International Journal of Surgery 67 (2019) 8–12

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.elsevier.com/locate/ijsu

Original Research

Awareness of surgical expenditure amongst UK trainees and consultants: A questionnaire study

M. Povey[a,*], N. Francis[b], R. Healy[a], S. Blacker[c], D. Vimalachandran[a], P.A. Sutton[a]

[a] Department of Surgery, Countess of Chester Hospital, Chester, UK
[b] Department of Surgery, Barts Hospital, London, UK
[c] Department of Surgery, St Helens and Knowsley Hospital, Liverpool, UK

ARTICLE INFO

Keywords:
Surgery
Health economics

ABSTRACT

Introduction: Limited knowledge of surgical device and service costs restricts a surgeon's ability to make cost efficient choices and contribute to the efficiency savings required by the NHS to reduce the financial deficit. This study aims to assess how aware surgeons are of surgical equipment and regularly used services.

Methods: A single sided hard copy questionnaire asking for the estimate cost of 24 surgical devices/services was handed out to individuals at two separate UK annual conferences. Items and services which are regularly used and/or clinically significant were selected and, where possible, alternatives to those items were included for comparison. Participants were also asked for their grade and specialty. An estimate was deemed correct if it was within 20% of the actual cost. Planned subgroup analyses for grade and specialty were performed.

Results: The 143 participants consisted of 23 (16%) consultants, 39 (27%) registrars, 33 (23%) SHOs and 48 (34%) foundation doctors. Of the 95 participants who were SHO grade or more senior, 67 (71%) work within general surgery. Across all items, only 9.6% of estimates were correct. There was no statistically significant difference between training levels (consultant 11.5%, registrar 10.1%, SHO 8.6%, foundation 8.9%; $p = 0.253$). Participants were significantly less successful in correctly estimating the cost of high value (> £150 [USD $198; EUR €175]) items (8.5% vs. 11.1%); $p = 0.011$, and the cost of devices as compared to the cost of services (7.4% vs. 15.0%); $p = 0.001$.

Conclusion: Surgeons across all grades and specialties have poor knowledge of device and service costs. It is important that this improves in order to allow surgeons to make a meaningful contribution to NHS efficiency savings by making informed decisions about their use of devices and services.

1. Introduction

The NHS is under ever increasing financial constraints, whilst service use is rising and the care offered is becoming increasingly complex. Since 2010, total NHS spend as a percentage of GDP has reduced from 7.59% to 7.26% as part of plans to reduce the national debt [1]. Between 2004 and 2014 there was a 27% increase in the number of hospital admissions for a surgical procedure [2]. Each year there are 1.8 million episodes of inpatient care under General Surgery costing £2.7 billion [USD $3.56B; EUR €3.15B] in total; 1.35 million of these require procedures [3]. In October 2014 the NHS developed the Five Year Forward View plan in which it outlies a target saving of 2–3% each year to reduce the NHS deficit from £30B [USD $39.6B; EUR €35B] to £22B [USD $29B; EUR €25.7B] by 2020 [4]. Part of this plan is an "obtainable" 1.5% year on year efficiency saving.

Surgeons have an ever expanding access to more expensive surgical equipment which often have cost efficient alternatives. Having the knowledge of device cost would allow the surgeon to make an informed decision while balancing this against the expense of theatre time. Only 5.7% of surgeons report undergraduate teaching in health economics and most (69.3%) feel that they would change their practice if they had better knowledge of surgical device cost [5]. It has been shown that informing surgeons of surgical supply costs can significantly reduce surgical spending [6–8]. Having an awareness of costs could therefore lead to a more economical use of goods and services which would in turn save the NHS money and contribute to its sustainability.

We aimed to evaluate the current awareness of the costs of surgical consumables amongst surgeons and surgical trainees in the UK.

