Nordic Academic Publishing in Health Economics

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Abstract: We analyse how the Nordic contribution to health economics has evolved over the past three decades – in quantitative and qualitative terms. Using a dataset of publications from five prominent field journals for health economics, we combine different empirical methods to analyse the general trends in terms of number of distinct publications, topics covered, and co-authorship relationships between countries and individuals. We find that the Nordic countries are responsible for a stable share of international publications in health economics. The topics that Nordic health economists publish on are relatively similar to those most prevalent in the international community, even though health insurance is remarkably absent as a research topic in Nordic countries. In terms of links between countries and co-authors, we see that Nordic researchers are well embedded in the international community, and that the Nordic research community has moved toward less hierarchical relationships.

JEL Classifications: I1, A11

Key words: health economics, bibliometrics, publishing, Nordic countries

1. Introduction

The purpose of this article is to study the evolution of research in health economics in the five Nordic countries over the past 30 years. Our emphasis is in particular on publications in international peer-reviewed field journals devoted to health economics, and measurable indicators that can be derived from data on such publications. Using standard bibliometric methods, we aim at giving an overview of how some quantitative aspects of academic publishing in health economics has evolved over the past three decades. We also study how the emphasis of published research from the Nordic countries has changed over time, and what co-authorship relationships reveal about networks within the Nordic countries and between these countries and the rest of the World.

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Quite naturally, a study of this kind needs to establish some clear delimitations in order to be meaningful. This is possibly of particular importance considering the field we are studying, given that there is no general agreement of what health economics actually is. One possible definition would be that health economics is the application of mainstream economic models and methods to decisions taken by individuals, health care providers and regulators with regard to health and health care [cf. Morris et al., 2007]. This definition would place health economics in the tradition of Kenneth Arrow’s seminal contribution [Arrow, 1965] and suggest that health economics is a sub-discipline of economics which applies the models and methods of the discipline to specific topics related to health and health care. Such a definition would however exclude a large body of research which is often labelled “health economics”, namely economic evaluations undertaken in the process of health technology assessment (HTA). The literature on economic evaluation in HTA is manifestly different from mainstream economics in the methods used and in the types of research questions asked – even though both fields of study rely on some common concepts like e.g. “efficiency” or “opportunity cost”.

In this paper we take a simple shortcut in order to avoid having to engage in lengthy discussions of definitions. We operationalise health economics research as the research that gets published in five leading international journals for health economics. The basis of our analysis is publications – the universe of publications – in the five health economics journals Journal of Health Economics (JHE); Health Economics (HE); the European Journal of Health Economics (EJHE); the American Journal of Health Economics (AJHE) and the International Journal of Health Economics and Management (IJHE).¹ It is clear that this operational definition, though very practical, has potential issues. One such issue is that we exclude research published in journals more strongly focused on economic evaluation (e.g. Medical Decision Making; PharmacoEconomics; Value in Health). Even though some of the journals we include do publish economic evaluations, it is likely that this field of research becomes under-represented in our analysis. It also, however, changes the group of authors that are considered in the analysis: the journals that we do consider are dominated by economists working in academia. The journals focusing on economic evaluation typically have a much larger share of authors working in the industry. Hence, we expect that the international co-authorship networks, as well as the topics covered, would look quite different if we included such journals.

On a more general level it should be noted that the operationalisation of fields and specialties in bibliometrics is a difficult task. The most common approach is to base it on specific journals, as we do here, due to its straightforwardness. Yet one problem with that approach is that journals – especially highly ranked ones – tend to cover a broad range of topics and specialties. While such journals may contain key contributions within a certain specialty, their general nature makes them less useful for analysing specific domains, such as health economics. Therefore, citation scores or rankings are usually not a very effective strategy when studying a research area. Instead, a recommended approach is to ask researchers within a specialty to select key journals and base the analysis on their recommendation. We have been unable to make a systematic selection along those lines for this study; however our eventual selection of journals is based on consultations with a number of prominent researchers in the field.

One consequence of this operationalisation is thus that we exclude research on health economics that gets published in general interest journals of the economics profession. This is problematic since these general interest journals typically have a better standing than the field

¹ The Nordic Journal of Health Economics is not indexed and could hence not be included in the analysis.
journals, because they are perceived to publish papers of higher quality. There is thus a concern that our database may be “censored” in the sense that many publications of particularly high quality are left out. We believe that this is a minor concern for our study, considering that most researchers in health economics will have the majority of their work published in the field journals we consider.

