Increasing Reporting of Adverse Events to Improve the Educational Value of the Morbidity and Mortality Conference

Terri P McVeigh, MB BAO BCh, MRCS, Peadar S Waters, MB BAO BCh, MRCS, Ruth Murphy, MB BAO BCh, MRCS, Gerrard T O'Donoghue, MB BAO BCh, FRCS, MD, Ray McLaughlin, MB BAO BCh FRCS, Michael J Kerin, MB BAO BCh, FRCS, MCh

BACKGROUND: The aim of this study was to investigate the impact of a validated complication proforma on surgical Morbidity and Mortality (M&M) conference reporting.

STUDY DESIGN: The ACS-NSQIP (American College of Surgeons-National Surgical Quality Improvement Program) 30-day complication proforma, when implemented, previously showed a 25% increase in morbidity and a 50% increase in mortality reporting. A pilot study introducing the paper-based proforma was undertaken, collecting prospective M&M data for 2,094 of 2,209 colorectal, upper gastrointestinal, breast, and vascular inpatients (94.7% compliance). A comparative analysis using the proforma vs traditional M&M data collection was used to compare accuracy of M&M data reporting.

RESULTS: There was a 73% increase in morbidities reported using the proforma as compared with M&M reporting (547 vs 316), and an increase of 10.81% (37 vs 41) in the reporting of mortalities. Of those patients with morbidities (n = 278), 70.24% (n = 203) had at least 1 surgical intervention. The median length of stay in patients with morbidities was 12 vs 3 days in those with no morbidities.

CONCLUSIONS: We demonstrated that prospective standardized incident recording provides significantly more accurate assessment of M&M data compared with current reporting methods. This increased accuracy should favorably affect surgical performance indicators and casemix funding. (J Am Coll Surg 2013;216:50–56. © 2013 by the American College of Surgeons)

The Morbidity and Mortality (M&M) conference is one of the most powerful forums for surgical teaching and learning. It is unique in providing an open comprehensive review process for consultants and trainees to examine their surgical practice, identify adverse events, critique outcomes, and correct errors, all without fear of blame or derision from their peers.[1]

This collaborative peer review process is essential to the identification and measurement of health care delivery outcomes within an institution.[2] Its highly structured format allows professionals to reliably collate and compare institutional data regarding outpatient clinics and procedures, which are increasingly being requested by health care regulators and finance departments.[3] It allows clear identification and honest open discussion, which is a critical aspect of quality assurance and education within a surgical department.[4]

Despite advancing standards in surgical quality and safety, M&M data reporting seems to have lagged behind,[4] with health care providers recognizing the need for significant improvement.[1] The integrity of the clinical data has been repeatedly questioned[3] with regard to the accuracy of its collation and subsequent peer review discussion.[5] Therefore, outcomes have often been viewed with skepticism[6] within the surgical and wider hospital specialities. The fundamental weakness repeatedly identified is the traditional retrospective haphazard method of data collection, frequently by inexperienced trainees.[7] In addition, adverse clinical events are often discussed in isolation in an anecdotal fashion, without consideration

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From the Department of Surgery, Galway University Hospital, Galway, Ireland.

Correspondence address: Terri P McVeigh, MB BAO BCh, MRCS, Department of Surgery, Clinical Sciences Institute, National University of Ireland, Galway, Galway University Hospital, Galway, Ireland. email: terri.mcveigh@gmail.com

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of previous similar events.[7] Inter- and intrainstitutional comparisons are often impeded by the lack of long-term data collation and absence of meaningful audit.[8]

The American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) is a quality improvement system to facilitate comparative evaluation and improvement of surgical care.[6] It is a prospectively collected, outcomes-based, risk adjusted program, which is nationally validated.[6] Its standardized morbidity and mortality endpoints and definitions provide reliable data[9] to facilitate continuous monitoring and enhancement of surgical care.[2]

Data collection in our institution was observed to be completed in a haphazard way, and complication rates were reported on more than 1 occasion as 0%, a rate not realistically obtainable in a unit dealing with emergent cases in an aging population with multiple comorbidities. However, similar under-reporting of adverse events has been consistently highlighted throughout the literature.[4,10,11]

The aim of this study was, first, to compare the efficacy of our institution's traditional retrospective M&M data collection with that of prospective data collection via the validated (ACS-NSQIP) paper-based proforma. Second, we sought to address factors leading to adverse events and to instigate changes to avoid their recurrence.

