

# Documentation of clinical review and vital signs after major surgery

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Numerous studies have shown that severe in-hospital adverse events, such as cardiac arrest and unexpected death, are frequently preceded by abnormal vital signs.<sup>1-5</sup> In addition, patients who have recently undergone major surgery are at higher risk of physiological deterioration or adverse events in hospital.<sup>6,7</sup> It therefore seems reasonable that all patients who have had major surgery be medically reviewed at least once per day, and that nursing review and measurement of vital signs be performed at least once per nursing shift.

This may be considered standard hospital practice, but several studies suggest that documentation of patient vital signs is commonly incomplete.<sup>8-16</sup> Some of these studies are limited either because they focus on a narrow group of patients or observation types,<sup>14,15</sup> or they report on the documentation of vital signs only in patients who have experienced a serious adverse event.<sup>8,10,11,16</sup> Few studies provide a clear picture of the overall quality of in-hospital documentation.<sup>9,12,13</sup>

We assessed the documentation of medical and nursing review and vital signs in a group of patients who had recently undergone major surgery in five Australian hospitals.

## METHODS

We performed a retrospective audit of patient records in each of the five participating Australian hospitals. Hospitals were located in Victoria or New South Wales and were referral or tertiary metropolitan institutions. Patients aged under 18 years were excluded.

As described by Birkmeyer and colleagues,<sup>17</sup> we selected patients who had undergone one of 14 major surgical operations, identified by the International Classification of Diseases, 10th revision (ICD-10) codes: cardiac (coronary artery bypass grafting [38497-00-03, 38500-00, 38503-00], aortic valve replacement [38488-00-01], or mitral valve replacement [38488-06-07]); vascular (carotid endarterectomy [32751-00], lower limb bypass grafting [32739-00, 32742-00], or open repair of an abdominal aortic aneurysm [33115-00, 33154-00]); gastrointestinal (colectomy [32000-00, 32003-00-01, 32004-00, 32006-00-01,

## ABSTRACT

**Objective:** To describe the quality of postoperative documentation of vital signs and of medical and nursing review and to identify the patient and hospital factors associated with incomplete documentation.

**Design, setting and participants:** Retrospective audit of medical records of 211 adult patients following major surgery in five Australian hospitals, August 2003 – July 2005.

**Main outcome measures:** Proportion of patients with complete documentation of medical review (each day) and nursing review and vital signs (heart rate, blood pressure, respiratory rate, temperature and oxygen saturation) (each nursing shift), and the proportion of available opportunities for medical and nursing review where documentation was incomplete. Univariate and multivariate odds ratios for the association between incomplete documentation and hospital and patient factors.

**Results:** During the first 3 postoperative ward days, 17% of medical records had complete documentation of vital signs and medical and nursing review. During the first 7 postoperative ward days, nursing review was undocumented for 5.6% of available shifts and medical review for 14.9% of available days. Respiratory rate was the most commonly undocumented observation (15.4% undocumented). Certain hospitals were significantly associated with incomplete documentation. Vital signs were more commonly undocumented in patients without epidural or patient-controlled (PC) analgesia, during evening nursing shifts, and during successive postoperative ward days. Nursing review was more commonly undocumented in the evening and for patients without epidural or PC analgesia. Medical review was more commonly undocumented on weekends.

**Conclusion:** Hospital and patient factors are associated with incomplete documentation of clinical review and vital signs after major surgery.

MJA 2008; 189: 380–383

32012-00], gastrectomy [30521-00, 30523-00, 30524-00], oesophagectomy [30535-00, 30536-00-01, 30541-00-01, 30545-00-01], or pancreatic resection [30593-00]); urological (nephrectomy [36516-00-01], or cystectomy [37001-00-01, 37914-00]); and thoracic (lobectomy [38438-00-01, 38441-00], or pneumonectomy [38438-02, 38441-01]).

Patients' records were examined if they had undergone a selected operation between 1 August 2003 and 31 July 2005. A 2-year period was chosen to allow time to achieve three consecutive patients for the less common operations (eg, pneumonectomy).

We collected data on the three patients who had most recently undergone each of the 14 surgical procedures in each hospital. Patients were selected in this manner to achieve an overview of the quality of postoperative documentation. The record review was completed between August 2005 and August 2006.

A single researcher at each institution examined the medical records covering the

first 7 postoperative ward days, and collected data using a standardised data collection form and predefined criteria. To assess the quality of the record review, an additional researcher reviewed a sample of the selected patient records at each hospital. Minimal to no discrepancies were observed for these selected records.

