



The changing tides of Irish orthopaedic research

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Abstract

Introduction Research is fundamental to bridging theory, practice and education in orthopaedics. Following the restructuring of the surgical training pathway in Ireland, the opportunity to undertake clinical- or lab-based research has fallen.

Aims Our aim was to investigate the trends of research in orthopaedics and the implications there.

Methods We reviewed the trend in publications by Irish trauma and orthopaedic (T&O) trainees over the past 20 years across three different classes of journal. We also reviewed the Irish participation in the annual British Orthopaedic Association (BOA) meeting over the past 10 years as well as the rates of abstract submission to the annual Irish Orthopaedic Association (IOA) meeting.

Results We found that publication rates were as follows: *JBJS* 2005–2010 mean 4.8 vs. 2000–2005 mean 1.6 and 2010–2015 mean 0.2; *Injury* 2005–2010 mean 3.6 vs. 2000–2005 mean 3.4 and 2010–2015 mean 2.2; *IJMS* 2010–2015 mean 4.4 vs. 2000–2010 mean 1.1. The number of Irish presentations at the BOA fell from a mean of 5 between 2000 and 2010 to a mean of 1.2 between 2011 and 2017. The rate of IOA abstract submissions compared over the same period has fallen by 21%. We also found that 4% of Irish orthopaedic publications in the *IJMS* were scientific in nature; this figure was 3.7% of publications in injury and 32.6% in *JBJS* (UK).

Conclusions There has been a significant decrease in publication rates by T&O trainees in high-quality journals. There has also been a notable decline in Irish representation at the BOA and a drop in the number of abstract submissions to the IOA. We suggest these findings coincide with the streamlining of surgical training in Ireland, which does not provide for the pursuit in research that is crucial to our practice as clinicians, to the future of our specialty and to the Irish orthopaedic representation internationally.

Keywords Clinical research · Irish orthopaedic training · Orthopaedic research

Introduction

Research is fundamental to bridging theory, practice and education in surgery. The importance of research in the development and promotion of evidence-based practice is long established. In 1900, the pioneering surgeon Ernest A. Codman, a trailblazer in the area of patient care, developed a system for linking medical intervention to long-term patient outcomes, predicting that if one was to collect and assess outcomes creating a database, with the analysis thereof a “true clinical science” would begin [1]. Ubbink et al. described evidence-based medicine (EBM) as the conscientious, explicit and judicious use of best available evidence in making decisions about individual patient care [2].

The integration of EBM is more challenging in surgery than in medicine as high quality surgical research is more problematic than pharmacotherapeutic research [3, 4]. The observation that approximately 50% of medicine in comparison to 24% of surgery is based on level 1 evidence from randomised controlled trials illustrates this [5]. Of note, only 3.4% of all publications in high impact surgical journals are randomised controlled trials [6].

As a rapidly evolving specialty surgery is evolving rapidly, it surgery is characterised by the innovation of new techniques and materials with continual refinement of existing ones, whose emergence is reliant on EBM. Successful decision-making in surgery depends on the integration of evidence, the biologic understanding of the condition, and our experience, taking into account patient profile. The balanced application of evidence is the cornerstone of our practice and involves the culmination of clinical expertise and judgement, patient and societal values, as well as the best available evidence [7]. Indeed, the majority of surgical discoveries have emerged from the curiosity of a surgeon who was confronted with a clinical problem, such as Mr. Marius

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Nygaard Smith-Petersen who served in World War I with the First Harvard Medical Unit who developed the three-flanged steel nail for hip fracture fixation, inspired by his experiences of military trauma on the front line in France [8].

The need for quality research to promote evidence-based practice and optimise patient care is particularly relevant in trauma and orthopaedic surgery, especially as trauma is a leading cause of morbidity and mortality worldwide. Research remains integral to the amalgamation of theory, practice, and education. A gap exists, however, between research and practice. The scope of orthopaedic research has widened hugely in recent years, focusing on basic sciences involving regenerative research, molecular biology as well as computer-assisted imaging and operating as well as translational research [9, 10].

