The Laryngoscope

Laryngeal Cancer: Quantitative and Qualitative Assessment of Research Output, 1945–2010

Ronan W. Glynn, MBcHB; Aoife J. Lowery, PhD; Cristian Scutaru, PhD;
Tadhg O'Dwyer, MD; Ivan Keogh, MD

Objectives/Hypothesis: To provide an in-depth evaluation of research yield in laryngeal cancer from 1945 to 2010, using large-scale data analysis, employment of bibliometric indicators of production and quality, and density equalizing mapping.

Study Design: Bibliometic analysis incorporating the Web of Science Database.

Methods: The search strategy employed was as follows; "TS = ((Laryngeal Neoplasm$) OR (Larynx Neoplasm$) OR (Larynx Cancer$) OR (Laryngeal Cancer$))." Author and journal data and cooperation networks were computed following analysis of combinations of countries and institutions that registered cooperation during the study period. Mapping was performed as described by Groneberg-Kloft in 2004.

Results: A total of 8,658 items relating to laryngeal cancer were published over the study period, accounting for 139,700 citations. The United States was the most prolific country, accounting for 28.83% (n = 2,496) of total output. Other prolific nations included Italy (n = 794) and Germany (n = 792). There were 973 items published as a consequence of international cooperation; this practice increased steadily over time and accounted for 15.58% (88 of 565) of output in 2010. There were 1,073 different journals publishing articles on laryngeal cancer, although the top 20 (1.8%) most prolific titles were together responsible for more than 43% of the total output; these were led by *Laryngoscope* (n = 368) and *Head and Neck, Journal of the Scientific Specialties* (n = 364). A total of 24,682 authors contributed to the literature on laryngeal cancer; the leading author by output was Alfio Ferlito (n = 120); Carlo La Vecchia recorded the highest *h*-index (h = 32).

Conclusions: This work represents the first attempt to provide quantitative and qualitative analysis of laryngeal cancer research output, whilst in tandem identifying the key bibliometric benchmarks to which those involved in the production of that output might aspire.

Key Words: Laryngeal cancer, research output, impact factor, bibliometric, h-index.

Levels of Evidence: 5

***Laryngoscope,* 122:1967–1973, 2012**

INTRODUCTION

A number of recent studies have demonstrated the decline in survival rates for laryngeal cancer during the past 30 years.[1–3] In particular, Hoffman et al. demonstrated that laryngeal cancer was unique amongst 24 cancers analyzed in that it demonstrated decreasing survival rates.[3] Despite these trends, the National Cancer Institute spent less than a quarter of a million dollars on laryngeal cancer in 2010 with, for comparison, breast and prostate cancer receiving a combined total of more than $900 million.[4] Given the apparent difficulty that laryngeal cancer appears to have in attracting research funding, it is all the more important that its associated research benchmarks are identified, such that those applying for funding are not compared unfavorably with those applying for funding into areas of larger research appeal such as, for example, breast cancer.

One method through which these issues might be addressed is through the quantitative and qualitative assessment of scientific output, otherwise known as bibliometrics. Bibliometrics was first popularized by Garfield in the 1950s[5] and, as evidenced by a multitude of recent reports,[6–8] the achievement of bibliometric benchmarks has become of paramount importance, as individual scientists and entire research fields increasingly compete for limited amounts of money.

This study thus aimed to provide an in-depth analysis of the quantity and quality of laryngeal cancer research output, whilst simultaneously establishing global bibliometric benchmarks for those contributing to that output. In doing so, we further aimed to examine the geographical distribution of publications on laryngeal cancer and to identify the core titles associated with those publications.

MATERIALS AND METHODS

Data were retrieved from the Web of Science (WOS) Science Citation Expanded database (SCI-Expanded) produced by

From the Academic Department of Otorhinolaryngology, National University of Ireland Galway and Galway University Hospitals (R.W.G., A.J.L., I.K.), Galway, Ireland; Charite University (C.S.), Berlin, Germany; and Department of Otorhinolaryngology, Mater Misericordiae Hospital (T.O.D.), Dublin, Ireland.

Editor's Note: This Manuscript was accepted for publication April 11, 2012.

The authors have no funding, financial relationships, or conflicts of interest to disclose.

