

Bibliometrics: A Means of Visualizing Occupational Licensure Scholarship

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Introduction: Occupational licensure has recently been a focus of media and legislative attention, leading to debates regarding the value of and need for professional regulation. **Objective:** The aim of this study is to systematically identify, analyze, visualize, and interpret scholarship in this important domain. **Methods:** This study uses a bibliometric analysis of the articles published on occupational licensure in the peer-reviewed literature as indexed in bibliographic databases. **Results:** The occupational licensure research is focused around the emergence of a number of areas of inquiry: educational preparation, economic impact, labor market entry, benefits of occupational licensure, adverse impacts on minority groups, and scope of practice. A single researcher is central to the literature and views the topic through an economic and labor-market participation lens. **Conclusions:** The absence of scholarship relating to public protection must be urgently addressed if occupational licensure models that are proportionate to the level of risk posed by the practitioner are to be developed and enforced.

Keywords: Legislation, occupational licensure, professional regulation

From time to time, occupational licensure has been the focus of media and legislative attention, leading some to question the value of professional regulation. However, to our knowledge, no previous attempt has been made to systematically identify, analyze, visualize, and interpret scholarship in this important domain. This article addresses this gap through the use of bibliometrics.

Bibliometrics, sometimes referred to a *scientometrics* or *altmetrics*, is an analytical technique to quantify research articles that has grown in popularity. Figure 1 shows the number of published papers that used the bibliometric technique and were indexed in PubMed from 1958 to 2017. The rate of growth in papers started in the late 1980s and coincided with the development of technology that facilitates such analysis (Haustein & Lariviere, 2014).

Bibliometrics have been defined by Pritchard (1969) as “the application of mathematical and statistical methods to books and other media communication.” This study will not detail the wide range of techniques available to undertake such analyses, as this information can be found elsewhere (Shiffrin & Borner, 2003; Archambault & Gagne, 2004; De Bellis, 2009). Instead, only those techniques used in this study will be provided along with a short explanation of the primary purpose of the approach.

According to De Bellis (2009), bibliometrics examines a range of issues related to the state of scholarship pertaining to a domain of interest. It identifies the most dominant contributors to a field and how they draw upon the literature to develop their work. Examination of frequently occurring themes as well

as how they emerge and change over time provides insights into the evolution of thinking and a synopsis of the current state of the science. Furthermore, TUDelft (2017) produced a comprehensive toolkit that describes the wide range of bibliometric applications using illustrative case studies. Bibliometrics can be used to identify well-researched or under-researched areas and is ideally suited to provide a high-level analysis or wide-angle view of the current state of scholarship by topic of interest (Benton & Ferguson, 2017)

Occupational Licensure

The media, legislators, think tanks, and foundations recently intensified their interest in occupational licensure (Cottle, 2017; Department of the Treasury of Economic Policy, Council of Economic Advisers, & Department of Labor, 2015; Shapiro, 2017). To examine occupational licensure, an operational definition is required. For the purposes of this paper, we broadly define occupational licensure as a form of government regulation that requires an individual to obtain a license to pursue a profession or vocation for compensation.

Originally, occupational licensure emerged from a realization that certain professions could place the public at significant risk of serious harm or even death if they included incompetent or fraudulent practitioners. Recently, there has been a rapid increase in the number of licensed disciplines in the United States. In their 2012 report, *License to Work*, the Institute for Justice noted

FIGURE 1

Articles Using Bibliometrics and Indexed in PubMed

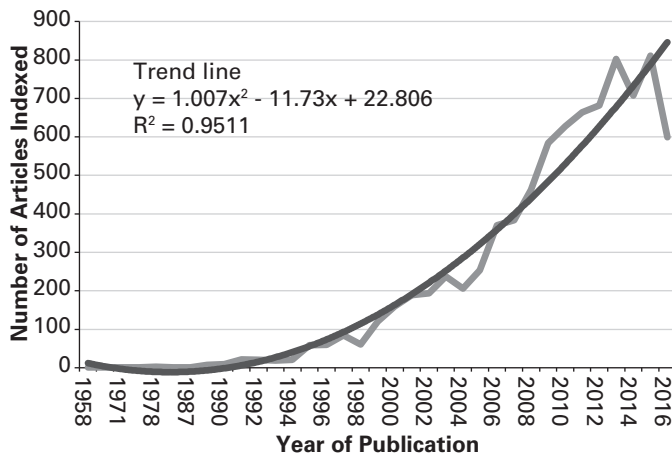
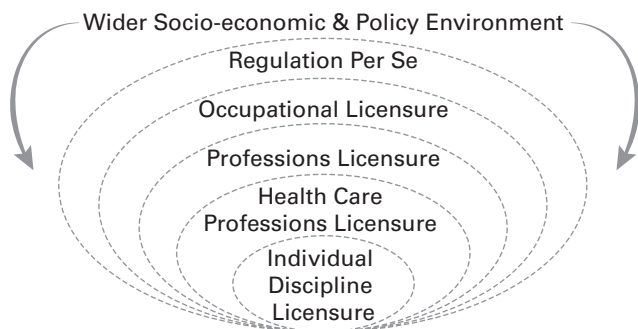