In Ireland, there has been augmentation of the surgical training pathway with the aim of streamlining training. As part of this new pathway, trainees complete 2 years of basic surgical training (BST) and apply during their second year of training directly for higher specialist training lasting 6 years [11]. Following this, trainees are encouraged to seek fellowships in centres of excellence abroad. With focus on the acquisition of operative skills during a shortened training period, the time to embark upon meaningful research during training has diminished. Therefore, our aims were to analyse the changing tides of research, both published and presented, by Irish orthopaedic trainees over a 20-year period transcending three periods of training restructuring.

Methods

We reviewed the publication records of Irish orthopaedics trainees across a spectrum of journals according to the impact factor from 1997 to 2017. We included only trainees within the Republic of Ireland Deanery; however, this included trainees at basic and higher specialist training level, as well as those within Irish Orthopaedics but outside of specialist training. The journal selection included one high impact factor orthopaedic journal—Journal of Bone and Joint Surgery (UK), one middle impact factor journal—Injury and one lower impact factor journal—Irish Journal of Medical Sciences providing a broad sample of a spectrum of orthopaedic journals commonly contributed to by Irish orthopaedic trainees; the search was performed using the PubMed database. Only peer-reviewed publications were included and only publications that were PubMed indexed were included in this study. Published abstracts or conference publications were also excluded. We then cross referenced our findings with the Web of Science database. We compared the number of publications from all three journals across three phases of restructuring of orthopaedic training.

We then reviewed the number of Irish presentations at the British Orthopaedic Association annual meeting over the same period of time. We included only podium presentations and

those performed by fellows from abroad undertaking fellowships in Ireland. We also excluded any annual meetings which were held in partnership with the Irish Orthopaedic Association. We also analysed the abstract submission rates over the same period to the Irish Orthopaedics Association annual meeting by Irish orthopaedic trainees. Statistical analysis was performed using unpaired *t* testing \pm Welch's unequal variances *t* test using the Graphpad software and for all statistical analysis, a value of $P < 0.05$ inferred statistical significance.

Results

We found that publication rates in JBJS (UK) to be 2005–2010 (group B) mean 4.8 vs. 2000–2005 (group A) mean 1.6 and 2010–2015 (group C) mean 0.2 (Fig. 1). The mean publication rate of group B minus group A equals 3.60, with a 95% confidence interval of this difference from 1.18 to 6.02 and was found to be statistically significant. Publication rates in the journal *Injury* between 2005 and 2010 (group B) were found to be a mean of 3.6 vs. a mean between 2000 and 2005 (group A) of 3.4 and a mean of 2.2 between 2010 and 2015 (group C) (Fig. 2). The mean of group B minus group C equals -0.60 with 95% confidence interval of this difference ranging from -3.78 to 2.58 and was found not to be statistically significant. The rates of publication the IJMS group B were found to be a mean of 4.4 vs. mean of 1.1 in group A (Fig. 3). The mean rate of publication in IJMS in group B minus group C equals -4.00 with a 95% confidence interval of this difference: from -6.06 to -1.94 and this was found to be statistically significant.

The number of Irish presentations at the BOA fell from a mean of 5 from 2000 to 2010 to a mean of 1.2 between 2011 and 2017 (Fig. 4). The mean of 2002–2009 minus 2010–2017 equalled 3.00. There was 95% confidence interval of this difference from 1.51 to 4.49 and was found to be statistically significant. The rate of IOA abstract submissions compared over the same period has fallen by 21% (Fig. 5). The mean number of submissions from 2010 to 2013 minus 2014–2016 was found to be 48.67 with 95% confidence interval of this difference: From -19.97 to 117.30 and was therefore found not to be statistically significant. We also found that 4% of Irish orthopaedic publications in the IJMS were scientific in nature (Fig. 6); this figure was 3.7% (Fig. 7) of publications in injury and 32.6% in JBJS (UK) (Fig. 8).