Send correspondence to Ronan W. Glynn, MD, Department of Otorhinolaryngology, University College Hospital Galway, Galway, Ireland. E-mail: ronanglynn@doctors.net.uk

DOI: 10.1002/lary.23401

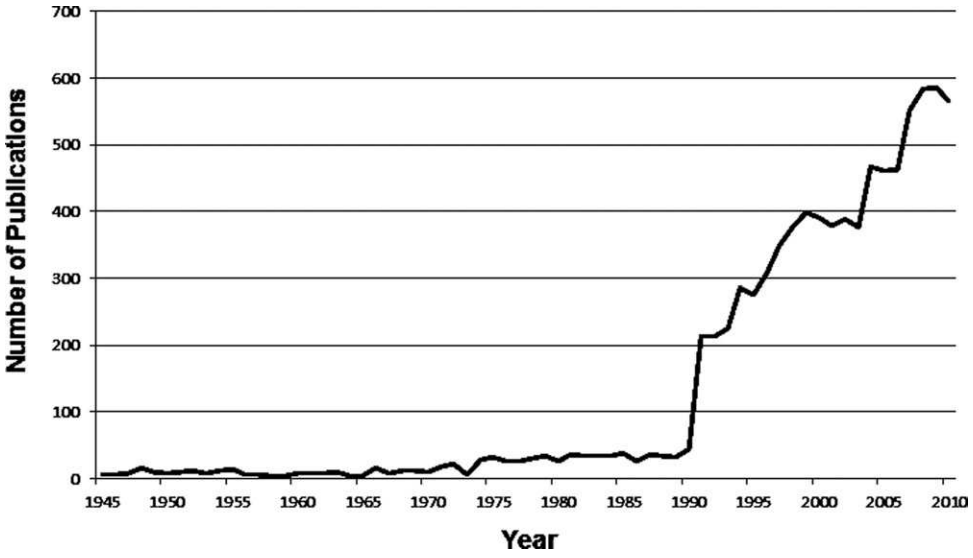

Fig. 1. Research output on laryngeal cancer, 1945 to 2010.

Thomson Reuters. To approximate the overall number of published items on laryngeal cancer, the following search strategy was employed: TS = ((Laryngeal Neoplasm$) OR (Larynx Neoplasm$) OR (Larynx Cancer$) OR (Laryngeal Cancer$)), where TS = topic search and $ = any character. Because this work was designed to assess overall activity in relation to laryngeal cancer, we did not refine our search to include some document types such as original articles or reviews or to exclude others such as letters and editorials. The time span analyzed was 1945 to 2010, inclusive. The search was performed in February 2011, and so 2011was excluded because database entries for this period would not have been complete at the time of the search.

Each item of information downloaded from the WOS was contained in a "data block." Each block was preceded by a tag that gave information about the content of the block (i.e, AU = authors, TI = title, PY = publication year). Software developed at the Charite University in Berlin was then employed to parse the data—each time it found a tag it read the associated data and saved it to a Microsoft Access (Microsoft, Redmond, WA) database; the information was then later transferred to a Microsoft Excel database for analysis. Published items were analyzed using the citation report method as described previously.[9,10] The number of citations per year and the average number of citations per item were assessed, thereby indicating the average number of citing articles for all items in the set. This is the sum of the times cited divided by the number of results found.

Authors with the greatest number of publications, citations, and their associated *h*-indexes were identified. Hirsch explained his *h*-index as follows: "A scientist has index *h* if *h* of his/her Np papers have at least *h* citations each and the other (*Np-h*) papers have no more than *h* citations each."[11] The *h*-index is thus the greatest number of articles that an individual is the author or coauthor of that have each been cited *h* or more number of times. An *h*-index of 6, for example, indicates that an author has six publications, each with at least six citations each, with the remainder of his/her publications having achieved less than six citations.

Journals that had published articles on laryngeal cancer were analyzed relative to both the journal impact factor (IF) and the recently developed Eigenfactor (EF). The former is based on two elements: the numerator, which is the number of citations in the current year to items published in the previous 2 years, and the denominator, which is the number of substantive articles and reviews published in the same 2 years.[12] The EF is calculated based on a complex algorithm that takes into account not only the quantity of citations but also their "quality" by assigning weights to the source of the citations. The full details of the algorithm can be found online.[13]

Mapping was performed as described by Groneberg-Kloft et al. in 2008.[14] Those nations that had contributed output were resized according to one of a number of different variables under study, that is, the average number of citations per item from each country. As part of this resizing procedure, the area of each country was scaled relative to, for example, the total number of items it had published on laryngeal cancer. Specific calculations were based on Gastner and Newman's algorithm,[15] published in 2004. These calculations employ a diffusion equation in the Fourier domain borrowed from elementary physics, which allows variable resolution by tracking moving boundaries.[15,16]

Cooperation analysis was employed to determine bilateral and multilateral cooperation between countries on laryngeal cancer research. A cooperation network between countries was computed by checking all combinations of those countries that registered international cooperation on at least five items over the study period. These data were then saved to a "matrix" or two-dimensional table, and the software then read this matrix and produced a density-equalizing map, which graphically represented these data. The threshold of five articles was set to improve readability.

