Why you should read this article:

- To familiarise yourself with the aims of the Royal College of Nursing (RCN) fellowship award
- To understand how bibliometrics can be used to analyse scholarly publications
- To recognise how RCN fellows have contributed to advancing the nursing profession and improving healthcare

An enduring legacy: contributions of Royal College of Nursing fellows to nursing science

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Citation
Benton D, Tierney A, Watson R, McCourt K (2020) An enduring legacy: contributions of Royal College of Nursing fellows to nursing science. Nursing Standard. doi: 10.7748/ns.2020.e11584

Peer review
This article has been subject to external double-blind peer review and checked for plagiarism using automated software

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Conflict of interest
None declared

Accepted
2 June 2020

Published online
September 2020

Abstract

Background The Royal College of Nursing (RCN) initiated a fellowship programme in 1976 as a means of recognising outstanding registered nurses who have demonstrated a commitment to advancing the art and science of the profession and the improvement of healthcare.

Aim To conduct a bibliometric analysis of the scholarly output of RCN fellows, thereby documenting their coverage, connectivity and contribution to the indexed professional literature.

Method This study used a mixed-methods approach, analysing publicly available data to identify and report thematic and quantitative measures of the scholarship of fellows through the application of bibliometric analysis.

Results In total, 193 fellowships were awarded between the inception of the scheme in 1976 and 2019. Collectively, fellows have 9,336 publications indexed in Scopus and have accrued 131,408 citations resulting from 116,961 citing articles. Overall, 166 fellows produced one or more indexed articles. The 166 fellows engaged 9,908 co-authors in the production of this work from a total of 72 countries or territories. The work of the fellows covers 24 themes that include major healthcare priorities and a variety of clinical settings, as well as themes essential to the advancement of the nursing profession and the quality of services.

Conclusion While there are limitations to this study in terms of its coverage of the indexed database, it has established a useful baseline of the published scholarship contributions of RCN fellows. The contributions made reflect the original intent of the RCN fellowship award – to acknowledge nurses who have demonstrated a commitment to advancing the art and science of the profession and the improvement of healthcare.

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Keywords

audit, data collection, literature search, mixed methods, quantitative research, research, research methods, service improvement

Background

The Royal College of Nursing (RCN) in the UK initiated a fellowship programme in 1976 as a means of recognising outstanding registered nurses who have demonstrated a commitment to advancing the art and science of the profession and the improvement of healthcare. Fellowship of the RCN entitles recipients to use the post-nominal letters 'FRCN' and is the highest award that can be granted to RCN members (RCN 2020a). Recipients may work in clinical practice, or in the managerial, education, research or policy domains of nursing. In addition, the RCN also grants honorary fellowships to nurses who

Acknowledgement
The authors wish to acknowledge and thank professor Daniel Kelly, University of Cardiff, Wales, for his helpful comments and suggestions in the drafting of this article

are registered outside of the UK, as well as non-nurses, for example clinicians who work with nurses on topics of mutual interest such as child health, and who have demonstrated a positive effect on nursing or healthcare.

Fellows often contribute to RCN policy debates or contribute by serving on various committees and taskforces, and by working on the production of a range of guidance documents. Additionally, since 1986, several of the fellows have contributed to the RCN's oral history collection by telling their life stories, which provide an insight into their personal experiences of nurse training and clinical skills, and which are stored digitally at the RCN archive in Edinburgh, Scotland (RCN 2020b).

While RCN fellowship is awarded for a wide range of contributions, many fellows regularly contribute to the literature. Some fellows – particularly those who are recognised for their clinical, managerial or policy contributions – produce guidelines or exemplars of best practice, or publish in the grey literature. However, up until this point, no systematic analysis of the corpus of published and indexed material has been conducted. As nurses around the world celebrate 2020 as the International Year of the Nurse and Midwife, it seemed appropriate to distil the work of the RCN fellows to identify the quantity and breadth of their contribution.

Aim

To conduct a bibliometric analysis of the scholarly output of RCN fellows, thereby documenting their coverage, connectivity and contribution to the indexed professional literature.

