonfeld, R.C. & Housewright, R. (2010). *Faculty survey 2009: Key strategic insights for libraries, publishers and societies*. Ithaka S+R. Retrieved on February 2011, from http://www.ithaka.org/ithaka-s-r/research/faculty-surveys-2000-2009/Faculty%20Study%202009.pdf

Schroter, S., Tite, L., Smith, R. (2005). Perceptions of open access publishing: interviews with journal authors. *BMJ*, January 26. doi:10.1136/bmj.38359.695220.82. Retrieved on July 02, 2011 from http://www.bmj.com/content/330/7494/756.full

Science, Thomson Reuters. (n.d.). Retrieved on July, 2011 from http://scientific.thomson.com/index.html

Sedwick, (2005). Opening access to cell biology. *PLoS Biology*, 3(12), e426. doi: 10.1371/journal.pbio.0030426. Retrieved on January, 2011 from http://www.plosbiology.org/article/info:doi%2F10.1371%2Fjournal.pbio.0030426

Seidman, I. (2006). Interviewing as qualitative research: A guide for researchers in education and the social sciences. NY: Teachers College.

Shieber, S. (2009, May). *What percentage of open-access journals charge publications fees? The Occasional Pamphlet*. Retrieved on March 2011, from http://blogs.law.harvard.edu/pamphlet/2009/05/29/what-percentage-of-open-access-journals-charge-publication-fees/

Smith, J.A. & Osborn, M. (2008). Interpretative phenomenological analysis. In J.A. Smith (ed.). *Qualitative psychology: A practical guide to research methods* (2nd edition). London: Sage

Sotudeh, H. & Horri, A. (2009). Countries positioning in open access journals system: an investigation of citation distribution patterns. *Scientometrics*, 81(1), 7-31. doi: 10.1007/s11192-009-1870-4

Stenbacka, C. (2001). Qualitative research requires quality concepts of its own. *Management Decision*, 39(7), 551- 555.

Stimson, N. (2009). National Institutes of Health public access policy assistance: One library's approach. *Journal of the Medical Library Association*, 97(4), 238- 240

Suber, P. (2004a). *Open access overview: Focusing on open access to peer-reviewed research articles and their preprints*. Retrieved from http://www.earlham.edu/~peters/fos/overview.htm#

Suber, P. (2004b). *Guide to the open access movement*. Retrieved from http://www.earlham.edu/~peters/fos/guide.htm#self-archiving

Suber, P. (2004c). The open-access plan from the House Appropriations Committee. *SPARC Open Access Newsletter*, (76), Retrieved on October 29, 2010 from http://www.earlham.edu/~peters/fos/newsletter/08-02-04.htm#nih

Suber, P. (2005, December 2). Strengthening the NIH policy. *SPARC Open Access*

Newsletter, (92). Retrieved on October 31, 2010 from http://www.earlham.edu/~peters/fos/newsletter/12-02-05.htm#nih

Suber, P. (2006a). Open access mandate coming to the NIH. *SPARC Open Access Newsletter*, (99). Retrieved on October 31, 2010 from http://www.earlham.edu/~peters/fos/newsletter/07-02-06.htm#nih

Suber, P. (2006b). Update on the NIH policy. *SPARC Open Access Newsletter*, (95). Retrieved on October 31, 2010 from http://www.earlham.edu/~peters/fos/newsletter/03-02-06.htm#nih

Suber, P. (2007a). Progress toward an OA mandate at the NIH, one more time. *SPARC Open Access Newsletter*, (112). Retrieved on October 31, 2010 from http://www.earlham.edu/~peters/fos/newsletter/08-02-07.htm#nih

Suber, P. (2007b). Victory in the Senate: Update on the Bill to mandate open access at the NIH. *SPARC Open Access Newsletter*, (115). Retrieved on October 31, 2010 from http://www.earlham.edu/~peters/fos/newsletter/11-02-07.htm#nih

Suber, P. (2008a). The open-access mandate at Harvard. *SPARC Open Access Newsletter*, 117. Retrieved on October 2010, from http://www.earlham.edu/~peters/fos/newsletter/03-02-08.htm