Discussion

An understanding of the fundamentals of basic science and the skills required to critically evaluate the results of research are synonymous with the successful integration of scientific developments into clinical practice [12]. The role of the investigative surgeon has been highlighted in recent times by Basson et al.



Fig. 1 Publications rates in JBJS

noting that surgeons with an academic interest have the ability to ask research questions within our field that our academic colleagues might not recognise [13]. The concept of the surgeon scientist places one in a unique position to ask clinically relevant questions but with the academic knowledge and skills to answer them [13].

Over the course of the last century, surgical training has predominantly followed the model proposed by Halsted in the 1890s at Johns Hopkins University [14]. An increasing

number of surgical residents are now opting to dedicate greater than 1 year to research; this has almost doubled within 20 years, 9.8 vs. 22.4% [14]. The benefits of nurturing an academic mentality amongst surgical trainees are widely acknowledged. In the US, studies have reported that resident orientated research programmes contribute to improved clinical care [15–17]. A focus on research during surgical training has been shown to help trainees understand how new medical knowledge is generated and promotes valuable life-long

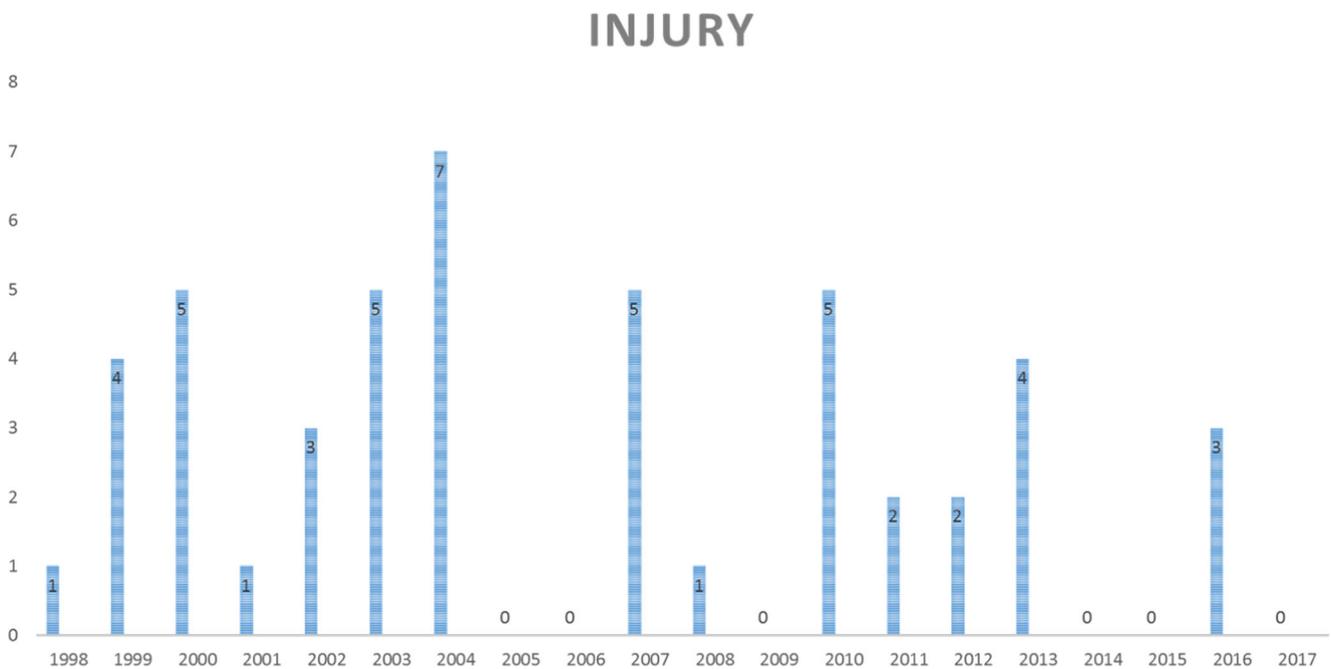


Fig. 2 Publication rates in the journal *Injury*

IJMS

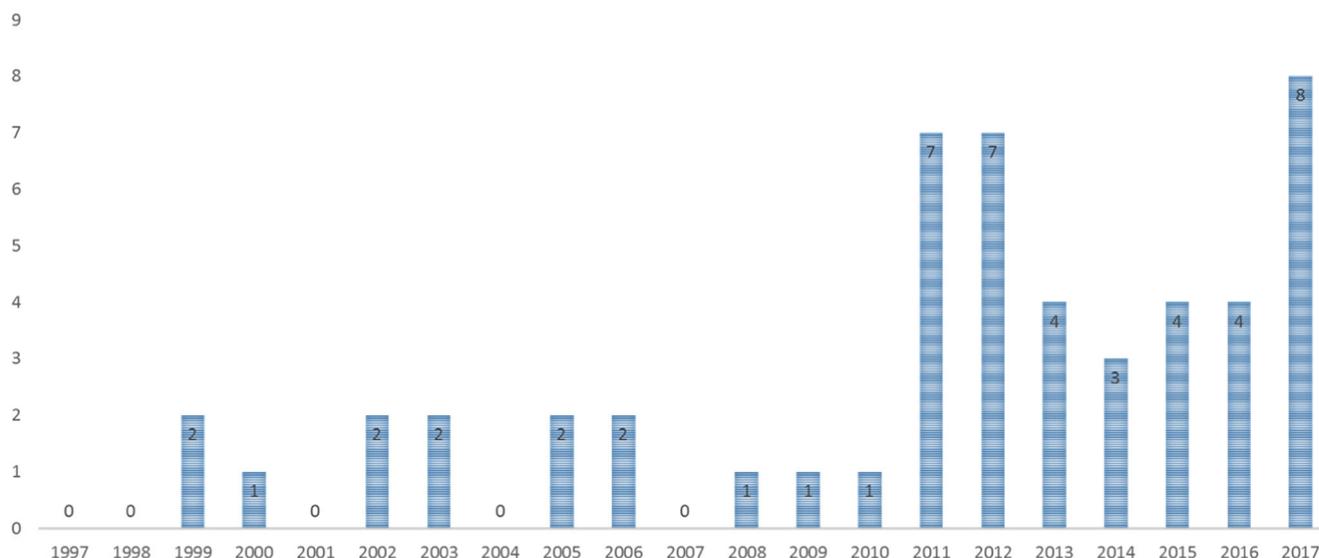


Fig. 3 The mean rates of publication in IJMS

learning skills fostering a mentality of evidence-based medicine [18]. It has been demonstrated in the UK that treatment in trusts with strong participation in interventional clinical research is linked with better patient outcomes. Downing et al. found that there was an independent association between survival and participation in interventional clinical studies for all patients with colorectal cancer treated in a study carried out in St. James’s Hospital in Leeds [19].

Orthopaedic surgeons with an understanding in science and the ability to critically evaluate basic and clinical research are

essential for the translation of science into clinical practice. It had previously been demonstrated by Mc Donald et al. that fewer number of years spent training prior to achieving higher surgical training has had a proportional decrease in the number of published papers by Irish surgical trainees [20]. Our findings demonstrate a significant decrease in publications rates by trauma and orthopaedics trainees in high quality journals. We noted a statistically significant decrease in the number of publications by Irish orthopaedic trainees in the selected high impact journal *JBJS* (UK) from the period of

