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# Pediatric Anesthesia

## Lessons for pediatric anesthesia from audit and incident reporting

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## Lessons for pediatric anesthesia from audit and incident reporting

This review will attempt to put the various systems that allow clinicians to assess errors, omissions or avoidable incidents into context and where possible, look for areas that deserve more or less attention and resource specifically for those of us who practice paediatric anaesthesia. Different approaches will be contrasted with respect to their outputs in terms of positive impact on the practice of anaesthesia. These approaches include audits by governmental organisations, national representative bodies, specialist societies, commissioned boards of inquiry, medico legal sources and police force investigations. Implementation strategies are considered alongside the reports as the reports cannot be considered end points themselves. Specific areas where paediatric anaesthetics has failed to address recurring risk through any currently available tools will be highlighted.

### National large scale audit

It has been 10 years since the National Confidential Enquiry into Perioperative Death (NCEPOD) report 'Then and Now'[1] itself a 10 year retrospective which concluded that shortcomings in the provision of high dependency care persisted and the local systems for reviewing perioperative deaths were not fully effective, this was particularly the case for anaesthesia where the majority (72%) of deaths were not discussed formally within the department. If we are to learn the lessons from our most challenging cases there must be suitable platform to analyze the cases. The NCEPOD reporters took care to distinguish between multidisciplinary review and

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2  
3 departmental morbidity/mortality review, re-stating the importance of both. The  
4  
5 benefits of multidisciplinary audit are echoed throughout almost all the NCEPOD  
6  
7 reports, and this seems to be backed up by other recommendations which have  
8  
9 driven changes in our practice: For example the reduction in occasional practice in  
10  
11 paediatric surgery and anaesthesia that has occurred within the lifetime of the  
12  
13 NCEPOD reports, has been driven by departmental review against accepted  
14  
15 standards of care as laid down by NCEPOD. Such reviews are required by the  
16  
17 department of health and the General Medical Council in the UK [2]. *Adequately*  
18  
19 *funded national large scale audit recommendations will be implemented to a*  
20  
21 *reasonable extent if departments continue to function with their existing levels of*  
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23 *resource.*  
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33 Police/criminal investigations regarding pediatric anesthesia

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36 So should all large reports have their implementation policed? Paediatric  
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38 anaesthesia has experience of the legal systems involvement in the management of  
39  
40 specific incidents: Operation Orcadian involved several police forces in England  
41  
42 mounting an extremely thorough investigation on the suspicion that patients were  
43  
44 being deliberately harmed by the insertion of pieces of plastic into the anaesthetic  
45  
46 breathing system. The operation was highlighted and gained national prominence  
47  
48 after the death of a 9 year old boy. The police operation was relatively long, and  
49  
50 expensive, it concluded that there was no evidence of criminal offence in the 13  
51  
52 cases it considered. It gave rise to the Expert Group on Blocked Anaesthetic Tubing  
53  
54 (EGBAT) [3] under the guidance of the chief medical officer along with the National  
55  
56 Patient Safety Agency (NPSA) who took a broader view of patient breathing tube  
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3 blockage concluding that most were not due to foreign bodies. EGBAT also issued  
4  
5 guidance for some sensible, minor changes in equipment manufacture.  
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9 Police involvement lead to a specific report on 13 cases, it definitely highlighted a  
10  
11 specific problem, but was expensive and required the convening of a medical group  
12  
13 to carry the principle through to practice. The police force is of course just one part of  
14  
15 the legal infrastructure; the legal system has many expert analysts in the field of  
16  
17 medical error:  
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#### 20 21 22 23 24 25 Closed claims projects 26 27