Suber, P. (2008b). An open-access mandate for the NIH. *SPARC Open Access Newsletter*, 117. Retrieved on October 2010, from http://www.earlham.edu/~peters/fos/newsletter/01-02-08.htm

Suber, P. (2008c). Green/gold OA and gratis/libre OA. *Open Access News: News from the open access movement.* Retrieved on September 4, 2011 from http://www.earlham.edu/~peters/fos/2008/08/greengold-oa-and-gratislibre-oa.html

Suber, P. (2009). Open access policy options for funding agencies and universities. *SPARC Open Access Newsletter*, 130. Retrieved September 2010, from http://www.earlham.edu/~peters/fos/newsletter/02-02-09.htm#choicepoints

Suber, P. (2010a). *Open access overview.* Retrieved on September 2011, from http://www.earlham.edu/~peters/fos/overview.htm

Suber, P. (2010b). Thoughts on prestige, quality and open access. Logos, 21(1/2), 115-128. doi:10.1163/095796510X546959

Spivey, W. (2005). Developing an open access class for authors. *Journal of Electronic Resources in Medical Libraries*, 2(2), 49- 57. doi: 10.1300J383v02n02_05

Swan, A. (1999). What authors want: The ALPSP research study on the motivations and concerns of contributors to learned journals. *Learned Publishing*, 12(3).

Swan, A. (2005). *Open access self-archiving: An introduction*. UK: Key Perspectives. Retrieved from www.keyperspectives.co.uk/openaccessarchive/.../Open%20access%20self-archiving%20-%20an%20introduction.pdf

Swan, A. & Brown, S. (2004). Authors and open access publishing. *Learned Publishing*, 17(3), 219- 224.

Tschider, C. (2006). Investigating the "public" in the Public Library of Science: gifting economics in the Internet community. *First Monday*, 11(6). Retrieved February, 2011 from http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/1340/1260

Tonta, Y., Unal, Y., & Al, U. (2007). *The research impact of open access journal articles*. Proceedings of the Proceedings ELPUB 2007 conference on electronic publishing Vienna, Austria : http://eprints.rclis.org/9619/1/tonta-unal-al-elpub2007.pdf

Trochim, W. & Donnelly, J. (2007). *The research methods knowledge base* (3rd ed.). USA: Thomson.

Turk, N. (2008). Citation impact of open access journals. *New Library World*, 109(1/2), 65-74. doi: 10.1108/03074800810846010

Wagner, B. (2010- Winter). Open access citation advantage: an annotated bibliography. *Issues in Science and Technology Librarianship*. Retrieved on November 11, 2010, from http://www.istl.org/10-winter/article2.html

Warlick, S. E. (2006). *Publication transformation: why authors choose to publish in open access/free full-text journals*. (Master thesis). Retrieved on February 2011, repository http://etd.ils.unc.edu/dspace/bitstream/1901/299/1/stefaniewarlick.pdf

Warlick, S.E. & Vaughan, KTL. (2007). Factors influencing publication choice: why faculty choose open access. *Biomedical Digital Libraries*, 4(1). doi: 10.1186/1742-5581-4-1. Retrieved on June 25, 2011 from http://www.bio-diglib.com/content/4/1/1

Wirth, A. & Chandwell, F.A. (2010). Rights well: An author's right workshop for librarians. *portal: Libraries and the Academy*, 10(3), 337- 354. doi:10.1353/pla.0.0105

Xia, J. & Sun, L. (2006). Factors to assess self-archiving in institutional repositories. *Serials Review*, 33(2), 73- 80. doi:10.1016/j.serrev.2006.09.002

Xia, J. & Sun, L. (2007). Assessment of self-archiving in institutional repositories: depositorship and full-text availability. *Serials Review*, 33(1), 14- 21. doi:10.1016/j.serrev.2005.12.003

Xia, J. (2010). Longitudinal study of scholars attitudes and behaviors toward open-access journal publishing. *Journal of the American Society for Information Science and Technology*, 61(3), 615- 624. doi:10.1002/asi.21283

