



# Education

Bulletin

Mar./Apr. '00

2

**Education Specialty Practitioner of the Year:  
Patricia Munzer, MS, RRT**

**From the NBRC:  
Credentialing Examinations  
Computerized**

4

**Recruitment: The Magic  
Is in the Mix**

5

**Favorite Web Sites**

**The Use of Nitric Oxide  
Ventilation in  
Acute Respiratory  
Distress Syndrome**

7

**Diversity Workshop to  
Expand Sensitivity,  
Awareness**

8

**Specialty Practitioner  
of the Year**

**American Association  
for Respiratory Care**

## Notes from the Editor

by Arthur Jones, EdD, RRT

Although I was a mere child at the time, I can recall back to the 1960s when BF Skinner's genius gave rise to "teaching machines" for public school classrooms. Reputedly, these devices would teach kids everything they needed to know, at their own pace, while making classroom teachers a redundancy. Then, in the 1970s and 1980s, computers were going to do the same thing. Now, various forms of distance education, such as web-based and video-conference technology, are being touted as capable of accomplishing similar goals.

Granted, web-based and videoconference instruction have many appealing attributes. For one thing, students do not have to travel far from home to take the courses they want. These media are convenient, as well as economical. Furthermore, the opportunities afforded to practitioners who want to advance their education beyond the associate degree level are tremendous. So, will distance education technology replace the classroom teacher?

We are fairly certain that we won't be able to teach many laboratories or any clinical rotations via distance technology. But it seems that many of our lecture courses could be taught by some type of medium

that reaches beyond traditional classroom time and space. As with the previously tried instructional media, millions of dollars have been spent under this assumption. Only time will tell whether the present distance education "bandwagon" will produce the desired results and continue to proliferate. And student characteristics, rather than the invested time and money, will actually determine the success or failure of this model. Compared to the traditional classroom, learning by distance technology is relatively autonomous. Therefore, student characteristics critical to the success of such an endeavor include organizational skills, diligence, metacognition, and self-discipline.

So, fellow educators, what are your predictions on the outcomes for distance education, in general?

Perhaps those of you who have dabbled in distance education would like to share stories of your successful ventures, commiserate over those that were less-than-successful, or provide advice for those considering distance education through an article in this publication. We would like to hear from you. ■

## Notes from the Chair

by David W. Chang, EdD, RRT

As I embark on the second year of my two-year term as chair of the Education Section, I would like to take a moment to thank everyone who has assisted me along the way, including all of our section members, committee chairs, and committee members. Change and progress in the section are only possible through the tireless efforts of these individuals. In particular, I would like to thank Linda VanScoder (Education Annual Committee), Debbie Lierl (Long-Range Planning Committee), and Tim Opt'Holt (Program Planning Committee) for their outstanding service as chairs of their respective committees. They completed their terms at the end of 1999, after years of service on many different

committees and in many capacities. Thank you, Debbie, Linda, and Tim!

In January, another group of dedicated educators assumed the roles of committee chairs (see below). I ask you to give them the same level of support that you have provided in the past. And as always, if you would like to serve on any of these committees, please contact the chairs directly by mail, e-mail, or phone.

- Arthur Jones, Chair, Publications Committee (1999-2000), University of Texas Health Science Center of San Antonio, Department of Respiratory Care, 7703 Floyd Curl Drive, San

"Notes" continued on page 2

"Notes" continued from page 1

- Antonio, TX 78284-7784, (210) 567-8857, FAX (210) 567-8852, jonesap@uthscsa.edu
- Terry LeGrand, Chair, Nominating Committee (1999-2000), University of Texas Health Science Center of San Antonio, Department of Respiratory Care, 7703 Floyd Curl Drive, San Antonio, TX 78284-7784, (210) 567-8855, FAX (210) 567-8852, legrand@uthscsa.edu
  - Gudi Pryor, Chair, Abstract and Poster

- Presentation Committee (1999-2000), Washburn University of Topeka, 1700 SW College, Topeka, KS 66621, (785) 231-1010 (ext. 1287), zzpryor@washburn.edu
- David Shelledy, Chair, Education Annual Committee (2000-2001), University of Texas Health Science Center of San Antonio, Department of Respiratory Care, 7703 Floyd Curl Drive, San Antonio, TX 78284-7784, (210) 567-8850, FAX (210) 567-8852,

