



ADOPTING NEW RESPIRATORY TECHNOLOGIES IN THE NICU

by John Salyer RRT-NPS, MBA, FAARC

It doesn't take too much travelling around to realize that different NICU's often have very different rates of adoption of new respiratory technologies. Some centers use early intervention high frequency oscillation (HFOV) on most neonates with respiratory distress syndrome while in other units nary an oscillator is to be found. Ditto for the use of nasal CPAP (NCPAP) to prevent intubation or as a weaning tool. Surfactant administration techniques also vary greatly. So, why so much variation?

Great minds have puzzled over this till their puzzlers were sore (thanks to Dr. Seuss). It appears that some clinicians embrace new technologies earlier than others, or not at all? If so, why? It is said that science progresses through the death of scientists. This concept was more delicately described by the father of quantum theory, the German physicist Max Planck when he said, "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it". There is a great truth in this. It is surprisingly difficult to believe a thing to be true for years and then be forced to admit that your previous deeply held conviction turned out to be totally wrong, incorrect, erroneous and wide of the mark.

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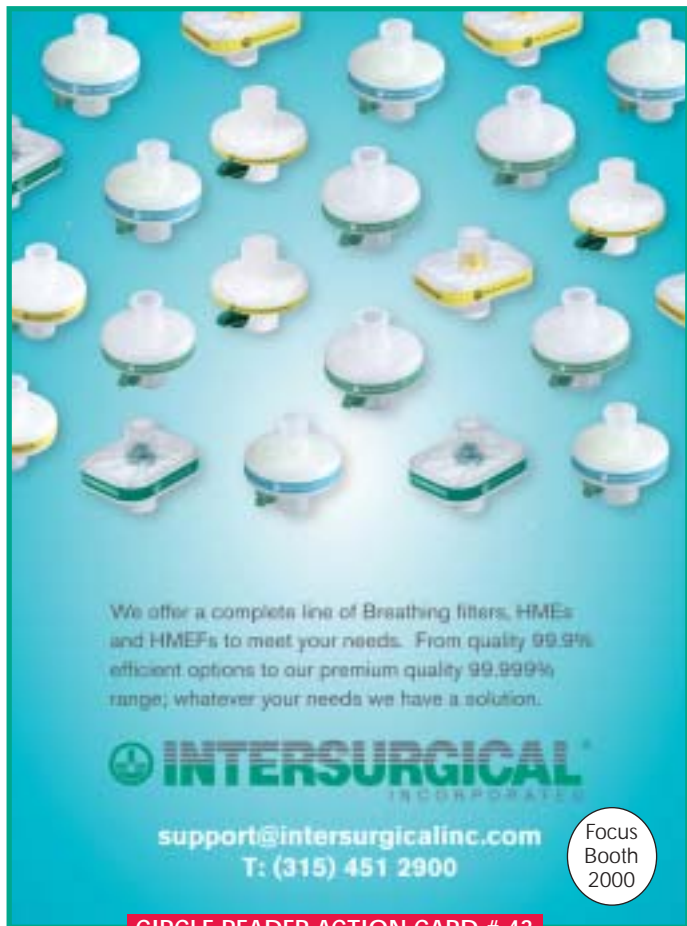
A very good paper on the topic of adoption of new respiratory technologies in neonates has recently been published (Bachman TE, Marks NE, Rimensberger PC. Factors effecting adoption of new neonatal and pediatric respiratory technologies. Intensive Care Med. 2008 Jan;34(1):174-8). In this study the investigators surveyed attendees at two highly respected neonatal ventilation conferences. They asked participates how much they used HFOV for early intervention in neonates, HFOV for ARDS in term infants and children, NCPAP to avoid intubation and NCPAP as a weaning tool. The authors graded the evidence to support these four interventions. Finally they estimated the actual use of these technologies in the general neonatal population. I represented some of their findings in table one which illustrates some interesting gaps. Shockingly, there is a gap between the evidence and practice. The authors suggest there is little if any published scientific evidence proving a benefit of NCPAP to avoid neonatal intubation, yet 74% of respondent's reports using NCPAP this way. Also note the gap between how these interventions are utilized by conference attendees and the general population of neonatal clinicians.

Everett Rogers (1931-2004) was a pioneer of a theory that describes the "diffusion of technology". This theory examines the factors that affect how quickly new technology is adopted. He constructed a system of categorizing individuals according to their personal bias towards adopting new technology. Bachman et al describe these categories and relative proportion of people who fall into each category as: adventurous Pioneers (2.5%), respected Early-Adopters (13.5%), deliberate Early-Majority (34%), skeptical Late-Majority (34%), and suspicious Laggards (16%). It might be instructive to ponder where you fall in this taxonomy. It might be personally gratifying to describe myself as an adventurous pioneer, but I suspect that most of my colleagues would more likely place me in with the suspicious laggards. More likely I am in the skeptical late-majority group. You might be tempted to think that early adopters are more progressive and enlightened, while skeptical late comers are holding back the inevitable march of progress.

I think it is actually much more complicated than that. If new technologies had been thoroughly tested and proven to be not only safe, but beneficial to our patients prior to introduction to the general clinical community, then I would happily get on the bandwagon and party with the adventurous pioneers. But this has often not been the case. There are lots of examples of technologies that have been introduced over the years in respiratory nation that have in been widely adopted, only to learn later that they were often of no benefit to patients and sometimes harmful. I do not have space in this column to elaborate much on this uneven history, but I do describe some of it in my book. (Managing the Respiratory Care Department. Jones and Bartlett. 2008). Feel free to shell out for a copy. Me personally, I think it is worth every penny.