Yamey, G. (2008). Excluding the poor from accessing biomedical literature: A rights violation that impedes global health. *Health and Human Rights: An international journal*, 10(1). Retrieved from http://www.hhrjournal.org/index.php/hhr/article/viewArticle/20/88

Zerhouni, E.A. (2004). Information access: NIH public access policy. *Science*, 306(5703), Retrieved on October 31, 2010 from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1808281/ doi:10.1126/science.1106929

Zivkovic, B. (11, March 2009). *Interview with a PLoS ONE frequent author: Seyed Hasnain*. [Web log message]. Retrieved on January, 2011 from http://blogs.plos.org/plos/2009/03/interview-with-a-plos-one-frequent-author-seyed-hasnain/

Appendices

Appendix A

Interview Protocol

Participant information

ID:_____

Date and time of the interview:_____

Institutional affiliation: _____

Field of research: _____

Tenure/non-tenure: _____

Questions

1. Tell me why did you choose to publish with PLoS?
2. How familiar are you with open access?
3. How did you learn about the compliance terms of the NIH policy?
4. When you submitted your first couple of times your manuscript to Pub Med Central, how was the submitting procedure and the software interface?
5. Are there parts of the policy that you find complicated? Can you explain by giving examples why these parts are confusing?
6. In your effort to better understand these complicated parts, where did you go for help and how would you rate that help?
7. Did you use to publish in open-access journals before you became subject to the NIH public-access policy? Yes or no and why?

8. After your NIH grand did you had to negotiate with a publisher to retain the copyrights of the article so that you are able to submit your manuscript to PubMed Central? Can you please explain the negotiation steps?
9. The PLoS journals charge a publication fee. How were you able to cover this expense?
10. How does the NIH policy affect your decision about which journal you publish your papers? Please give examples.
11. When you submitted your first work to a PLoS journal after your NIH funding, how did you understand the relationship between publishing in an open-access journal and complying with the NIH policy?
12. Would you say that your knowledge about available open-access publishing options changed after you became familiar with the NIH public-access policy? Please explain.
13. In what ways would you say that the mandatory NIH policy has affected your decision to publish in open-access journals?

Appendix B

First call for participants

Dear Doctor/Professor,

The Research Portfolio Online Reporting Tools (RePORT) records indicate that you are an NIH funded PI and that your research has been published in the Public Library of Science (PLoS) journals.

You have been selected to participate as an interviewee in the dissertation entitled ***"How the NIH public access policy influences the authors' publishing decisions"***. This study explores how the National Institutes of Health (NIH)-funded principal investigators (PIs) view open access and how the mandatory public-access NIH policy has influenced their publishing behavior.

According to the policy, which became effective on April 5, 2008, all NIH-funded PIs are required to submit to PubMed Central, immediately upon publication, the final peer-reviewed version of their published article(s), which will become available to the public free of cost after a maximum of 12 months embargo period.

The interview will be conducted through the Skype™ software during **April and May 2011** and will last approximately **20 minutes**. If you have any questions concerning the interview process or the research in general you can contact me at pontika.nancy@gmail.com.

T**o participate in this research, please email me at pontika.nancy@gmail.com.**

Your participation is totally voluntary and you may withdraw from the interview at any time. This research project has received the approval of the Simmons College Institutional Review Board (IRB), and the research results will be anonymous.

Thank you in advance for your time. I look forward to hearing from you.

Yours sincerely,

Athanasia (Nancy) Pontika

Doctoral Student

Graduate School of Library & Information Science

Simmons College

Boston, MA

Email: pontika.nancy@gmail.com

Tel: 617-749-8175

Prof. Robin Peek

Associate Professor- Chair, Dissertation Committee

Graduate School of Library & Information Science

Simmons College

Boston, MA

Email: peek@simmons.edu

Tel: 617-521-2807

Appendix C

Follow-up call for participants

Dear Professor [PI name],

I contacted you last week regarding my study of "***How the NIH public-access policy influences tahe authors' publishing decisions"***.

I was wondering if you would have the time to participate as an interviewee in the research. The interview will last for approximately 20 minutes.