Traditional recording method

Recording in our institution was previously carried out on a retrospective basis, typically by senior house officers and registrars. The sources of data collection included patient charts and operating room log books, as well as electronic discharge summaries, which were easily accessed on the hospital intranet. Coding of complications on these summaries was often suboptimal, which translated to inexact recording of adverse events in the M&M meeting. Furthermore, in the case of a patient death, medical notes were often released to the coroner as part of his investigation, precluding retrospective chart review of inpatient events by the surgical team. Moreover, in the case of patients with protracted inpatient stays, only the most recent volume of their medical notes was made available to the surgical team, hampering the capture of adverse events occurring early in their admission.

METHODS

Study design, sample size, and site

A prospective comparative study was undertaken. The study group included all patients admitted over a 6-month period under the breast, vascular, colorectal, upper gastrointestinal, and general surgical services in Galway University Hospital. Surgical day ward and endoscopy admissions were excluded, on the rationale that complicated patients would mandate formal inpatient admission, facilitating data capture.

Data collection

Data were collected on patient demographics, including age and sex, mode of admission, number of admissions over the study period, surgical interventions and reinventions, length of stay, and, if applicable, the number and type of adverse events occurring during their inpatient admission and up to 30 days postoperatively.

Proforma

A proforma (Fig. 1) was developed based on the ACS-NSQIP[2] platform. This paper-based proforma was inserted into each patient's chart at the time of admission. Information and training about completion of the proforma were delivered via the M&M meeting and also electronically via the Galway University Hospital Internal Webmail. Each member of every surgical team was encouraged to participate in completing the proforma, but ultimately, responsibility fell largely on the junior house officers (interns), who were ideally placed to complete the form on a prospective basis given their ward-based position. These nonconsultant hospital doctors (NCHDs) were specifically targeted for enhanced training. Patients were routinely reviewed at outpatient clinics 6 weeks after discharge. Forms were updated at that stage to include any complications occurring up to 30 days after discharge.

Data from Morbidity and Mortality meeting

Presentations for M&M conferences were prepared by senior house officers for their respective teams (Fig. 2). Data for these presentations were gleaned retrospectively by means of chart review or from electronic discharge summaries completed retrospectively at the point of discharge by junior house officers. The presentations from the M&M meeting were scrutinized by a single investigator in order to accurately record the number and type of adverse events reported in the traditional M&M forum.

Statistical analysis

A case-matched comparative analysis of complication reporting using this proforma was compared with a synchronous traditional retrospective data review of the same patients over the 6-month period. Data were analyzed and tabulated using PASW v.19 software. Scale type data were assessed for normal distribution using the

GALWAY UNIVERSITY HOSPITALS

COMPLICATIONS PROFORMA

PLEASE FILL IN **ALL** FIELDS APPLICABLE

Consultant: _____	Name: .....
Length of stay: _____	Address: .....
Date of Admission: _____	.....
Date of Discharge: _____	Hospital No.: ..... Date of Birth: .....
Diagnosis: _____	***Please attach address label***
Surgery ? Y / N	
If Y: Procedure: _____	

1. No Complications ☐
2. ARF (requiring dialysis) ☐
3. ARF (not requiring HD) ☐
4. Blood loss >4 units RCC transfusion in first 72 hrs ☐
5. Blood transfusion >4 units during admission ☐
6. Cardiac Arrest requiring CPR ☐
7. Cereberovascular event (Ischemia or Haemorrhage) ☐
8. Coma > 24 hours ☐
9. Deep Venous Thrombosis ☐
10. Death ☐
11. Haematoma ☐
12. Myocardial Infarction ☐
13. Pneumonia ☐
14. Pulmonary Embolus ☐
15. Sepsis ☐
16. Septic Shock ☐
17. Surgical site infection ☐
18. Systemic Inflammatory Response Syndrome ☐
19. Unplanned return to theatre ☐
    Please specify
    .....
    .....
20. Surgical intervention on the ward ☐
    Please specify
    .....
    .....
21. Unplanned re-intubation ☐
22. Urinary Tract Infection ☐
23. Ventilation > 48 hours ☐
24. Wound dehiscence ☐
25. Other ☐
    Please specify
    .....
    .....