Vital signs assessed were heart rate, respiratory rate, systolic blood pressure, oxygen saturation and temperature.

A patient was classified as having complete documentation on a given day if:

- a doctor had documented a review of the patient at least once;
- a nurse had documented a review of the patient for each nursing shift; and
- a numerical value for each vital sign had been recorded at least once per nursing shift.

If the patient was in an intensive care unit or operating theatre for part of the day, or was discharged, that period was excluded from analysis; remaining shifts were termed "available shifts". Documentation was considered lacking only if the

**1 Patient demographics at the five hospitals (A–E)**

	A (n = 42)	B (n = 42)	C (n = 42)	D (n = 43)	E (n = 42)
Age in years, median (range)	69.5 (32–87)	66.5 (20–82)	64.0 (27–87)	63.0 (26–91)	62.5 (34–89)
Male patients, no. (%)	30 (71%)	31 (74%)	26 (62%)	19 (44%)	29 (69%)
Elective operations, no. (%)	39 (93%)	37 (88%)	35 (83%)	43 (100%)	35 (83%)
Length of stay in days, median (range)	8 (2–61)	11 (3–86)	13 (2–71)	8 (3–27)	7 (3–27)

**2 Level of documentation during the initial postoperative period, by hospital**

	Patients with complete documentation,* no. (%)		Available shifts with complete documentation,* no. (%)	
	First 3 ward days <sup>†</sup>	First 7 ward days <sup>‡</sup>	First 3 ward days <sup>§</sup>	First 7 ward days <sup>§</sup>
Hospital A	2/42 (5%)	1/42 (2%)	149/312 (47.8%)	349/668 (52.2%)
Hospital B	9/42 (21%)	3/42 (7%)	225/341 (66.0%)	499/745 (67.0%)
Hospital C	10/42 (24%)	3/42 (7%)	262/360 (72.8%)	520/794 (65.5%)
Hospital D	6/43 (14%)	1/43 (2%)	217/342 (63.5%)	447/751 (59.5%)
Hospital E	8/42 (19%)	1/42 (2%)	266/354 (75.1%)	502/703 (71.4%)
<b>Total</b>	<b>35/211 (17%)</b>	<b>9/211 (4%)</b>	<b>1119/1709 (65.5%)</b>	<b>2317/3661 (63.3%)</b>

\* Complete documentation comprised documentation of all five vital signs (heart rate, respiratory rate, systolic blood pressure, temperature and oxygen saturation), nursing review each shift, and medical review each day. Available shifts excluded shifts where the patient was off the ward for the duration of the shift, or where the patient was already discharged. <sup>†</sup> *P* = 0.11 (Fisher's exact test). <sup>‡</sup> *P* = 0.67 (Fisher's exact test). <sup>§</sup> *P* < 0.001 ( $\chi^2$  test).

patient was present on the ward and no documentation occurred.

We hypothesised that several variables would be associated with incomplete documentation, including: the hospital, operation type and nature (emergency or elective), nursing shift type (morning, afternoon or evening), day of the week (weekday or weekend), patient age, presence of epidural or patient-controlled (PC) analgesia, and number of days spent on the ward since surgery.

The human research ethics committee of each hospital approved the study.

**Statistical analysis**

The  $\chi^2$  or Fisher's exact test was used to test for differences in categorical groups, and the Kruskal–Wallis test was used to test for differences in continuous variables with non-normal distributions (age, length of stay). Univariate and multivariate logistic regression were used to examine the factors associated with documentation of medical and nursing review and vital signs. Variables with a *P* < 0.2 in the univariate analysis were initially included in the multivariate analysis. Variables that did not reach statistical significance (*P* < 0.05) were then progres-

sively excluded from the model, until the most parsimonious model was found. Each of the previously excluded variables was then reintroduced into the model. The final multivariate model included only the variables that added significantly to the model using the likelihood ratio test.

Data were analysed using Stata, version 10.0 SE (StataCorp, College Station, Tex, USA).

**RESULTS**

The medical records of 211 patients were reviewed. Hospital D was unable to provide records of three pneumonectomy patients, and instead we examined the records of four patients who had each received one of the major gastrointestinal operations. For all operations except pneumonectomy, the three consecutive patients were selected within the period July 2004 – April 2005. Emergencies contributed to 22/211 (10.4%) operations.

