Establishing Thresholds for Adverse Patient Outcomes

MOHAMMAD Z. ANSARI, BRIAN T. COLLOPY and IAN G. MCDONALD

ACHS Care Evaluation Program (CEP), Australia
Centre for the Study of Clinical Practice, St. Vincents Hospital, Melbourne, Victoria, Australia

Objective: To establish thresholds for adverse patient outcomes in the absence of knowledge of patient illness severity indices.

Outcomes: Pulmonary embolism, unplanned return to operating rooms, unplanned readmissions, clean and contaminated wound infections, and hospital-acquired bacteraemia.

Design: Analysis of results of surveys of hospitals in Australia by the Australian Council on Healthcare Standards following the introduction of clinical performance measures into the Accreditation process.


Methods: Stratification of hospitals into small (1–99 beds), medium (100–199 beds), and large (>200 beds), calculation of mean rates for the above outcomes in each group, and establishment of thresholds based on two standard errors from the mean.

Results: The mean rate of occurrence of incidents was higher for larger hospitals. Thresholds were generally lower for smaller and higher for larger hospitals.

Conclusions: Bed-size is a useful index for "flagging" peer group variation. The methodological issues in establishing thresholds and their implications in monitoring the quality of care in hospitals are discussed. Copyright © 1996 Elsevier Science Ltd.

Key words: Thresholds, adverse outcomes.

INTRODUCTION

Performance measures called Clinical Indicators have been introduced into the Australian Council on Healthcare Standards' (ACHS) Accreditation Program to increase the clinical component of the Accreditation process, and to increase clinician involvement in quality activities (QA) [1]. Until 1993, the process was based on that of the Joint Commission on Accreditation of Healthcare Organizations in the USA, and had been directed largely at the structures and process of a hospital, with surveys of the various hospital departments conducted on a one- to three-year cycle. The ACHS Care Evaluation Program (CEP) has established a national aggregate data base which has facilitated the development of the indicators with the medical colleges. Data from more than 20% of Australia's acute health care facilities have now been entered into the database, and peer group results based primarily on hospital size are being established to allow hospitals to compare their performance with that of other hospitals in their peer group.

The definition of a clinical indicator is a measure of the clinical management and/or outcome of care. Table 1 shows examples of these indicators which may either measure an outcome of care (such as morbidity e.g., post-operative wound infection) or a process (such as compliance with criteria for management of a...
TABLE 1. Examples of Australian medical colleges' clinical indicators

<table>
<thead>
<tr>
<th>Australian and New Zealand College of Anaesthetists</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A recovery room stay of more than two hours</td>
</tr>
<tr>
<td>• An unplanned admission to an intensive care unit</td>
</tr>
<tr>
<td>• Within 24 hours of a procedure</td>
</tr>
<tr>
<td>The Royal Australasian College of Physicians</td>
</tr>
<tr>
<td>Endocrinology - diabetes mellitus</td>
</tr>
<tr>
<td>• Management and outcome of diabetes ketoacidosis</td>
</tr>
<tr>
<td>• Perioperative management of insulin-treated diabetes</td>
</tr>
<tr>
<td>Gastroenterology - haematemesis and melena</td>
</tr>
<tr>
<td>• Management of patents who receive a blood transfusion</td>
</tr>
<tr>
<td>The Royal Australasian College of Surgeons</td>
</tr>
<tr>
<td>Cardiothoracic</td>
</tr>
<tr>
<td>• Death following coronary artery graft surgery</td>
</tr>
<tr>
<td>• Colorectal surgery</td>
</tr>
<tr>
<td>• Anastomotic breakdown rate</td>
</tr>
<tr>
<td>• Death rate</td>
</tr>
<tr>
<td>The Royal Australian College of Obstetricians and</td>
</tr>
<tr>
<td>Gynaecologists</td>
</tr>
<tr>
<td>Obstetrics</td>
</tr>
<tr>
<td>• Primary caesarean section for failure to progress</td>
</tr>
<tr>
<td>• Term infant transferred to a neonatal intensive care unit for reasons other than congenital abnormality</td>
</tr>
<tr>
<td>Gynaecology</td>
</tr>
<tr>
<td>• Hysterectomy in women younger than 35 years</td>
</tr>
<tr>
<td>• Blood transfusion for gynaecologic surgery, other than radical hysterectomy, exenteration, or major vulval surgery</td>
</tr>
<tr>
<td>The Royal College of Pathologists of Australasia</td>
</tr>
<tr>
<td>Clinical chemistry</td>
</tr>
<tr>
<td>• Turnaround time for urgent serum/plasma potassium requests, from emergency departments and intensive care units</td>
</tr>
</tbody>
</table>

