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Preparing for DISASTER

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- TRANSPORT VENTILATORS
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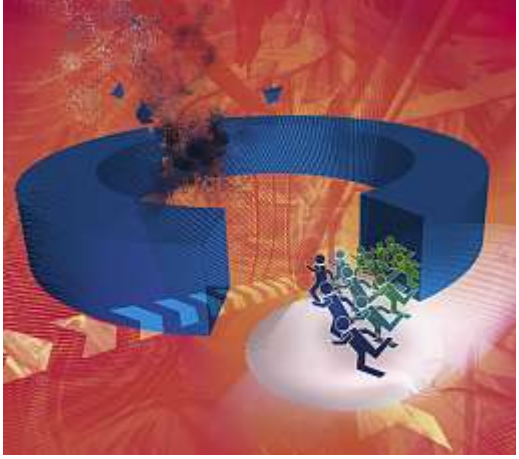

Editorial

Preparing for **Disaster**

As critical care specialists, we are accustomed to combating life-threatening illness and injury on a daily basis. Our staff must be vigilant and must be prepared to respond rapidly to any deterioration in a patient's condition, as that patient's life may depend on immediate medical intervention. Every day, around the world, critical care doctors and nurses save thousands of lives.

But what happens when thousands of lives are put in peril all at once, in one location? This summer alone, a number of disaster situations rocked the world – a train bombing in India, a tsunami in Indonesia, tropical storms in China and armed warfare in the Middle East, among others. Natural and man-made disasters alike can wreck havoc where they strike, leaving death, destruction, illness and injury in their wake. Trauma, shock, infectious disease – in the space of a few moments, a disaster may produce more imminently life-threatening medical situations than the average hospital would encounter under normal circumstances in weeks or even months.

When a hurricane, terrorist attack or other disaster hits, critical care specialists are called on more than ever to practice their life-saving services. But the overwhelming number of victims, along with the many logistical and infrastructure problems produced by a disaster situation, pose significant challenges to delivering timely, quality critical care. Disaster response requires phenomenal coordination of medical resources, space, priorities and personnel – both within a medical unit and across affected medical facilities. This, in turn, requires critical care managers to plan in advance, establish disaster response strategies and forge connections with the departments, hospitals and agencies that might prove crucial partners in a time of crisis.

This issue of **ICU Management** focuses on disaster management, in order to share insights that may help critical care managers strengthen their disaster preparedness programs. In this issue, Drs. Faltlhauser and Thomas share their expertise on care and transport, including the recent expansion of aeromedical evacuation operations to natural disaster situations. Dr. Maegele then gives an overview of the special considerations affecting patients who were evacuated to Europe following the 2004 tsunami disaster. Finally, Dr. Farmer highlights specific aspects of disaster preparedness that hospital and critical care managers should take into consideration well before disaster strikes. Each of these articles offers a unique and helpful perspective on coping with very different disaster response situations.

Disasters force us to make tough medical management decisions and enter into collaborative relationships that might not exist during regular ICU operations. In order to accomplish this effectively, we must be organized and develop plans in advance to manage worst-case scenarios. Preparedness is the key to successful disaster response. I hope that the articles in this issue of **ICU Management** offer ideas that help improve your unit's disaster response plans. May you never have to use them.

Jean-Louis Vincent
Head, Department of Intensive Care, Erasme Hospital Free University of Brussels, Belgium

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News World

WHO finds most countries fall short of ensuring a safe blood supply

www.who.int

World Blood Donor Day was June 14, 2006. To mark the occasion, the World Health Organization (WHO) released an announcement stating that the world is making slow progress towards the goal of 100% unpaid, voluntary blood donation. According to the WHO, regular, voluntary donors are desirable, as they are less likely to lie about their health status and may be more likely to keep themselves healthy. Nevertheless, many countries still fall short of ensuring the safety and the sustainability of blood supplies. Most developing countries still depend on paid donors or family members; however, some have made progress by applying stricter principles within their AIDS prevention programs.

A WHO survey showed 56 of 124 countries participating in the survey saw an increase in unpaid voluntary donation. The remaining 68 have either made no progress or have seen a decline in the number of unpaid, voluntary donors. Of the 124 countries, 49 have reached 100% unpaid voluntary blood donation. Furthermore, the number of donations per 1,000 population remains about 15 times greater in high-income than in low-income countries, despite the increased need for sustained, safe blood supplies in developing countries.

The WHO introduced the 100% unpaid, voluntary blood donation policy in 1997. World Blood Donor Day, celebrated annually on June 14, was established at the 58th World Health Assembly in May 2005 by the WHO's 192 Member States, to urge all countries in the world to thank blood donors, promote voluntary, unpaid blood donations and ensure safe supplies of blood for all.

News Industry

Biosite® Incorporated introduces Triage® MeterPro™

www.biosite.com

Biosite® Incorporated recently unveiled its third-generation testing platform, the Triage® MeterPro™ at the American Association for Clinical Chemistry (AACC) 2006 Annual Meeting in Chicago, Illinois, USA. According to a Biosite PRNewswire press release, the Triage MeterPro combines Biosite's rapid, easy-to-use technology with a more convenient user interface.

The Triage MeterPro is a portable, rapid testing platform designed to provide rapid, quantitative or qualitative results for immunoassays using urine, whole-blood or plasma and features comprehensive built-in quality control capabilities. The Triage MeterPro's user-friendly features are expected to make testing even easier to perform, while maintaining the high quality and performance standards of the existing Triage Meter platform. According to Biosite, enhancements to the Triage MeterPro include an alphanumeric keypad, 75 percent larger display, backlighting and faster printing. The Triage Meters also feature "Test Select™," enabling healthcare providers to customize test menus based on physician preference or patient presentation when using Triage Test Panels with multiple analytes. This allows customers to use the same multi-analyte Triage Panel but choose which assays to run at the time of testing.

Biosite's announcement assures that current and future Triage tests will continue to be compatible with the Triage MeterPro and the Triage MeterPlus. The Triage MeterPro is now available in the United States and will launch internationally in the second half of 2006.

Recent study notes automated CPR device helping save lives in one U.S. community

www.zoll.com

The AutoPulse®, a portable device that is strapped around the chest and does cardiopulmonary resuscitation (CPR) compressions automatically, has helped save lives in one U.S. community.

A study, appearing in the Journal of the American Medical Association (JAMA),* tracked AutoPulse® usage by the Richmond Ambulance Authority (RAA), based in the state of Virginia. The study found that, when compared to manual-CPR patients, AutoPulse patients showed higher rates of the following:

- Return of spontaneous circulation (34.5% vs. 20.2%);
- Survival to hospital admission (20.9% vs. 11.1%); and
- Survival to hospital discharge (9.7% vs. 2.9%).