* Corresponding author. Countess of Chester Hospital NHS Foundation Trust, Liverpool Road, Chester, CH2 1UL, UK.
E-mail address: m.povey@nhs.net (M. Povey).

https://doi.org/10.1016/j.ijsu.2019.04.008
Received 21 January 2019; Received in revised form 25 March 2019; Accepted 16 April 2019
Available online 22 April 2019

2. Methods

We prepared a single sided hard copy questionnaire asking for the estimate cost of 24 surgical devices and services, rounded to the nearest pound sterling. This list of items and services which are regularly used and/or clinically significant were identified by consensus amongst the research team. Where possible, alternatives to those items were included for comparison. Participants were also asked for their grade and specialty. Grade was categorised as foundation doctor, core trainee (SHO grade), registrar and consultant. The questionnaire was physically handed out to individuals during established breaks at two separate annual conferences; Association of Surgeons in Training (ASiT), Edinburgh 2018 and Association of Surgeons of Great Britain and Ireland (ASGBI), Liverpool 2018. Questionnaires were collected directly from each participant once they had completed it. For the purpose of data analysis, an estimate was deemed correct if it was within 20% of the actual cost. The methodology for accuracy of cost estimate has been extrapolated from the literature with a threshold of 20% determined by consensus [5,9,10]. Planned subgroup analyses for grade and specialty were performed, with statistical comparisons using the X^2 test. The study has been reported in line with the SQUIRE guideline [11].

Costs for each device/service were obtained from the procurement department of a UK NHS Foundation Trust. Service cost estimation consisted of running an operating theatre for one hour (including theatre staff, consumables and anaesthetics; not including consultant, junior medical staff or high cost devices/drugs), one day stay on ICU, one day stay on a general surgical ward and a new patient outpatient consultation were based on 2016/2017 NHS reference costs. Cost estimation for the sterilisation and preparation of a laparotomy tray, laboratory costs to run a panel of bloods tests (FBC, UE, LFT, CRP, Amylase) and a CT scan of the abdomen and pelvis were based on 2018/19 NHS planning costs.

The direct costs of devices were obtained for a diathermy pencil (Valleylab™), Harmonic® Shears (Ethicon), LigaSure™ Laparoscopic Sealer/Divider (Medtronic), linear stapler (e.g. GIA™, Medtronic), circular stapler (e.g. CDH, Ethicon), articulated laparoscopic stapler (e.g. ECHELON FLEX™ ENDOPATH®, Ethicon), optical entry trocar (e.g. Visiport™, Medtronic), ileostomy and colostomy appliances for 1 month (stoma bags and medical adhesive remover - as advised by a local stoma team), a pair of Biogel® surgical gloves (Mölnlycke®), single sachet of wound glue (e.g. LiquiBand® Standard, LiquiBand®), ENDOLOOP® Ligature (Ethicon), Endo Catch™ specimen retrieval pouch (Covidien), Bert™ bag for specimen retrieval (Steris®), 2/0 Vicryl® suture (Ethicon), Alexis® Wound Protector/Retractor (Applied Medical), 10 mm laparoscopic port (Kii® Fios® First Entry, Applied Medical).

3. Results

A total of 143 participants returned the questionnaire. The cohort consisted of 23 (16%) consultants, 39 (27%) registrars, 33 (23%) SHOs and 48 (34%) foundation doctors. Of the 95 participants who were core trainee (SHO grade) or more senior, 67 (71%) work within general surgery, 8 (8%) in trauma and orthopaedics, 7 (7%) in plastics, 7 (7%) in neurosurgery, 4 (4%) in ENT and 2 (2%) in paediatrics.

The cost of each item, along with the estimates and percentage of correct estimates are shown in Table 1. Participants overestimated the cost of: one day on a general surgical ward, the sterilisation and preparation of a laparotomy tray, a diathermy pencil, an optical entry trocar, colostomy appliances for 1 month, a panel of bloods tests, a CT of the abdomen and pelvis, one pair of Biogel® surgical gloves, a single sachet of wound glue, an ENDOLOOP® ligature, a Bert™ bag for specimen retrieval, a 2/0 Vicryl® suture, an Alexis® Wound Protector/Retractor. Participants underestimated the cost of: running an operating theatre for one hour, a one day stay on ICU, an outpatient consultation, Harmonic® Shears, LigaSure™ Laparoscopic Sealer/Divider, a linear stapler (e.g. GIA™), a circular stapler (e.g. CDH, Ethicon), an articulated laparoscopic stapler (e.g. ECHELON FLEX™ ENDOPATH®), ileostomy appliances for 1 month, an Endo Catch™ specimen retrieval pouch and a 10 mm laparoscopic port.