Another concept that is calling for a definition is what makes a researcher “Nordic”. One could in principle have based that definition on the nationality of a researcher. However, a researcher’s nationality is not always public knowledge and even if it were, the country of work might be preferred based on its relevance; in particular for the numerous researchers of non-Nordic origin who are working in Nordic institutions. Hence, we decided to use a very simple definition also in this case, and we denote a researcher as “Nordic” if they have their main affiliation with a Nordic research institution. It is important to keep this in mind when we refer to “Nordic researchers” below: some individuals that we include in this group are not citizens of a Nordic state.2

Our main findings may be summarised as follows. We find that despite a very rapid increase in the number of papers published each year, the Nordic authors are responsible for a very stable share of the total output; their work is also relatively evenly spread over the journals we consider. We find that topics covered in Nordic research are in line with international trends in general; however for natural reasons, there is less interest in topics related to health insurance among Nordic authors. We find that Nordic countries are a tightly knit part of the broader international community; whereas Denmark, Finland and Sweden represent a tight cluster throughout the period we consider, Norwegian authors are slightly more likely to publish with non-Nordic authors compared to the other three. Finally, we observe a remarkable decentralisation of Nordic co-authorship networks. In our concluding discussion, we discuss what this trend possibly reveals about the Nordic research community.

In the next section, we present our method and give an overview of the dataset. In Section 3 we provide a short description of how Nordic and international publishing has changed over the time period we study. Section 4 provides an analysis of topics prominent in this research, based on words appearing in Abstracts. Section 5 analyses co-authorship relationships between countries and individuals, and Section 6 concludes.

2. Method and Data

Bibliometrics – quantitative analyses of publications – offers methods for providing analytical overviews of fields and disciplines. Yet, the availability of qualitative bibliographic data restricts the scope of possible analyses, and these limitations are most visible in the humanities and social sciences. The main limitation is that monographs, book chapters, as well as publications in non-English sources, are poorly covered in citation databases such as the Web of Science or Scopus [Archambault et al., 2006]. A search engine like Google Scholar indeed has wider coverage, but the data quality is often too low for more advanced bibliometric analyses. In this study we base our analysis on five health economic journals indexed in the Web of Science core collection for the period of 1994-2021. The 1994 starting year is to some extent arbitrary, but it is hardly meaningful to go further back in time due to the very small number of publications. Our assumption is that the selected core journals, despite only covering a limited part of all research within the

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2 We deal with researchers active in other countries analogously – referring to them as “German” or “English” regardless of their actual nationality.
broad area of health economics, are fairly representative for major advances and trends within the field. The analysis is limited to articles (5,904 in total); other materials such as editorials and reviews are not part of the dataset. The dataset was downloaded from Web of Science on 13 of April 2022.

For the purpose of analysing and visualising the bibliometric data we use the software Vosviewer [Van Eck and Waltman, 2017]. It uses relational data, such as co-authorship, to render network visualisations in which connected entities form connections (lines) and clusters (colouring). Hence, connections are visualised through lines, while entities having a stronger connection than expected (given their overall connectedness) also are grouped in clusters. The same principles apply to the co-word visualizations, which are bases on word proximity in titles and abstracts. For example, the title “Publishing in Health Economics” generates a link between “publishing” and “Health Economics”, and if several articles use the same words in titles or abstracts this is illustrated by them being projected in close proximity on the map. Frequent words with little meaning, like “and”, are excluded using a “stop list” which omits a set of common words.

Table 1 provides an overview of our dataset. It gives summary statistics for the variables that are available for each publication: the publication year, the origin of the individual authors, the total number of authors as well as the journal in which the paper has been published. It becomes apparent in Table 1 that the two journals JHE and HE dominate academic publishing. At 97.6 per cent, this domination is almost complete in the 1994-2007 period – but also after 2007 these two journals represent the majority (68.8 per cent) of all papers.