The study compared 499 manual CPR cases and 284 cases using automated CPR, which involved the use of the AutoPulse. The study analyzed out-of-hospital cardiac arrest cases between January 2001 and March 2005 and evaluated data before and after RAA paramedics began using the AutoPulse.

The AutoPulse is designed to help improve blood flow to the heart and brain during sudden cardiac arrest by delivering continuous, uninterrupted chest compressions.*

According to its Medical Director Joseph P. Ornato, MD, RAA is the first EMS agency in the U.S. to have shown that significantly more patients can survive and be discharged from the hospital with use of the AutoPulse.

*Clinical data available upon request.

Teleflex MEDICAL

Teleflex Medical expands respiratory offering

www.teleflex.com

Teleflex Medical recently issued a press release announcing the launch of an innovative interface for non-invasive ventilation (NIV), designed to help patients breathe easier. According to the press release, the Nasal-Aire II Critical Care patient interface is a single patient use, disposable device intended for use in the hospital and other critical care settings for the administration of non-invasive ventilation. The new device comes with a unique, patented nosepiece that seals on the inside of the nose, rather than being compressed against it. According to Teleflex, this design renders obsolete the bulky headgear required to achieve a seal with traditional NIV patient interfaces, eliminating pressure on the face and bridge of the nose. This patient-friendly device also allows the user to converse, eat, drink and wear glasses while receiving therapy, actions which are often hindered by other NIV mask options. Nasal-Aire is a registered trademark of Innomed Technologies, Inc.

Strategic aeromedical evacuation in natural disasters: New tasks for military aeromedical evacuation systems

MedEvac has evolved into a versitile and useful medical tool for disaster response.

LtCdr. A. Faltlhauser, MD, DEAA

Col. A. Thomas, MD

Department for Anaesthesiology, Intensive Care Medicine, Emergency Medicine, Prehospital Ambulance and Helicopter Service (Head: Col. A. Thomas, MD)

Bundeswehr Central Hospital Koblenz, Germany (Head: BrigGen. C. Veit, MD)

History

Prior to World War II, Germany had little experience in aeromedical evacuation (AE) of sick and wounded patients. The need for a specialised AE organisation was recognised, organised and used extensively on all fronts during World War II. Nearly 2.5 million casualties were transported by regular troop carriers and 11 specialised AE Units, which concentrated on the intensive care air transport of the seriously wounded, especially those with brain, eye, jaw, thoracic and abdominal injuries, or with gunshot fractures. The AE Units were equipped with Junkers Ju-52s, which could carry up to 12 litter patients, plus 3 to 5 ambulatory patients, each. The AE Units of the Luftwaffe - the "*Sanitaetsflugbereitschaften*" - made an outstanding contribution to military medical care in evacuating this significant number of casualties under the humanitarian symbol of the Red Cross. This was the birth of the modern AE systems.

The modern system

Nowadays, almost all continuously available AE systems operating around the world are still run by military institutions. The worldwide military engagements of Western countries – for example, the NATO partner countries – make AE systems inevitable. Therefore, the German Air Force -

Interior Stretcher Configuration
Airbus A-310 "MedEvac"

Litter Kit Section

Intermediate Care Section

ICU Section (see diagram, right)

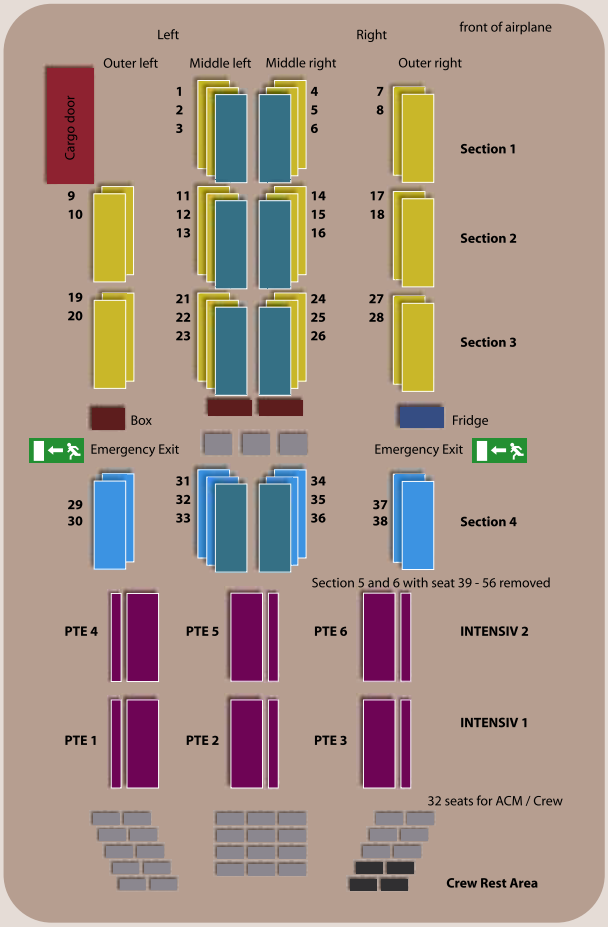

Figure 1: Onboard with StratAirMedevac

together with the Medical Service - created a Strategic Aeromedical Evacuation System (StratAirMedevac). The primary goal of this AE system is to provide high standard medical care for Bundeswehr soldiers. It was set up to conduct long-range evacuation operations for soldiers in critical medical condition, transporting them from deployments like Afghanistan back to Germany. StratAirMedevac employs a variety of aircrafts, such as the CL-601 Challenger jet, the C-160 Transall turbo prop aircraft and, most important for long-range StratAirMedevac, the Airbus A 310 (see figure 1).

Onboard a StratAirMedevac flight

The multi-role AE air carrier is the logistic basis of a flying intensive care unit for a total of 44 recumbant patients. It is subdivided into a litter kit section for 28 patients, an intermediate care section for 10 patients and 6 patient transport units (PTU) meeting level 1 trauma ICU standards (see figure 1). The litter kit section has basic monitoring capabilities (3-lead ECG, NIBP and pulse oxymetry), as well as a limited number of emergency respirators (Draeger Oxylog 2000).

All six PTUs are equally equipped and standardised (see figure 2). They provide full ICU care and monitoring and are able to function independent from aircraft electric and oxygen supply systems for a minimum of six hours. Even emergency surgical procedures are possible. All PTUs are connected to a central monitoring unit for surveillance and documentation purposes.