Method

This study used a mixed-methods approach, analysing readily available data to identify and report thematic and quantitative measures of the scholarship of RCN fellows through the application of bibliometric analysis. It was not the intention of this study to examine the specific and detailed output of individual fellows because this would require a more nuanced approach (Benton 2017).

Bibliometrics

Bibliometrics is a method used to analyse scholarly publications and identifies a range of characteristics, including the general themes contained within the published work and the existence or non-existence of collaborative networks of scholars, as well as a wide range of other measures (Ball 2017).

While bibliometrics has been used by information and library scientists for several years, it is only within the past decade that it has been used extensively by nurse researchers (Smith and Hazelton 2011). There is a wide range of measures both at an aggregate level of analysis (across the population of interest, in this case the fellows), and an individual level (the authors or specific fellows), that can be used to conduct bibliometric analysis. However, only aggregate metrics relevant to this study will be covered in detail in this article.

In the past, rudimentary analysis of individual scholarship has been conducted to quantify the output of nurse academics in the UK, Canada and Australia (Hack et al 2010, Thompson and Watson 2010, Hunt et al 2011). All of these previous studies have examined metrics relating to individuals, but this study encompasses general individual and population measures.

Data collection and analysis

The RCN maintains a roll of honour of fellows and honorary fellows. For the purpose of this study, the analysis was limited to individuals who have been awarded full fellowship of the college, with honorary fellows not included (RCN 2020c).

There are three potential aggregate sources that could be used to extract bibliometric data relating to the RCN fellows and the citation of their work – Scopus, Web of Science or Google Scholar. Of the three, Scopus has the most comprehensive coverage of nursing-related content, and although it requires individual scholars to ensure their entries are up to date, the authors selected it as the database of choice for extracting the necessary information.

There are several challenges associated with indexing databases such as Scopus, including variations in the spelling of author names or institutional attribution (Jacso 2008, Hack et al 2010). Additionally, on occasion, work published by an author with a name similar to the author of interest can be misattributed, so careful data cleansing is necessary. While Scopus has the most comprehensive coverage of nursing content, it does not index all of the nursing material produced. Some journals and grey literature are not indexed in the Scopus database; therefore, the analysis presented in this article was an under-representation of the scientific contribution of fellows. Nevertheless, the study provides a valuable starting point.

The study focused on five variables of interest for each fellow – the total number of indexed publications, the number of citations received, the number of citing articles, the *h*-index (highly cited index) and the number of co-authors. Using the summary analysis function of Scopus, these five variables of interest were recorded in a tabular format for each fellow to calculate the basic aggregate statistics of median, average (mean) and maximum value for each variable.

The *h*-index was developed by Hirsch (2005) as a means of quantifying the aggregate effect of an individual's scholarship and is increasingly used in the academic sector to assess the output of researchers (Thompson and Watson 2010). The *h*-index is calculated based on both the number of articles published and the frequency of the citation, and is insensitive to the potentially distorting influence of a small number of highly cited works (Watson et al 2016).

Several authors have offered suggestions on the importance of either the number of citations that an article receives, or the *h*-index of the author as a means of identifying the most prolific and impactful scholars (Hack et al 2010, Thompson and Watson 2010). These authors have noted that the cut points (the numerical values that represent boundaries between categories) that determine what constitutes a 'good' number of citations or *h*-index may vary

between disciplines, roles within the same discipline or even the subtopics being studied. One way to objectively assess such data is to use Jenks' natural breaks analysis, which identifies natural breaks in the data to ascertain if there are naturally occurring cut points (Jenks 1967, Moffitt 2019).