I once had a therapist ask me why it was that he could not get more neonatologists to put babies on HFOV earlier. I told him that the evidence was equivocal. I pointed out there are several large multicenter randomized controlled trials of HFOV that have different findings. Some show a modest benefit, some show no benefit, and some show worse outcomes when compared to conventional mechanical ventilation. Twenty years into the journey and some of the questions about high frequency ventilation remain unanswered. Thus you have a neonatal community that has very uneven utilization of this technology.

The other side of the coin reveals that there are well proven therapies and technologies all over the health care universe that ought to be widely adopted but are not. I have always thought this was largely because of the application of Newton's first law, which can be very loosely transliterated in this context as, "the



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TABLE ONE: RATES OF UTILIZATION AND EVIDENCE SUPPORTING THE USE OF FOUR NEONATAL RESPIRATORY TECHNOLOGIES*

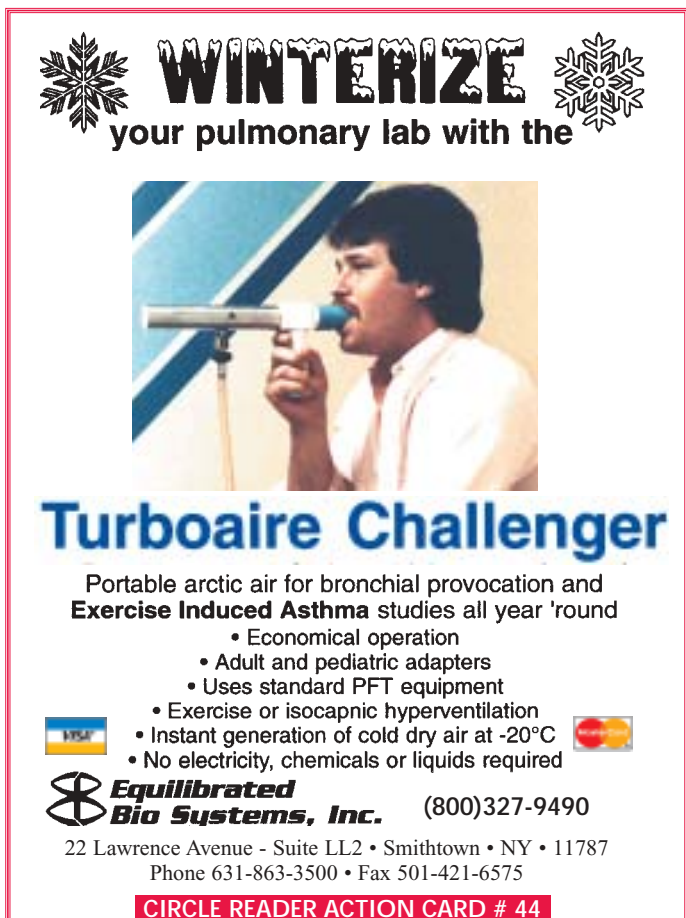
INTERVENTION	STRENGTH OF EVIDENCE	SELF REPORTED UTILIZATION **	ESTIMATED GENERAL UTILIZATION
EARLY HFOV FOR RDS IN NEONATES	CONTRADICTORY	74%	< 6%
HFOV FOR ARDS IN TERM INFANTS AND CHILDREN	POSITIVE BUT LIMITED	82%	>84%
NCPAP FOR NEONATAL WEANING	STRONG	95%	>84%
NCPAP TO AVOID NEONATAL INTUBATION	NONE	95%	< 16%

* ADAPTED FROM *INTENSIVE CARE MED* 2008 JAN; 34(1):174-8).
 ** THE READER SHOULD REMEMBER THAT THESE RATES OF UTILIZATION ARE AMONG ATTENDEES AT TWO NEONATAL VENTILATION CONFERENCES AND DON'T REALLY REPRESENT THE NEONATAL COMMUNITY AS A WHOLE.

most immutable force in all creation is inertia." But it seems my explanation is somewhat simplistic. Professor Rogers also constructed an interesting conceptual framework for why adoption of innovation sometimes lags behind. These factors include scientific rationale (complexity), evidence of advantage, compatibility, trial-ability, and observe-ability. To quote Bachman et al, "The first of these other factors is "complexity," which translates to scientific rationale. No medical advance is seriously considered without a clear understanding of the mechanism of action. "Observe-ability" refers to the ability to readily see differences resulting from the new technology. "Trial-ability" refers to the ease by which the new technology can be tried. Finally, "compatibility" refers to how the new technology fits with the social and technical infrastructure." I found these concepts to be very enlightening and I plan to study and try to understand the complex factors that affect new technology adoption.

Such is the state of affairs. We need to continue to unflinchingly demand that practice be evidence based. Of course we don't always have evidence to support the things we are already doing and there is little chance that much of current practice will be subjected to the kind of scientific rigor that would be needed to prove benefit to patients. As long as there is this evidence gap (which will basically probably last, well, forever) we are forced to use all our faculties including experience, judgment and reason to guide some of our practice. But what we could do is put some more rigorous evidence based requirements in place for the introduction of new technology. As painful as this sounds, I think we should effectively slow down the introduction of new technologies, requiring that the have been clearly shown to be of benefit to patients. Whenever possible this should be done with large randomized trials. Remember that the burden of proof is not on the skeptic. It is on the interventionist. If Dr. Casey wants to use alcuritol to treat fever, and you object, you do not have to prove that alcuritol does not work in the treatment. Instead Dr. Casey must prove that it does.

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