This "flying ICU" is operated by a medical crew consisting of: a Senior Medical Officer "Flight Surgeon," serving as organising "Medical Director;" an Emergency Care Specialist Nurse "Crew Chief;" a Medical Equipment Technician; two Anaesthesiology and intensive care medicine Specialists; two Emergency Care Physicians; an ICU Care Specialist Nurse; six Emergency Care Specialist Nurses; five Emergency Care Assistant Nurses; and six Medical Staff Soldiers. The Medical Director, assisted by the Medical Crew Chief, is responsible for coordination and organisation. As an experienced flight surgeon, he is the link between the flight crew and the medical team. Together with one of the Anaesthesiology Specialists, he takes responsibility for pre-flight patient triage and positioning in the aircraft, as well as for patient loading and unloading.

Moving such a large number of severely injured patients involves challenging behind-the-scene logistics. Adequate patient collection, staging and loading facilities on-scene are essential (e.g. patients have to be moved into the airplane with a high lifter through the cargo door). Sufficient energy and oxygen supply during long flights and distinct planning of patient movement after arrival at the destination airport are other key issues in setting up an AE operation. Finally, this highly sophisticated tool for individualised patient transport needs adequate airport infrastructure, as landing is only possible at airports with long enough, concrete runways. If there is no fixed building available for patient

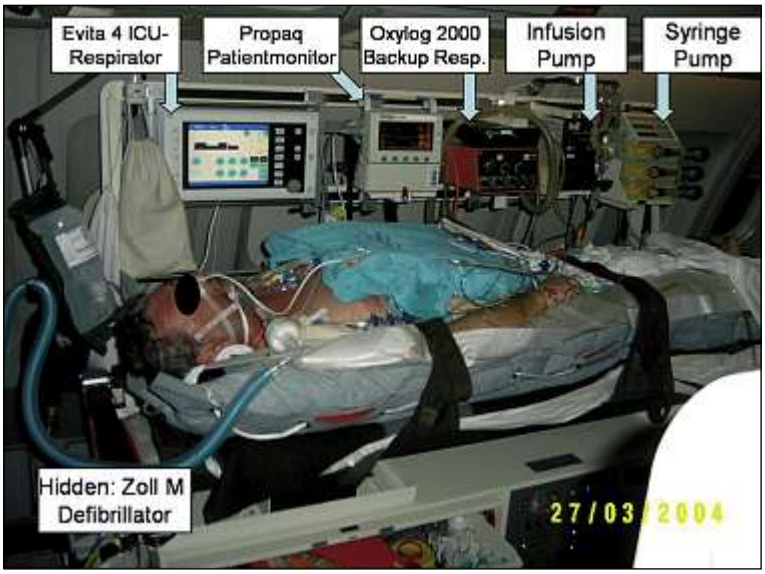

Figure 2: Medical Equipment, PTU

handover, the consequences of patient transfer outside of clinical conditions – often in extreme climatic surroundings and under massive public and media interest – have an enormous impact on AE staff's work performance. Therefore, advance access to detailed medical information about all patients to be transported is extremely helpful to the AE crew. Aside from certain infectious diseases (e.g. hemorrhagic fever), there is almost no contraindication for StratAirMedevac transport. StratAirMedevac evacuation may be contraindicated for conditions such as untreated intracranial air, uncontrolled bleeding and massive ARDS, depending on the local situation, drug supply, surgical capacity onboard and flight time.

New tasks for the "MedEvac-Airbus"

Although AE began primarily as a military function, more and more governmental and private organisations, such as travel agency reinsurance companies, are requesting the "MedEvac-Airbus" to repatriate their customers from disaster areas. Prior to the 2005 Southeast Asian tsunami disaster, the "MedEvac-Airbus" was used for repatriating casualties from bomb attacks (e.g. Karachi, Pakistan, 2002 and Djerba, Tunisia, 2002) and major accidents (bus crash in Puebla, Mexico, 2004). With the 2005 tsunami disaster, the "MedEvac-Airbus" took on a new role, responding to natural disasters.

Figure 3: Left: Typical transport situation in early phase after disaster AE
Right: Unloading and patient distribution after 3rd tsunami flight

In the aftermath of the tsunami, a total of three Airbus flights were conducted over six days, carrying a total of 123 severely injured (ISS >25 in more than 30%) European citizens back home. Although later StratAirMedevac flights focused purely on transport of severely injured citizens, the medical crewmembers of the first flight were also involved in patient selection and emergency medical care in Thai hospitals prior to the repatriation flight. In this situation, based on a functional infrastructure in the home country, the "MedEvac-Airbus" was the perfect tool not only for returning Western European tourists to their homes, but also to relieve the Thai medical system from an overwhelming number of patients in a very short period of time.

Conclusion

The mission of a StratAirMedevac in natural disasters is twofold. In the initial phase following a natural disaster, an operation is primarily focused on bringing material, personnel and expertise to the affected area. Even if this is not the primary goal of an AE operation, basic medical aid for the suffering and search and rescue activities on-site are the most crucial tasks. In the second phase, after initial stabilisation of the local situation, a neatly planned AE operation is an option, to relieve the local medical system from difficult and resource-consuming patients. AE with a highly sophisticated system as the "MedEvac-Airbus" only makes sense for use in repatriating foreign citizens, because of limited air transportation capacities in areas with destroyed infrastructure. Ongoing globalisation spreads Western European citizens over the whole world. Therefore, the legal and commercial interests of reinsurance companies and governmental authorities for evacuation of their citizens or customers after major incidents make the future civil use of AE systems a more and more likely scenario. ■

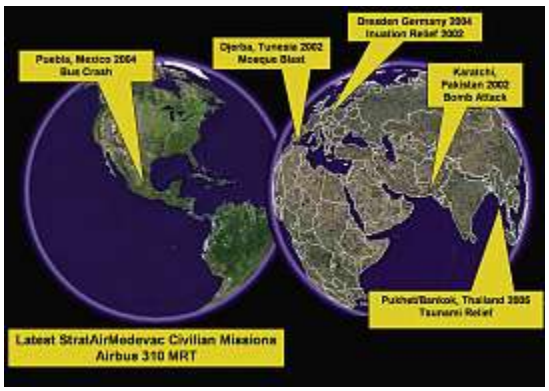

Figure 4: Civilian StratAirMedevac operation 2002-2006

Photographs, in part, have been generously provided by:
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LtCol. S. Schaefer DiplMed,
LtCol. G. Hölldobler MD,
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Tertiary intensive care to victims repatriated to Europe after the 2004 tsunami disaster

Marc Maegele, M.D.
Department of Trauma and Orthopedic Surgery
Intensive Care Unit of the Department of Trauma and Orthopedic Surgery
(Director: Prof. Dr. Bertil Bouillon, M.D.)
Cologne-Merheim Medical Center (CMMC)
University of Witten/Herdecke
E-Mail: Marc.Maegele@t-online.de

Individuals evacuated following the 2004 tsunami disaster sustained traumatic injuries to the head, chest and limbs that were contaminated with highly resistant bacteria. Transferred patients from disaster areas should be isolated until their microbial flora are identified, as they may introduce new and unusual pathogens into an intensive care unit (ICU). Aggressive debridement, together with vacuum-assisted closure for the interim, broad antimicrobial coverage and psychoemotional intervention, were cornerstones of the successful management of the evacuated tsunami victims.