28 The closed claims project [4] has, as its raw data, summaries of closed medico legal  
29  
30 insurance claims. These are interpreted by a group of experienced clinicians who  
31  
32 have produced an impressive array of reports for the profession. One of the project's  
33  
34 inescapable findings is that even when an anaesthesiologist provides appropriate  
35  
36 care (as judged by his/her peers), there is a 40% chance that a malpractice payment  
37  
38 will be made [5]. The closed claims study includes over 60% of settled claims,  
39  
40 presumably a representative sample, but cannot estimate the incidence of the  
41  
42 complications as the denominator is unknown. Although this study is laboured with a  
43  
44 protracted legal timeframe and as a consequence reflects practice about 5 years  
45  
46 previous to it own reporting, it has been instrumental in influencing practice such as  
47  
48 difficult airway management and improved monitoring guidelines.  
49  
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53  
54 Both police investigations and the closed claims study have a legal starting point,  
55  
56 this usually means that the analysis will focus on individuals' actions. These are  
57  
58 important, however much of what we now understand about the genesis of common  
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3 errors or failures in practice is that there are deficiencies in the system. This may  
4 simply constitute awkwardness in achieving best practice: Adequate hand hygiene  
5 requires time, availability of appropriate cleaning materials, well stocked at the point  
6 of patient care. An education and monitoring system is also necessary and finally an  
7 enforcement policy. If any of these is missing an imperfect system exists and this  
8 may explain the continued poor compliance and prevalence of MRSA [6]. More  
9 complex processes are even more vulnerable to system errors, but remain amenable  
10 to change once best practice has been defined. Better methods of prescribing  
11 opiates to children by well motivated, well lead and adequately resourced groups of  
12 clinicians were able to reduce opiate related adverse drug events by 67% [7].  
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### 31 Subspecialty registry of adverse events

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34 The closed claims study pointed to differences in the aetiology of adult and  
35 paediatric cardiac arrest, there was a recognition that this was an important area for  
36 further study, and also that the closed claim methodology alone would be insufficient  
37 for such a detailed purpose. The Pediatric Perioperative Cardiac Arrest (POCA)  
38 Registry [8] was formed as a result; it used a system of voluntary participation,  
39 specific institutional reporting officers and anonymisation. Somewhat surprisingly, the  
40 POCA registry findings of predominantly cardiac aetiology of cardiac arrest under  
41 anaesthesia did not mirror the closed claims study findings of predominantly  
42 respiratory aetiology. The causes of these differences were perhaps under-reporting  
43 of respiratory events, under-reporting of very sensitive cases (this may also be  
44 rephrased as extreme caution in spite of the anonymisation), different time frames of  
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3 study and participation bias – larger institutions were more likely to subscribe to the  
4 registry however prosecutors of malpractice claims show no institutional favouritism.  
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8 Reports from the POCA registry continue to provide valuable data and practical  
9 advice for clinicians concerning the highest risk groups, associated procedures and  
10 optimum management strategies for management [9]. It is the largest study of its  
11 kind and certainly one of the most valuable. Even the best designed self report  
12 audits are likely to suffer from bias and under-reporting but do have the potential to  
13 collect specific and clinically relevant information which would be difficult to obtain  
14 otherwise. As the Pediatric Sedation Research Consortium reported, the participants  
15 in such audits tend to be organised, well motivated departments and thus the  
16 findings may reflect best practice [10]. This group found that only 2 patients out of  
17 50000 required CPR during propofol sedation.  
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37 Quantification of risk is important in allowing us to allocate resources and in  
38 communicating with patients and their parents. Putting a figure onto the frequency of  
39 a particular adverse event elevates the information from soft to hard evidence, thus  
40 strengthening the information and allowing strategies for the avoidance of the event  
41 to be measured.  
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49 The Australian Incident Monitoring System (AIMS) [11] is perhaps the best  
50 established structured incident review process. Now running for over 20 years it has  
51 evolved, expanded and informed. Has this process ensured that the health service  
52 learns lessons and alter practice? Staff impressions are that patient outcomes have  
53 improved on account of the AIMS process, however many of these are difficult to  
54 quantify. Some improvements have been measured and once more, the more  
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3 specific the information is, the more appropriate clinical data can be produced. The  
4  
5 specialty AIMS found that in the lifetime of the project there were very encouraging  
6  
7 improvements in problem areas that AIMS had specifically highlighted; breathing  
8  
9 system disconnection associated with hypoxic brain injury, recognition of  
10  
11 endobronchial intubation and improved monitoring of anaesthetic agents. Although  
12  
13 AIMS cannot claim absolute responsibility for these quality improvements it would be  
14  
15 churlish not to admit that the introduction of the AIMS system was a hugely  
16  
17 significant factor in the safety culture that engendered these changes. *Well*  
18  
19 *administered national reporting systems can play a major role in enhancing a safety*  
20  
21 *culture and establishing best practice. Evidence supports the leadership of such*  
22  
23 *projects being translated into clinical actions [12].*  
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30 In contrast to the British and the North American system that have generally  
31  
32 focussed on projects of limited lifetimes, or changed focus to specific areas as  
33  
34 specific concerns arise, the AIMS has remained more consistent in its methodology.  
35  
36 This raises the possibility of using the data collected to monitor effectiveness over  
37  
38 time. The administrators of the AIMS system realise that this may introduce a dis-  
39  
40 incentive to reporting, which would be unwelcome in the context of low reporting  
41  
42 rates by medical staff [12]. The lesson for implementation here is not that medical  
43  
44 staff does not wish to have their case reviewed but that they may wish only to use  
45  
46 one system and national systems with a strictly formatted data entry system may  
47  
48 generate less appropriate analysis than local review? This view would seem to be  
49  
50 supported by the infrequency with which units attempted to benchmark their data to  
51  
52 the national dataset. *Longer term audits must address concerns about ease of*  
53  
54 *entering an appropriate dataset and work to ensure those contributing feel a degree*  
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3 of 'ownership' of the system [12]. This includes maintaining a focus on safety  
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6 improvements, not monitoring directives [13].  
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9 The Australian patient safety foundation has upgraded their data input, now called  
10  
11 the Advanced Incident Monitoring Study. They have also produced an evidence  
12  
13 based crisis management manual for acute healthcare workers which sets  
14  
15 emergency algorithms in context.  
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#### 18 19 20 21 22 Specialty society audits