In addition to the descriptive statistics, multivariate cluster analysis was conducted to determine whether the fellows comprised a connected scholarship community (co-author analysis of authorship). To achieve this, the software package VOSviewer, which was developed at the University of Leiden in the Netherlands by van Eck and Waltman (2010), was used. This software examines the bibliographic data relating to each article and examines the co-authors of individual fellows. A visualisation of the co-authors' network is then displayed in the form of a cluster diagram, with individuals who regularly work with each other allocated to a colour-coded cluster. However, the physical location of an author is calculated based on the relationships between all authors and co-authors and consequently individuals can be 'stacked' on top of one another, resulting in only the uppermost author being visible on a printed image. In large datasets such as the one used in this study, the consequence is that when a two-dimensional cluster diagram is displayed by the software, some authors' names are obscured by their peers. While it is not ideal that the visual representation of the co-authors' network obscures the work of some fellows at the expense of others, this is an inherent limitation of the software, because it seeks to present an overview of the fellows' collective work. When using the VOSviewer software, it is possible to zoom into and rotate the image to view a particular individual, but this will then obscure others.

The VOSviewer software also enables the frequency of co-authorship to be set. Callon et al (1983) stated that a minimum of three articles is sufficient to identify regular co-authorship. Furthermore, by examining the co-author's country of affiliation, the extent of any network of collaborators beyond the UK can also be displayed.

To ascertain the general themes associated with the work of the fellows, a co-occurrence analysis of author keywords was conducted. A co-occurrence analysis examines the keywords that the author has allocated to an article. The VOSviewer software examines the most frequently occurring keywords and clusters them together based on their co-occurrence within articles. As a result, clusters of commonly occurring keywords are generated, then mapped as an image. Closely related keywords are located near to each other and non-related words are located further apart. These keyword clusters can contain a mixture of research methods, the populations being studied as well as the subject matter under investigation. To summarise the content of the keyword clusters, each of them was reviewed independently by the authors of this article and a brief title and succinct description was generated for each cluster. Having completed this work independently, the authors compared their results and where there were differences in interpretation, these were discussed until agreement was reached.

After parsing the data to identify commonly occurring terms and the relationships between them, a visualisation of the relationship between the variable of interest is constructed and displayed by the VOSviewer software. The more related the concepts, authors, countries or keywords are to one another, the closer they are located on the visualisation. The more prolific a topic, author or country is, the larger the circle drawn on the mapped image. Connections marked by lines between the circles on the mapped image display the relationships between the variables being studied; the thicker these lines, the stronger the connection between the two variables.

Ethical approval

The study analysed data obtained from a publicly available database and used a secondary analysis of literature, therefore no ethical approval was required. However, for the purposes of courtesy, RCN fellows were informed in advance that the analysis was being undertaken.

Results

RCN fellowships were awarded for the first time in 1976, with the number of fellowships awarded each year ranging from none in 2005, to 11 in 2014. Data from the list of 193 fellows (1976-2019) was extracted from Scopus on 12 January 2020. Collectively, the fellows had a total of 9,336 publications indexed in Scopus, which accrued 131,408 citations resulting from 116,961 citing articles. It was identified that 166 fellows produced one or more indexed articles, and they engaged 9,908 co-authors in the production of this work. Table 1 provides a synopsis of fellows' descriptive statistics calculated across the variables of interest (indexed publications, citations, citing articles, *h*-index and co-authors).

By applying Jenks' natural breaks analysis to the data set, using four progressive levels related to the fellows' productivity (entry level, well-established level, excellent level and exceptional level) (Hack et al 2010), numerical ranges were calculated based on grouping the data from all 193 fellows into four clusters for each of the five variables of interest. The Jenks' natural breaks analysis of fellows'