Introduction

On December 26, 2004, a giant earthquake shocked Southeast Asia, triggering deadly flood waves (tsunami) across the Indian Ocean. More than 310,000 people were reported dead and millions left destitute. Shortly thereafter, European governments repatriated the most severely injured tourists using Medical Evacuation ("MedEvac") aircrafts. Upon arrival in Europe, patients were distributed to various medical centers. One cohort of severely injured patients was admitted to the Cologne-Merheim Medical Center (CMMC) in Germany for further surgical and intensive care unit (ICU) treatment (Maegele et al. 2005; Maegele et al. 2006).

Triage and Air Transfer

Following the tsunami, European governments quickly organized airlifts to evacuate injured citizens from the disaster area. Their strategy was to evacuate patients with minor injuries first, simultaneously providing capacity to care for more severely injured and hospitalized patients, who were unable to reach the airport for evacuation. Following the establishment of first-aid and collecting points at evacuation airports, "scout" teams were formed to search for injured tourists. Initial surveys along the coasts quickly indicated that only dead bodies remained at and near the seashore, and thus the ongoing search focused primarily on local hospitals in which victims had received first-aid and treatment focusing on basic stabilization of cardio-respiratory functions, wound management and infection control.

Upon triage at the collecting point, patients with minor injuries were airlifted via regular or ambulance aircraft. Critically ill patients were evacuated by Airbus A310 MRT MedEvac aircraft following stabilization of vital functions (Zylka-Mehnhorn 2005). Within a short time, approximately 2,500 uninjured tourists and tourists with minor injuries, as well as 300 more severely injured tourists from various countries, were evacuated. Upon arrival after the 15-hour MedEvac flight from Phuket to the Cologne, Germany, military airport, one cohort of severely injured patients was taken directly to the CMMC for further surgical and ICU treatment. No deaths were reported en route.

Major problem: Contaminated wounds and uncommon respiratory infections

The predominant pattern of injury in the tsunami victims consisted of multiple large-scale, soft-tissue wounds (range: 2x3 cm – 60x60 cm) in the lower extremities (88%), upper extremities (29%) and head (18%) (see figure 1, page 12). Additional injuries included thoracic trauma with hemopneumothorax and serial rib fractures (41%) and peripheral bone fractures (47%), both open and closed.

A major problem associated with wound management in these patients was significant contamination. Microbiological assessment identified not only a variety of common isolates (Pseudomonas 54%, Enterobacteriae 36%, Aeromonas spp. 27%), but also uncommon isolates, which were often multi-resistant (multi-resistant Acinetobacter and ESBL-positive E. coli, 18% each). The process of near-drowning in seawater involves the aspiration of immersion fluids, as well as marine debris, into the respiratory tract, thus providing intrapulmonary inoculation of bacteria and inducing pneumonitis and pneumonia. All our patients showed radiological and clinical signs of pneumonitis upon arrival, and respiratory tract specimens contained a high rate of multi-resistant Acinetobacter species, as well as methicillin-resistant Staphylococcus aureus (MRSA), Aeromonas hydrophilia, Pseudomonas species and Candida albicans. Table 1 on page 25 summarizes causative pathogens and locations from which they had been identified.

Wound management focused on aggressive and repetitive debridement, including removal of devitalized tissues. In two cases, amputations were inevitable. Between initial wound surgery and delayed secondary closure, with or without skin grafting, wounds were protected using VAC® therapy (Vacuum Assisted Closure®/ V.A.C. Vakuumquellen, KCI Therapie Geräte, Höchstadt, Germany) (Argenta and Morykwas 1997; Joseph et al. 2000; Mullner et al. 1997).

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Our initial choice of anti-infective therapy was a combination of a potent quinolone with clindamycin. This strategy is commonly followed in our facility for infection of unknown origin and generally corresponds to the guidelines of the Paul-Ehrlich Society for Chemotherapy (Bodman and Vogel 2001). This approach covered major pathogens that could initially be expected in our incoming patients (Lim 2005). Anti-infective management was immediately adopted according to incoming results from microbiology and resistance patterns (see table 1, page 25).

Psychoemotional aftermath

The full impact of the tidal wave on the mental health of survivors is still unknown (Miller 2005). In February 2005, the World Health Organization (WHO) estimated that up to 50% of the five million people affected by the tsunami would experience moderate to severe psychological distress. Approximately 5-10% would develop more persistent problems, e.g. depression, posttraumatic stress disorder (PTSD) or other anxiety disorders unlikely to resolve without intervention.

Among all patients and relatives that were treated in our facility, clinical symptoms of posttraumatic psychological stress response were noted. All patients treated in our hospital had suffered loss of at least one relative, and two mothers of our cohort lost both of their children. Major complaints included nightmares, emotional detachment, sleep difficulties, flashbacks, headaches and intrusive thoughts based upon individual experiences during the disaster. Psychoemotional responses further comprised distress about injuries sustained, dissociation, optical, acoustical and olfactory intrusions and, in some cases, agitation.

Figure 1: Large scale soft tissue wunds and vacuum sealing

To cover the psychoemotional trauma associated with the disaster, non-governmental organizations (NGOs) and their local partners undertook efforts to assure initial psychological support already at the scene of the tsunami, in particular for children who, in part, suffered the loss of both parents. Upon arrival in Germany, psychological care for the evacuees was continued directly at the airport by disaster intervention teams and emergency pastors, coordinated by *Nachsorge, Opfer- und Angehörigenhilfe* (NOAH), a special division of the Federal Office for Civil Protection and Disaster Management (*Bundesamt für Bevölkerungsschutz und Katastophenhilfe*, or BKK). This support network also introduced telephone hotlines, assembled (together with airline companies) passenger lists of the less severely injured patients who were evacuated on regular flights and distributed educational pamphlets on typical clinical signs of posttraumatic stress syndrome to each arriving victim, indicating when to consult professional support. Upon federal request, the Department of Psychotrauma of the University of Heidelberg assembled a comprehensive list of 400 qualified psychotherapists offering immediate support nationwide when needed. These materials are intended to be preserved or further developed for future disasters, and the foundation of a nationwide and independent Institute for Psychotrauma is being discussed (Bühring 2005). Psychotherapeutic support for patients and relatives treated in the Cologne-Merheim Medical Center was provided by the department´s psychotherapeutic intervention team, consisting of three qualified and experienced psychotraumatologists, available 24/7 upon request.