FIGURE 2

Delineating the Licensure Landscape



Source: Modified from Benton et al, 2013.

that in the 1950s, only 1 in 20 Americans needed a license to work, but by 2012, nearly 1 in 3 needed a license to pursue their chosen career. Due to the rapid increase in the use of this regulatory tool, questions are being asked regarding the impact of occupational licensure on the professions, the services they offer, and the consequences that this has on the recipients of their services. Some authors, such as Kleiner (2006) referenced the fact that not all occupations have the same level of risk. Shimberg and Roederer (1994) formulated a set of questions to help differentiate such risk, but most writings fail to address this point in any detail. Although Benton, González-Jurado, and Beneit-Montesinos (2013), as part of wider work on comparing nurse regulatory bodies, sought to graphically delineate the regulatory landscape (Figure 2), the study ultimately focused on board performance rather than occupational licensure. Thus, to date, there has been no attempt to systematically examine and map research scholarship on occupational licensure.

The need for this study is urgent, especially as policy makers move from an emotive discourse on issues, where those who shout loudest or hold the ear of key opinion leaders influence outcomes, to an evidence-based discussion before transparent decisions are made.

Aim

The aim of this study was to perform a bibliometric analysis of occupational licensure articles published in the peer-reviewed literature as indexed in bibliographic databases to identify, visualize, and analyze the themes, central actors, and their impact on scholarship in this domain.

Methods

In this study, we systematically explored bibliographic databases to identify papers published on occupational accreditation, licensure, regulation, or certification. The following search criteria were used to identify materials:

TITLE-ABS-KEY («occupational licensure» OR «occupational license» OR “occupational accreditation” OR “occupational regulation” OR «occupational certification»)

The databases examined included Scopus (Elsevier), PubMed, and Web of Science (Clarivate Analytics). A structured search of these databases was performed on November 2, 2017. The titles and abstracts of the material, identified through the Boolean search, were examined individually to ensure that they complied with the focus of this study. Owing to limitations of the analysis and visualization software, only articles published in English were included.

Results from each of the searches were exported as an RIS (Research Information Systems) file and then imported into bibliographic management software Endnote version 8 (Clarivate Analytics). Duplicate items were deleted, and a consolidated single file was created for analysis.

Data Analysis

Descriptive statistics from the data, which included a graph of the numbers of papers published per year, and frequency data on the most common sources in terms of countries, affiliated institutions, and subject areas were provided. In addition, author and source information on the most-cited articles extracted from the databases were identified.

To enable the visualization and analysis of the bibliometric data, VOSviewer, software developed by academics at the University of Leiden Centre for Science and Technology Studies, was used (van Eck & Waltman, 2014). This software imports and displays data from an increasing number of sources based on a

visualization of similarities (VOS) through a multidimensional scaling technique. The software also generates a map of the relationships between the values of the variable of interest. Closely related values are displayed near each other and those that are distantly related are displayed farthest away from each other. Groups of like items are color coded (van Eck, Waltman, Dekker, & van den Berg, 2010). The software enables users to focus on single elements of the map, highlight connections, and zoom in to the image for more detail.

VOSviewer can focus on a range of variables, such as the author, the journal, keywords, or a natural language analysis of commonly occurring words contained in the title and abstract. Various analytical techniques can be used to visualize the relationships between the topic of analysis. Table 1 sets out the techniques used in this study.

Results

Initially, 2,002 articles were retrieved (1,870 from PubMed, 109 from Scopus, and 23 from Web of Science). After reviewing for alignment with the topic of interest, ensuring the papers were published in English, and removing duplicates, 69 articles remained for analysis.

There is a paucity of articles about occupational licensing (Figure 3). The earliest article identified was published in 1959. Since then, on several occasions, a number of years passed without published work on occupational licensing; however, from 2011 onward, there has been a modest increase in the frequency of publication ranging from 3 to 7 articles per year.