Across all items, only 9.6% of estimates were correct (i.e. within 20%). There was no statistically significant difference between training levels (consultant 11.5%, registrar 10.1%, SHO 8.6%, foundation 8.9%; $p = 0.253$). Although participants with an interest in general surgery had more correct estimates when compared to non-general surgical colleagues (10.3% *vs.* 9.0%), this failed to reach statistical significance ($p = 0.319$).

The service and device costs most frequently correctly estimated were that of an outpatient consultation (29%), CT scan (24%), and a laparoscopic port (18%). The least frequently correctly estimated were diathermy pencil (1%), wound protector (1%) and LigaSure™ (3%). The services and devices in which the median estimated cost was closest to the actual cost were the cost of colostomy appliances for 1 month (£200 [USD $264; EUR €233] *vs.* £193.40 [USD $256; EUR €226]), CT of the abdomen and pelvis (£118 [USD $156; EUR €137] *vs.* £101 [USD $133; EUR €118]) and outpatient consultation (£120 [USD $158; EUR €140] *vs.* £173 [USD $228; EUR €201]). Overestimation was greatest when approximating the cost of a panel of blood tests (£100 [USD $132; EUR €116] *vs.* £3.70 [USD $4.88; EUR €4.31]), diathermy pencil (£30 [USD $40; EUR €35] *vs.* £1.96 [USD $2.59; EUR €2.29]) and sterilisation and preparation of laparotomy tray (£100 [USD $132; EUR €116] *vs.* £16.78 [USD $22; EUR €20]). Underestimation was greatest when participants were asked for the cost of the Harmonic® Shears (£80 [USD $105; EUR €93] *vs.* £478 [USD $630; EUR €557]), LigaSure™ Laparoscopic Sealer/Divider (£60 [USD $79; EUR €70] *vs.* £402.33 [USD $532; EUR €470]) and Endo Catch™ specimen retrieval pouch (£20 [USD $26; EUR €23] *vs.* £72.02 [USD $95; EUR €84]). Participants were significantly less successful in correctly estimating the cost of high value (> £150 [USD $198; EUR €175]) items (8.5% *vs.* 11.1%); $p = 0.011$, and the cost of devices as compared to the cost of services (7.4% *vs.* 15.0%); $p = 0.001$(see Fig. 1).

4. Discussion

The 143 participants consisted of 23 consultants, 39 registrars, 33 SHOs and 48 foundation doctors. Of the participants who were SHO grade or more senior, 71% work within general surgery. This highlights an underwhelming representation of non-general surgery specialties (29%). Although this could be seen as a limitation, a lack of cost awareness has previously been shown in other specialties such as otolaryngology and orthopaedics [9,12]. Participants who are working in general surgery were slightly better at estimating costs (10.3% *vs.* 9.0%) than other specialities, however this was not statistically significant. This small difference may be explained by an increased utilisation of some of the studied devices in general surgery compared to other specialties. We must also be clear that there is likely to be some variation in the cost of these devices between institutions depending on, for example, volume of utilisation. This is not likely however to account for the orders of magnitude we have reported in this study.

Across all items, only 9.6% of estimates were correct (i.e. within 20%) highlighting poor knowledge of costs which is comparable to other studies [5,9,12,13]. There was no statistically significant difference between training levels. Many would expect consultants and senior trainees to have better knowledge of cost given their experience. It is fair to assume they are also more likely to make the decisions regarding device choice and the need for services. However, our results show that results are poor across all training levels which may highlight both the historical and current lack of education in health economics for surgical trainees. These findings support the work undertaken by Ryan *et al* [5], however a more recent study has shown that faculty members are significantly better at estimating cost than their trainees (25% *vs.* 12%) [9]. This difference could be related to the predominantly private structure of the US healthcare system.

Table 1
Cost of each item, estimates and percentage of correct estimates.