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25 The Royal College of Anaesthetists in the UK has led a series of large audits, the  
26  
27 two most recent having been very successful in engaging the profession. National  
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29 Audit Project 3 (NAP3) concerning complications of neuraxial block [14], obtained  
30  
31 an impressive 100% return from anaesthetic departments in the UK for its census  
32  
33 phase, thus enabling the authors to publish data with denominators and estimate  
34  
35 risks with accuracy and confidence intervals. No self report audit could ever claim a  
36  
37 100% numerator but the methodology allowed for easy reporting before a review  
38  
39 stage at which an expert panel adjudicated on the causation of the adverse affect  
40  
41 reported. Despite having 21 500 children in the denominator the confidence  
42  
43 intervals for risks of complications were very wide and paediatric anaesthetists are  
44  
45 left to extrapolate from the findings based on adult patients. NAP4 concerning  
46  
47 complications of airway management will report in the first half of 2011. The college  
48  
49 has followed up their audits with widespread dissemination of the findings in multiple  
50  
51 formats, and is studying how these have been presented and discussed at the  
52  
53 departmental level; initial analysis shows 98% of anaesthetists were aware of the  
54  
55 results and 2/3 had changed their practice as a result [15]. When published in full  
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3 this should give all auditors valuable information as to the most efficacious methods  
4 of result feedback. *It is possible to obtain risk estimation data for serious*  
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8 *complications through large scale audits.*  
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11 The process of obtaining information from private institutions was more difficult than  
12 from the NHS and this conclusion potentially applies to systems where the major  
13 health provider is the government.  
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### 21 22 Multicentred audits

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25 An interesting comparison is possible between NAP3 and the national paediatric  
26 epidural audit [16] as these two projects concern a similar subject matter with the  
27 same population over a comparable period in time. They did not set out to achieve  
28 the same end points as a consequence of their design with NAP3 looking for major  
29 complications only whereas the paediatric audit through a network of voluntary  
30 reporting centres was able to capture minor complications as well. Caution must be  
31 exercised when interpreting reported minor complication rates from multicentre  
32 audits: The national paediatric opiate audit in the UK [17] studied major and minor  
33 incidents with opiate infusions, one of the subsidiary findings was that a high  
34 percentage of pump programming errors were reported from one centre. This seems  
35 to be a reporting difference rather than an actual complication rate difference. The  
36 moral is that whilst we can easily agree on whether a patient has nerve damage  
37 present 6 months after an intervention, we find it harder to consistently agree what  
38 pump programming errors present a real risk to the patient. *The easier an event is to*  
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*define for an audit reporter, the more reliably it will be recorded and thus the strength*  
*of conclusion will be greatest for unmistakable events.*

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3 The recently formed Wake up Safe group [18], a body of the Society for Pediatric  
4 Anesthesia in the USA aims to provide a high level peer review for serious incidents  
5 and use this information as the building blocks for quality improvement programmes,  
6 their initial findings regarding wrong sided procedures and drug errors will be familiar  
7 to most experienced practitioners. Whether the multicentre peer review they use can  
8 effect greater changes in practice than departmental critical incident analysis or  
9 national programmes remains to be seen.  
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#### 20 21 22 23 24 Implementation of findings

