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Publication patterns on neonatal surgery over 65 years

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Abstract

Background/Purpose: Staying abreast of the literature in a given speciality is difficult. The aim of this study is to analyze the publication patterns of the neonatal surgical literature over the last six decades.

Materials: A search strategy for the Web of Science database was designed using MeSH defined terms for 10 index neonatal surgical conditions, with output analyzed over two time-periods.

Results: There were 6215 and 6144 publications for periods 1 (1945–1994) and 2 (1995–2010), respectively. There were 24 and 546 articles published in 1945 and 2010, respectively. The mean citation counts of the top 50 publications are 228 and 156 for periods 1 and 2, respectively. There were 6 and 11 authors with two or more publications in the top 50 list in periods 1 and 2, respectively. Three of the pediatric surgery journals cumulatively have published 30.9% of the total articles.

Conclusions: Publication patterns for neonatal surgical conditions have changed significantly over time. The majority of articles are published outside of pediatric surgical journals. Pediatric surgeons should not limit their reading to these journals.

There have been over 20 million publications referenced on PubMed (the National Library of Medicine (NLM)) since 1945, and in excess of 44 million on the Web of Science (WoS) (Thompson Reuters). In 2010 alone, there have been 924,123 publications on PubMed and 1,695,105 on the WoS. The proliferation of medical research has been aided by the development of Internet search engines and on-line publishing, which whilst facilitating the dissemination of published research, has simultaneously made it virtually impossible for one to review all that is now published on a given topic of interest. In an environment in which both time and financial pressures make it increasingly difficult to stay abreast of the literature, clinicians are faced with having to rationalise journal subscriptions, and must focus their attention on a limited spectrum of published output.

Neonatal surgery is a highly specialised area within the realm of pediatric surgery. It includes not only gastrointestinal conditions such as necrotising enterocolitis (NEC), Hirschsprung's disease (HD), malrotation and gastrointestinal atresias, but also thoraco-abdominal defects such as congenital diaphragmatic hernia (CDH), exomphalos and gastroschisis. The true extent of the number of publications on these topics, as well as the number of journals they are published in, is unknown. In addition, it is unclear which categories of journal(s) (pediatric, pediatric surgery, general surgery or adult mainstream) are the key publishers of neonatal surgical articles. Finally, the most influential publications (based on the number of citations of that article) within this sphere have not been elucidated thus far.

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Bibliometric analysis is a method used to evaluate publication trends and patterns in a given scientific field. It has been utilized in the past to identify the "top cited articles" or "citation classics", both within single journals [1–3] and within specialties [4,5]. Furthermore, it has been employed to examine the relationship between cancer research output and both research funding and geographical location [6,7] and, more recently, to analyze the proportion and quality of publications of the more common cancers [8]. In addition, bibliometrics has been used to rank surgical departments within academic hospitals in given geographical locations [9], and to identify research gaps within different specialties [10,11]. Interestingly, bibliometric benchmarks are now being used by some grant authorities to decide on where funding should be distributed.

The aim of this paper is to analyze the publication patterns of the neonatal surgery literature over time using bibliometric methodology.

1. Materials and methods

The neonatal surgical conditions included in the study were NEC, CDH, tracheo-esophageal fistula & esophageal atresia, HD, gastroschisis, exomphalos, intestinal atresia, imperforate anus and malrotation. Using the medical subject heading (MeSH) term in PubMed for each of the neonatal surgical conditions in this study, the subheadings under each MeSH term were obtained. These subheadings were then used to perform a search within the WoS database. The search was limited to include only publications with at least one MeSH subheading in the title of the publication. MeSH subheadings for inguinal hernia and volvulus were excluded as these conditions are also found in the adult literature and thus would be confounding factors. WoS was chosen over PubMed as the search engine for the study due to the fact that it has more citable references and it provides a citation count which PubMed does not.

Data were retrieved from the WoS database for two reference periods.

- Period 1 — 01/01/1945 to 31/12/1994 (First 50% of publications)
- Period 2 — 01/01/1995 to 31/12/2010 (Second 50% of publications)

All searches were conducted between November 2011 and March 2012. Search results from the WoS included entries from the "Science Citation Index-Expanded" and the Social Sciences Citation" databases. The data downloaded from the WoS were assessed and analyzed using Microsoft Excel spreadsheet software. Results are expressed as mean with range in brackets throughout the manuscript.

