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HEALTH LITERACY: A BIBLIOMETRIC AND CITATION ANALYSIS

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ABSTRACT OF THESIS

HEALTH LITERACY: A BIBLIOMETRIC AND CITATION ANALYSIS

The concept of health literacy finds its origins in the field of education. In its brief history the definition, structure, and direction of the field has changed dramatically and has emerged as a multidisciplinary endeavor full of discipline specific manifestations, most recently, public health literacy. Using bibliometric and citation analyses, this study investigated the field of health literacy from the first use of the term in 1974 to the present year, 2010. A range of databases from the various fields that have contributed to the field were searched using the keyword string, "health literacy." Data was organized, cleaned and parsed using EndNote X3. A free, Java-based application, CiteSpace, was utilized for visualization of author co-citations, document co-citations, keyword co-occurrences, and document co-citation clusters. This research presents researchers, librarians and those interested in the field with information to efficiently conduct literature searches and understand the structure of the field. In addition, this research provides insight into how and where the field may be progressing in terms of multi- and interdisciplinary research

KEYWORDS: Health Literacy, Bibliometrics, Citation Analysis, CiteSpace, Visualization

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May 5, 2010

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A BIBLIOMETRIC AND CITATION ANALYSIS

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Robert M. Shapiro II

The Graduate School
University of Kentucky
2010

HEALTH LITERACY:
A BIBLIOMETRIC AND CITATION ANALYSIS

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Arts in the
School of Library and Information Science
at the University of Kentucky

By

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Lexington, Kentucky

Director: Dr. Jeffrey T. Huber, Professor of Library and Information Science

Lexington, Kentucky

2010

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To Meghan, for her incessant pestering, but more importantly, for her infinite patience and love

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TABLE OF CONTENTS

Acknowledgements_____	iii
List of Tables_____	vi
List of Figures_____	vii
 Chapter One: Introduction	
Background_____	1
Purpose_____	2
Research Questions_____	2
Definition of Terms_____	3
Significance of Study_____	6
Rationale_____	6
 Chapter Two: Literature Review	
Governmental and Organizational Support for Health Literacy_____	10
The Measurement of Health Literacy_____	13
The Concept of Health Literacy_____	14
Public Health Literacy_____	18
Bibliographies of Health Literacy_____	20
Health Literacy and Bibliometrics_____	22
Summary_____	23
 Chapter Three: Methods	
Phase 1	
Articles By Database and Over Time_____	26
Author Frequency_____	26
Journal Frequency_____	26
Phase 2	
Citation Analysis and Clustering_____	27
 Chapter Four: Results	
Records By Database_____	28
Records Over Time_____	29
Author Frequency_____	29
Journal Frequency_____	31
Network of Co-Authorship and Collaboration_____	33
Network of Author Co-Citation_____	34
Network of Document Co-Citation_____	36
Network of Concepts: Keywords_____	38
Network of Concepts: Clusters By Co-Citation_____	40
 Chapter Five: Discussion	
Research Question 1_____	42

Research Question 2 and 3	45
Research Question 4	47
Limitations and Areas of Future Research	50
Conclusion	51
Appendix A	
Introduction to CiteSpace: Visualizing Patterns and Trends in Scientific Literature	53
Bibliography of CiteSpace Articles	54
Appendix B	
Database Descriptions	56
References	60

LIST OF TABLES

Table 4.1, Author frequency	30
Table 4.2, Journal frequency	31

LIST OF FIGURES

Figure 4a, Database Distribution	28
Figure 4b, Number of Records Per Year	29
Figure 4c, Network of Co-authorship	33
Figure 4d, Network of Co-citation	35
Figure 4e, Network of Document Co-citation	36
Figure 4f, Network of Document Co-citation – Timeline	37
Figure 4g, Network of Concepts – Keywords	39
Figure 4h, Network of Concepts – Clusters by Co-citation	40

Chapter One: Introduction

Background

Although the term health literacy was first used in 1974, the concept that people ought to have the basic skills needed to function in the healthcare environment has had a long history in the United States. In the 1940's when our soldiers were coming home from World War II, the military recognized that health-related material they were providing the soldiers was unreadable by most and that some sort of plain language was needed to be universally understandable. Intelligence began to be seen as capital in the 1960's and, sparked by the consumer movement, health information began to be demanded by patients. The previously passive patient began to take an active role in an increasingly more personalized healthcare environment.

During the last decades of the 20th century, the United States identified a growing disparity in the education levels of its citizens and demands made, not only by everyday activities, but the progressively more complex healthcare system. In 1999, the American Medical Association formally defined health literacy as “the constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the health care environment” [1]. Since then it has undergone several iterations. And although many of the definitions have originated in significant agencies and organizations, as recent as July of 2009 scholars are still calling for “the need to refine health literacy definitions and conceptual models” [2].

Perhaps some of the confusion is due to the diverse disciplines studying and participating in the field. Nearly every aspect of the health care system, including primary care, nursing, and public health, the education system, including early childhood, adolescent, and adult and continuing education, and communication fields, including mass communication, risk and crisis communication, library and information sciences, and health communication, are engaged in the health literacy field in one way or another. One way to make sense of the field—clarify its past, understand its present, and predict its future—is to look at published literature.

Bibliometrics is a field of research that “shed[s] light on the processes of written communication and of the nature and course of development of a discipline (in so far as this is displayed through written communication) by means of counting and analyzing the various facets of written communication” [3]. This study attempted to do just that.

Purpose

Over the course of nearly 50 years, a tremendous amount of literature has been published regarding health literacy. The purpose of this bibliometric analysis was to make sense of a great deal of that literature and to describe health literacy research written in English from the first use of the term in 1974 to the present day. A secondary purpose of this research was to describe the evolving patterns of scholarly activity in the field of health literacy as represented in the citation patterns of published health literacy literature. Furthermore, a tertiary purpose was to describe the evolving intellectual structure of the scholarly community in the field of health literacy as represented in the citation patterns of health literacy literature. Finally, this study mapped the diffusion of the term health literacy over time and described its various iterations and their origins.

Research Questions

The questions addressed in this study were:

1. What are the bibliometric properties of the field of health literacy as represented by published health literacy literature?
2. What are the evolving patterns of scholarly activity in the field of health literacy as represented in the citation patterns of published health literacy literature?
3. What is the evolving intellectual structure of the scholarly community in the field of health literacy as represented in the citation patterns of health literacy literature?
4. How has the concept “health literacy” diffused through disciplines and scholarly communities beginning from Simonds’ conception in 1974?

By investigating the bibliometric properties of the field of health literacy—the producers, artifacts, and concepts included in the bibliographic information—this study provided a

robust description of the field of health literacy as represented by published literature. The variables defined below describe the scholarly communities and networks as well as the growth and evolution of the field of health literacy, both over time and through disciplines.

Furthermore, the evolving patterns of scholarly activity in the field are represented in the citation patterns of published literature. By tracking citation and co-citation patterns one is able to compare the rate and the direction of change in research interests. This study also investigated the changes over time in the composition and relationships among and across disciplines.

In addition, this study investigated the evolving intellectual structure of the scholarly community by tracking the number of retrieved articles from particular disciplines over time. Investigating intellectual structure produces a map of the scholarly community and a fuller understanding of the scholarly communities with respect to the variables discipline and time.

Finally, the diffusion of the concept of health literacy is traced through citations. This study documented the changes made to definitions and the disciplines from which literature is published, again both over time and through disciplines.

Definition of Terms

The following definitions were used for this study:

Health literacy

The Institute of Medicine defines health literacy as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” [4]. This is the definition of health literacy that was used for the remainder of this analysis unless otherwise specified.

Health information literacy

The Medical Library Association defines health information literacy as the ability to “recognize a health information need; identify likely information sources and use them to

retrieve relevant information; assess the quality of the information and its applicability to a specific situation; and analyze, understand, and use the information to make good health decisions” [5].

Bibliometrics

Borgman [6] states that the most widely accepted definition of bibliometrics is that of Pritchard’s which describes its purpose as “to shed light on the processes of written communication and of the nature and course of development of a discipline (in so far as this is displayed through written communication), by means of counting and analyzing facets of written communication” [3].

Bibliometric properties

Diodato provides a definition of “bibliometric data” which this study used interchangeably with the concept “bibliometric properties.” These “properties,” or “data,” are “the author, title, place of publication, and other such information about a document” [7].

Scholarly communication

This study used a variation of the definition for scholarly communication given by Borgman, as “the study of how scholars in any field (e.g. physical, biological, social, and behavioral sciences, humanities, technology) use and disseminate information through formal and informal channels” [6].

Growth in the field

Growth in the field was defined by an increase in literature over time. Literature was defined as published results retrieved from a search of a database. A database is a collection of items, systematically organized for representation and retrieval.

Structure of the field

The structure of the field was defined by the items retrieved by searching databases, but also from emerging patterns defined by citation and co-citation analyses. A citation is a

reference to a document which is acknowledged by the author of another document. Wolfram describes the close nature of the terms citation and reference, noting that “a *reference* is made within a citing document and represents an acknowledgement to another work. A *citation* represents the acknowledgement received by the cited document” [8]. For this analysis, the term “citation” was used to represent both concepts. Co-citation is an instance of two or more documents being cited by a separate document [7].

Author

Literature regarding author count revealed three approaches to calculating authorship; these are straight count (first author only receives credit), whole count (each author receives full credit regardless of position), and adjusted count (fractions are given to each co-author). Writing about citation-based auditing of academic performance, Cronin and Overfelt argue that if there is a trend in the field toward collaboration, and if multiauthorship tends to be more highly cited than single authorship, and if the scholarly community perceived co-authorship as meriting equal credit, then “there is a powerful argument for using whole counts in citation analyses of both individuals and academic departments/programs” [9]. It has been shown that in health literacy literature there is a trend toward collaboration, both in the cases of multiauthorship and across disciplines, and multiauthorship is cited more often. This study did not address whether the scholarly community perceives co-authorship as meriting equal credit, but given the affirmation of the first two criteria, this study utilized whole counts.

Publication Title

A publication title was considered to be the name of the source in which the article is found, for example, a journal.

Discipline

This study considered an author’s discipline as the field in which the author practices. That is, an author may publish in a library and information science journal, but be a nurse practitioner, in which case, the author’s discipline would be considered “nursing.”

Moreover, a journal may have a discipline; for example, the *Journal of the Medical Library Association* (JMLA) would be considered in the library and information science discipline. There are however, journals that publish for multiple disciplines, such as *Health Communication*. This journal is topically focused on health communication, yet its audience is researchers in communications, public health, library and information science, and the allied health fields. In cases such as these, the journal's discipline was derived from the primary intended audience. Disciplines were defined by various authoritative database thesauri.

Significance of Study

There has been an increase in the published literature on health literacy [10]. However, with the exception of three studies, there has been little attention paid to who is publishing it, what authors are being cited, and from which discipline it arises. A comprehensive bibliometric analysis not only sheds light on these issues, but may assist researchers and information specialists in developing a more complete picture and understanding of the concept of health literacy. Results of this study provide information to more efficiently conduct literature searches and also add to the understanding of the structure of the field and the collaboration between institutions and authors.

Rationale

Despite the attempts from across the healthcare spectrum to improve people's health, the World Health Organization ranks the United States at 37th overall, 14th in preventable deaths, 24th in life expectancy, and yet, 2nd in total health expenditures. Could it be conceivable that we do not have a clear understanding of the factors that are affecting the health of our citizens? Close to half—90 million—Americans have difficulty understanding and acting on health information [4]. In fact, the National Assessment of Adult Literacy conducted in 2003 reports that only 12% of Americans have proficient health literacy skills [11]. The Surgeon General's Workshop on improving health literacy reported that there is a strong, independent association between health literacy and health outcomes [12].

Programs to address low health literacy abound. The National Institutes of Health (NIH) are currently funding nearly 50 projects and report several Health and Human Services agencies including the Agency for Healthcare Research and Quality and the Centers for Disease Control and Prevention, have joined together to support health literacy research [13]. In addition, the NIH sponsored the first annual Health Literacy Research Conference in October of 2009 whereas the Institute for Healthcare Advancement is putting on its ninth annual conference on health literacy in May of 2010. Preliminary objectives from Healthy People 2020 show a continued effort to improve the nation's health literacy rate [14]. Conducting a comprehensive bibliometric analysis of health literacy enables a rich and fruitful description of the field of health literacy and describes the scholarly communities and networks of the field as it grew through time and diffused through disciplines. It provides a clear picture of the intellectual structure of the scholarly community and illustrates the relationships between disciplines as they relate to health literacy. In addition, a bibliometric analysis allows the tracking of an amorphous term through disciplines and over time, and provides a clearer understanding of our current conception.

Previous bibliometric analyses of health literacy have used various databases and search strategies to determine the sample of literature. In a brief study conducted by Kondilis, Soteriades and Falagas attempting to provide a brief description of health literacy research in Europe, four search strings—"health literacy," "readability," "health competence," and "informed consent"—were used in one database—PubMed [15]. A more in depth investigation into health literacy in the European Union by Kondilis et al included several additional terms—"health perception," "health knowledge," "health awareness," "health AND communication," "health promotion," and "health information," and still used only PubMed [16]. The most recent bibliometric analysis of health literacy conducted by Bankson utilizes only one search string, "health literacy" and expanded the databases searched to the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Health Source: Nursing/ Academic Version, SOCIndex, PsychINFO, Academic Search Premier, Education Full-Text, Educational Resources Information Center (ERIC), and Library and Information Science Technology Abstracts (LISTA) [10].

In addition to the bibliometric analyses, seven bibliographies have been compiled regarding health literacy. The NLM's two Current Bibliographies of Medicine include series notes stating the likely databases that were searched: MEDLINE, AVLINE, BIOETHICSLINE, CANCERLIT, CATLINE, HEALTHSTAR, POPLINE, and TOXLINE [17-18]. No indication was given as to what search strategies were used to retrieve results. The NLM first published a special query for PubMed in March of 2006 and one could assume the previous bibliographies, published in 2000 and 2004, were achieved through a similar means, however this is pure speculation and no statement by the NLM authors was given. Bankson states, though, that using the NLM's special health literacy query yielded "more than one million hits from multidisciplinary databases such as Academic Search Premier"[10]. Harvard's Department of Society, Human Development, and Health conducted five bibliographies of health literacy beginning with a "full review" from 1970-1999 and subsequent reviews for 1990-2000, 2000, 2001, and 2002 [19-23]. For each of these bibliographies, a series of health literacy-relevant terms were used—for example, "literacy, illiteracy, illiterate, readability, educational status, and communication barriers"—however the only database searched was MEDLINE [19]. Bankson states that "[o]ther useful analyses of this topic could include citation analysis to determine core journals' impact factors and studies of degree of collaboration among authors. Analyzing possible additional health literacy indexing terms apart from those utilized in this study and removing length, time period, and publication type limitations would also retrieve a larger number of articles for a more in-depth study"[10]. On Bankson's advice, this study conducted the citation analysis as well as removed previous study limitations. However, due to the various multidisciplinary databases which the study utilized, the search strategy remained fairly basic.

