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Human life cost in anaesthesiology cost-benefit decisions

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Dear Editor,

The United States (US) aviation industry provides a potentially useful mental model for dealing with certain cost-benefit decisions in aesthesiology. The Federal Aviation Administration (FAA), the national aviation authority of the United States, quantifies a price for the value of a human life based on the U.S. Department of Transportation's (DOT) value of a statistical life (VSL) unit. The current VSL is around $9.6 million, indexed to grow with consideration given to inflation and wage changes from the 2016 baseline of $9.4 million [1]. To illustrate the concept, if the FAA estimates that 100 people are likely to die in the future given the current practice standards then the monetary cost of this loss will be $940 million. The FAA uses this estimated monetary value as an official reference point in its regulatory decisions, and the agency publishes in detail how it derives the estimated value. When proposing new regulations, the FAA bases its decisions on comparisons of the human life cost associated with the existing regulation versus the alternative cost that the industry stakeholders will incur subsequent to the adoption of the regulation. In this example, if the cost incurred by the industry is more than the $940 million cost then the FAA will not adopt the proposed regulation and hence will not require the industry to undertake this cost.

The complexity of these extensive FAA benefit-cost analyses is impressive, but what is also interesting is the level of involvement of the industry in this process. The FAA publishes their calculations of their estimates and invites industry stakeholders to respond with alternative estimations and reasoning. The FAA addresses the merit of alternative estimations in a public discussion that resembles the peer review process of an academic journal.

The FAA has applied this process to duty hour regulations, prevention and testing of alcohol and drug misuse, and the frequency and extent of recurrent training and testing. These topics are pertinent to anaesthesiology. To illustrate, in its ruling the FAA notes that "The recurrent training/testing required annually for each pilot will start in the second year of the 10-year time frame of the rule. The FAA estimates that the training will take approximately 15 minutes and cost $12 ($48 per hour × .25) per pilot. This cost estimate multiplied by the total number of pilots (29,300) results in estimated annual recurrent training costs of $350,000. Over the next 10 years, this cost will be $3.2 million (or $2.2 million, discounted)… The final rule will generate potential safety benefits of $14.2 million (or $10.0 million, discounted) over the next 10 years" [2].

In aesthesiology we are constantly faced with having to decide whether to adopt new technologies or drugs. As another example, in recent years sugammadex has gained popularity and attention as an alternative agent for reversal of neuromuscular blockade. Some clinicians use it routinely for block reversal instead of neostigmine

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while others opt to use it more selectively. In our opinion, it is reasonable for professional societies in the field or other regulatory agencies to consider issuing guidance documents based on estimated rates of expected or observed adverse events. For example, if it is believed that one patient a year will die from hypoventilation-related complications in an average post-anaesthesia care unit, then this would represent a cost of $9.4 million per practice. On the other hand, if on average a practice performs 150,000 surgeries with paralysis a year and incurs an average cost of $100 per sugammadex administration, then the relative cost of such standard would be $15 million per practice, and therefore adoption of such guidelines would not be favoured. The above is a mere example, not an actual analysis of the cost-benefit of sugammadex. If one was to undertake a thorough cost-benefit analysis of sugammadex, other aspects such emergence time and OR facility cost and throughput time costs would have to be considered as well. Other areas of practice in which the VSL approach may serve useful are the need for pre-operative "clearance" visits and pre-operative testing such as EKG, Echo, carotid ultrasound, and blood testing. This cost approach may be useful in assessing protocols that call for the use of certain specialized equipment for the purpose of preventing rare occurrences such as airway or operating room fires.

Despite the many parallels that can be drawn between anaesthesia and aviation, some considerable differences remain in the risk assessment approach to possible negative outcomes in these different industries. The negative outcome in aviation can be viewed as mainly binary (death vs. no death) whereas medical adverse events are not simply a mortality uncertainty but obviously are further complicated by morbidity outcomes. The DOT further provides values for different disutility levels through their Abbreviated Injury Scale (AIS) which categorizes injuries into six severity levels and assigns them the following VSL fraction: minor (0.03), moderate (0.047), serious (0.105), severe (0.266), critical (0.593), and unsurvivable (1.0). These relative values as well as the VSL are likely to differ among different countries, so the cost-benefit conclusions may differ as well.

The doctor-patient relationship is a fiduciary obligation that, like many human decisions, is financially influenced. It is important to consider that cost-benefit analyses often vary enormously from the perspective of an individual player vs. the collective group perspective. As a result, there are times when a conflict exists between the individual player's incentives and the incentives of society. These situations, in our opinion, are where the FAA's VSL approach provides the most merit because it emphasizes collective value, which arguably is the regulator's role. Accordingly, we propose the VSL approach as a tool for professional societies or medical boards, not for decision-making in an individual anaesthesia practice.

We wish to stress that assigning this proposed monetary value to a human life in no way devalues it. On the contrary, in the US the VSL is much higher than the average malpractice claim indemnity of $309,066 based on the incidence of anaesthesia closed malpractice claims [3]. The FAA approach is a very pragmatic and practical one and, in our opinion, applicable to certain regulatory decisions in anaesthesia.

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