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27 Implementation of the findings of national audit is often a more difficult task than the  
28 completion of the audit itself. There is no specific funding for implementation. Most  
29 units will have clinical governance frameworks and many will have senior clinicians  
30 responsible for leading audit processes within the department. An ideal  
31 implementation strategy will begin with presentation of the audit findings and  
32 provision of supporting educational material – for instance local service audit and  
33 local case numbers appropriate to the national audit findings presented. Strategies  
34 for improved diagnosis of problems will help to raise awareness at all levels, for  
35 acute pain service problems this may take the form of clearer pain monitoring charts,  
36 or prompts on the charts regarding when ward staff should seek advice from pain  
37 team specialists. These changes will have to be underpinned by education of all staff  
38 groups involved with the patients care. Lessons for the individual are less important  
39 than those for the team or the organisation [19]. Industry has learned how to bridge  
40 the gap between ideal systems and normal day to day practice, this transition needs  
41 to happen in medical care as well. Doctors are good at accumulating knowledge and  
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3 much less accomplished at translating this knowledge into practice, behavioural  
4 change is the key and by that we must understand behaviour of the whole medical  
5 team, once again the actions of the individual are less important [20]. Do all our  
6 hospitals have incident meetings engaging all staff groups – or do they tend to  
7 revolve around groups of senior clinicians with little other input? Some of the issues  
8 with implementation of quality improvement (QI) are historical – it is a new science  
9 but one which anaesthetists should be keen to adopt as targeted QI packages seem  
10 to have more effect in acute than chronic care settings [21]. A collaboration of NICUs  
11 using structured QI methodology [22] was able to greatly improve their ‘on-time’  
12 administration of surfactant compared to units using traditional feedback through  
13 audit programmes [21].  
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30 Institution of practice guidelines sometimes seems like a blunt instrument and  
31 guidelines need to be locally appropriate, but sometimes being pedantic and stating  
32 the obvious is all that is required; a good example would be the NPSA guidance to  
33 prevent the retention of throat packs following surgery [23]; use at least one visual  
34 and one written procedure to indicate a throat pack is in place, know who the  
35 responsible person is and educate all staff about standard operating procedures  
36 (SOPs). This raises the question, why does it help us to re-state something we  
37 already know? The reason is that knowledge failure is less common than  
38 implementation failure [24]. Evaluation systems for the kind of non-technical skills  
39 that lead to these implementation failures exist but even with expert leadership it  
40 can be difficult to implement their use in the clinical environment [25]. Some notable  
41 progress has been made in guideline implementation recently; the programme of  
42 care ‘bundles’ by the Institute for Healthcare Improvement has very practical advice  
43 and up to date audit data which provides clear information exchange on proven  
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3 effective interventions for those wishing to reduce the incidence of ventilator–  
4 associated pneumonia in PICU for example [26].  
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## 10 11 Audits and guidelines

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15 Audits are one of the principal tools for learning about resuscitation. Resuscitation is  
16 perhaps the most obvious of protocol directed management in anaesthesia.  
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20 Conventional study design presents practical difficulties that are extremely difficult to  
21 overcome and large retrospective cohort studies yield valuable information  
22 concerning cardiopulmonary resuscitation. What does analysis of this area tell us  
23 about implementation of findings of audit? Little in isolation is the first point to make,  
24 there have been changes in practice such as more widespread teaching of advanced  
25 life support courses and simplification / convergence of resuscitation algorithms that  
26 have served well to improve outcome [27, 28]. But these changes would not have  
27 occurred without the audits that raised concerns and pointed towards the best route  
28 forwards. SOPs are the way in which the military ensure that predictable tasks are  
29 completed efficiently and thoroughly. SOPs fit hand in hand with military culture.  
30  
31 SOPs are readily established by pre-deployment training for military clinicians and  
32 this approach has measured positive outputs [29]. Healthcare providers are not as  
33 easily able to send teams of clinicians on intensive training courses but the principle  
34 of focussing on reliable stepwise completion of important procedures remains sound,  
35 even if the implementation is by coercion not compulsion. The WHO surgical safety  
36 checklist is an example of team behaviour change driven by repeated serious  
37 incidents, an immense amount of effort was necessary for this to be established but  
38 the demonstrated improvements should enshrine this process into routine medical  
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3 care [30]. Individual behavioural change in healthcare workers is possible by  
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5 identifying and removing the many barriers that may make adherence to good  
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7 practice difficult - hand hygiene is an obvious example again [22]. Continually  
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9 audited small incremental change may engender better behavioural change than one  
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11 fell swoop, according to the Breakthrough Series curricula [31].  
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### 19 Departmental audits