Chapter Two: Literature Review

The term health literacy was first used in 1974 by Simonds in a paper titled “Health Education as Social Policy” [24] as a goal to be established for grades K through 12. Yet the concept was not developed in a vacuum. Indeed, it was the confluence of several concepts that led to Simonds’ use of the term. As early as World War II, the federal government recognized the importance of literacy and the need for universally understandable language [25]. Additionally, intelligence was emerging as capital, in and of itself, and it was becoming increasingly more important to have a literate citizenry [26]. In 1966, the federal government passed the Adult Education Act of 1966 [27] which recognized the need for a literate population, and set adult literacy as a priority for the country. During this time, nurses were engaged in patient education as a method for health improvement [28]. The consumer movement—which began in the 1960’s—was well underway when the Medical Library Association established the Ad Hoc Committee for Consumer Health Information. The committee understood that the demand for information required a specialist to pair the request with appropriate information resources.

In 1990, National Literacy Day was declared and the first iteration of the U.S. Department of Health and Human Services’ *Healthy People* was established. *Healthy People 2000* did not include any direct reference to health literacy but it was the precursor to both later iterations of *Healthy People* which did. It was responsible for setting the stage for significant governmental, private and academic interest in the field and challenging the nation to approach having a healthy population through prevention rather than innovative medical treatments [29]. In 1991, the National Literacy Act of 1991 [30] and the Strengthening Education for American Families Act [31] were passed. Among other things, the National Literacy Act instructed the National Center for Education Statistics to carry out a national literacy assessment and in 1992, the National Adult Literacy Survey [32] was conducted. In the following years, several assessments of reading and literacy were developed.

Governmental and Organizational Support for Health Literacy

On the heels of the publication of the National Adult Literacy Survey (NALS) in 1993 which found that the average reading level of Americans was between the eighth and ninth grade levels,[33] members of the medical profession began turning their attention to the ability of patients to understand the medical system and terminology. Although the term “health literacy” was first used in 1974 it would not be until 1999 that an ad hoc committee of the Council of Scientific Affairs of the American Medical Association (AMA) officially recognized and defined functional health literacy as “the ability to read and comprehend prescription bottles, appointment slips, and the other essential health-related materials required to successfully function as a patient.”[1] The Agency for Healthcare Research and Quality(AHRQ) later broadened the AMA’s definition calling it, “a constellation of skills that constitute the ability to perform basic reading and numerical tasks for functioning in the health care environment and acting on health care information.”[34] International organizations took interest in health literacy and in 1997 the Plain Language Service was established in Canada [35], and in 1998, the Canadian Public Health Association began its National Literacy and Health Program [36]. Between Simonds’ use and the first operationalization, a substantial body of literature was being formed around the concept of health literacy. Writing for the National Library of Medicine (NLM) in 2000, Selden et al.[17] found 479 citations from January 1990 to October 1999. Four years later in 2004, Selden et al. produced a complementary bibliography which covered January 1998 to November 2003—including a selection of earlier and later items—and found 651 citations. After the first Current Bibliography of Medicine (CBM) regarding health literacy, the United States Department for Health and Human Services (HHS) had embraced the concept and included an objective in their *Healthy People 2010* document stating “(Developmental) Improve the health literacy of persons with inadequate or marginal literacy skills” [37]. In 2003, the United States Department of Education (DOE), with the support of the Institute of Educational Sciences, National Center for Education Statistics, administered the National Assessment of Adult Literacy (NAAL)—the re-named NALS—and included a health literacy component to collect data for the *Healthy People 2010* objective.

The NAAL was the first large scale measurement of health literacy with more than 19,000 adults having participated. Three domains of health were assessed: clinical, preventive, and navigation of the health system. These are reflected in the definition utilized by the DOE, which was at that point also being used by the HHS in their *Healthy People 2010* document and the Institute of Medicine in their *Health Literacy: A Prescription to End Confusion* report [4]. This definition stated health literacy was “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions”[11]. A closer investigation reveals that this definition was actually first stated in Selden et al.[17] by Ratzen and Parker who wrote the introduction to the CBM. Ratzen and Parker adopted the above definition for the purposes of the bibliography, which they state are “to help define and describe the evidence base for advancing health literacy programs by examining theories, strategies, and tactics in the published literature,” and to further the study of health literacy. This definition clearly broadened the scope of health literacy. It removed specific examples—for instance, language about prescription bottles and appointment slips were discarded—and placed less emphasis on the “patient.” For such a tremendous change in the scope of health literacy though, the reasons behind it were not made lucid.

Private and for-profit companies were also recognizing the importance of having a health literate population. The most notable has been Pfizer Inc. who, through programs such as their Clear Health Communication Initiative, actively engaged the research and practice communities. In a white paper published in 2003, Pfizer defined health literacy “simply as the ability to read, understand, and act on health information” [38]. This was the first conception of health literacy that required the individual to actually act on the health information, a notion that warrants particular attention later in a discussion on a complementary concept, “health information literacy.”

Concurrent with the publication of the Pfizer white paper, AHRQ was conducting an assessment of literacy and health outcomes. Using a search strategy based on the

keywords “health literacy,” “literacy,” and “numeracy,” as well as standardized test acronyms such as the Wide Range Achievement Test (WRAT), the Rapid Estimate of Adult Literacy in Medicine (REALM), and the Test of Functional Health Literacy in Adults (TOFHLA), researchers at AHRQ conducted searches in MEDLINE, the Cumulative Index to Nursing and Allied Health (CINAHL), the Cochrane Library, the Educational Resources Information Center (ERIC), the Public Affairs Information Service (PAIS), and the Industrial and Labor Relations Review (ILRR). As a result, 73 articles were found to be relevant to the two questions being asked:

1. Are literacy skills related to a) use of healthcare services? b) health outcomes? c) costs of healthcare? and d) disparities in health outcomes or healthcare service use according to race, ethnicity, culture, or age?
2. For individuals with low literacy skills, what are effective interventions to a) improve use of healthcare services? b) improve health outcomes? c) affect the costs of healthcare? d) improve health outcomes and/or healthcare service use among different racial, ethnic, cultural, or age groups?[34]

In general, the AHRQ report reached similar conclusions to previous analyses of health literacy and health outcomes, specifically, that the literature revealed “low reading skill and poor health are clearly related.” [34]

The National Institutes for Health (NIH) held a Surgeon General’s Workshop on Improving Health Literacy in September of 2006 [12]. Individuals from across the healthcare spectrum participated in a joint effort to describe the state of health literacy. The workshop was divided into three panels: Health literacy, literacy and health outcomes; Meeting the health literacy needs of special populations; and Toward an informed and engaged public. As a result of the workshop, four basic conclusions were reached. First, the role of public health officials in health communication was defined and it was concluded that the public cannot be expected to adopt health behaviors without clear communication, the implicit assumption being that communication begins with public health professionals. Second, without attending to health literacy, advances in medicine, health information technology and the delivery of healthcare will not be

realized. Third, health literacy must be viewed within the context of complex systems such as social, cultural, education, and public health systems. And fourth, that although there is sufficient information to make improvements in health literacy, more research is needed [12]. That same year, the first Institute of Medicine Roundtable on Health Literacy was held—since then, seven subsequent meetings have occurred. The National Library of Medicine, led by Marcia Zorn, created a special query for health literacy for their PubMed database in 2006 as well. In 2007, the Health Literacy Act of 2007 [39] was proposed in the Senate and, the Medical Library Association adjusted their definition of health literacy to “health information literacy” highlighting the need for a person to recognize a need and have the ability to find, evaluate, and actually use the information. And in 2010, after a great deal of squabbling over definitions, NLM established “health literacy” as a Medical Subject Heading (MeSH) [40].

The Measurement of Health Literacy

In the years following the NALS, several assessments of reading and literacy were developed, some with the specific intention of being utilized in a healthcare setting or with health-related vocabulary. For example, in 1993, Davis et al. created the Rapid Estimate of Adult Literacy of Medicine (REALM) [41]. Parker et al. followed in 1995 with the creation of the Test for Functional Health Literacy in Adults (TOFHLA)[42]. Baker et al. later developed the S-TOFHLA, a shorter version of the TOFHLA [43]. In 2004, Rudd, Kirsch and Yamamoto (need citation), working for the Educational Testing Service analyzed data from the NALS and IALS and developed the Health Activities Literacy Scale (HALS) [44]; the following year, Weiss et al. developed the Newest Vital Sign [45]. The recognition of the need for a health literate population and the importance of quantifying it was not unique to the United States. Indeed, in 1994, the Organisation for Economic Co-operation and Development (OECD) conducted the International Adult Literacy Survey [46]. During this time of instrument development the need to operationalize health literacy became increasingly clear. As discussed above, the American Medical Association’s Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs was the first group to formally define the term, but since then it has

undergone several iterations. Even as recent as July 2009, scholars are still calling for “the need to refine health literacy definitions and conceptual models [2].

The Concept of Health Literacy

As the discussion above highlights, the definition of health literacy, and subsequently the conceptualization of the term, has undergone substantial changes through its brief history.

Mancuso provides an excellent summation of the history. She states:

“health literacy has originated from the necessary skills of reading and numeracy to one of critical thinking, problem-solving, decision-making, information-seeking, and communication, along with a multitude of social, personal, and cognitive skills that are imperative in order to function in the health-care system. In addition, health literacy has expanded into the realm of culture, context, and language” [47].

Two formal concept analyses have been conducted regarding health literacy, both from the nursing literature, however the two authors used different methods. In 2005, Speros performed an analysis of the concept of health literacy in order to clarify its meaning, reduce ambiguities and promote consistency using an eight step process of concept analysis first described by Walker and Avant [48-49] Mancuso’s aims were similar in that she sought to develop a clearer understanding of the term, however, she used a methodology defined by Rodgers [50-51]. If we assume a necessary step of selecting a concept, these two methods, Walker and Avant and Rodgers,’ share only the requirement to define attributes of the concept and the identification of antecedents and consequences. As such it is justified to address each briefly.

Whereas Walker and Avant’s concept analysis follows eight steps:

1. Select a concept
2. Determine the purpose of the analysis
3. Identify all uses of the concept
4. Determine the defining attributes
5. Construct a model case
6. Construct a borderline and contrary case
7. Identify antecedents and consequences
8. Define empirical referents;[49]

Rodgers' method is defined by five:

1. Select a concept
2. Identify the data-collection strategies
3. Collect the relevant data to identify attributes, antecedents and consequences
4. Analyze the data to abstract the above characteristics of the concept
5. Define the concept from the data analysis

In addition, Mancuso utilizes six questions taken from Caron and Bowers to analyze the philosophical “underpinnings, perspective, and context for health literacy” [51]. These questions are:

1. What are the dimensions of the concept and how are these properties related to each other?
2. What is the perspective reflected in the text?
3. What are the contextual elements that contribute to the definition and use of the concept?
4. What are the assumptions the author(s) integrates into the text?
5. What are the implications of how the concept is constructed and used?
6. From which philosophical frame of reference is the concept derived?

Speros and Mancuso arrive at fairly similar conclusions. Regarding the antecedents of health literacy, Speros cites reading skills, numeracy skills, comprehension, capacity to use health information in decision-making and successful functioning in the patient role. Mancuso defines six dimensions of competence from the literature: operational, interactive, autonomous, informational, contextual, and cultural. Mancuso's attributes—capacity, comprehension, and communication—fall into Speros' literacy attribute, yet she includes having health related experiences as well. Interestingly, with the differences described above, both arrive at the same consequences: improved self-reported health status, lower health costs, increased health knowledge, shorter hospitalizations and decreased use of health services.

Mancuso provides further analysis of the concept by using Caron and Bowers' [52] methods of dimensional analysis. She presents the philosophical foundation, perspective and context for the term from five disciplines: educational, library and information science, healthcare, public health, and mental health.

In 2005, the National Health Education Standards defined health literacy as “the capacity of individuals to obtain, interpret, and understand basic health information and services and the competence to use such information and services in ways which enhance health” [53]. Drawing from this definition, Mancuso argues that from an educator’s perspective, health literacy is a “complex relationship between both knowledge and skills that individuals (referred to as learners) need to attain as a result of instruction to obtain the goal of health literacy” [51].

The healthcare setting, Mancuso argues, uses the American Medical Association (AMA) definition adopted in 1999 as “a constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the healthcare environment. Patients with adequate health literacy can read, understand, and act on healthcare information” [1]. She also argues the healthcare setting has adopted the National Library of Medicine’s definition, “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” [17]. Yet, Mancuso claims that the library and information science (LIS) profession has a different understanding of health literacy and extends their definition to include a moral aspect, stating that one has a “right to access and understand health information.” Citing Burnham and Peterson [54] she indicates that LIS also considers the individual as active agent in what could be considered as the health literacy process, that is, the individual must act upon information. This is unique in conception of health literacy as typically the use of the information is not included. Herein, and with Mancuso’s conception, lies the perpetuation of the confusion regarding the difference between health literacy and health information literacy. Burnham and Peterson’s article was entitled “Health *Information* Literacy: A Library Case Study,” (my italics), and under a section “What is Health Literacy?” they state the Medical Library Association definition of health information literacy. A common theme in defining health information literacy is reflected in the MLA’s process. First, health literacy is defined, followed by information literacy, and health finally health information literacy. The assumption is simply to understand the concept of health information literacy as the combination of

health literacy and information literacy. Although adopted in 2003, no one in the literature has attempted to parse or clarify the impact of including the concept of information literacy in health literacy.

Mental health professionals have begun focusing attention on health literacy issues, particularly as they apply to mental illnesses and the attitudes that aid in the “recognition and help-seeking in those afflicted with mental illness, the knowledge of how to seek mental health information, and the knowledge and beliefs about risk factors and causes, self help interventions, and professional help for the mentally ill” [51].

