However, we would disagree with Dr. Reed's assertion that the exclusion of high-risk patients means that the "results and conclusions are not applicable to . . . even the general population." The original manuscript indicates that 113 patients with three or more grade 3 (difficult) mask ventilation risk factors underwent elective awake fiberoptic intubation and were excluded from the study.[1] More importantly, table 6 of the original manuscript shows that our data did include mask ventilation attempts on 1,670 patients with three or more risk factors.[1] This sample size of 1,670 high-risk patients is larger than the entire patient population analyzed by previous mask ventilation studies.[2,3] As a result, we believe that the data can be used to derive conclusions regarding the predictors of grade 3 mask ventilation in all but the highest-risk patients, those diverted to an elective awake fiberoptic intubation. Unfortunately, the study of the difficult airway will always suffer from this limitation due to the provider's responsibility to deliver ethical clinical care before considering the scientific value of a given patient's inclusion in a study.

We share Dr. Reed's curiosity regarding the predictors of grade 4 (impossible) mask ventilation. As detailed in the discussion of our data, "despite our large overall sample size, we were unable to detect a large number of IMV [impossible mask ventilation] cases and struggle to provide conclusions regarding IMV risk factors. Further studies assessing incidence, predictors, and impact of IMV are essential."[1] We are unable to explain the lack of overlap between grade 3 and grade 4 mask ventilation risk factors. Because only 37 episodes were detected, we lack the statistical power to address whether distinct pathophysiology is the root cause. We look forward to further studies addressing impossible mask ventilation.

We also thank Dr. Calder for his interest in our work. We agree with Dr. Yentis in his editorial accompanying our article and Dr. Calder when they suggest that we should inform morbidly obese patients of their increased perioperative risk due their increased weight.[4] Although this point was not highlighted in our article because of space constraints, our omission should not be construed as implicit approval of unhealthy lifestyles resulting in morbid obesity. Every clinician has experienced the multitude of challenges posed by the increasing prevalence of obesity throughout the world, and our data demonstrate that difficult mask ventilation is among those challenges.

Dr. Calder poses an interesting question regarding the role of neuromuscular blockade in difficult airway management. Our article did not specifically address the role of these medications in mask ventilation because of previous work that did not demonstrate a relationship.[2,5] However, Dr. Calder's query regarding the use of neuromuscular blockade in a specific subset, patients in whom mask ventilation was impossible, is intriguing. As a result, we have reviewed the 37 patients with grade 4 mask ventilation in our data set. Of these, only one patient was not given any form of neuromuscular blockade before intubation. This patient was intubated successfully with a grade 1 direct laryngoscopy view. Four patients were administered a nondepolarizing neuromuscular blocking agent before the observation of grade 4 mask ventilation. Of these four patients, one patient could not be intubated and required an emergent cricothyrotomy. The remaining 32 patients received a dose of succinylcholine before the first attempt at intubation. All of these patients were intubated successfully.

The conclusions or recommendations to be drawn from these data are controversial. Some may propose that routine practice should include establishing "excellent intubating conditions,"[6] especially if impossible mask ventilation is encountered. This would optimize the attempt to control the airway. Unfortunately, recent research has found that commonly used succinylcholine doses result in neuromuscular blockade ranging from 4.4 to 7.5 min in duration.[7] If tracheal intubation could not be achieved in these patients, only laryngeal mask airway ventilation or surgical airway access remain an option to prevent hypoxia during these crucial minutes.[8]

Others may prefer to follow the conventional wisdom that if mask ventilation cannot be established, neuromuscular blockade should be withheld. If tracheal intubation is not successful, the patient should be awoken and fiberoptic intubation should be pursued. As mentioned earlier, research into management of the difficult airway remains limited by exclusion of patients requiring an elective awake fiberoptic intubation, and there are little additional data to guide our recommendations.

In summary, we appreciate Drs. Reed and Calder's insightful commentary. We believe that our data offer insight into the incidence and risk factors of grade 3 and 4 mask ventilation. Nevertheless, further investigations are clearly needed in this understudied area of airway management. In addition, we hope that the additional data presented regarding the use of neuromuscular blockade in patients with grade 4 mask ventilation ignites a thoughtful debate.

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Using the Process Dissociation Procedure: The Meaning and Value of Comparable Base Rates

To the Editor:—Memory formation during anesthesia is a hotly debated topic. In carefully controlled studies of the phenomenon, patients are typically presented with a series of word stimuli for which memory is tested after recovery. Besides questions into recollection, other tests are suitable. One such test is a word stem completion task in which the first (three) letters of a word are presented, which the subject completes to a word. Completion to a word presented during anesthesia must be taken as evidence of memory if a word surfaces more often when people were presented with it compared with a group of people who were not presented with it. The task has been used in numerous studies of memory function in general and during anesthesia in particular.