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22 Local audits generally do not reach the pages of widely read medical journals,  
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24 Editors must be increasingly cogent of their impact factor in an age where medical  
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26 publishing competes with internet based sources of information and only the highest  
27  
28 quality paper publications will survive. The benchmark for publication of audits  
29  
30 seems to be very high indeed, departments who keep internal databases including  
31  
32 morbidity can produce important findings that would be extremely difficult to obtain  
33  
34 using other audit methodologies. The Boston children's hospital was able to  
35  
36 determine that although the incidence of cardiac arrest was higher in children  
37  
38 undergoing cardiac procedures, the mortality was not [32]. The Neurosurgical centre  
39  
40 in Belgrade were able to highlight the sitting position and operative time >2hours –  
41  
42 but not age - were associated complications [33]. If as a profession we believe in the  
43  
44 dissemination of findings and good practice could the bulletins and supplements that  
45  
46 accompany our scientific journals carry an audit of the month page? Local audits  
47  
48 have the benefits of specific design for the area being studied and consistency of  
49  
50 data collection. Perhaps most importantly, the findings will be relevant to the working  
51  
52 environment. This is why local audits can be a powerful force for change. All readers  
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54 will be aware that this change does not always follow well intentioned  
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3 recommendations. Lack of implementation is often a resource issue, the other main  
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5 barrier is one professional group recommending changes that affect the work of  
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7 another group. A well designed project will form a team at the start that can  
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9 represent all parties to whom recommendations may apply. Whilst we require a large  
10  
11 denominator when studying complications, consistency of recording is the most  
12  
13 important factor in audit design when examining efficacy; only local audits have been  
14  
15 able to detailed efficacy e.g. pain scores. No large scale audit has been able to  
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17 achieve this which serves to emphasize the requirement of local *and* national audits  
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19 to guide the provision of appropriate services.  
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29 The future of audit self educating and steering the profession can in no way be taken  
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31 for granted. The president of the Royal College of anaesthetists in the UK has  
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33 recently appealed for greater participation in the ongoing NCEPOD study examining  
34  
35 perioperative death in children [34]. Under-reporting appears to be common in local  
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37 audits as well as national projects, simple apathy that reporting will do no good is  
38  
39 one reason, concerns regarding the confidentiality centrally held databases reduce  
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41 reporting rates in addition to possible disciplinary consequences must also be  
42  
43 considered. In the UK the privileged status of anonymised audit records from legal  
44  
45 scrutiny has yet to be tested in the courts[35] The Australian legal system has taken  
46  
47 a pragmatic approach and protected the anonymity of databases held for quality  
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49 improvement  
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56 Challenges for audit in paediatric anaesthesia  
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59 When audit goes wrong; the ramifications of the Kennedy report into cardiac surgical  
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services from children at Bristol [36] continue to affect the way that medical care is