If you would like to be interviewed, please contact me at pontika.nancy@gmail.com.

Best,

Nancy

===

Athanasia (Nancy) Pontika

Doctoral Student

Graduate School of Library & Information Science

Simmons College

Boston, MA

Email: pontika.nancy@gmail.com

Tel: 617-749-8175

Prof. Robin Peek

Associate Professor- Chair, Dissertation Committee

Graduate School of Library & Information Science

Simmons College

Boston, MA

Email: peek@simmons.edu

Tel: 617-521-2807

Dear Doctor/Professor,

The Research Portfolio Online Reporting Tools (RePORT) records indicate that you are an NIH funded PI and that your research has been published in the Public Library of Science (PLoS) journals.

You have been selected to participate as an interviewee in the dissertation entitled ***"How the NIH public access policy influences the authors' publishing decisions"***. This study explores how the National Institutes of Health (NIH)-funded principal investigators (PIs) view open access and how the mandatory public-access NIH policy has influenced their publishing behavior.

According to the policy, which became effective on April 5, 2008, all NIH-funded PIs are required to submit to PubMed Central, immediately upon publication, the final peer-reviewed version of their published article(s), which will become available to the public free of cost after a maximum of 12 months embargo period.

The interview will be conducted through the Skype™ software during **April and May 2011** and will last approximately **20 minutes**. If you have any questions concerning

the interview process or the research in general you can contact me at pontika.nancy@gmail.com.

To participate in this research, please email me at pontika.nancy@gmail.com.

Your participation is totally voluntary and you may withdraw from the interview at any time. This research project has received the approval of the Simmons College Institutional Review Board (IRB), and the research results will be anonymous.

Thank you in advance for your time. I look forward to hearing from you.

Yours sincerely,

Athanasia (Nancy) Pontika

Doctoral Student

Graduate School of Library & Information Science

Simmons College

Boston, MA

Email: pontika.nancy@gmail.com

Tel: 617-749-8175

Prof. Robin Peek

Associate Professor- Chair, Dissertation Committee

Graduate School of Library & Information Science

Simmons College

Boston, MA

Email: peek@simmons.edu

Tel: 617-521-2807

Appendix D

PLoS Twitter post call for participants

Posted on April 18 & March 18

Calling all NIH funded PI's who have published with PLoS (2005-2011) - join fascinating research project http://tinyurl.com/NIHPIresearch

Appendix E

Informed Consent Form

Welcome to the doctoral dissertation research study on the effect of the NIH public-access policy on PIs' publication habits.

This study explores how the National Institutes of Health (NIH)-funded principal investigators (PIs) view of open access and how the mandatory public access NIH policy has influenced their publishing behavior. As a participant in this study, you will be asked to answer approximately 10 open questions, in which you can express your personal opinion about your publication habits. The interview will be conducted through the SkypeTM software and will last approximately 15-20 minutes. During the interview, I will record our conversation. The recordings will be saved in my personal laptop and will be password protected. All the recordings will be destroyed after the completion of the study.

This research project has received the approval of the Simmons College Institutional Review Board (IRB). There are no potential risks or privacy issues associated with using the SkypeTM software; all conversations will remain private between the researcher and the participant, and the software company will not gain any access to the participants' accounts or the recorded files. There are no other foreseeable risks associated with this study and your participation is strictly voluntary. You may withdraw from the study at any time and you will be released without penalty. I also reassure you that your name will not be associated with any of the information that you will provide during the course of the interview.

The principal investigator conducting this study is Athanasia (Nancy) Pontika, PhD Student at the Graduate School of Library and Information Science, Simmons College. If you

have any questions, concerns, or complaints about this study, please feel free to contact me at 617-749-8175, or at pontika.nancy@gmail.com. You may also contact the Human Protections Administrator in the Office of Sponsored Programs at 617- 521-2415 at any time during this study if you believe there is an ethical problem with the research.

If you have decided to participate, please hit the "Accept" button below which will imply your consent.

To save a copy of the informed consent for your records hit the browser's "Print" button.

I really appreciate your participation. Thank you for your time!

