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# Financial impact of surgical training on hospital economics: An income analysis of 1184 out-patient clinic consultations

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ABSTRACT

*Introduction:* In many countries healthcare commissioning bodies (state or insurance-based) reimburse hospitals for their activity. The costs associated with post-graduate clinical training as part of this are poorly understood. This study quantified the financial revenue generated by surgical trainees in the out-patient clinic setting.

*Methods:* A retrospective analysis of surgical out-patient ambulatory care appointments under 6 full-time equivalent Consultants (Attendings) in one hospital over 2 months. Clinic attendance lists were generated from the Patient Access System. Appointments were categorised as: 'new', 'review' or 'procedure' as per the Department of Health Payment by Results (PbR) Outpatient Tariff (Outpatient Treatment Function Code 104; Outpatient Procedure Code OPRSI1).

*Results:* During the study period 78 clinics offered 1184 appointments; 133 of these were not attended (11.2%). Of those attended 1029 had sufficient detail for analysis (98%). 261 (25.4%) patients were seen by a trainee. Applying PbR reimbursement criteria to these gave a projected annual income of £GBP 218,712 (€EU 266,527; $USD 353,657) generated by 6 surgical trainees (Residents). This is equivalent to approximately £GBP 36,452 (€EU 44,415; $USD 58,943) per trainee annually compared to £GBP 48,732 (€EU 59,378; $USD 78,800) per Consultant. This projected yearly income off-set 95% of the trainee's basic salary.

*Conclusion:* Surgical trainees generated a quarter of the out-patient clinic activity related income in this study, with each trainee producing three-quarters of that generated by a Consultant. This offers considerable commercial value to hospitals. Although this must offset productivity differences and overall running costs, training bodies should ensure hospitals offer an appropriate return. In a competitive market hospitals could be invited to compete for trainees, with preference given to those providing excellence in training.



## 1. Introduction

Health care funding continues to be a topical consideration internationally. The Director of the World Health Organisation recently stated that 'In every region of the world, the costs of health care are going up as populations age, chronic diseases increase, and new and more expensive treatments become available'.[1] Governments and healthcare commissioners are consequently attempting to make their healthcare services more productive and efficient to prevent costs escalating.

Set against this is the cost of training new doctors to supply the healthcare workforce. For undergraduate medical training, attempts can be made to calculate this. University and healthcare sources have historically estimated instructional costs of $USD 40,000–50,000 (£GBP 24,745–30,931; €EU 30,155–37,693) per student per year in the United States, therefore totalling up to $USD 278,300 (£GBP 172,162; €EU 209,800) adjusting for current inflation.[2] In the United Kingdom, costs have been previously been estimated at approximately £GBP 200,000 per student in 1997

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(£GBP 298,600; €EU 363,880; $USD 482,836 adjusted for inflation), which also takes into account costs to the National Health Service (NHS) as well as costs to local University departments.[3]

The costs associated with postgraduate training are more complex and difficult to quantify given the introduction of salary and benefits balanced against the capacity for income generation through clinical activity. Additional confounding factors are introduced by the differences in efficiency potentially exhibited by trainees together with a potential decrease in productivity arising from the additional time taken for training.

Whilst these factors will apply to all medical specialities, the procedural emphasis of surgical training together with its associated long apprenticeship puts it at particular risk of placing a financial burden on employers. Understanding the income generated by trainees through their hospital service is therefore an important consideration in the economics of training. Although previous attempts have been made to analyse the costs of training in the out-patient setting,[4] little is known about the capacity for income generation by hospital clinical staff or their relative contributions towards hospital revenue in this area.

This paper aimed to quantify the income generated from surgical trainee work in the elective outpatient clinic setting.