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3 delivered. Problems came to light after an audit by an anaesthetist found a high  
4 mortality, the data was inadequately scrutinised prior to wide reporting and created  
5 huge amounts of bad feeling between groups of doctors and between doctors and  
6 patients. This led to an inglorious mud slinging match between several parties in the  
7 medical and national press [37]. The report by Ian Kennedy, Professor of Health  
8 Law, Ethics and Policy was a detailed retrospective examination geared to produce a  
9 set of recommendations for future practice, it espoused the principles of patient  
10 centred care, openness, competence, accountability and quality improvement. To its  
11 credit is one of the few large reports on the fundamental causes of adverse incidents  
12 that has sustainable funding to ensure there is continuing audit and appropriate risk  
13 management processes in place. *It is incumbent on those who administer audits and*  
14 *incident management programmes to feed back adequately to those who provide*  
15 *the input. Kennedy realised that bad systems would perpetuate bad decisions, these*  
16 *systems may be physical, procedural or administrative* in which clinicians are apt to  
17 fail unless they are either very good or very lucky. Unfortunately, systems are harder  
18 to test than individuals and the tools used for appraisal and revalidation are largely  
19 blind to the context in which the clinician works.  
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44 We continue to fail on the implementation as well as the process of incident reporting  
45 in some areas as well; Cases of administration of epidural medicines into  
46 intravenous lines continue to be reported albeit rarely, but with disastrous  
47 consequences. These are not new complications – their solution may involve the  
48 profession acting with equipment manufacturers . Manufacturers continue to produce  
49 more sophisticated devices, smart infusion pumps for example may have the  
50 capacity to reduce medication errors – one of our most common type of error in  
51 pediatric practice, but this potential frequently is not realised [38]. The type of errors  
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3 may change, but behavioural aspects and basic programming errors e.g. decimal  
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5 point errors still persist.  
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9 Changing practice on the result of local or national incident reports is not as  
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11 important as a unit adopting a process of quality improvement involving evaluation of  
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13 changes within the workplace.  
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20 Another example of failure to progress a relatively common problem is the lack of  
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22 consistent labelling and administration system for medications. Other articles have  
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24 explored the reasons why these errors continue to happen [39]. But one common  
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26 factor in our professions inability to implement working solutions here seems to be  
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28 that these issues demand partnership with industry, the FDA or its equivalent.  
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36 Our representative bodies do engage with these industries, but whereas ASA  
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38 guidelines will be adopted by the profession, no such degree of influence can be  
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40 brought to bear on other industries – or the problems mentioned would have been  
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42 resolved. A higher level of control is required and this will require our professional  
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44 bodies continuing to lobby government.  
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Table 1. Incident and error report types and outcomes

Type of report	Examples	Lessons learned concern these areas	Caveats	Chances of Implementation
Nationally funded mortality audit	NCEPOD [1]	Organisation of healthcare. Local mortality review	Implementation not well funded and administered	Reasonable chances but slow
National incident database. (Long-term)	AIMS[12]	Wide range of common errors and problems	Lack of denominator, report rates fall over time	Good
Sub-specialty specific prospective database	POCA registry.[8] National pediatric epidural and opiate audits.[9]	Detailed clinical patterns and outcomes	Lacks incidence data	Extremely good (and inexpensive)
National focussed prospective audit	NAP audits (RCOA, UK) [14]	Specific Incidence data of major complications	Despite size of audit, paediatric figures less specific	Good
Boards of Inquiry	Kennedy report (Bristol Children's Cardiac) [36]	Governance of medical care, culture within systems and monitoring of outcomes	Lessons from one system must be extrapolated to others	Very good due to high profile and funding
Police investigation	Operation Orcadian [3]	Criminal responsibility	Expensive, very limited scope	Poor, unless professional bodies engaged
Medico legal (analysis by	Closed claims	Patterns of significant	Long timeframe and	Reasonable, if

clinicians)	study[4]	incidents	lack of specificity	slow
Local audits	[32,33]	Specific areas of practice. Able to examine efficacy accurately	Variable reporting and quality	Excellent potential but variable in practice

## References

1. The 2000 Report of the National Confidential Enquiry into Perioperative Deaths. Published 21 November 2000 ISBN 0 9522069 7 8
2. The requirement to participate in the work of NCEPOD? <http://www.ncepod.org.uk/about.htm>. accessed 13/12/2010
3. Protecting the breathing circuit in anaesthesia. Report to the Chief Medical Officer of an Expert Group on blocked anaesthetic tubing. May 2004, Department of Health Publications
4. Morray J, Geiduschek J, Caplan R, Posner K, Gild W, B JD, Cheney F. A Comparison of Pediatric and Adult Anesthesia Closed Malpractice Claims. *Anesthesiologist*. 1993; 78(3):461-467
5. Cheney FW, Posner K, Caplan RA, Ward RJ. Standard of care and anesthesia liability. *JAMA*. 1989; 261(11):1599-603.
6. Goldmann D. System Failure versus personal accountability – the case for clean hands. *New England Journal of Medicine*. 2006; 335(2): 121-3
7. Sharek PJ, McClead RE, Taketomo C, Luria JW, Takata GS, Walti B, Tanski M, Nelson C, Logson TR, Thurm C, Frederico F. An intervention to decrease narcotic-related adverse drug events in children's hospitals. *Pediatrics*. 2008; 122 e861-e866