Summary / Conclusion

A pattern of severe, large-scale, soft-tissue damage including high-level contamination was common to all tsunami victims evacuated to our medical facility. Microbiological assessment identified common aquatic pathogens, but also an unusually high rate of multi-resistant strains that may spread easily among patients treated in local hospitals. Strict isolation and broad microbiological assessment is recommended for infection control in patients arriving from those areas. For optimum treatment, tight collaboration between surgeons, intensivists and microbiologists is mandatory. In addition, care for the physical needs of disaster victims needs to be balanced with care for the patients' emotional needs. Thus, a network of psychological support is an essential component in disaster management. Using this holistic, body-and-mind approach to critical care, our hospital was successful in treating the severely injured tsunami victims, preventing the spread of unusual microbes throughout our hospital and setting the stage for our patients' long-term healing process following one of the biggest natural disasters of our time.

continued on p. 25

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The evolving role of critical care medicine in disaster medical response

Disasters are often unexpected and can cause significant strain on critical care resources. Dr. Farmer discusses key considerations in critical care disaster planning.

J. Christopher Farmer, M.D.
Professor of Medicine and Consultant in Critical Care Medicine
Mayo Clinic
Rochester, MN
507-255-3275
farmer.j@mayo.edu

Overview

We have traditionally focused on the pre-hospital care setting as the primary building block of our disaster medical response systems. We assume that the hospital will "be there," will receive casualties on short-notice, will rapidly escalate emergency care capabilities and will reliably meet the unexpected demands imposed on the system. Unfortunately, this notion is both short-sighted and dangerous.

Most hospitals are chronically under-funded, and many struggle just to meet daily, routine care requirements. In addition, and as we have seen time and time again, during a major disaster, the need for critical care expansion becomes universal. The hospital becomes an over-sized intensive care unit (ICU), both for pre-existing patients and disaster victims. Unfortunately, most hospitals lack the necessary clinical training programs, sufficient personnel and the necessary equipment/supply stockpiles to meet these demands.

Furthermore, we assume that the hospital structure will physically "be there" and will be usable during a disaster. What if the building itself is rendered unusable? What if it is partially under water? What if a communicable disease drastically reduces the available personnel pool needed to care for patients? Many hospitals do not have reality-based, executable plans for these potential scenarios.

Framing the issues in order to formulate necessary solutions

Let us enumerate the issues that we must address in order to assure that hospitals are "on-line" and capable of meeting the critical care demands when a major disaster occurs:

1. Education and training – Education and training are relatively low-cost, high-yield interventions that tangibly enhance disaster medical response at every level. However, current disaster medical education programs for hospital personnel are not coordinated in scope and content and do not adequately address the needs of critical care personnel. Educational initiatives must: a) heighten disaster response awareness; b) measurably enhance skill sets; c) define and teach individual roles and responsibilities; d) teach alternate communication methods for use during a disaster; e) include self-preservation training; and, f) introduce the concept of how to work together during mayhem. Most importantly, non-critical care, hospital personnel must be taught a limited (defined) ICU skill set.

2. Portable critical care – A large-scale disaster response may require the provision of high-level critical care in unanticipated locales (non-hospital, non-ICU). We must develop civil response systems of portable critical care for use during large disasters. United States military experiences with "far forward" critical care, including the U.S. Air Force Critical Care Aeromedical Transport Teams (CCATT) program, offer a useful perspective for the development of civil-response, portable critical care programs. CCATT has already dealt with many of the challenges that we must overcome in order to care for patients who require care beyond the hospital, and its applicability should be further explored.

3. Augmented on-site care capabilities – Of all the medical device and supply issues that we face, the biggest conundrum is mechanical ventilators. In our already busy critical care units, an outbreak of pandemic influenza or avian influenza would quickly outstrip available respiratory care resources (machines and personnel). Moreover, the recent SARS outbreak harshly reminded us of the personal health risks to ICU personnel caring for afflicted patients with respiratory failure, further complicating care processes. Many questions remain unanswered. Where will additional ventilators come from? Who will pay for them? What level of machine sophistication is mandatory? Who will operate these devices?

4. The impact of chronic critical illness – We have a significantly increasing population of ICU patients for whom our therapeutic endpoint is not the elimination of critical illness, but rather establishing a sustainable equilibrium with acute disease. These patients require access to regular and frequent care. Where do these patients go for care during a disaster? This problem is not dealt with in any meaningful way by existing disaster response plans. The only workable solution involves the geographical movement of these patients to other locales in order to "offload" the disaster site response system. Again, this will require the existence of a portable critical care response capability.

5. Improved interoperability – Cooperation among hospitals during day-to-day operations is nil. Financially and otherwise, it largely remains a facility-by-facility struggle for daily survival. Therefore, the expectation that during a disaster,

continued on p. 25

Tight glycemic control during critical illness: Overcoming the obstacles

Salient literature is reviewed describing the benefits and concerns of tight glycemic control in critically ill patients. Hypoglycemia and other pitfalls with implementation of an intensive insulin protocol are discussed.

Critically ill patients frequently develop hyperglycemia. Until recently, there have been few scientific reasons put forth for correcting this hyperglycemia.

Despite very little exploratory investigation to precede it, Van den Berghe and colleagues boldly embarked upon the Leuven study: a large prospective, randomized, surgical intensive care unit, controlled trial testing the hypothesis that strict euglycemic control using intensive insulin infusions could increase survival and reduce morbidity in a critical care population (Van den Berghe et al. 2001). They studied 1,548 surgical patients (62% post cardiac surgery), with the aim of maintaining a blood glucose range between 80 - 110 mg/dL (4.4 - 6.1 mmol/L). They observed a 42% reduction in risk of death and in various morbidities, particularly in the prolonged stay group of patients. Other comparative studies followed, in cardiac surgery (Finney et al. 2003; Lazar et al. 2004), trauma (Grey and Perdrizet 2004), mixed medical-surgical (Krinsley 2004) and a large medical ICU population (Van den Berghe et al. 2006), reproducing the same signal in approximately 5,000 combined patients, i.e., that hyperglycemic management decreases mortality and morbidity.

A single, large German study (VISEP), as yet unpublished, failed to show benefit with intensive insulin in 537 patients with severe sepsis (Brunkhorst et al. 2005). However, the experimental design failed to exclude confounding variables by not controlling for conventional aspects of sepsis care (antibiotics, resuscitation, mechanical ventilation). Because the study was stopped prematurely due to potential but unrealized harm from hypoglycemia, it is not surprising that no conclusive observations related to benefit could be made.