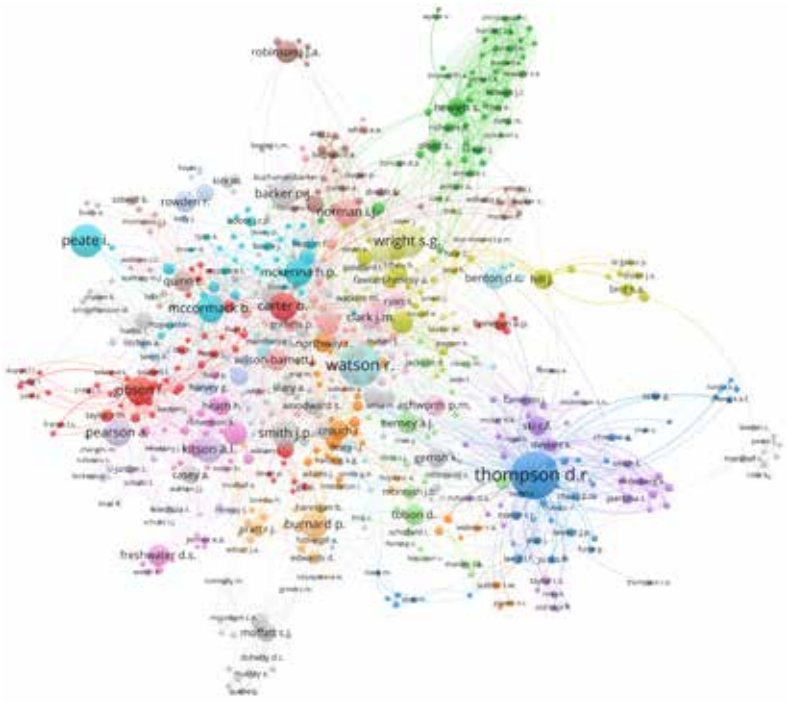
Table 1. Synopsis of fellows' descriptive statistics calculated across the variables of interest

	Indexed publications	Aggregate citations	Citing articles	*h*-index	Co-authors
Median	17	30	28	3	7
Average (mean)	48	681	606	7	51
Maximum value	632	16,289	12,708	57	1,071

Table 2. Jenks' natural breaks analysis of fellows' indexed publications, aggregate citations, citing articles, *h*-index and co-authors

Level of productivity	Indexed publications		Aggregate citations		Citing articles		*h*-index		Co-authors	
	Range	Number of fellows	Range	Number of fellows	Range	Number of fellows	Range	Number of fellows	Range	Number of fellows
Entry level	0-49	135	0-1,057	163	0-961	164	0-4	114	0-73	153
Well-established level	52-142	42	1,302-3,531	20	1,145-2,916	19	5-12	35	81-245	34
Excellent level	150-274	14	4,223-7,397	9	3,270-5,043	8	13-25	26	303-531	5
Exceptional level	470-632	2	16,289-16,289	1	12,228-12,708	2	26-57	18	1071-1071	1

Figure 1. Mapping of the connections between fellows and their co-authors



indexed publications, aggregate citations, citing articles, *h*-index and co-authors is shown in Table 2.

Multivariate analysis

Figure 1 provides a mapping of the connections between fellows and their co-authors. Many of the co-authors are not fellows and, in some cases, come from disciplines other than nursing. As can be seen in Figure 1, this is a highly complex and connected map. Several fellows are prolific authors and have many co-authors. In this two-dimensional image, some fellows are obscured by having the data of other authors placed on top of their own data.

It was identified that the most prolific fellows are David Thompson and Roger Watson, but the larger circles show that there are a significant number of fellows who – over a period of just under 20 years on average – have contributed to nursing scholarship on multiple occasions.

To gain further insight and to visualise an individual fellow's one-step connections (those who the fellow is directly linked to through publishing activity), it is possible to use the VOSviewer software to identify a fellow's network of co-authors by clicking on their name, which will then detail their one-step network. For example, Figure 2 shows the one-step co-author network of David Thompson's Scopus indexed work. Authors who are part of the same cluster have the same colour and form a network that routinely works on related issues.

Co-authorship analysis of collaborations by country yielded a complex and diverse network of 72 country or territory connections. As can be seen from the co-authorship connections by country or territory shown in Figure 3, the most dominant countries or territories (those with the largest-sized circles) are the UK, Australia, the US, Hong Kong and Canada. There are also significant connections to, and among, various European countries. Additionally, there are connections to Middle Eastern and Asian countries, Commonwealth member states, and even the Pacific Islands territory of Wallis and Futuna.