## 2. Method

### 2.1. Financial setting

In the UK and other countries with insurance or state healthcare systems, funding structures have been introduced to reimburse hospitals for patients being seen or treated. The UK system for this was introduced in 2004 and is known as "Payment by Results" (PbR). The government has previously stated various reasons for introducing this in the National Health Service (NHS), namely: 'to support patient choice, reward efficiency and encourage activity to reduce waiting times', amongst others.[5]

PbR is the national framework for reimbursements to public hospitals based on their activity. Two concepts underpin this: 'Currencies' and 'Tariffs'. Currencies are the 'unit of healthcare for which a payment is made' (for example a new outpatient attendance at a clinic) and a Tariff is 'the set price paid for each currency'.[5] Funding amounts are then calculated by looking at the type of treatment a patient has received.

Currencies are put into clinically meaningful groups of diagnoses and interventions based on similar levels of consumption of resources known as Healthcare Resource Groups (HRG's).[6] When a patient is reviewed or treated in hospital, a Clinical Coder translates this care into the appropriate HRG codes. These are used to determine how much the healthcare commissioner owes the hospital. This system currently covers the majority of healthcare in hospitals, with tariffs reflecting national average costs for admitted patient care, outpatient attendances, accident and emergency (A&E), and some outpatient procedures.

Basic salaries for junior doctors in recognised NHS training posts are provided by their regional training bodies (Deaneries), while hospitals fund their on-call supplement. Trainees are therefore potentially valuable income-generators relative to the NHS-funded component of their salaries due to the revenue they earn the hospital for service provided and reimbursed through the PbR funding system.

### 2.2. Study setting and data collection

Nottingham University Hospital is a large regional teaching hospital and tertiary referral centre. This study was undertaken as a service provision audit, with approval granted by Nottingham University Hospitals NHS Trust.

Data from all colorectal general surgery out-patient appointments taking place in the Queen's Medical Centre Campus was collected retrospectively from the hospital's clinic attendance list generated by the Patient Access System (PAS) over a 2 month continuous period. No private or independent treatment centre appointments were included. The out-patient case mix included a full range of routine and specialist colorectal surgical referrals in addition to some routine non-subspecialist general surgical appointments e.g. inguinal hernias, etc. Care was provided under the responsibility of 7 individual Consultants (Attendings), who worked as 6 full-time-equivalents. These consultants supervised a total of 6 surgical trainees (Residents) working in the department, 1 Staff Grade doctor and 5 Nurse Practitioners.

Staff grade doctors are senior non-consultant, non-training grade clinicians running independent clinics under the indirect supervision of a consultant. These doctors are primarily employed in the United Kingdom in a service provision role, without the administrative or training responsibilities additionally undertaken by a consultant. Nurse practitioners are senior nurses undertaking an extended role within a defined and limited scope of practice indirectly supervised by a consultant who takes clinical responsibility. This is comparable to the role of physician extenders in North America.

Clinic attendance or non-attendance by the patient was recorded. For those patients attending their appointment, this was then categorised according to the three potential PbR funding payments at the prevailing rate: a new appointment (£GBP 180; €EU 219; $USD 291), a review appointment (£GBP 92; €EU 112; $USD 149) or a procedure (rigid sigmoidoscopy) (£GBP 189; €EU 230; $USD 305) as per Department of Health Payment by Results 2008/09 Outpatient Tariff (Outpatient Treatment Function Code 104; Outpatient Procedure Code OPRSI1).

The representative trainee salary was derived from the prevailing NHS Employers National Pay and Conditions for Medicine and Dentistry during the study period.[7] The basic salary (i.e. the proportion funded by Deaneries rather than the on-call supplement provided by hospitals) without banding was calculated as the mean income before tax based on speciality training registrar (StR) years 1–9 (where years 1 and 2 are the equivalent of the former Senior House Office (SHO) grade).

The grade of doctor providing the clinical care was also recorded: Consultant, surgical trainee, Staff Grade, Nurse Practitioner or research/teaching fellow. This was based on the grade of staff member dictating the relevant clinic letter together with the contents of this if it was clear the letter was being dictated on behalf of another grade of clinician.

