**UK PAEDIATRIC SURGICAL ACADEMIC OUTPUT (2005-2020)**

**A CAUSE FOR CONCERN?**

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**Abstract**

**Background:** The publication record can be regarded as a key metric of the academic output of a craft surgical specialty with an almost exponential increase in the number of such publications worldwide over the past 20 years (Ashfaq et al. J Surg Res 2018;229:10-11). We aimed to examine and explore if this was the experience within UK paediatric surgery centres.

**Methods**

The academic search engine Scopus™ (Elsevier) was used to track every paediatric surgeon’s (NHS or University) publication history between Jan. 2005 – Dec. 2020. This was validated by an algorithmic search of PubMed™. The *h*-index (citations/publication), considered a validated metric of career academic output, was also calculated for each individual surgeon. A Field-Weighted Citation Index (Scopus™) (FWCI) was used to assess impact of individual publications. Textbooks, book chapters, abstracts, duplications (“double dipping“) and output attributed to UK BAPS-CASS national studies were excluded. Some output(s), not considered as relevant to “paediatric surgery”, was edited. Data are quoted as median(range).

**Results**

During this 16-year period, there were 3838 publications identified from 26 centres with a “top ten” listing of those paediatric surgical units contributing over half the output (n =2189, 57%). To look for evidence of trend(s) we analysed the output from these surgical centres in two 5-year periods (2005-9 and 2015-19) and showed an overall fall in output(s) - [730 (53.4%) to 645 (46.4%)] with 6/10 (60%) ‘ top ten ‘ centres here recording a reduction in publications.

The median h-index of the 232 contributing paediatric surgical consultants was 12 (range 1-56). The best performing publication from the “top ten” centres had 96.5(51-442) citations with the FWCI being 4.5 (2.2 – 30.2).

**Conclusions**

This study highlights current paediatric surgery publication output metrics in UK centres. There is evidence of a relative reduction in outputs overall which is a cause for concern for the future, although individual publications from the 10 most active units in the UK remain highly cited. These findings may serve purpose in several ways: (i) UK paediatric surgical centre rankings may be helpful for guiding residency / trainee application; (ii) surgical research funding for the top performing units may be better facilitated and finally (iii) UK centres showing a ‘ fertile ground ‘ for nurturing and training paediatric surgeons with academic aspirations could be useful for future workforce planning.

**KEYWORDS:** UK paediatric surgery; academic output; Hirsch index; university surgeon.

**Author Declarations:**

* We declare that we have no financial or commercial interest in the contents of this work.
* We declare that all authors contributed to the work and are aware of the final submission.
* We declare that the work is original and not under consideration elsewhere.

**Introduction**

Paediatric surgery is a relatively small craft specialty that emerged out of the field of general surgery in Europe and North America, largely during the 1950s and 1960s with the establishment of professional organisations in the 1950s (e.g. British Association of Paediatric Surgery), and a specialty-dedicated journal (Journal of Pediatric Surgery) in 1966. Its surgical remit has always been wide, encompassing for example both fetal surgery and adolescent bariatric surgery at its extremes. Although most academic output in paediatric surgery may be regarded as clinical themed research there has always been a basic science foundation niche to the speciality with a small cadre of university surgeons working in some of the major UK centres.

Academic or research output, whether in an individual surgeon or from a department, can be a difficult concept to define though above all seeks to measure, particularly for those outside of a university-setting , one’s ‘ performance ‘. Publications can be regarded as one of the key metrics of academic output [1,2, 3]. In order to try and factor the impact or influence of a publication further metrics have also been devised. The Hirsch *h*-index - a composite of the number of citations and number of publications - is a validated metric of an individual’s academic output which alters during one’s professional career [4, 5]. These tools of measurement can also be applied to learned institutions [5] including examining national output(s) within specific subject areas [6].

The current study seeks to provide a contemporary overview of the academic profile of paediatric surgery in the UK and Northern Ireland.