Irish presentations at BOA

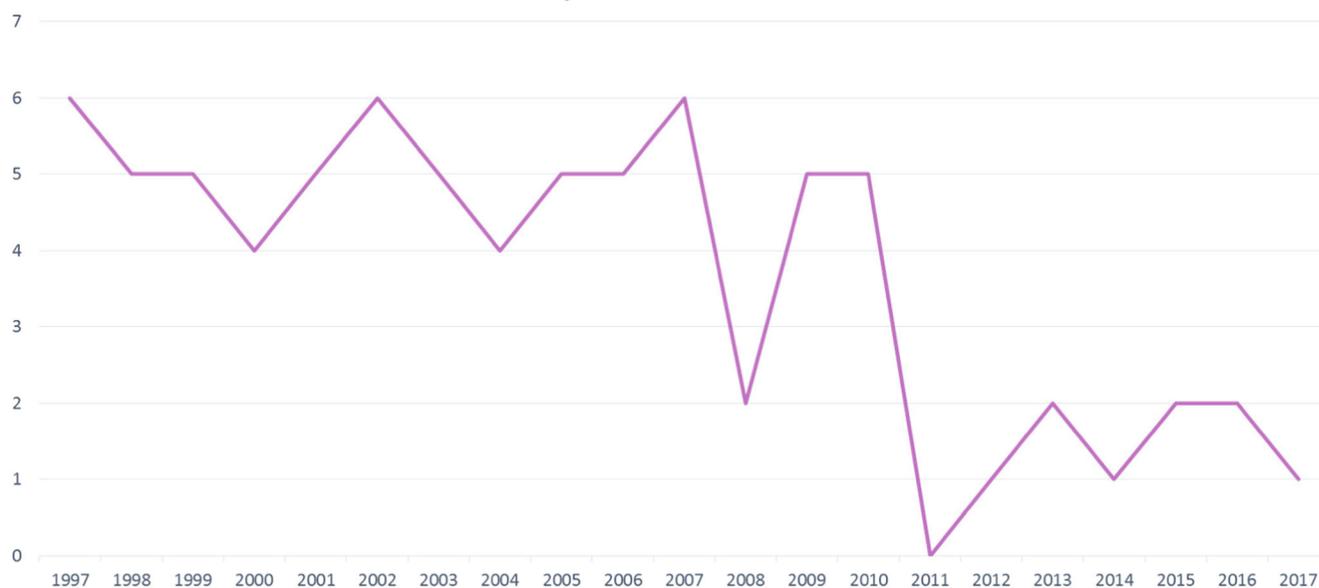


Fig. 4 The number of Irish presentations at the BOA

ABSTRACT SUBMISSIONS TO THE IOA

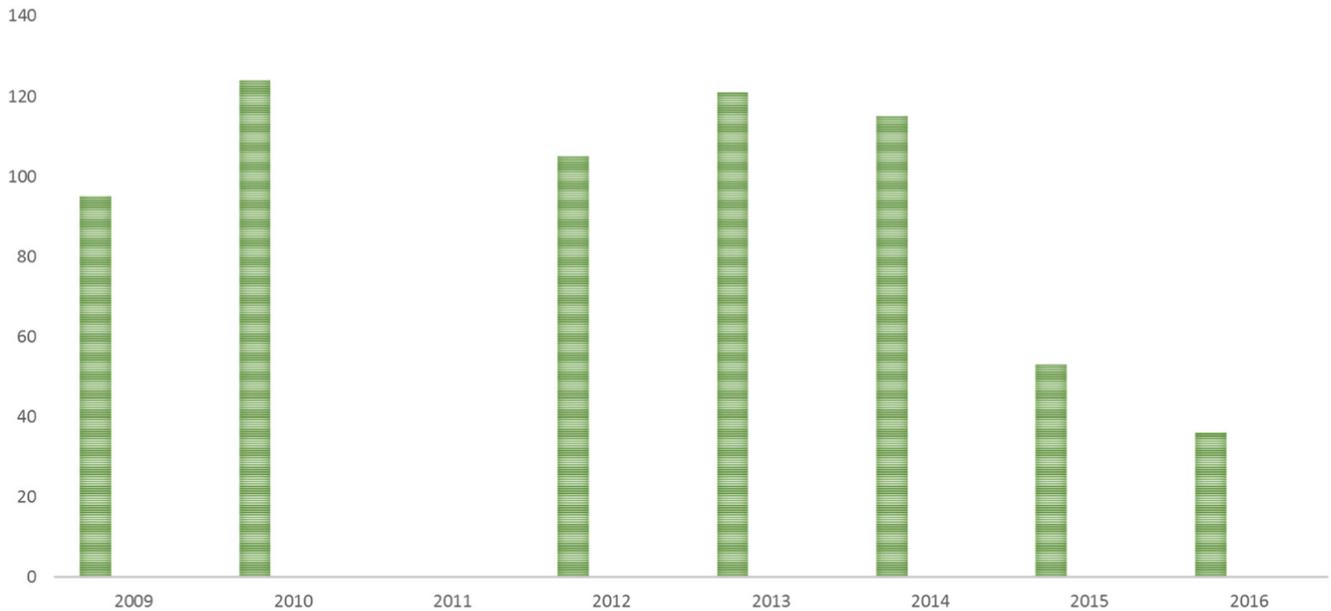


Fig. 5 The rate of IOA abstract submissions

2005–2010 in comparison to 2010–2015. This reflected the findings of Mc Donald et al., which showed there has been a significant decrease in the quantity of peer-reviewed publications by the new pathway trainees, which began in 2013 compared to the old pathway trainees, which allowed for a gap year or two to pursue research interests following basic surgical training prior to application to higher surgical training [20].

There was also a significant trend related to predominance of clinical research over scientific research across all three journals; however, there was a higher number of scientific papers which satisfied criteria for publication within the JBJS than in injury of IJMS. Overall, clinically orientated

papers were far more commonplace indicating a paucity of scientific research being undertaken. There has also been a notable decline in Irish representation at the BOA over the past 20 years, which was also found to be statistically significant and a drop in the number of abstract submissions to the IOA over the past 6 years, which however was not found to be statistically significant. We suggest these findings coincide with the streamlining of surgical training in Ireland, which no longer allows for the pursuit of research prior to progression to higher specialist training (HST).

A correlation has been found between the augmentation of the surgical training pathway in 2013 and a decreased rate of