Item	Cost (£GBP exc. VAT)	Median (IQR) Estimate (£GBP exc. VAT)	Median Estimate/Actual Cost	% of Respondents within 20%
One pair of Biogel® surgical gloves (Mölnlycke®)	1.83 [USD $2.42; EUR €2.14]	10 (5–25) [USD $13.18; EUR €11.65]	5.46	4
2/0 Vicryl® suture (Ethicon)	1.88 [USD $2.48; EUR €2.19]	10 (5–30) [USD $13.18; EUR €11.65]	5.32	7
Diathermy pencil (Valleylab™)	1.96 [USD $2.59; EUR €2.29]	30 (10–88) [USD $40; EUR €35]	15.31	1
Lab costs to run a full blood count, liver function tests, urea and electrolytes, amylase, CRP	3.70 [USD $4.89; EUR €4.32]	100 (40–675) [USD $132; EUR €117]	27.03	4
Single sachet of wound glue (e.g. LiquiBand® Standard, LiquiBand®)	4.58 [USD $6.06; EUR €5.34]	10 (5–25) [USD $13.18; EUR €11.65]	2.18	18
Alexis® Wound Protector/Retractor (Applied Medical)	7.24 [USD $9.57; EUR €8.45]	20 (10–50) [USD $26; EUR €23]	2.76	1
ENDOLOOP® Ligature (Ethicon)	14.77 [USD $20; EUR €17]	20 (10–60) [USD $26; EUR €23]	1.35	8
Bert™ bag for specimen retrieval (Steris®)	15.16 [USD $20; EUR €18]	20 (10–74) [USD $26; EUR €23]	1.32	4
Sterilisation and preparation of a laparotomy tray	16.78 [USD $22; EUR €20]	100 (30–200) [USD $132; EUR €117]	5.96	10
10 mm laparoscopic port (Kii® Fios® First Entry)	23.54 [USD $31; EUR €27]	20 (10–55) [USD $26; EUR €23]	0.85	18
Optical entry trocar (e.g. Visiport™, Medtronic)	29.40 [USD $39; EUR €34]	85 (30–265) [USD $112; EUR €99]	2.89	5
Endo Catch™ specimen retrieval pouch (Covidien)	72.02 [USD $95; EUR €84]	20 (10–60) [USD $26; EUR €23]	0.28	7
CT of abdomen and pelvis	101.00 [USD $134; EUR €118]	118 (70–300) [USD $156; EUR €138]	1.17	24
Linear stapler (e.g. GIA™, Medtronic)	111.97 [USD $148; EUR €131]	60 (20–200) [USD $79; EUR €70]	0.54	10
An outpatient consultation	173.00 [USD $229; EUR €202]	120 (80–200) [USD $158; EUR €140]	0.69	29
Colostomy appliances for 1 month	193.40 [USD $256; EUR €226]	200 (70–400) [USD $264; EUR €233]	1.03	11
Circular stapler (e.g. CDH, Ethicon)	243.92 [USD $323; EUR €285]	80 (20–200) [USD $105; EUR €93]	0.33	9
One day stay on a general surgical ward	245.00 [USD $324; EUR €286]	500 (300–1000) [USD $659; EUR €583]	2.04	8
Articulated laparoscopic stapler (e.g. ECHELON FLEX™ ENDOPATH®, Ethicon)	305.55 [USD $404; EUR €357]	100 (30–200) [USD $132; EUR €117]	0.33	8
Ileostomy appliances for 1 month	321.20 [USD $425; EUR €375]	200 (70–400) [USD $264; EUR €233]	0.62	10
LigaSure™ Laparoscopic Sealer/Divider (Medtronic)	402.33 [USD $532; EUR €470]	60 (20–200) [USD $79; EUR €70]	0.15	3
Harmonic® Shears (Ethicon)	478.00 [USD $633; EUR €558]	80 (26–200) [USD $105; EUR €93]	0.17	4
Run an operating theatre for one hour	917.00 [USD $1213; EUR €1071]	500 (180–1000) [USD $659; EUR €583]	0.55	18
One day stay on ICU	1511.00 [USD $1999; EUR €1765]	1000 (600–1500) [USD $1318; EUR €1165]	0.66	13