Authorship is dominated by material from the United States (38 articles) followed by Australia (5 articles), Canada (3 articles), the United Kingdom (2 articles), and Germany (2 articles). The remaining articles come from a diverse range of countries. The top three academic institutions affiliated with the literature were the U.S. National Bureau of Economic Research, the University of Illinois at Chicago, and the University of Twin Cities. That these institutions were all U.S. based is not surprising given the dominance of U.S.-based articles identified. In terms of subject area classification, most articles relate to social sciences (25 articles), economics (20 articles), or medicine (17 articles).

To examine the most active scholars in the field, a number of metrics were considered. Table 2 highlights several articles that meet the criteria set by Hack, Crooks, Plohman, and Kepron (2010) regarding the likely quality of articles based on citation frequency. The most cited authors are Kleiner and Krueger (2010), Parry and Oates (2000), and Elbaum (1989). According to Hack et al. (2010), articles cited 50 times or more are likely to be “very good” and influential in the domain. The remaining articles are designated as “good” as they meet the criteria of 10 or more citations. None of the articles are deemed “excellent” under the criteria set by Hack et al. (2010) because none were cited 100 times or more. However, Tsay (1999) identified that accumulat-

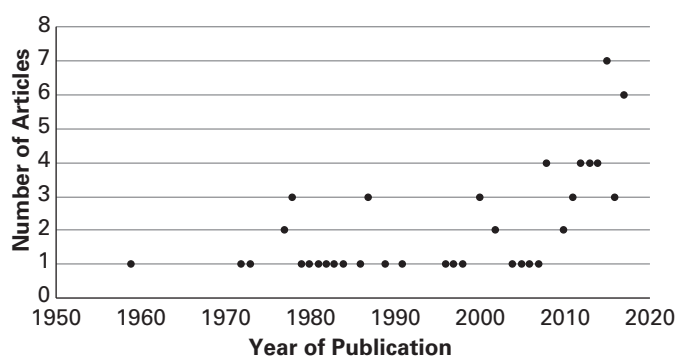
TABLE 1

Brief Description of Analytical Techniques Used in This Study

Technique	Short Description
Coauthorship Analysis	Provides a map of authors who are publishing together on the topic of interest. It is possible to identify small groups of collaborators as well as expanded networks of individuals connected through the process of paper coauthorship. The relatedness of authors is determined based on their shared numbers of coauthored documents.
Co-citation Analysis	Provides a future-orientated assessment on document similarity as the citations that a paper receives in the future depend on the evolution of the academic field. Consequently, co-citation frequencies may change over time. The relatedness of the items, such as authors, sources, or specific references, is determined by the number of times the items are cited together in subsequent papers.
Co-word Analysis	Offers a means of analyzing the content of documents to identify and map the strength of association between frequently occurring terms to reveal and visualize the evolution of the domain of scholarship under review.

FIGURE 3

Occupational Licensure Articles Published Per Year



ing the total number of citations can take between 10 to 15 years and, accordingly, some of these articles may reach the 100-citation threshold in the years to come.

Another way of looking at scholarship is identifying author collaboration on certain topics. Collaboration can indicate the presence of either formal or informal groups of researchers with a specific area of interest. In her seminal work on how scholars communicate, Crane (1972) described these collaborations as *invisible colleges*, where groups of researchers work across institutional boundaries to focus on topics of shared interest. Coauthor analysis of the data revealed that although a number of authors have col-

TABLE 2

Cited Articles Meeting a Minimum Threshold of 10 Citations

Author(s)	Date of Publication	Number of Citations	Likely Quality
Kleiner, M., & Krueger, A.	2010	53	Very Good
Parry, I., & Oates, W.	2000	51	Very Good
Elbaum, B.	1989	50	Very Good
Angrist, J., & Guryan, J.	2008	33	Good
Kugler, A., & Sauer, R.	2005	30	Good
Martin, P., & Straubhaar, T.	2002	14	Good
White, W.	1978	14	Good
Deming, D., Yucktman, N., Abulafi, A., Goldin, C., & Katz, L.	2016	12	Good
Johnson, L., & Loucks, C.	1986	11	Good
Thornton, R., & Timmons, E.	2013	10	Good
Begun, J., Crowe, E., & Feldman, R.	1981	10	Good

laborated on individual papers, complex webs of collaboration do not yet exist. The only scholar acting as a bridge, between four authorship groups covering three aspects of scholarship in occupational licensure, is Morris Kleiner (Figure 4).