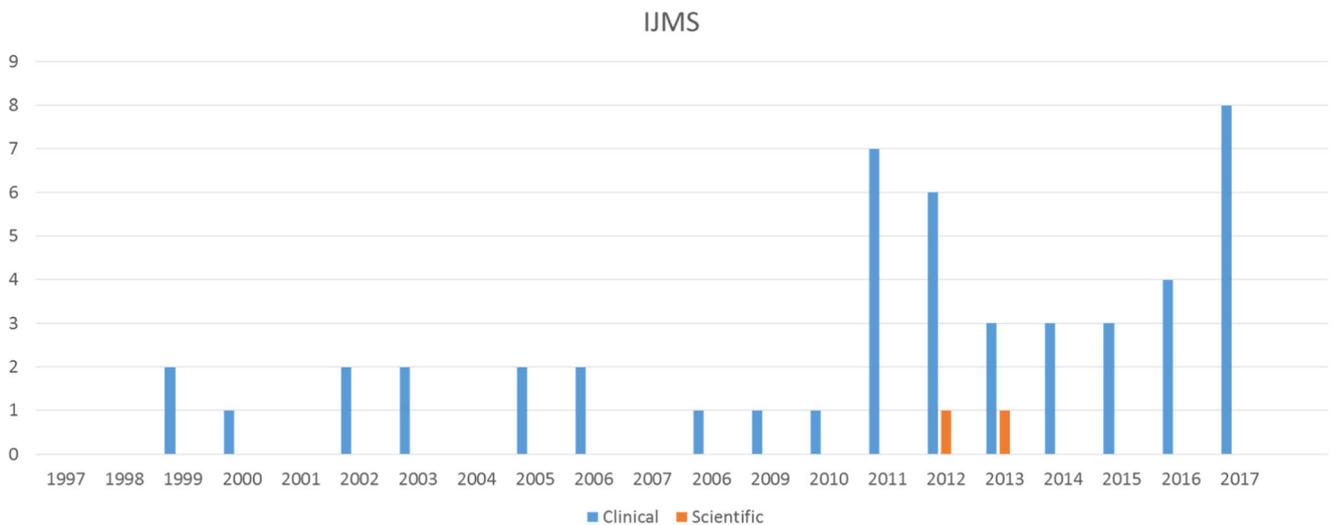


Fig. 6 Irish orthopaedic publications in the IJMS

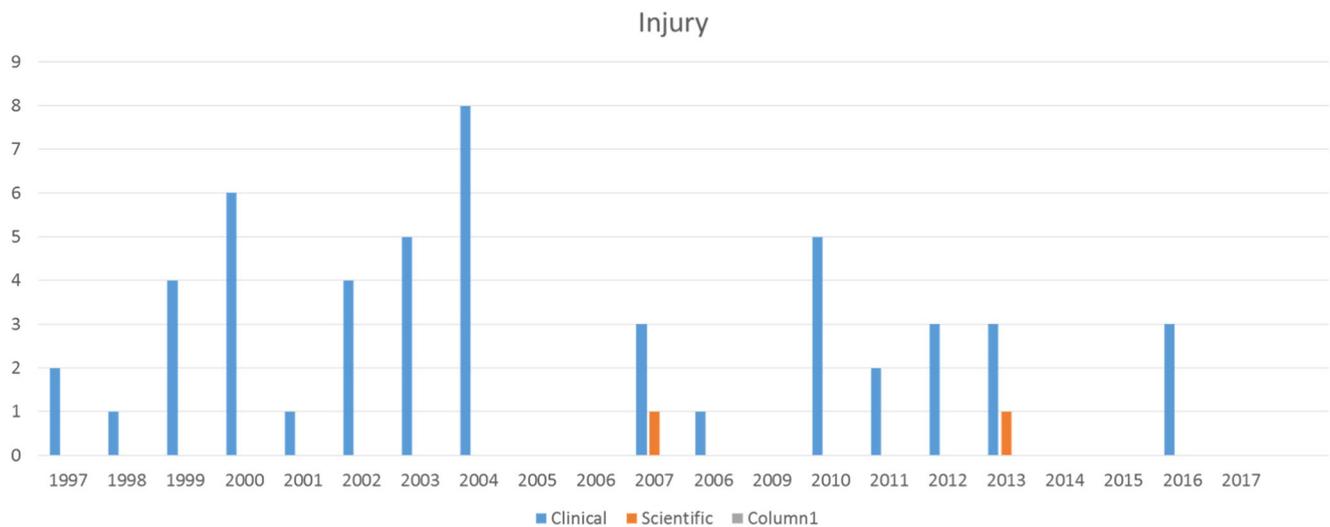


Fig. 7 Irish orthopaedic publications in injury

Irish orthopaedic research production in high quality journals, as well as a fall in Irish representation at the largest meeting across the British and Irish orthopaedic calendar. Irish higher surgical training in trauma and orthopaedic training promotes the pursuit of fellowship abroad to gain operative and clinical skills within a specific area in of interest following completion of higher specialist training. It has been demonstrated that following completion of fellowship examinations the presence of a thesis by higher degree and research as the distinguishing criterion in the search for competitive fellowship [14]. Following the streamlining of surgical training in Ireland the opportunity to engage in meaningful research contributing to CV development is no longer available to Irish trainees, making the acquisition of competitive fellowships more difficult. Thus, a paucity of new skills being brought home from abroad to patients in Irish centres may emerge, impacting on surgical development and patient care in Ireland.

Our study provides a snapshot of current Irish orthopaedic research practice; however, it is limited in the choice of three journals according to impact factor, in which we reviewed Irish orthopaedic trainee publications. Another way of analysing Irish orthopaedic research output may involve calculating an author's H index and compare those prior and following streamlining of orthopaedic training. Our study is also limited by the data available on the number of abstracts submitted for consideration at the Irish Orthopaedic Association, a more accurate trend may be obtained with data available over a longer period. This study may be further developed as run through trainees complete higher specialist training and seek fellowships abroad. Possible confounding variables include a shift in on call patterns in line with EU working time directive compliance in the direction of scheduled shift work.