- shelledy@uthscsa.edu
- Gina Buldra, Chair, Long-Range Planning Committee (2000-2001), New Mexico University Roswell, NM, (505) 624-7217, buldrag@lib.enmuros.cc.nm.us
  - Beth Ann Tinkler, Chair, Program Planning Committee (2000-2001), Georgia State University, University Plaza, Atlanta, GA 30303, (404) 651-1506, FAX (404) 651-1531, btinkler@langate.gsu.edu ■

## **Education Specialty Practitioner of the Year: Patricia Munzer, MS, RRT**

Promoting scientific investigation in respiratory care has been a major goal of the AARC over the past decade. During her

### **Education Bulletin**

is published by the  
**American Association  
for Respiratory Care**  
11030 Ables Lane  
Dallas, TX 75229-4593  
(972) 243-2272  
FAX (972) 484-2720  
e-mail: info@aarc.org

**Kelli Hagen**  
AARC communications coordinator

**Debbie Bunch**  
Bulletin managing editor

**Edwards Printing**  
Bulletin typesetting

*Chair*  
**David Chang, EdD, RRT**  
Respiratory Therapy  
Columbus State University  
4225 University Avenue  
Columbus, GA 31907  
(706) 568-2469  
FAX (706) 569-3101  
e-mail: chang\_david@colstate.edu

*Bulletin Editor*  
**Arthur Jones, EdD, RRT**  
Department of Respiratory Care  
The University of Texas Health Science  
Center at San Antonio  
7703 Floyd Curl Drive  
San Antonio, TX 78284-7784  
(210) 567-8857  
FAX (210) 567-8852  
e-mail: jonesap@uthscsa.edu

*Medical Advisor*  
**Richard Sheldon, MD (ATS)**  
(909) 792-7563  
FAX (909) 792-1641

tenure as chair of the Education Section's Abstract and Poster Presentation Committee, Pat Munzer, from Washburn University in Topeka, KS, accomplished that goal and more. "Over the years, the quality of submissions and presentations has been on the rise," says Terry S. Le Grand, PhD, RRT, a colleague from the University of Texas Health Science Center at San Antonio. "I think Pat is mainly responsible for the recent advancement in the area of educational research and scholarship."

While serving as Abstract and Poster Presentation Committee chair, Munzer both promoted educational research to her colleagues and worked with them to ensure that submissions and presentations alike met high standards. The result has been an increase in

the number of education-related Open Forum and Summer Forum presentations.

"I can honestly say that the presentations are the highlight of the Summer Forum and International Respiratory Congress," says Le Grande. The increased popularity of the presentations has also led to a more open dialogue between members of the educational community regarding the best methods to employ in the training of new members of the profession.

Munzer believes membership in the section has afforded her the opportunity to "network with others who are also trying to advance the respiratory therapy profession . . . why reinvent the wheel when there is probably an educator out there who has been there, done that?" ■

## **From the NBRC: Credentialing Examinations Computerized**

*by Gary A. Smith, associate executive director, NBRC*

The arrival of the new millennium also ushered in a new era for respiratory care credentialing with the computerized administration of the national examinations in 2000. Not since the Clinical Simulation Examination replaced the RRT Oral Examinations in 1979 has respiratory care credentialing experienced such a major change. This article briefly describes some significant aspects of the change to computer-based testing (CBT). For additional information, I encourage you to visit the NBRC web site at [www.nbrc.org](http://www.nbrc.org).

### **Electronic eligibility database established**

Beginning this year, NBRC examinations will be offered daily (Monday-Friday)

via computer at AMP Assessment Centers located within selected offices of H&R Block throughout the country. A list of the testing sites and their addresses, as well as a link to generate specific driving directions, may be accessed via the NBRC's web site. Since candidates will now receive examination results upon leaving the assessment center, graduation from an accredited respiratory therapy education program is required before an individual's eligibility can be confirmed and a testing appointment scheduled. Thus, the previous "expected graduation" admission provision, which allowed candidates to apply prior to actual graduation, has been eliminated.