condition e.g., severe asthma). The indicators are intended to act as flags to possible problems in management allowing these to be addressed in a hospital's formal QA program. A most important consideration is the setting of a threshold. If a rate exceeds this threshold, it is a signal indicating that corrective action may be necessary. For those indicators which are rate-based, thresholds are being established, determined initially from field testing and subsequently from data obtained during hospital surveys. They, therefore, differ from benchmarks which would be set at the best practice end of the range, and to which hospitals should aspire.

Data obtained by the CEP contain no information with regard to the case mix and illness severity of the patient load for each health care facility. Attempts to obtain such information nationally would result in an enormous and complex data base, and still not ensure evaluation of the true quality of care [2]. This paper describes the establishment of thresholds determined by results obtained according to hospital size. This allows a hospital to compare itself with others which are likely to have similar patient populations with regard to case mix and illness severity.

METHODS

Acute general hospitals applying for voluntary accreditation during 1993 and 1994 were required to present clinical indicator data to a medical surveyor at the time of the accreditation survey as a component of their medical quality activities. Those data were then forwarded to the CEP. This included rate-based data related to post-operative pulmonary embolism, unplanned readmissions to hospital, unplanned return to the operating room, clean and contaminated wound infections and hospital acquired bacteremia. Indicator definitions and sources of data are described below [3,4].

Hospitals have been categorized according to size in terms of the number of beds since this has been shown to bear a relationship to case mix. Larger hospitals with more sophisticated technology, i.e. magnetic resonance imaging (MRI), and specialist units e.g., haematology, provide a tertiary referral function and, in general, treat more complex cases [5]. Thus bed-size was categorised as small (1-99), medium (100-199) or large (≥200). After pooling 1993 and 1994 data, the mean rate of occurrence of each indicator (X) was calculated for each category. Statistically unusual results were those which fell outside the thresholds which were designated as the Upper Control Limit (UCL), estimated as X plus two times the Standard Error (SE), and the Lower Control Limit (LCL), estimated as X minus two times the SE. Hence:

\[ \text{UCL}_X = X + 2 \left( \frac{SD}{\sqrt{n}} \right) \]

\[ \text{LCL}_X = X - 2 \left( \frac{SD}{\sqrt{n}} \right) \]

where SD = standard deviation and n = number of hospitals in each category. As is
conventional, the LCL was taken to be zero when the LCL calculation yielded a negative number.

The unit of analysis is the hospital as patient-level data are not available in the national aggregate database. All hospitals are given equal weight in the calculation of aggregate rates within a peer group. The thresholds are therefore based on the assumption that hospitals within a peer group are similar. The data were analysed using SYSTAT [6].

Definitions [3-4]

Pulmonary embolism. This term refers to those inpatients who have undergone surgery with a length of stay equal to or greater than seven days and who develop postoperative pulmonary embolism. Postoperative transfers from other health care facilities are not included and the day of surgery is considered equal to day zero.

Unplanned hospital readmissions. This refers to those admissions due to an unexpected requirement for:

(a) further treatment of the condition for which the patient was previously hospitalized;
(b) treatment of a condition related to the one for which the patient was previously hospitalized;
(c) a complication of the condition for which the patient was previously hospitalized.

Unplanned return to the operating room

(a) Unplanned refers to the necessity for a further operation for complication(s) related to a previous operation/procedure in the operating room.
(b) Return refers to a re-admission to the operating room for a further procedure.

Hospital-acquired infection

(a) Surgery is defined as including those therapeutic procedures for which there is a visible incision which can be assessed, without the need for special instrumentation, in the postoperative period. Thus all endoscopies are excluded, as are intra-cavity procedures, such as per oral, aural, nasal, urethral, vaginal, and anal operations.

(b) Clean operations are those performed in a sterile field i.e. uncontaminated by bacteria.

