Hospital mortality under surgical care

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ABSTRACT

INTRODUCTION The 'hospital standardised mortality ratio' (HSMR) has been used in England since 1999 to measure NHS hospital performance. Large variations in reported HSMR between English hospitals have recently led to heavy criticism of their use as a surrogate measure of hospital performance. This paper aims to review the mortality data for a consultant general surgeon contributed by his NHS trust over a 3-year period as part of the trust's HSMR calculation and evaluate the accuracy of coding the diagnoses and covariates for case mix adjustment.

SUBJECTS AND METHODS The Dr Foster Intelligence database was interrogated to extract the NHS trust's HSMR benchmark data on inpatient mortality for the surgeon from 1 April 2006 to 31 March 2009 and compared to the hospital notes.

RESULTS 30 patients were identified of whom 12 had no evidence of being managed by the surgeon. This represents a potential 40% inaccuracy rate in designating consultant responsibility. The remaining 18 patients could be separated into 'operative' (11 patients) and 'non-operative' (7 patients) groups. Only 27% in the operative group and 43% of the non-operative mortality group respectively had a Charlson co-morbidity index recorded despite 94% of the cases having significant co-morbidities.

CONCLUSIONS Highlighting crude and inaccurate clinician-specific mortality data when only 1–5% of deaths under surgical care may be associated with avoidable adverse events seems potentially irresponsible.

KEYWORDS

Hospital standardised mortality ratio – Surgical care – Inpatient mortality

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Over the past decade, healthcare providers worldwide have had to become increasingly more accountable to the public for the quality of care that they provide to patients. In the UK revelations from the Bristol inquiry into paediatric cardiac surgery deaths from 1999–2001,¹ combined with changes in the way the healthcare is commissioned and purchased through 'payment by results', have led to a drive to identify measures by which NHS trusts can be judged.²

Until 2005 UK hospitals were compared using the Healthcare Commission's 'star' rating system, which combined indicators covering a range of administrative, financial management and clinical services. Since 2005 hospitals are judged through the 'annual health check', whereby performance is measured against existing national targets such as whether the patient waited more than 4 hours in accident and emergency. Mortality data derived from routine Hospital Episode Statistics (HES) are also collected, with NHS hospitals mandated to submit this at least quarterly to the Department of Health. Like the US, Canada, Netherlands and Sweden, the UK now publishes standardised mortality ratio league tables for its hospitals.

The 'hospital standardised mortality ratio' (HSMR) has been used in England since 1999 to measure NHS hospital performance.³ HSMR is the ratio of the actual number of acute in-hospital deaths to the expected number of in-hospital deaths for conditions accounting for 80% of inpatient mortality. The Dr Foster unit at Imperial College London

has since developed this methodology, which is used by Dr Foster Intelligence, a public–private partnership organisation that annually publishes standardised mortality ratios for English hospitals in the national press.⁴

The Dr Foster unit's HSMR calculation method uses routinely collected HES data from which HSMR is derived by applying logistic regression models based on 56 primary diagnosis groups. These are obtained from HES data accounting for 80% of hospital mortality. Covariates for case mix adjustment in the model are sex, age group, method of admission (emergency or elective), socioeconomic deprivation, primary diagnosis, the number of emergency admissions in the previous year, whether the patient was admitted to a palliative care specialty and the Charlson co-morbidity index (CCI).⁵

In the past, the Dr Foster HSMR calculation has been shown to be vulnerable to differences in clinical coding and admission practices across the NHS.⁶ Variation in Dr Foster-reported HSMR of up to 60% in 2009 between English hospitals⁴ has led to heavy criticism of their use as a surrogate measure of hospital performance. Inadequacies in the availability of end-of-life care resulting in hospitals being used as a place for people to die, variations in cause of death labelling, inaccurate co-morbidity labelling and a failure of HES data to recognise palliative admissions are just a few reasons why HSMR is felt to be an inaccurate reflection of performance.⁷

The recent case of Mid Staffordshire Foundation NHS Trust, which was branded ‘appalling’ by the Care Quality Commission, yet rated among the five ‘most improved hospitals’ in the past three years by Dr Foster’s 2009 hospital guide illustrates the potential frailties of HSMR, which in this case were thought to be due to variations in diagnostic coding.⁸ The question that is now being asked is whether HSMR should be used at all to calculate excess deaths resulting from poor care.⁹