Large multi-national studies ongoing in Europe (GLUControl) and in Australia/New Zealand and Canada (NICE-SUGAR) together will target some 8,000 patients and should elucidate the actual benefits of intensive insulin. However, results of a United States Veterans Affairs Medical Centers database investigation (announced at the June 2006 American Diabetes Association annual meeting) may have put the entire issue to rest. To wit, this study of 216,775 critically ill patients from 177 mixed ICUs demonstrated that each incremental increase in blood glucose above 6.1 mmol/L increased mortality. Survival with normoglycemia increased in medical and in septic patients, not just in patients with cardiovascular or surgical diseases (Falciglia American Diabetes Association, June 2006).

ICU Stakeholder

- Anaesthesiology
- Cardiology
- Pharmacy
- ➤ **Internal medicine**
- Microbiology
- Nephrology
- Respiratory
- ...

Management of hyperglycemia has become a top priority in the care of critically ill patients, with the Joint Commission on Accreditation of Healthcare Organization, the Institute of Healthcare Improvement, the American Diabetes Association and The Volunteer Hospital Association all strongly advocating for its implementation.

The chief obstacles to implementation of rigorous, tight glycemic control are twofold: nursing "pushback" and fear of hypoglycemia. Pushback occurs because intensive insulin treatment requires frequent, often hourly, blood glucose monitoring; this practice is inherently labor intensive, placing significant demands on the bedside nurse. Protocolizing euglycemic management is a means of insuring standardized care, reducing variability and increasing the likelihood of hitting the target blood glucose range in the earliest time possible. Even with protocolization, studies have shown that daily fluctuations in blood glucose are common and significant (Finney et al. 2003; Zimmerman et al. 2004).

Hypoglycemia, defined as a blood glucose < 40-60 mg/dL [2.2-3.3 mmol/L], is now recognized to be frequent (see figure 1) and often severe (Vriesendorp et al. 2006; Kanji et al. 2004). Few if any irreversible consequences of hypoglycemia

Stanley A. Nasraway, Jr., MD, FCCM
Director Surgical Intense Care Units
Professor Surgical Medicine and Anesthesia
Department of Surgery
Tufts-New England Medical Center
Washington St.,
Boston, MA 02111
Snasraway@tufts-nemc.org

Financial disclosure: Santra Medical Corporation, Investigator

have been published in the setting of intensive insulin, but such consequences simply may have been unobserved or unreported. Renal failure, because it lengthens the duration of action of insulin, and the unadjusted discontinuation of nutrition/feedings without a decrease in concomitant insulin administration are the two most common risk factors associated with hypoglycemia. Additionally, recent evidence suggests that "fingerstick" capillary blood tested by bedside glucometer may be frequently inaccurate, particularly in the hypoglycemic range during which the true blood glucose is actually underestimated (Kanji et al. 2005).

Looking to the Future

Many questions remain to be answered. What is the proper blood glucose threshold that must be maintained? It may well be that different types of patients require different thresholds of blood glucose to achieve a benefit. How can intensive insulin therapy be provided in the least laborious, nurse-intensive fashion? There will have to be improvements in bedside blood glucose monitoring. The holy grail of device technology undoubtedly will be the ability to continuously monitor patient blood glucose concentrations, perhaps using fiberoptic or infrared technology (Krinsley et al. 2005). Continuous monitoring will provide multiple benefits: first, it will permit smoother, timelier adjustments in insulin infusions to more quickly achieve the blood glucose endpoint; and second, it will provide early warning to caregivers about incipient hypoglycemia. This latter concern has been a flashpoint of debate in intensive care units that are balancing strict euglycemia against safety concerns for the patient. Continuous monitoring will be pivotal not only in measuring absolute blood glucose values, but more importantly in signaling emerging trends over time. ■

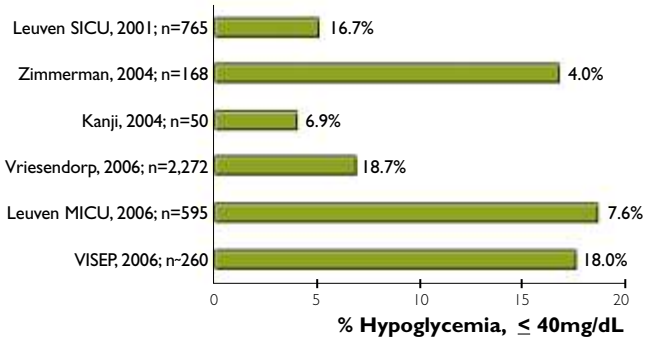

Figure 1: Hypoglycemia in studies

Benefits of a separate airway emergency response team

Dr. Afifi and colleagues explain how establishing a dedicated hospital-based airway emergency response team resulted in the reduction of cardiac arrest calls, efficient use of available resources and minimized disruption in routine patient care. They also describe the method of process improvement used by an active, multidisciplinary team.

ICU Stakeholder

- Anaesthesiology
- Cardiology
- Pharmacy
- Internal medicine
- Microbiology
- Nephrology
- **Respiratory**
- ...

Background

Northwestern Memorial Hospital is a nationally recognized, 744-bed academic medical center located in Chicago, Illinois, USA. It is the primary teaching hospital for Northwestern University's Feinberg School of Medicine. The cardiac arrest team has been Northwestern Memorial Hospital's traditional standard for emergency response in the event of sudden cardiac arrest or patient unresponsiveness. The cardiac arrest team is a multidisciplinary team of healthcare professionals consisting of physicians from medicine, surgery, anesthesiology, nursing services, pharmacy and respiratory care. Members of the cardiac arrest team are concurrently paged to respond to a cardiac arrest by the hospital operator, once an automated arrest call button, located in any inpatient or outpatient clinical area, has been activated.

Quality monitoring and data collection

Quality monitoring and arrest data are reviewed on a monthly basis by the Cardio-Pulmonary Resuscitation (CPR) Committee. The CPR Committee is a multidisciplinary committee comprised of representatives from both clinical departments and non-clinical support departments. The CPR Committee is under the medical direction of the Department of Anesthesiology and is chaired by a critical care anesthesiologist, who is responsible for coordinating the quality monitoring process, data collection and emergency response operations within the hospital. The CPR Committee regularly reviews any sentinel events from the previous month, as well as the volume of cardiac arrests, the location of each arrest and the probable cause linked to each cardiac arrest (as determined by the medical team attending the arrest and documented in the arrest summary).

Cardiac arrest data review

Sequential reviews of the cardiac arrest data by the CPR Committee revealed that a significant number of cardiac arrest team calls were activated for patients that initially experienced a documented airway complication prior to their cardiac arrest (see figure 1, page 19). Upon review of this data, the CPR Committee theorized that the patient population experiencing respiratory failure prior to cardiac arrest may not have progressed to an actual cardiac arrest if earlier medical intervention by specialized clinicians was available to treat and augment respiratory efforts. Thus, the CPR Committee embarked on a quality improvement project to better respond to these patients.

