Elusive Artifact and Cost Issues with Computerized Patient Records for Anesthesia (CPRA)

To the Editor — We read with great interest and applaud the work by Sanborn et al.1 and the accompanying editorial by Cooper2 discussing the value of computer based records for anesthesia (CPRA, AAR, AARK, etc.). It would be good to settle on a standard nomenclature. We suggest the Computer-based Patient Record Institute's suggestion of CPR(type) for Computer-based Patient Record for (Anesthesia, Obstetrics etc). Sanborn's article was very thorough and accurate, however, in such a complex subject there were a few issues that require comment.

Although Sanborn states that the computer record is devoid of the smoothing issue. Data gathered at 15-s intervals and then represented in time columns of various lengths on the record, means that the data is compressed by various statistical methods depending on the computer system being used. Sanborn did not state the compression method used but all of the methods result in smoothing and detail is lost. This loss of detail makes it harder for the reviewer to assess whether a data item is or is not an artifact. Therefore the review is best done on a printed interval of no longer than one min in duration. Even then, there seems to be many items where the data cannot be positively identified as an artifact.

Next is the issue of artifact detection. One can not determine with assurance whether a digital trend was an artifact or not from the digital temporal pattern alone. (This is especially true if the printed record being reviewed is printed on a compressed scale as stated above.) Sanborn states, ‘Our study shows that, through visual inspection, some of these events (artifacts) can be identified.’ Actually the study shows that some (how many?) of the events can be judged to have likely been due to artifacts, but it does not in any way show that they were artifacts. Although manually entered notes by the clinician help in that determination, what methods were used to assure that true values were not tagged as artifacts or that artifacts were not left untagged? Also, artifact frequency varies based on the parameter and the model of monitor being assessed. These are very difficult issues to study and are almost nonexistent in the CPR(s) literature. One cannot be sure if the digital trend is artifactual in nature unless one can see the waveform that generated the value. Only with this ‘full disclosure’ can we be sure in retrospect that a given value is an artifact.

Another way to study the true incidence of artifact might be to have two or more sources of the parameter being questioned with the true value being determined by multiple data verification. Without one or both of these methods being employed, the assessment of the presence of an artifact is only speculation.

The next point to raise is also one of database accuracy, specifically, the presence of false positive and false negative manual entries by the anesthetist as to the presence of an indicator occurring. The frequency of artifacts in the record is far more likely with a manual entry than an automatic entry. We have found two features of manual entry to be critical in improving accuracy of the data. The first is real time entry. The longer the interval from the event to the entry of that event into the record by the anesthetist, the more likely the event will be recorded incorrectly. This is true of notes, drugs, QA events, and airway data. We studied over 4000 records and found that if the manual entry into the record was within 2 min of the actual occurrence of the event then <1% of anesthesia records contained an obvious error, i.e., pentothal induction dose was stated as having been given after the intubation. If the delay interval was >10 min, then more than 8% of the records contained at least one error. In Sanborn’s case, the entry onto the electronic QA event sheet was done in PACU probably long after the actual event. If the event was not stressful for the anesthetist, then it is natural for the event to be forgotten. One recalls items based on the emotionality or the frequency of their occurrence Sanborn may have found better accuracy in self-reporting if real-time entry had been used.