RESULTS

The total number of papers published during the study period was 8,658. Output increased steadily during the study period, reaching a peak in 2009 (n = 585); more than 60% (n = 5,205) of the total output had been published since the millennium (Fig. 1). These publications were associated with a total of 139,700 citations, giving an average citation rate of 16.13 citations per item published.

Authorship data were analyzed from 1975 onward. There were 24,682 different authors who had been associated with at least one publication on laryngeal cancer during this study period; 17,764 of these had been

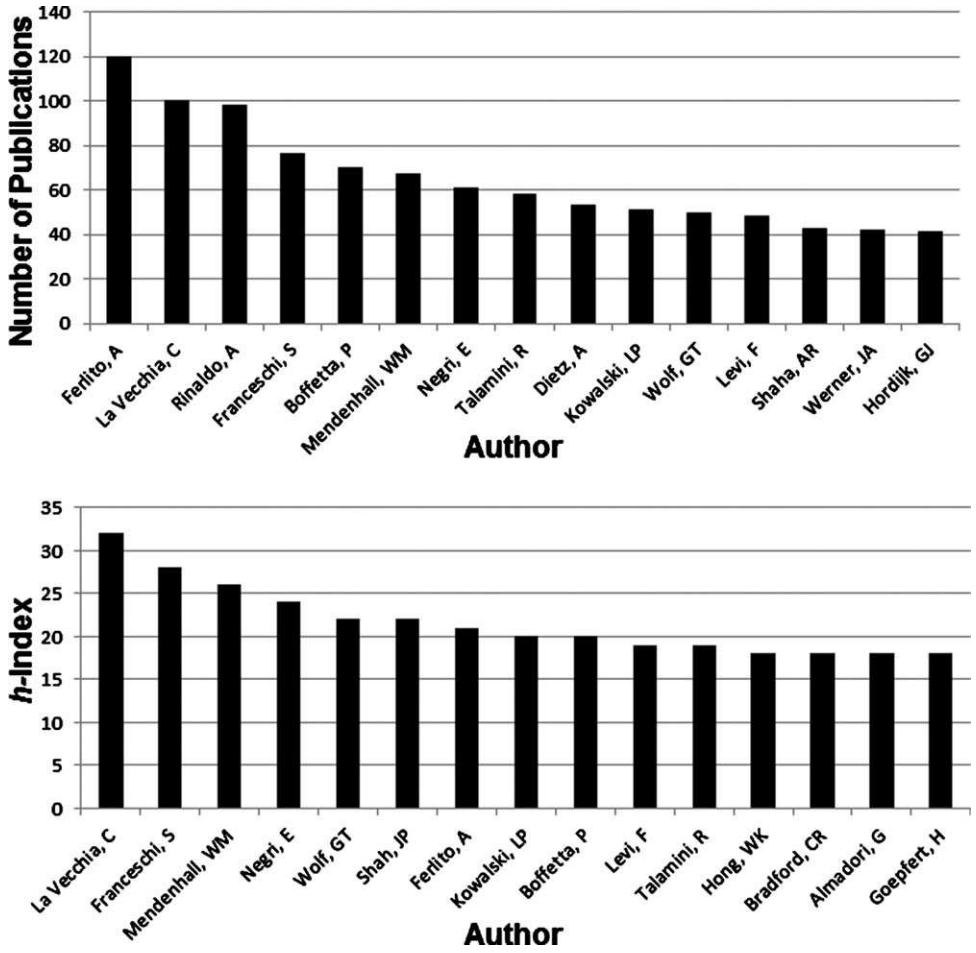

Fig. 2. Leading authors by output and *h*-Index.

associated with just one publication, with 333 authors having published 11 or more publications. These 333 authors were together associated with 6,285 published articles and returned a median *h*-index of 9. The average number of authors per publication increased steadily over the period, from 2.23 in 1975 to 6.49 in 2010. The leading author by output was Alfio Ferlito, with 120 papers published and an associated *h*-index of 21 (Fig. 2). The leading author by *h*-index was Carlo la Vecchia, with an *h*-index of 32 (from 100 papers published). An *h*-index of 18 or above gets one into the top 15 authors on laryngeal cancer, by *h*-index, globally (Fig. 2).

There were 1,073 journals that had contributed to the data on laryngeal cancer during the study period. The 20 most prolific titles, representing just 1.8% of all contributing journals, were together responsible for 43.98% (n = 3,808) of the total output. The leading titles, by output, were *Laryngoscope* (n = 368) and *Head and Neck, Journal of the Scientific Specialties* (n = 364) (Table I). Eleven of these top 20 titles were in the category "otorhinolaryngology" of the Journal Citation Report; other represented subject categories included "oncology" (n = 8), "surgery" (n = 3), "radiology, nuclear medicine and medical imaging" (n = 2), "dentistry, oral surgery, and medicine" (n = 1) and "medicine, research and experimental" (n = 1). The median IF and EF of these titles were 1.61 and 0.01198, respectively. Titles associated with the greatest number of citations were led by the *International Journal of Radiation Oncology* (n = 7,959), *Cancer* (n = 6,810) and *Head and Neck, Journal of the Scientific Specialties* (n = 6,186) (Table I).