As surgeons we represent a group for whom mortality may be used as a measure of performance and indeed fitness to practise. Limitations of the use of HES data in determining surgical mortality are well known.¹⁰ The fact that these data are collected by the hospitals in which we work and sent to organisations such as Dr Foster, combined with the media frenzy that surrounds hospital league tables for surgeons, means that it is very important that we evaluate the way in which mortality is attributed to us. This paper aims to review the mortality data for a consultant surgeon (Mr X) sent to Dr Foster by his NHS trust over a 3-year period and to evaluate the accuracy of coding the diagnoses and covariates for case mix adjustment. These data are ultimately used to calculate the HSMR for the hospital and may one day be used to calculate the standardised mortality ratio for individual surgeons.

Subjects and Methods

Data extraction: Dr Foster database

The Dr Foster Intelligence database was interrogated to identify East and North Hertfordshire NHS Trust’s HSMR benchmark data on inpatient mortality for a single consultant general surgeon (Mr X). This information was provided to us by the trust. Information has been contributed to the database by this trust since 2005 but the use of patient identifiers (hospital numbers) to allow a review of patient notes has only been possible from April 2006. We therefore investigated deaths that occurred over the 3-year period from 1 April 2006 to 31 March 2009. The ‘drill down’ parameters used to narrow this search included a discharge destination

(death), specialty of discharge (general surgery) and team on discharge (single consultant). Data extracted included date of admission, patient name, hospital number, sex, age, co-morbidity risk adjustment (CCI) and risk estimate.

Data extraction: patient hospital notes

The hospital notes of patients identified by the Dr Foster database were interrogated independently by three authors (LH, DF and GW) to extract the following parameters: patient name, hospital number, age, sex, admission type (elective or emergency), presenting complaint/admission diagnosis, decision to operate/not operate, family involvement, operative findings, operation performed, primary surgeon, length of stay, certified cause of death, whether a postmortem examination was performed, patient co-morbidity, American Society of Anesthesiologists (ASA) grade, home situation, mobility and whether the patient was admitted to an intensive care unit (ICU).

In addition to this, the Waterlow score, which predicts risk of pressure ulcer formation, was documented. This scoring system is calculated for every patient admitted to the East and North Hertfordshire NHS Trust and includes assessments for body mass index, continence, skin type at risk areas, mobility, malnutrition, neurological deficit and trauma. A score of 10–14 suggests the patient is at risk, 15–19 suggests the patient is at high risk and ≥ 20 suggests the patient is at very high risk of developing pressure sores.

Data analysis

Two authors (OA and TH) independently analysed these data, correlating Dr Foster database information to that acquired directly from patient notes. Mortalities were grouped into three categories: attributed to Mr X, attributed to other surgeons and attributed to the non-surgical team. The mortalities attributed to Mr X were then classified as ‘operative’ or ‘non-operative’. Procedure-specific operative mortality rates were calculated by interrogating our electronic theatre operation database and dividing the number of deaths by the total number of operations performed by Mr X in the 3 years of this study.

Results

Interrogation of the Dr Foster Intelligence database identified 30 patients, over the 3 years of this study, for whom the consultant on discharge was recorded as Mr X. A review of these patients' notes resulted in the exclusion of 12 patients, for whom no evidence of them being managed by Mr X could be found. Of these, 3 patients were excluded because their notes from this admission could not be found within the trust, 1 patient was under the care of a medical team with no documented surgical diagnosis and 8 patients were under the care of other consultant surgeons within the same trust (5 non-operative and 3 operative deaths). The remaining 18 patients were correctly attributed to Mr X and could be separated into 'operative' (11 patients) and 'non-operative' (7 patients) groups. The results for all mortalities between 1 April 2006 and 31 March 2009 attributed to a Mr X are summarised in Figure 1.

Mr X operative mortality

Over the period 1 April 2006 to 31 March 2009, 1,210 operations were undertaken under the care of Mr X and 989 of these were inpatients. As there were 11 deaths in this population, an overall inpatient operative mortality rate of 1.1% was calculated for Mr X. The patient demographics for these 11 postoperative mortalities are shown in Table 1. The mean age of patients in this group was 78.09 (standard deviation [SD]: 8.25) years and 64.6% of patients were female. Of note was that 73% of these patients were emergency admissions and only 18% had postmortem examinations performed to determine the cause of death. Finally, the mean length of stay for these patients was 8.2 (SD: 5.1) days. The co-morbidities, preoperative risk factors and quality of life parameters for these patients are shown in Table 2. The mean Waterlow score for this group was 18.9 (SD: 6.7) and the mean Dr Foster risk score was 14.46% (SD: 11.97%). It should be noted, however, that 8 patients had a CCI of 0 recorded despite having significant co-morbidities.