The second important item that leads to errors in manual entries is the issue of defaults. Easy data entry is still a driving force in market acceptance instead of accurate database development. Many vendors present the concept of ‘Macros’ as a method of data entry for intense data entry periods such as intubation. A macro is the linking of a series of defaults that allows the anesthetist to enter all of those items into the record with one or more keystrokes. For example, a macro may contain defaults of “one attempt MAC 3 blade, easy atraumatic intubation, cords seen, oral 7.0 intubation with 7 cc placed in the cuff and tube secure at 21 cm.” This makes data entry very easy. However, what if, in fact, the event was “one attempt failed with a MAC 3, second attempt successful with a Miller 3, resulting in a small laceration to the lip, cords not seen, artryenoids seen while placing a 6.5 RAE tube at 19 cm with 4cc in the cuff.” The anesthetist enters the original macro real time with the intention of returning later in the case to make the corrections. But, once again, with retrospective entry he/she forgets to correct the error. I would suggest that Sanborn’s results from manual entry would have been improved if the answer to the questions had not been defaulted to “no”. Instead, a specific action should be required on ‘yes’ or ‘no’ with a separate keystroke action for moving to the next question. The use of a default “yes” would have given interesting results and the incidence of false positive entries by the anesthetist would have certainly risen above the one false-positive case that was found. Macros and defaults should be banned. The companies must find a way to allow real-time entry of every discrete data field into the record in a manner that is friendly for the anesthesiologist and does not distract him/her from the primary task of delivering anesthesia.

In reference to the editorial, Cooper addresses the issue of cost and correctly calculates a reasonably accurate cost per case of $6. The justification is easy when the system can be used to reduce the hospital anesthetic pharmacy acquisition costs as has been done at Leominster Hospital from $42/case in 1994 to $17/case in 1996. At the same time the post operative emesis rate decreased from >20% to <5%. Carroll has stated, that the cost per case of emesis is $400. Either of these cost reductions pays for the system.
CORRESPONDENCE

In Reply—Dr. Edsall's concern regarding the "smoothing issue" does not apply to our study. The computer scanning process, which identified records with defined intraoperative incidents, scanned the originally recorded data strings at 15-s intervals, not averaged data. In addition, our procedure for screening each record for artifacts included visual inspection of both the printed record (which does represent averaged data) and the originally recorded data strings at 15-s intervals. The CompuRecord® system used in the study included a software module which facilitated rapid access to the originally recorded data.

Nevertheless, Dr. Edsall is correct to remind readers that retrospective review of any form of anesthesia record is unlikely to identify all artifacts with 100% certainty. We were very concerned about this problem and did our best to correctly identify artifacts when we visually examined each record selected by the computer system. But we agree with Dr. Edsall that identification of artifact remains a major challenge for anesthesia information management systems (AIMS). Concerning nomenclature, it seems that CPR (computer-based patient record) would be an unfortunate choice as an abbreviation for anything in the medical field other than cardiopulmonary resuscitation. Isn't that asking too much of context?

Among the anesthesiologists we studied, there was a very low compliance with voluntary reporting of intraoperative incidents identified by the computer. Dr. Edsall provides two more interesting and credible explanations for this low compliance. First, there is a delay of minutes or hours between the occurrence of the incident in the operating room and the opportunity to report the incident on the quality assurance computer in the PACU. Second, as we stated in our methods, the default answer to all quality assurance questions on the computer screen was 'no.' Dr. Edsall makes a convincing argument that these two conditions may have led to an unknown number of false negative entries.

Finally, we would echo Dr. Edsall's statement that Dr. Cooper's calculated cost of $6 per case for AIMS will easily be recovered by the savings which information management is likely to affect. Savings could be expected in expenditures for several categories, including pharmacy, billing, operating room efficiency, and medical record retrieval.

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Self-reporting Can Be a Reliable Means of Tracking Adverse Perioperative Events

To the Editor—Sanborn et al. suggest that automated anesthesia records can identify, track, and report deviations from specific limits for physiologic variables, and that this might be preferable to self-reporting of adverse events. Cooper concluded in his accompanying editorial that "anesthesiologists ... do not report most events meeting criteria that they themselves had defined as relevant to QA." We strongly disagree and published evidence to the contrary (Lagasse et al.). In fact, we demonstrated that with a non-threatening QA system with 100% concurrent medical record review, anesthesiologists reported approximately 90% of adverse clinical outcomes. Our present QA system relies on self-reporting of adverse outcomes associated with 35,000 anesthetics performed annually. The resultant database

References
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