Process improvement - DMAIC

At Northwestern Memorial Hospital, quality improvement projects utilize a process improvement technique referred to as "DMAIC Process Improvement." DMAIC is an acronym that stands for Define, Measure, Analyze, Improve and Control. DMAIC is a step-by-step approach to process improvement. The goal of DMAIC process improvement is to reduce the defects or inefficiencies associated with a process, deliver measurable improvements and maintain these improvements over time. DMAIC is a very simple way for any group to organize their efforts to improve a complicated process.

Define

The first phase is Define. In the Define phase, the objective is to determine and define the problem that needs to be solved. The problem discovered through the CPR Committee's cardiac arrest data analysis was: the number of cardiac arrest team calls was increasing in patient populations that were not primary cardiac patients. The CPR Committee suspected that this increase was attributable to patients that developed airway complications, which, over time, progressed into cardiac stress and eventual cardiac arrest.

Brian L. Smith, RCP, R.R.T.
Administrative/Clinical Director, Respiratory Care
Northwestern Memorial Hospital, Department of Anesthesiology
Northwestern University Feinberg School of Medicine
bsmith@nmh.org

Sherif Afifi, MD, FCCM, FCCP
Chief, Division of Critical Care Medicine, Northwestern Memorial Hospital
Associate Professor of Anesthesiology
Northwestern University Feinberg School of Medicine
s-afifi@northwestern.edu

Michael Ault, MD
Assistant Professor of Anesthesiology
Northwestern University Feinberg School of Medicine
mault@northwestern.edu

Linda L. Morris, Ph.D., APN, CCNS
Clinical Nurse Specialist, Respiratory Care
Northwestern Memorial Hospital,
Assistant Professor of Clinical Anesthesiology
Northwestern University Feinberg School of Medicine
limorris@nmh.org

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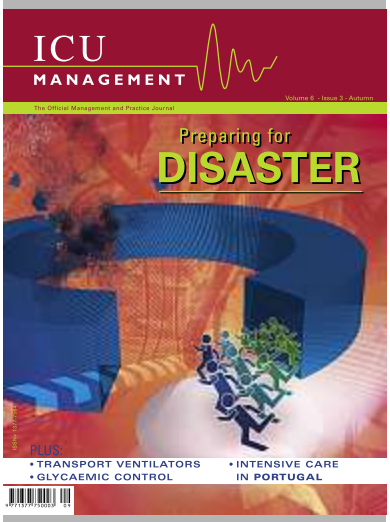

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Measure

During the Measure phase, a strategy is established to determine how to measure the process and collect the data that is required to analyze performance. The cardiac arrest team nurse collected data on every cardiac arrest call to determine the number of cardiac arrest calls and the root cause for each. This data was then submitted monthly to the CPR Committee for their review.

Analyze

The third phase is Analyze. In this phase, the data is drilled down to the root causes of performance variation. This is the most analytical and statistically intensive phase. Data can often be displayed using a graph format to visually compare trends and highlight variation. The data obtained from this project indicated that, in a large number of cardiac arrest calls, the patient had a primary airway respiratory component, which was determined to be the root cause for the cardiac arrest. In these cases, the cardiac arrest was a consequence of respiratory failure.

Improve

In the Improve phase, the goal is to generate alternatives to the current process, assess the risk associated with each alternative, select the best alternative and pilot the solution. The CPR Committee responded to the findings by establishing an additional emergency response team called the Airway Emergency Response Team (AERT). The AERT would be activated for any patient who required emergent endotracheal intubation or any other emergency airway assistance. The AERT was chartered to provide early intervention for the prevention of cardiac arrest in airway patients. The AERT, consisting of an anesthesiologist, a nurse and a respiratory therapist, was less labor-intensive than the cardiac arrest team, which deploys a larger group of medical and support personnel. Screening parameters for activating the airway team were put in place to ensure that the appropriate team was called to respond to emergencies. A hospital-wide educational initiative was established to educate the clinical staff about the AERT. Ongoing data is accumulating to help the CPR Committee monitor the AERT's success in reaching its goals of reducing the number of cardiac arrest calls over time, minimizing disruption to routine clinical operations and increasing efficiency by utilizing a specialized airway management team that requires fewer personnel than the cardiac arrest team.

Control

The final phase is Control. In the control phase, the intention is to error-proof the new process and to use tools to monitor the process. The data collected post-AERT implementation supported the hypothesis that the implementation of the AERT did reduce the number of emergency calls for the much larger cardiac arrest team. In fact, following implementation of the AERT, the ratio of emergency calls to the AERT to those of the cardiac arrest team underwent a gradual, but complete, reversal. (see figure 2). The CPR Committee did not note a significant increase in the number of total calls, which included both cardiac arrest and emergency airway calls. However, the cardiac arrest team calls decreased by more than half, whereas, over a period of 24 months, there was a 35% increase in the number of AERT calls. Continued monitoring of emergency response team data is critical for maintaining the improvements that were gained with the implementation of the AERT. The CPR Committee expects to observe a continued trend of a greater number of AERT calls compared to cardiac arrest calls.

Conclusion

The implementation of a dedicated, hospital-based airway emergency response team reduced the number of emergency calls for cardiac arrest. The airway emergency response team minimized the disruption in routine patient care compared to the cardiac arrest team, which requires a large number of clinical staff responders to be pulled away from their primary clinical areas. ■

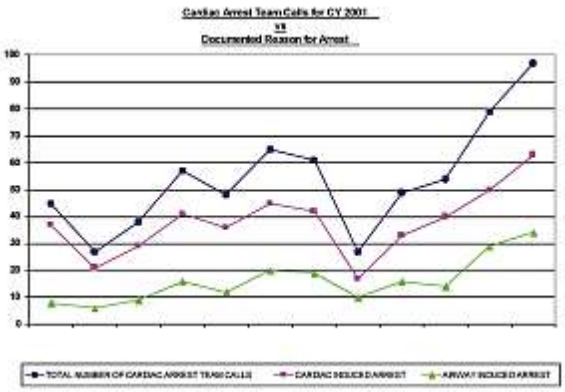

Figure 1

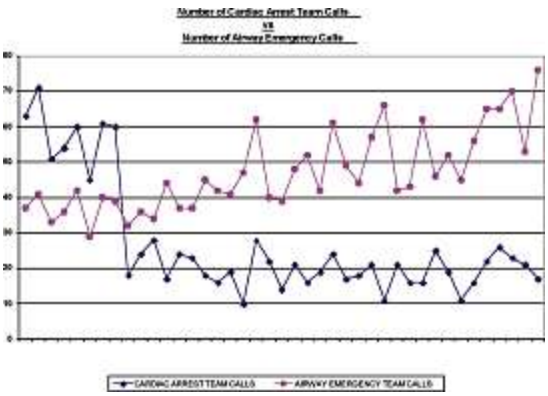

Figure 2

Transport Ventilators

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ECRI Europe
Weltech Centre Ridgeway
Welwyn Garden City
Herts AL7 2AA,
United Kingdom

Tel. +44 (0)1707 871511
Fax. +44 (0)1707 393138

info@ecri.org.uk
www.ecri.org.uk

ECRI's focus is medical device technology, healthcare risk and quality management and health technology assessment. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organizations, ministries of health, government and planning agencies, voluntary sector organizations and accrediting agencies worldwide. Its databases (over 30), publications, information services and technical assistance services set the standard for the healthcare community.