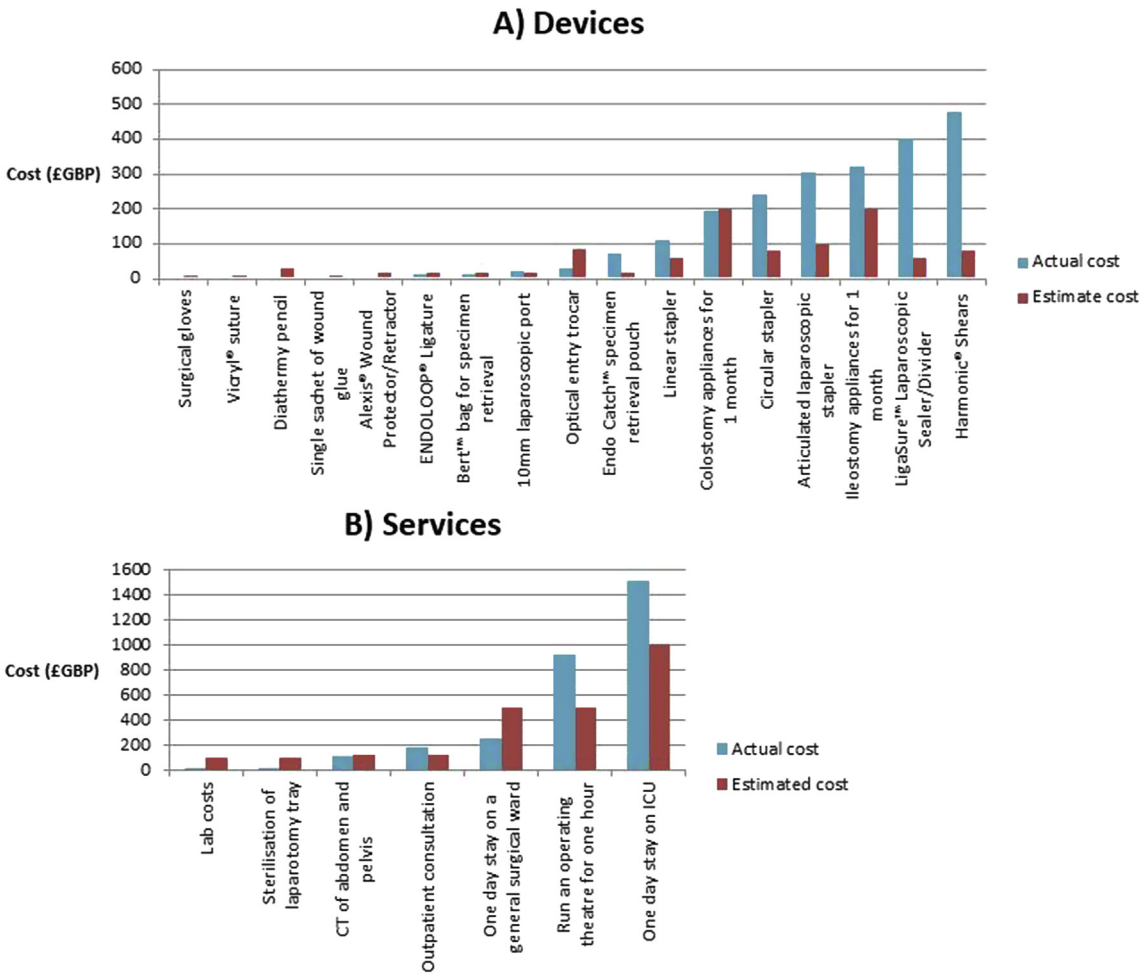

Fig. 1. Comparison between actual cost and median estimate cost for devices and services.

The two items most frequently correctly estimated were services (outpatient consultation and cost of a CT scan). All three of the items least frequently correctly estimated were devices (diathermy pencil, wound protector and LigaSure™). When comparing devices and services across the study, participants were twice as likely to correctly estimate the cost of a service (15.0% *vs*. 7.4%). The fact that some devices are more commonly utilised in general surgery may again contribute but this is contradicted by the similarity in successful estimates between general and non-general specialties. Participants were significantly less successful in correctly estimating the cost of high value (> £150 [USD $198; EUR €175]) items (8.5% *vs.* 11.1%); p = 0.011. Median estimate results show that overall 79% of the low cost items were overestimated and 80% of the high cost items were underestimated. The greatest underestimates were related to the Harmonic® Shears and the LigaSure™ Laparoscopic Sealer, and the greatest overestimates were related to the cost of a panel of blood tests and the diathermy pencil.