In the November 2006 issue of Anesthesiology, Stonell *et al.*[1] report an elegant use of the word stem completion test to address sex differences in memory formation during anesthesia. They used the task in combination with the process dissociation procedure (PDP), which allows a closer look of the memory formed. In particular, the PDP touches upon the question whether the memory arose unconsciously ("implicit memory") or consciously ("explicit"). Rather than relying on different tests (*e.g.*, a recall questionnaire and a word stem completion task), the PDP relies on a single task that is performed under two, only marginally different, instructions. The purpose of this setup is to contrast performance on the same task when the subject tries to retrieve and use information (inclusion instruction) *versus* memory retrieval without using the information (exclusion instruction). By contrasting the two conditions, by virtue of their similarity, estimates for implicit and explicit memory can be calculated using relatively simple mathematical equations.[2] Using PDP, we reported evidence for implicit memory function during general anesthesia.[3,4]

The PDP relies on various assumptions, the least controversial of which is that tasks are comparable. Or, as the founding father of the procedure put it,[2,5] subjects must use the same "response criterion" in the inclusion and exclusion conditions if one wants to use the calculations that render the PDP so popular. Subjects should have, or rather, be enabled to have, a similar tendency to use previously presented items in both conditions. If not, the parameters that represent the two bases of memory in the various equations do not represent the same concept and, therefore, cannot be mathematically extracted.

Some evidence for equal response criteria comes from the distractor hit rate, also referred to as the "base rate," which represents the probability of responding with a study word without being previously presented with it. Some subjects, for example, will complete the stem COU__ to *couch* simply because it works, regardless of whether they heard the word during anesthesia. Base rates, in other words, establish chance performance and tell us something about response tendencies. By the same token, differences between base rates in the inclusion and exclusion condition indicate that subjects used different response criteria (which violates the PDP).

Stonell *et al.*[1] observed significantly different base rates (Kate Leslie, M.D., written communication, November 2006) but nonetheless calculated PDP estimates based on which the authors suggested that both implicit and explicit memory function contributed significantly to the memory effect observed. This conclusion is hard to reconcile with the PDP model and clinical findings so far, where either implicit or explicit uses of memory usually account for observed effects: Hit rates are either boosted in both the inclusion and exclusion conditions (indicative of implicit memory) or they are in the inclusion condition only (indicating explicit memory). Because the rates across all conditions in the work of Stonell *et al.* varied substantially, it is hard to discern what was at play in this study. From the inclusion condition, it can be derived that reliable memory was formed, but we can only guess the type of learning that may be held accountable for this effect.

A likely reason for the different base rates in the study by Stonell *et al.*[1] is the instructions given to the subjects upon stem completion testing. In our studies, we have observed comparable base rates and instruct patients in both conditions to use the word stem as an aid (cue) to recall words presented during anesthesia.[3,6–8] Memory retrieval is thus encouraged in both parts of the test. In the inclusion condition, subjects are then told to complete stems with the recalled word, whereas such words are not to be used for stem completion in the exclusion condition. In contrast, Stonell *et al.* instructed subjects in the exclusion condition to use words not heard during anesthesia. Although subtle, the distinction between their and our instructions is important to the PDP procedure and its calculations. Because Stonell *et al.* gave dissimilar instructions in the inclusion and exclusion conditions, encouraging memory in one but not in the other part of the test, the tasks are not directly comparable and the PDP assumption of equal criteria is violated. The dissimilarity may have caused subjects to complete fewer exclusion than inclusion stems and to use unusual words in the exclusion part of the test, as the authors noted in the discussion of their report, observations that are in line with the notion of different response criteria. The conclusion, therefore, that both implicit and explicit memory function are to be held accountable for the memory observed by Stonell *et al.* was inappropriately drawn, although the conclusion that memory was formed at Bispectral Index values between 50 to 55 is clearly correct.

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Statistical Approach to Word Stem Completion Test

To the Editor:—I recently read the interesting study of Stonell *et al.*[1] about the use of the word stem completion test to measure implicit and explicit memory formation during general anesthesia. I think that the word stem completion test is one of the most useful and clinically feasible models to study the implicit form of awareness in general anesthesia, and it is an important tool to validate systems for awareness prevention.

Stonell *et al.* used a word presentation counterbalancing scheme based on a previous study by Lubke *et al.*[2,3] In this scheme, two of four words lists are given to patients during surgery, after induction of anesthesia; these lists are defined as inclusion target and exclusion target, whereas the two lists not given are defined as inclusion distracter and exclusion distracter.

Postoperatively, patients are asked to complete a column of word stems (inclusion target and inclusion distracter) with the words that they remember hearing during anesthesia, and then they are asked to complete another column of word stems (exclusion target and exclusion distracter) with words they have surely not heard during surgical anesthesia.