"NBRC" continued on page 3

"NBRC" continued from page 2

To facilitate prompt scheduling of program graduates for testing, the NBRC has established an Electronic Eligibility Database in which accredited education programs may enroll. Program directors were sent a mailing with enrollment instructions in late December. Unique passwords are issued to programs that enroll to allow them to electronically enter information about graduates of their programs via a secure area on the NBRC's web site. Thus, when a graduate's application for testing is received in the NBRC Executive Office, it can be expeditiously processed using the graduation confirmation supplied and endorsed by the accredited program. This service will help program candidates qualify more rapidly for daily, computerized testing appointments.

Enrolled programs agree to be responsible for the accuracy of graduation information transmitted to the NBRC via the eligibility database. Authorized users designated by the school are allowed to access the database and enter graduate information. The database is not intended to track graduates who completed accredited programs prior to January 1, and graduation dates prior to this date may not be entered. Additionally, graduation dates may not be prospectively entered in the database; the system will only allow graduation dates on or before the date the database is accessed to be entered in the system.

The NBRC hopes this system will be helpful to accredited programs and their graduates. In addition, it will likely serve as the basis for reporting convenient summary information about graduate test performance in the future. If your program is not enrolled, or if you need additional information, please contact me in care of the NBRC Executive Office.

### **Pretesting of examination questions**

The delivery of immediate examination scores on the day of testing has engendered another important change in the credentialing experience in 2000. Previously, in the pen and pencil format, new and untried questions were included in each form of the examination; the examination committees were able to review the performance of previously untried items, identify any questions that did not perform well, and implement scoring adjustments prior to the release of final examination scores to the thousands of candidates who attempted the national administrations of the respective

credentialing examinations. With daily CBT and immediate release of examination scores, such scoring reviews are not possible. Examination forms are now assembled according to an even more stringent test blueprint using only already tried items to ensure a constant level of difficulty, and the number of correct answers required to achieve a passing scaled score does not change when a candidate attempts a different version of the test.

With CBT, new test questions are pretested, and these untried items are not included in the candidate's score on the credentialing examination. For example, candidates will now answer 160 questions when attempting the Entry Level CRT Examination, but their score reports for the credentialing examination will reflect the number of correct answers out of the 140 previously used and scored questions included on the actual credentialing examination. The performance of items being pretested is reviewed by the respective examination committee before these items are eligible to be included as scored items on future versions of the credentialing examination. The number of items to be answered by candidates for all of the multiple-choice credentialing examinations is presented in Table 1. While the number of questions on each test has increased, the time limits for the examinations remain unchanged; examination committees believe the total number of questions presented to candidates and the total testing time remain within accepted psychometric guidelines.

**Table 1. Number of Questions for Multiple-Choice Examinations**

Test	Total Questions	Scored Items	Pretest Items
Entry Level CRT	160	140	20
RRT Written	115	100	15
Perinatal Pediatrics Specialty	140	120	20
CPFT	115	100	15
RPFT	115	100	15

### **Candidates can authorize release of test results**

For many years, respiratory care educators have been requesting that the NBRC release candidate names and test scores with program summary reports. The Board of Trustees recently adopted a new policy that allows the release of test scores with candidate names to education programs.

Beginning this year, the NBRC will

release names with examination results to accredited programs, provided the candidate specifically authorized such release by signing the statement in "Section IV. Education Information" on the new NBRC application. The names and scores for candidates who do not sign the release statement will not be communicated to schools in any identifiable manner. However, programs will continue to receive test performance summary data for all graduates. Program directors and other faculty should discuss the need for release of names and scores with their students, and they should always respect the student's privacy and concerns when reviewing or dealing with test performance information.

### **Future school summary reports**

The NBRC is planning to expand its web site to provide online access to school summary information to accredited programs. By this summer, program directors will be able to run test performance summaries for graduates who have attempted an examination from the web site via computer at their convenience.

It is important to note that the school summary reports for the final paper and pencil administrations of the national examinations in 1999 will likely be the last ones in the current format based on a single, national administration of an examination. Since CBT candidates will be taking multiple forms of the respective credentialing examinations, the performance of a program's graduates will be summarized by content

area over several different versions of the examination. Current plans are to make CBT summary information available to schools at least twice a year. However, we hope to allow program directors to generate their own reports over a specific date range for testing and possibly other sorting criteria such as graduation date. Program directors will likely be able to monitor the performance of their graduates on the credentialing

"NBRC" continued on page 4

"NBRC" continued from page 3

examinations as close to graduation and testing as possible.