The public health profession is also a field which has seen an increase in interest in the health literacy. Although literature dates only back to 2000, Mancuso claims “[w]ithin the domain of health care, public health is a dominant force in the literature of health literacy” [51]. The public health conception of health literacy includes notions of empowerment, civic engagement, and takes a population based approach to what had previously been an individual approach. Freedman et al. define public health literacy as “The degree to which individuals and groups can obtain, process, understand, evaluate, and act upon information needed to make public health decisions that benefit the community” [55]. Although the authors claim this is a conceptualization that is both distinct and related to individual health literacy, it proposes a dramatic shift from the approach. They argue health literacy, as conceived outside the public health realm, is limited in two senses: one, that it approaches health literacy as an individual problem, and two, that it addresses “secondary and tertiary [aspects] rather than the primary prevention of the disease” [55].

Finally, Mancuso’s concept analysis includes a rare philosophical analysis of health literacy from the fields discussed above. It is not clear how, or what criteria were used to determine the philosophical framework other than acknowledging Caron and Bowers’[52] final question in dimensional analysis, “From what philosophical frame of reference is the concept developed?”[51] Mancuso claims the education field has philosophical aspects of interpretive and constructivist theories; the healthcare

profession—which includes the NLM—primarily utilizes empiricism; the library and information science field embraces empiricism as well; although mental health professionals include facets of interpretive and constructivist theories, the most common approach is critical social theory; and public health professionals utilize primarily critical social theory.

It is not clear yet if health literacy is an interdisciplinary or multidisciplinary field. The issues concerning health literacy are largely transdisciplinary in nature but that fact alone does not necessitate collaboration in research and practice and certainly does not necessitate the development of new concepts. The various discipline specific conceptualizations described by Mancuso and Speros—and more recent work such as Cagle [56] and Horowitz's [57]—support this in that they show a trend toward discipline specific definitions, theories, and philosophies. If our metric for comparing the different approaches—that is, those definitions, theories, and philosophies—is the degree of dissimilarity then we can assume that the projects are being conducted within each discipline. This would cause the literature to be published in clusters, determined by discipline, with high instances of same-discipline co-citation. It is important to understand this phenomenon over time though, and public health literacy shows why this is so important.

Public Health Literacy

Through the progression of definitions of health literacy we see a trend from focusing on functional literacy, to communicative and interactive literacy, to critical literacy. This trend is exemplified by the conceptualizations made by the IOM,[4] the MLA,[5] and finally, the World Health Organization (WHO) [58-59]. Nutbeam cites the WHO's definition of health literacy as, “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health,” and further, “[h]ealth literacy means more than being able to read pamphlets and successfully make appointments. By improving people's access to health information and their capacity to use it effectively,

health literacy is critical to empowerment” [59]. This conceptualization, argues Nutbeam, has three implications, it broadens the scope of health literacy, it indicates the personal and social benefits of a health literate population, and it has direct and profound implications for approaches to health literacy [59]. He concludes by stating that if we are to achieve the ultimate goal for health literacy—which he argues is to promote autonomy and empowerment in both individuals and communities—then what is needed is a recognition of the political aspects of education and a focus on overcoming the “structural barriers,” often called “social determinants,” of health. In addition, this attempt to build health literacy on a foundation of empowerment and collective good enabled public health professionals to argue that health literacy is an ethical imperative [60]. Since then, there have been fragmented attempts to advocate for a public health literacy [61]. Zarcadoolas, Pleasant and Greer expand the concept of public health literacy and describe in detail what each “constituent domain,” that is, fundamental literacy, scientific literacy, civic literacy and cultural literacy, would encompass in such a conceptualization. They advocate for a clearer understanding of the various domains and, “[t]hat understanding will help to create successful health communication efforts, provide an analytical framework from which to analyze health communication as it is encountered, and ultimately lead to development of a fuller measure of health literacy” [62]. Following Zarcadoolas, Pleasant and Greer, Pleasant and Kuruville suggest a two tiered approach to health literacy, one from a clinical perspective and one from a public health approach. They advocate for collaborative and complementary approaches rather than the “unproductive relationship between those perspectives to date” [63]. Most recently, Freedman et al. operationalized public health literacy as “the degree to which individuals and groups can obtain, process, understand, evaluate, and act upon information needed to make public health decisions that benefit the community” [55]. Moreover they stated its target population, the public, its purpose, “improve health of the public,” and its primary aims, “engage more stakeholders in public health efforts; address social and environmental determinants of health” [55]. Health literacy, it would seem, has turned full circle; from Simonds’ 1974 article about health education as a means of social change, to a medical interpretation of fundamental literacy skills needed to operate in the healthcare system, to a multidimensional concept such as health information literacy, and

back to a primary focus on the social, environmental, and systemic issues affecting one's health and the health of one's community. This holds true only for public health literacy, though. Other fields, such as primary care medicine, are still largely concerned with the ability of patients to function in the healthcare system and much less attention, if at all, is given to empowering individuals to be civically engaged. We would expect then, that over time, different concepts would describe health literacy at different times for a particular discipline. The cluster of discipline specific citations could be tracked through the various conceptions. Further, we could assume that although the citations were clustered around particular disciplines, there would be certain seminal works that are cited universally. These documents would be, interestingly, a commonality both over time, and between disciplines. To test these assumptions, a bibliography of health literacy literature is needed.

Bibliographies of Health Literacy

Several attempts have been made to summarize the health literacy literature. The two endeavors by the NLM—one in 2000 and one in 2004—not only underscore the federal government's interest in the concept, but also stand as the first two attempts to review the literature. The Harvard Department of Society, Human Development, and Health has conducted five reviews of health literacy literature beginning with a deep retrospective from 1970-1999 and followed by a 1990-2000 review, and subsequent 2000, 2001 and 2002's. According to the Harvard Literacy Studies webpage, limited funding has prevented the project staff from conducting further reviews [64]. These studies are relevant to the current project as they could both help shape the search strategy, and moreover, aid in the decision regarding which databases to search.

The first bibliography regarding health literacy was compiled by the NLM in 2000. In addition to being the first attempt at collocating health literacy literature, this document is also the source of one of the most referred to definitions of health literacy. Appropriately, the authors state the purpose was to “help define and describe the evidence base for advancing health literacy programs by examining theories, strategies, and tactics in the

published literature” [17]. The description of methods is fairly general, and lacks any indication with regard to which databases were searched or which terms were used. Furthermore, the authors state that “a number of” health communication and health education journals were manually searched, however none of the journals are named specifically. Some insight may be gleaned from a series note preceding all Current Bibliographies of Medicine (CBM). It states that CBMs are “usually derived from searching a variety of online databases. NLM databases utilized include MEDLINE, AVLINE, BIOETHICSLINE, CANCERLIT, CATLINE, HEALTHSTAR, POPLINE, and TOXLINE. The only criterion for the inclusion of a particular published work is its relevance to the topic being presented; the format, ownership, or location of the material is not considered” [17].

Claiming an increased interest in the field of health literacy and a subsequent increase in the number of disciplines contributing to the corpus of literature, the NLM developed a complementary bibliography to its first endeavor. Citations for this bibliography were “identified primarily searching online databases and the Internet” [18]. Limitations were placed on language (English only), publication type (“generally excluding” letters and editorials), and publication date (1998-2003). Although some indication is given to criteria for inclusion, the search terms are not identified explicitly. Furthermore, due to the increased interest in various fields, one could assume that different databases were used, but no overt indication of such is made [18].

The Harvard Department of Society, Human Development, and Health has conducted five literature reviews of health literacy, one they call a “full review” (1970-1999) and four subsequent reviews 1990-2000, 2000, 2001 and 2002 [19-23]. Though the full review does not give any indication as to which databases or terms were used, later reviews made both clear. For example, the 1990-2000 review searched only in MEDLINE and used the terms “literacy, illiteracy, illiterate, readability, educational status, and communication barriers” [20]. This same search was employed for the 2000, 2001, and 2002 reviews yet with the respective years associated with the study. Each was limited to English language publications.

Health Literacy and Bibliometrics

The literature regarding both health literacy and bibliometrics is sparse at best. Indeed, a comprehensive literature review retrieved only three such articles. Two of the articles intended to provide a comparison of health literacy research being conducted in Europe to the United States while one purported to enable interested parties to search and retrieve scholarly literature more efficiently. Each article spoke to the limitations of conducting a bibliometric analysis across multiple databases, most importantly, that a simple search strategy was required as each database often has its own distinct syntax. Bankson [10] used the terms “health literacy” and searched in nine databases: CINAHL, HealthSource: Nursing/ Academic Version, PubMed, SocIndex, PsychINFO, Academic Search Premiere, Education Full-Text, Educational Resources Information Center (ERIC), and Library and Information Science Technology Abstracts (LISTA). On the other hand, in a brief study, Kondilis, Soteriades, and Falagas [15] conducted searches only in PubMed, but for the terms, “health literacy,” “readability,” “health competence,” “informed consent.” In a following study, Kondilis et al [16] again searched only PubMed but used the terms “health perception,” “health literacy,” “readability,” “health knowledge,” “health awareness,” “health AND communication,” “health promotion,” “health competence,” “informed consent,” and “health information.” It seemed date restrictions were included arbitrarily. Bankson limited her search to 1997 – 2007, Kondilis, Soteriades, and Falagas, from 1985 – 2005, and Kondilis et al from 1991 – 2005 [10, 15-16].

Kondilis, Steriades and Falagas determined that there was considerable neglect of health literacy research being conducted in Europe.[15] Kondilis et al. took that analysis a bit further by utilizing more comprehensive searches, but also by adjusting the total research productivity by factoring in gross domestic product (GDP)—specifically the annual spending on research and design—for each of the countries [16]. After adjusting for population and GDP, Sweden, Finland and Ireland led the countries analyzed, however, the authors found that the 25 European Union countries produced 16% of health literacy research when compared to the United States.

Bankson found that PubMed indexed the majority of health literacy articles, followed by Education Full-Text, and that there was an upward trend in the number of articles produced by year [10]. She suggested that sudden increases in published articles could be attributed to the Medical Library Association (MLA) defining their role in health literacy in 2002, the 2003 MLA's ongoing efforts to highlight health literacy research, and in 2004, the release of the 2003 National Assessment of Adult Literacy data which included a health literacy component. Bankson also provides a hypothesis for the dramatic increase from 2006 to 2007 as an indication of health literacy reaching a wider audience.

Bankson concludes by indicating a need for further research in health literacy using bibliometric methods. She states, “[o]ther useful analyses of this topic could include citation analysis to determine the core journal’s impact factors and studies of degree of collaboration among authors. Analyzing possible additional health literacy indexing terms apart from those utilized this study and removing length, time period, and publication type limitations would also retrieve a larger number of articles for a more in-depth study” [10].

Summary

This review represents the literature relevant to the confluence of health literacy and bibliometrics. It provides a brief history of health literacy, and examines milestones in the field as they relate to the development of published literature and the concept itself. It shows that although there has been an increased interest from public agencies and private organizations and the number of publications have increased over the years, the concept is still vague and misinterpreted. The field is becoming more specialized and discipline specific, evidenced by “new” definitions and calls for new instruments. Several publications have attempted to collect, synthesize, and understand the literature surrounding health literacy since its operationalization, three of them bibliometric analyses. There are gaps in the literature, though: there is a need for a study that presents a comprehensive bibliometric analysis of the field from its impetus; additionally there is a

need for an investigation into the intellectual structure of the field; there is a need to describe the evolution of the intellectual structure of the scholarly community; and further, there is a need for a diffusion analysis of the concept.

Chapter Three: Methods

The methods used in this study reflect the needs of the research questions. In order to define the bibliometric properties of health literacy, a corpus of literature must be defined; to investigate the evolving patterns of scholarly activity and the structure of such a scholarly community, a citation analysis of the literature must be conducted. A further description of these methods, data, and tools for analysis follows.

By the precedent set by Bankson [10], and the evidence given in previous bibliometric analyses and bibliographies of health literacy, this study used the search strategy “health literacy” as a quoted keyword phrase. This study gathered citations from the search “health literacy” in the years 1974 to 2010 as 1974 was the first year the term was formally used and 2010 would reflect the most recent literature written about the subject. A clear need for utilizing other relevant databases has been stated by Bankson [10], and is justified by Selden et al.[17], Zorn [18], Allen and Horowitz [57], the Harvard studies [19, 21-23], and most importantly, the nature of health literacy. Health literacy is a multidisciplinary field which draws researchers from not only the health sciences and library and information sciences, but also from education and communication. As such, a representative sample of journals from each discipline, as well as multidisciplinary databases such as Academic Search Premier, was utilized. The analysis of the literature took place in two phases. The following databases subscribed to by the University of Kentucky Libraries were searched for the collection of Phase 1 data: Academic Search Premier, AgeLine, Agricola, Allied and Complimentary Medicine (AMED), CAB Abstracts, CINAHL, Communication and Mass Media Complete (CMMC), Dissertation Abstracts, Education Full-Text, ERIC, Electronics and Communications Abstracts, EMBASE (1974+), Library, Information Science and Technology Abstracts (LISTA), Library Literature and Information Science (Library Lit), MEDLINE (1950+), PsychINFO, Social SciSearch, SciSearch (1990+), and Wilson Library Literature. Phase 2 data were collected using the same search string, but by searching only Web of Science. Please see Appendix B, Database Descriptions for further information about each database.

Phase 1

Articles by database and over time

A search for “health literacy” was conducted in the above databases. Results from each database were exported into an EndNote library for further manipulation. A rank frequency table for database providers was produced through a “Subject Bibliography” tool in EndNote. Subject Bibliography allows the sorting and ranking of records by a chosen field. Each database provider was assigned a “Group” in EndNote to allow for comparisons of records between providers. Duplicate records were then identified and exported to a separate library using a “Remove Duplicates” tool in EndNote. The citations in the master library were then cleaned to ensure duplicates were appropriately removed. In some cases, the “remove duplicate” feature in EndNote will not properly identify two or more of the same record. These cases are generally differences in an aspect that can be recognized by a manual investigation of the record. For example, a journal title that is given in *Index Medicus* style, and one written fully out would be indentified as two unique records by EndNote. In addition, author names and journal titles were cleaned to ensure syntactical uniformity. This resulted in a master library and allowed an analysis of unique records. Using the master library, article years were parsed to form a table of article frequency by year.