From these data the procedure-specific mortality was also determined:

1. **Colonic resection:** There were 4 deaths following colonic resection in the 3 years examined in this report, 3 of which followed resection for colorectal cancer. Patient 2 (71 years old) died 10 days after an emergency right hemicolectomy for an obstructing caecal tumour following a postoperative myocardial infarction. She had aplastic anaemia and required platelet transfusions. Patient 4 (89 years old) had a locally advanced hepatic flexure carcinoma intimately associated with the gall-bladder, which was removed in continuity. This patient died 4 days post surgery following an acute cardio-respiratory arrest. Patient 9 (86 years old) died following a Hartmann's operation for perforated diverticular disease. Patient 11 (68 years old) had been extensively investigated by another team for possible Crohn's disease before being admitted urgently with an obstructing sigmoid cancer. The patient had a Hartmann's operation and deteriorated 24 hours after surgery, requiring a relaparotomy to exclude an intra-abdominal catastrophic cause. A postmortem examination demonstrated evi-

dence of an infective colitis as a contributory cause. In total, Mr X undertook 102 colonic resections in this time period, resulting in a 4% mortality for all colonic resections. All colorectal cancer patients had been entered into the National Bowel Cancer Audit.

2. **Oesophago-gastric resection:** Patient 6 (80 years old) died after a partial oesophago-gastrectomy for proximal gastric cancer. The patient had a preoperative staging of T2/T3 disease and was deemed unsuitable for neoadjuvant chemotherapy. A proximal transabdominal oesophago-gastrectomy was undertaken since the patient was felt to be anaesthetically unsuitable for a 2-stage operation. The tumour was staged postoperatively as T3 with 18 of 18 nodes involved. His respiratory function deteriorated postoperatively and it was decided, following discussion with his family, that he should not be re-ventilated. He died 16 days post surgery of respiratory failure. Our unit keeps its own audit figures, contributing fully to the National Oesophago-Gastric Cancer Audit, and the unit mortality for oesophago-gastric cancer resections was 4.9% from 2001–2007.
3. **Small bowel surgery:** Five patients underwent surgery for small bowel obstruction. Patient 1 (75 years old) was admitted with small bowel obstruction and taken to theatre where a jejunal perforation secondary to small bowel adhesive obstruction was identified and treated. She had a raised troponin postoperatively and required ICU admission for sepsis and disseminated intravascular coagulopathy. She deteriorated after a CT of her brain had shown multiple infarcts and died 2 weeks after surgery. Patient 3 (89 years old) had originally been reviewed by another surgical team and returned 3 days later with small bowel obstruction and a femoral hernia. The hernia was repaired and a segment of small bowel was resected. The patient developed atrial fibrillation 5 days postoperatively and, after discussion with family members and the ICU, the patient was 'designated not active resuscitation' (DNAR). The patient deteriorated and died 2 days later. Patient 5 (70 years old) had metastatic disseminated pancreatic cancer identified at surgery for small bowel obstruction and died a week post bypass surgery. Patient 7 (85 years old) was under the care of a medical team with a lower respiratory tract infection when she developed abdominal distension and vomiting. She had been on warfarin for atrial fibrillation and was considered a poor surgical risk. An initial medical DNAR decision was reversed following a CT scan showing small bowel obstruction. Omental bands and an internal hernia with a localised recent perforation were identified and treated. The patient died 3 days later following an episode of hypotension, hypoxia and bradycardia. Patient 10 (68 years old) had a recurrent metastatic carcinoid tumour, having had a right hemicolectomy 8 years earlier. He had been admitted several times with small bowel obstruction due to recurrent disease but on this occasion the obstruction did not settle. An entero-colic bypass was undertaken but the patient died following a myocardial infarction 5 days later.
4. **Bleeding peptic ulcer:** Patient 8 (78 years old) had been

Table 1 Patient demographics for 11 postoperative mortalities correctly attributed to Mr X