Another way of examining how ideas diffuse across the domain is to analyze co-citation within the published literature. Work frequently cited together provides insight on who is working on specific areas of interest and the role their work plays in the emergence of the field. Figure 4 confirms the central role (see the size of the circle) that Kleiner plays in the occupational licensure domain. His frequently cited work relates to a number of aspects of inquiry interfacing with three major areas of scholarship within the general occupational licensure domain. Within the three areas of inquiry, three other authors—Friedman (upper group of scholars), Goldhaber (right-hand group), and Law (left-hand group)—are influential within their individual areas of inquiry.

Before reporting on and examining in detail the themes addressed in the occupational licensure domain, it is possible to identify through co-citation analyses of journal sources the overarching scientific fields of inquiry by looking for commonalities in the types of journals that attract and publish the articles. Analyses of the journal sources revealed that scholarship in this domain is driven from an economic, law, labor, sociology, or political sciences perspective. It is important to note the presence of only two discipline-specific journals (in the disciplines of allied health professionals and real estate) and the absence of material coming from other health disciplines and the safety or quality domains.

By conducting a co-word analysis, six keyword clusters were identified (Figure 5). By considering the words associated

with each cluster and referring to the original source documents, we identified the overarching theme for each cluster: educational preparation, economic impact, labor market entry, benefits of occupational licensure, adverse impacts on minority groups, and scope of practice.

Each of these themes are at differing stages of development. By examining the frequency of links between the elements (see the large number in the economic impact theme) and the average of the publication dates from which the various words were derived, it is possible to map the evolution of scholarship on these topics over time. Economic impact is the most well-established, reaching back to the 1980s and 1990s. Work on educational preparation and labor market entry is less developed and tended to be the focus of scholarship during the 1990s and early 2000s. The focus shifted to scope of practice and benefits of occupational licensure from 2005 to 2010. The most recent topic, adverse impacts on minority groups, has only consistently emerged over the past 5 years.

Discussion

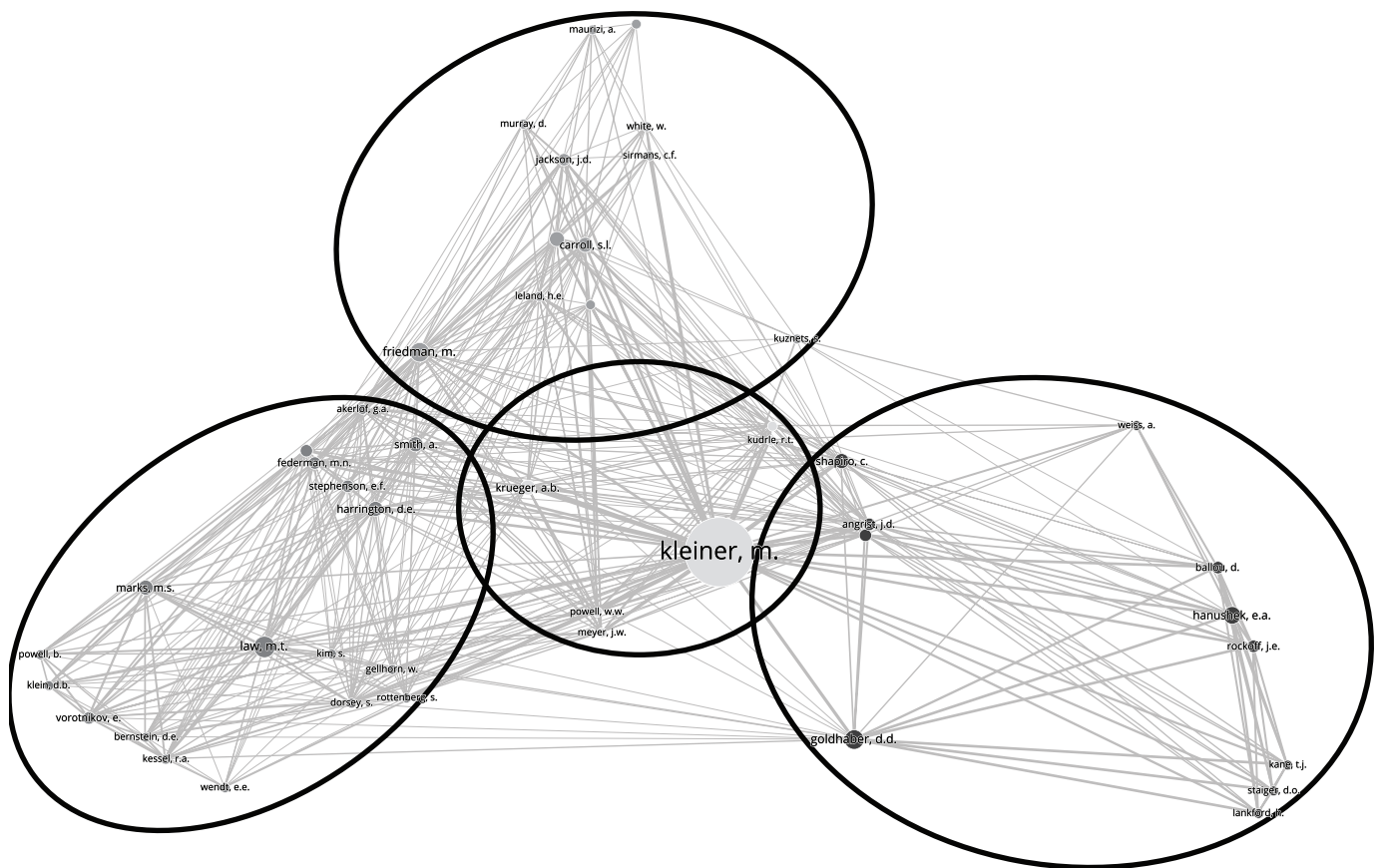
Bibliometrics, unlike a systematic review, tracks themes and points to areas that might warrant a meta-analysis, systematic, or integrative review. In short, it offers a 30,000-foot view rather than a microscopic image. There may be sufficient material to conduct a meta-analysis or systematic review in the economic impact area; however, meaningful, valid, reliable, and conclusive results would likely not be generated with the other themes. Although there is limited and relatively recent work on the benefits of occupational licensure, studies have focused only on the impact of licensure on teachers rather than the benefits of licensure to the profession and the quality of the teaching that results. Hence, we are confident in identifying and drawing attention to the paucity of evidence in this area.