Author frequency

Author names were extracted from the master library author fields using a feature in EndNote to calculate frequency. Author counts were conducted using whole counts following Cronin and Overfelt’s research of citation-based auditing of academic performance [9].

Journal frequency

Journal titles were extracted from the master library journal fields using the same feature in EndNote. Each journal was weighted evenly, and journals that changed names during the period from 1974 to 2010 were counted as one journal.

Phase 2

Citation analysis and clustering

A search for the string “health literacy” was conducted in Thompson Reuters’ Web of Science (WoS) for citation analysis. The retrieved citations were then imported into CiteSpace, a free Java application for visualizing and analyzing trends and patterns in literature. WoS was solely used for this phase due to limitations of the current version of CiteSpace. With the exception of the final step, this study used the procedures outlined by Chen [65] and applied by Chen et al. [66]:

1. Identify a knowledge domain using the broadest possible term. In this case, the knowledge domain was health literacy.
2. Data collection. Bibliographic records were collected from WoS using a keyword search for the quoted phrase “health literacy.”
3. Extract research front terms. CiteSpace searches the titles, abstracts, and descriptors of bibliographic records. A burstness calculation is produced by the application to determine fast-growing interests and topical clusters [66].
4. Time slicing. During this stage the user sets both the total time range to be analyzed and the length of one slice.
5. Threshold selection. CiteSpace allows the user to set three threshold levels for citation counts, co-citation counts, and co-citation coefficients. Moreover, it allows the user to choose four types of nodes (authors, papers, journals, and burst terms) and three types of links (co-occurrence, co-citation, or referential).
6. Pruning and merging. This study utilized the default, pathfinder network scaling.
7. Layout. Both a standard graph view and time-zone view were utilized for this study.
8. Visual Inspection. CiteSpace allows the manipulation of a number of visual parameters without affecting the underlying algorithm. This study used the default parameters unless otherwise stated in the results.
9. Verify pivotal points. Chen advocates for using domain experts to verify pivotal points. This study utilized the current author as well as the thesis chair and committee.

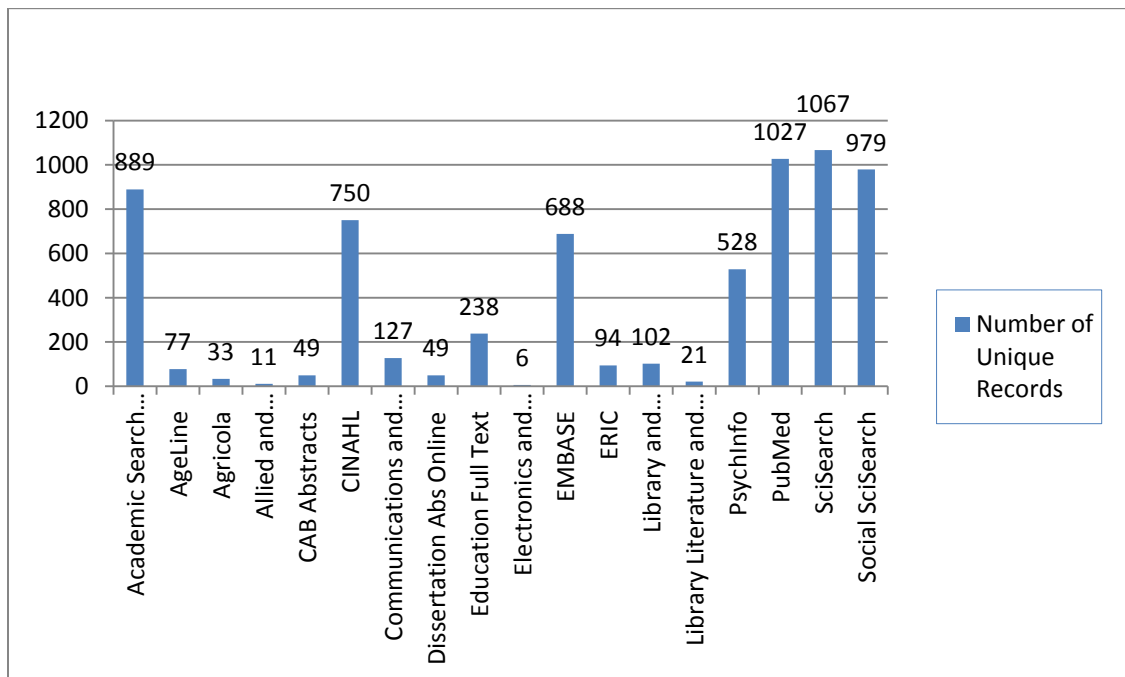
CiteSpace was used to determine networks of coauthors, collaboration networks, author co-citation networks, document co-citation networks and concept networks of noun phrases and keywords. The time slicing operation enabled the visualization of these networks over time. Please see Appendix A, Introduction to CiteSpace: Visualizing Patterns and Trends in Scientific Literature for further information regarding CiteSpace.

Chapter Four: Results

Records by database

A total of 6,719 items were collected from the search strategies described in the methods section. 3,929 were found to be duplicates across all databases, resulting in a total of 2,790 unique records. Before duplicates were removed to form the master library, duplicates were removed in each database in order to determine how many total unique records could be attributed to each database. The distribution of database-unique records relative to the total unique records is illustrated in Figure 4a. SciSearch indexed the greatest number of unique records (1,067) representative of 38.24% of the total (2,790) records. PubMed ranked second (1,027) with 36.81%, followed by Social SciSearch (979; 35.09%), Academic Search Premier (889; 31.86%), and CINAHL (750; 26.88%) to round out the top five.

Figure 4a, Database Distribution



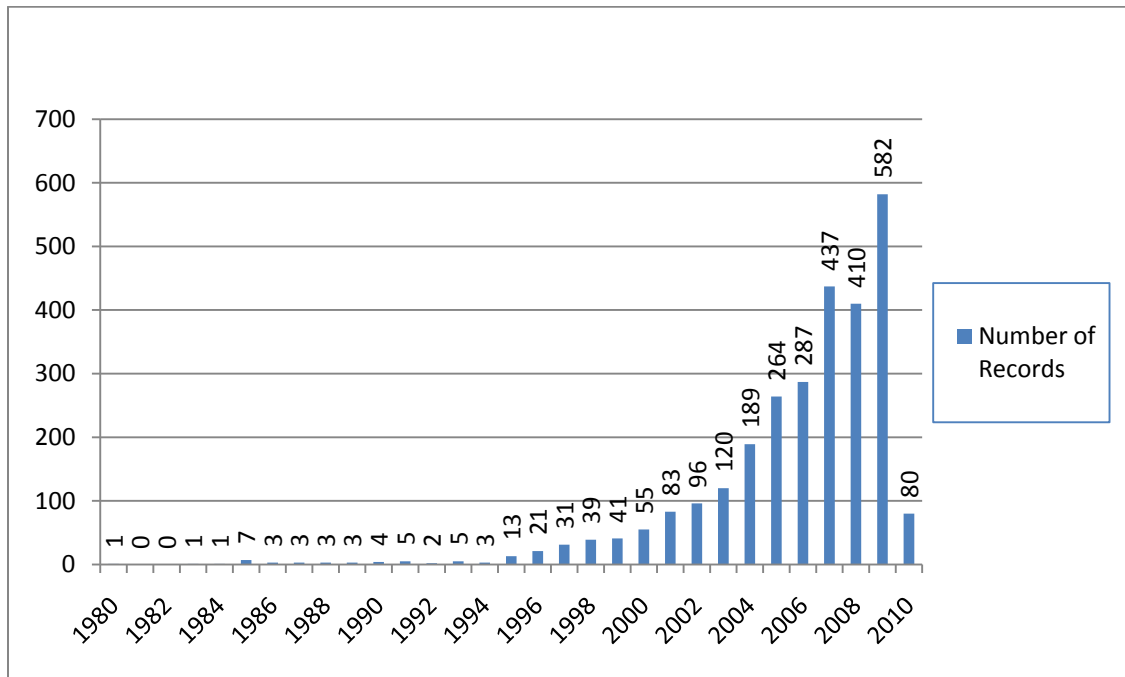
The databases required to fully capture the literature of the field needed to range in discipline focus and/or be multidisciplinary themselves. The results of database

distribution verify that claim, but also indicate that health literacy is still overwhelmingly more popular in the medical sciences than anywhere else.

Records over time

Of the 2,790 unique records that were identified, 2,789 had listed publication dates. A global search was conducted to determine the date of the remaining record which yielded a publication date of “198-.” A frequency chart of records through time is included in Figure 4b. Data from Figure 4b shows a trend in health literacy publications increasing over the years culminating in 2009 with 582. The remarkably low 80 in 2010 will be discussed in the next section.

Figure 4b, Number of Records Per Year



These results indicate a clear trend toward growth in health literacy literature. Pivotal points in health literacy research can be attributed to certain growths in publications, but do not fully explain the trend. Further discussion is provided in the next chapter.

Author frequency

From the 2,790 unique records, a total of 5,420 authors were identified. The top eighty-four authors, which represent those individuals who have authored seven or more records, are illustrated in Table 4.1.

Table 4.1, Author Frequency

Rank	Author	# of Records	Rank	Author	# of Records
1	Wolf, MS	72	43	Guerra, CE	10
2	Davis, TC	59	44	Osborne, H	10
3	Parker, RM	56	45	Parker, G	10
4	Jorm, AF	53	46	Weinberger, M	10
5	Schillinger, D	40	47	Angermeyer, MC	9
6	Paasche-Orlow, MK	35	48	Cavanaugh, KL	9
7	Baker, DW	34	49	Goldney, RD	9
8	Williams, MV	32	50	Owen, C	9
9	Gazmararian, JA	30	51	Ratzan, SC	9
10	DeWalt, DA	28	52	Sanders, LM	9
11	Bennett, CL	27	53	Weiner, M	9
12	Rothman, RL	26	54	Bennett, IM	8
13	Rudd, RE	26	55	Bryant, B	8
14	Kripalani, S	23	56	Clark, DO	8
15	Pignone, M	23	57	Furnham, A	8
16	Weiss, BD	22	58	Jacobson, TA	8
17	Wallace, LS	19	59	Kelly, CM	8
18	Christensen, H	16	60	Kickbusch, IS	8
19	Shea, JA	15	61	Wallston, KA	8
20	Hay, PJ	14	62	Williams, BA	8
21	Hoffman-Goetz, L	14	63	Asch, DA	7
22	Malone, R	14	64	Bailey, SC	7
23	Mond, JM	14	65	Bosworth, HB	7
24	Arozullah, AM	13	66	Chew, LD	7
25	Kalichman, SC	13	67	Falagas, ME	7
26	Morrow, DG	13	68	Fisher, LJ	7
27	Nurss, JR	13	69	Harris, MG	7
28	Osborn, CY	13	70	Kim, SH	7
29	Rodgers, B	13	71	Kitchener, BA	7
30	Bass, PF	12	72	Lauber, C	7
31	Griffiths, KM	12	73	Littenberg, B	7
32	Murray, MD	12	74	Makoul, G	7
33	Sudore, RL	12	75	Matschinger, H	7
34	Wang, FF	12	76	Mayer, GG	7
35	Arnold, CL	11	77	Pleasant, AF	7
36	Dreyer, BP	11	78	Ravenell, KL	7
37	Nutbeam, D	11	79	Rootman, I	7

Table 4.1, Author Frequency (continued)

38	Piette, JD	11	80	Rowlands, G	7
39	Schwartzberg, JG	11	81	Scott, TL	7
40	Wright, A	11	82	Shrank, WH	7
41	Donelle, L	10	83	Tu, W	7
42	Federman, AD	10	84	Villaire, M	7

Further investigation into the top ten producing authors using WoS reveals they are from predominately medical fields, the exception being Schillinger and Gazmararian.

Journal frequency

A total of 956 unique journal titles were identified. Table 4.2 ranks, by number of records, the top 87 journal titles, which represent those titles with 6 or more records. Journal impact factors and immediacy indexes from 2008 (at time of publishing, the most recent year available) were included, in parentheses, for the first ten available titles.

Table 4.2, Journal Frequency

Rank	Title (Impact Factor /Immediacy Index)	#	Rank	Title (Impact Factor /Immediacy Index)	#
1	Patient Education & Counseling (2.219/ 0.307)	93	45	American Journal of Public Health	8
2	Journal of General Internal Medicine (2.720/ 1.523)	71	46	Australian e-Journal for the Advancement of Mental Health	8
3	Journal of School Health (1.273/ 0.115)	35	47	Educational Gerontology	8
4	Journal of Health Communication (2.057/ 0.087)	31	48	Journal of Health Care for the Poor & Underserved	8
5	Australian & New Zealand Journal of Psychiatry (2.318/ 0.408)	27	49	Medical Library Association News	8
6	Journal of the American Medical Association (31.718/ 7.556)	26	50	Nursing Economic\$	8
7	AIDS Education and Prevention (1.505/ 0.116)	23	51	Orthopaedic Nursing	8
8	Journal of Consumer Health on the Internet (not available/not available)	21	52	Adult Basic Education & Literacy Journal	7
9	Pediatrics (4.789/ 0.976)	21	53	Annals of Family Medicine	7
10	American Journal of Health Education (not available/not available)	20	54	Australasian Psychiatry	7
11	Social Psychiatry & Psychiatric Epidemiology (1.959/ 0.389)	20	55	BMC Psychiatry	7

Table 4.2, Journal Frequency (continued)

