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Academic Productivity in the Field of Otolaryngology Head and Neck Surgery from 1996 to 2019 in Regard to National Economic indicators among the countries of the Organization for Economic Co-Operation and Development

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Abstract

Abstract Background: The relation between health investment and research has been portrayed previously in several medical fields, showing a positive relation between economic resources and academic yield. Purpose: To assess the relations between various economic and bibliometric parameters in otolaryngology - head and neck surgery (ORL-HNS) of the OECD countries. Methods: Data regarding bibliometric parameters in ORL-HNS; number of publications, citations, citations per document and H index, between the years 1996 and 2019, were gathered from the Scimago Journal and Country Rank source. These data were then analysed in several breakdowns – seldom county, regional and language comparisons, in order to assess variations in ORL-HNS scholar activity. Economic data regarding each OECD country; GDP per capita, total health expenditure as percent of the GDP and GERD as percent of the GDP were gathered from the OECD and World Bank websites. The correlation between economic and bibliometric indicators was analysed. Results: Among 209,949 documents analysed, a strong correlation was found between H index and health expenditure (r=0.734, p=0.000), and a moderate connection was found between H index and both GDP per capita (r=0.459, p=0.005) and GERD as percent of GDP (r=0.579, p=0.000). Health expenditure showed the strongest correlations to bibliometric parameters. Nonetheless, most data showed some degree of positive correlations between economics and scholar productivity. Conclusion: This study emphasizes the positive relation between scholar productivity and economic indicators, mostly health expenditure, in the OECD countries in the field of ORL-HNS, implying the importance of health investment to ORL-HNS research.

Key points

- This study reports a data analysis of ORL-HNS research of the OECD countries in the years of 1996-2019 and in comparison to economic indicators, all from open resource databases
- The bibliometric data was compared among different global regions innkeeping with SJR criteria and in reference to native English-speaking countries
- The bibliometric data was also analyzed in relation to economic indicators in search of correlations between said parameters.
- Different OECD regions vary in their scholar achievements; number of publications, citations and H index in ORL-HNS. Differences were also seen between native and non-native English-speaking countries
- Bibliometric analysis showed positive correlations between scholar and economic indicators in various degrees, with a strong correlation between H index and health expenditure in the field of ORL-HNS

Keywords

Otolaryngology, bibliometrics, ORL-HNS, OECD, scientometrics, H index

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Introduction

Medical research is a crucial part of improvement in healthcare, and provides advancements and alterations in both diagnostics and therapeutics. One way to assess academical research is scholarly productivity, as measured by research output. Bibliometrics is a science that integrates statistics into scholar productivity and can be useful in assessing academic yield in various levels; from an individual to global standards comparisons. This growing field of research is implemented in diverse medical fields, and with various implications such as in the use of journals' impact factors and the assessment of specific literature on medical contributes.

Various parameters have been researched and studied in the use of bibliometrics in the medical field such as citation and publication count to reflect scholar productivity. But with the inherit drawbacks of these parameters a need for a more advanced parameter has risen, hence created the H index as published by Hirsh in 2005. This parameter allows for the comparison of different subjects whilst alimenting specific confounders such as arbitrariness and relevance of publication. Ever since, the H index has established as the standard of scientometrics and is used widely to evaluate and compare an individual's academic work, as well as institutions and countries.

A number of papers have been published in the field of otolaryngology – head and neck surgery (ORL-HNS) concerning data of specific researchers, country to country comparison or the contribution of a specific country to overall scholarly productivity and impact. Previous studies have demonstrated a certain correlation between academic yield to percentage of gross domestic product (GDP) spent on health in other medical fields. In this article, we would like to assess national economic parameters in the Countries of the Organisation for Economic Co-operation and Development (OECD) in a period of 24 years to ORL-HNS academics.

Methods

In order to assess these correlations, we collected data referring to scholar productivity, as expressed by the number of publications, citable documents, citations, citations per document and the H index for the OECD countries using The Scimago Journal and Country rank (SJR) (http://www.scimagojr.com, accessed at June 26, 2020). It is an open database which includes both journals and country indicators powered by Elsevier's B.V. Scopus database. The data collected were limited to the field of ORL-HNS between the years 1996-2019. The 2018 GDP per capita (in 2010 US dollars) was collected from the World Bank (http://www.worldbank.org, accessed at accessed at June 26, 2020). Data regarding total health spending as percent of GDP (health expenditure) in 2018 were derived from the OECD Web site (https://data.oecd.org/healthres/health-spending.htm, accessed at accessed at June 26, 2020). Data regarding gross domestic expenditure in research and development as percent of the GDP (GERD) for the year 2015 or more recent (latest available) were obtained from the United Nations Educational, Scientific, and Cultural Organization (UNESCO) (http://www.unesco.org, accessed at accessed at June 26, 2020).

