Lung protective strategies in an award-winning children’s hospital lead to reduction of ARDS mortality from 50% to 12%
Arkansas Children's Hospital is a non-profit organization and one of the largest institutions for children in the United States. It has received national acclaim as one of the best children’s hospitals in the country, with recognition from Child magazine and U.S. News and World Report.

The hospital’s Pediatric Intensive Care Unit, Neonatal Intensive Care Unit, Cardiovascular Intensive Care Unit and Burn Unit admit and treat over 3,000 patients a year. Many of these patients are transported to the hospital by means of two helicopters from a surrounding five-state region. The extremely high patient acuity at this institution, and comprehensive research programs conducted at the non-profit Arkansas Children’s Hospital Research Institute, require continuous refinement of ventilatory care procedures by staff for the broad range of conditions that the children present with.

Critical Care News talked to Professor Mark Heulitt MD about his experiences of the challenges in research and treatment of pediatric and neonatal patients.

Lung protective strategies in an award-winning children’s hospital lead to reduction of ARDS mortality from 50% to 12%

Can you briefly describe the unique environment here, in the hospital and in the PICU?

I have been working here for 15 years. I did two fellowships, one in neonatology at Duke University in North Carolina and one in pediatric critical care medicine at Southwestern University in Texas. I came here to Arkansas Children’s in 1990, and started as an Assistant Professor. But now I am a full Professor in Pediatrics, Physiology and Biophysics.

This hospital is an amazing place to work. We are constantly expanding, and it is truly an institution focused on children’s needs. We invest a lot of effort, energy and money in ensuring that this is a good environment for our children. Everyone likes to work here, as it is a very positive environment where the attitude is always “how can we help this?” and never “I can’t do that.”

We had a problem recently. I called one of the senior management and said something wasn’t working and it was fixed within 45 minutes. The focus here on service is phenomenal.

The unique aspect of our PICU is that we are...
one of the largest in the US, especially when you take into account that we don’t have post-op heart patients here; our post-op heart children go to a separate ICU within the facility, the CVICU. There are PICUs that are larger than ours, but they are a mix of post-op hearts, general medical and general surgical cases. Our unit is medical, with neurosurgical, trauma and other post-op surgical cases. A 26-bed PICU like we have here with that kind of mix is very unique. Our PICU nurses are great; they could work anywhere in the hospital since they do just about everything here. For example, you could have one neuro ICU patient with increased cranial pressure, and in the next bed you could have a septic shock patient. Our PICU nurses are well trained and can take care of a diverse range of problems.

It’s amazing how the environment of the PICU changes from day to day and hour to hour. Right now in the summer we see a lot of neuro ICU patients. Being the only children’s hospital for the state, we get our regional patients from Missouri to the north, and from Texas to the west. From the south we get a lot of patients from Louisiana, and from the East they come from Tennessee and Mississippi.

We have patients from this large area since we have facilities that the other states just don’t have. There are other children’s hospitals in this region but they don’t have the broad specialty areas we offer.

What are some of the challenges of pediatric and neonatal ventilation therapies, as opposed to treating adult patients?

Kids are definitely very different to adults in terms of anatomy and physiology. They are more than just a smaller patient. They are dynamically different. We like to term them as “God’s work in progress.” The way they breathe is different. So a ventilator must meet certain needs in the pediatric patient that are different to the adult patient. In the newborn period, a child may breathe 60 breaths per minute or more. The ventilator has to cycle every second, in contrast to every 6 seconds for an adult patient. This puts a demand on the technology of the ventilator to rapidly respond to the patient’s needs. In one cycle per second there are an enormous number of things that must occur – prior to when the ventilator is triggered, to after the ventilator is triggered, to the phase of when air departs the lung during expiration. During that entire cycle there are many factors that can disrupt the synchrony of the patient and ventilator. The key to pediatric and neonatal patients is to have the...
technology capable to interface rapidly, and that is the nice thing about the SERVO-i ventilators and our use of them. There are two key components that really make a difference. One is a sophisticated flow delivery system that allows extremely rapid response between the patient and the ventilator. It is truly unique. It is active even during the expiratory phase, and it samples 2,000 times per second, which is amazing. The other key component is an interface that allows the information to be processed through the ventilator and can also provide information output to the physician for interpretation. At my research laboratory, we have worked with a number of models to evaluate the SERVO-i and continuing developments to it. We can ventilate animals as small as 25 grams with the SERVO-i with no difficulties. With our animal models, we can replicate some of what we are doing up here in the ICU, as well as evaluating and trying out new ideas as we make technological changes.