Figure 4 shows a co-occurrence analysis of the connectivity between 893 author-defined keywords that met the minimum frequency requirement of at least three occurrences. These are grouped into 24 keyword clusters comprising 10-67 terms per cluster. Due to the density and overlapping nature of the clusters, which limited the visibility of underlying terms, a detailed co-occurrence analysis of the clusters was conducted and

Figure 2. One-step co-author network of David Thompson's Scopus indexed work

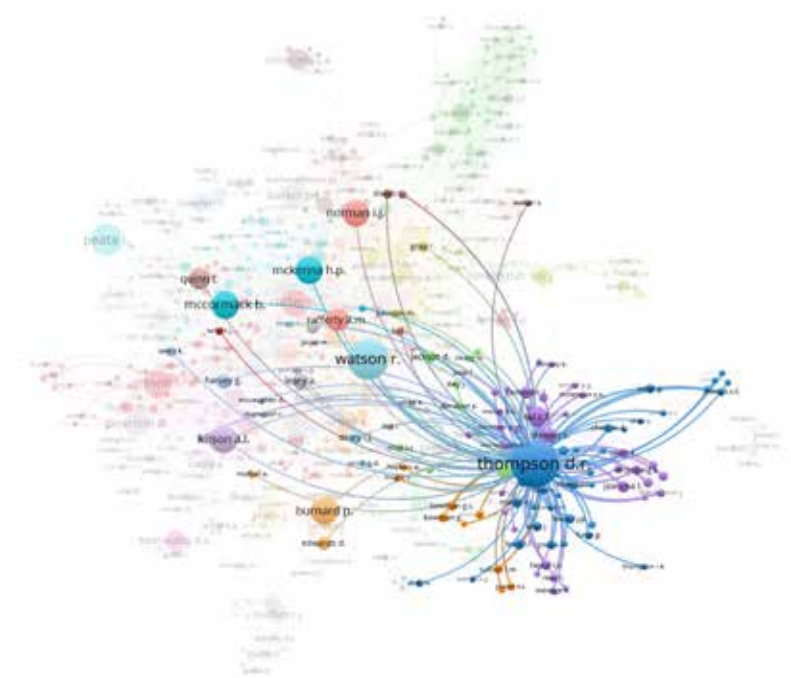
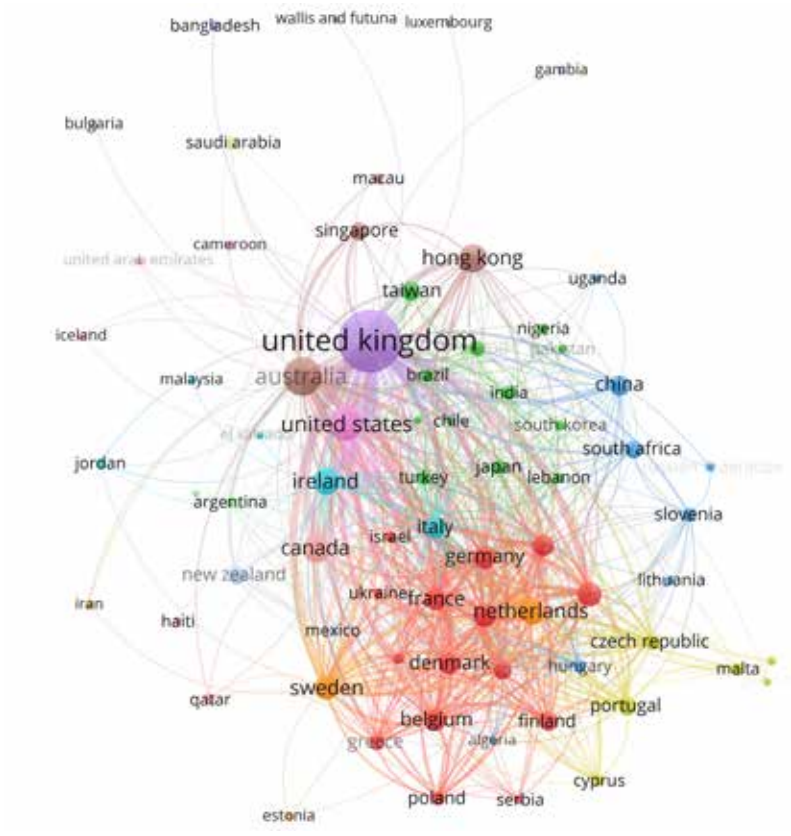


Figure 3. Co-authorship connections by country or territory



is summarised in Table 3. Table 3 provides a brief title and succinct description of each of the keyword clusters from the co-occurrence analysis, which were derived from analysis of the terms included in each cluster.