(c) Contaminated operations include: i) those which breach the gastrointestinal, respiratory and genito-urinary tracts; ii) those in which a break in aseptic technique occurs; iii) traumatic wounds.

(d) Dirty operations are those in which a perforated viscus or pus is found (this classification is provided only to distinguish between dirty and contaminated).

(e) Wound infection refers to any surgical wound from which purulent material drains or is obtained. Microbiological confirmation is not necessary. A reaction around suture material is excluded. Patients having two incisions in the same operation (e.g., chest and leg for coronary artery bypass graft surgery) are counted as one patient, while patients having a separate incision in separate/subsequent operations are counted as two patients.

Hospital-acquired bacteraemia. This is defined as a positive blood culture for an inpatient who was afebrile on admission, i.e. temperature less than 37.4°C, 48 hours after admission. In this definition of bacteraemia it is not necessary to specify the type of organism as even standard contaminants may sometimes be pathogenic.

Data format and sources

Pulmonary embolism (PE). Numerator: the number of inpatients undergoing surgery with a post-operative length of stay equal to or greater than 7 days who develop PE during the time period under study.

Denominator: the total number of inpatients who undergo surgery and have a length of stay equal to or greater than seven days during the time period under study.

Source: inpatient medical record, computerized/manual disease index, imaging department.

Unplanned hospital readmissions. The data format does not include day only patients or readmission for unrelated conditions.

Numerator: total number of unplanned readmissions within 28 days of discharge.

Denominator: total number of discharges during the period under study.

Source: inpatient medical record, notification in admission departments, admission list, accounting/disease index computer reports.
The period for readmission was taken as being within 28 days of discharge from the index event. The period has been previously used by other investigators with the intent of flagging potentially avoidable readmissions [7–9]. It allows for ease of identification of the event from hospital mainframe programs. Some under-reporting will result from omission of occasional later (than 28 days) readmissions, but the extent is most likely similar for peer hospitals.

**Unplanned return to the operating room.** The data excludes day surgery patients.

Numerator: the number of patients having unplanned returns to the operating room during the same admission during the time period under study.

Denominator: the number of patients having operations/procedures in the operating room during the time period under study.

Source: inpatient medical record, operating room register and booking system, computerized disease index.

**Clean wound infection.** Numerator: the number of inpatients having evidence of wound infection on or after the 5th post-operative day following clean surgery, during the time period under study.

Denominator: the total number of inpatients undergoing clean surgery within the time period under study.

Source: infection control reports, inpatient medical record, surgical audit data, microbiology results, wound survey sheets, disease index, operation sheet, and operation room register.

**Contaminated wound infection.** Numerator: the number of inpatients having evidence of wound infection on or after the 5th post-operative day following contaminated surgery, during the time period under study.

Denominator: the total number of inpatients undergoing contaminated surgery within the time period under study with a post-operative length of stay equal to or greater than 5 days.

Source: same as for clean wound infection.

**Hospital acquired bacteraemia.** The data format does not include day-stay patients.

Numerator: total number of inpatients who acquire bacteraemia (as in the definition of terms above) during the time period under study.

Denominator: total number of separations during the study period.

Source: blood culture log book, laboratory worksheets, infection control reports, inpatient medical records, computerized/manual disease index.

**RESULTS**

The mean rate of occurrence of incidents was higher for larger hospitals. Other factors being equal, the larger number of smaller hospitals would tend to generate a smaller estimate of standard error purely on statistical grounds (large n). This was observed (Tables 2 and 3). Thus thresholds were generally lower for smaller and higher for larger hospitals. A smaller estimate of standard error would therefore result in a narrow band between thresholds, hence easier detection of an incident, defined as an event which fell outside limits defined in terms of standard error.

(i) Pulmonary embolism: based on 1994 data, the threshold for large hospitals was 0.8. No thresholds have been set for small and medium hospitals because of previous recommendations by ACHS CEP [10].

(ii) Unplanned readmissions: 185 hospitals reported rates for this indicator, with 62% of unplanned readmissions occurring in large hospitals. The thresholds were 3.8, 4.2, and 4.8 for small, medium and large hospitals, respectively.

(iii) Unplanned return to operating room: more than 57% of these incidents occurred in large hospitals. The thresholds for small, medium and large hospitals were 0.4, 0.9, and 1.2, respectively.