This research may raise more questions than it has answered, but in order to stay relevant and remain competitive

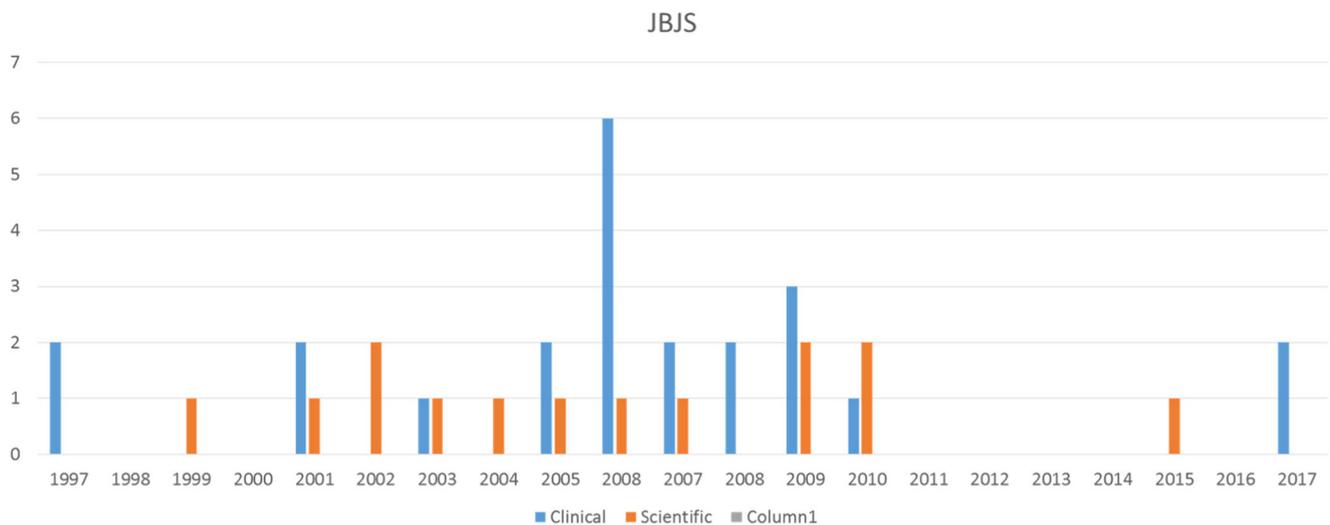


Fig. 8 Irish orthopaedic publications in JBJS

internationally, we need re focus on the importance of research amongst our training surgeons. The reintroduction and integration of a gap research year either prior or during the early years of higher surgical training is a possible solution. This period would also allow for lab research to be conducted, which is often demanding of time and therefore shown to be in decline due to the challenges encountered carrying out such research during clinical training. The facilitation of half-time clinical half-time research postings for those with an interest in the career of an academic surgeon is also another option and has been adopted by a number of residency programmes in the USA with a view towards fostering the mentality of the academic surgeon [15]. This facilitates the concurrent development of surgical skills along with the pursuit of meaningful research, negating concerns regarding the potential loss of surgical technique during a ‘gap year’ period. Another possibility is the incentivisation of research goals as part of yearly training assessments with a view towards fostering a renewed focus and enthusiasm in evidence-based medicine. This may be attained by broadening the role of HST mentor to incorporate research guidance with an integrated research component running in parallel with clinical rotations, which has been shown to work well as part of residency programmes in the USA [21]. This should be with the aim of developing a CV aimed towards the acquisition of competitive fellowships.

In conclusion, we have demonstrated a correlation between the augmentation of the surgical training pathway in 2013 and a decreased rate of Irish Orthopaedic Research production. We have shown evidence of a lower tide in both the rate and the quality at which Irish orthopaedic research is being produced but have also proposed plausible solutions to this issue. Overall, renewed focus on the importance of research amongst Irish orthopaedic training is required to ensure we are not swept out to sea.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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