2. Results

2.1. Total output

There were 12,359 publications on the neonatal conditions under study between 1945 and 2010. There has been a 22-fold increase in the number of publications from 1945 (24) to 2010 (546). Almost 50% (6144) of the publications were published in the 49 years between 1945 and 1994 (period 1). The remaining 50% (6215) were subsequently published in the 16 years between 1995 and 2010 (period 2) (Fig. 1).

2.2. Top cited articles

The top 10 of the 50 most-cited publications in periods 1 and 2 are listed in Table 1. The mean number of citations to these articles is 228 (144-672) and 156 (106-427) for periods 1 and 2, respectively. There are 9 and 25 laboratory based articles, and 41 and 25 clinical based papers for periods 1 and 2, respectively.

The top 50 cited articles were analyzed with respect to the WoS categories: 'pediatrics', 'surgery', 'genetics/hereditary' and 'biochemistry/molecular biology' and are ranked in the top 5 across both periods. The category of 'genetics/hereditary' increased in importance during period 2. NEC, CDH and HD are the three commonest published neonatal surgical conditions across both periods and the number of publications on CDH and NEC remains constant at each time point at 16 and 10, respectively. This is in contrast to HD which has increased publications from 14 to 21 articles.

2.3. Top cited authors

The first or senior authors with more than one publication in the top 50 cited articles for each period are listed in Table 2. There were 6 and 11 authors with more than one publication in the top 50 list for periods 1 and 2, respectively. Two authors appeared in the top 50 list in both periods and between them they accumulated 22 publications. There were 12 authors with >1 publication in one time period only. There were 72 and 62 authors with a single publication in periods 1 and 2, respectively.

2.4. Top cited journals

The number of journals publishing these articles was 591 and 711 for periods 1 and 2, respectively. There were 24 and 17 journals that had published more than 50% of the articles for period 1 and period 2, respectively. When these journals were classified into 'surgery', 'pediatric', 'pediatric surgery' and other journals, the surgery journals in recent years have declined in importance. In period 1, 'surgery' journals published 18.5% of these articles but have declined to 0% in period 2. 'Pediatric' journals accounted for one third of these for period 1 and 44% in period 2. 'Pediatric surgery'

