sample size enrolled from a single community-based institution staffed by critical care specialists. This study design reduces the variability in the patient population and the CPR methodology. In addition, the sample population was accumulated over a relatively brief period of time, reducing the effects of changes in medical practice that could influence the observations reported in this study. The sound statistical analysis adds further strength to this investigation.

The use of a community-based sample population further strengthens this study. Most clinical studies are generated from university-based, teaching institutions that typically have patient populations not representative of patients in the community setting. The presence of population differences may be evident in the survival rate of 16% in the study by Bialecki et al, which is considerably higher than observations reported from teaching hospitals.

The major weaknesses of this report are inherent to any retrospective study. Lack of adequate control groups, potential selection bias, and dependence on medical records for data acquisition are but a few of the difficulties that may influence the results. Therefore, any conclusions reached from retrospective, uncontrolled data must be applied with extreme caution to the prospective management of individual patients in daily clinical practice. The real value of such retrospective analysis is to guide the development of important hypotheses to test in prospective, controlled trials. Despite these limitations, studies such as the one reported by Bialecki and Woodward offer an invaluable contribution by attempting to apply observations generated in the academic setting to clinical practice in the community setting. Community-based investigators need to be commended for conducting clinical investigation in a nonacademic setting where the resources for research are scarce.

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Work of Breathing Measurements

Can They Help Identify Patients Who Can Be Successfully Extubated?

Determining when mechanical ventilation can be discontinued and the patient extubated is often a very difficult decision, which even the most astute clinician can not always correctly make. Regardless of the criteria used to make this decision, some patients will inevitably be misclassified, ie, patients who cannot sustain breathing on their own are extubated and require reintubation and patients who could have been successfully extubated are returned to mechanical ventilation. When patients are prematurely extubated and require reintubation, the clinicians receive immediate feedback that their decision was incorrect and that feedback may influence their subsequent decision-making. Unfortunately, when a patient is returned to mechanical ventilation (for signs of respiratory distress as opposed to progressive hypercapnia), there is no way to know for sure whether this decision was correct. Complications associated with mechanical ventilation may increase with increasing duration of therapy, so an overly cautious approach to extubation could have adverse consequences. Thus, any measurement that could successfully identify a subgroup of patients who appear to fail a weaning trial but who can be successfully extubated would be useful.

In this issue of CHEST (see page 1021), Kirton and colleagues report their experience of measuring patient work of breathing during a trial of spontaneous breathing to help them identify patients who they had thought failed a weaning trial based on specific clinical criteria but who could be successfully extubated. Physiologists have measured the work of breathing and its component parts for many years. However, such measurements are quite difficult to perform and have not been widely applied at the bedside. Recently, a computerized commercial monitor has become available that allows these measurements to be made in a more user-friendly manner, which has increased clinical interest in making these measurements in the ICU setting.

When the load faced by the inspiratory muscles is excessive relative to their capacity, hypercapnic respiratory failure will ensue. As the work of breathing is an index of respiratory load, it might be useful in predicting weaning outcome. Prior studies have examined whether work of breathing measurements can predict weaning outcome. Threshold values were found posthoc (different values in each study) that were only moderately useful in predicting weaning outcome. When patients breathe spontaneously through a ventilator circuit, however, considerable work must be performed to overcome the resistance of the endotracheal tube and ventilator circuit (imposed work). Imposed work of breathing (Wimp) can be measured by placing a catheter just beyond the endotracheal tube. This allows partitioning of the work of breathing into that because of the patient (Wpat) and because of the ventilator apparatus (Wimp). The authors’ reasoned that if Wpat is not excessive, patients should be able to tolerate discontinuation of mechanical ventilation. They applied this reasoning to patients who failed a weaning trial (because of tachypnea) in their ICU and did identify a substantial number of patients with acceptable Wpat who were successfully extubated.
Before their findings can be generalized, however, a number of considerations need to be addressed.

First, definitions of weaning failure differ among clinicians. The author's considered the patient to have failed a weaning trial if the respiratory rate was greater than 30 breaths per minute even if arterial blood gases were acceptable and the patient displayed no other signs of distress. Some clinicians use less stringent criteria to define weaning success, which could reduce the number of patients falsely classified as weaning failures. Many of the author's patients, however, had respiratory rates above 40 breaths per minute, which would worry even the most aggressive physician.

Second, methodology used in weaning trials differs among clinicians. The authors applied 5 cm H₂O continuous positive airway pressure (CPAP) with no supplemental oxygen in the weaning trial. No patient had a PaO₂ <55 mm Hg. Whether oxygen supplementation and a modest amount of pressure support, ie, 5 cm H₂O, would have resulted in less tachypnea in weaning remains to be determined.

Third, the threshold used to define an acceptable work of breathing is arbitrary. The normal range for work of breathing is not very well defined. In one large study of 100 healthy men, work per liter was 0.48±0.22 J/L. Taking the upper limit of normal as two standard deviations from the mean would result in a threshold value of 0.92 J/L.

Fourth, the study was performed in a trauma ICU and patients did not have preexisting lung disease or neuromuscular disease. Patients with lung disease have an increased work of breathing when they are stable. Threshold values based on normal subjects are less likely to be useful in such patients. Similarly, even a normal work of breathing may be too high in a patient with severe respiratory muscle weakness.

Finally, work of breathing can be quantified as work/liter, or work/minute, or both. Previous studies have suggested that the combination of these two measurements may be better at predicting weaning outcome than either measurement alone.

Despite these comments, the authors have clearly shown that some patients who develop pronounced tachypnea in weaning can be successfully extubated. These findings are very provocative and bring into question our ability to accurately define a patient's readiness for extubation. The idea of partitioning work of breathing to identify patients developing respiratory distress in weaning because of an excessive imposed work of breathing is conceptually attractive. However, the ultimate use of such an approach particularly in ICUs with different patient populations needs further study.

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References

Management of Pediatric Acute Hypoxemic Respiratory Insufficiency with Bilevel Positive Pressure Nasal Mask Ventilation

In this issue of CHEST (see page 1059), the description by Fortenberry et al of the successful use of bilevel positive pressure nasal mask ventilation in children with hypoxemic respiratory failure is intriguing. Although the results must be interpreted with caution because of the retrospective nature of the study and a design which may have underestimated treatment fail-