Patient	Age	Sex	Admission	Admission diagnosis	Operative findings	Operation	Length of stay	Cause of death	Postmortem examination
1	75	F	Emergency	Adhesional small bowel obstruction	Intra-abdominal adhesions with jejunal small bowel perforation and incidental Meckel's diverticulum	Laparotomy, adhesiolysis, primary repair of small bowel perforation and Meckel's diverticulum excision	14 days	1. a) Multi-organ failure; b) sepsis; c) small bowel perforation due to adhesions; 2. laparoscopic cholecystectomy, hysterectomy	N
2	71	M	Emergency	Obstructing caecal tumour	Caecal tumour (Dukes C2, pT4 N2)	Right hemicolectomy	10 days	1. a) Intra-abdominal haemorrhage; b) haemorrhage into mesentery; 2. myocardial infarction	N
3	89	F	Emergency	Small bowel obstruction	Femoral hernia with small bowel volvulus and ischaemic bowel	Laparotomy, small bowel wedge resection and primary anastomosis with repair of femoral hernia	7 days	1. a) Myocardial infarction; congestive heart failure; 2. laparotomy for strangulated hernia	N
4	89	M	Elective	Advanced right colonic carcinoma	Hepatic flexure colon cancer (Dukes C2, pT3 N2) with locally advanced disease infiltrating gallbladder	Laparotomy, right hemicolectomy and cholecystectomy	4 days	1. a) Bronchopneumonia; 2. bowel cancer	N
5	70	F	Emergency	Small bowel obstruction secondary to intra-abdominal tumour	Advanced pancreatic cancer	Laparoscopy followed by laparotomy and debulking of omental tumour with ileo-transverse bypass	7 days	1. a) disseminated intra-abdominal malignancy	N
6	80	M	Elective	Proximal gastric carcinoma	T3 proximal gastric carcinoma, 18/18 lymph nodes involved with positive resection margins	Transabdominal proximal oesophago-gastrectomy and splenectomy	16 days	1. a) Bronchopneumonia; b) oesophago-gastric cancer; 2. resection	N
7	85	F	Emergency	Lower respiratory tract infection (admitted under medical team); while an inpatient developed small bowel obstruction	Small bowel obstruction with omental band adhesions and internal hernia; recent perforation of small bowel	Laparotomy: division of adhesions, reduction of internal hernia and oversewing of small bowel perforation	2 days	1. a) Cardio-pulmonary failure; b) chronic atrial fibrillation/left ventricular failure; 2. lower respiratory tract infection, breast cancer	N
8	78	F	Emergency	Fractured neck of femur and ribs, heart failure; developed upper gastrointestinal bleeding; failed endoscopy	Bleeding duodenal ulcer	Laparotomy and under-running of bleeding duodenal ulcer	12 days	1. a) Bleeding duodenal ulcer	N
9	86	F	Emergency	Large bowel obstruction	Perforated distal transverse colon diverticulum	Left hemicolectomy and Hartmann's procedure	2 days	1. a) Abdominal sepsis; b) non-resolving peritonitis; 2. bowel perforation (post-operative)	Y
10	68	M	Emergency	Small bowel obstruction secondary to advanced recurrent right colonic carcinoma tumour of bowel	Right iliac fossa tumour mass causing small bowel obstruction	Laparotomy and palliative ileo-colic bypass.	4 days	1. a) Myocardial infarction; 2. laparotomy and entero-colic bypass for recurrent small bowel obstruction secondary to malignant carcinoid of the bowel	N
11	68	F	Elective	Vomiting, weight loss and infective colitis (admitted under medical team); later developed large bowel obstruction	Annular stenosing cancer of mid-sigmoid colon	Laparotomy and Hartmann's procedure; re-laparotomy and peritoneal lavage for sepsis	2 days	1. a) Sepsis; b) infective colitis; 2. cancer of the colon operated	Y

Table 2 Co-morbidities, preoperative risk factors and quality of life parameters for the 11 postoperative mortalities correctly attributed to Mr X