The NBRC is also collaborating with the CoARC to develop specifications for a summary report that programs could generate to submit data with their CoARC annual reports and threshold information. We will continue to work with the accreditation process to ensure as much support from the

NBRC as is possible on this valuable tool.

The NBRC Board of Trustees and Executive Office staff have worked diligently to ensure that the transition to CBT would go as smoothly as possible, and we recognize the importance of adequate support to candidates for credentialing and educators. We will continue to work ardently to perfect the new credentialing activities

and ensure prompt and courteous service to candidates, educators, credentialed members, and others. We appreciate this opportunity to share information with members of the AARC's Education Section, and we welcome suggestions for improving credentialing services. ■

## **Recruitment: The Magic Is in the Mix**

*by Bob Langenderfer, MEd, RRT, respiratory care program director, Northern Kentucky University*

Effective recruitment is the sine qua non of program survival. When a lack of applicants threatens the viability of your program, which recruitment strategies can put you back in business? Here's what worked for our program.

In the spring of 1999, our recruitment efforts were almost fruitless. Despite open houses, ads in the campus newspaper, flyers posted on campus, and involvement in the usual campus recruitment activities, we didn't have enough qualified applicants to start the fall class. Informed of this situation in late spring, our dean told me to develop a recruitment plan that would get the program back on track and build a pipeline of applicants for the future, or face "reallocation of resources."

As a five semester, 74 credit hour associate degree program on a metropolitan university campus of 12,000 students, we felt that we had a lot to offer. Jobs for graduates and students were readily available. The community was very supportive, and the program's reputation was good. Why couldn't we get applicants? We suspected that poor name recognition and low public awareness of the opportunities available in the respiratory care program were the underlying problems, along with bad press about hospital restructuring and a strong economy with fewer displaced workers.

We met with the Advisory Board and consulted with the university's marketing and admissions offices to develop a plan. Our first decision was to set a target date for our efforts. New students usually begin the program in August with the fall semester, but we decided to rearrange the course sequence and to start a new group in January of 2000. We realized that to be effective, a recruitment plan would need to be tailored to fit our particular situation. We tried a lot of approaches; some worked and some didn't. Here are some of the components of our marketing plan:

1. We planned three open houses in the fall and two in the spring to serve as focal information sessions. To make them more convincing, we decided to invite graduates and clinical instructors, as well as full time faculty and current students.
2. We surveyed the local hospitals and home care providers and found that they had 30 current RC vacancies. We used this fact as evidence of job availability.
3. We attached stacks of tear-off business reply postcards to revamped program posters so that prospects could register for a specific open house and send us their name and address. We responded to each postcard with a personalized letter and a program brochure.
4. We updated our web site to include an online form to request information or to register for one of the open houses. Anyone submitting the form was sent a personalized letter and program information.
5. We spoke to high school science classes about the respiratory system and careers in respiratory care. We sent flyers with invitations to our open houses to high school guidance counselors. (Results from these efforts were meant to help build next fall's class.)
6. Accompanied by a cover letter from our medical director, we sent program posters with tear-off reply cards to 50 physicians' offices, including pulmonologists and allergists. (We had noticed that many of our students first got interested in the profession because of a personal or family experience with respiratory disease.)
7. From the university data base, we developed targeted mailing lists of current students with undeclared majors, good GPAs, and successful completion of human A&P or chemistry. Our mar-
- keting people told us that prospects usually need to receive a message numerous times from different sources before they will decide to act on it. So we looked for a variety of ways to publicize our program and profession.
8. Prior to each open house we sent marketing letters/invitations to the 300-400 names on each mailing list. Marketing people helped us revise our letters to make them short and focused on a few key selling points: a) short, intense two-year program, b) meaningful and personally rewarding work, c) ready placement in 30 local jobs starting at about \$30,000 a year, d) student employment in hospital RC departments.
9. We distributed a similar informational invitation to all 600 students in 30 sections of UNV 101 Orientation to College and Beyond, a preliminary course that covers study skills and university resources while introducing a wide variety of possible majors.
10. Prior to each open house we ran brief classified ads in campus and community newspapers, and we submitted succinct descriptions of the open houses to the community newspapers for their local announcements page.
11. At the majors fair that was a component of UNV 101, we set up a vivid display with a PB-7200ae ventilating our intubation manikin and RC students describing the program while measuring peak flows and oxygen saturations. Interested students were sent program information and invited to the next open house.
12. We made short presentations to the first year nursing students to inform them of the rewards and opportunities available in respiratory care, and we

"Recruitment" continued on page 5

"Recruitment" continued from page 4

invited them to pass this information along to interested friends and relatives.

