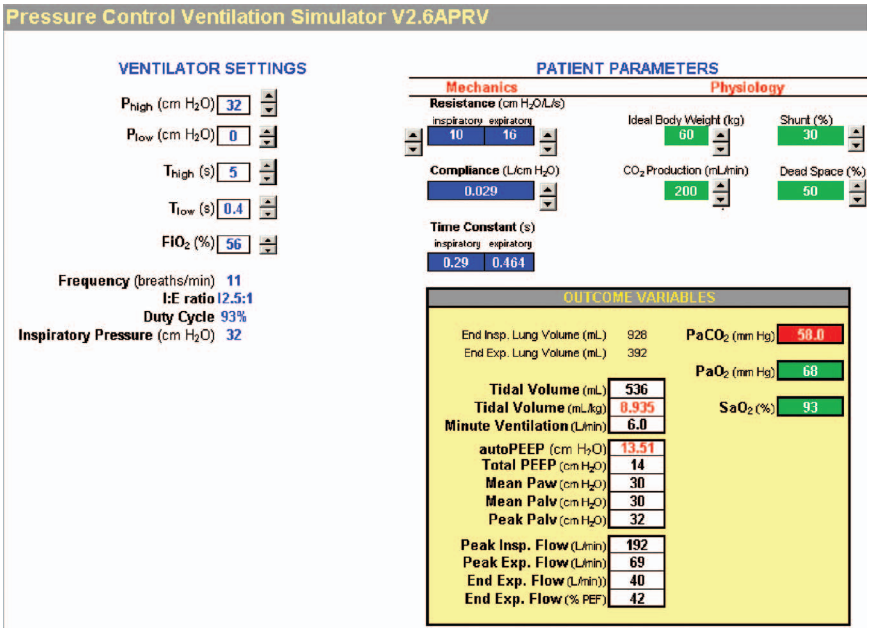

Fig. 2. Microsoft Excel-based airway pressure release ventilation simulator. Courtesy Mandu Press.

a T_{low} set long enough to avoid auto-PEEP. This approach decouples the level of mechanical support from the level of auto-PEEP, making clinical management easier and more predictable.

Perhaps the last word should go to John Downs (the inventor of APRV) and colleagues who commented on the largest study of APRV to date.[18] In a letter to the editor in the Journal of Trauma, they said "Many clinicians use APRV as a rescue mode for the treatment of ARDS. No study supports…the use of APRV in that way…"[19] In their response to the letter, the authors of the study stated that "We do not believe that APRV should be used as a rescue mode either."

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We Agree!!

In Reply

As we discussed in our article,[1] the use of auto-PEEP to establish PEEP always results in different PEEP levels occurring in various lung units based on the lung mechanics of the unit. Lung units with long time constants (high airway resistance and/or high compliance) always develop the greatest auto-PEEP, whereas lung units with the shortest time constants (low compliance and/or low resistance) always develop the least auto-PEEP. As shown in the mathematical discussion by Chatburn and Kallet, lung units that are really stiff, as in severe ARDS, may have such short time constants that they fully collapse, even with a very short low CPAP time. This, as discussed, results in a repetitive opening and closing of lung units, causing atelectrauma.

Attempting to base the needed PEEP level on the use of auto-PEEP is always physiologically unsound and always has the potential of causing more lung injury. In our opinion, one should never establish PEEP by the use of auto-PEEP, because the risks *always* outnumber the potential benefits.

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Dr Mirelea-Cabodevila has a patent on mid-frequency ventilation with no monetary gain. Dr Kacmarek has disclosed relationships with Covidien, Orange Med, and Venner Medical.

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Intermittent Mandatory Ventilation Will Live Forever

To the Editor:

Reading the article by Kacmarek and Branson[1] about whether intermittent mandatory ventilation (IMV) should be abolished, it seemed like arguing whether flip phones should be abolished (eg, in favor of smart phones). Yes, flip phones are still used, but they represent a technological anachronism, and any discussion about their role in everyday communications has become essentially irrelevant. But whether the discussion about IMV is irrelevant depends on how it is defined.

In the introduction of the paper,[1] IMV was defined as "a mode of ventilation where intermittent mandatory breaths are delivered at clinician-defined intervals, and between these mandatory breaths, the patient can breathe spontaneously or with pressure-supported breaths." In the first place, thinking of IMV as a "mode" (vs the breath sequence component of a complete mode classification[2]) is a very restricted use of the term. It indicates an outdated paradigm that limits understanding of currently available options for ventilation and prevents a clear vision of future developments.

More importantly, the authors never give definitions for "mandatory" or "spontaneous" breaths, upon which the definition of IMV depends. The result is a certain level of ambiguity that might prevent the reader from appreciating the full scope of the subject. A spontaneous breath is one for which inspiration is both triggered and cycled by the patient (ie, the patient's brain); a mandatory breath is one for which inspiration is either triggered or cycled by the ventilator.[2] Note that the definition of a spontaneous breath does not imply any particular level of assistance for the work of breathing and, indeed, does not even imply connection to a ventilator. Non-intubated people breathe spontaneously, and intubated patients on CPAP breathe spontaneously, as do those on some type of assistance (eg, pressure support, proportional assist ventilation plus, neurally adjusted ventilatory assist, automatic tube compensation).

Herein lies the problem. The authors completely ignore the fact that there are actually 3 different varieties of IMV. In type 1, preset mandatory breath frequency is always delivered; in type 2, mandatory breaths are delivered only when the spontaneous breath frequency is less than the preset mandatory breath frequency; and in type 3, mandatory breaths are delivered only when the spontaneous minute ventilation (ie, spontaneous breath frequency times average spontaneous breath tidal volume) is less than the preset minute ventilation.[2]

Type 1 IMV was the original, as described by Kacmarek and Branson.[1] Type 2 IMV exists today as, for example, on the Philips Respironics V60 ventilator in the mode called "spontaneous/timed."[3] Type 3 IMV was originally invented way back in 1977 by Hewlett et al[4] and called "mandatory minute ventilation." That mode is still available today on Dräger ventilators (called "mandatory minute volume ventilation") and on Maquet ventilators (called "AutoMode"[5]) and has evolved further into the mode called "adaptive support ventilation" on Hamilton ventilators.[6]

The important point is that type 2 and 3 IMV both *allow spontaneous breaths to suppress mandatory breaths*. That feature casts a whole new light on IMV. To put this into a clinical context, it is helpful to categorize patients into 4 basic groups: (1) those incapable of generating spontaneous breaths (eg, organ donors and patients under neuromuscular blockade); (2) those with unreliable spontaneous breath rates (eg, premature infants); (3) those with little risk of apnea (perhaps the majority of ventilated patients); and (4) those with no need of mandatory breaths at all (eg, patients undergoing spontaneous breathing trials). Of course, this spectrum of breathing ability can and often does occur in a single patient, so perhaps it is better to think of the 4 groups as levels of mandatory breath requirement (ie, complete dependence, intermittent depen-