A total of 90 different countries contributed to the literature on laryngeal cancer during the study period. The United States was the most prolific country and was associated with 2,496, or 28% of the total output (Fig. 3). Other prolific nations included Italy and Germany, with almost 800 items published each, the United Kingdom (n = 628), and France (n = 544). There were 33 nations that published 30 or more articles on laryngeal cancer during the study period; amongst these, the countries that demonstrated the highest average citation rate per item published were Denmark (32.7), Switzerland (31.5), Sweden (27.5), Belgium (24.9), Norway (24.8), and the United States (24.5) (Fig. 4).

In total, 973 items were produced as a result of international cooperation. This practice increased steadily during the study period, with 735 articles arising as a result since the millennium, compared with just 238 in the 27 years preceding the year 2000. Figure 5 depicts this effort, with the broader and darker lines indicating more significant collaborative relationships. Cooperation between the United States and Italy was the most

TABLE I.
Leading Titles by Total Output and Number of Associated Citations.

Top 20 Titles by Output					Top 20 Titles by Citation Count		
Title	IF	EF	IP	Citations	Title	IP	Citations
Laryngoscope	2.10	0.03	368	6,104	*Int J Radiat Oncol*	327	7,959
Head Neck-J Sci Spec	2.18	0.01	364	6,186	*Cancer*	189	6,810
J Laryngol Otol	0.70	0.01	332	2,163	*Head Neck-J Sci Spec*	364	6,186
Int J Radiat Oncol	4.50	0.07	327	7,959	*Laryngoscope*	368	6,104
Eur Arch Otoo-Rhinol-L	1.21	0.01	301	1,954	*N Engl J Med*	26	5,239
Arch Otolaryngol	1.57	0.01	246	5,143	*Arch Otolaryngol*	246	5,143
Ann Otol Rhinol Laryngol	1.34	0.01	227	3,802	*Int J Cancer*	127	4,259
Acta Otolaryngol	1.20	0.01	217	1,449	*Radiother Oncol*	147	3,813
Cancer	5.13	0.12	189	6,810	*Ann Otol Rhinol Laryngol*	227	3,802
Otolaryngol Head Neck	1.57	0.02	188	2,307	*J Clin Oncol*	83	3,079
Radiother Oncol	4.34	0.02	147	3,813	*J Natl Cancer I*	32	3,034
Int J Cancer	4.93	0.11	127	4,259	*Cancer Cause Control*	60	2,902
Clin Otolaryngol	1.56	0.00	108	1,338	*Cancer Res*	36	2,352
Laryngol Rhinol Otol	0.73	0.00	107	456	*Otolaryngol Head Neck*	188	2,307
Anticancer Res	1.66	0.02	102	1,127	*Brit J Cancer*	94	2,272
Orl J Otol Rhinol Laryngol	0.84	0.00	96	766	*Lancet*	20	2,240
Oral Oncol	2.87	0.01	96	612	*J Laryngol Otol*	332	2,163
Brit J Cancer	4.83	0.09	94	2,272	*Cancer Epidem Biomar*	51	1,970
HNO	0.54	0.00	89	356	*Eur Arch Otol-Rhinol-L*	301	1,954
J Clin Oncol	18.97	0.40	83	3,079	*Radiology*	57	1,935

IF = impact factor; EF = Eigenfactor; IP = items published.

common form of bilateral cooperation (n = 118), followed by that between France and Italy (n = 95) and between France and the United States (n = 79).

DISCUSSION

There were 3,560 people who were expected to die of laryngeal cancer in the United States in 2011.[17] Five-year overall survival for those diagnosed with laryngeal cancer in Europe between 1995 and 1999 was just 55%[18]; in the United States that figure has been estimated at 52%.[3] Although alternative treatment approaches have evolved during the past two decades, controversy still surrounds many of these options, particularly in the case of advanced laryngeal cancer; it has been suggested that the more extensive use of chemoradiation in preference to total laryngectomy has led to a concomitant drop in survival.[19]

Despite, or perhaps because of, the lack of concordance over appropriate treatment strategies and the resultant poor associated outcomes, funding for laryngeal cancer research has been sparse. Whilst the