Patient	Co-morbidity	ASA grade	Home situation	Mobility	Waterlow score	ICU admission	Dr Foster Charlson index	Dr Foster risk score
1	Bilateral hemiarthroplasty, laparoscopic cholecystectomy, hysterectomy and blindness secondary to macular degeneration	2	Independent, lives alone	Independently mobile	31	Y	0	12.70%
2	Aplastic anaemia, bladder transitional cell carcinoma, angina at 40 yards' exertion, thrombocytopaenia, hypertension, right total hip replacement	3	Nursing home	Mobilises with frame	9	Y	0	11.50%
3	Hypertension	3	Independent, lives alone	Independently mobile	16	Y	0	18.20%
4	Osteoarthritis, chronic renal impairment	2	N/A	N/A	18	N	10	7.30%
5	Nil	1	Independent, lives alone	N/A	11	N	0	42.60%
6	Hypertension, hypercholesterolaemia, basal cell carcinoma of left knee	2	N/A	N/A	16	Y	0	3.00%
7	Hypertension, atrial fibrillation on warfarin, impaired left ventricular function, left mastectomy for breast cancer, osteoporosis with vertebral collapse, chronic obstructive pulmonary disease	3	Dependent, requires care, lives with family	Mobile with stick	15	Y	0	15.80%
8	Total hip replacement, osteoarthritis, dementia	1	Independent, lives alone	Independently mobile	20	Y	0	2.80%
9	Osteoarthritis, asthma, total shoulder replacement, total hip replacement, total knee replacement, open cholecystectomy	2	Dependent, requires care, lives with family	Mobile with frame	22	Y	4	19.20%
10	Bowel resection for right colonic carcinoid tumour, liver metastases, 4 previous admissions for small bowel obstruction, diabetes mellitus, hypertension, benign prostatic hypertrophy	3	N/A	Independently mobile	22	Y	30	24.60%
11	Depression, hiatus hernia	1 and 5	Independent, lives alone	Independently mobile	28	Y	0	1.40%

Table 3 Patient demographics for the 7 non-operative mortalities correctly attributed to Mr X

Patient	Age	Sex	Admission type	Presenting complaint and admission diagnosis	Reason not to operate	Family agreement	Length of stay	Cause of death	Postmortem examination
12	82	F	Emergency (medical team)	Cerebrovascular accident, hypotension, abdominal distension and pain, suspected ischaemic bowel; CT scan clear evidence of ischaemic bowel	Deemed too unfit to survive major surgery	Y	1 day	1. a) Acute intestinal obstruction; b) intestinal infarction	N
13	93	F	Emergency	Abdominal pain suspected ischaemic bowel	Deemed too unfit to survive major surgery	Y	0 days	1. a) Peritonitis; b) perforated duodenal ulcer	Y
14	83	F	Emergency	Abdominal pain suspected ischaemic bowel	Deemed too unfit to survive major surgery	Y	1 day	1. a) Ischaemic bowel	N
15	60	M	Emergency	Chest infection, rectal bleeding from suspicious rectal mass	Developed severe respiratory failure and died before he could have a CT scan to confirm diagnosis	Y	1 day	1. a) Gastrointestinal bleed; b) colorectal cancer; 2. chest infection	N
16	83	M	Emergency	Hypoxia secondary to metastatic lung cancer, gallstones; abdominal pain and vomiting	Palliative patient, no surgery indicated	Y	15 days	1. a) Bronchogenic carcinoma	N
17	88	F	Emergency	Suspected ischaemic bowel	Patient had expressed wish not to have surgery	Y	1 day	1. a) Ischaemic bowel	N
18	79	F	Emergency	Weight loss, abdominal pain and collapse; CT scan showed disseminated intra-abdominal malignancy	Deemed too unfit to survive major surgery	Y	31 days	1. a) Disseminated intra-abdominal malignancy	N

Table 4 Co-morbidities, preoperative risk factors and quality of life parameters for the 7 non-operative mortalities correctly attributed to Mr X