In order to compare different bibliometric parameters to various global regions, each of the OECD countries was categorized into a different region according to the SJR categories; North America, Latin America, Western Europe, Eastern Europe, Asiatic region, Middle East and the Pacific Region. The different regions were evaluated for bibliometric parameters. To further analyse the data retrieved, the OCED countries were labelled in accordance to their native language; native or non-native English-speaking. The same comparisons were then applied to these two groups.

Statistical Analysis

The data retrieved were recorded on Microsoft Excel spreadsheets (Microsoft 365 Office ProPlus, Microsoft Inc.) and further analysed to assess the relations between said economic parameters to scholar productivity in each OECD country. SPSS version 21 (IBM, Chicago, Il) was used for statistical analyses. Normal distribution of variables was tested analytically by the Shapiro-Wilk test. Descriptive statistics are presented as a mean ± standard deviation (SD) for normal distributed variables and as a median with interquartile range

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(IQR) for non-normal distributed variables. The correlation between economic and bibliometric indicators was assessed by Pearson's correlation or Spearman's rank correlation, as appropriate according to the normality test. The analyses of the differences in academic productivity between native and non-native English countries and between global regions were performed using the Mann-Whitney test.

Results

A total number of 209,949 documents published between the years of 1996-2019 were analysed for this study. In that period of time, the median number of documents per country was 1967.5 with an interquartile range (IQR) of 6248.3. per OECD country, the median number of citable documents was 1875 (IQR of 5957.8), the median number of citations per document was 14.43 with an IQR of 8.42 and the median H index during the study period was 67.5 with and IQR of 59.3. All bibliometric data referring to each of the OECD countries are presented in **Table 1** .

When equating academic parameters between the various regions, there was a statically significant difference between Eastern Europe and North American regions in the number of documents published, citable documents, citations and H index in favour to North America (p=0.044 for all data). Similar results were seen when comparing Eastern Europe to the Asiatic Region (p=0.044 for all data). A statically significant higher number of documents published, citable documents, citations, citations per document and H index was shown in Western Europe in comparison to Eastern Europe (p=0.005, p=0.005, p=0.001, p=0.016 and p=0.001, respectively). When comparing publication data between Eastern Europe to the Middle East, a significant difference in the number citations and H index in favour of the Middle East region was found (p=0.044). When comparing Western Europe to the Asiatic Region there was a difference in citations per document in favour on Western Europe (p=0.021) **Table 2** .

When further dividing the OECD countries into native English speakers versus non-native speakers, there was a statistically significant difference in the number of citations (p=0.046) and H index (p=0.026), with an advantage to native English-speaking countries **Table 2** .

The various economic indicators for the OECD counties are represented in**Table 3** . Correlations found between economic indicators and scholarly productivity parameters are presented in **Table 4** . A strong correlation was found between health expenditure and H index (r =0.734, p=0.000), a statistically significant moderate correlation was found between health expenditure and number of documents (r =0.572, p=0.000), number of citable documents (r =0.574 p=0.000) and number of citations (r =0.639 p=0.000). A statistically significant moderate correlation was also fund between the GERD as a percent GDP and the number of documents (r =0.471 p=0.004), number of citable documents (r =0.471 p=0.004), number of citations (r =0.503 p=0.002), number of citations per documents (r =0.518 p=0.001) and the H index (r =0.579 p=0.000). A moderate association was found between GDP per capita and the H index (r =0.459 p=0.005) and a weak correlation was found between the GDP per capita and the number of citations (r =0.355 p=0.034). No other statistically significant correlations between economic and bibliometric indices were found.

Discussion

Bibliometric science is ever growing and establishing itself as an accurate way of estimating and portraying both scholar productivity for itself, assessing different variables connected to academic productivity or showing non-partial and affective way of critiquing one's scientific output's quality and quantity.

As ORL-HNS is a field of medicine that interphases with numerous other medical disciplines, advancements in ORL-HNS may have an effect in Oncology, Neurology, Endocrinology, Maxillofacial surgery and even Paediatrics. Therefore, many patients and medical teams can profit from research in this medical field. With a constant need in new research and development in the field of ORL-HNS, the data portrayed in this study shed an important light on the connection of economic investment in research and research output.

In this current study, we have examined the association between economic and bibliometric indicators in ORL-NHS scholar productivity of the different OECD countries and examined the association between said

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indicators. As far as we know, this is the most updated and broad study in ORL-HNS scientometrics to date.

