Health problem addressed
Neonatal intensive care ventilators provide ventilatory support to preterm and critically ill infants who suffer from respiratory failure and who generally have low-compliance lungs, small tidal volumes, high airway resistance, and high respiratory rates. These mechanical ventilators promote alveolar gas exchange (oxygenation and carbon dioxide \([\text{CO}_2]\) elimination) by generating positive pressure to inflate the lungs of an infant who is incapable of adequate independent breathing.

Product description
A typical neonatal ventilator system consists of a breathing circuit, a humidification system, gas-delivery systems, monitors and their associated alarms, and gas sources for oxygen (O2) and compressed air. Ventilators also require an integral or add-on-oxygen-air proportioner (blender) to deliver a fraction of inspired FiO2 between 21 and 100%. Controls are used to determine the operating mode and ventilation variables. Most ventilators have several operating modes.

Principles of operation
Intensive care ventilators designed for neonatal and/or pediatric respiratory support are mostly time-cycled pressure-control devices. CPAP is useful for infants with restrictive lung disease or decreased lung compliance and alveolar collapse (infants with hyaline membrane disease); PEEP maintains lung volume and prevents alveolar collapse. High-frequency ventilation delivers small tidal volumes around a near-constant mean airway pressure (MAP) at frequencies higher than those produced during the fastest possible panting (i.e., above 100 breaths per minute), thus avoiding both high and low extremes of lung volume.

Operating steps
Users first check that the unit is ready for use (e.g., run performance and calibration checks). They next make sure that settings (including alarm levels) are correct and appropriate for the patient type and condition. Once completed, the patient is connected to the ventilator. When the ventilator-patient connection is completed, users ensure the patient is being properly ventilated. While patient is being ventilated, caregivers should monitor/evaluate the patient, and respond promptly to alarms.

Reported problems
Risk of acquiring pneumonia may be minimized by following proper infection control procedures. Leaks in the breathing circuit or components may prevent the ventilator from delivering the appropriate amount of ventilation. Proper maintenance and avoiding operator errors or machine failures can be critical. Critical changes in patient conditions can be missed if alarms are not set properly or are not noted by clinical staff.