Patient	Co-morbidity	ASA grade	Home situation	Mobility	Waterlow score	Dr Foster Charlson index	Dr Foster risk score
12	Diabetes mellitus type 2, hypertension, cerebrovascular accident, hiatus hernia, osteoarthritis	2	Independent, lives with partner/family	Mobile with stick	N/A	14	57.00%
13	Cerebrovascular accident, ischaemic heart disease, atrial fibrillation (on warfarin), Sydenham's chorea, hiatus hernia and breast cancer	3	Dependent, lives in residential home	Mobilises with wheelchair	18	5	8.50%
14	Hyperthyroid, hypertension, Raynaud's phenomenon	2	Dependent, requires care, lives with family	N/A	N/A	0	38.70%
15	Severe chronic obstructive pulmonary disease, gout	3	Independent, lives alone	N/A	13	0	6.30%
16	Chronic obstructive pulmonary disease, lung cancer with spinal metastases, lobectomy, left hemicolectomy for adenoma	3	Independent, lives with partner/family	Independently mobile but housebound	22	0	34.40%
17	Breast cancer, chronic obstructive pulmonary disease, mitral regurgitation, osteoarthritis, osteoporosis, hypothyroid and ischaemic heart disease, non-Hodgkin lymphoma	3	Dependent, lives in residential home	Mobile with frame	16	4	45.10%
18	Hypertension, osteoporosis, epilepsy, drug-induced thyrotoxicosis, cardiac arrhythmias, left ventricular hypertrophy	3	Independent, lives with partner/family	Independently mobile	16	0	45.00%

on a medical ward for a month with fractured ribs and left ventricular failure when she began to bleed from a duodenal ulcer. This was treated with an under-running when it did not respond to injection therapy. Five days later there was evidence of further bleeding and, following a discussion between surgical and gastroenterology teams, it was decided to treat the patient conservatively. She died 4 days later.

Mr X non-operative mortality

The demographics for the 7 non-operative mortalities correctly attributed to Mr X are shown in Table 3. The mean age was 81.14 (SD: 10.38) years and 71.4% of patients were female. Of note is that all of these patients were emergency admissions and only one had a postmortem examination performed. In all cases a preoperative decision was made not to operate based on postoperative prognosis and the patients' families were consulted. The mean length of stay was 7.1 (SD: 11.8) days and 71.4% of patients died within the first two days of admission illustrating the severity of their condition. The co-morbidities, preoperative risk factors and quality of life parameters for these patients are shown in Table 4. The Waterlow score was not available for 2 of the patients but for the remaining 5 the mean score was 17 (SD: 3.3) and the mean Dr Foster risk score was 33.57% (SD: 19.20 percentage points). It should be noted, however, that 4 patients had a CCI of 0 recorded having significant co-morbidities.

In 4 cases (Patients 12, 13, 14 and 17) ischaemic bowel was suspected. The mean age of these patients was 86 years and all died within 24 hours of admission following fluid replacement and transfer to the Liverpool Care Pathway (LCP). The remaining 3 patients had confirmed or suspected metastatic cancer. Patient 16 came under surgical care as gallstones were considered to be contributing to sepsis; however, following review it became apparent that metastatic lung cancer was the cause and the LCP was instigated. Patient 18 was suspected of having advanced ovarian cancer and was appropriately reviewed and deemed unfit for surgery. Finally, Patient 15 was a 60-year-old man who presented with rectal bleeding from a clinical rectal mass and respiratory infection. He was a heavy smoker with a known history of emphysema and metastatic disease was suspected. He was resuscitated and ventilated on an ICU due to respiratory deterioration but died before further confirmatory investigations could be carried out.

Discussion

The data included in this study have already been used by Dr Foster to determine our NHS hospital's HSMR. The fact that the 30 patients included in this paper have indeed died as inpatients in this hospital is not in doubt; however, what is clear and indeed worrying is that a large number of these have been incorrectly attributed to Mr X. Discounting the 3 patients for whom notes surrounding their last admission could not be found, at least 9/30 patients had no evidence of any connection with the surgeon concerned, representing a minimum 30% overestimate of surgeon-attributed mortality. It is of course also possible that some cases that should have

been attributed to Mr X were incorrectly attributed to other consultants, making the process of using HES data to determine a surgeon's crude mortality very challenging. In either event, this raises very serious concerns about the accuracy of HES data to calculate a surgeon's standardised mortality ratio, should this information be sought by the media or members of the public.

In this study Mr X was found to have an overall inpatient operative mortality of 1.1%. These findings are favourable when it is considered that the American College of Surgeons National Surgical Quality Improvement Program looking at deaths and complications following 84,730 inpatient general and vascular surgery operations found a 3.5% postoperative mortality in good quality centres.¹¹ Again, the finding that Mr X's overall operative mortality would have been more than double (2%) according to Dr Foster data raises significant concerns should this data appear in published league tables.