As we've compared the various OCED countries regions there seemed to by a constant different between several bibliometric indices in Eastern Europe and almost all other region for the exception of Latin America. Moreover, a consistent difference was evident in H index, which is, as stated above considered to be the gold standard of scientometrics. This tendency is further fortified by the significant difference seen in native English versus non-native English-speaking countries, with an overall difference in both H index and number of citations. this leaning was shown in the past, though not as significantly in other medical fields by our group. These said differences may be attributed to both economic investments and to the fact that the leading language in global academics is in fact English, which may cause a publication barrier for non-native academics.

When valuating said bibliometric data against economic parameters, a strong correlation is seen between health expenditure as calculated for 2018 as percentage of the GDP and H index, a moderate correlation is seen between health expenditure and all other bibliometric data as well as between the GERD and all bibliometric parameters. Furthermore, we can state that the H index, our gold standard for scientometrics data as mentions previously, is moderately to strongly connected to any of the economic indicators examined in our study. When referring to GDP per capita, the indicator which is, out of our economic parameters, least directly linked to medical investment is where whiteness the weakest correlations with only two parameters with a significant link; citations (weak correlation) and H index (a moderate correlation).

There are several drawbacks to our study, one being the fact that the number of publications is not adjusted to the population size or number of ORL-NHS surgeons per country, data that may have significance when assessing absolute bibliometric parameters such as the number of publications or total citations. Furthermore, when evaluating large countries such as the United States there is no state-to-state breakdown, and the variations between states may be of scientific importance. Nonetheless, our comparison does allow to review the United States contribution as a whole, and its' impact on global research, and allows to assess each country's contribution regardless to its' size. Another limitation is the use of solemnly open sources, which are not always updated at the time of data collection (GDP per capita, 2018; health expenditure, 2018; GERD, latest updated). However, we believe that the still provide a satisfactorily accurate reflection of each of the OECD countries economic averages and are sufficient to prove the conclusions conducted in this article. Another drawback of the study is that it differs only to the OECD countries, and the conclusions made in it may not be generalised to the rest of the worlds' countries. In spite of this, using only OECD countries provided us with a precise data collection and made its results more valid.

As bibliometrics is crucial to accurately demonstrating scholar productivity, the results of our study enhance the importance of health expenditure and investment in science as a catalysator for academic advancement in the field of ORL-HNS, more so than general economic variables as is the GDP per capita. This assumption, mainly of health expenditure, was proven in the past in different medical fields such as Cardiology and Rheumatology. We assume that in wealthy healthcare systems, affluent with manpower and advanced infrastructure, there is more time and means for conducting research. In addition, one can argue that as clinical research is integrated with the daily medical practice, investment in health indirectly results in investment in health academics.

Conclusions

This article shows a direct connection between economic health indicators and scientific output. Notwithstanding its limitations, our study illustrates the general assumption that investment in health and health scholarship are entwined in the field of ORL-HNS and may suggest an additional need for investment in medical care. Further research in other medical fields is desired to extrapolate our conclusions to more specialties.

References

Table 1.

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Country	Region	Documents	Citable documents	Citations	Citations per document	H index
Mexico	Latin America	699	672	8278	11.84	41
Turkey	Middle East	9089	8565	82673	9.1	68
Chile	Latin America	577	556	4507	7.81	29
Latvia	Eastern Europe	22	20	342	15.55	10
Hungary	Eastern Europe	488	460	6371	13.06	35
Poland	Eastern Europe	2907	2799	17041	5.86	46
Lithuania	Eastern Europe	91	91	1148	12.62	19
Estonia	Eastern Europe	29	29	283	9.76	9
Slovakia	Eastern Europe	225	221	1669	7.42	20
Czech Republic	Eastern Europe	1177	1123	6011	5.11	34
Greece	Western Europe	1874	1771	27255	14.54	63
Portugal	Western Europe	692	658	7451	10.77	34
Slovenia	Eastern Europe	252	239	4639	18.41	36
South Korea	Asiatic Region	7204	6874	68919	9.57	67
Spain	Western Europe	8037	7750	74192	9.23	76
Israel	Middle East	2507	2417	43261	17.26	76
Italy	Western Europe	10161	9512	129229	12.72	95
New Zealand	Pacific Region	943	885	14923	15.83	54
United Kingdom	Western Europe	18636	15912	264515	14.19	138
France	Western Europe	7494	6979	75085	10.02	89
Belgium	Western Europe	3113	2963	52834	16.97	85
Germany	Western Europe	16374	15397	203841	12.45	121
Finland	Western Europe	2056	1977	37999	18.48	73
Japan	Asiatic Region	22999	22668	179649	7.81	101
Austria	Western Europe	1879	1771	35756	19.03	76
Iceland	Western Europe	39	36	728	18.67	16
Canada	North America	5804	5535	103323	17.8	105
United States	North America	64577	60212	1154785	17.88	216
Netherlands	Western Europe	5475	5106	100554	18.37	106
Australia	Pacific Region	5315	5010	94885	17.85	109
Sweden	Western Europe	3203	3099	68618	21.42	96
Denmark	Western Europe	1549	1509	31005	20.02	68
Ireland	Western Europe	796	724	11410	14.33	45
Switzerland	Western Europe	2728	2604	48352	17.72	82
Norway	Western Europe	898	857	18216	20.29	61
Luxembourg	Western Europe	40	35	970	24.25	10

Bibliometric Data Regarding OECD Countries 1996–2019.