**Methods**

Two methods were used to ensure complete data capture.

A list of all paediatric surgeons working in the 26 UK and N. Ireland paediatric surgical centres was compiled who were active within the period Jan. 2005 – Dec. 2020. The academic search engine Scopus™ (Elsevier) has an abstract and citation database covering over 7,000 health science titles which was then used to track an individual’s (NHS or university consultant) publication history. Publications were attributed to the senior author and counted only once to calculate the yearly departmental output. Collaborative publications involving more than one institution was counted for as many as were involved. The only exceptions to this principle were those publications arising from the national collaborative British Association of Paediatric Surgeons Congenital Anomaly Surveillance System (BAPS-CASS) group [e.g. 7]. This, by definition, analyses data from all UK units and its output was therefore counted separately.

A PubMed™ search was conducted on “https://pubmed.ncbi.nlm.nih.gov” on 17/9/2020 with the following search terms: ((("Paediatric surgery") OR ("Pediatric surgery") OR ("Neonatal surgery") OR ("Foetal surgery") OR ("Fetal surgery") OR ("Newborn surgery")) AND (("UK") OR ("United Kingdom") OR ("Scotland") OR ("England") OR ("Wales") OR ("Northern Ireland") OR ("Britain") OR ("Ireland"))). Papers were exported by selecting "Send to" followed by "Citation Manager", "All Results" and finally - "Create file". The PubMed identifiers were then inputted into the Web of Knowledge at “https://webofknowledge.com”. Citation reports were generated and exported as text files in batches of 500. The exported files were analysed using a Python script (Python v3.8.9, Notebook v6.0.3 and Pandas 1.0.3). An iPython notebook is available at request from the study authors.

Citations from textbooks, abstracts, conference proceedings, which are listed in Scopus, were excluded. There were also some surgeons who contributed to publications where the principal content was far removed from any paediatric surgical subject matter. These were also excluded from their departmental output.

The *h*-index, as calculated by Scopus, was noted for each individual surgeon, but unlike a departmental output metric, reflects that person’s entire publication career and also includes every subject.

Individual quoted publications were also assessed for “impact” using the Field-Weighted Citation Impact (FWCI) which gives the document's citations to the average number of citations received by all similar documents in that speciality field over a three-year window. A value >1 typically implies that the document is more cited than expected according to the average.

Data were quoted as median (range), unless otherwise indicated.

**Results**

There were 3838 publications identified from 26 UK paediatric surgical units from Jan. 2005 to Dec. 2020 (Table 1) with the “top ten”units contributing over half of all outputs (n = 2189, 57%). The highest performing unit was Great Ormond Street Hospital (GOSH), London with 11.8% (n = 454) of the total with Alder Hey Children’s Hospital, University Of Liverpool and Kings College Hospital London together here comprising the ‘ top 3 ‘ UK centres. There was also a clear step-change between positions 10 and 11 of the UK centre rankings in terms of output (Fig.1). In order to look for evidence of any trends during the study period, at least in the most productive ‘ top ten ‘ paediatric surgery units, we examined two complete five-year periods (2005-9 and 2015-19). Overall, there was a contraction in activity from 730 (53.4%) to 645 (46.4%) publications with only four UK paediatric surgical units producing more output than before. In the remaining institutions there was an increase in output from 211 (46.2%) to 246 (53.8%), with the totals therefore showing an absolute decline from 941 (51.4%) to 891 (48.6%).

Table 2 lists the top cited publication from each of the ‘top ten’ UK paediatric surgical centres [8-19]. Rather ironically, the top-cited publication from GOSH, London was actually a case-report, albeit one involving a tissue-engineered tracheal transplant [8], so here two more representative publications were also quoted [9,10]. Still, as can be seen by its FWCI of 30.2 this case-report has had a considerable citation impact in the field. Most publications from UK surgical centres were clinical study series or some form of systematic review(s), but 55% (6/11) scored here >100 citations with a median of 96.5(51- 442). Only 45% manuscripts (5/11) were published in the past decade. Median FWCI was 4.5 (range 2.2 – 30.2).