The out-patient clinic system was run such that patients were seen by either a Staff Grade doctor in their named clinic (typically without trainees present), by a Nurse Practitioner in their named clinic (typically without trainees present) or by a Consultant in their named clinic (which included trainees). No trainee-only clinics were run. New patient referrals could be seen in either a Staff Grade, Nurse Practitioner or Consultant-led clinic, depending on the presenting complaint. New referrals would not necessarily be seen by a Consultant at their first appointment. Patients seen by trainees would only be reviewed by the Consultant if required.

Financial conversions from £GBP to $USD and €Euro are based on prevailing market rates on 27 December 2012 using the Citibank exchange rate (Citibank N.A, New York, USA), rounded to the nearest whole unit of currency.

## 3. Results

During the two-month study period 78 out-patient clinics offered 1184 appointments. Of these, 133 (11.2%) appointments were not attended by the patient. Of those patients who attended, 1029 (98%) had sufficient detail (i.e. a clinic letter summarising the consultation) for inclusion. From these 491 (48%) patients were new referrals to the department, 538 (52%) were review appointments and 269 underwent rigid sigmoidoscopy ('procedural appointments'). A detailed breakdown of clinic types and appointment categories is provided in Table 1.

Variations were seen in the number of patients seen by the various staff groups. Consultants saw 398 (38.7%), surgical trainees (resident-grade clinicians) 261 (25.4%), Staff Grades 106 (10.3%), Nurse Practitioners 223 (21.7%) and research/teaching fellows 41 (4.0%).

Applying PbR payment criteria to these appointments ('new', 'review' or 'procedural'), the total income generated during the study period was £GBP 143,025 (€EU 174,293; $USD 231,271). Extrapolated to 12 months this represented £GBP 858,150 (€EU 1,045,390; $USD 1,387,629) of hospital income. These figures are summarised in Table 2.

**Table 1**
Breakdown of out-patient clinic details during the two-month study period.

| | |
|---|---|
| **Out-patient clinic appointments** | |
| Total appointments | 1184 |
| Not attended by patient | 133 (11.2%) |
| Exclusions due to insufficient detail | 22 (1.9%) |
| Total included in analysis | 1029 |
| **Out-patient clinic types** | |
| Total clinics | 78 |
| Consultant-led | 35 |
| Staff-grade led | 14 |
| Nurse-practitioner led | 29 |
| **Out-patient appointment types** | |
| Total new patients included | 491 |
| Total review patients included | 538 |

**Table 2**
Out-patients seen during the study period by clinician grade and PbR payment category with projected yearly income generated.

| Grade seeing patient | Number of staff | New appointment | | Review appointment | | Procedure appointment | | Total during study period | | Income during study period | | Projected total annual income | Projected annual per capita income |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *n* | % | *n* | % | *n* | % | *n* | % | £ | % | £ | £ |
| Consultant | 6 FTE | 98 | 38.7 | 264 | 52.1 | 36 | 13.4 | 398 | 38.7 | 48,732 | 34.1 | 292,392 | 48,732 |
| Surgical trainee | 6 | 62 | 24.5 | 127 | 25.0 | 72 | 26.8 | 261 | 25.4 | 36,452 | 25.5 | 218,712 | 36,452 |
| Staff grade | 1 | 55 | 21.7 | 20 | 3.9 | 31 | 11.5 | 106 | 10.3 | 17,599 | 12.3 | 105,594 | 105,594 |
| Nurse practitioner | 5 | 30 | 11.9 | 76 | 15.0 | 117 | 43.5 | 223 | 21.7 | 34,505 | 24.1 | 207,030 | 41,406 |
| Research/teaching fellow | Variable | 8 | 3.2 | 20 | 3.9 | 13 | 4.8 | 41 | 4.0 | 5737 | 4.0 | 34,422 | – |
| | | | | | | | | Total: | | 143,025 | | 858,150 | – |

PbR = Payment by results (NHS funding framework).
FTE = Full-time equivalent.

For patients seen by one of the 6 surgical trainees, the projected yearly income was £GBP 218,712 (€EU 266,433; $USD 353,548), giving a mean income of £GBP 36,452 (€EU 44,421; $USD 59,030) generated by each trainee. The mean basic salary before tax for these Speciality Training Registrars (StR) was £GBP 38,330 (€EU 46,693; $USD 62,072) per annum during the study period. This projected yearly income therefore off-set 95.1% of each trainee's mean basic salary, excluding the variable on-call banding supplement funded directly by the employing hospital.