Table 2 .

	Documents*	**Citable documents^**	**Citations$**	**Citations per document&**	**H index£**
Region					
North America (N=2)	35190	32873.5	629054	17.84	160.5
Latin America (N=2)	638	614	6392.5	9.825	35

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Western Europe (N=18)	2392	2290.5	43175.5	17.345	76
Eastern Europe (N=8)	238.5	230	3154	11.19	27
Asiatic region (N=2)	15101.5	14771	124284	8.69	84
Middle East (N=2)	5798	5491	62967	13.18	72
Pacific Region (N=2)	3129	2947	54904	16.84	81.5
English Speaking					
Non-native (N=30)	1876.5	1771	29130	13.625	65
Native (n=6)	1967.5	1874	3380.5	14.435	67.5

Median values are presented

Bibliometric Data Regarding OECD Countries 1996–2019 by Regions and Language.

***** Eastern Europe < North America, Western Europe, Asiatic region ($p<0.05$)

Region ($p<0.05$)

$ Eastern Europe < North America, Western Europe, Asiatic Region, Middle East ($p<0.05$), Non-native < Native ($p<0.05$)

& Eastern Europe < Western Europe ($p<0.05$), Asiatic Region < Western Europe ($p<0.05$)

£ Eastern Europe < North America, Western Europe, Asiatic Region, Middle East, Pacific Region ($P<0.05$), Non-native < Native ($p<0.05$)

Table 3 .

Country	GDP per capita (constant 2010 US$)	Health Expenditure 2018 (%GDP)	GERD as percent of GDP
Mexico	10,403.50	5.457	0.313
Turkey	15,069.00	4.172	0.96
Chile	15,130.20	8.911	0.355
Latvia	16,269.00	5.866	0.639
Hungary	16,647.70	6.593	1.533
Poland	16,659.30	6.288	1.213
Lithuania	17,708.50	6.805	0.877
Estonia	19,954.10	6.449	1.404
Slovakia	20,599.10	6.729	0.837
Czech Republic	23,358.90	7.515	1.93
Greece	23,558.10	7.846	1.177
Portugal	23,994.70	9.099	1.35
Slovenia	26,768.40	7.946	1.95
South Korea	26,761.90	8.102	4.528
Spain	32,949.60	8.86	1.243
Israel	34,745.80	7.463	4.941
Italy	35,431.90	8.813	1.392
New Zealand	37,997.40	9.341	1.366
United Kingdom	43,324.60	9.768	1.706

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Country	GDP per capita (constant 2010 US$)	Health Expenditure 2018 (%GDP)	GERD as percent of GDP
France	43,663.60	11.177	2.2
Belgium	47,166.50	10.372	2.764
Germany	47,477.80	11.229	3.133
Finland	48,749.10	9.075	2.746
Japan	48,919.80	10.918	3.264
Austria	50,019.90	10.33	3.217
Iceland	52,103.20	8.34	2.03
Canada	51,391.70	10.734	1.541
United States	54,579.00	16.937	2.826
Netherlands	55,022.90	9.941	2.164
Australia	56,842.30	9.252	1.789
Sweden	57,921.40	11.037	3.309
Denmark	63,873.50	10.47	3.033
Ireland	76,880.80	7.095	1.146
Switzerland	79,214.40	12.183	3.368
Norway	92,077.60	10.182	2.073
Luxembourg	110,742.30	5.408	1.211

Economic Indicators for the OECD Countries in 1996–2019: GDP per Capita, Total Health Expenditure as %GDP, Gross Domestic Expenditure on Research and Development (GERD) as %GDP.

Table 4.

		Documents	Citable documents	Citations	Citations p
GDP per capita (constant 2010 US$)	Correlation Coefficient	.249	.245	.355	.309
	p-value	.143	.150	.034	.067
Health Expenditure 2018 (%GDP)	Correlation Coefficient	.572	.574	.639	.304*
	p-value	.000	.000	.000	.072
GERD as percent of GDP	Correlation Coefficient	.471	.471	.503	.518
	p-value	.004	.004	.002	.001

Correlation Analysis Between Economic and Bibliometric Indicators.

All data analysed as Spearman's correlation unless pointed otherwise.

*Pearson Correlation