Signature: _____ **Date:** _____

Print Name: _____ **Designation:** _____

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Figure 1. American College of Surgeons-National Surgical Quality Improvement Program-based proforma.

Shapiro-Wilk[12] test, with parametric and nonparametric tests applied as appropriate.

Data were tabulated in SPSS and univariate analyses performed using the chi-square test of contingency tables.

RESULTS

Over the 6-month study period, a total of 2,209 inpatients were recorded for the 9 teams. Of these 2,209 admissions, 2,094 forms were completed (94.7% compliance).

The vast majority of admissions were nonelective, with 65% (n = 1,431) coming via the emergency department, 4% (n = 99) from outpatient clinic reviews, and 2% as transfers from peripheral secondary centers (n = 36). Only 29% (n = 643) of all admissions were elective. Of 2,209 admissions to the surgical unit, 48% (n = 1,061)

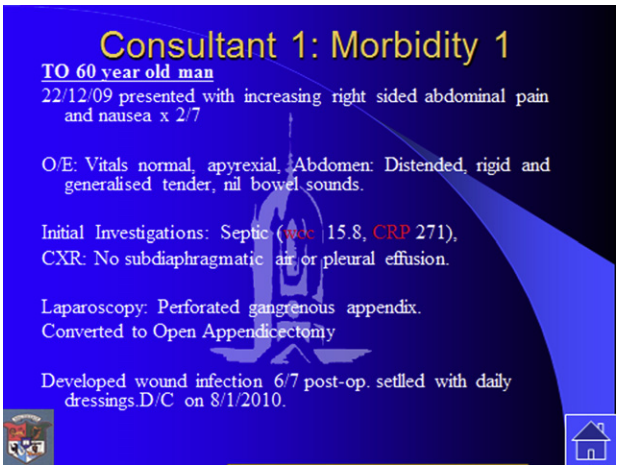

Figure 2. Example of traditional morbidity and mortality data recording. CRP, c-reactive protein; CXR, chest x-ray; D/C, discharge; O/E, on examination; WCC, white cell count.

underwent at least 1 surgical intervention, with a further 0.7% (n = 16) undergoing a simple endoscopic investigatory procedure. The remaining patients were managed conservatively.

Number of adverse events captured

The number of cases in which an adverse event was captured by means of the proforma was 278, an increase of 143 as compared with the M&M (n = 135), ($p < 0.001$, chi-squared; Table 1). The number of individual adverse events captured by the proforma was 547, compared with 316 reported in the M&M ($p < 0.001$, chi-squared). The number of mortalities, as coded in the traditional M&M was 37, compared with 41 captured by use of the proforma ($p < 0.001$, chi-squared).

As recorded in the M&M, complications were reported in 6.45% of patients, and rate of mortality was reported at 1.77%. Records obtained by means of the proforma indicated a 13.28% incidence of morbidity and a 1.96% incidence of mortality (Table 2). This translated to an increased capture of morbidities of 106% by use of standardized proforma, and 10.81% increased capture of mortalities.

Complications were further assessed, comparing each individual complication as outlined on the proforma, giving a total of 22 variables (Table 3). Adverse events listed in the free text space on the proforma were tabulated and examined for frequency of occurrence (Table 4). For each specified complication, rates reported using the standardized proforma were significantly higher than those recorded in the M&M meeting.

We further analyzed the implications of M&M on length of stay (Table 5). Patients in whom an adverse event occurred had a protracted length of stay compared with uncomplicated cases (median length of stay 12 days [range 0 to 155 days] vs 3 days [range 0 to 70 days]).