13. All inquiries received a personal response via letter, phone call, or both. Current university students who met the admission requirements were informed of that fact in a positive letter. Weak students were encouraged to take needed courses during the spring so that they could begin RC courses in August.

Our recruitment efforts were successful. By December 10, 16 new students had met

the admission criteria, been accepted, and were registered to begin professional RC courses and co-requisite science courses in January. Twelve additional students had declared pre-respiratory care as their major and chose courses to prepare themselves to start RC in August. We were back in business!

In our situation, we found that letters sent to a pre-selected list of students with decent GPAs and undeclared majors were the most effective recruiting tools. The tear-off response cards also worked well, as did the web site's new online information

request form. The open houses provided a non-threatening forum for sharing success stories and admissions information. In our case, newspaper ads and posters in physicians' offices were not effective, but other programs have had good results with these mechanisms.

The key to any recruitment effort, however, is diversity. As our marketing colleague told us, "the magic is in the mix." Success came from a variety of recruitment tools applied energetically and with lots of personal follow-up. ■

## **Favorite Web Sites**

by David W. Chang, EdD, RRT and Arthur Jones, EdD, RRT

<http://www.dialpad.com>

Grade: B+

This site claims, "you may make unlimited free long-distance phone calls to anyone in the U.S. at dialpad.com. There's nothing to download or install —your web browser uses our Java-based technology to place call while you're online." Only a few minutes after joining as a member at no cost, I signed on and called from my computer-mounted microphone in Georgia to Art Jones in Texas. The sound quality was surprisingly good when I called in the morning. But the sound quality during peak hours was not so good. When I called my buddy, Brian Parker, in Florida at night, he had to call me back on a regular phone just to continue our conversation!

Dialpad is a big improvement over the traditional "webphone." With the web-phone, the caller and the receiver of the call use the computer speakers and microphone. With Dialpad, the receiver picks up the phone just as if he or she was getting call during dinner at home. However, Dialpad

does not support oversea calls, and at the present time the connection during peak hours is poor and you often get busy signals. Still, it is definitely worth your time to look into Dialpad.com if you make long-distance calls on a regular basis during the daytime! As computer phone technology makes further refinements, who knows what the future will hold for the long-distance carriers, as well as the users?

- David Chang

Stay out of Jail Free Site

<http://www.utsystem.edu/ogc/intellectualproperty/ogc.htm>

For various and sundry reasons, teachers have always been notorious for "borrowing" the work of others from published texts and other media. Although I have never been guilty of such dastardly practices, I have observed many of my colleagues borrowing text, diagrams, and photographs for their instructional materials.

Generally, one can get away with this within the confines of a classroom.

However, once an instructor considers transmitting his or her instruction through electronic media, the risk of getting caught and prosecuted increases tremendously. Therefore, it is important that we are forewarned and forearmed with knowledge of the laws that pertain to the use of copyrighted materials. This web site intends to provide that knowledge.

Attorneys on the legal staff at the University of Texas System researched current copyright law and assembled pertinent information in language that non-legal personnel can understand. Under "Links to Other Resources," there is a tutorial called the "Crash Course Tutorial" that provides the basics in copyright law for instructors. The site also provides a question and answer link directly to attorneys; however, this is intended for University of Texas System employees exclusively. So, if you are not one of those fortunate few, please do not try the Q&A.

- Arthur Jones

## **The Use of Nitric Oxide Ventilation in Acute Respiratory Distress Syndrome**

by Anne Edwards

**Editor's Note:** Anne Edwards is the 1999 recipient of the ARCF William W. Burgin, Jr., MD Education Recognition Award. She was recognized at the AARC International Respiratory Congress held last December in Las Vegas, NV. Anne is a student in the respiratory care program at Delgado Community College in New Orleans, LA. To obtain information on this and other competitive awards for RC students, contact the American Respiratory Care Foundation at (972) 243-2272.