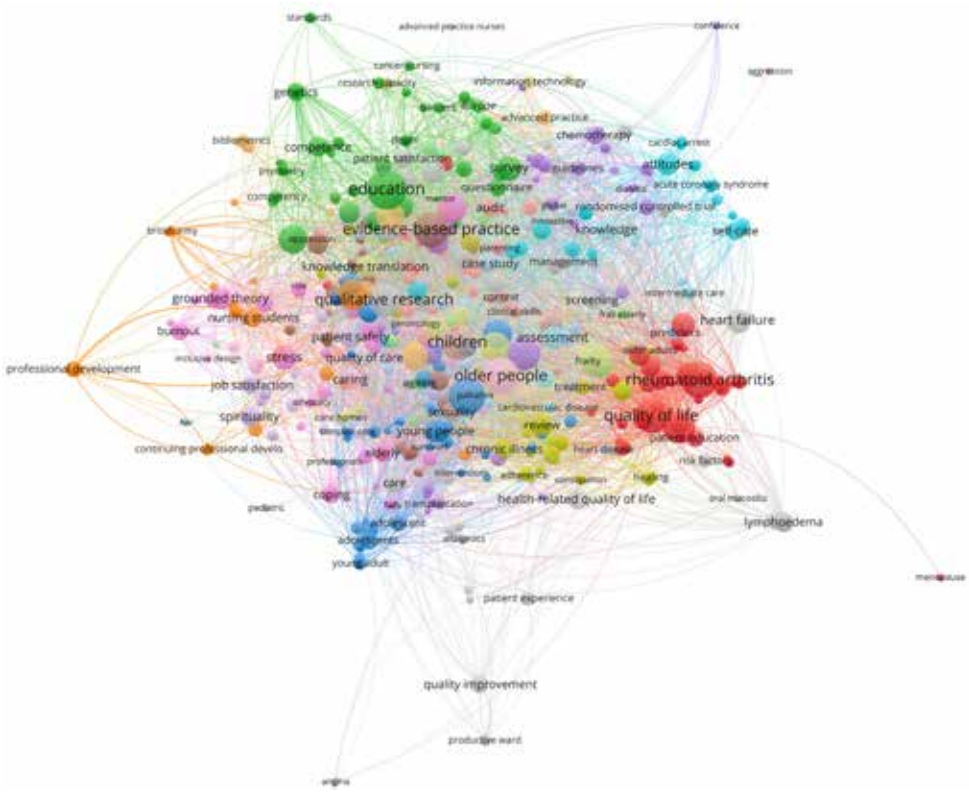
Discussion

The *h*-index is a useful measure of publication productivity and impact that has been used to examine the work of nurse academics in the UK, Australia and Canada (Thompson and Watson 2010, Hack et al 2010, McKenna et al 2018). Each of these studies have reported a set of descriptive measures such as mode, median and average score, and have offered suggestions as to how the *h*-index score or range of scores could be classified with relevance to the group being studied. For example, Hack et al (2010) undertook a citation analysis of research publications by Canadian nursing academics, and suggested that those with an *h*-index of 5-9 should be viewed as having a well-established publication record, those with an *h*-index of 10-14 an excellent record and those with an *h*-index of 15 or more an exceptional record.

This study, unlike the earlier work on academics by Thompson and Watson (2010), Hack et al (2010) and McKenna et al (2018), considered the entire population of fellows and – rather than using an undefined method of determining the cut points – used Jenks' natural breaks analysis, allocating scores to one of four categories. In this study, the *h*-index level ranges identified for fellows were generally higher when compared with Thomson and Watson (2010) (entry level 0-4; well-established level 5-12; excellent level 13-25; and exceptional level 26-57). This could be because Thomson and Watson (2010) examined the published work of UK scholars and some of the RCN fellows were included; therefore, the published work of these fellows has continued to accrue additional citations over the previous 10 years and their *h*-indices have increased.