Consultants were found to generate approximately £GBP 48,732 (€EU 59,365; $USD 78,658) each per full-time equivalent; the Staff Grade generated £GBP 105,594 (€EU 128,634; $USD 170,439) and each Nurse Practitioner generated £GBP 41,406 (€EU 50,440; $USD 67,053).

Overall surgical trainees generated a quarter of the out-patient clinic activity related income in this study. At an individual level this equates to an average 74.8% of the revenue generated from Consultant out-patient clinic activity.

## 4. Discussion

This study is the first to establish the financial contribution of surgical trainees to hospital income in the ambulatory clinic setting. It indicates that through their out-patient clinical activity individual trainees can generate three-quarters of a Consultant's clinic-related income, offsetting 95% of their mean basic salary before taxes. This is important in determining the economic value of trainees in the healthcare workforce and ensuring that hospitals provide appropriate training quality in return.

Although there is a large body of published literature examining the financial costs of medical and surgical treatments together with their cost-effectiveness, there is a paucity of data surrounding the costs associated with training the clinical workforce. Although this study demonstrates trainees are able to generate a quarter of out-patient clinic activity related income this must be set against the overall costs of both training and running the clinical service. Although direct training costs may be relatively straightforward to measure, the impact of indirect costs such as changes in productivity and efficiency are more difficult to establish. Examples of potential direct and indirect training costs for surgery are provided in Table 3. Although attempts have been made to establish direct costs for an anaesthesia residency programme,[8] no similar models for surgery currently exist.

One major academic medical centre study in North America has previously highlighted that faculty teaching activities for junior medical staff and students are poorly compensated through existing funding streams.[9] Surgical training may pose an additional financial burden through its procedural nature. One American study investigating the cost of teaching surgical residents in the operating theatre found that the average cost incurred from teaching each graduate resident was approximately $USD 47,970 (£GBP 29,622; €EU 36,163).[10] Despite this additional cost, there is no conclusive evidence in the literature that supervised operative training results in any significant difference in clinical outcomes and hence additional financial costs.[11–13] Several studies have extended this to calculate costs relating to surgery. Goodwin et al. showed that in patients undergoing coronary artery bypass surgery there were no significant differences in hospital costs when the results of trainee surgeons were compared to those of consultants.[14] Martin et al. however showed an overall increase in costs relating to increased demands on hospital time and facilities,[15] while Lee et al. demonstrated that operative times and costs were significantly higher for training general surgery residents in paediatric surgery cases.[16]

Previous research has investigated whether the use of trainees in a hospital outpatient clinic, rather than Consultants, would save money overall given the reduced costs of employment. This indicated that it would be incorrect to assume anything other than short-term savings. Administrative and clinical costs generated by unnecessary investigations and follow-up arising from trainee-led consultations could potentially cost more in the long-term.[17]

The comparative revenue generated by the different staff in this study considers only income generated by out-patient activity. The interpretation of the relative financial value provided requires an understanding of the different job roles. In this study, a Staff Grade doctor generated the highest out-patient activity related income, however this role is solely out-patient and elective surgery focussed with no on-call activity or other Consultant-level responsibilities such as administration or training. Similarly, Nurse Practitioners are limited in the scope of their work and their out-patient activity is responsible for a major proportion of this. In contrast, Consultants and trainees share out-patient activities with numerous other clinical and non-clinical responsibilities meaning this income represents a relatively smaller fraction of overall job-related activity. In addition, while Consultants, Staff Grades and Nurse Practitioners will always be present at their named-clinics

**Table 3**
Direct versus indirect training costs in surgery.

| |
|---|
| **Direct training costs** |
| • Trainee salaries and benefits |
| • Supervision-related costs |
| • Training facilities e.g. skills-labs |
| • Faculty development |
| • Administration of trainees and training programme |
| **Indirect training costs** |
| • Differences in procedural time |
| • Changes in unit productivity |
| • Variations in efficiency |
| • Differences in resource utilisation |
| • Facility-related overheads |

when they are run, trainees may not be due to conflicting responsibilities such as on-call or teaching commitments. An additional factor is the source of salary payment, which is solely from the hospital for Consultants, Staff Grades and Nurse Practitioners, whereas for trainees the hospital only funds the variable on-call banding supplement and not basic salary, potentially providing better value.