When Mr X's procedure-specific mortality is examined, the finding of a 4% mortality (4/102) following colorectal resections is below the 2009 National Bowel Cancer Audit reports of a mean 30-day mortality of 4.5% following colorectal cancer surgery.¹² For oesophago-gastric cancer surgery there was 1 death in the context of 27 oesophago-gastric resections undertaken by Mr X over the 3-year period. This 3.7% mortality figure stands well below the 2009 National Oesophago-Gastric Cancer Audit's 5% 30-day postoperative mortality figure for oesophageal cancer resection.¹³ This suggests that condition-specific comparative mortality figures are a more accurate reflection of relative quality of care and emphasise the case for comprehensive entry of patient data into national audits. The data in these audits are a more accurate reflection of a surgeon's performance.

This study has shown that 18 patients died under the care of Mr X over a 3-year period, with 11 (61%) of these deaths occurring after surgery. When all patients are considered, 14 of the 27 evaluable cases (52%) had undergone an operation. It is important to interpret these findings in light of larger scale audits of surgical mortality. The Western Australia Audit of Surgical Mortality (WAASM) has reviewed deaths occurring under surgical care over several years. In 2009 this audit demonstrated that 74% of surgical mortality cases had undergone one or more operations¹⁴ and in 2008 the Tasmanian Audit of Surgical Mortality (TASM) demonstrated that 69% of cases had undergone an operation.¹⁵ The 2009 Scottish Audit of Surgical Mortality (SASM) showed only 45% of patients had undergone an operation.¹⁶

All of these state/national audits have reviewed deaths under surgical care, evaluating factors contributing to deaths and in particular areas of concern. In the Scottish study there were areas of concern in 15% of deaths, while in only 5% of cases and 7.5% of those who had undergone surgery was this considered to contribute to or cause the death.¹⁶ In the Tasmanian audit areas of concern were identified in 35% of elective cases and 20% of emergency cases.¹⁵ In the WAASM 2009 report of deaths in surgical care from 2002–2008 only 17% of cases were assessed to have areas of concern and in only 2% of these cases was the adverse event considered to be preventable.¹⁴ A report of the National Confidential Enquiry into Patient Outcome and Death published in 2009 audited

both surgical and medical deaths within 96 hours of admission and found that in 60.9% of patients there was evidence of good practice, in 34.2% room for improvement and in only 4.9% care was judged to be less than satisfactory.¹⁷

While our cases have not been externally assessed, there is no clear evidence of adverse events that might have contributed to death and that the surgeon could have avoided. It is therefore important that we do not misinform the public with crude mortality figures that might give alarm when careful critical appraisal suggests that the overwhelming majority of deaths under surgical care are either a result of underlying terminal disease or within an acceptable range of postoperative risk. It is important that surgeons should not be discouraged from operating on patients with ruptured aneurysms or perforated bowels merely to reduce postoperative mortality statistics.

The next most striking finding in this study was that so much co-morbidity was missing in the Dr Foster database when compared with the patients' notes. In the case of post-operative deaths only 27% of patients (3/11) were given a CCI score. This was 43% (3/7) in the non-operative deaths group. When it is considered that 17 of the 18 cases (94%) had recorded co-morbidity and an ASA score greater than 1, this is extremely worrying, particularly when the impact of risk assessment on HSMRs has been shown to be significant. Interestingly, our findings are in keeping with WAASM, TASM and SASM co-morbidity figures, which range from 86 to 99%.

The Waterlow score is used in our trust to calculate the risk of patients developing bedsores.¹⁸ It was interesting to note that being a mandatory part of a patient's nursing care in our trust, this was recorded for 16 of the 18 patients (89%). The finding that 81% of the patients had Waterlow scores of 15 or above putting them at high or very high risk of pressure ulcers is a significant one and is indicative of their co-morbidities. What this suggests is that a measure of co-morbidity such as the Waterlow score, which is collected prospectively, is a more accurate means of risk adjustment than retrospective co-morbidity coding by clinical coders who have never met the patient.

In this study the mean age at death was 78.3 years for male patients and 80.4 years for females. The United Nations 2005–2010 life expectancy for men in the UK is 77.2 years and for women it is 81.6 years.¹⁹ The findings that the patients who died over the 3-year period of this study achieved their anticipated life expectancy and that many of them presented to hospital with pre-terminal conditions such as disseminated malignancies suggest that we are underplaying the role that hospitals play in society as places where people are brought to die.