Children are unique not only in terms of development of their lungs, but also of their brains. The ability to interface on a number of different levels is very important. I speak at a lot of meetings and lectures, and I am usually the lone pediatric representative. But what works in adults does not work in children; it is more than simply an issue of size. The ventilator we use has to have the capability to take into account these dynamic differences we see in the children, to meet the patients’ needs. When we talk about ventilation, we are talking about three things: the equipment, the patients and decision-making. With this new technology, by providing better information, the clinician is able to make better decisions. In previous years, we didn’t have this information. You put the patient on the ventilator and the patient and ventilator fought back and forth, until the patient became exhausted and did what the ventilator wanted to do. Now we have the capability to form an interface between the patient and the ventilator, to allow the clinician to make decisions. Our objective here in our patient care and in our research is to decide what are the best decisions to give the best care and get the best outcomes. The best outcome for us is the shortest time on the ventilator, getting the patients off quickly with the minimum amount of complications.

**What clinical difference does sampling 2,000 times a second make?**

It really makes a difference in our research. When you look at sampling 100 times per second, or 200 times per second, there is an enormous amount of information that is lost. In the respiratory cycle there are certain phases that are very dynamic. An enormous amount of information is necessary for the patient to be synchronous with the ventilator, for the patient to be comfortable, and for gas to be delivered properly. These dynamics occur during those phases, and if you’re not adjusting for that information, the patient can head in the wrong direction, especially in pediatric and neonatal patients with these short cycles. In adult patients it may not be as important, but it is always important in cases where the patient and the ventilator are asynchronous. The ventilator technology pays its dividends in that subset of patients who are on the ventilator for a long period of time and are very sick. This is where these differences in speed are really significant. We all believe that these patients should be breathing spontaneously, and not heavily sedated with blocking agents as there are a lot of problems associated with these. That will delay the healing process.

**What different categories do you have throughout the year?**

We get the whole gamut of pediatric problems. From a seasonal standpoint, we see a lot of trauma in the summertime. In the fall months, we see more respiratory problems as temperatures drop and the asthmatics start to suffer. In wintertime, we see patients with RSV – respiratory syncytial virus. This is partly due to the fact of the changing environment. We see some patients here with unique metabolic disease; we have a large sickle-cell population in this state, we have CF patients and follow them to adult stages. Other types of infections that we are seeing right now include pertussis – there is a very large outbreak right now. Children and babies are coming in prior to their immunizations. Pertussis in adults and immunized children presents with the same symptoms as a cold. But babies and children who are not immunized can be severely affected. It is a unique disease that requires a ventilator to meet our needs, since pertussis patients have conditions that can change dramatically in a short period of time. The patient may be on the ventilator and be doing well, and suddenly have a paroxysmal coughing episode. A lot of dynamics can happen, and this is when a ventilator with response of 2,000 samples per second can make a big difference. What can you do? Give the patient high doses of drugs and paralysis agents, and wait for them to recover, but that is not good since it will...
extend the time on the ventilator. We prefer the patients and ventilator to work together in a way that the patient’s needs are being met.

We see everything. We also have a very large burn unit here, with a director who is an ex-burn victim himself. We work very closely together. Burn patients who are very complicated from a respiratory point of view are transferred up here to the PICU. If the burns are more complicated, we cover the respiratory needs in the burn unit.

What range in ages do you see in your ICU patients?

We take care of babies who have been sent home, but come back to the hospital with difficulties. So our age groups range from neonates up to patients of 21 years of age. But in some cases we do admit older patients who may have a unique need that requires treatment in our center, which no other center can administer. So we do have patients in their 40s and 50s who also come for support on our ECMO system.