<table>
<thead>
<tr>
<th>Variable</th>
<th>MEAN</th>
<th>S.D.</th>
<th>MIN</th>
<th>MAX</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
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<td>7.1</td>
<td>1994.0</td>
<td>2021.0</td>
<td>5,904</td>
</tr>
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<td>0</td>
<td>1</td>
<td>5,904</td>
</tr>
<tr>
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<td>0.39</td>
<td>0</td>
<td>1</td>
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</tr>
<tr>
<td>German Author</td>
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<td>1</td>
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<tr>
<td>Total Authors</td>
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</tr>
<tr>
<td>Total English Authors</td>
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<tr>
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<td>0.50</td>
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<tr>
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<td>0</td>
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<tr>
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<tr>
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<td>0</td>
<td>1</td>
<td>5,904</td>
</tr>
</tbody>
</table>

3. Publishing in Health Economics – Nordics versus the World

Figure 1 gives an overview of how our analysis sample evolves over time. The top curve shows the total number of papers published in any of the five journals in a year, and the dashed curve shows the proportion of these papers that can be attributed to Nordic authors. The addition of
new journals (EJHE in 2000, IJHEM in 2001 and AJHE in 2015) has, in combination with a general tendency for journals to publish more papers, led to a large increase in the total number of papers published. In the years around 2010, around 250 papers were published each year; a decade later, that number had increased to 350.

Contributions of Nordic authors have moved largely in parallel to these general trends. This maybe not visible in Figure 1, but becomes clear when we zoom in on the proportion of papers from Nordic authors in Figure 2. In that figure we compare the proportion of papers with at least one Nordic author to the corresponding statistics for English and German authors. Since the late 1990s, the share of papers with Nordic authors has been relatively stable at 5-10 per cent. The share of papers authored by English academics has been declining from a high level in the late 1990s and early 2000s – whereas Germany has seen tremendous growth in research outputs since around 2000. Still, the Nordic countries continue to perform relatively well in comparison to these other countries: in 2021, Nordic authors were responsible for 7.6 per cent of total publications, German authors for 7.1 per cent, and English authors for 11.5 per cent. Considering the combined population of 27 million in the Nordic countries, it is clear that these countries are much more productive than Germany (population 83 million) but also slightly more than England (population 56 million). A fair assessment would also need to take into account that there are potential (dis-) advantages associated with the publishing language [Henshall, 2018] or with the fact that the two oldest journals – Health Economics and the Journal of Health Economics – used to draw most of their editors from the Anglo-Saxon countries.

Figure 1: Papers Published in Five Health Economics Journals 1994–2021.

Note: Own calculations based on the analysis sample. Vertical lines represent the introduction of new journals. The first year of indexation is 2007 for EJHE and 2015 for IJHEM. For papers with several nationalities among the authors, each nationality is assigned a fraction corresponding to its share of total authors.

3 The journals do not always become indexed in the year that they are introduced: EJHE is indexed from 2007; IJHEM from 2015 and AJHE right from the start in 2015.
Next, we consider the propensity to publish in certain journals over time. Figure 3 shows the number of papers published in different journals in four chosen years; distinguishing the contributions of Nordic authors from the rest. It becomes clear that Nordic researchers have a roughly equal propensity to publish in the different journals, with the notable exception of the American Journal of Health Economics, which tends to publish a much smaller proportion of papers by Nordic authors. In addition, Nordic authors seem to have a slight preference for publishing in the JHE and the EJHE rather than in Health Economics.

Finally, we look into trends in the number of authors per paper. Figure 4a shows the average number of co-authors of papers written by Nordic authors compared to the rest of the World. It is clear that Nordic publications follow a common trend with the rest of the World and that occasional deviations are due to the small sample of Nordic papers. The period we consider is characterised by a continuous trend toward ever larger numbers of authors: in 1994 the average was 2 authors per paper; in the most recent year we consider, it is well above 3.

**Figure 2: Papers Published by Country of Residence 1994–2021.**

![Graph showing the number of papers published by country from 1994 to 2021, with trends for England, Germany, Nordic countries, and all countries combined.

*Note:* Own calculations based on the analysis sample. For papers with several nationalities among the authors, each nationality is assigned a fraction corresponding to its share of total authors.

In Figure 4b we take a closer look at this shift toward more authors per paper. Since Figure 4a suggests there are no relevant differences between Nordic countries and the rest of the World, we study the entire sample and contrast the early years (1994–2007) to later years (2008–2021). Clearly, the trend is driven by a strong reduction in the share of single-authored papers and papers with two authors: in the early period, two-thirds of papers were authored in these constellations, whereas in the later years, it is less than half. Conversely, any number of authors from three and above has become more common in the later period.
Figure 3: Papers Published by Journal 1995–2020.

Note: Own calculations based on the analysis sample. For papers with several nationalities among the authors, each nationality is assigned a fraction corresponding to its share of total authors.