Table 1. Recording of Morbidity and Mortality

Months	M&M, n	Proforma, n	Difference, n	Difference, %
Patients experiencing at least one adverse event				
1	30	53	23	77
2	15	33	18	120
3	31	52	21	68
4	33	60	27	82
5	15	44	29	193
6	11	36	25	227
Total	135	278	143	106
Mortalities				
1	6	7	1	16.67
2	4	5	1	25.00
3	6	6	0	0
4	10	10	0	0
5	6	7	1	16.67
6	5	6	1	20.00
Total	37	41	4	10.81
Unique adverse events				
1	83	131	48	58
2	36	70	34	94
3	55	88	33	60
4	71	108	37	52
5	45	88	43	96
6	26	62	36	138
Total	316	547	231	73

M&M, morbidity and mortality.

DISCUSSION

Traditionally, the retrospective haphazard method of M&M data collation has led to failure of identification and therefore, under-reporting of adverse events.[3,6,7] Disappointingly but unsurprisingly, our results confirm this under-reporting in both morbidity and mortality rates using the historical method of data collection. When looking at particular reasons for these results, we can postulate a number of causes. It has been suggested repeatedly in the literature that surgeons may be unwilling to report all of their complications for fear of

Table 2. Reported Incidences of Morbidities and Mortalities

Variable	M&M, n (%)	Proforma, n (%)	Increase, n (%)
Patients with morbidities	135 (6.15)	278 (12.67)	143 (106)
Mortalities	37 (1.68)	41 (1.86)	4 (10.8)

M&M, morbidity and mortality.

Table 3. Complications

Complication	M&M, n	Proforma, n	Difference, n	Increased capture of adverse events, %
Acute renal failure	24	30	6	25.00
Acute renal failure not requiring hemodialysis	4	13	9	225.00
Transfusion >4 U	18	33	15	83.33
Arrest	14	15	1	7.14
Cerebrovascular accident	2	6	4	200.00
Coma >24 h	4	4	0	0
Deep venous thrombosis	3	5	2	66.67
Myocardial infarction	10	12	2	20.00
Lower respiratory tract infection	25	61	36	144.00
Pulmonary embolism	5	9	4	80.00
Sepsis	20	32	12	60.00
Septic shock	6	10	4	66.67
Systemic inflammatory response syndrome	7	10	3	42.86
Unplanned return to operating room	33	41	8	24.24
Urinary tract infection	4	15	11	275.00
Intervention on the ward	3	6	3	100.00
Reintubation	11	15	4	36.36
Ventilation >48 h	20	26	6	30.00
Wound dehiscence	16	22	6	37.5
Wound infection	37	74	37	100.00
Wound hematoma	11	16	5	45.45

M&M, morbidity and mortality.

derision by their peers combined with fear of litigation and possible institutional constraints, which may be applied to their working practices, namely, a "blame and shame" ethos. Time constraints due to the difficult and labor-intensive nature of retrospective collection have been shown to attribute to under-reporting of data.[7] In certain instances, poor knowledge and differing opinions of what constitutes reportable complications lead to errors and omissions.

The most commonly under-reported morbidities in our study group were lower respiratory tract infections, wound infections, cerebrovascular events (cerebrovascular accidents and transient ischemic attacks), and acute renal failure not requiring dialysis. We speculate that these events were under-reported in the electronic discharge summaries because of successful treatment before discharge. This highlights the need for prospective collection of data pertaining to complications. It may also address a lack of training of junior staff regarding correct coding of data in electronic discharge summaries.

A particularly concerning finding in this study was the omission of 4 mortalities from reporting in the M&M conference. This may be attributed to a host of interrelated factors. First, investigation of in-hospital mortalities by the coroner greatly impeded access of the surgical team to the medical notes, precluding chart review. Furthermore, changeover of junior staff between surgical teams or transfer of care of patients between specialities or hospitals inevitably disrupted continuity of recording of adverse events. Postulated reasons for omission of mortalities in the literature include substandard method of ad hoc retrospective reporting and issues including fear of blame,[1] as well as time pressures and poor record keeping.[7]

The Hawthorne effect[13] describes the impact of participants' awareness of being observed on their behavior over the course of the observation period. In this particular study, we expected the NCHDs to become more acutely aware of ongoing scrutiny on the M&M meeting, and increasing accuracy of reporting over the time period of the study. Furthermore, the NCHDs filling out the proformas were not segregated from the NCHDs compiling the M&M report. We expected this to affect the reporting behavior of the NCHDs and lead to narrowed differences in reporting methods over the study period. It is interesting, therefore, that the differences in recording between the 2 methods peaked at the final month of the study. This may highlight once again the fear of public disclosure of adverse events; NCHDs were far more amenable to outlining patient outcomes anonymously, but were less keen to do so in a public forum.