The output(s) of 232 UK paediatric surgery consultants were listed as contributors with an individual *h*-index of 12 (range 1-56).

BAPS-CASS has published some 24 articles from 9 national surveys (UK and Ireland), since its inception in 2006. These are all available Open Access and the original manuscript on management of gastroschisis reached 99 citations [20]. Table 3 lists the principal publications from these nationwide surveys with both their overall number of citations and FWCI subsequently [20-26].

**Discussion**

Academic output is necessarily difficult to quantify but published output is one relatively simple metric that might be thought of as broadly reflective. Clearly it has obvious weaknesses as seen in this current study by equating a case report with a randomised controlled trial, but departments that perform well tend to produce both sorts of output. Furthermore most randomised controlled trials in UK paediatric surgery over the past 15 years have been very much multicentre efforts, albeit organised by larger institutions. Our survey showed a variable landscape across the UK with too many paediatric surgical units having a limited expectation of any kind of publication. Others, by contrast, seemed to thrive and were consistent performers throughout the period.

Published medical and surgical output(s) have been increasing year on year with over 88,000 in the PubMed database recorded in 2015 originating from the UK - currently the 3rd most prolific world country [1]. Given this evident expansion, it is perhaps somewhat surprising that there was evidence that UK paediatric surgical output was somewhat static during the period with therefore a relative decline in output. It is difficult to understand why this is happening, given the relative ease of medical writing and web access to the surgical literature, together with the huge proliferation of journals to submit to. In addition, there are certainly more consultants and indeed surgical trainees in our speciality now than there were at the beginning of the study period. However, there are also many more bureaucratic and regulatory hurdles that have to be overcome before a formal surgical research or audit project is even given the green light. Access to funding may be difficult particularly if there is no individual track record or the project comes from outside a recognized surgical research centre. Laboratory or experimental surgical research has declined considerably since the 1990s, and is now probably confined to only a few resource-rich and usually university-based institutions.

The *h*-index has become increasingly recognised as a tool to measure an individual’s scientific output incorporating not only number of publications but also citations. It correlates with academic ranking, so that a mean *h*-index for American Professors in Surgery was 28 compared to 12 for Associate Professors in one recent study [5]. So how well do we do perform in UK paediatric surgery by comparison to other countries or indeed specialties? Well, there has been actually very little published national data to interrogate. Ashfaq et al. [5] recently calculated the *h*-index for all surgical specialists (>3,700) in the USA. The highest departmental median *h*-index was for Thoracic Surgeons scoring 14 but Paediatric Surgery as a speciality (n=136) were not far behind with a median of 12 and a range of 0 - 90. This corresponds exactly to our own median value (12), though our highest individual *h*-score ranking was an *Emeritus* Professor of Paediatric Surgery at GOSH (Lewis Spitz) which was somewhat less at 56.

The vast majority of publications in the specialty field are in only three journals: Journal of Pediatric Surgery (JPS), Pediatric Surgery International (PSI) and European Journal of Pediatric Surgery (EJPS). Jehangir et al. [2] surveyed their output over the past 3 decades noting not only a significant increase in publications *per se*, of about 20% per decade, but also qualitative changes with significant increases in the mean number of authors, article length and multi-institutional collaborations. Unsurprisingly, there was also evidence of consistent regional bias (e.g. 40-60% of JPS content was from North America compared to <10% in the EJPS). None of these journals scores highly in terms of Impact Factor ranging from 1 to 2, but then neither does surgery as a whole with leading European (British Journal of Surgery) and American surgical journals (Annals of Surgery) as examples having current IFs of only 5.9 and 9.2 respectively, far below their brethren in the general or medical genetic fields (general scientific) (e.g. Lancet 59, Nature 43).