Figure 4: Number of Authors per Paper 1994–2020.

Note: Own calculations based on the analysis sample. For papers with several nationalities among the authors, papers with a majority of Nordic authors are defined as Nordic papers.

4. Topics in Health Economics

Figure 5 displays patterns of co-occurrence of words in abstracts of papers published by Nordic authors during the 1994-2007 period. The figure distinguishes three broad thematic fields: the largest one, depicted in red, appears to be concerned with methods for economic evaluation (QALY, preference, health state, etc); the distinct group, in green, deals with the different agents
of the health care system, and their decisions (patient, physician, information, etc.). The third group, in blue, is smaller and somewhat vague, but appears to be focused on ethical concerns and distributional issues (equity, distribution).

In order to get a better understanding of how Figure 5 is generated, consider Tor Iversen’s 2004 paper on the effects of patient shortages on the incomes and patient lists of general practitioners [Iversen, 2004]. The paper is highly influential within the literature on physician behaviour and deals with an identification problem inherent in the physician-induced-demand literature: that it is challenging to empirically distinguish demand inducement from the effects of patient access. Exploiting information on preferred list sizes of physicians, the paper delivers clear evidence that a patient shortage leads to increased treatment intensity for listed patients. The abstract of Iversen [2004] contains the words ‘cost’, ‘demand’, ‘effect’, ‘income’, ‘information’, ‘Norway’, ‘patient’ and ‘physician’ and is hence firmly integrated in the green cluster of the figure.

Figure 5: Co-Word Analysis, Nordic Contributions, 1994-2007.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. Words included in the figure are terms used in abstracts; for a term to qualify, it is necessary that it is used 10 times or more in the dataset. The size of nodes represents their relative frequency in the sample. Hence, a more frequently used word is represented by a larger circle. The position of circles, as well as the connections between nodes, is based on their use in abstracts. Concepts which are frequently used together (e.g. "country" and "health care") are depicted closer to each other. Frequent terms, but non-specific terms, such as "analysis", "report" or "study" are excluded using a "stop word-list".
In the later period, depicted in Figure 6, two of the previous thematic clusters can still be detected: the economic evaluation cluster (now in green) includes terms like cost-effectiveness analysis; value; and QALY. Another cluster, in red, appears to be dealing with economic decisions among agents within the health care system: hospital; service; physician; fee. The third cluster, in blue, is new in this later period, and it seems to reflect the emergence of the “credibility revolution” in health economic research [Angrist and Pischke, 2010]: terms like ‘causal effect’; ‘reform’; ‘association’ and ‘relationship’ suggest that a lot of effort goes into estimating causal effects of natural experiments; something which appears to have been largely absent in the early period.

Figure 6: Co-Word Analysis, Nordic Contributions, 2008-2021.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. Words included in the figure are terms used in abstracts; for a term to qualify, it is necessary that it is used 10 times or more in the dataset. The size of nodes represents their relative frequency in the sample. Hence, a more frequently used word is represented by a larger circle. The position of circles, as well as the connections between nodes, is based on their use in abstracts. Concepts which are frequently used together (e.g. "Life year" and "quality") are depicted closer to each other. Frequent, but non-specific terms, such as "analysis", "report" or "study" are excluded using a "stop word-list".

Of course, Nordic researchers do to some extent follow international trends regarding research questions as well as research methods. In the Appendix we provide the same co-word analysis for all publications in the selected journals (Figure A1 and Figure A2). A comparison reveals that the main clusters are indeed very similar, however a) the health economic research from other countries includes “health insurance” as one important topic in both periods, and b) the “credibility revolution” focusing on causal inference appears to have happened earlier outside the Nordic countries, or at least terms like ‘determinant’, ‘policy’, and ‘effect’ are a
prevalent cluster already in the early period. These are the general patterns, but the omission of certain terms in the co-word analysis does not imply they are completely absent in research. For example, Michael Hoel, Tor Iversen and some coauthors have studied implications of genetic testing for health insurance markets [Hoel and Iversen, 2002, Hoel et al., 2006]; these contributions are however too few to make insurance enter the visualisations for Nordic countries.

5. Co-Authorship Networks

In what follows, we study networks of co-authorship relationships with a main focus of the betweenness centrality of countries or individuals [Freeman, 1977]. Betweenness centrality measures the amount of influence a node has over the flow of information in the graph. The measure is used to identify nodes that serve as a bridge between various parts of a graph. The algorithm calculates unweighted shortest paths between all pairs of nodes in a graph. Betweenness centrality quantifies the number of times a node acts as a bridge along the shortest path between two other nodes. It was introduced as a measure for quantifying the control of a human on the communication between other humans in a social network.