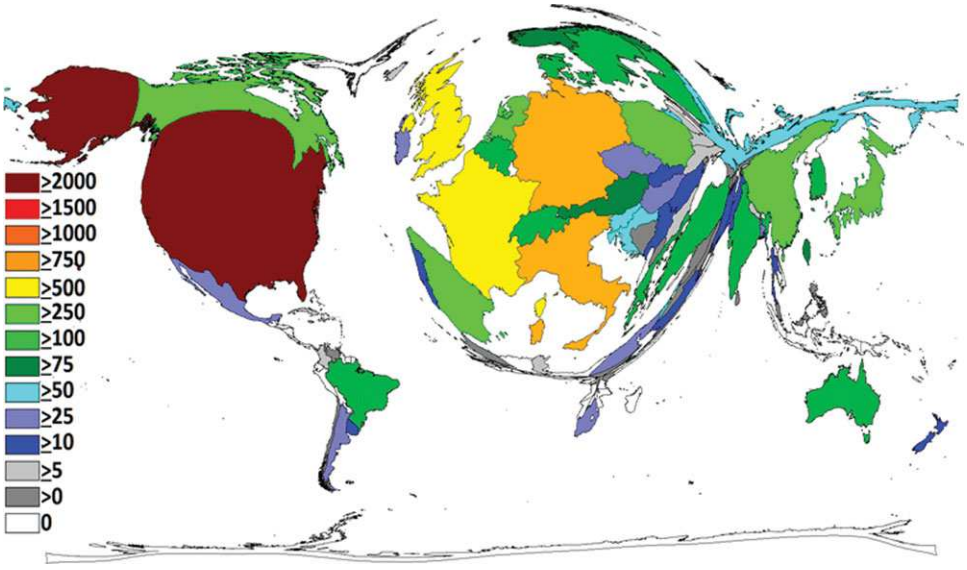

Fig. 3. Density equalizing mapping, total output by nation. Illustration of the total number of laryngeal cancer–related items, per country. The size of each country has been scaled in proportion to the total number of publications. A color-coded system shows the publication numbers.

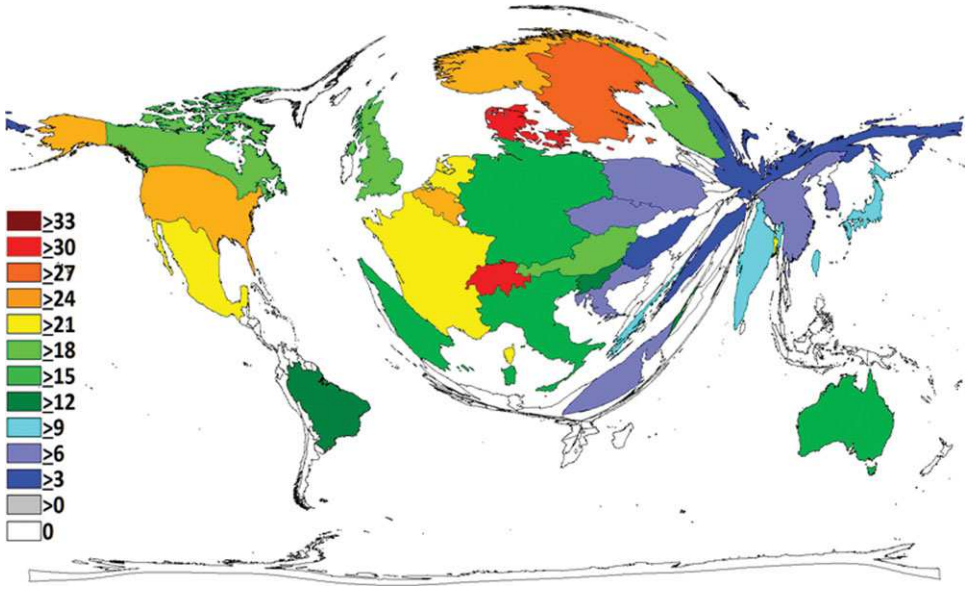

Fig. 4. Density equalizing mapping, average citations per item published. Illustration of the average number of citations per laryngeal cancer–related item, per country. The size of each country has been scaled in proportion to the average number of citations per item. A color-coded system shows the average number of citations per item. Threshold excludes countries with <30 items published.

allocation almost doubled in the United Kingdom between 2002 (£378,626) and 2006 (£723,244), this still accounted for just 0.2% of the entire cancer research budget.[20] As discussed in the introduction, the situation in the United States is worse still. Given the global economic crisis that pervades at present, it is unlikely that research funding generally is going to increase. Indeed, Cancer Research UK has recently been forced to announce that it is to cut its research spending by 10% over the next 3 years.[21]

In this environment, it is reassuring to note that output on laryngeal cancer continues to increase