Do you have any standard ventilation protocols for different patient categories?

We have pretty much standardized our approach to PRVC-Volume Support. When a patient comes in we use PRVC with a protocol, and when they begin to trigger, we switch them over to Volume Support. We also use Automode to allow the patient and ventilator to interact. We keep them on Automode and Volume Support until the FiO₂ is less than 30%, the PEEP is 6 or less and peak inspiratory pressure is 20 cm H₂O or less. At that point, we extubate. We have outstanding results utilizing this approach. In ARDS patients, we have reduced mortality rates from 50% to 12% since 1991.

What are your clinical experiences with regard to upper airway mechanisms in small children?

We do a lot of non-invasive ventilation support, without endotracheal tubes. To be able to do non-invasive ventilation with SERVO-i will serve a lot of patients here who need positive pressure support, but don’t need an endotracheal tube. In my research, we look at the way the airway as it responds to bronchodilators, and what happens to children. When children grow, their lungs grow faster than their airways do. So the airways take some time to catch up, and many people don’t realize this important fact. We have been able to demonstrate this in a rat model with constricted airways, to simulate the development that happens in children. So we can look at what happens when children become sick, and what happens when we put them on positive pressure ventilation. This teaches us, and supports the educational effort, that a one-month old is much different from a one-year old, who will differ greatly from a five-year-old, who is in sharp contrast to a ten-year-old. We need to meet very specific needs in each different age group, and we need to identify their requirements: pharmacologically, mechanically and from technique and decision-making standpoints.

In my research we intubate rats from 2 weeks of age on, or about 25 grams in weight. With the technique we have developed here, we can visualize the airway with the tube in, and extubate and recover the rats with a 96-98% survival rate. This allows us to study them over time, to monitor developmental changes that occur rapidly, as rats reach maturity within 2-3 months. The human developmental rate is obviously much slower, and would require years to do the same research we are doing on the animal models. It gives us the capability to observe these dynamic processes, which we can apply by means of the ventilator to other research, such as gene therapy in asthma. We can take different points of research and combine them and streamline them to provide more information than we have had in the past.

Your institution has gradually replaced the SERVO 300 ventilators with the SERVO-i platform. From a clinical perspective, how does SERVO-i compare to the previous product generation?

The SERVO 300 was an outstanding ventilator, but a bit intimidating. From my perspective, the SERVO 300 took time and had a steep learning curve. The SERVO-i interface is phenomenal: in a very short period of time you can learn to use it and get a lot of information. It is very intuitive. The graphics allow for physiological output and data that is minimally filtered, and the rapid response rate and sampling are so high that you can easily interpret the graphics and see what is going on with your patient. Some of the problems with other graphic packages or interfaces are that they are so heavily filtered or have sample rates so low that you clinically lose the decision-making opportunities. Every breath looks exactly the same and the patient looks wonderful in graphics, but terrible at the bedside. Something is missing, and it is usually the inferior graphic interface that is hiding something. The SERVO-i graphic interface is also beneficial from a teaching aspect, since I can teach a resident about some of the activity on the screen, and we can go back and identify key events and learn about them. The answer is not to heavily sedate the patient, but to solve the problem and fix what is going on in that particular condition.

We are still using some of the same modes as we did with the SERVO 300, but some of the advances in SERVO-i in terms of weaning support are distinctly different. And some developments such as the Open Lung Tool allow us to see changes in our patients that were not possible before. I personally use the Open Lung Tool in patients with pulmonary collapse or severe atelectasis, where their peak inspiratory pressure is no greater than 35. In these types of situations we are beginning to use the Open Lung Tool instead of the oscillator. But not every

PICU staff members Jay Duncan MD, Patricia Bryon (PICU social worker), Mark Heulitt MD, Sharon M Goodman MD and Matt Jaeger MD
lungs is recruitable. There are a number of dynamic processes going on. But if you need to re-establish the lungs to establish adequate gas exchange, the Open Lung Tool may be used.