Acute respiratory distress syndrome, also known as ARDS, was initially viewed as a surfactant abnormality similar to that seen in neonatal respiratory distress syndrome (Troncy 979). Today ARDS is characterized by sudden, generalized lung

inflammation that can induce non-cardiogenic pulmonary edema, pulmonary arterial hypertension, reduced lung compliance, and ventilation/perfusion mismatching which can lead to an increased intrapulmonary right-to-left shunt area and pro-

gressive systemic hypoxemia (Gerlach 184). Dr. Gordon R. Bernard defines ARDS as a PaO<sub>2</sub>/FIO<sub>2</sub> ratio of less than 200, bilateral infiltrates on a chest x-ray,

"Distress" continued on page 6

"Distress" continued from page 5

normal pulmonary capillary wedge pressure, and a risk factor. He also distinguishes between direct and indirect ARDS, with direct ARDS being from pneumonia, aspiration, near drowning, or other direct injuries to the lung. Indirect ARDS is a more systemic disease caused by trauma, burns, or sepsis (Branson 41-42).

The main treatment in the management of ARDS continues to be ventilatory support. Many different approaches are used in ventilatory support, including PEEP, inverse-ratios, pressure-controlled ventilation, high-frequency jet ventilation, permissive hypercapnia, ventilation in the prone position, and ECMO. These strategies are used to increase systemic oxygenation, reduce potential oxygen toxicity, and reduce barotrauma or volutrauma (Troncy 979-980). Other important factors include treatment of underlying causes of ARDS, preventing complications with careful monitoring, using sedation for comfort rather than paralysis, and using fluid and hemodynamic support (Branson 43). Careful monitoring, improved ICU care, and experienced respiratory therapists have decreased the mortality of ARDS from 60% to 40% over the last decade (Branson 89).

Inhaled nitric oxide (iNO) is a relatively new therapy being used in the treatment of ARDS. Intact vascular endothelium was found to produce vascular relaxation, and later, nitric oxide (NO) was identified as the active substance of the endothelium derived relaxing factor. The article, "Inhaled Nitric Oxide for Acute Respiratory Distress Syndrome" states that, "After inhalation, exogenous NO freely diffuses into the alveolar capillaries and within seconds binds to the heme group of hemoglobin with a 1500-fold higher affinity than carbon monoxide" (Gerlach 185). This led to theories of NO as a selective pulmonary vasodilator. In 1988 the first pilot study, conducted by Higenbottam, demonstrated that NO could indeed dilate pulmonary vessels without affecting systemic circulation (Gerlach 185).

A secondary hypothesis was that oxygenation in acute lung injury could be improved with iNO. Intravenous NO had been used until this time, but this caused diffuse vasodilation of pulmonary vessels and worsened oxygenation. Because iNO was delivered to the well-ventilated areas of the lungs, it would only vasodilate these areas. This caused an increase in oxygenation by avoiding an increase in ventilation/perfusion mismatch. Therefore, oxy-

genation would improve through reductions in venous admixture. The selective delivery of iNO and its brief duration of action make it effective in the increased oxygenation of ARDS patients (Hurford 360).

Another benefit is that iNO reduces pulmonary artery pressure without reducing systemic vascular pressures. Decreased pulmonary capillary pressure decreases pulmonary edema, improves lung compliance, and improves resolution of lung injury (Hurford 360). Studies also indicate that iNO not only improves oxygenation but helps eliminate carbon dioxide by improving ventilation/perfusion mismatch as well. These results were found in patients with greater than 50 mm Hg of PaCO<sub>2</sub> (Iotti 1169).

After two cases of poisoning by nitrous oxide anesthesia administration in 1967, attention was drawn to the acute toxicity of iNO. These issues have become important again with the increasing use of NO for therapeutic ventilation. Two studies were conducted with follow-up of patients treated with iNO. One study was on infants with persistent pulmonary hypertension of the newborn. The medical and neurological outcomes of these infants were similar to those of infants who were treated by conventional means. Also, 16 ARDS survivors treated with iNO were evaluated and found to have pulmonary impairment equal to that of ARDS survivors treated with other therapies (Hess 315).

One adverse effect of iNO is the dependence that occurs after long-term treatment. Weaning procedures are necessary to avoid rebound phenomena regarding both pulmonary hypertension and systemic oxygenation. The exogenously supplied NO inhibits the endothelial NO synthase and is probably the cause of the dependence of iNO. Thus, if NO is withdrawn suddenly, vasoconstriction in the ventilated areas may reoccur (Gerlach 185-186).