Furthermore, Bornmann and Daniel (2007) acknowledged that the *h*-index profile differs by discipline, country and career

Figure 4. Co-occurrence analysis of the connectivity between 893 author-defined keywords



level. Therefore, the results of this study should not be viewed as potentially comparable to other groups, but rather as a benchmark for future study of the scholarship profile of RCN fellows and how their scores relate to similar groups such as fellows of the American Academy of Nursing.

Figures 1 and 2 demonstrate that the fellows not only collaborate with each other in the production of scholarship, but also collaborate extensively with other colleagues in nursing and other disciplines. Furthermore, as Figure 3 indicates, fellows do not restrict their collaborative work to colleagues in the UK, but rather have an extensive range of co-authors from multiple countries and territories around the world. Therefore, RCN fellows are part of a global scholarship community, sharing their expertise worldwide, and could be thought of as informal global ambassadors for the RCN.

The extent of these global connections is perhaps surprising based on previous findings by Benton and Ferguson (2017) and Benton et al (2019) who, when examining links between nurse leaders across countries or common interests, identified that such connections were infrequent and weak. However, in their study of how nurse leaders connect, Benton and Ferguson (2014) noted that one factor that supported the development of national and international collaboration was participation in professional associations. The data presented in this study on RCN fellowship supports Benton and Ferguson's (2014) observation that professional association membership positively affects the establishment and sustainability of collaboration across professional networks, nationally and internationally.

In this study, the co-occurrence analysis of keywords used to describe the content of the published work demonstrated the diversity of fellows' expertise. This expertise is closely aligned with major healthcare priorities, covers the entire life course, and relates to a wide range of conditions essential to the delivery of universal healthcare, as well as other topics essential to the attainment of United Nations' sustainable development goals (sdgs.un.org/goals). RCN fellows provide a rich source of knowledge and have extensive connections that contribute to policy development across a variety of highly relevant and contemporary issues. While Table 3 details various high-disease-burden topics such as long-term and non-communicable disease, it also includes care settings and themes that are essential to the advancement of the profession and the quality of services. These topics include professional education, fundamentals of nursing, nurse-sensitive outcomes, evidence-based practice, care left undone, nurse-led care, professional regulation, service development and quality improvement. These topics also demonstrate the future-orientated work of the fellows and that they are committed to advancing the art and science of nursing and the improvement of healthcare.

Limitations

There are four limitations that need to be considered in relation to this study.

First, while Scopus has the most comprehensive coverage of material and offers integrated citation data on indexed articles, it is incomplete because not all peer-reviewed journals are included and on occasion there is a delay in the publication of an article and its subsequent inclusion in the index. As a result, the findings of this study underestimate the contributions made by fellows to the scholarship literature. This has implications for underestimating the extent of the co-authorship networks established and maintained by fellows. It is likely that the fellows have a wider and more extensive national and international network of collaborators than the analysis presented in this article demonstrates.

Second, on occasion Scopus misattributes the work of one individual to another, resulting in either an overestimation or underestimation of a fellow's contribution. By carefully cleansing the data, the authors were able to ensure that articles not authored by a fellow were removed. As a result, the authors do not believe

Table 3. Brief title and succinct descriptions of the keyword clusters from the co-occurrence analysis