A number of studies have attempted to improve physician understanding of the cost implications of their clinical practice. A nationwide survey of US radiology trainees examined estimates of commonly performed scans with respect to previous training in health economics and other non-medical qualifications. No difference in correct estimates was seen across the spectrum of experience and training, implying that whilst training in health economics may be desirable for surgical trainees, this may not necessarily improve awareness of current or future economic costs [10]. An alternative approach has been individual surgeon level education regarding their specific device and consumable costs. This approach is clearly resource intensive, however it has been shown to deliver cost reduction for laparoscopic appendicectomy (17%), laparoscopic cholecystectomy (10%) and laparoscopic hernia repair (21%) [6,7,14]. Whilst this educational intervention is procedure specific, elements of financial strategy may be generalizable to other procedures performed by the same surgeon. This was demonstrated by utilisation of audit and individual feedback of patient cost and charge data to improve cost efficiency in a private hospital system [15].

A prospective controlled trial performed in the US clustered specialties into an intervention arm of SCORE cards (Surgical COst REduction) for comparison with standard care. SCORE cards provided both individual surgeons and departments with monthly costings for specific procedures as well as descriptive statistics and ranking. Units were financially incentivised to achieve a cost reduction of 5% over the study period of 1 year. Those utilising the SCORE cards and so incentivised (n = 63) achieved an average cost reduction of 6.54% per case, compared to their counterparts (n = 186) who saw an increase in cost over the same time period of 7.42% [9]. This highlights the need for improved cost awareness merely to ensure costs do not escalate significantly over time. This study also raises the question of whether financial incentives, either positively or negatively, may help achieve cost savings in surgery as they have in other areas of healthcare practice.

Data gathered by the UK Getting It Right First Time (GIRFT) programme showed huge variation in procurement costs for commonly used surgical devices between trusts, with a possible available saving of 59% when the lowest cost items were used. Variation is not only due to different procurement costs but also the use of alternative suppliers for devices which have the same basic purpose. Differences between the items purchased did not seem to have a clinical impact. Although the

GIRFT programme focuses mainly on procurement strategies rather than intraoperative device choice, procurement clearly impacts on selection through device availability, and surgeons are likely to be involved to some extent in the procurement arrangements of their hospital. GIRFT plan to instigate pricing transparency in procurement for general surgery so individual trusts can use this insight to deliver more cost effective procurement. Furthermore they are working to identify centres with good procurement practice and investigate how it is achieved [3]. Once this has been established, it will be a matter for each institution to ascertain how best to improve awareness and cost savings. We would recommend consideration of providing individual and departmental cost feedback, a 'STOP' moment before accessing high cost items to ensure they are being appropriately utilised and that a cheaper version is not available, and data from publications such as this being utilised for educational interventions.

Our study has shown poor understanding of costs of regularly used devices and services related to surgery amongst surgeons of all grades. It is vital that this improves in order to allow surgeons to make a meaningful contribution to NHS efficiency savings by making informed decisions about their use of devices and services. Improving understanding of health economics, direct education strategies and local incentives may help achieve this. Further work is needed, however, to find innovative ways to facilitate surgeons to make informed decisions on cost whilst continuing to prioritise excellent surgical outcomes.

Ethical approval

None required.

Sources of funding

No sources of funding

Conflicts of interest

No conflicts of interest.

Author contribution

Meical Povey: Study design, data collection, data analysis, writing.
Niroshan Francis: data collection.
Rion Healy: data collection.
Sarah Blacker: data collection.
Dale Vimalachandran: study design, writing.
Paul Sutton: Study design, data analysis, writing.

Research registration number

This study has been registered with the Open Science Framework.

Sutton, P. (2019, January 21). Awareness of surgical expenditure amongst UK trainees and consultants: A questionnaire study. https://doi.org/10.17605/OSF.IO/4TURJ.

Guarantor

Meical G Povey.
Paul A Sutton.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Data statement

The authors confirm that the data supporting the findings of this study are available within the article. More detailed data is available on request.

CRediT authorship contribution statement

M. Povey: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Visualization, Writing - original draft, Writing - review & editing. **N. Francis:** Investigation. **R. Healy:** Investigation. **S. Blacker:** Investigation. **D. Vimalachandran:** Conceptualization, Methodology, Project administration, Supervision, Validation, Writing - original draft. **P.A. Sutton:** Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijsu.2019.04.008.