We recently had an interesting case relating to this: a young man with gram-negative septic shock. In the old days, that would be somebody who would not do very well, with septic shock, lung disease, and a downward spiral. Part of the reason for that downward spiral would be that even as we started curing the sepsis, we would be damaging the lungs, which would deteriorate. In this young man, we had the septic shock under control within 48 hours, and his lungs are doing great. I started out with the Open Lung Tool and went over to adequate levels of PEEP. The Open Lung Tool helped to define the levels of PEEP that would be adequate, and he slowly started to respond positively.

We have done a lot of training with the Open Lung Tool, and we have provided training to physicians from other institutions as well. We are thinking about putting together a symposium for mechanical ventilation every other year in the U.S. The European counterpart in Montreux, Switzerland is a great opportunity for physicians to get together and learn and define new opportunities for treatments. We hope to have a lung recruitment symposium here in our research facilities during 2007, and offer lung recruitment training possibilities for remote participants who can’t physically join us. There are a lot of opportunities for teaching, and physicians want to learn how to protect the lungs earlier, from the first breath.

How have you managed the transfer of technology from a practical perspective?

We have 54 SERVO-i units in the PICU. We had 50 SERVO 300s, and we slowly phased in the new technology, and donated some and released some. We have a relationship with an organization in California, who have helped us transfer equipment to a hospital in the Philippines – the National Children's Hospital in Manila – as we have upgraded our fleet. It is all working equipment that they can make good use of, and it is a good feeling that it can be used to save other children's lives.

All the intensive care units now have SERVO-i. When you have one platform, it is so much easier to deal with. There is no perfect system out there; they all have their positive and negative points. But when you have three or four different ventilator models within an institution, you are constantly faced with negatives, as it generates confusion for the staff, for the rotating staff, for the clinicians, for staff wherever you need to use it right. We use SERVO-i as our mainstay. We use the oscillator as our secondary option, and we use ECMO in our tertiary care. Between these three, we can meet any patient's needs. Since introduction of SERVO-i and the Open Lung Tool, we are using much less of the others. It's now rare for us to use ECMO. And high frequency is now only used if we cannot recruit the patient's lungs with conventional ventilation.

The SERVO-i is extremely accurate in its measurements of volume, in contrast to SERVO 300, which was not at that level. We recognize that 1 cc or 2 cc per kilo can make a significant difference. We know that we need to know more in pediatric and neonatal patients. As clinicians, we need to know that we are accurately delivering volumes. And that is a benefit of using SERVO-i.

What do you see as the most significant development in ventilation therapies over the past decade?

Definitely lung-protective strategies. I wrote the first review paper in 1994 or 1995 on recommending protective ventilatory strategies from a pediatric standpoint, with 150 references. Lung protective strategies are currently the major therapeutic consideration. In the future, I think the focus will be patient-ventilator synchrony, and what happens when patients are on the ventilator 24 hours a day. Marco Ranieri presented some fascinating research recently about what happens when patients are sleeping and how they interact with ventilators. It started me thinking along the same lines in pediatrics, since this is an area where we know very little. When you look at logs, it is not uncommon that patients have problems at night. We really need to focus our attention on how the patient and ventilator interface together. Currently, the Open Lung strategy and other lung recruitment

Laura Huber, RRT-NPS in NICU with 1.5 kg twin born at 30 weeks gestation, treated for respiratory distress syndrome
Lung/lung protective strategies are still important to research, especially in children. We have seen that by simply modifying our approaches in children, we have improved mortality, without any big studies. But we still need to address these issues.

### Biography

Mark Heulitt, MD, FAARC, FCCP, FCCM, is Professor of Pediatrics, Physiology and Biophysics at the University of Arkansas Medical Sciences School of Medicine; Associate Medical Director of Respiratory Care Services at Arkansas Children’s Hospital; and Director of the Applied Respiratory Physiology Laboratory at Arkansas Children’s Research Institute.

He initiated his training as medical doctor at Far Eastern University in Manila, Philippines in 1982, with internship, residency and the position of Pediatric Chief Resident at St. Luke’s-Roosevelt Hospital at Colombia University during 1982-1986. His Neonatal-Perinatal Fellowship was obtained at Duke University Medical Center 1986-1988, and his Pediatric Critical Care Fellowship at Southwestern Medical School, Children’s Medical Center, University of Texas from 1988-1990.