Figure 7 displays prominent co-authorship links between countries in the early (1994-2007) period. The figure includes countries with sufficient contributions. The Nordic countries are clearly clustered in vicinity to each other; however, their cluster is not exclusively Nordic since there are also strong ties to a number of Mediterranean countries. Norway stands out a little bit by having stronger links than the rest to Western Europe and to Anglo-Saxon countries.

The situation in the later period, pictured in Figure 8, is quite different. Regarding the overall pattern, the most striking differences are a) that the network has become more coherent, with more connections between countries in general, and b) that this increased intensity of links has reinforced the Anglo-Saxon countries’ central position in the network. This is remarkable considering what was found in Figure 2 which showed that the share of English contributions has been in decline.
Figure 7: Co-Authorship Links Between Countries, 1994-2007.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. Countries with 1 or more occurrences (authors) are represented in the map. The size of nodes represents their relative frequency in the sample while position and connections of a of circles represent links in the form of co-authorship relations. Hence, a paper co-authored by one author from Norway, and one form Sweden will result in a link between the two. A few nodes have not been identified with country names to avoid overlapping labels. For example, the red node between Canada and England is Australia.
Figure 8: Co-Authorship Links Between Countries, 2008-2021.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. Countries with 5 or more occurrences (authors) are represented in the map. The size of nodes represents their relative frequency in the sample while position and connections of a of circles represent links in the form of co-authorship relations. Hence, a paper co-authored by one author from Norway, and one from Sweden will result in a link between the two. A few nodes have not been identified with country names to avoid overlapping labels. For example, the red node to the left of France is Spain. The red node to the left of England is The Netherlands, while the red node just above England is Germany.

As regards the Nordic countries, the pattern remains that Denmark, Sweden and Finland are somewhat more tightly connected between themselves than to Norway. The Mediterranean countries are now less closely linked to the Nordic countries, and instead several countries in Central and Eastern Europe have appeared as important partners for co-authorships.

When it comes to co-authorship relationships between individuals, an interesting restructuring can be observed between the two periods. Figure 9 shows the situation in the early period. Individuals with co-authorship links between each other are shown in distinct colours; co-authorship links between such clusters are explicitly displayed with connections in the figure. It becomes clear that the early period is characterised by a couple of researchers in each country having a central position as nodes around which clusters are built: Unto Häkkinen in Finland; Ulf Gerdtham and Magnus Johannesson in Sweden; Dorte Gyrd-Hansen in Denmark; Jostein Grytten and Tor Iversen in Norway.
In Figure 9, we have chosen a visualisation putting emphasis on names and less emphasis on connections between them. In the appendix Figure A3 we present an alternative visualisation which emphasises connections and thus gives a better overview of the network – at the expense of losing some prominent names.

**Figure 9:** Individual Co-Authorship Relationships, 1994–2007.

*Note:* Own calculations based on the analysis sample using the VosViewer software (Van Eck and Waltman 2017). All co-authorship relations are analysed, however the software only visualizes those that are part of the larger network. The size of nodes represents their relative frequency in the sample while position and connections of circles represent links in the form of co-authorship relations. Some names that meet inclusion criteria are not visible in the figure. An interactive map of all names may be found at [https://tinyurl.com/29cd3f8u](https://tinyurl.com/29cd3f8u).

When it comes to the late period, the picture is quite different. Figure 10 is characterised by a larger number of co-authorship links in general, but also by greater dispersion. It is now much more difficult to identify the key players who are of central importance for co-authorship relationships. This suggests that research in health economics has become less hierachical – maybe as a result of increased interaction between researchers at different levels of seniority across
institutions. This tendency to a greater dispersion is also visible in the increased number of international scholars that appears in the map of Nordic co-authorship relationships.

As for the early period, we present an alternative visualisation in the appendix Figure A4.

6. Discussion

Based on a sample of 5,904 research articles published in five international peer reviewed journals for health economics over the 1994–2021 period, we have made an attempt at characterising Nordic research in health economics and how it has evolved over time. Using journal publications from select journals in order to infer something about how a research area is evolving suffers from a number of important limitations. Still, we believe that our analysis has delivered a number of important insights.