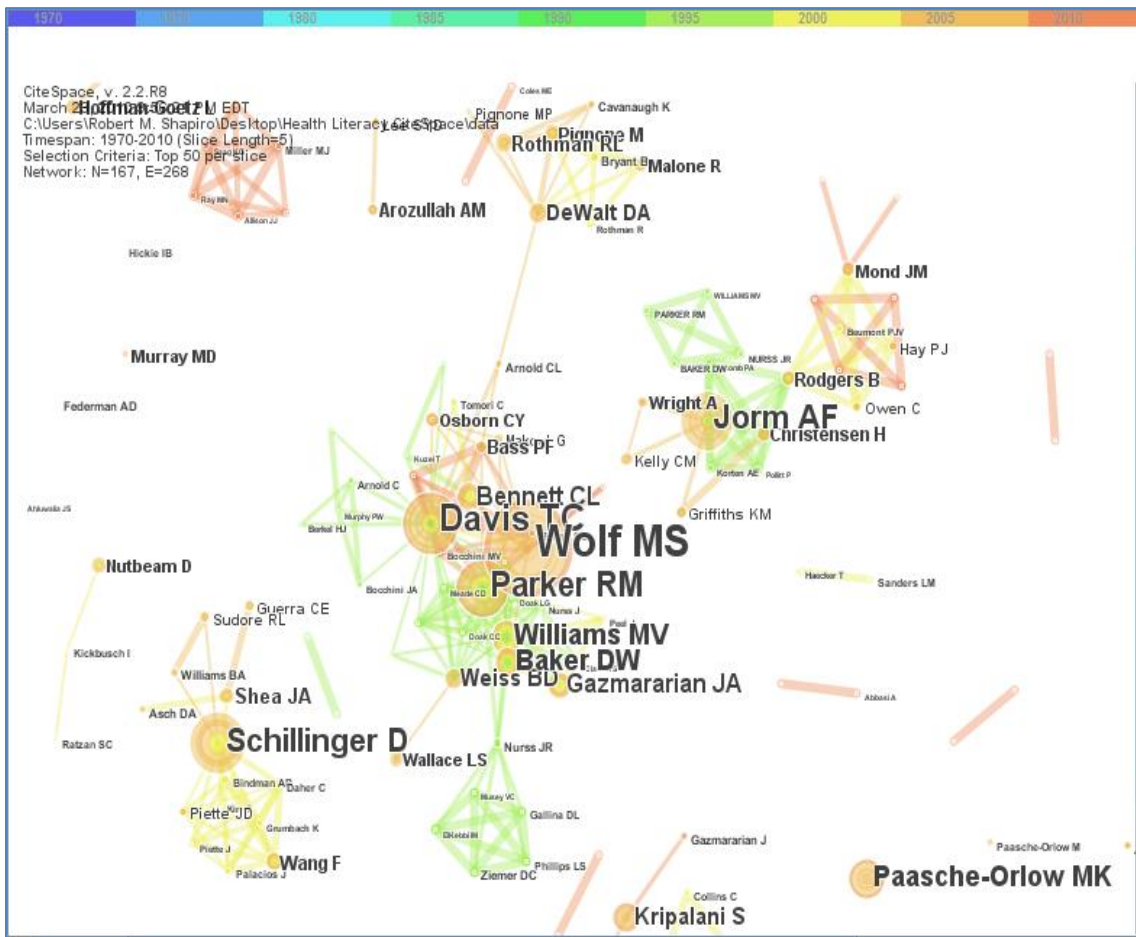
12	American Journal of Health Behavior (1.357/ 0.288)	19	56	British Medical Journal	7
13	Health Promotion International	19	57	Cancer	7
14	American Journal of Preventive Medicine	17	58	Health Education	7
15	Diabetes Care	16	59	Health Education Research	7
16	Journal of National Medical Association	16	60	Health Expectations	7
17	Patient Education Management	16	61	International Journal of Eating Disorders	7
18	Conference Papers -- International Communication Association	15	62	International Journal Public Health	7
19	National Network	15	63	Journal of Consumer Affairs	7
20	College Student Journal	14	64	Medical Decision Making	7
21	Journal of American College Health	14	65	New York Times	7
22	Journal of Hospital Librarianship	14	66	Obstetrics & Gynecology	7
23	Journal of Medical Library Association	14	67	AIDS Patient Care & STDs	6
24	Studies in Communication Sciences	14	68	American Dental Association News	6
25	Family Medicine	13	69	American Journal of Medicine	6
26	AHRQ Research Activities	12	70	American Journal of Nursing	6
27	American Journal of Bioethics	12	71	American Medical Informatics Annual Symposium Proceedings	6
28	Medical Care	12	72	Annals of Internal Medicine	6
29	On Call	12	73	American Speech-Language-Hearing Association Leader	6
30	Annals of Pharmacotherapy	11	74	BMC Public Health	6
31	Diabetes Educator	11	75	Conference Papers -- National Communication Association	6
32	Journal of American Geriatrics Society	11	76	Health Communication	6
33	Social Science & Medicine	11	77	Journal of American Dental Association	6
34	American Journal of Health-System Pharmacy	10	78	Journal of American Dietetic Association	6
35	Medical Journal of Australia	10	79	Journal of Asthma	6
36	Annals of Pharmacotherapy	9	80	Journal of Community Health	6
37	Archives of Internal Medicine	9	81	Journal of Continuing Education in Nursing	6
38	Health Education & Behavior	9	82	Journal of Nursing Education	6
39	Health Promotion Practice	9	83	Lancet	6
40	International Journal of Social Psychiatry	9	84	North Carolina Medical Journal	6
41	Journal of Affective Disorders	9	85	Nursing & Health Sciences	6
42	Journal of Communication in Healthcare	9	86	Prairie Rose	6
43	Journal of Health Education	9	87	Public Health	6
44	Adult Learning	8			

The most frequently published in journal, Patient Education and Counseling, is an interdisciplinary journal; the next 19 represent specific disciplines including internal medicine, nursing, communication, psychiatry, library and information science and public health.

Network of co-authorship and collaboration

Figure 4c was comprised of the 50 most cited authors for each time slice. Time slices were set at 5 years between 1970 and 2010. In this case the nodes are authors and the links are instances of co-authorship. The colors of the links correspond to the legend at the top of the image and represent the year of co-authorship. Node sizes were reduced for clarity, however, CiteSpace locks ratios and as such no vital information is lost or misconstrued

Figure 4c, Network of Co-authorship



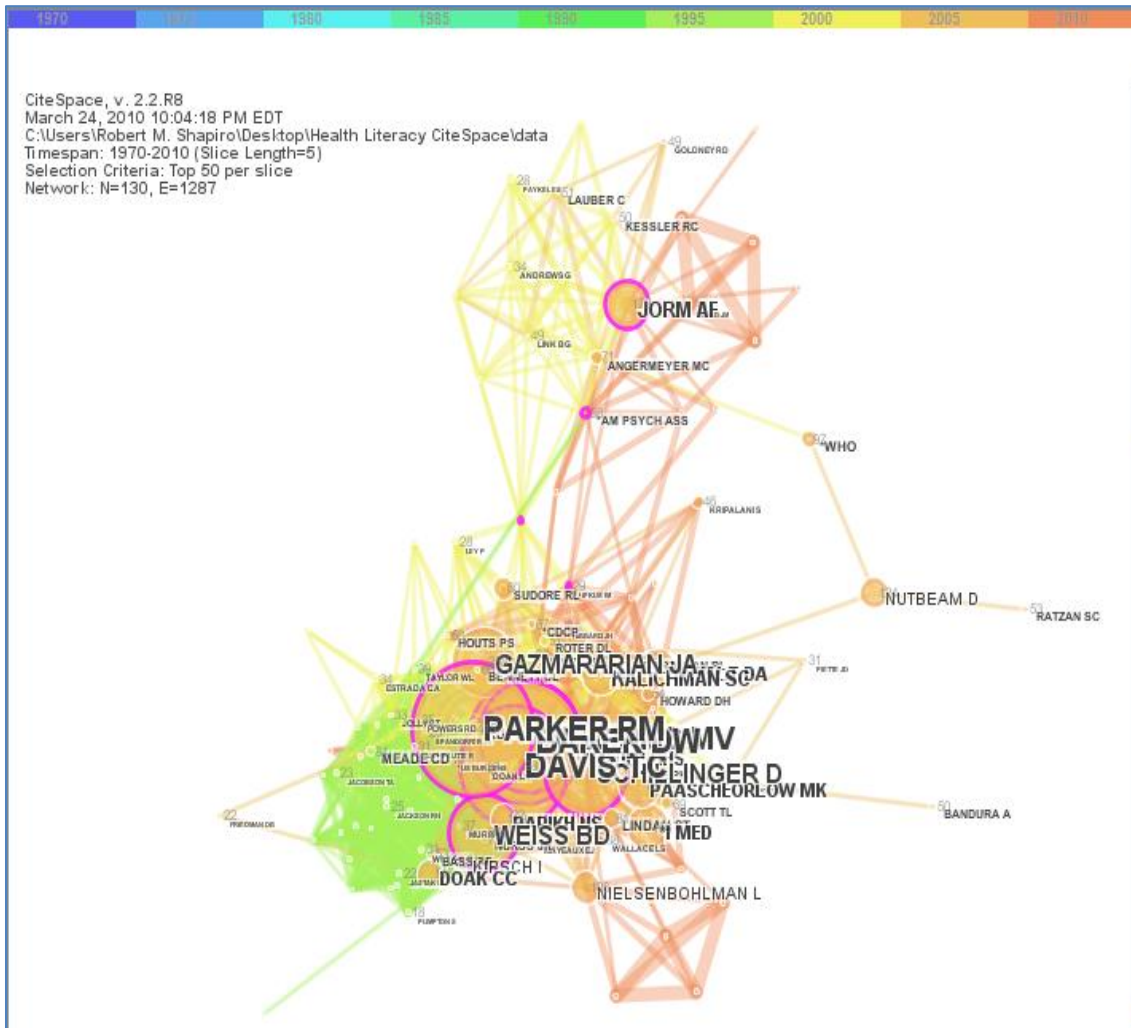
The pruning of the data for Figure 4c resulted in 1 author during the time slice 1975-1979, 1 author in the slice 1990-1994, and 50 articles in 1995-1999, 2000-2004, 2005-2009, and 2010-2010. There were no reported links in the earliest two records. A respective number of 125, 77, 103, and 55 links were reported for the remaining time slices. Some peripheral nodes are not shown for clarity.

Figure 4c depicts the results in Phase 1 that point to the most prolific authors—it is clear authors such as Wolf, Parker, Davis, Jorm, Schillinger, Paasche-Orlow and others are publishing the most frequently. However, in terms of collaboration, we find that there are distinct clusters representing certain disciplines or even invisible colleges. Further discussion is provided in the following chapter.

Network of author co-citation

Figure 4d was comprised of the 50 most cited authors retrieved from the WoS search from each time slice. Time slices were set at 5 years between 1970 and 2010. In this case, nodes are authors and links are co-citations. The colors of the links correspond to the legend at the top of the image and represent the year of co-citation. Node sizes were reduced for clarity.

Figure 4d, Network of Co-citation



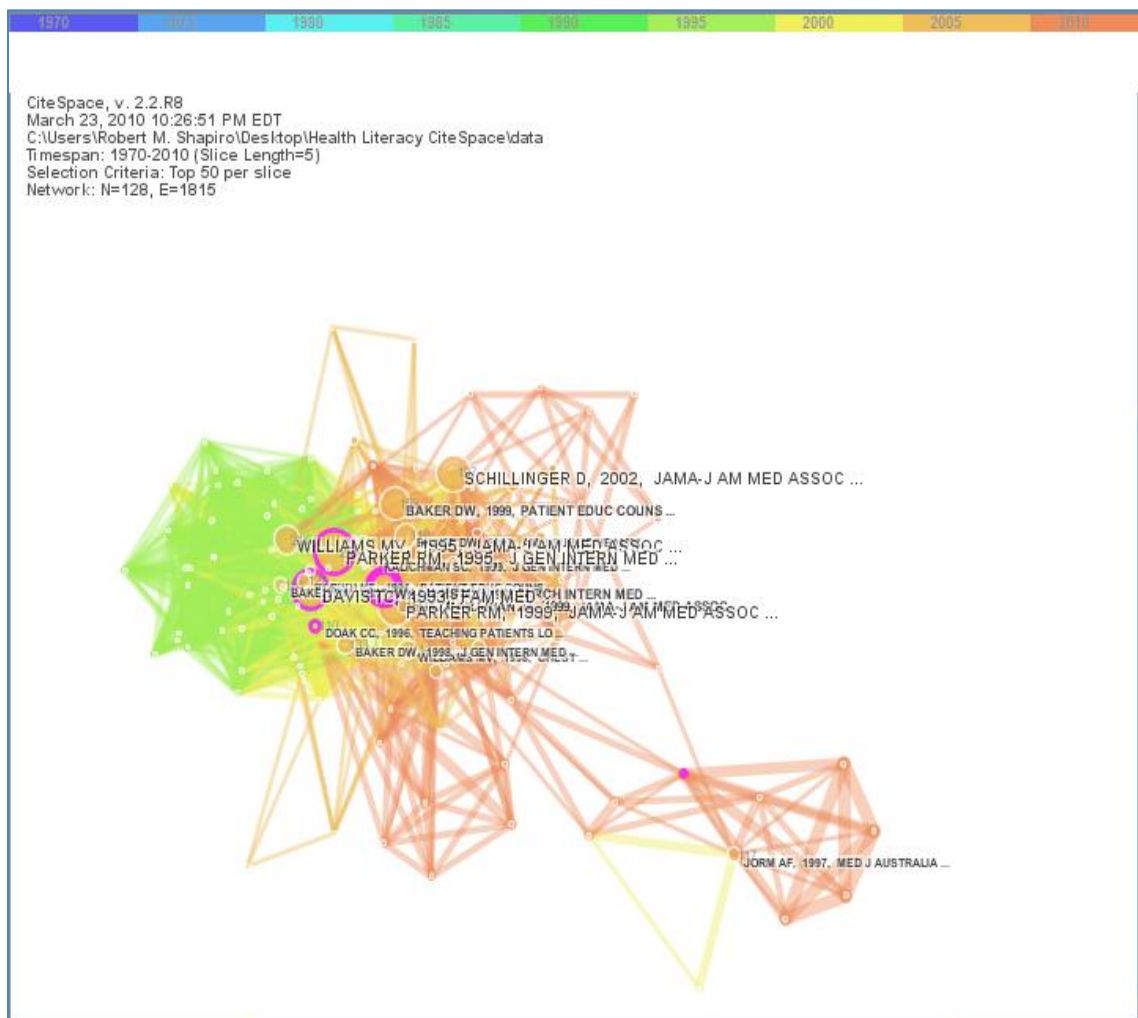
Pruning of the data for Figure 4d resulted in 4 nodes for the years 1974-1979, with 6 links. For the years 1995-1999 there were 896 links, 2000-2004, 665 links, 2005-2009, 943 links and in 2010, 289 links. Author last names and initials are in dark font; corporate authors are in the same font and are indicated by an asterisk (*). Left justified, gray font represents the frequency of the author co-citation.