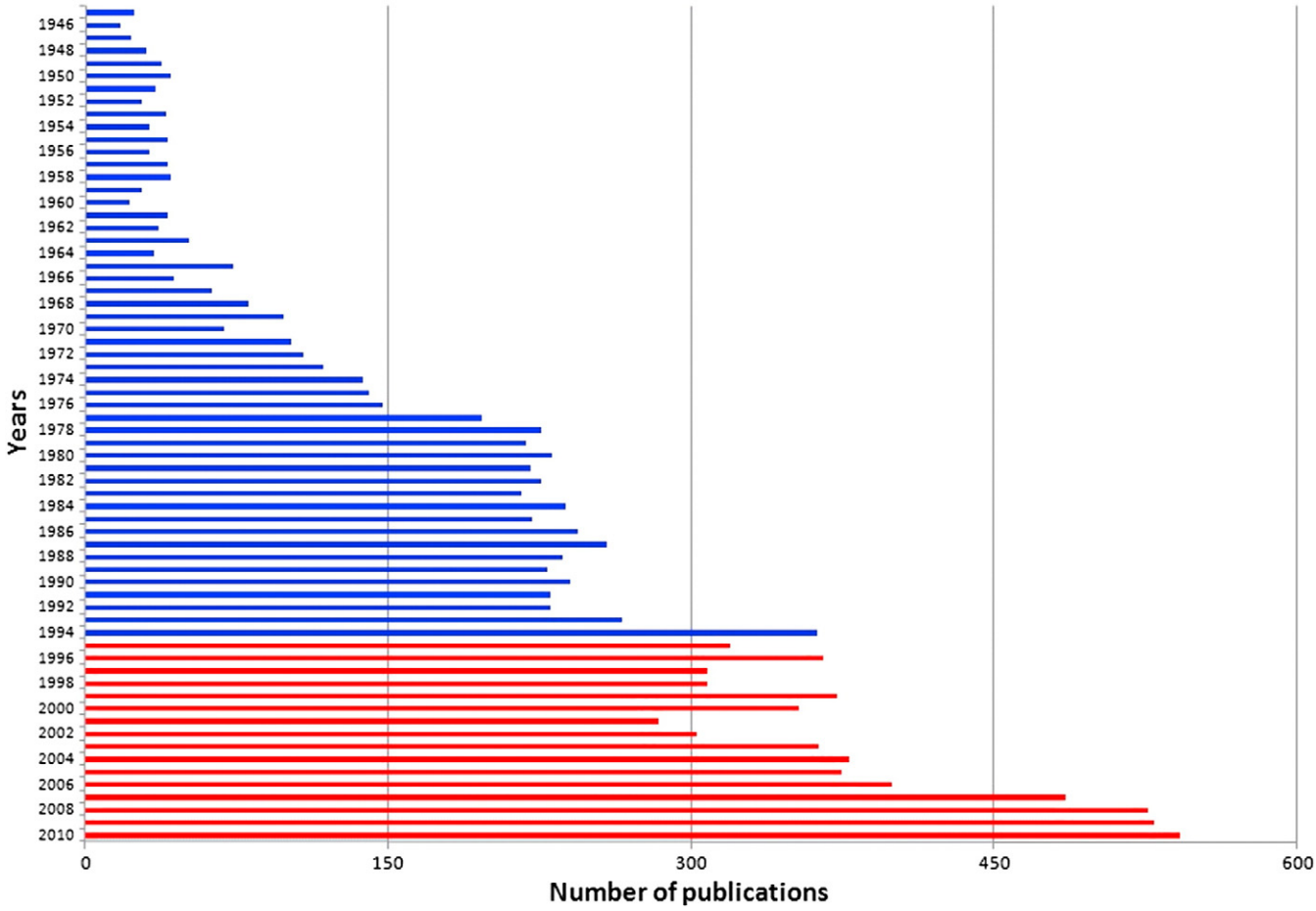

Fig. 1 Publication trend from 1945 to 2010.

journals accounted for 17% in period 2 compared to 11% in period 1 (Table 3).

The Journal of Pediatric Surgery has published the highest number of articles on the topics in the study across both time points. This is followed closely by Pediatric Surgery International which lies in third and second place for periods 1 and 2, respectively. The European Journal of Pediatric Surgery lies in fourth place in period 2. The journals with the highest number of publications, accounting for 50% of cumulative publications for period 2, are listed in Table 4.

When analyzing the journals in which the 50 top cited articles were published, the Journal of Pediatric Surgery ranked second in period 1 and first in period 2. The number of top 50 cited publications published in the Journal of Pediatric Surgery for periods 1 and 2 was 9 and 11, respectively. The Journal of Pediatrics published 11 and 1 articles in periods 1 and 2, respectively. The New England Journal of Medicine appeared on the top 50 cited list, publishing 4 articles in period 1 and 2 articles in period 2.

2.5. Nations' contributions

The USA consistently ranked first with equal numbers of publications in periods 1 and 2. The UK ranked second but had a 20% increase in the number of publications in period 2 compared with period 1. Japan, the Netherlands, Spain, Germany, and Ireland all doubled their output from period 1 to period 2. Italy, Belgium and Saudi Arabia all experienced a 3-fold increase in publications between periods. Both Turkey and Taiwan experienced a 20-fold increase in publications over the two periods (Table 5).

3. Discussion

The proliferation of medical research in recent years has also been observed in neonatal surgical conditions. Of the most commonly published neonatal surgical conditions, NEC has the highest incidence, followed by CDH and then HD [12-14]. The number of publications for each condition does not follow suit. HD has the third most common incidence but it has the highest number of publications while NEC has the highest incidence but only the third highest publication rate. The results from our study demonstrates a transition from clinically oriented output in the 1945–1994 time period, to a situation in which the output today is equally split between clinical and laboratory-based research. This transition likely emanates from advances in medical

Table 1 List of top 10 cited articles in periods 1 & 2.