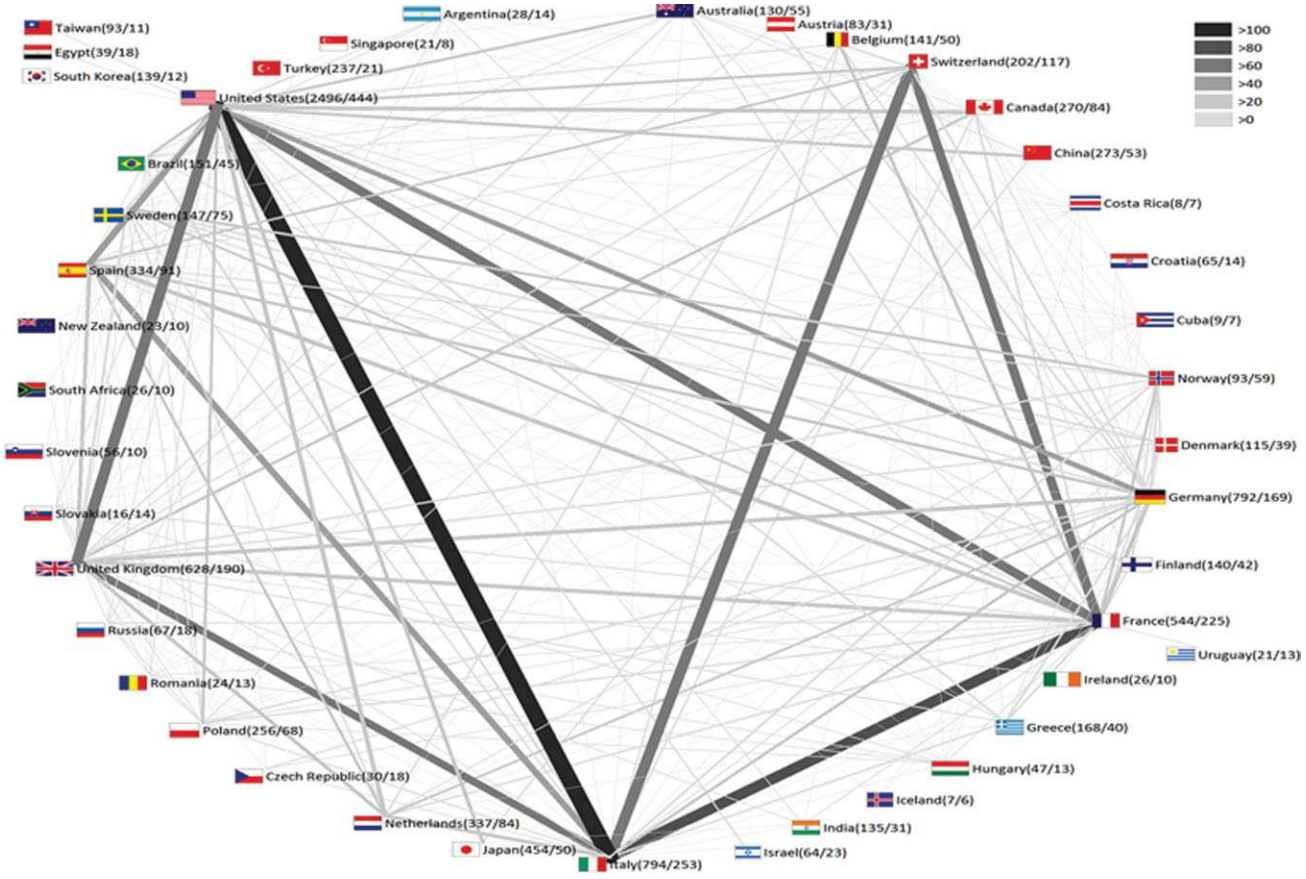

Fig. 5. Radar chart of international cooperation. Threshold >5 international cooperative partnerships.

year-on-year. That said, it is increasing from an extremely modest starting point; the entire scientific yield on laryngeal cancer over the six decades under study was less than half of the total output on breast cancer in 2007 alone.[22] A key finding of this work, and indeed a plausible explanation for this disparity, is the size of the research community contributing to the scientific yield. It has been previously demonstrated that, for a similar time frame, more than 180,000 authors contributed to the literature on breast cancer[23]; this is in stark contrast to the 24,000 reported here for laryngeal cancer. This disparity in research-field size has repeatedly been demonstrated to weigh against smaller research areas when it comes to proxy measures of journal quality, most notably the IF.[24,25] This has the potential, in turn, to weigh against applications for funding for these "lesser lights," given that the research will potentially end up published in much less prestigious titles, at least as assessed through traditional indicators. Indeed, recognition of this bias toward larger research fields recently led Labadie and Fitzpatrick to propose a solution aimed at leveling the playing field for smaller specialties like otolaryngology; to overcome the population-related bias that favors larger specialty areas, the authors proposed a percentile-based impact factor, wherein the top journal within a field is given 100%, the worst 0%, and all other journals' IFs are proportionately scaled in between the two extremes.[26]