Figure 4d provides a different picture of the field than the one illustrated by Figure 4c. It indicates that there is a significant amount of co-citation that must exist across disciplines, geography, and time.

Network of document co-citation

Figure 4e was comprised of the 50 most cited articles retrieved from the WoS search from each time slice. Time slices were set at 5 years between 1970 and 2010. In this case, nodes are articles and links are co-citations. The colors of the links correspond to the legend at the top of the image and represent the year of co-citation. Node sizes were reduced for clarity.

Figure 4e, Network of Document Co-citation



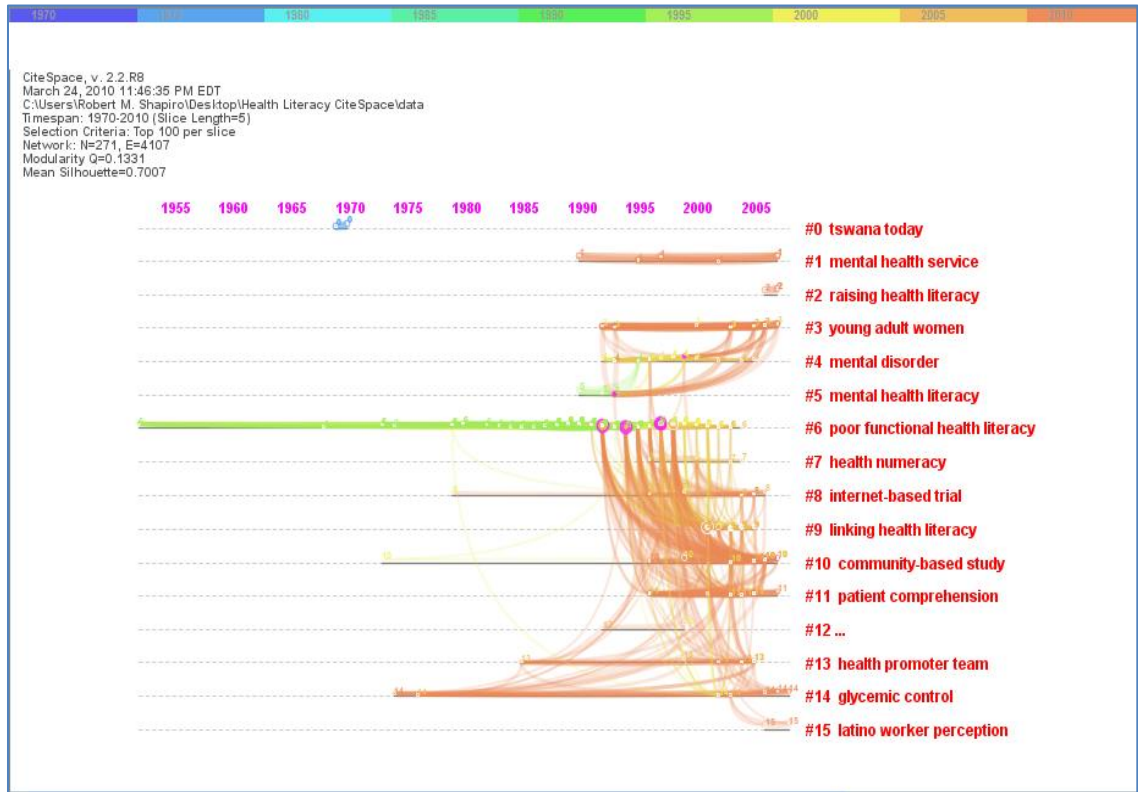
Pruning the data for Figure 4e resulted in 4 nodes from 1975-1979 with 6 links, 1995-1999, (1,115 links) 2000-2004, (1,004 links) 2005-2009, (1,147 links) and 2010-2010 (340 links) each with 50 nodes. Two peripheral clusters of co-citations are not included for clarity. The text displayed indicates the highest threshold of co-citations. First author,

year, and journal name are included in dark font; lighter font justified left of the citation indicates the total co-citation count.

Figure 4e reiterates the notion of multi-disciplinary while providing insight into the core articles for the field in terms of document co-citation. Although again we see a large cluster of articles from the late 1980's and early 1990's, the predominate articles are those published in the mid to late 1990's.

Figure 4f was comprised of the 100 most cited articles retrieved from the WoS search from each time slice. Time slices were set at 5 years between 1970 and 2010. In this case, nodes are articles and links are co-citations. The colors of the links correspond to the legend at the top of the image and represent the year of co-citation. Node sizes were reduced for clarity. Figure 4f is displayed in a “timeline” rather than “cluster” layout. Timeline layouts display clusters (defined by title, abstract, keyword and identifiers) along the y-axis with time along the x-axis.

Figure 4f, Network of Document Co-citation – Timeline



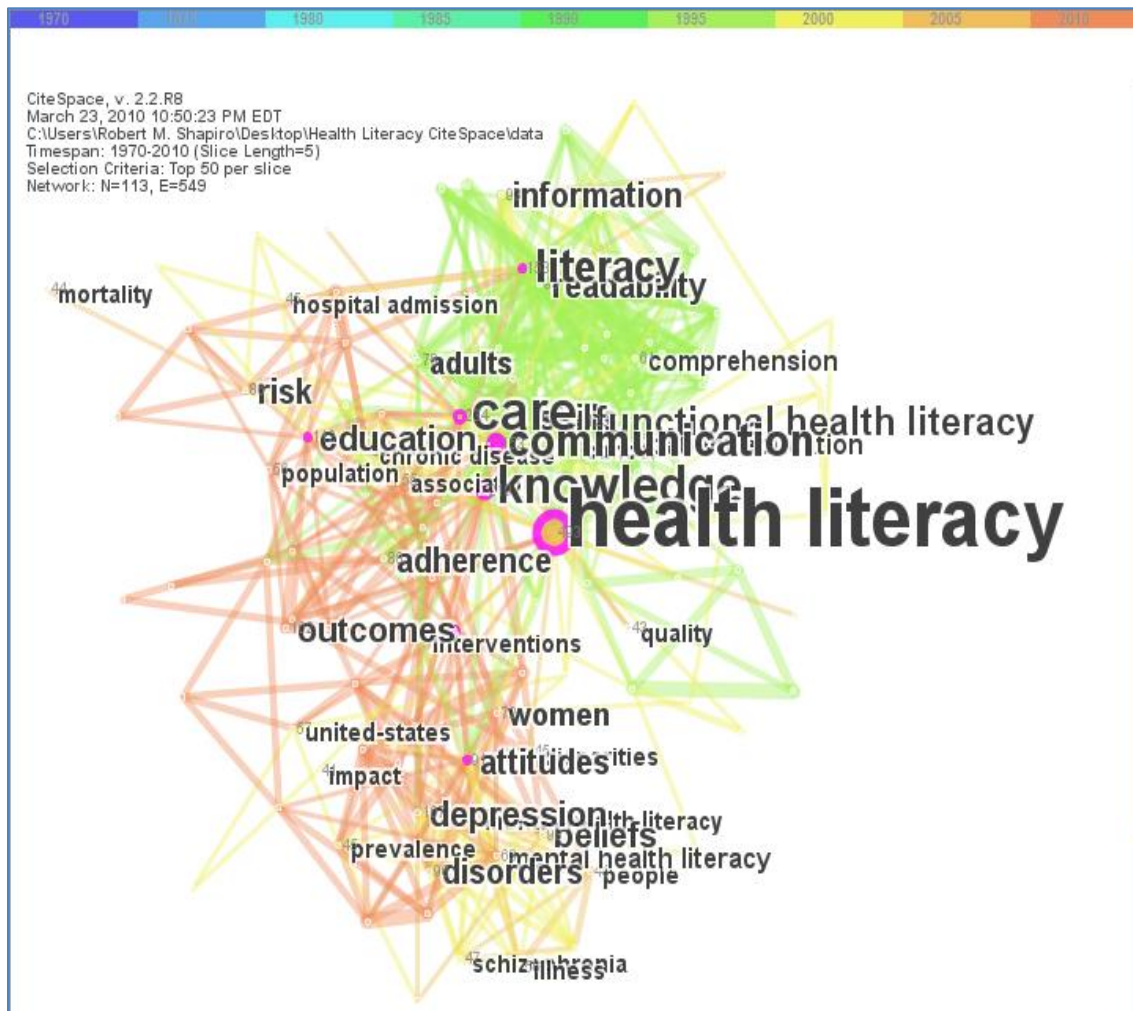
Pruning for the data in Figure 4f resulted in 6 links during the 1974-1979 time-span, 2,815 during the 1995-1999; 2,524 during 2000-2004; 3,633 during 2005-2009; and 752 during the year 2010. A total of 15 clusters were defined with one cluster having an insufficient amount of data to select meaningful features.

Figure 4f indicates that the large contingency of articles published in the late 1980's and early 1990's are concerned with poor functional health literacy, and further, that a large portion of the articles published in the mid to late 1990's are citing that literature, likely as justification for their work. We also begin to see in Figure 4f, a mapping of fields outside the realm of medicine, for example, cluster 4, mental disorder.

Network of concepts: keywords

Figure 4g was comprised of the 50 most common co-occurrences of keywords and identifiers (derived from titles, abstracts—when provided—descriptors and identifiers). Time slices were set at 5 years between 1970 and 2010. In this case, nodes are keywords and/or identifiers and links are co-occurrences of those terms. The colors of the links correspond to the legend at the top of the image and represent the year of co-citation. Node sizes were reduced for clarity.

Figure 4g, Network of Concepts – Keywords



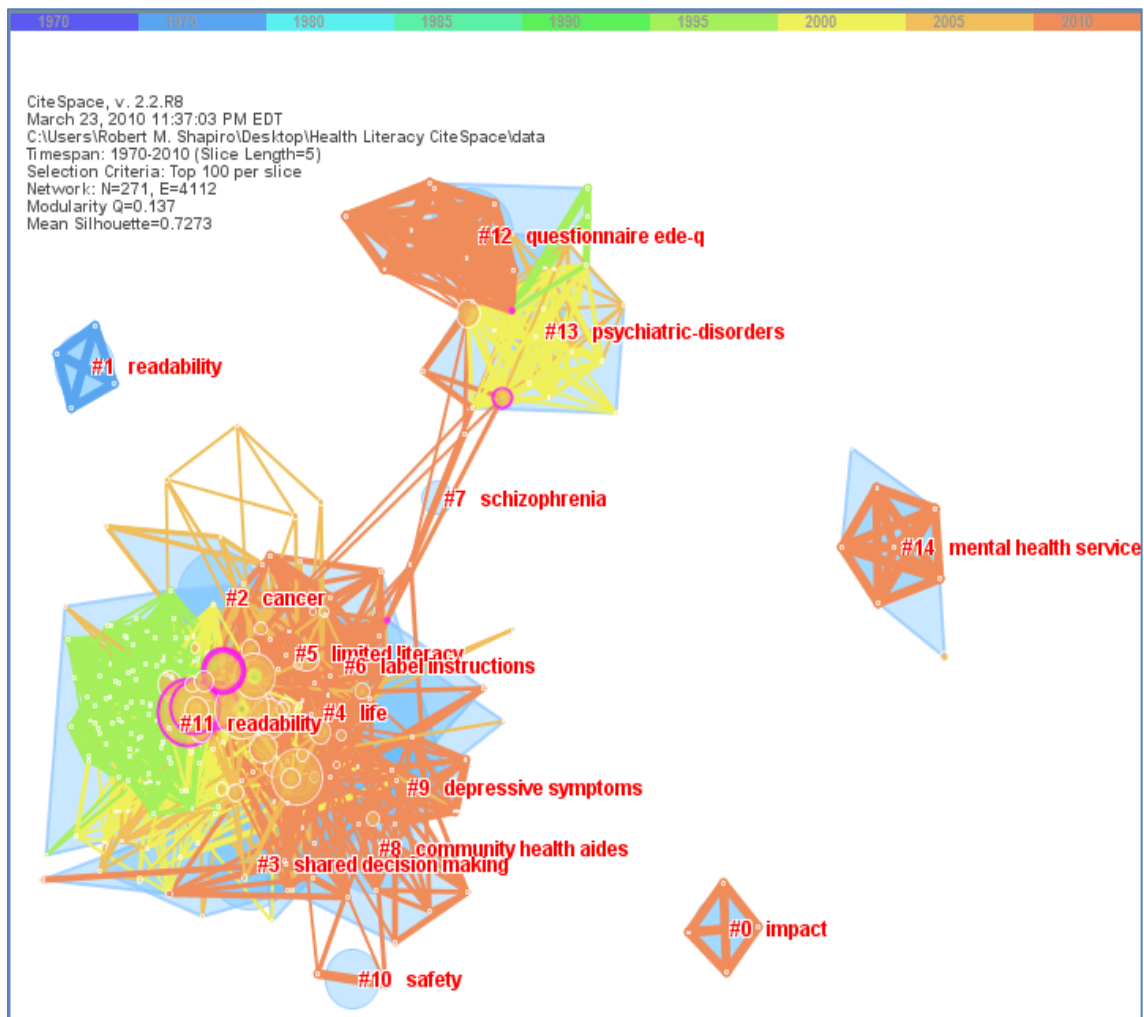
Pruning for the data in Figure 4g resulted in links between articles published in 1995-1999 (355), 2000-2004 (460), 2005-2009 (962), and 2010-2010 (277). One peripheral node (“primary care”) was not included for clarity.

It is in Figure 4g that we see the co-occurrence of keywords derived from titles, identifiers and descriptors and abstracts, when provided. It can be drawn from the occurrence, and subsequent co-occurrence, of these terms, that these were significant concepts in addition to simply existing. For example we can see that during the late 1980’s and early 1990’s literacy (in general) and readability were the most co-occurring concepts.

Network of concepts: clusters by co-citation

Figure 4h was comprised of the top 100 most cited articles in the WoS dataset. Time slices were set at 5 years between 1970 and 2010. In this case, the nodes are articles and the links are co-citations. The colors of the links correspond to the legend at the top of the image and represent the year of co-citation. Node sizes were reduced for clarity.

Figure 4h, Network of Concepts – Clusters by Co-citation



Pruning for the data in Figure 4h resulted in 6 links during the 1974-1979 time-span, 2,815 during the 1995-1999; 2,524 during 2000-2004; 3,633 during 2005-2009; and 752 during the year 2010. Clusters were determined through probabilistic semantic analysis of terms from titles, descriptors and identifiers.