Rank	Top 10 cited publications	Count
Period 1 (1945–1994)		
1	Bell MJ, Ternberg JL, Feigin RD, et al: Neonatal Necrotizing Enterocolitis — Therapeutic Decisions Based Upon Clinical Staging. Ann Surg 1978;187:1–7.	672
2	Puffenberger EG, Hosoda K, Washington SS, et al: A Missense Mutation of the Endothelin-B Receptor Gene in Multigenic Hirschsprung's Disease. Cell 1994;79:1257–66.	615
3	Lucas A, Cole TJ: Breast-Milk and Neonatal Necrotizing Enterocolitis. Lancet 1990;336:1519–23.	563
4	Edery P, Lyonnet S, Mulligan LM, et al: Mutations of the Ret Protooncogene in Hirschsprung's Disease. Nature 1994;367:378–80.	540
5	Santulli TV, Schullinger JN, Heird WC, et al: Acute Necrotizing Enterocolitis in Infancy — Review of 64 Cases. Pediatrics 1975;55:376–87.	355
6	Quan L, Smith DW: Vater Association. Vertebral Defects, Anal Atresia, T-E Fistula with Esophageal Atresia, Radial and Renal Dysplasia — Spectrum of Associated Defects. J Pediatr 1973;82:104–7.	349
7	Walsh MC, Kliegman RM: Necrotizing Enterocolitis — Treatment Based on Staging Criteria. Pediatr Clin North Am 1986;33:179–201.	341
8	Louw JH, Barnard CN: Congenital Intestinal Atresia — Observations on Its Origin. Lancet 1955;2:1065–7.	334
9	Kliegman RM, Fanaroff AA: Necrotizing Enterocolitis. N Engl J Med 1984;310:1093–103.	310
10	Holder TM, Cloud DT, Pilling GP, et al: Esophageal Atresia+Tracheoesophageal Fistula — Survey of Its Members by Surgical Section of American Academy of Pediatrics. Pediatrics 1964;34:542–9.	261
Period 2 (1995–2010)		
1	Pingault V, Bondurand N, Kuhlbrodt K, et al: SOX10 mutations in patients with Waardenburg–Hirschsprung disease. Nat Genet 1998;18:171–3.	433
2	Edery P, Attie T, Amiel J, et al: Mutation of the endothelin-3 gene in the Waardenburg–Hirschsprung disease (Shah–Waardenburg syndrome). Nat Genet 1996;12:442–4.	266
3	Metkus AP, Filly RA, Stringer MD, et al: Sonographic predictors of survival in fetal diaphragmatic hernia. J Pediatr Surg 1996;31:148–52.	243
4	Van Acker J, De Smet F, Muyldermans G, et al: Outbreak of necrotizing enterocolitis associated with Enterobacter sakazakii in powdered milk formula. J Clin Microbiol 2001;39:293–7.	240
5	Attie T, Pelet A, Edery P, et al: Diversity of Ret Protooncogene Mutations in Familial and Sporadic Hirschsprung Disease. Hum Mol Genet 1995;4:1381–6.	235
6	Harrison MR, Keller RL, Hawgood SB, et al: A randomized trial of fetal endoscopic tracheal occlusion for severe fetal congenital diaphragmatic hernia. N Engl J Med 2003;349:1916–24.	231
7	Vanderwinden JM, Rumessen JJ, Liu H, et al: Interstitial cells of Cajal in human colon and in Hirschsprung's disease. Gastroenterology 1996;111:901–10.	224
8	Eng C: Seminars in medicine of the Beth Israel Hospital, Boston: The RET proto-oncogene in multiple endocrine neoplasia type 2 and Hirschsprung's disease. N Engl J Med 1996;335:943–51.	206
9	Lin HC, Su BH, Chen AC, et al: Oral Probiotics reduce the incidence and severity of necrotizing enterocolitis in very low birth weight infants. Pediatrics 2005;115:1–4.	201
10	Herbarth B, Pingault V, Bondurand N, et al: Mutation of the Sry-related Sox10 gene in Dominant megacolon, a mouse model for human Hirschsprung disease. Proc Natl Acad Sci U S A 1998;95:5161–5.	199

diagnostics and laboratory based technology, and increased focus on the need, and subsequent funding allocation, for laboratory-based investigation.

This work has reflected the evolution of the medical journal over the past half century, with the rise of the 'specialist journal'. Specifically within neonatal surgery; medical genetics and pediatric surgical titles have come to the fore whilst general surgery journals now have less influence within this sphere. With the advances in other areas of science and science technology, the human genome has been explored and so new areas of medical science have emerged. Moreover, pediatric surgery has come into its own as a surgical subspecialty with its own dedicated journals. The Journal of Pediatric Surgery was the first pediatric surgical journal published in 1966. As a result, it is probably more appropriate for pediatric surgery papers to be published in pediatric surgery journals. However other non-pediatric/pediatric surgery journals still remain important. Nevertheless, by reading just one journal (Journal of Pediatric Surgery) one will have access to 20% of the relevant literature. By regularly using the top 3 pediatric surgery journals approximately one third of the relevant literature will be captured. To aid the pickup rate of the relevant literature, the use of an automated search engine could be utilized. "My NCBI" is one such search engine [15]. However, this methodology requires careful prospective evaluation.

The United States was the most prolific nation in terms of output for all periods with in excess of 2,000 publications for

Table 2 First or senior authors with more than one publication in the top 50 cited articles for each time-period.