He started working at the Arkansas Children’s Hospital in 1990 as Assistant Professor Pediatrics in Critical Care Medicine, and was named Co-Medical Director, Mobile ECMO, in 1992. He has held his current position as Associate Medical Director of Respiratory Care Services since 1993.

Mark Heulitt has won numerous awards and honors within the areas of critical care medicine and respiratory care, including the Strathmore’s Who’s Who list for 2001-2002 and the A Gerald Shapiro, MD Award from the New Jersey Society AARC for Outstanding Leadership in Respiratory Care in 2003. He has held several editorial assignments and positions for Critical Care Medicine, Pediatric Critical Care Medicine, Respiratory Care, and the Society of Critical Care Medicine.

Mark Heulitt has conducted substantial research in the area of critical care medicine and published numerous articles in peer-reviewed publications.

### References


### Books


| Respiratory Training and Education |

There are 151 respiratory therapists on the staff at Arkansas Children’s Hospital to serve the PICU, NICU, CVICU and Burn Unit, as well as patient air and land transports. Coordinating training and education procedures may be a challenge in this dynamic environment, but is of great significance for optimal workflow. Critical Care News spoke with respiratory therapists Randy Willis, staff development/clinical specialist for NICU, CVICU and PICU, and Ben Downs, staff development and education in respiratory care.

Ben Downs, RRT, Staff Development and Education and Randy Willis, RRT, Staff Development/Clinical Specialist for NICU, CVICU and PICU discuss the challenges of training and education

There is an extensive RT staff at this institution. How do you handle continuing education and training?

Randy Willis: Once a year we hold a conference to help our staff stay current, which is also offered to staff at hospitals in surrounding states. We conduct continuing education at this conference to assess skills validation and to discuss any new needs or issues that have developed that need to be addressed in education and training.

Ben Downs: We also have a new monthly program that recently started, which we are very proud of: the RCS Educational Rounds. It’s a wonderful opportunity for respiratory therapists to come together and review case studies and presentations on special topics. We also have physicians participating in the program. It has been very successful, and we are already booked into next year. It is also an opportunity for respiratory therapists to earn Continuing Education (CE) credits towards their licenses.

What is your objective with regard to continuing education and training?

Randy Willis: Our objective is to provide our RT staff with a minimum of 12 training opportunities per year. But I think that Ben and I have averaged at least 50 educational opportunities for our staff to attend this past year, either in meetings and presentations, or online training.

Ben Downs: We work together to develop a hospital online program for RTs to read about special new procedures, or to refresh skills in procedures that they have not used recently. We put together in-services online, visual tools as well as written tools that they can review and refer to.

What do you do about specific modes of ventilation or new techniques to educate and train on?

Randy Willis: This requires a lot of in-servicing. One example is our Burn Unit. They have used a lot of BiVent in their ventilation therapy, which the rest of us were not too familiar with. We suggested strategies to physicians to streamline our management. We contacted MAQUET, who coordinated with an RT specialist in Springfield, Missouri, who helped us set up new protocols and guidelines for respiratory management in our Burn Unit.
Most people here were familiar with in-services. This is important since we have a large RT staff here: 151 respiratory therapists, which means that training everyone can be a challenge at times. But we have in-services. When incorporating something new for everyone, it is especially important that everyone understands this new information.

Alot of the basic principles were the same, with the SERVO 300, but there were some jumps to understanding the new technology. It allowed us to provide the babies with pressure-supported breaths spontaneously and still have a controlled breath that is pressure regulated. It has become our primary mode in the nursery.

You have upgraded your ventilator fleet with new models in several ICU departments in recent years. How did you manage staff training?