Given the large number of journals that have contributed to the literature on laryngeal cancer, it would be difficult for those interested to appraise the entire scientific yield. This work has identified a core set of 20 titles, together responsible for greater than 43% of the output during the study period, that we propose should form the basis for any journal collection on laryngeal cancer. Importantly, seven of these titles are not specific to otolaryngology and hence might not have been recognized by those tasked with rationalizing subscription budgets. The median IF and EF of this core set of titles are markedly below those previously recorded in breast cancer, but again this is more likely to be related to the relatively modest size of the research community involved as opposed to being an indication that the quality of the research output itself is of any less high a standard. At any rate, the impact factor was originally proposed as a measure of a journal's quality, and it was never intended that this should be extrapolated to indicate any individual paper's quality.

Key benchmarks for individual authors on laryngeal cancer have been identified. Our finding that the median *h*-index for those authors who had published more than 10 articles on laryngeal cancer is 9 is markedly lower than that found either in other fields of medicine[23] or science[11] or indeed for otolaryngology as a whole.[27] Of course, laryngeal cancer is a subspecialist area within otolaryngology, and hence it would be expected that the majority of authors would have published on other areas within this specialty, thereby raising their *h*-scores. This again highlights the importance of confining the use of bibliometric indicators to field-specific comparisons, such that there is not incorrect bias against authors/journals/nations in the incorporation of research performance into decisions regarding funding allocation or career advancement.

The influence of the United States on global research output, previously reported across diverse fields within the physical and life sciences,[22,28] is mirrored in the results presented here. That performance is particularly impressive within laryngeal cancer where, despite accounting for 1,702 articles more than the next most prolific nation, the United States still ranked sixth in terms of average citations per item published, a proxy indicator of research quality. Concerns have been raised that the developing world is neglected in terms of research activity and output,[29,30] and Figure 3 attests to this issue. Whilst some commentators have suggested that one of the barriers to improving this situation is the "brain drain," wherein Western institutions recruit the brightest and best from developing nations,[31] a massive expansion in global health research has also been demonstrated within the United States itself.[32] One method of improving output from developing nations may be through active collaboration between these nations and those in Europe and the United States.[33] It is clear that international collaboration in laryngeal cancer research is steadily increasing, and conscious efforts need to be made to foster this trend through the involvement of developing nations. This is particularly important in the context of head and neck cancer, and otolaryngology in general, wherein the paucity of clinical services and research and training opportunities was highlighted by Fagan and Jacobs in a 2009 report on the situation in Africa.[34]

There are a number of important limitations to this work. This is a bibliometric analysis using proxy indicators of yield quality; whilst these same indicators are increasingly incorporated into decision-making processes, they nevertheless remain indicators only; none is without significant limitations, and none can substitute for the gold standard method of assessment, which is to actually read a given article. To provide field-specific benchmarks, we focused the search strategy on laryngeal cancer specifically; hence it is plausible that some potentially relevant articles concerning laryngeal cancer in the context of head and neck cancer in general may have been omitted from the final analysis. Furthermore, this work has focused on entries contained in the Web of Science only, and it should be noted that the employment of other databases including PubMed and Scopus may have yielded slightly different results. That said, the Web of Science covers the oldest publications with archived records going back to 1900[35] and should provide an accurate overview of output for the entire study period.

CONCLUSION

This work represents the first attempt to provide quantitative and qualitative analysis of laryngeal cancer research output, whilst in tandem identifying the key bibliometric benchmarks to which those involved in the production of that output might aspire. Utilization of

these data should aid those tasked with securing funding for future research projects on laryngeal cancer. Finally, the results presented here serve as a reminder that the developing world remains significantly underrepresented in cancer research, and there is an onus on those in developed nations to recognize and address this imbalance through international cooperation.