NO has also been shown to prolong bleeding time in healthy humans and inhibit platelet aggregation in patients with ARDS. After being exposed to iNO for 15 minutes, bleeding time increased by 33% in healthy individuals. Another study showed that while platelet aggregation and agglutination were significantly decreased in ARDS patients, the antithrombotic effect was not associated with a change in bleeding time (Hess 316). Serious bleeding disorders from NO inhalation, which can lead to cerebral hemorrhage and death, have been reported. This is an important consid-

eration for future clinical studies of NO inhalation, although so far none of the controlled clinical studies on ARDS patients have shown an increase in bleeding disorders (Gerlach 186).

In some patients with severe left ventricular dysfunction, high doses of iNO have been reported to decrease pulmonary vascular resistance and increase pulmonary capillary wedge pressure. Pulmonary venous return to the left heart is increased by the acute reduction of right ventricular afterload. Left ventricular filling pressure is then increased and could worsen pulmonary edema. iNO should be avoided in patients with severe left ventricular dysfunction, even though this effect may be dose related (Hess 317).

Another adverse effect of iNO is the production of methemoglobinemia. Normal blood levels of methemoglobinemia may be due in part to metabolism of endogenous NO, and levels below 5% do not require treatment. High concentrations of iNO, such as 2%, quickly produce methemoglobinemia and death in dogs, but other studies show that this is uncommon with doses used for NO ventilation. Four out of 177 patients in a randomized study of iNO in the treatment of ARDS had methemoglobin levels greater than 5%, but none had levels greater than 7%. Methemoglobin levels are directly related to the dose of iNO, and there has been no significant level of methemoglobinemia with the use of low levels of iNO (Hess 319-321).

In very high concentrations, iNO may have a direct toxic effect on the lungs. The lungs go through histologic changes, such as edema, focal collapse, hyperinflation, intravascular congestion, bronchopneumonia, and intra-alveolar hemorrhage. The concentrations necessary for these changes are much higher than the therapeutic levels and also higher than the levels stored in therapeutic NO cylinders. NO concentrations as great as 1000 ppm are present in cigarette smoke and do not produce acute mortality (Hess 322).

NO and oxygen spontaneously produce nitrogen dioxide. Safety limits for nitrogen dioxide exposure of five ppm have been set by the Occupational Safety and Health Administration (OSHA), but exposures less than two ppm have reportedly caused airway reactivity and parenchymal lung injury. The parenchymal effects include

"Distress" continued on page 7

"Distress" continued from page 6

pulmonary edema, hemorrhage, changes in surfactant, reduction in the number of alveoli, and death. Lungs of healthy individuals are protected by antioxidants, but in injured lungs, such as in ARDS, the effects are unknown. In obstructive lung diseases, prolonged NO residence times in the alveoli are more likely to convert NO to nitrogen dioxide (Hess 323).

Some patients fail to respond to iNO therapy with an improved PaO<sub>2</sub> or pulmonary vascular resistance. This may not be an adverse effect, but about 40% of ARDS patients have no improvement in PaO<sub>2</sub> and about 20% do not improve their pulmonary vascular resistance. Studies indicate that when the hypoxemia is due to a low ventilation/perfusion mismatch rather than shunt, iNO would be contraindicated, with the possibility of worsening the PaO<sub>2</sub> (Hess 315). The amount of vasodilation in ARDS does not reflect what effect the NO will have on the PaO<sub>2</sub>, and the reason for a low response is unknown. Also, even a good response to therapy may fade within 24-72 hours (Bigatello 332).

There are two categories of enhancements for the physiological effects of iNO. One is the direct intensification of NO with the use of phosphodiesterase (PDE) inhibitors or NO donors. A second effective method would be treatments with an additive effect, such as alveolar recruitment. The use of PDE inhibitors and NO donors is limited because neither have pulmonary selectivity. Alveolar recruitment can be achieved with increasing positive airway

pressure or the use of surfactants, as well as the positioning of patients in the prone position (Bigatello 333-334). Using alveolar recruitment is the best enhancement overall to NO ventilation.

As with any treatment or medication, the respiratory therapist and physician should consider the risks versus the benefits. Even oxygen has toxic levels that must be considered when treating hypoxemia. Using iNO at low levels and in conjunction with other treatments to enhance the effects of the NO, as well as close monitoring of the patient, gives the ARDS patient the best possibility of survival. With continued research, NO ventilation will be a promising therapy of the future.