This chapter has presented the results of the bibliometric and citation analyses with brief discussions to clarify when necessary. Further discussion and analysis regarding the results is presented below.

One would expect from this a slightly different distribution of clusters due to the inclusion of 50 additional articles. We see in Figure 4h a figure similar to that of Figure 4d and Figure 4e, albeit rotated 90 degrees. Using a probabilistic semantic analysis of title, descriptor and identifier terms, CiteSpace defined 14 distinct clusters.

Chapter Five: Discussion

This section details the efforts by this project to build on previous bibliometric analyses of health literacy and denotes the marked differences between previous efforts and the current project's results. This section intersperses implications for practice that arise from the results where appropriate. This section also addresses each research question from the Introduction.

As mentioned in the literature review, previous bibliometric analyses have been limited by time, publication type, database, and the lack of citation analyses. To this end, this analysis attempted to extend the time limitation to the year of the first use of the term. There was no publication type restriction, and numerous databases were searched using the equivalent of keyword search strategy to assure the broadest retrieval. Searches were not limited to country, nor were they limited to language.

Research Question 1

What are the bibliometric properties of the field of health literacy as represented by published health literacy literature?

It is often said that health literacy is a multidisciplinary field, and as such, the databases required to fully capture the literature of the field needed to range in discipline focus and/or be multidisciplinary themselves. The results of database distribution verify that claim, but also indicate that health literacy is still overwhelmingly more popular in the medical sciences than anywhere else. This is supported by examining the top grossing databases. Though they focus on a variety of specialties, SciSearch, PubMed, PsychInfo, CINAHL, and EMBASE are primarily of the health and medical sciences. Social SciSearch and Academic Search Premier rank high as well, but these are both multidisciplinary databases. Health literacy articles from education vary, for example 238 articles were found in Education Full Text and 94 in ERIC; however taken together, these define the next highest tier in terms of discipline specific databases. Library and information science and communication are the next groups that stand out. One might expect that the reason for this is either that the literature from these fields is indexed in the multidisciplinary databases, Social SciSearch and Academic Search Premier, or that

since these fields are fairly multidisciplinary themselves, the literature is being indexed in the health science databases. The implications for practice should be clear, the most comprehensive database for health literacy is SciSearch, followed closely by PubMed and Social SciSearch. As SciSearch and Social SciSearch are both purchased databases, it seems the researcher could be comfortable with the results using the free version of MEDLINE, PubMed. This is further supported by the fact that “health literacy” was added to the controlled vocabulary that indexes PubMed, MeSH (Medical Subject Headings), in 2010.

Previous bibliometric analyses have shown there is a trend toward growth of health literacy literature. The exclusion of time limitations and inclusion of various databases did not prove otherwise; indeed, it verifies the fact. Since 1995, it appears health literacy literature is doubling approximately every two years: 1996 (21), 1998 (39), 2000 (55), 2002 (96), 2004 (189), 2006 (287), etc. The marked drop in publications in 2010 can be explained by the fact that the searches were conducted in March of that year. It is remarkable though that in just three months, not including the lag-time in indexing and assuming it continues to grow at the current rate, that the growth seems to be on par with the previous year. There are pivotal points in the history of health literacy that perhaps can be used to explain the increase in publications. For example, 1999 was the publication of the AMA’s operationalization of the term; yet in this case, literature had been growing steadily years prior. It is conceivable that the interest that sparked the AMA to form a committee to develop an operationalization was the same interest that is shown by the growth prior to 1999. Indeed, it was during these years that the REALM (1993) and TOFHLA (1995) were being developed. In 2000, the first iteration of Healthy People with a health literacy component was published and we can infer that some of the growth in publications may be attributed to the funding that the NIH and other organizations released as a result of Healthy People 2010. In 2002, the NAAL results were published, and in 2004 the Institute of Medicine published its *Prescription to End Confusion*. However, the steep and even increase does not give much support to one particular event that inspired more interest in health literacy. In general, the field reflects quasi-linear growth without the leveling off typically seen in such a pattern. It may be that the field is still too young to determine if this is a quasi- or true linear growth.

It was reported that 5,420 authors contributed to the publishing of 2,790 unique items, an indication that multiple authorship is more prevalent than single authorship. This is further support for the use of whole counts for authorship as an appropriate method in this, and future bibliometric analyses. Further investigation into the top ten producing authors using WoS reveals they are from predominately medical fields, the exception being Schillinger and Gazmararian. One would assume falsely, though, that a disproportional amount of specifically medical journals would be in the most frequently published in journals. It is indeed the opposite.

It is particularly interesting to find the variety of journal titles that resulted from the analysis, specifically, the nature of their audience. The most frequently published in journal, Patient Education and Counseling, is an interdisciplinary journal according to the publishers website [67] written for “patient education and health promotion researchers, managers, physicians, nurses and other health care providers.” The next 19 represent specific disciplines including internal medicine, nursing, communication, psychiatry, library and information science and public health. Both of these points support the assumption that health literacy is a multidisciplinary field. That is, researchers and practitioners are approaching the issues surrounding health literacy together, but in the confines of their individual disciplines. The transition to an interdisciplinary field would require the formation of new concepts and new methods specific to the field, something the data from the current research does not support. Yet this still has direct implications for practice and funding. In terms of practice, it means that as a field we must work in multidisciplinary ways to solve a clearly multidisciplinary problem. In terms of funding, it means that there must be both multi- and interdisciplinary support. The NIH has recently released R01, R03 and R21 grants through a number of institutes, and consequently, a diverse group of disciplines [68]. This is recognition that the issues surrounding health literacy are far from resolved, and in addition, that they are not simply specific to one discipline.

Finally, the impact factors and immediacy indexes of the top 12 journal titles depict a field that has both significant publications as well as less significant, insofar as two in the top ten did not even have citation reports available. It is interesting to note that although a

powerhouse of medical literature (the Journal of the American Medical Association) was included in the top ten, the majority of publications had low impact factors and immediacy indexes. There are a few assumptions one could then draw from these results: first, the current research in health literacy is simply not being published in journals that carry high impact factors and immediacy indexes; second, the research is not worthy of such publications and so it must fall to titles with lower scores; or third, it is further indication of the multidisciplinary nature of the field. The third warrants a bit more attention. One of the criticisms leveled at the Journal Citation Report is that the scores are discipline dependent and that scores across disciplines vary significantly. The substantial differences between impact factors of even just the top 12 journal titles seem to give evidence to support this. The conclusion then would be that because health literacy is a multidisciplinary field, one would expect considerable variance in impact factors, which is indeed what we find with this data.

Research Question 2 & 3

What are the evolving patterns of scholarly activity in the field of health literacy as represented in the citation patterns of published health literacy literature?

What is the evolving intellectual structure of the scholarly community in the field of health literacy as represented in the citation patterns of health literacy literature?

Figure 4c depicts the results in Phase 1 that point to the most prolific authors—it is clear authors such as Wolf, Parker, Davis, Jorm, Schillinger, Paasche-Orlow and others are publishing the most frequently. However, in terms of collaboration, we find that there are distinct clusters representing certain disciplines or even invisible colleges. Jorm, for example, is from psychiatry; there are no links between the cluster he dominates to others. Schillinger is central to another non-connected cluster in which we find population-based and public health authors. There could be a number of reasons though, independent of discipline, that are the catalysts behind these clusters. For example, an investigation of the titles and abstracts of the articles in the cluster centered around Schillinger reveal a topical connection. These articles address issues of self-management, in a broad sense for some, but in others, in a more specific context: diabetes. One could

hypothesize that the nature of collaboration depicted in the other clusters of Figure 4c are topical as well. Further support for this notion is the cluster centered on Jorm. Again, an investigation of the titles and abstracts of the peripheral articles around Jorm clearly reveals a topical commonality of mental health literacy. It should not be surprising to see that collaboration among authors is topically based; however, it has implications for the diffusion of knowledge to these independent academic endeavors. Indeed, one could foster more interdisciplinary work by encouraging the nexuses of these clusters to collaborate outside their respective niches. More research in the area of the nature of collaboration is necessary to fully understand this figure. Figure 4c also indicates that before and between 1995 and 2000 there was significant collaboration. The prevalence of links in the central cluster, dominated by authors from medical fields, is indication of a development of a research base for the field. It was during this time that instruments were being developed and the operationalization was being defined.

Figure 4d provides a different picture of the field than the one illustrated by Figure 4c. It indicates that there is a significant amount of co-citation that must exist across disciplines, geography, and time. Naturally, co-citation is greatest within each time slice—note for example the cluster of green representing the late 1980's and 1990's—but the overall nature of the figure is defined by its centrality. That is, although there is one significant cluster distanced from the center, the predominance of literature must be co-citing. This would again support the notion that health literacy is a multidisciplinary field. A field wherein the prevailing trend is discipline specific work would see clusters of each discipline co-citing rather than one large cluster of co-citation. Figure 4d also provides an interesting perspective of the conceptual development in health literacy. It is in this figure that we see Albert Bandura's work cited. Central to Bandura's work on social learning theory was the concept of self-efficacy. It would be wrong to assume why, exactly, his work was being cited, but it would not be difficult to hypothesize that it was for this concept of self-efficacy, and given the cluster in which it was cited, one could further hypothesize it was related to the patient being "literate" enough to be self-efficacious. Figure 4e reiterates this notion while providing insight into the core articles for the field in terms of document co-citation. Although again we see a large cluster of articles from the late 1980's and early 1990's, the predominate articles are those published in the mid

to late 1990's. This is an indication that the instruments that were being developed and written about during this time have remained significant to the field. This however could be interpreted in several ways; it could mean they are being utilized, perhaps criticized, or even built upon. The fact remains though, they are clearly relevant.

Research Question 4

How has the concept "health literacy" diffused through disciplines and scholarly communities beginning from Simonds' conception in 1974?

Figure 4f reiterates the significance of the 1990's in the development of the field, but it adds by providing content-based clusters to the timeline. We see, for example, that the large contingency of articles published in the late 1980's and early 1990's are concerned with poor functional health literacy, and further, that a large portion of the articles published in the mid to late 1990's are citing that literature, likely as justification for their work. We also begin to see in Figure 4f, a mapping of fields outside the realm of medicine, for example, cluster 4, mental disorder. There are clear outliers, notably "tswana today" and "latino worker perception." "Tswana today" is the title of a publication that, according to these results, published a series of articles in the 1970's regarding health literacy. The title of the article, "Tswana today – A brief summary of social-change in subsistence, health, literacy and administration" indicates that the article could have been retrieved as a consequence of "health" and "literacy" being adjacent. Indeed, the text of the article supports this notion. Mention of health and literacy are only in relation to the country's changing social climate and not in any respect to the topic health literacy. This highlights two areas of further research detailed below: one, the use of other citation software to investigate the data; and two, how, in fact, health literacy manifests itself in non-western and underdeveloped countries. There is no indication, unfortunately, that these articles—"Tswana Today" and "latino worker perception"—were picked up by the continental European or American audiences, both at the time of publication and today. A previous bibliometric analysis [16] of health literacy specifically addressed the disparity between research conducted in the United States as compared to European countries, but again, these articles indicate a need to investigate the concept of health literacy outside the Western world and perhaps in different terms.

Figure 4g, a network of keyword concepts, begins to illustrate conceptually how the collection of literature is organized. It is in Figure 4g that we see the co-occurrence of keywords derived from titles, identifiers and descriptors and abstracts, when provided. It can be drawn from the occurrence, and subsequent co-occurrence, of these terms, that these were significant concepts in addition to simply existing. For example we can see that during the late 1980's and early 1990's literacy (in general) and readability were the most co-occurring concepts. Combined with "comprehension" and "information," we can begin to build an understanding of the concerns of the field during that time. "Health literacy" clearly dominates in terms of frequency and we see connections to all other aspects of this mapping. We also see a prevalence of mental health-related terminology at the bottom of the figure. This is particularly interesting as it reflects other figures that suggest a cluster of mental health literacy articles. Note, for example, in Figure 4d, the cluster surrounding Jorm, who was previously described as from the field of psychiatry. It could be inferred that other clusters illustrated in previous figures are represented in this cluster as well. In the 1990's we see the importance of "education" and "outcomes" as well as "adherence" and it may be that the articles coming from the field of medicine reflect, topically, the importance of adherence and outcomes.

Figure 4h provides further insight into the conceptual distribution of the articles retrieved using WoS. Whereas Figure 4g utilized the 50 most common co-occurrences, Figure 4h utilized the top 100 most cited articles. One would expect from this a slightly different distribution of clusters due to the inclusion of 50 additional articles. We see in Figure 4h a figure similar to that of Figure 4d and Figure 4e, albeit rotated 90 degrees. Using a probabilistic semantic analysis of title, descriptor and identifier terms, CiteSpace defined 14 distinct clusters. Again, we see psychiatry represented in the top cluster, identified in Figure 4h by cluster 13, "psychiatric-disorders," yet we see that "readability" best describes the articles described above as "tswana today." Figure 4h provides yet another data point, per se, in a full description of what the field of health literacy "looks like." For example, from the above figures we know that the central cluster is defined by authors from medical fields, publishing largely intra-disciplinarily, and that there is a high co-occurrence of the concepts adherence and outcomes in addition to the most predominant concepts of health literacy and knowledge. We can now assume that these same articles

can be described as being concerned with “limited literacy” and “label instructions” as well. Interestingly though, we find “functional health literacy” in Figure 4g to be closer to the late 1980’s early 1990’s cluster than would be expected with a concept such as “label instructions” so closely imbedded to the center of the cluster.