Cluster number	Number of keywords	Brief title	Succinct description
1	67	Long-term and non-communicable disease	The management of lifestyle factors such as exercise and diet that can result in long-term and non-communicable disease that can be ameliorated by lifestyle changes
2	67	Professional education	The evidence and university-based programmes that develop research-informed clinical competence and critical thinking
3	60	Life-limiting child and adolescent care	The physical and psychological effects of serious life-limiting conditions on children, adolescents and their family members
4	56	Nurse-sensitive outcomes	The development and use of research-based guidelines to address common conditions that can affect activities of daily living and delay recovery
5	51	Evidence-based practice	The use of a range of approaches to optimise the delivery of care through specialist and advanced nursing practice
6	49	Acute cardiac event treatment	Physical and psychological emergency interventions and services available to support patients who experience acute cardiac events and their families
7	42	Transcultural nursing	The development and implementation of culturally competent practice and awareness of prevalent conditions prevalent in various ethnic groups
8	41	Fundamentals of nursing	The mechanisms used to identify, develop and refine fundamental nursing care and its theoretical basis
9	41	Psychological wellbeing	Factors, resulting potential issues and modes of intervention associated with disturbances in psychological wellbeing
10	38	Nursing policy interests	Diverse nursing policy interests covering the entire life course as well as clinical, managerial and educational-based themes
11	36	Measuring older person's functioning	The wide range of measurement instruments and techniques that can be used to assess the functional abilities of older people
12	34	Interpersonal abuse	Focuses on women and children who may be the subject of physical or psychological abuse and how this can be identified and addressed
13	32	Care of the older person	Physical and psychological issues and needs that are prevalent in the care of the older person
14	32	Factors leading to care left undone	Care setting and other factors to be considered in the delivery and prioritisation of interventions within available resources
15	30	Nurse-led care	Conditions where nurses can take a leading role in assessment, diagnosis and treatment, for example cardiac care, HIV (human immunodeficiency virus), hypertension and sexual health
16	30	Professional regulation	Different nursing roles and how regulation and legislation can support public protection through education, standards and guidance
17	30	Nursing concepts and processes	A wide range of nursing concepts and processes relating to the practice of nursing, including assessment, diagnosis, classification, intervention and evaluation
18	28	Patient-centred long-term care	The provision of person-centred care to older people and those with long-term conditions
19	28	Mental health care	The use of therapeutic interventions – both psychotherapeutic and medicines – including their management and potential iatrogenic effects
20	27	Heart failure	Risk factors and consequences of chronic heart disease and congestive cardiac failure
21	24	Primary and community assessment	Various aspects of risk screening for alcohol and tobacco use as well as detailing primary and community service provision
22	23	Service development	The importance of teamwork, change management and other service development approaches to addressing various common clinical challenges
23	17	Triage	Triage and evidence-based clinical decision-making to prioritise access to services in urgent care settings (emergency departments, general practice, day surgery and out-of-hours provision)
24	10	Quality improvement	A range of methods used to improve quality, efficiency and effectiveness of services including application of research and quality improvement methodologies

that errors in attribution have resulted in any overestimations of fellows' profiles. By completing the two-stage search for authors, the authors of this article believe they have minimised underestimation of fellows' profiles, but they cannot provide a definitive statement on this issue. Given that one of the aims of the Nursing Now (2020) campaign is to ensure that nurses and midwives have an increasingly prominent voice in health policymaking, the RCN may wish to emphasise this issue to the fellows and their membership to ensure that nursing in general, and individual nurses in particular, are fully discoverable through bibliographic searches.

Third, although modern technology can capture data concerning mentions of an individual's work on social media platforms such as Twitter and LinkedIn, this is not a factor that the software used in this study was able to accommodate.

Fourth and finally, this study explored data from indexed sources and as a result has not captured the entirety of contributions made by the fellows, particularly those who work in clinical or policy areas. Based on these limitations, the authors conclude that the findings of this article do not fully document the scholarly impact of fellows, but nevertheless offer an important insight into their interests and connections.

Conclusion

Since the inception of the RCN fellowship award, no attempt to produce a systematic analysis of the scholarship contribution of fellows has been made up until this point. While there are limitations to this study in terms of its coverage, it has established a useful baseline and it is clear that fellows' indexed contributions reflect the original intent of the award, which is to acknowledge nurses who demonstrate a commitment to advancing the art and science of nursing and the improvement of healthcare.

IMPLICATIONS FOR PRACTICE

- The study identifies the current foci of the RCN fellows and for nurses with an interest in working in the areas detailed in Table 3, there is a clearly identified source of mentorship
- Nurses starting their journey in scholarship should examine the work of the fellows to identify topics that they may wish to study further or, through identifying gaps in the literature, find new areas of inquiry
- Bibliometrics is a versatile technique that can be used to explore groups of scholars or domains of practice and can offer valuable insights into the current state of the science, thereby providing direction for those wanting to undertake original research or consolidate findings through systematic reviews and meta-analysis

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