	Number of publications	Number of authors	Author
Period 1 (1945–1994)	7	1	Harrison, MR
	4	1	Delorimier, AA
	3	1	Chakravarti, A
	2	3	Howell, LJ Kliegman, RM Puffenberger, EG
Period 2 (1995–2010)	7	1	Chakravarti, A
	6	1	Lyonnet, S
	5	1	Harrison, MR
	3	1	Amiel, J
	2	7	Angrist, M Attie, T Eng, C Filly, RA Stolar, CJH Walker WA Wilson, JM

each of periods 1 and 2. The expansion of journal output is obvious given that the periods 1 and 2 are 45 and 16 years long. The USA does tend to dominate medical and scientific publishing [16]. However, many nations have increased their output in recent years. So, China, South Korea, Taiwan and Turkey have all dramatically increased (greater than 10 fold increase) their output. There may be many reasons for this dramatic increase in scientific productivity. There is an increased awareness of the importance of research with consequent increases in funding. Increased scientific collaboration between developed and developing countries has undoubtedly increased the number of publications from these developing countries [17]. Previously, poor Internet penetration in developing countries was a significant barrier to meaningful scientific output. This no longer appears to be the case with virtually everywhere having easier instant access to journals and articles, and greatly facilitating research.

One limitation of WoS data retrieval and analysis is that it is not possible to segregate the articles relating to adult and pediatric patients, if the disease exists in both populations. Hence, two important neonatal surgical conditions, volvulus and inguinal hernia, were excluded from this work. No bibliometric analysis can guarantee that it will include only those papers which are relevant while completely excluding

Table 3 Comparison of publications and journals by timescale.

	Period 1 (1945–1994)	Period 2 (1995–2010)
Number of articles	6144	6215
Number of journals	591	711
Journals with most publications [a]	24	17
Surgery journals	6	0
Pediatric journals	7	8
Pediatric surgery journals	3	3
Other journals	8	6
Top 50 cited publications		
Surgery journals	8	0
Pediatric journals	15	8
Pediatric surgery journals	9	12
Other journals	18	30
Mean citation count (range)	228 (144–672)	156 (106–427)
PubMed total output	10,780,045	9,607,162
Web of Science total output	22,780,152	21,459,794

[a] Journals with the highest number of publications accounting for 50% of the cumulative publications for the given time period.

Table 4 Top 17 journals (50.59% of articles in 2.39% of journals) for period 2.

Journal title	Count	%
Journal of Pediatric Surgery	1272	20.48
Pediatric Surgery International	489	7.87
Pediatric Research	281	4.52
European Journal of Pediatric Surgery	159	2.56
American Journal of Obstetrics and Gynecology	119	1.92
Gastroenterology	103	1.66
Pediatrics	92	1.48
American Journal of Human Genetics	76	1.22
Acta Paediatrica	74	1.19
Ultrasound in Obstetrics and Gynecology	73	1.18
American Journal of Medical Genetics Part A	65	1.05
Journal of Pediatric Gastroenterology and Nutrition	65	1.05
Prenatal Diagnosis	64	1.03
American Journal of Medical Genetics	54	0.87
Pediatric Radiology	53	0.85
Journal of Pediatrics	52	0.84
Teratology (Birth Defects Research Part A: Clinical and Molecular Teratology)	51	0.82
Total	3142	50.59%

Table 5 Countries ranked by number of publications.

Rank	Period 1 (1945–1994)	Count	Period 2 (1995–2010)	Count
1	USA	2033	USA	2078
2	UK	479	UK	578
3	France	290	Japan	381
4	Germany	265	France	371
5	Canada	262	Canada	322
6	Australia	184	Germany	316
7	Japan	168	Netherlands	267
8	Netherlands	114	Italy	260
9	Italy	93	Turkey	203
10	Israel	88	Australia	179

those which are of peripheral or no interest. This limitation notwithstanding however, bibliometric investigation can provide stakeholders with a snapshot of research trends within their specialty of interest and, providing that search strategies are included, furnish a reproducible method of monitoring these trends into the future.

We have shown the growth in publication output over time. Importantly, in a subject area which has traditionally been published across a spectrum of titles, we have identified those journals in which this literature is concentrated. We have shown that, by concentrating solely on those titles, stakeholders are likely to miss a significant proportion of the relevant literature. The evolution of the Internet and the development of cloud based technologies should facilitate those interested to stay abreast of the scientific yield. The search strategies employed here and indeed the search engines available need to be prospectively evaluated.

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