References

[1] J. Appleby, 70 Years of NHS Spending. Nuffield Trust Comment, (2018) [blog] March 2018. Available at: https://www.nuffieldtrust.org.uk/news-item/70-years-of-nhs-spending#then-and-now , Accessed date: 1 September 2018.
[2] Surgery and the NHS in Numbers, Royal College of Surgeons, https://www.rcseng.ac.uk/news-and-events/media-centre/media-background-briefings-and-statistics/surgery-and-the-nhs-in-numbers/ , Accessed date: 1 September 2018.
[3] General Surgery, GIRFT Programme National Specialty Report, (2017) Available at: http://gettingitrightfirsttime.co.uk/wp-content/uploads/2018/08/GIRFT-GeneralSurgery-Aug17-O1.pdf , Accessed date: 1 November 2018.
[4] Five Year Forward View, NHS England, Available at: https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf, (2014) , Accessed date: 3 September 2018.
[5] J.M. Ryan, A.C. Rogers, W.B. Robb, A study evaluating cost awareness amongst surgeons in a health service under financial strain, Int J Surg. (2018), https://doi.org/10.1016/j.ijsu.2018.06.027.
[6] M.J. Guzman, M.E. Gitelis, J.G. Linn, M.B. Ujiki, M. Waskerwitz, K. Umanskiy, J.P. Muldoon, A model of cost reduction and standardization: improved cost savings while maintaining the quality of care, Dis. Colon Rectum 58 (11) (2015) 1104–1107, https://doi.org/10.1097/dcr.0000000000000463.
[7] M. Gitelis, Y. Vigneswaran, M.B. Ujiki, W. Denham, M. Talamonti, J.P. Muldoon, J.G. Linn, Educating surgeons on intraoperative disposable supply costs during laparoscopic cholecystectomy: a regional health system's experience, Am. J. Surg. 209 (3) (2015) 488–492, https://doi.org/10.1016/j.amjsurg.2014.09.023.
[8] C.C. Zygourakis, V. Valencia, C. Moriates, C.K. Boscardin, S. Catschegn, A. Rajkomar, K.J. Bozic, K. Soo Hoo, A.N. Goldberg, L. Pitts, M.T. Lawton, R.A. Dudley, R. Gonzales, Association between surgeon scorecard use and operating room costs, JAMA Surg. 152 (3) (2017) 284–291, https://doi.org/10.1001/jamasurg.2016.4674.
[9] C.R. Jackson, R.D. Eavey, D.O. Francis, Surgeon awareness of operating room supply costs, Ann. Otol. Rhinol. Laryngol. 125 (5) (2016) 369–377, https://doi.org/10.1177/0003489415614864.
[10] A. Vijayasarathi, C.M. Hawkins, D.R. Hughes, M.E. Mullins, R. Duszak Jr., How much do common imaging studies cost? A nationwide survey of radiology trainees, Am. J. Roentgenol. 205 (5) (2015) 929–935, https://doi.org/10.2214/ajr.14.14167.
[11] G. Ogrinc, S.E. Mooney, C. Estrada, T. Foster, D. Goldmann, L.W. Hall, M.M. Huizinga, S.K. Liu, P. Mills, J. Neily, W. Nelson, P.J. Pronovost, L. Provost, L.V. Rubenstein, T. Speroff, M. Splaine, R. Thomson, A.M. Tomolo, B. Watts, The SQUIRE (Standards for QUality Improvement Reporting Excellence) guidelines for quality improvement reporting: explanation and elaboration, BMJ Qual. Saf. 17 (Suppl 1) (2008) i13–i32.
[12] K. Kulkarni, S. Shepherd, Do we know the cost of orthopaedic care? Int. J. Health Plan. Manag. (2018), https://doi.org/10.1002/hpm.2571.
[13] K. Bade, J. Hoogerburg, Awareness of surgical costs: a multicentre cross-sectional survey, J. Surg. Educ. 72 (1) (2015) 23–27.
[14] Y. Vigneswaran, J.G. Linn, M. Gitelis, J.P. Muldoon, B. Lapin, W. Denham, M. Talamonti, M.B. Ujiki, Educating surgeons may allow for reduced intraoperative costs for inguinal herniorrhaphy, J. Am. Coll. Surg. 220 (6) (2015) 1107–1112.
[15] M.A. Al Zamil, M.A. Arafa, Awareness of surgeons in Saudi Arabia about the surgical costs and investigations: multicenter study, J. Surg. Educ. 74 (2) (2017) 187–190.