(iv) Clean and contaminated wound infection: 107 hospitals reported rates of clean wound infection and 101 reported rates of contaminated wound infection. Only 16% were larger hospitals. The thresholds for small, medium, and large hospitals were 2.6, 3.2 and 4.1 for clean, and 3.8, 5.9, and 7.9 for contaminated wound infection, respectively.

(v) Hospital-acquired bacteraemia: 146 hospitals reported rates for this indicator, with 27% ≥200 beds. The thresholds were 0.3, 0.9, and 0.6 for small, medium, and large hospitals, respectively. A variation in rates up to 0.9% by large
TABLE 2. Distribution of beds for rate-based indicators

<table>
<thead>
<tr>
<th>MWM</th>
<th>No of cases</th>
<th>No of hospitals</th>
<th>Total beds</th>
<th>No of cases</th>
<th>No of hospitals</th>
<th>Total beds</th>
<th>No of cases</th>
<th>No of hospitals</th>
<th>Total beds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonary embolism</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>165</td>
<td>24</td>
<td>9089</td>
<td>2455</td>
<td>2</td>
<td>775</td>
</tr>
<tr>
<td>Unplanned readmission</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7024</td>
<td>34</td>
<td>12389</td>
<td>2455</td>
<td>11</td>
<td>5928</td>
</tr>
<tr>
<td>Unplanned return to operating room</td>
<td>385</td>
<td>92</td>
<td>5313</td>
<td>360</td>
<td>39</td>
<td>5157</td>
<td>1024</td>
<td>31</td>
<td>11033</td>
</tr>
<tr>
<td>Clean wound infection</td>
<td>107</td>
<td>66</td>
<td>3728</td>
<td>102</td>
<td>24</td>
<td>3202</td>
<td>257</td>
<td>17</td>
<td>5894</td>
</tr>
<tr>
<td>Contaminated wound infection</td>
<td>126</td>
<td>61</td>
<td>3513</td>
<td>93</td>
<td>24</td>
<td>3202</td>
<td>138</td>
<td>16</td>
<td>5477</td>
</tr>
<tr>
<td>Hospital acquired bacteraemia</td>
<td>60</td>
<td>75</td>
<td>4062</td>
<td>105</td>
<td>31</td>
<td>4156</td>
<td>1322</td>
<td>40</td>
<td>15271</td>
</tr>
</tbody>
</table>

TABLE 3. Thresholds for rate-based indicators based on hospital size

|HWMI | Hospital size
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-99 beds</td>
<td>100-199 beds</td>
<td>≥ 200 beds</td>
<td>1-99 beds</td>
<td>100-199 beds</td>
<td>≥ 200 beds</td>
<td>1-99 beds</td>
<td>100-199 beds</td>
<td>≥ 200 beds</td>
<td>1-99 beds</td>
<td>100-199 beds</td>
<td>≥ 200 beds</td>
<td>1-99 beds</td>
<td>100-199 beds</td>
<td>≥ 200 beds</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
<td>0.3</td>
<td>2.6-0.8</td>
<td>3.6</td>
<td>0.6</td>
<td>2.4-0.8</td>
<td>0.5</td>
<td>0.3</td>
<td>2.6-0.8</td>
</tr>
<tr>
<td>Unplanned readmissions</td>
<td>3.2</td>
<td>0.3</td>
<td>2.6-3.8</td>
<td>3.0</td>
<td>0.6</td>
<td>1.8-4.2</td>
<td>0.5</td>
<td>0.3</td>
<td>2.6-0.8</td>
<td>3.6</td>
<td>0.6</td>
<td>2.4-0.8</td>
<td>0.5</td>
<td>0.3</td>
<td>2.6-0.8</td>
</tr>
<tr>
<td>Unplanned return to operating room</td>
<td>0.3</td>
<td>0.5</td>
<td>0.2-0.4</td>
<td>0.7</td>
<td>0.1</td>
<td>0.5-0.9</td>
<td>1.0</td>
<td>0.1</td>
<td>0.8-1.2</td>
<td>0.5</td>
<td>0.3</td>
<td>1.4-2.6</td>
<td>0.5</td>
<td>0.3</td>
<td>1.4-2.6</td>
</tr>
<tr>
<td>Clean wound infection</td>
<td>2.0</td>
<td>0.3</td>
<td>1.4-2.6</td>
<td>2.2</td>
<td>0.5</td>
<td>1.2-3.2</td>
<td>2.9</td>
<td>0.6</td>
<td>1.7-4.1</td>
<td>0.5</td>
<td>0.3</td>
<td>1.4-2.6</td>
<td>0.5</td>
<td>0.3</td>
<td>1.4-2.6</td>
</tr>
<tr>
<td>Contaminated wound infection</td>
<td>2.6</td>
<td>0.6</td>
<td>1.4-3.8</td>
<td>4.1</td>
<td>0.9</td>
<td>2.3-5.9</td>
<td>5.7</td>
<td>1.1</td>
<td>3.5-7.9</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1-0.9</td>
<td>0.2</td>
<td>0.2</td>
<td>0-0.6</td>
</tr>
<tr>
<td>Hospital acquired bacteraemia</td>
<td>0.1</td>
<td>0.1</td>
<td>0-0.3</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1-0.9</td>
<td>0.2</td>
<td>0.2</td>
<td>0-0.6</td>
<td>0.1</td>
<td>0.1</td>
<td>0-0.3</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1-0.9</td>
</tr>
</tbody>
</table>