Conclusions

This study has highlighted two key areas of concern with regards to public reporting of surgical mortality. First, the inadequacies of HSMRs mean that they are a very poor measure of surgical performance. The potential harm that publishing these data could do to individual surgeons and the impact that this would have on the way that surgery is practised is unthinkable. Second, the coding of co-morbidity

in HES data and the use of this by Dr Foster to adjust for risk is an extremely poor reflection of reality. When we consider that co-morbidity plays such an important part in our patient management decisions, it is staggering to see it so poorly reported in data that are so publicly available.

Both these factors could be addressed through the collection of data by surgeons themselves as part of large audits such as the SASM, WAASM and TASM. We must not abandon attempts to quantify and benchmark our performance as we strive to provide high quality care for our patients and we should enter patients into national prospective audits such as the National Bowel Cancer Audit and National Oesophago-Gastric Cancer Audit. Surgeons should themselves be more involved in providing the public an account of their own performance rather than relying on inaccurate surrogates such as HSMRs.

References

1. Bristol Royal Infirmary Inquiry. *Learning from Bristol: the report of the public inquiry into children's heart surgery at the Bristol Royal Infirmary 1984–1995*. London: Crown Copyright 2001.
2. Bottle A, Aylin P. Intelligent information: a national system for monitoring clinical performance. *Health Serv Res* 2008; **43**: 10–31.
3. Jarman B, Gault S, Alves B *et al*. Explaining differences in English hospital death rates using routinely collected data. *BMJ* 1999; **318**: 1,515–1,520.
4. Dr Foster. *Hospital Guide 2010*. London: Dr Foster; 2010.
5. Jarman B, Pieter D, van der Veen AA *et al*. The hospital standardised mortality ratio: a powerful tool for Dutch hospitals to assess their quality of care? *Qual Saf Health Care* 2010; **19**: 9–13.
6. Mohammed MA, Deeks JJ, Gilling A *et al*. Evidence of methodological bias in hospital standardised mortality ratios: retrospective database study of English hospitals. *BMJ* 2009; **338**: b780.
7. Black N. Assessing the quality of hospitals. *BMJ* 2010; **340**: c2,066.
8. Hawkes N. Patient coding and the ratings game. *BMJ* 2010; **340**: c2,153.
9. Lilford R, Pronovost P. Using hospital mortality rates to judge hospital performance: a bad idea that just won't go away. *BMJ* 2010; **340**: c2,016.
10. Westaby S, Archer N, Manning N *et al*. Comparison of hospital episode statistics and central cardiac audit database in public reporting of congenital heart surgery mortality. *BMJ* 2007; **335**: 759.
11. Ghaferi AA, Birkmeyer JD, Dimick JB. Variation in hospital mortality associated with inpatient surgery. *N Engl J Med* 2009; **361**: 1,368–1,375.
12. Association of Coloproctology of Great Britain and Ireland, Northern and Yorkshire Cancer Registry and Information Service, NHS Information Centre. *National Bowel Cancer Audit 2009*. London: NHS Information Centre; 2009.
13. Royal College of Surgeons of England, Association of Upper Gastrointestinal Surgeons, British Society of Gastroenterology, National Clinical Audit Support Programme. *National Oesophago-Gastric Cancer Audit 2009*. London: NHS Information Centre; 2009.
14. Royal Australasian College of Surgeons. *Western Australian Audit of Surgical Mortality Annual Report 2009*. Melbourne, Australia: RACS; 2009.
15. Royal Australasian College of Surgeons. *Tasmanian Audit of Surgical Mortality Project Report 2008*. Melbourne, Australia: RACS; 2008.
16. NHS National Services Scotland. *Scottish Audit of Surgical Mortality Summary Report 2008 data*. Edinburgh: NHS National Services Scotland; 2009.
17. National Confidential Enquiry into Patient Outcome and Death. *Deaths in Acute Hospitals: Caring to the End?* London: NCEPOD; 2009.
18. Serpa LF, de Gouveia Santos VL, Gomboski G, Rosado SM. Predictive validity of Waterlow Scale for pressure ulcer development risk in hospitalized patients. *J Wound Ostomy Continence Nurs* 2009; **36**: 640–646.
19. Social indicators. United Nations Statistics Division. <http://unstats.un.org/unsd/demographic/products/socind/health.htm> (cited November 2010).