- 1  
2  
3 8. Moray J P, Geiduschek JM, Ramamoorthy C, Haberkern C M, Hackel A, Capan  
4 R A, Domino K , Posner K, Cheney F W. Anesthesia-related Cardiac Arrest in  
5 Children; Initial Findings of the Pediatric Perioperative Cardiac Arrest (POCA)  
6 Registry. *Anesthesiology* 2000; 93:6-14  
7  
8
- 9  
10 9. Ramamoorthy C, Haberkern C M, Bhananker SM, Domino KB, Posner KL,  
11 Campos SL, Morray JP, Anesthesia-Related Cardiac Arrest in Children with Heart  
12 Disease: Data from the Pediatric Perioperative Cardiac Arrest (POCA) Registry.  
13 *Anesthesia & Analgesia* 2010. 110(5): 1376-82  
14  
15  
16  
17
- 18 10. Cravero JP, Beach ML, Blike GT, Gallagher SM, Hertzog JH, and Pediatric  
19 Sedation Research Consortium . The Incidence and Nature of Adverse Events  
20 During Pediatric Sedation/Anesthesia With Propofol for Procedures Outside the  
21 Operating Room: A Report From the Pediatric Sedation Research Consortium  
22 Anaesthesia & Analgesia March 2009; 108,3: 795-804  
23  
24  
25
- 26 11. Webb RK, Currie M, Morgan CA, Williamson JA, Mackay P, Russell WJ,  
27 Runciman WB. The Australian Incident Monitoring Study: an analysis of 2000  
28 incident reports. *Anaesth Intensive Care* 1993; 21(5):520-8.  
29  
30  
31  
32
- 33 12. Spigelman AD, Swan J. Review of the Australian incident monitoring system.  
34 *Australia and New Zealand Journal of Surgery* 2005. Aug;75(8):657-61.  
35  
36  
37  
38
- 39 13. Anaesthesia Crisis Management Manual. Australian Patient Safety Foundation  
40 [http://www.apsf.com.au/crisis\\_management/Crisis\\_Management\\_Start.htm](http://www.apsf.com.au/crisis_management/Crisis_Management_Start.htm).  
41 accessed 13/12/2010  
42  
43  
44  
45
- 46 14. Cook TM, Counsell D, Wildsmith JAW. Major complications of central neuraxial  
47 block: report on the Third National Audit of The Royal College of Anaesthetists. *Br J*  
48 *Anaesth* (2009) 102:179–90  
49  
50  
51  
52
- 53 15. Bell G / Cook TM. personal communication 20/07/2010  
54  
55  
56  
57
- 58 16. Llewellyn N, Moriarty A. The national pediatric epidural audit. *Paediatr Anaesth*  
59 2007;17:520–533.  
60

1  
2  
3 17. Morton N S, Errera A. APA national audit of pediatric opioid infusions. *Paediatric*  
4 *Anaesth* 2010; 20(2): 119-125(7)  
5  
6

7  
8  
9 18. <http://www.wakeupsafe.org/index.iphtml> accessed 13/12/2010  
10  
11

12  
13 19. Fong KJ. Risk management, NASA and the National Health Service: lessons we  
14 should learn. *British Journal of Anaesthesia* 2010.105(1): 6-8  
15  
16

17 20. Ting HH, Shojania KG, Montori VM, Bradley EH. Quality improvement science  
18 and action. *Circulation* . 2009; 119:1962-1974  
19

20 21. Boonyasai RT, Windish DM, Chakraborti C, Feldman LS, Rubin HR, Bass EB.  
21 Effectiveness of testing quality improvement to physicians. *Journal of the American*  
22 *Medical Association*. 2007; 298: 1023-1037  
23  
24

25 22. McDonald KM, Graham ID, Grimshaw J. Chapter 3. Towards a theoretic basis for  
26 quality improvement interventions in Technical review Number 9 Closing the gap: A  
27 critical Analysis of Quality improvement strategies. Agency for healthcare research &  
28 quality Publication 04-0051-1 August 204  
29  
30

31 23. NPSA ; Reducing the risk of retained throat packs after surgery 28 April 2009  
32 Ref: NPSA/2009/SPN001. <http://www.nrls.npsa.nhs.uk/resources/?entryid45=59853>  
33  
34