In terms of training experience, it is debatable whether a unit that generates high levels of income from trainees in clinic is acting as the best unit for training. It could be argued that such calculations should be considered when allocating trainees in order to identify heavy service provision commitments. Depending on the speciality and seniority of the trainees, in some instances they may be better allocated to units who's trainees generate less economic return for the employing hospital assuming they are be being trained rather than providing service. Similarly, units where high proportions of income are generated by Nurse Practitioners and Staff Grades may indicate lost training opportunities for junior doctors.

Although this study quantifies income generated by trainees in the outpatient setting, we are unable to state that NHS hospitals are necessarily profiting. The PbR payment received is intended to cover all additional costs incurred in running an outpatient clinic, including other staff members (nursing, secretarial, etc), equipment costs, and the overheads associated with running and maintaining the facilities. Previous estimates as part of a review of ambulatory education put this at between $USD 200–300 (£GBP 124–186; €EU 151–226) per day to teach a resident (at 1997 prices).[18]

There is also considerable disagreement regarding the accuracy and validity of the PbR funding system in the NHS, both around the tariffs as well as the inclusivity of the system. Abbott et al. have demonstrated that even when conducted perfectly efficiently, some operations are always unprofitable, whereas others are profitable even when performed inefficiently.[19] As well as these inaccuracies, the Healthcare Resource Groups (HRG's) are too general as they do not take into account the extra time specific procedures require.[20] Tariffs are not altered for training despite the fact that it has been shown trainees take more time to carry out an operation, even when under direct supervision by a Consultant.[21] Therefore a normally profitable operation can make a loss. This relationship is not necessarily clear, and Babineau et al. highlighted that although the time of an operation may increase when a surgical trainee is present, this does not necessarily translate into a financial burden for the hospital. This is because many of the costs involved are fixed and the fact that the length of the operation is extended by a period of time only increases the 'variable costs'. This factor is not always taken into account, therefore the fact that an operation may take slightly longer does not necessarily mean that it will cost a lot more.[22] Nonetheless, the additional direct and indirect costs detailed in Table 3 may mean that the use of specific 'training' PbR tariffs is required to both incentivise and reward clinical training in the hospital setting.

Funding systems in other countries also pose problems. In the USA, trainees (Residents) are unable to charge healthcare insurance companies for their services as Medicare, the national social insurance programme for patients ≥65-years old and other select groups, provides the majority of federal funding support for most residency training programmes. This funding is derived from taxation revenues, with Direct Graduate Medical Education (DGME) payments to support costs including Resident's and teaching physicians' salaries, and Indirect Medical Education (IME) funding to subsidise costs incurred by teaching hospitals offering such training programmes.[23] Although this funding structure differs from the UK National Health Service, such subsidy can in some situations offer similar financial incentives to training.

Resident derived Medicare income has previously been estimated in the paediatric out-patient clinic setting, and contrasted against simulated resident billing as if they were charging for their activities. Despite a predicted $USD 67,230 (£GBP 41,590; €EU 50,682) in income per annum (set in 2001) by first-year residents, significant levels of under-coding reduced reimbursement due to their lack of training in coding practices.[24,25] In a surgical setting, private insurance companies do not finance American trainees, yet they are not charged for the operative work that trainees perform. This presents a significant loss of income for training institutions. Feinstein et al. estimated that over a 9-year period $USD 2,269,083 (£GBP 1,403,700; €EU 1,710,580) of revenue was lost as a result of unbilled private insurance funded work by trainees, and future billing for these services could help fund graduate medical education.[26]