Randy Willis: We now use SERVO-i in all of our intensive care units: Burn, CV, NICU, and PICU. We initiated starting switching in the PICU, Burn Unit and NICU. We transitioned with 20 SERVO-i ventilators, and developed in-service training for our staff to train on the new equipment. We contacted MAQUET, who sent in a clinical specialist and helped us set up a program. The specialist was here for a week, basically 24 hours a day, to help us implement the program initially. Even though we initially had had a few SERVO-i units that many of our therapists had exposure to, we wanted comprehensive training when the more extensive fleet was coming in.

Ben Downs: Most people here were familiar with the SERVO 300, but there were some jumps to understanding the new technology. A lot of the basic principles were the same, though, which made for an easier transition.

From an RT standpoint, what was your experience of the transition process?

Randy Willis: It went smoothly and flawlessly from our perspective. We like the new modes such as SIMV-PRVC, especially up in the nursery. It allows us to provide the babies with pressure-supported breaths spontaneously and still have a controlled breath that is pressure regulated. It has become our primary mode in the nursery.

Ben Downs: We had the basic skills from the SERVO 300. When we switched over to SERVO-i, the biggest thing was going from a ventilator where you turned knobs to touchscreen and graphic presentation of information. The learning curve on the pre-use check and flow module took a little time. We had some challenges in teaching everyone how we were addressing the circuit compensation, making sure that everyone understood how to handle it, especially with our smallest patients.

How does having one platform in all departments affect the respiratory therapists?

Randy Willis: That works well for us, especially with 151 respiratory therapists in all of our ICUs. Some of the RTs are dedicated to the PICU, NICU, Burn Unit, etc; we have 3-4 core therapists on every shift, but we also have a large number of staff who rotate between the units. SERVO-i works great in this respect. Staff are pulled to different units, depending on patient volumes. They find the same ventilator and can provide therapy no matter where they are for that particular day, for infants or larger pediatric patients. It greatly minimizes the risk for errors, which easily happen if a hospital is using five or six ventilator models. It’s scary enough if you are used to working in one unit and are pulled into another department needing extra staff. It’s reassuring to have the same familiar ventilator platform wherever you go.

What are the proportions of helicopter transports to ambulance transports?

The majority come in by helicopter. Ambulances are used for cases where weather prohibits air transport, or the helicopter is down for routine maintenance.

Do the respiratory therapists accompany patient transport flights?

We have different teams that accompany the different types of patients. For nursery patients, a nurse and a therapist. For all other transports there is a physician, a nurse and a respiratory therapist in attendance. For twins, we have double teams from the nursery.

How many patient transports are planned, versus emergency?

For the nursery they are almost always unplanned. We don’t know until they deliver the babies. The patients will be coming from smaller hospitals, and we are taking them, but many of these are emergency situations with patients who need to be stabilized. We have roughly 150-170 patient air transports per month, so the numbers are quite substantial. There are three teams on call at all times, with a fourth team that can be called in if needed.

What are the most important factors in terms of treatment when transporting a ventilated patient by helicopter?

Ideally, the patient should receive the same ventilation therapy in air transport as he does in the ICU, since we are dealing with the same problems and complications. The traditional transport ventilators are limited therapeutically to just a few ventilation modes. When we first started out in the nursery we saw babies coming in on pressure-controlled ventilation. If we could match that situation with PRVC, we could keep the same lung protective strategy and follow the patient clinically in a more optimal manner.
Comprehensive respiratory research

The Arkansas Children’s Hospital Research Institute (ACHRI) is a non-profit organization owned by Arkansas Children’s Hospital. It provides research programs in infectious disease, endocrinology, osteogenesis and pediatric pharmacology, and is home to the Center for Applied Research and Evaluation. Critical Care News met with Mark Heulitt and research respiratory therapist Shirley Holt, RRT, to hear about the intensive care research projects to evaluate and modify ventilation therapies for the smallest of neonatal patients.

Can you tell us about some of the innovative research and work on methods you are conducting here?

Mark Heulitt: We have a number of computer systems measuring in milliseconds when we conduct ventilation therapy research on animals. We can validate directly from the ventilator to the computer system, and at all times look at this information together and analyze it. That allows us to change things when we are trying to validate new equipment, or evaluate protocols that need adjustments. We also have a state-of-the-art blood gas system, as well as Aerogen nebulizers. Our research lab is essentially a mini ICU; we have all the capabilities that the intensive care department offers right here in our laboratory.