Originally introduced by Price in 1965 [69], the concept of a research front was used to characterize the transitory nature of a research field. The research front represents a small percentage of articles from a field that are being actively cited. This concept is in opposition to the intellectual base, which is the core of publications cited by the research front [70]. Building on work by Price and Persson, Chen [65] defines the research front slightly differently, emphasizing “emerging trends and abrupt changes” and in turn, he conceptualizes intellectual bases as the trail of citations of the research front. Data from Figures 4, 5.1, and 5.2 depict both concepts with regard to health literacy and speak directly to Research Question 4. Using strictly Figures 4 and 5.1, a clear intellectual base formed around Parker, Davis, Baker, and Shillinger is evident. Figure 4f illustrates yet another intellectual base, but this is the base that Parker, Davis, Baker, etc used as their intellectual base. This second intellectual base is the literature published in 1980’s and early 1990’s and is visually represented by the green links. From Figure 4f, we can see that some of the literature being cited by this second intellectual base dates back to the 1950’s. The same figures allow us to make statements regarding the research front. It is clear that the work being conducted by Jorm (mental health literacy) and Nutbeam (public health literacy) are the forefront of the research community. This runs counter to the notion that the field is moving toward being interdisciplinary, in fact, it supports that the field is multidisciplinary. We can then characterize the diffusion of health literacy from its inception in 1974 to the present day. Although the concept arose from education literature, it fell off the radar until the 1980’s when it was picked up by medical fields. Since then, we have seen a trend toward discipline centered research and the emergence of discipline specific concepts, for example, “public health literacy.” If other fields could be used as models, it would be expected that the discipline specific research will only be able to progress so far and at some point, perhaps some sort of terminal velocity will be achieved and true interdisciplinary work will be necessary for progress to occur in the field. It is unfortunate that the conceptual visualizations, Figures 6 and 7, do not provide

much for discussion of discipline specific definitions. Although, we can extrapolate which keywords and concepts arise from certain discipline clusters, there is little evidence of one-to-one similarities. This is largely due to the fact that the discipline specific definitions are coming from emerging vectors of the field, that is, those clusters that represent the research front and are as such not as well developed in the visualizations. It is also worth noting again that the terms used for these visualizations arise from titles, abstracts (when available), descriptors and identifiers. These terms may not provide the granularity needed to describe specific aspects of the various conceptualizations.

Limitations and Areas of Further Research

One of the suggested stages of analysis Chen describes [66] indicates the need for qualitative expert analysis of the visualizations. The current discussion is certainly one attempt at such an analysis; however, analysis from the prevalent authors indicated by both Phase 1 and Phase 2 of the current project would only add to richness of the discussion.

It is clear that the field of health literacy is growing, but what are the catalysts? Evidence from the current study indicates that seminal publications could be one reason, but it would be fruitful to have unambiguous support that funding is a catalyst.

This and other studies have indicated that health literacy is not always called “health literacy.” Indeed an article may never mention the term, but address issues of readability, or navigating the healthcare system, or having the ability to decide which foods are healthiest for your children. This leads directly to the need for a controlled term and consistency in indexing health literacy literature. NLM recently introduced “health literacy” as a MeSH term, but there are few databases that utilize MeSH, and it will take years to back index all the relevant articles. Two points are warranted here: first, further studies should build from the current work in keeping time and database limits but expand the search strategy to encompass those articles that do not explicitly use the term “health literacy;” and second, that this represents a limitation of the current study. In a

similar vein, a systematic review of the conceptual research conducted regarding health literacy would produce a richer understanding of the field from a meta-perspective.

As stated above, this research was not overtly limited to the United States, that is, no specific limitation was set to only search for literature from the United States, but it seems that it retrieved literature mostly from Western countries. This could be a consequence of the databases, or the time frame, or simply put, the concept itself. It would be interesting to see if and how the concept of health literacy arises in non-Western and under-developed countries. For example, would the predominant themes be those of adherence and label instructions or would there be more of a focus on empowerment, self-reliance and self-management?

A comparative analysis of citation analysis software is justified as each typically offers a different way of sampling and determining clusters. Further research regarding the nature and future evolution of the field is warranted. This study provides strong evidence to support the claim that the field is multidisciplinary, but it would be particularly interesting to see if this multidisciplinary research is more effective than the single-disciplinary work. It would also be productive to conduct a systematic review of all interdisciplinary work that has been conducted in health literacy and compare it to the general collection of literature in terms of some key indicators such as impact and immediacy factors, centrality and total citations. In a similar vein, further network analyses ought to be conducted to define strong, quantitative and measurable collaboration between disciplines and other variables such as institutions or countries. This type of research could have direct implications for advocating for funding streams to support new interdisciplinary work.

Conclusion

This study has direct implications for practice. First and foremost, it provided researchers, librarians and those interested in the field with information to efficiently conduct literature searches and understand the structure of the field. This includes providing information regarding a core set of authors and journals. Furthermore, it provided insight into how and where the field may be moving in terms of multi- and

interdisciplinary research. This has implications for policy makers and organizations who will be funding health literacy endeavors in the future.

This study investigated the field of health literacy through bibliometric and citation visualization methods. It determined the distribution of articles between databases and over time, as well as determined the most prolific authors and frequented publications. A number of citation analyses were utilized to visualize the literature of the field using a Java-based application CiteSpace which enabled the determination of co-authorship, author and document co-citation, co-occurrence of keywords, and conceptual clusters by co-citation. This research furthered our understanding of the field of health literacy through investigating its literature, and introduced an innovative method of investigation, citation visualization, to the field for the first time. This study identified thematic trends and temporal patterns in the field of health literacy. Most importantly it continued a dialog concerning the literature of health literacy and the variables that shape it.

Appendix A: Introduction to CiteSpace: Visualizing Patterns and Trends in Scientific Literature

CiteSpace is a visual analytic tool for studying the dynamic networks of a given topic. Developed in 2004 by Chen, CiteSpace is a web-based, Java application that creates networks and clusters determined by citation data. The primary source of citation data is Thompson Reuter's Web of Science (WoS). While this enables the collection of data on many disciplines, WoS is not without its criticisms and as such stands to be one of the major limitations to CiteSpace at this time.

After a search is conducted, "full records" of selected citations are exported in plain text format. Two folders must be created for CiteSpace to operate, a Data folder and a Project folder. The exported plain text files are uploaded into the Data file. During the creation of a new project, users direct the application to find the plain text files in the Data folder and reference the Project folder. It is at this point that users begin to shape the parameters for the visualizations.

First, research front terms are selected from titles, abstracts, descriptors and identifiers. The user defines any or all of these to be used for term determination. Term selection is then determined to be either noun phrases or burst phrases. Both noun phrases and burst terms are single or multi-word phrases extracted from the above fields, the difference being, noun phrases require parts of speech tags to be determined by the program first whereas burst terms represent a simple frequency of all terms.

Time slices are determined next. During this stage, the user defines both the total range to be analyzed and the length of time within one slice. A time slice is a parameter that enables the investigation of records within smaller time periods in addition to the entire set.

Next, threshold parameters are set for the visualization. These include levels for citation counts, co-citation counts, and co-citation coefficients as well as determining the nodes (authors, papers, journals, and burst terms) and link types (co-occurrence, co-citation, or referential).

Pruning and merging occur next. CiteSpace uses a pathfinder network scaling method as the default option for network pruning. According to Chen and colleagues, "CiteSpace merges individual networks by taking a set union of all the vertices and selecting links that do not violate a triangle inequality condition in overlapping areas between networks" [8]. Users determine first whether to apply the scaling operation to individual networks, and then whether or not to prune the merged network in its entirety.

After selecting "GO," CiteSpace runs its algorithms and a display interface pops out from the initial screen. Users are enabled to determine the overall layout of the visualization by choosing from a standard graph (cluster) view, timeline view and time-zone view. Each has its own particular benefits, for example, the time-zone view (not used in this study) restricts the movement of nodes to vertical time zones which correspond to their time of publication.

It is at this point that users are able to save the entire visualization—along with its parameters—as well as save individual images. These files are, by default, saved to the Project folder.

A bibliography of CiteSpace articles suggested by the developer, as well as those cited above, is provided below for readers interested in further investigation of the program.

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Appendix B: Databases Descriptions

Database	Years Covered	Scope
Academic Search Premier	1865 - present	Covers a broad range of subjects. Indexes over 8,000 publications; almost 7,000 are scholarly journals; full-text available for issues of almost 5,000 publications. Footnotes listed from articles in almost 1,000 journals. Includes an Image Collection. [1]
AgeLine	1978 - present (selected coverage from 1966-1977)	Indexing of literature focusing on the population aged 50+ and issues of aging. Includes social gerontology and aging-related content from the health sciences, psychology, sociology, social work, economics, and public policy. Indexes over 600 journals, books, book chapters, reports, dissertations, consumer guides, and educational videos. Produced by AARP. [1]
Agricola	1970 - present	Citations and abstracts of materials acquired by the National Agricultural Library (NAL) and cooperating institutions in the agricultural and related sciences. Ninety percent of the records describe journal articles and book chapters, and the remaining ten percent describe monographs, series, microforms, audiovisuals, maps, and other types of materials. Coverage is worldwide. In addition, the database includes subfiles of citations from the Food and Nutrition Information Center (FNIC) and the American Agricultural Economics Documentation Center (AAEDC). [1]
Allied and Complimentary Medicine (AMED)	1985 - present	Provides citations to the published journal articles in fields allied to medicine and alternatives to conventional medicine. Focuses on alternatives to conventional medicine, including herbal/nutritional remedies and other non-traditional approaches to health and healing. Created by the Health Care Information Service of the British Library. [1]
CAB Abstracts	1910 - present	Agricultural and applied life sciences resources, with emphasis on agronomy, forestry, public health, environmental issues, and the management of natural resources. Particular attention is paid to the needs of developing countries. Among specific subjects covered: animal and crop husbandry, animal and plant breeding, biofuels, bioterrorism, leisure tourism, plant protection, genetics, forestry engineering, economics, veterinary medicine, human nutrition, and rural development. Coverage includes 11,000 journals, books, conference proceedings, reports, theses and other kinds of literature published internationally. The current file (1973 - present) and the archive (1910 - 1972) may be searched separately. Includes abstracts and links to full-text from CAB Abstracts Reviews Archive: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources. [1]

CINAHL	1982 - present	Indexes and provides full-text (for 520 journals) for English-language and selected foreign-language nursing journals, publications from the American Nurses' Association and the National League for Nursing, and journals from 17 allied health disciplines. Also covers biomedicine, management, behavioral sciences, health sciences librarianship, education, consumer health, chiropractic, and health services administration literature. Formats include books, book chapters, pamphlets, audiovisuals, dissertations, educational software, selected conference proceedings, standards of professional practice, nurse practice acts, critical paths, and research instruments. Includes selected original and full-text material: several state nursing journals and some newsletters, standards of practice, practice acts, government publications, research instruments, and patient education material. [1]
Communication and Mass Media Complete (CMMC)	1915 - present	Incorporates CommSearch (formerly produced by the National Communication Association) and Mass Media Articles Index (formerly produced by Penn State) along with numerous other journals, offering cover-to-cover indexing and abstracts for over 300 journals, and selected coverage of over 100 more. Includes full-text for nearly 200 journals. [1]
Dissertation Abstracts	1861 - present; abstracts since 1980; theses abstracts since 1988	Includes references to U.S., Canadian, British, and other European dissertations and theses, with detailed abstracts. Each dissertation published since July 1980 includes a 350-word abstract written by the author. Master's theses published since 1988 include 150-word abstracts. [1]
Education Full-Text	1983 - present; full-text coverage 1986 - present	International coverage of English-language periodicals, monographs and yearbooks. [1]
ERIC	1966 - present	Consists of two files: the Resources in Education (RIE) file of ERIC document citations and the Current Index to Journals in Education (CIJE) file of journal article citations from over 1,000 journals. Both files provide abstracts. In addition, ERIC now contains over 2,200 ERIC Digest records that feature the full-text of the original document. Also provides coverage of conferences, meetings, government documents, theses, dissertations, reports, audiovisual media, bibliographies, directories, books and monographs. [1]

Electronics and Communications Abstracts	1981 - present (a few materials back to 1961)	Provides international coverage with the monitoring of over 3,000 serial titles as well as numerous non-serial publications. Major areas of coverage include circuits, components and materials, photonics, control and systems, telecommunications (including equipment and instrumentation), power systems, theoretical aspects, and electronics and communications milieux. [1]
EMBASE (1974+)	1947- present	The Excerpta Medica database, is a biomedical and pharmacological database that provides the most up-to-date information about medical and drug-related subjects. Each record is indexed by medical research specialists who assign terms and codes in accordance with Emtree, a highly developed classification schedule and controlled vocabulary, consisting of 50,000 terms and approximately 218,000 synonyms. Journal articles are added to the database within two weeks after receipt of the journal. [2]
Library, Information Science and Technology Abstracts (LISTA)	1965 - present	Provides abstracting and indexing coverage on, for example, librarianship, classification, cataloging, bibliometrics, online information retrieval, and information management in more than 600 periodicals plus books, research reports, and proceedings. [1]
Library Literature and Information Science (Library Lit)	1984 - present; full-text coverage 1997 - present	Indexing of over 380 selected library journals (over 100 full-text), books (more than 300 a year), conference proceedings, library school theses, pamphlets, and book reviews. [1]
MEDLINE (1950+)	1950 - present	MEDLINE includes citations and abstracts on such topics as microbiology, delivery of health care (medicine, nursing, dentistry, veterinary medicine, the health care system and preclinical sciences), nutrition, pharmacology, and environmental health. The categories covered in the database include anatomy, organisms, diseases, chemicals and drugs, techniques and equipment, psychiatry and psychology, biological sciences, physical sciences, social sciences and education, technology, agriculture, food, industry, humanities, information science and communications, and health care. Coverage of over 4,800 journals includes publications from the U.S. and 70 other countries. [1]
PsychINFO	1840 - present	From the American Psychological Association. Contains over two million citations and summaries of journal articles, book chapters, books and dissertations, all in psychology and related disciplines. Journal coverage includes international material selected from nearly 2,000 periodicals in over 24 languages. It also includes information about the psychological aspects of related fields such as medicine, psychiatry, nursing, sociology, education, pharmacology, physiology, linguistics, anthropology, business and law. [1]

Social SciSearch	1972- present	International, multidisciplinary index to the literature of the social, behavioral and related sciences. Offers citation indexing, which permits searching by cited references. [2]
SciSearch (1990+)	1990- present	An international, multidisciplinary index to the literature of science, technology, biomedicine and related disciplines. Indexes all significant items (articles, review papers, meeting abstracts, letters, editorials, book reviews, correction notices, etc.) from over 6,100 major scientific and technical journals. Offers citation indexing, which permits searching by cited references. [2]
<p>1. Descriptions from the University of Kentucky Library's description of electronic resources. Respective database descriptions found at: http://www.uky.edu/Libraries/dbsearch.php</p> <p>2. Descriptions from the Thompson Corporation's Dialog/Datatar Database Catalog, 2008. Respective database descriptions found at: http://support.dialog.com/publications/dbcat/</p>		

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