It is clear from the analysis that research in the space of professional regulation and occupational licensure is dominated by economic and labor market participation perspectives. To date, work addressing the impacts of regulatory models on public safety is conspicuous by its almost complete absence. While authors such as Kleiner (2006) noted this bias toward an economics lens, reaching back centuries to Adam Smith and his seminal text on the wealth of nations, researchers have not adequately embraced the opportunity to address this knowledge gap. This gap in evidence is particularly problematic in today's policy climate.

As calls to deregulate professions increase, often under the guise of reduction in bureaucracy and removal of red tape, more robust evidence is needed to inform these decisions if the right balance between economic, labor, and safety impacts is to be achieved. To do this justice in the health care licensure space, more information regarding the impact on clinical outcomes of the different types and levels of providers is needed. To this end, data that are a byproduct of clinical interventions captured in

FIGURE 4

Co-citation of Authors in the Occupational Licensure Literature



the electronic health record are also needed. We agree with the observation that the growth of licensure requirements, increasing from 1 in 20 persons in the United States in the 1950s to 1 in 3 today, requires attention (Institute for Justice, 2012). We advocate for a critical review of the wide range of service providers who now populate the occupational licensing space. We also believe a one-size-fits-all approach is not appropriate and licensure solutions must be proportionate to the risk posed to the user of the service. In the case of health and social care professionals, the potential risk could not be more extreme. Getting it wrong is literally a matter of life or death. Unfortunately, although some authors acknowledge that the health and social care sector is different, the conclusions reached and solutions offered are framed as applying to occupational licensure per se. We argue that a more granular and finessed set of recommendations for occupational licensure reform is needed. Evidence that clearly articulates why health and social care professions are different is required if the regulation of health professions is to avoid being swept up in wider deregulatory reform.

Limitations

Owing to limitations of the software, only articles published in English were included in the analysis, which may have limited the identification of concepts. However, a review of those articles removed from the analysis does not suggest any additional themes would have emerged.

It is possible to enter data from unpublished literature into the analysis matrix; however, this would compromise the reliability and validity of the findings because many of these documents are funded by foundations that have a particular policy perspective. By limiting the analysis to peer-reviewed literature, it was possible to minimize the risk of policy or ideology bias.

Conclusion and Recommendations

In our bibliometric analysis of the peer-reviewed occupational licensure literature, we identified the coverage and emergence of a number of areas of inquiry—namely, educational preparation, economic impact, labor market entry, benefits of occupational licensure, adverse impacts on minority groups, and scope of practice. We also identified the dominance of one researcher in this

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