We also use a forced oscillation respiratory mechanics system. This is a computerized ventilator that is connected to a cylinder and piston. The computer knows the position of the piston at all times and the diameter of the cylinder. This system allows us to utilize a forced oscillation technique, to make respiratory mechanics measurements. We are not dependent upon gas flow moving in and out of the lungs; we are dependent upon measurements moving in the system. When utilizing this system, we are able to determine the resistance of the endotracheal tube and subtract it. This gives us the capability of obtaining very accurate measurements in very small models – animals down to 10 g. The system is extremely sensitive. We are currently using this on intubated subjects, and are modifying it for use in non-invasive ventilation.

Shirley Holt: We have modified masks for use in non-invasive ventilation in our pig models, and we can intubate and ventilate rats as small as two weeks old. To intubate our rats, we use IV catheters. We can subtract the resistance in the system, so we can get very accurate measurements in developmental models. Since rats grow so quickly, they are ideal models for respiratory dynamics. The same measurements would take years in human growth development. We have different sized cylinders, so we can treat and analyze patient data from animals as small as 10 g up to 10 kg in size.

Our data collection system allows us to download information collected at the patient’s airway, as well as hemodynamic and continuous blood gas information. In addition we utilize the SERVO-i ventilator, which is microprocessor based, and have the capability to receive a signal directly from the ventilator that allows us to see when the inspiratory valve opens. This lets us see when the patient took a breath and when the ventilator responded to that breath. It enables us to do very sophisticated research.

Are there any problems with leakage with the rats intubated with IV catheters?

Shirley Holt: No, we use several different sizes. For the tiniest animals we use the smallest IV catheters available, and for larger animals we go up to the 14 Fr size. We almost never have leakage problems.
Maintaining cost efficiencies in respiratory care

Providing quality respiratory care service in a non-profit environment at one of the largest children’s hospitals in the United States creates special challenges for administrators who must also maintain cost efficiencies. Critical Care News discussed these challenges with Patty Burge, RRT, Director for Respiratory Services at Arkansas Children’s Hospital.

This is a non-profit organization. What are your objectives regarding cost efficiency for respiratory therapy services?

Our main objective is quality patient care. As far as cost savings are concerned, we have found it very beneficial to have one ventilator platform for use throughout the institution. I have a very large staff of 181 employees. To ensure that everyone is proficient on the equipment to be used, it has been very beneficial to streamline everyone’s training to one single ventilator platform.

We have one of the largest RT departments in the United States. The therapists are working throughout the hospital, and in all of the intensive care environments. We have a very high acuity here; we average around 50 ventilators, where the average children’s hospital has between 25 and 30 ventilators running on any given day. We have 112 intensive care beds, which also contributes to our high acuity.

What were the key factors that contributed to the decision to invest in one fleet of ventilators?

We have used SERVO ventilators for many years. We had the 900B and 900C, and the SERVO 300, so the SERVO-i was a natural progression. It’s ideal because it can be used on patients from tiny infants all the way up to adults.

We started by replacing the SERVO 900. We usually purchase about 20 ventilators at any given time, so the replacement process occurred naturally and gradually over a period of time.

A big advantage has been the work of Dr. Heulitt and education of the medical staff in the uses of SERVO-i. They respect his research and they have accepted his recommendations for use of the ventilator.

Will there be continued growth of respiratory services in the future?

I started here as a supervisor of the pulmonary lab in June 1980. At that time there were only about 18 respiratory therapists. We have seen enormous growth and the acuity is extremely high. We are the only children’s hospital in a large area, and I am sure that the patient admissions will continue to increase in the coming years.

The intensive care environment is oriented towards children, with bright colors, murals and light. The institution was recently entirely remodeled.

Patty Burge, RRT, Director for Respiratory Services

Pediatric patient on pet therapy day. The Arkansas Children’s staff may enroll their pets in a three week training program. When pets are approved, they visit the hospital once a week, at the wards and in play areas.