First, it is clear that Nordic researchers remain an established part of the international research community throughout the period we consider: their proportion of papers published in the five journals we consider is very stable across the years, and the productivity relative to the population compares favourably to that of England or Germany. Nordic researchers are visible in all the main journals we consider, with the possible exception of the AJHE.

Second, even if the Nordic countries are tightly linked through co-authorship relationships, there is not an exclusive Nordic cluster in either the earlier (1994-2007) or in the later (2008-2021) period. Nordic authors are apparently equally open to doing joint work with researchers from other countries, and this group of other countries has changed a bit over the years: the early period is characterised by close links to Mediterranean countries whereas some Central and Eastern European countries gained prominence in the later period. The English-speaking countries remain important partners for co-authorship throughout.

Third, images of individual-level co-authorship networks suggest that the research landscape has become more decentralised. The early period is characterised by a few “big names” being central nodes which maintain coauthorship relationships with a large number of colleagues. In the later period, these influential researchers are still present, but their degree of centrality has been reduced.

The latter point could be due to authors making up the central nodes in the first period being good mentors and research leaders, who promote younger colleagues and enable them to build their own independent research networks. We would like to illustrate this point with reference to Tor Iversen of the University of Oslo. Iversen is one of the most prominent researchers, in terms of productivity and betweenness centrality, in both periods. Just as for the other senior researchers present in Figure 9, his centrality does not increase in the second period. Such a superficial consideration of the figure would however understated Iversen’s legacy. What also happens in Figure 10 is that a number of more junior researchers enter the network, who have benefited in various ways from Iversen’s mentoring and support. This group of people includes his former doctoral student Eline Aas, it includes a number of people with whom he has had joint research projects (e.g. Tron Moger, Hans Olav Melberg, Tor Helge Holma’s, and Luigi Siciliani), and it includes a number of researchers (e.g. Anna Godøy and Martin Karlsson) who have been invited to work in part-time positions at the Department of Health Management and Health Economics at the University of Oslo. Not all of these collaborations have generated joint publications, and some of them have generated publications in journals that are not included in this study. But they have
provided this next generation of researchers with great opportunities; and these opportunities manifest themselves in a prolific research output further down the line.

**Figure 10:** Individual Co-Authorship Relationships, 2008–2021.

*Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. All co-authorship relations are analysed, however the software only visualizes those that are part of the larger network. The size of nodes represents their relative frequency in the sample while position and connections of circles represent links in the form of co-authorship relations. Some names that meet inclusion criteria are not visible in the figure. An interactive map of all names may be found at [https://tinyurl.com/29cd3f8u](https://tinyurl.com/29cd3f8u).*

This observation illustrates an important point regarding the method: a great leader in research might erode their own measured influence by promoting their students’ ability to build their own independent networks. In this sense, the analysis represents a very narrow view of influence in the academic community. On the other hand, the outcomes delivered in this analysis might well be considered as inputs of an analysis of academic genealogy. Used in this way, the
data would probably give a very accurate representation of who the most influential leaders are. Such an analysis is, however, beyond the scope of this article.

References


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Appendix

Figure A1: Co-Word Analysis, All Contributions, 1994-2007.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. Words included in the figure are terms used in abstracts; for a term to qualify, it is necessary that it is used 20 times or more in the dataset. The size of nodes represents their relative frequency in the sample. Hence, a more frequently used word is represented by a larger circle. The position of circles, as well as the connections between nodes, is based on their use in abstracts.
Figure A2: Co-Word Analysis, All Contributions, 2008-2021.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. Words included in the figure are terms used in abstracts; for a term to qualify, it is necessary that it is used 100 times or more in the dataset. The size of nodes represents their relative frequency in the sample. Hence, a more frequently used word is represented by a larger circle. The position of circles, as well as the connections between nodes, is based on their use in abstracts.
Figure A3: Individual Co-Authorship Relationships, 1994–2007.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. All co-authorship relations are analysed, however the software only visualizes those that are part of the larger network. The size of nodes represents their relative frequency in the sample while position and connections of circles represent links in the form of co-authorship relations.
Figure A4: Individual Co-Authorship Relationships, 2008–2021.

Note: Own calculations based on the analysis sample using the VosViewer software [Van Eck and Waltman, 2017]. All co-authorship relations are analysed, however the software only visualizes those that are part of the larger network. The size of nodes represents their relative frequency in the sample while position and connections of circles represent links in the form of co-authorship relations.