Appendix F

Definition of terms

Self-archiving: The package of scholars putting their works online at institutional or individual OAI-compliant archives (Suber, 2004b).

Gratis open access: Removes price barriers from publications (Suber, 2008c).

Libre open access: Gratis open access that removes at least some permission barriers (Suber, 2008c).

Toll-access journals (TA): Toll-access journals charge for access to their research articles. They may provide open-access to abstracts, table of contents, news and some other content. (Suber, 2010a)

Appendix G

Codebook

PLoS publication drive		
PLoS	PLoS_quality	PLoS_quality=toll.access
		PLoS.Pathogenes_high_quality
		PLoS_best.OAJ
		PLoS.ONE_questionable
	PLoS.article.processing	PLoS.coopearation
		same.format
	PLoS_esteem	PLoS.reputation
		publication.promotion
		work.quality
	PLoS_speed	peer-review
		Submitting
		Accepting
	PLoS_OA	PLoS_dissemination
		PLoS_wide.access
		PLoS_citation.advantage
	PLoS_online	
	PLoS_readership	PLoS_specialization
	PLoS_OAnotfactor	

	PLoS_OAplus	
	PLoS_peer.review	pr.fast
		pr.old.fashion
		pr.scientists
		pr.democratic
		PLoS_ed.board
	PLoS_IF	
	PLoS_new.trend	
	PLoS_cheap	
OA	OA_online	OA_science
	OA.supporter	
	public_access	sponsors_access
		scientists_access
		profit_research
ForProfitJournals	FRJ_corrupted	CNS_power
		CNS_status.quo
		CNS_pub.delays
		CNS_top
		CNS.FP.model

		CNS.commercialization
Open-access publishing before the NIH public-access policy		
before_yes	Quality	
	dissemination	
	institutions.culture	
	Visibility	
	world.access	
	oa.advocate	
	Citations	
	oa.editor	
	Internet	
	Access	
	IF	
	Speed	
	oa#nih	
before_no	seek.quality	
	seek.dissemination	
	oa.2consideration	
	oa#nih	
	oaj.noquality	

	oaj.noIF	
	Expensive	
Publication charges		
how	nih.grant	salary.expense
	institutional.grant	
	other.grant	Philanthropies
	ask.institution	
yes.enough	Budget	
no.enough	publications.expensive	
	never.enough	
	not.all.oa	
Publishing influence		
factors	field.related	
	strong.journal	
	author.preferences	
	IF	
	work.impact	
No	pmc.makesworkOA	

	manyways2comply	
	toll.access.encourages	
Yes	always.chooseOA	
	policy.embargo	
	OA.advocate	
	early.yes	
	comply.jrnls	
policy	policy2late	
	yes.moreOAjrnls	
	Political.compromise	
Influence to publish in open-access journals		
Yes	policy.nochoice.comply	
	policy.OA.influence	
	inclined.more.oa	
No	pmc.less.important	
	embargo.ok	policy.12.embargo
	unfunded.mandate	
	budget.cuts.4.pubs	

	oa.2.expensive	
	go.by.IF	
	oa.plus	
	Easycolleagues	
	same.pubs	just.comply
	only.OA.pubs	
Learned about the NIH-policy		
NIH	nih.applications	
	nih.letter	
	nih.email	
	nih.progress.report	
	nih.bulletins	
	nih.website	
	nih.e-commons	
	nih.communication	
Institution	inst.email	inst.late.action
	inst.grant.dept.email	

	inst.prj.mngr	
	inst.rsrc.offc	
	inst.colleagues	Disscusions
	inst.wrksp	
Library	lib.workshops	
	lib.notes	
Other	News	
	Editorials	OAJ editorials
		TAJ editorials
	Congress	
	Websites	
PubMed Central submission evaluation		
Good	good.reason	
	12month.toolong	
Bad	unanswered.parts	
	Figureout	
	extra.work	
	upoloading.complicated	
	Formatting	

	took6months	
	first.difficult	
	wait.approval.frustrate	
	multiple.steps	
	PMCID.confusing	
	practice.complicated	
	Proofreading	
	too.long	
	editor.monitoring	
assistance	jrnls.submit	
	jrnls.submit.plus	
	lib.assistant	
	Assistant	
	designated.assistant	
	Student	
	nih.guides	
	nih.staff.helpful	