*Standard error.

Reliability and validity of indicators

As Jewel has rightly commented, setting standards is only the first step towards analysing and changing clinician behaviour [11]. The ACHS CEP recognizes that continued interest and monitoring of indicators by clinicians depend on the content validity of the quantitative information, its reproducibility and reliability, and its capacity to induce a change in clinical practice.

DISCUSSION

Content validity of the indicator was determined by establishing clear definitions for performance measures. Brown et al. have shown that different definitions of, for example, surgical mortality may produce widely differing results [12]. The CEP definitions are published in clinical indicators users' manuals (released by the ACHS for each set of indicators) and reinforced through educational programs for data collection [3,4]. Only data collected according to the CEP criteria and definitions for indicators are included in the aggregate database. Despite these efforts, some subjective variation in reporting is expected as more than 20% of Australia's acute hospitals were involved in the reporting of results.
Function of a threshold

A clinical indicator is a tool for warning of a likely adverse influence intruding on a system of care. Once the statistical threshold is approached or crossed, it is expected to act as a stimulus for hospitals to respond to the indicator data and initiate quality activities for identifying and rectifying special cause variation. Use of thresholds should therefore help hospitals to improve their quality of care, and help in better allocation of resources for quality improvement. Hospitals receive feedback on where their results stand in relation to the thresholds and their peer group. The qualitative information received by the CEP shows that monitoring of indicators has stimulated a variety of quality activities within hospitals, and there has been a greater involvement of doctors [13]. Alterations in practice are also being increasingly reported, e.g. new or revised protocols for intravenous cannula insertions, heparin and antibiotic prophylaxis, reporting of adverse drug reactions, and modifications in admissions and discharge policies [14,15].

The threshold for a clinical indicator is selected for the purpose of statistical monitoring. In a stable system, in the absence of any external influence, the indicator values are likely to show minor variations which do not transgress upper or lower range thresholds. They usually represent random variations caused by interaction of multiple variables within the system, hence do not cause concern with regard to the quality of system operation. Should the indicator measurement stray outside the band between the thresholds, it is correspondingly likely that there has been a deviation from stable system function, most likely through an external influence [16]. While a lower than expected indicator value could represent some system improvement leading to fewer adverse events, more common is an above threshold outcome which means more such events, hence an untoward intrusion requiring investigation and correction. More consistent performance would, other factors being equal, reduce variation and lower the threshold value, making a deviation due to an adverse extrasytemic effect easier to detect. Hence clinical indicator measurement can be used to monitor unusually poor, that is adverse, system effects, or unusually good performance and improvement or deterioration in the overall stable function of the system.