BIBLIOGRAPHY

1. Cosetti M, Yu GP, Schantz SP. Five-year survival rates and time trends of laryngeal cancer in the US population. *Arch Otolaryngol Head Neck Surg* 2008;134:370–379.
2. Carvalho AL, Nishimoto IN, Califano JA, Kowalski LP. Trends in incidence and prognosis for head and neck cancer in the United States: a site-specific analysis of the SEER database. *Int J Cancer* 2005;114:806–816.
3. Hoffman HT, Porter K, Karnell LH, et al. Laryngeal cancer in the United States: changes in demographics, patterns of care, and survival. *Laryngoscope* 2006;116:1–13.
4. National Cancer Institute. NCI funded research portfolio. Available at: http://fundedresearch.cancer.gov/. Accessed December 22, 2011.
5. Garfield E. Citation indexes for science - new dimension in documentation through association of ideas. *Science* 1955;122:108–111.
6. Forfas. Research strengths in Ireland: a bibliometric study of the public research base. Available at: http://www.forfas.ie. Accessed December 23, 2011.
7. What next for the UK's research assessment exercise? *Lancet* 2007;370: 1738.
8. Lane J, Bertuzzi S. Research funding. Measuring the results of science investments. *Science* 2011;331:678–680.
9. Borger JA, Neye N, Scutaru C, et al. Models of asthma: density-equalizing mapping and output benchmarking. *J Occup Med Toxicol* 2008; (3 Suppl 1):S7.
10. Groneberg-Kloft B, Dinh QT, Scutaru C, et al. Cough as a symptom and a disease entity: scientometric analysis and density-equalizing calculations. *J Investig Allergol Clin Immunol* 2009;19:266–275.
11. Hirsch JE. An index to quantify an individual's scientific research output. *Proc Natl Acad Sci U S A* 2005;102:16569–16572.
12. Garfield E. The history and meaning of the journal impact factor. *JAMA* 2006;295:90–93.
13. http://www.eigenfactor.org/.
14. Groneberg-Kloft B, Scutaru C, Kreiter C, Kolzow S, Fischer A, Quarcoo D. Institutional operating figures in basic and applied sciences: scientometric analysis of quantitative output benchmarking. *Health Res Policy Syst* 2008;6:6.
15. Gastner MT, Newman ME. From the cover: diffusion-based method for producing density-equalizing maps. *Proc Natl Acad Sci U S A* 2004;101: 7499–7504.
16. Sui D. A perfect distortion? Cartograms deserve more attention. Available at: www.geoplace.com. Accessed October 23, 2010.
17. American Cancer Society. Cancer facts and figures 2011. Available at: http://www.cancer.org. Accessed December 23, 2011.
18. Sant M, Allemani C, Santaquilani M, Knijn A, Marchesi F, Capocaccia R. EUROCARE-4. Survival of cancer patients diagnosed in 1995-1999. Results and commentary. *Eur J Cancer* 2009;45:931–991.
19. Chen AY, Fedewa S, Zhu J. Temporal trends in the treatment of early- and advanced-stage laryngeal cancer in the United States, 1985-2007. *Arch Otolaryngol Head Neck Surg* 2011;137:1017–1024.
20. National Cancer Research Institute. Available at: www.ncri.co.uk. Accessed December 23, 2011.
21. Torjesen I. Funding crisis forces Cancer Research UK to cut spending by 10%. *BMJ* 2011;343:d8068.
22. Glynn RW, Scutaru C, Kerin MJ, Sweeney KJ. Breast cancer research output, 1945-2008: a bibliometric and density-equalizing analysis. *Breast Cancer Res* 2010;12:R108.
23. Healy NA, Glynn RW, Scutaru C, Groneberg D, Kerin MJ, Sweeney KJ. The h index and the identification of global benchmarks for breast cancer research output. *Breast Cancer Res Treat* 2011;127:845–851.
24. Hecht F, Hecht BK, Sandberg AA. The journal "impact factor": a misnamed, misleading, misused measure. *Cancer Genet Cytogenet* 1998;104: 77–81.
25. Sieck GC. The "impact factor": what it means to the impact of applied physiology. *J Appl Physiol* 2000;89:865–866.
26. Labadie RF, Fitzpatrick JM. Can otolaryngology compete with larger fields regarding impact factor? Is percentile-based impact factor a solution? *Otolaryngol Head Neck Surg* 2011;145:15–17.
27. Kulasegarah J, Fenton JE. Comparison of the h index with standard bibliometric indicators to rank influential otolaryngologists in Europe and North America. *Eur Arch Otorhinolaryngol* 2010;267:455–458.
28. Michalopoulos A, Falagas ME. A bibliometric analysis of global research production in respiratory medicine. *Chest* 2005;128:3993–3998.
29. Kirigia JM, Wambebe C. Status of national health research systems in ten countries of the WHO African Region. *BMC Health Serv Res* 2006;6:135.
30. Ramsay S. No closure in sight for the 10/90 health-research gap. *Lancet* 2001;358:1348.
31. Hagopian A, Thompson MJ, Fordyce M, Johnson KE, Hart LG. The migration of physicians from sub-Saharan Africa to the United States of America: measures of the African brain drain. *Hum Resour Health* 2004;2:17.
32. Merson M, Chapman Page K. *The Dramatic Expansion of University Engagement in Global Health. Implications for US Policy.* Washington, DC: Center for Strategic & International Studies; 2009.
33. Piot P, Garnett G. Health is global. *Lancet* 2009;374:1122–1123.
34. Fagan JJ, Jacobs M. Survey of ENT services in Africa: need for a comprehensive intervention. *Glob Health Action* 2009;2.
35. Falagas ME, Pitsouni EI, Malietzis GA, Pappas G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. *FASEB J* 2008;22:338–342.