It could be said that the UK has led the field in surveys of national outcome studies not only in some individual surgical diseases such as biliary atresia [14], but also consistently in its annual BAPS-CASS returns on many major congenital abnormalities. This was funded in part by the BAPS national organisation and also external competitive research grants co-led with designated UK consultant paediatric surgeons by a public health expert working at University of Oxford - Prof. Marian Knight. BAPS CASS provided prospective, observational, real world and realistic outcomes though never really tried to test hypotheses or drive innovation. Furthermore, as Table 3 shows BAPS CASS has had relatively little citation impact. This programme has now recently come to an end. There have been some successor organisations which have emerged such as the new BAPS RCSEng Multicentre Collaborative Research Initiative [27] which was designed to facilitate collaborative research and observational studies with current initiatives focused on the effect of COVID on appendicitis (CASCADE study), a project examining timing of stoma closure in neonates (ToSCiN study) and benefits (or otherwise) of antacid therapies ameliorating stricture rate(s) in oesophageal atresia (TOAST).

Very little regard is currently placed on academic achievement when entering UK specialist surgical training or indeed at the end of a training programme when competing for consultant appointments. Certainly it seems the concept of *“publish or perish”* belongs to “ a bygone age “ , both for them and the younger cohort of newly-appointed UK NHS consultants. For these surgeons the drive seems to come from within the individual rather than from any kind of institutional expectation. UK university-funded positions are increasingly rare in our speciality with professorial chairs existing only at Great Ormond Street, London; Southampton (Associate); Oxford and Liverpool.

So what does the future hold for paediatric surgical research in the UK? It is clear that there is still very much an appetite amongst trainee paediatric surgeons for this pursuit as a worthy personal endeavour, though very few now will attempt formal academic degrees (e.g. PhD) or explicit academic training. Moreover, our survey perhaps suggests that actual completion and publication depends much more on the institutional environment than on an individual’s capability. One avenue that is gaining some momentum is that of peer-group collaboration with a number of different projects initiated by the Paediatric Surgical Trainees Research Network [28]. This, perhaps to some extent may overcome the problem inherent in most paediatric surgical themed subjects i.e. low index case volume and rare diseases - by amalgamating a network experience [29].

Our aim was to best reflect the publishing record of UK paediatric surgical units and we excluded some published work that we considered as predominantly scientific, typically genetic and molecular biological in nature, that had only at best a tenuous relationship to our surgical field. Certainly there are some paediatric surgeons who are involved in highly respected science departments where genetic publications might involve over 100 authors and have > 1000 citations [30]. Similarly we did not have access to some metrics which have been thought important in academic endeavours, namely the number and amount of research funding and awards. As mentioned above such awards, and certainly the truly scientific are very much restricted to those with allied university departments.

The role of research should be unquestioned in driving this craft-based specialty forward. High-quality research does require a combination of scientific translational research; hypothesis-based, ideally randomised, controlled trials; and long-term disease-specific registries, but we must be realistic is stating the positive role of quality retrospective case-control series in this surgical arena.

In conclusion and to the best of our knowledge this study appears to be the first comprehensive appraisal examining national academic output in UK paediatric surgery. The findings may serve purpose in several ways e.g. (i) UK paediatric surgical centre rankings linked to the National Selection training programmes may be helpful for guiding residency / trainee application (ii) UK surgical research funding for the top performing units may be better facilitated and finally (iii) UK surgical departments showing a ‘fertile ground‘ for nurturing and training paediatric surgeons with academic aspirations could be useful [31].

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**TABLE & FIGURE LEGENDS**

Table 1: List of Paediatric Surgical Units - UK and Northern Ireland

Table 2: Top cited papers for each institution published within period 2005 – 2020.

Table 3: BAPS-CASS: Principal publication record listed by subject of interest

Figure 1: Publishing Output by Paediatric Surgical Centre.