Statistical and clinical issues

When setting thresholds and interpreting indicator values, there are both statistical and clinical factors to consider. In industry, three standard errors above the mean is a common threshold for an indicator which increases with deterioration of performance [17]. In our clinical database, thresholds have been set at two standard errors from the mean value of the indicator. The precise value set is somewhat arbitrary but does determine the ratio of true and false positive results. A higher threshold, based on three times the standard error, for example, will generate fewer false positive signals (type I errors), but the price will be more false negative signals (type II errors). The adverse clinical consequences of the indicators being addressed are often serious and may be fatal. For example, pulmonary embolism may be massive and fatal, or recurrent leading to heart failure. Nosocomial bacteraemia is a serious illness and sometimes fatal in a patient already compromised. A staphylococcal infection complicating a heart valve replacement carries a high morbidity and mortality risk. So too does return to the operating room for a patient, especially if operated on before recovery from the first procedure or in an emergency. In these medical data, because the stakes are high, the inevitable trade-off between false alarm with unnecessary investigation and missing an important deterioration in system function has been tilted in the direction of the former by choosing a less stringent threshold. If the data are normally distributed, 2.5% of cases which cross the upper threshold will represent a false positive signal, an uncommon random event. Brewer and Grasser (1993) observed that false positive signals are rare. They monitored nosocomial infections for a period of three years and found only one false-positive signal based on a threshold of two standard errors from the mean [18].

It is important to note that the threshold values, since they are calculated from the standard error, depend on the sample size. Hence, in a database such as the CEP's, other things being equal, a larger group (large n) of hospitals will have a smaller standard error, and
hence a narrower band between thresholds. A small change in an indicator will then be detected as statistically significant and will signal a need to consider corrective action. In general, therefore, the upper thresholds are higher for large hospitals compared to medium or small hospitals; a smaller sample size (n) could explain this greater variation, or at least contribute to it. However, an indicator in a large hospital would be more likely to cross the threshold if the institution treated higher risk patients, as is likely to be the case. Hence, because the sample size is small, and perhaps because of reduced illness severity, the CEP data indicate that monitoring the indicator for pulmonary embolism for hospitals with bed-size less than 200 is unlikely to be useful as a measure of quality of care [10].

Initially the provisional thresholds set by the CEP were based on hospital type (private or public) rather than on hospital bed-size [3,4]. Smaller hospitals with fewer patients crossed these thresholds more often because of random variation. Large hospitals crossed these thresholds presumably because they treated high risk patients. These thresholds, therefore, biased the results in favour of medium-sized hospitals. Current thresholds, based on hospital size, should be less affected by this potential bias.

The purpose of the thresholds reported in this paper is to allow hospitals to compare rates of occurrence of incidents between themselves as a contribution to continuous quality improvement. We have shown that an unavoidable limitation of setting thresholds in this setting is that a smaller group of hospitals will display more variation for statistical reasons alone (larger standard error), resulting in a higher threshold for action. In this sense, an indicator would be less sensitive, more conservative. However, if individual hospitals were monitoring trends for their own indicators on-line, a steadily increasing sample size would result in a statistically narrower, or tighter acceptable range of function with a lower threshold for action, so that the impact of an extrasystemic influence requiring corrective action could be more confidently detected. In fact, a trend of rising indicator values could be statistically significant well before exceeding the upper threshold. If the problem was potentially serious, clinical corrective action might be warranted in a situation of lower statistical risk of untoward external influences. Hence, indicators used for comparison between hospitals stratified for size would be complemented by those used in individual hospitals to monitor local indicator trends. This is what is likely to happen as hospitals move towards continuous monitoring of clinical indicators based on the recommendation of ACHS CEP. As the goal of quality assurance is one of constant improvement, these hospitals will need to recalculate their baseline rates from time to time, and develop their own thresholds. This will improve detection of special cause variation that may be missed against the background of a previously high endemic rate. If the baseline rate is not changed, the extrasystemic influence might not be detected.

Conclusion

Some investigators use the case mix of presenting patients to allow for inter-hospital differences. Adjustment according to the types of cases treated in differing hospitals is used to allow for comparison of outcome and/or costs according to DRG classifications [2]. However, as case mix is directed at resource utilization and is not a measure of illness severity, it is still questionable whether comparisons between case mix determined groups of hospitals are a valid step in quality assessment [2]. The usefulness of other illness severity indices such as Patient Management Categories (PMC), Coded Disease Staging (CDC), and Medical Illness Severity Grouping System (MEDISGRPS) in measuring the quality of care has also not been established [2,19,20]. Establishment of thresholds stratified by bed-size is a simpler alternative, and a useful index for flagging peer group variation and monitoring the quality of care in Australian hospitals.

REFERENCES