Box 1 shows patient demographics by hospital. There were two in-hospital deaths. Complete documentation during the first 3 postoperative ward days varied by hospital, ranging from 5% to 24% of patients, and 47.8% to 75.1% of available shifts with

complete documentation (Box 2). Respiratory rate was four times more likely to be undocumented (15.4%) than systolic blood pressure (3.7%). A nursing review was not documented for 5.6% of available shifts and a medical review was undocumented on 14.9% of available days (Box 3).

In univariate analysis, the hospital, type of surgery, presence of epidural or PC analgesia, type of vital sign and number of days spent on the ward since surgery were significantly associated with documentation status (data not shown).

In multivariate analysis, the hospital and number of days spent on the ward since surgery were significantly associated with documentation status (Box 4). With increasing time on the ward, documentation of observations was less likely, but nursing and medical review documentation were more likely. Incomplete documentation of vital signs was associated with the type of surgery, observation type and absence of epidural or PC analgesia. Incomplete documentation of nursing review was more likely on evening shifts and in the absence of epidural or PC analgesia. Undocumented medical review was more likely on weekends.

**DISCUSSION**

In our retrospective review of documentation of vital signs during the first 7 postoperative ward days following major surgery, we found significant levels of incomplete documentation. During the first 3 postoperative ward days, complete documentation of medical and nursing review and vital signs were seen in 17% of patient records and two-thirds of shifts. In multivariate analysis, only the hospital and number of days spent on the ward since surgery influenced all forms of documentation.

Medical review was less frequently documented on weekends. Doctors may not perform ward rounds on weekends, or may not routinely document them. Inadequate physician documentation of obstetric deliveries,<sup>18</sup> postoperative notes,<sup>19</sup> blood-product administration<sup>20</sup> and neonatal examination<sup>21</sup> have been described. However, the level of documentation of review of patients postoperatively has not been previously described.

Nursing review was more likely to be undocumented at certain hospitals and on evening shifts, which may reflect hospital cultural patterns. However, there was no significant difference between documentation on weekdays versus weekends for nursing review or vital signs. The presence of epidural

**3 Level of documentation of clinical review and vital signs**

	% of opportunities missed* (95% CI)
<b>Vital sign (per shift)</b>	
Systolic blood pressure	3.7% (3.1%–4.4%)
Heart rate	4.2% (3.6%–4.9%)
Respiratory rate	15.4% (14.2%–16.6%)
Oxygen saturation	6.7% (6.0%–7.6%)
Temperature	7.1% (6.3%–8.0%)
<b>Review</b>	
Nursing (per shift)	5.6% (4.9%–6.4%)
Medical (per day)	14.9% (13.1%–17.0%)

\* Opportunities for documentation where documentation did not occur. ◆

or PC analgesia made documentation of nursing review and vital signs more likely, perhaps due to more frequent mandatory documentation requirements. An increased number of days spent on the ward since surgery also made documentation of vital signs less likely, perhaps suggesting a perception that the patient was stable. Inadequate nursing documentation could be attributed to the repetitive, time-consuming nature of the tasks.<sup>22–24</sup> A survey of 28 nurses found that 68% felt observations should be performed as required and 29% opposed documenting observations at night.<sup>13</sup>

The hospital and type of observation strongly affected the documentation of vital signs, with the respiratory rate the most neglected vital sign. This observation is also supported by recent studies.<sup>8,12</sup> Of all of the vital signs, an abnormal respiratory rate has been shown to be the most specific predictor of a major adverse event within the next 24 hours.<sup>25–27</sup> However, respiratory rate is generally measured by observation. A nurse must spend 30 seconds observing a patient to determine the respiratory rate accurately, but with the aid of a monitor it could be measured simultaneously with other vital signs. Charts with labelled sections for individual vital sign measurements, or even automatic collation of vital sign data in patients' records, might improve compliance.

However, technological change alone is unlikely to improve the rate of documentation of medical and nursing review. Cultural factors, particularly the expectations of the organisation, morale of the team and the example of senior clinicians are of greater

**4 The association of hospital and patient factors with incomplete documentation of clinical review and vital signs: multivariate logistic regression analysis**

