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On Attributing Critical Incidents to Factors in the Environment

To the Editor:—Dr. Eichhorn's interesting investigation¹ should not be used to draw conclusions regarding the effect monitoring standards on anesthesia safety. Despite the lack of statistical significance in the study as a whole, Dr. Eichhorn argues that additional monitoring devices could have provided early indications of what were to become disasters. Drawing conclusions in this fashion constitutes hindsight bias and weak counterfactual reasoning.² This particular type of retrospective analysis can support virtually limitless numbers of interpretations regarding hypothetical interventions. Accidents are rarely caused by single factors; rather they represent the confluence of multiple events, alone insufficient but in combination leading to disaster.³ The highly connected and interdependent nature of operating room systems largely invalidates independent elemental analyses.⁴

It is possible, however, to draw conclusions about the genesis of those critical incidents that lead to both near misses and bad outcomes.^{5,6} Formal methods for investigating critical incidents are available and have been used successfully in other domains as well as in anesthesiology.⁷ These methods reconstruct the unfolding incident including available cues, those cues actually noted by participants, and participant's interpretation in the immediate, larger institutional, and professional context. To use incident analysis to understand the actual effect of monitoring devices, experimental designs should include critical incidents from comparable monitored and unmonitored situations.⁸

The kinds of records available to Eichhorn are insufficient for such detailed analysis. Capturing these sorts of data requires early, in-depth investigation of multiple sources of information. This is only possible in a positive environment, one where it is clear from the outset that data will be used to understand the practice of anesthesia itself rather than the role of any single practitioner and where the first goal is understanding rather than assignment of blame. Methodologically sound analysis of cases offers the best prospect for insight into anesthesia accidents. The challenge of anesthesia safety in 1989 is to devise practical methods of uncensored and detailed investigation of incidents as they occur.

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Did Monitoring Standards Influence Outcome?

To the Editor:—Eichhorn¹ presented important data on the incidence of intraoperative anesthesia-related patient injuries. Collection and publication of these data is welcome, worthwhile, and has important implications for patient care, but we have several questions regarding his analysis and conclusions. Although the Harvard monitoring standards² were adopted in July 1985, many (most) physicians in the nine component hospitals of the Harvard Department of Anaesthesia undoubtedly had been using these standards routinely long before mandatory use was decided upon. Therefore the division of patients into two cohorts, namely one cared for "without" standards and a cohort

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REFERENCES

1. Eichhorn JH: Prevention of intraoperative anesthesia accidents and related severe injury through safety monitoring. *ANESTHESIOLOGY* 70:572-577, 1989
2. Kahneman D, Miller DT: Norm theory: Comparing reality to its alternatives. *Psychol Rev* 93:136-153, 1986
3. Cooper JB: Toward prevention of anesthetic mishaps. *Analysis of Anesthetic Mishaps*. Edited by Pierce EC Jr, Cooper JB. Boston, Little, Brown, 1984, pp 167-283
4. Gaba DM, Maxwell M, DeAnda A: Anesthetic Mishaps: Breaking the chain of accident evolution. *ANESTHESIOLOGY* 66: 106-109, 1988
5. Reason J: *Human Error*. Cambridge, Cambridge University Press, 1989
6. Cooper JB, Newbower RS, Kitz RJ: An analysis of major errors and equipment failures in anesthesia management: conditions for prevention and detection. *ANESTHESIOLOGY* 60:34-42, 1984
7. Pew RW, Miller DC, Feehrer C: *Evaluation of Proposed Control Room Improvements Through Analysis of Critical Operator Decisions*. Palo Alto, Electric Power Research Institute, 1981
8. Woods DD, O'Brien J, Hanes L: Human factors challenges in process control, *Handbook of Human Factors*. Edited by Salvendy G. New York, Wiley and Sons, 1987, pp 1724-1770

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cared for "with" standards may not, in fact, be valid. Other epidemiologic studies have discussed the difficulty in precisely defining the starting point or "zero time" when a new treatment is introduced.³ The phenomenon of "zero-time shift," also called "lead-time bias,"³ may have influenced the results of Dr. Eichhorn's study.

Next, although Dr. Eichhorn indicated that the data were not statistically significant, he implied that such significance was achievable with a relatively small number of additional "post-standards" cases. Using his database, we were interested in determining the actual sample size that would be necessary to achieve statistical significance at a 0.05