This study relies on the accuracy of the clinical coding that translates the appointment types and procedures into suitable PbR tariffs. A number of studies have highlighted potential inaccuracies in this coding for surgical specialities, although these largely relate to inpatient care.[27–30] Of the 500 case notes reviewed in one study, 127 patients were found to have at least one form of coding error (25.5%). The total lost revenue was found to be around £GBP 30,000 (€EU 36,546; $USD 48,582).[28] As our study derived appropriate coding from clinic letters, it is likely that a proportion may have been inaccurate. In particular, procedures may be omitted from the coding if not clearly recorded, leading to an underestimation of the income generated. If procedures are not documented then hospitals are unable to claim back for the services they provide; more may need to be done to improve recording and coding systems to ensure that claims are representative of the procedures actually performed.[31]

For this study we recorded the grade of staff reviewing each patient in the outpatient clinic. As this was based on the clinician dictating the letter, this may not equate to the same grade of clinician providing that episode of care. It may not reflect whether they were additionally seen by a Consultant or discussed with them, introducing a potential source of bias in the results.

Financial calculations deriving the percentage offset of trainees' basic salary are based upon the mean income as determined by national pay scales during the study period. The use of the mean figure means that extrapolation of the results to other units or hospitals must take account of the seniority of trainees employed. In the United Kingdom the completion of each training year will move the trainee up a predetermined escalating pay-ladder, such that more senior trainees will earn more than junior colleagues (pay scale during this study period: year 1 speciality training registrar = £30,749 to year 9 = £45,562). More senior trainees will therefore offset a smaller proportion of their income; however this may be partly compensated by greater autonomy and efficiency in their practice with reduced consultant involvement. An analysis of outpatient Obstetrics and Gynaecology teaching in an American university medical centre indicated that first-year residents were an expense to the practice site, second-year residents were close to breaking even, and third-year residents began to generate a net gain.[32]

The results presented are based on colorectal/general surgery clinic activity. The proportion of out-patient workload is variable between different specialities and therefore caution is required regarding the degree to which these specific figures can be used to generalise or be extrapolated to other disciplines. Similarly, these clinics included funding for specific out-patient clinic activities e.g. rigid sigmoidoscopy. Such procedural activity may vary in other clinics, with different funding structures, which will further limit the generalisability of the findings.

A greater awareness of the potential financial income generated by the work of trainees raises questions for training bodies and care providers alike. Training bodies may ask whether trainees receive

an appropriate return in terms of quality of training. It also has the potential to commercialise training to a greater degree, with hospitals potentially competing for trainees in order to secure a potentially positive funding stream associated with them. Future studies should seek to investigate such trainee-generated income across other specialities and hospital settings, ideally as part of a prospective multi-centre and multi-speciality study. This will play a central role in establishing a wider cost-construction model for surgical training, which is a notable omission in the current surgical training literature and an important future research objective.

## 5. Conclusion

Little data has been previously published regarding the economics of surgical training for the healthcare provider. This study indicates that surgical trainees make substantial contributions to the income generated and therefore hospitals could potentially benefit from employing trainees. This raises questions as to whether trainees receive adequate training opportunities in return for the funding income they bring to employing hospitals. Regulatory systems are evaluating training quality and are seeking to identify hospitals offering high quality training experiences. It is appropriate that training bodies give preference to those hospitals providing excellence in training when organising training programmes. In future hospitals could be made to compete for trainees, along with the income they bring with them, through the provision of higher quality training.

*Ethical approval*

Audit approval for this study was granted by Nottingham University Hospitals NHS Trust.

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*Author contribution*

All authors were involved in formulating the study design, data analysis and writing. J.E.F. Fitzgerald, P. Ravindra and A. Armstrong additionally performed the data collection. All authors reviewed and edited the manuscript prior to submission.

*Conflict of interest*

J.E.F. Fitzgerald, P. Ravindra and A. Bhangu are current surgical trainees. The authors have no other relevant financial or personal conflicts of interest to declare in relation to this paper.

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