Policy understanding		
Wording	which.papers.PMC	
	just.upload	
	review.articles	
	author.sets.embargo	
	Commentaries	
	report.papers	
	paper.format	
process(-)	time.consuming	
	administrative.burden	
	low.priority	
	need.specialist	
	complicated.submission	
	no.details	
	embargo.long	
process(+)	Understanding	
Submission	upload.status	
	nih.form.complicated	
	PMCID	
	many.screens	

	3databases	
journals	Copyright	
	indv.pub.policies	
	Notreadyjs	
ideal	nih.journals.deal	
Seeking help		
where (y)	Students	
	Assistant	
	institution.workshop	
	nih.webiste	good info
		bad info
	Colleagues	
	jrnls.website	
	prog.officer	
	Websites	Wikipedia
		SPARC
		CC
	lbr.staff.proactive	
	Statute	

where(n)	NIH	
	just.submit	figured.out
	assistant.deals	waste.time
	lack.time	
	my.interpretation	
assistantship	inst.proactive	
Open access familiarity		
f_oa.models		
f_oa.concepts		
f_oa=oa.access	f_oa.universal_access	
	f_oa.free.download	
	f_oa.immediate_access	
	f_oa.articles	
f_oa.science		
f_oaj	f_oaj.reader	
f_oa.author	publishes.in.OA.journals	
f_oa.models		
f_oa.interest	f_oa.editorials	

	f_oa.literature	
f_oa.reviewer		
f_oa.copyright		
f_oa.cost.free	f_taj.cost	f_taj.cost
Open-access journal publishing and compliance with the policy		
frustrating.question		
	pub.ineasy.jrnls	
	just.publish.oa	
	oa.publishing.nih.requirement	
related	oaj.autocomply	
	oaj.easy.comply	
	oaj.immediate.access	
	oaj.copyright	
non-related	q.automatic	
	plenty.jrnls.comply	
	submitted.PMC	

Open-access knowledge impact		
no	pub.same.jrnls	
	pub.appropriate.jrnls	
	policy.redudant	
OA.advocates	policy.slow	
	already.know	
	Familiar	
	OA.advocate	
yes	independent	
	due.OA.dvlp	make.OA.easy
		make.OA.cheap
	institutional.focus	
	more.attention	
	more.willing.OA	
	think.OA.benefits	
	Understanding	colleague
		student
	oa.nih.sametime	developed
	nih.forces.oa	
	PLoS.IF.help	

	wrks.oa&nih	
Copyrights		
no	nopublish.meanj	nihfund.important
	jlicense.checkbox	
	joa.fee	
	journals.comply	
	always.submit	
yes	non.medical.journals	
	write.copyright	
	\letter	

Biographical Statement

Athanasia (Nancy) Pontika graduated from the School of Librarianship and Information Systems in 2005. Her thesis on “Ethics, its codes and their application in Librarianship and Information Science” was presented at the14th Panhellenic Conference on Academic Libraries. For almost two years she was a Chief Librarian at the Hellenic Foundation for European and Foreign Policy (ELIAMEP), where she worked on the European Information Network on International Relations and Area Studies (EINIRAS)- a European project for the creation of a multilingual thesaurus in international relations.

In 2007 she started her Doctoral studies in the Library and Information Science PhD Program, Graduate School of Library and Information Science (GSLIS), Simmons College. Her main area of interest is the open-access movement. She is the Assistant Editor on the Open Access Directory- a wiki of factual lists on open access. During the Summer and Fall 2009 she was an intern at the Berkman Center for Internet and Society, Harvard Law School, working on the Open Access Tracking Project (OATP). In Summer 2009 she took part in the Student Summit on the Right to Research Coalition at the Scholarly Publishing and Communication Resources Coalition (SPARC) and organized a series of events at GSLIS for the International Open Access Week celebrations. For almost three years she taught the core course “Introduction to Technology for Information Professionals” and technology workshops at Simmons College.