35 24. Shapey IM, Foster MA, Whitehouse T, Jumaa P. Bion JF. Central venous  
36 catheter-related bloodstream infections: improving post insertion catheter care,  
37 *Journal of Hospital Infection* 2010. 71(2); 117-122  
38  
39

40 25. Fin R, Patey R, Glavin R, Maran. Anaesthetists' non-technical skills. *British*  
41 *Journal of Anaesthesia* 2010. 105(1): 38-44.  
42  
43

44 26. [http://www.ihl.org/IHI/Programs/Campaign/mentor\\_registry\\_vap.htm](http://www.ihl.org/IHI/Programs/Campaign/mentor_registry_vap.htm) accessed  
45 14<sup>th</sup> March 2011.  
46  
47

48 27. Berg MD, Schexnayder SM, Chameides L, Terry M, Donoghue A, Hickey RW,  
49 Berg RA, Sutton RM, Hazinski MF. Part 13: Pediatric basic life support: 2010  
50 American Heart Association Guidelines for Cardiopulmonary Resuscitation and  
51 Emergency Cardiovascular Care. *Circulation*. 2010;122:S862–S875.  
52  
53

54 28. Travers AH, Rea TD, Bobrow BJ, Edelson DP, Berg RA, Sayre MR, Berg MD,  
55 Chameides L, O'Connor RE, Swor RA. Part 4: CPR overview: 2010 American Heart  
56 Association Guidelines for Cardiopulmonary Resuscitation and Emergency  
57 Cardiovascular Care. *Circulation*. 2010;122(suppl 3):S676–S684.  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
29. National Audit Office, Support to High intensity operations. ISBN: 9780102954999  
May 2009. [http://www.nao.org.uk/publications/0809/high\\_intensity\\_operations.aspx](http://www.nao.org.uk/publications/0809/high_intensity_operations.aspx)  
[accessed 8th August 2010](http://www.nao.org.uk/publications/0809/high_intensity_operations.aspx)

10  
11  
12  
13  
14  
15  
30. World health organisation, Safe surgery saves lives.  
<http://www.who.int/patientsafety/safesurgery/en/> accessed 15<sup>th</sup> March 2011.

16  
17  
18  
19  
20  
21  
31. *The Breakthrough Series: IHI's Collaborative Model for Achieving Breakthrough Improvement*. IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement; 2003. (Available on [www.IHI.org](http://www.IHI.org))

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56  
57  
58  
59  
60  
32. Odegard KC, DiNardo, JA, KussmanBD, Shukla, A, Harrington, J, CastaA, McGowanFX, Hickey PR, Bacha EA, Thiagarajan RR, Laussen, PC. The Frequency of Anesthesia-Related Cardiac Arrests in Patients with Congenital Heart Disease Undergoing Cardiac Surgery. *Anesthesia & Analgesia*. 105(2):335-343, August 2007.

33. Aleksic V, Radulovicd, Milakovicb, Nagulic M, Vucovic D, Antunovic V, Djordjevic M. A retrospective analysis of anesthesiologic complications in pediatric neurosurgery. *Pediatric Anesthesia*. 19(9):879-886, September 2009.

34. Nightingale P. The presidents statement. *The Royal College of Anaesthetists Bulletin* 2010. 62: 4-5

35. Womack C, Roger S, Lavin M. Disclosure of clinical audit records in law: risks and possible defences. *BMJ* 1997;315:1369-1370

36. Learning from Bristol: the report of the public inquiry into children's heart surgery at the Bristol Royal Infirmary 1984 -1995. Command Paper: CM 5207;  
<http://www.bristol-inquiry.org.uk/>

37. Bolsin SN. The Wisheart affair: responses to Dunn. *British Medical Journal* 1998 Dec 5;317(7172):1579-80 and related correspondence

1  
2  
3 38. Rothschild JM, Keohane CA, Cook EF, Orav EJ, Burdick E, Thompson S, Hayes  
4 J, Bates DW. A controlled trial of smart infusion pumps to improve medication safety  
5 in critically ill patients. *Crit Care Med.* 2005;33(3):533-40.  
6  
7  
8  
9

10 39. Wheeler, S. J. Wheeler, D. W. Title Medication errors in anaesthesia and critical  
11 care. *Anaesthesia.* 60(3):257-273, March 2005.  
12  
13  
14  
15  
16  
17  
18  
19  
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