Independent variable	Undocumented observations (per shift)		Undocumented nursing reviews (per shift)		Undocumented medical reviews (per day)	
	OR* (95% CI)	P	OR* (95% CI)	P	OR* (95% CI)	P
<b>Hospital</b>						
Hospital A	1.00		1.00		1.00	
Hospital B	1.37 (1.10–1.71)	0.004	0.01 (0.00–0.03)	< 0.001	0.95 (0.61–1.48)	0.82
Hospital C	1.86 (1.51–2.28)	< 0.001	0.00 (0.00–0.02)	< 0.001	0.44 (0.26–0.72)	0.001
Hospital D	3.12 (2.44–3.98)	< 0.001	0.06 (0.03–0.12)	< 0.001	0.87 (0.55–1.37)	0.56
Hospital E	1.41 (1.13–1.77)	0.003	—		0.38 (0.22–0.66)	< 0.001
<b>Age</b>	ns		ns		ns	
<b>Sex</b>						
Male	1.00		1.00		ns	
Female	1.16 (1.00–1.34)	0.04	0.82 (0.56–1.21)	0.32		
<b>Weekday/weekend shift</b>						
Weekend	ns		ns		1.00	
Weekday					0.43 (0.31–0.60)	< 0.001
<b>Nursing shift</b>						
Morning	1.00		1.00		ns	
Afternoon	1.12 (0.95–1.32)	0.19	0.90 (0.58–1.40)	0.63		
Evening	1.56 (1.33–1.84)	< 0.001	1.81 (1.20–2.74)	0.005		
<b>Surgery</b>						
Gastrointestinal	1.00		1.00		1.00	
Urological	1.11 (0.88–1.40)	0.36	0.40 (0.22–0.74)	0.003	0.78 (0.47–1.31)	0.35
Thoracic	2.28 (1.86–2.80)	< 0.001	0.60 (0.31–1.05)	0.07	1.66 (1.04–2.65)	0.03
Cardiac	1.66 (1.35–2.04)	< 0.001	1.57 (0.96–2.56)	0.07	0.55 (0.32–0.95)	0.03
Vascular	2.35 (1.92–2.88)	< 0.001	0.77 (0.46–1.29)	0.33	1.42 (0.90–2.22)	0.13
<b>Emergency or elective surgery</b>	ns		ns		ns	
<b>Vital sign</b>						
Blood pressure	1.00		na		na	
Heart rate	1.08 (0.81–1.43)	0.61				
O <sub>2</sub> saturation	1.98 (1.54–2.55)	< 0.001				
Temperature	2.26 (1.76–2.90)	< 0.001				
Respiratory rate	5.71 (4.54–7.17)	< 0.001				
<b>Receiving patient-controlled or epidural analgesia</b>						
Yes	1.00		1.00		1.00	
No	1.94 (1.59–2.36)	< 0.001	2.24 (1.41–3.58)	0.001	0.97 (0.66–1.42)	0.87
<b>Days on the ward since surgery increase</b>						
For each 1-day increase	1.19 (1.14–1.23)	< 0.001	0.81 (0.73–0.89)	< 0.001	0.85 (0.78–0.93)	0.001

OR = odds ratio. na = not applicable. ns = not significant. — = could not be calculated as all observations were present. \* ORs relate to the odds of incomplete documentation of clinical review or vital signs. ◆

importance. It is uncommon for consultant surgeons to document postoperative ward rounds in their patients' medical records. Similarly, nursing leadership may be important in establishing and adequately reward-

ing a culture of diligence with documentation. Our finding that hospital allocation was a powerful determinant of such diligence suggests that these local cultural factors are paramount.<sup>13</sup>

Our study included patients from five hospitals to better examine the level of postoperative documentation in Australia. A larger study is required to examine whether hospitals with a higher rate of incomplete documentation also have a greater risk of serious adverse events. Previous studies of documentation of postoperative inpatient care have been of fewer patients, of single wards or hospitals, of shorter duration, have not compared weekdays and weekends or nursing shifts, or have not examined medical review.<sup>9,10,12,13</sup>

It is possible that staff did review patients, but failed to document it because of time constraints or forgetfulness. However, it seems unlikely that this could account for all the incomplete documentation.

Despite the apparent incompleteness of documentation, the mortality rate in this cohort of patients was low. This finding raises the question as to whether such lack of documentation, particularly nursing and medical review, is important to patient outcome. Such documentation is a record of human activity and does not represent a therapeutic intervention; its absence does not necessarily imply lack of attention to patient care. However, if a culture of limited documentation is applied to higher-risk patients (older or after emergency procedures), it may have appreciable negative consequences. In specific patients, documentation of previous physiological variables may be important for assessing their current condition. Nonetheless, it must be acknowledged that no controlled studies have studied the appropriate level of monitoring and documentation of ward patients.

In summary, in a study of the first week spent on the ward following major surgery for patients in five Australian hospitals, we found that documentation of medical and nursing review and patient vital signs was commonly incomplete. Further studies are needed to understand the reasons for this systematic failure and to develop strategies to improve postoperative documentation of observations and review of patients.

**COMPETING INTERESTS**

None identified.

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