Table 4. Miscellaneous Complications Captured in the Free Text Area of the Proforma

Complication	M&M, n	Proforma, n	Difference, n	Increased capture of adverse events, %
Circulatory shock	8	11	3	37.5
Anastomotic leak	5	7	2	40.0
Arrythmia	5	13	8	160.0
Vancomycin-resistant enterococci	4	8	4	100.0
Drug reaction	2	4	2	100.0
Iatrogenic injury	4	11	7	175.0
Adult respiratory distress syndrome	1	2	1	100.0
C difficile infection	1	4	3	300.0
Conjunctival hemorrhage	1	1	0	0
Pneumothorax	2	4	2	100.0
Multiple organ failure	0	1	1	—
Exposure keratitis	1	3	2	200.0
Transient ischemic attack	0	2	2	—
Bleeding postprocedure	0	7	7	—
Disseminated intravascular coagulation	2	2	0	0
Electrolyte disturbances	2	8	6	300.0
Anesthetic complication	0	1	1	—
Hematemesis postextubation	0	1	1	—
Transfusion reaction	1	1	0	0
Pancreatitis following medical intervention (ERCP)	0	1	1	—

M&M, morbidity and mortality.

The use of validated prospective reporting systems is one method of intervention aimed at increasing reporting of complications. Our study using the validated ACS-NSQIP 30-day complication proforma improved capture of morbidity data by 106%, and by 10.81% for our mortality data. Such data can then be incorporated into M&M conferences to give an accurate estimation of true institutional complications. We believe this to be the first reported use of an ACS-NSQIP–based platform for complication recording outside of North America. It is certainly a novel method in Ireland.

It is recognized, however, that the effect of such interventions are often short lived and the natural course is to relapse into historical under-reporting.[7] As in our study, the real time visual use of the proforma during M&M conferences helps to reinforce its value. This, combined with regular presentations from principal investigators, is critical in changing the mind-set of residents toward prospective proforma-based reporting.

In a culture moving toward increased transparency and increased quality and safety in health care environments, honest and accurate reporting is critical. In an increasingly gloomy economic climate, hospital funding is becoming increasingly guarded. Remuneration of diagnostic and therapeutic procedures for presenting complaints and any subsequent morbidity is based on Hospital Inpatient Enquiry scheme[14](HIPE), data, which is coded from electronic discharge summaries. Incorporation of this proforma in an electronic format into the discharge summary application would address the paucity in recording of complications, thereby increasing accuracy of Hospital Inpatient Enquiry scheme coding and

Table 5. Impact of Adverse Events on Length of Stay

	Complicated case	Uncomplicated case	p Value
Length of stay, d			
Mean±SD	17.98±20.44	5.04±5.44	<0.01*
Median (range)	12 (0–155)	3 (0–70)	
Postoperative length of stay, d			
Mean±SD	15.78±19.96	3.51±3.62	<0.01*
Median (range)	10 (0–153)	2 (0–28)	

*Independent samples median test.

ensuring correct financial reimbursement to the hospital. This, in turn, has obvious implications for service provision.

The ultimate success of such ventures as a measure of quality improvement rests on the enthusiasm and support of surgeons. Unified surgical support is necessary to ensure its acceptance compared with traditional but less well validated systems.

Author Contributions

Study conception and design: McVeigh, O'Donoghue, Kerin

Acquisition of data: McVeigh, Waters, Murphy

Analysis and interpretation of data: McVeigh, O'Donoghue

Drafting of manuscript: McVeigh, O'Donoghue, Kerin

Critical revision: McVeigh, O'Donoghue, McLaughlin, Kerin

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