#### **Works cited**

- Bigatello, Luca M., MD. "Strategies to Enhance the Efficacy of Nitric Oxide Therapy." *Respiratory Care* Mar. 1999: 331-339.
- Branson, Richard D., BA, RRT. "Adult Respiratory Distress Syndrome: New Approaches to a Serious Illness." *AARC Times* Feb. 1999: 41-43, 89.
- Gerlach, Marlene, MD, Didier Keh, MD, and Herwig Gerlach, MD. "Inhaled Nitric Oxide for Acute Respiratory Distress Syndrome." *Respiratory Care* Feb. 1999: 184-195.
- Hess, Dean R., PhD, RRT, FAARC. "Adverse Effects and Toxicity of Inhaled Nitric Oxide." *Respiratory Care* Mar. 1999: 315-330.

## **Diversity Workshop to Expand Sensitivity, Awareness**

Many of you are probably thinking, "So, what is all this talk about 'diversity,' and is it really all that important?" Come find out immediately following Summer Forum: Sunday, June 4, 1 - 4 pm, in Vale, Colorado. Join AARC Cultural Diversity Committee Chair Janyth Bolden and her special guest Joseph Ponds, PhD, for a special workshop on the basics of diversity awareness.

- Recognize your level of sensitivity as well as your prejudices
- Learn how to determine if your patients' noncompliance is culturally based
- Improve your communication skills with people of other cultures

Do you know which group is likely to be offended by being handed a gift from your left hand?... What about being turned off by seeing the soles of your shoes?... And did you know that an affectionate pat on the head can be quite an insult to people from some cultures?...

You'll discover interesting facts like this and much more, so make plans now to attend the AARC's Diversity Workshop!

Workshop is free of charge. For more information contact Janyth Bolden by phone 530/926-6073 or email [rgranny@jps.net](mailto:rgranny@jps.net) ■

- Hurford, William E., MD. "Conference Summary: Is Inhaled Nitric Oxide Therapeutic?" *Respiratory Care* Mar. 1999: 360-365.
- Iotti, G.A., et al. "Acute Effects of Inhaled Nitric Oxide in Adult Respiratory Distress Syndrome." *European Respiratory Journal* Dec. 1998: 1164-1171.
- Troncy, Eric, DVM, MSC, Martin Francoeur, RRT, and Gilbert Blaise, MD. "Inhaled Nitric Oxide: Clinical Applications, Indications, and Toxicology." *Canadian Journal of Anaesthesia* Sep 1997: 973-988. ■

## **Submission Guidelines For Bulletin Articles**

All section members are encouraged to share information about their programs through articles in the *Bulletin*. Here are our guidelines for submission:

**Article length:** *Bulletin* articles may be between 500 and 1,000 words.

**Format:** In addition to a paper copy, all articles must be submitted on a 3½ inch floppy disk saved in Microsoft Word or TEXT ONLY (ASCII) formats, or emailed to the editor in one of those formats.

**Deadlines:** All articles must be submitted to the editor according to the following schedule of deadlines-

Jan.-Feb.: December 1  
Mar.-April: February 1  
May-June: April 1  
July-Aug.: June 1  
Sept.-Oct.: August 1  
Nov.-Dec.: October 1

**Article Review:** All authors may review a copy of their article before it goes to press. If you would like to review a copy of your article, please include a FAX number when you submit it to the editor. It is the responsibility of the author to: 1) request the opportunity to review the article before it goes to press, and 2) contact the editor by the stated deadline if any changes need to be made before the article goes to press.

# **Specialty Practitioner of the Year**

Don't forget to make your nominations for the 2000 Education *Specialty Practitioner of the Year*. This honor is given to an outstanding practitioner from this section each year at the AARC's Annual Convention.

The recipient of this award will be determined by the section chair or a selection committee appointed by the chair. Each nominee must be a member of the AARC and a member of the section.

Use the following form to send in your nominations for this important award:

I would like to nominate \_\_\_\_\_ for Education Specialty Practitioner of the Year because \_\_\_\_\_

### Nominee

## Hospital

## Address

## City

## Phone

Your Name

## Hospital

## Address

### **City**

Mail or FAX this form to the section chair at the address/number listed on page 2 of this issue.