All of ECRI's products and services are available through the European Office, addressing the special requirements of Europe and the UK. Utilizing some of the world's largest health related databases, help, support and guidance can be given to our European clients at a local level.

ECRI is pleased to provide readers of ICU Management with sample information on products for transport ventilators, designed for use in critical care from its Healthcare Product Comparison System (HPCS). The HPCS reports contain extensive information about the technology, its purpose, its principles of operation, stage of development specifications, reported problems and recommended specifications.

The data are extracted from ECRI's 2004 database and have additionally been reviewed and updated by the respective manufacturers. Publication of all submitted data is not possible: for further information please contact editorial@icu-management.org.

Footnotes used in pages 20 to 23

1. These recommendatons are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.
2. EP version only.
3. B10 without alarms is FDA approved.

Healthcare Product Comparison System

	ECRI RECOMMENDED SPECIFICATIONS[1]	
MODEL	**BASIC TRANSPORT VENTILATOR**	
WHERE MARKETED		
FDA CLEARANCE		
CE MARK (MDD)		
PATIENT TYPE	Adult, pediatric, infant, neonatal	
CONTROLS		
Pressure level, cm H_2O	0-50	
Pressure ramp		
Tidal volume, mL	100-2,000	
Breath rate, br/min	0-50	
Insp time, sec	0-2	
PEEP, cm H_2O	0-20	
Pressure support		
FiO_2 , %	21-90	
I:E	1:1 to 1:3	
Trigger mechanism	Flow or pressure	
Panel lock	Yes	
OPERATING MODES		
Assist/control		
Volume breaths	Yes	
Pressure breaths	Yes	
SIMV		
Volume breaths	Optional	
Pressure breaths	Yes	
Pressure support	Yes	
Spontaneous/CPAP		
Pressure support	Yes	
Apnea-backup vent	Yes	
Other		
MONITORED PARAMETERS PEEP	Yes	
PEEP		
PIP	Yes	
MAP	Yes	
Exhaled tidal volume	Optional	
Exhaled minute volume	Optional	
Other		
PATIENT ALARMS O_2	Yes	
FiO_2		
Lo/hi minute volume	Optional	
Low insp pressure	Yes	
High pressure	Yes	
Loss of PEEP	Optional	
Apnea	Optional	
Inverse I:E	Optional	
High continuous pressure/occlusion	Yes	
High resp rate	Optional	
EQUIPMENT ALARMS		
Gas-supply failure	Yes	
Power failure	Yes	
Vent inoperative	Yes	
Low battery	Yes	
Self-diagnostic	Yes	
Other		
MRI COMPATIBLE	Preferred	
POWER	Standard	

Dräger medical A Dräger and Siemens Company	Dräger medical A Dräger and Siemens Company	Dräger medical A Dräger and Siemens Company	Dräger medical A Dräger and Siemens Company	Dräger medical A Dräger and Siemens Company
Oxylog 1000	**Oxylog 2000**	**Oxylog 3000**	**Savina**	**Evita 4 edition**
Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	510(k) pending	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Not specified	Not specified	Not specified	Adult, paediatric	Adult, paediatric, neonatal
25 - 55	20 - 60	0 - 55	0-99	0-80
Not applicable	Not applicable	Yes	yes	yes
Minute volume setting	100 - 1500	50 - 2000	50-2000	3-2,000 with NeoFlow
4 - 54	5 - 40	2 - 60	2-80	0-150
Depending on set frequency	Depending on set frequency and I:E ratio	0.2 - 10	0.2-10	0.1-30
0 - 20	0 - 15	0 - 20	0-35	0-35
Not specified	Not specified	0 - 35 above PEEP	0-70	0-80
60 or 100%	60 or 100%	40 - 100	21-100	21-100
1:1.5	1:3 to 2:1	1:4 to 3:1	1:150 to 150:1	1:300 to 300:1
Not applicable	Flow	Flow	Flow (pressure)	Flow (pressure)
No	No	No	Yes	Yes
Yes	Yes	Yes	Yes, AutoFlow	Yes, AutoFlow
Not specified	Not specified	Not specified	Yes	Yes
Not specified	Yes	Yes	Yes	Yes
Not specified	Pressure limited	Yes	Yes	Yes
Not specified	Not specified	Yes	Yes	Yes
Not specified	CPAP, no pressure support	Yes	Yes	Yes
Not specified (CMV only)	Not specified	Yes	Yes	Yes
Not specified	Not specified	PCV+, noninvasive delivery possible for CPAP and PCV+	PCV+, AutoFlow, nCPAP, all modes have noninvasive (NIV) delivery option	PCV+, AutoFlow, MMV, bilevel / APRV, automatic-tube compensation (all patient ranges) including nCPAP, all modes have noninvasive (NIV) delivery option, optional independent lung ventilation
Not specified	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Not specified	Yes	Yes	Yes	Yes
Not specified	Yes	Yes	Yes	Yes
Not specified	Yes	Yes	Yes	Yes
	Respiratory rate, inspiratory time, CPAP pressure level, expiratory tidal volume	Sponteneous respiratory rate, sponteneous minute volume, plateau pressure, FiO_2	MV spont, MV leak, FiO_2, RR, T insp, I:E, R, C, Temp.	MV spont, MV leak, FiO_2, RR, T insp, T exp, I:E, CO_2, R, C, Temp.
Not specified	Not specified	Yes	Yes	Yes
Not specified	Not specified	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Not specified	Not specified	Yes	Yes	Yes
Not applicable, CMV ventilation	Yes	Yes	Yes	Yes
Not specified	Not specified	Not specified	Not specified	Yes
Yes	Yes	Yes	Yes	Yes
Not specified	Not specified	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes, 100% pneumatic	Yes	Yes	Yes	Yes
Not applicable, 100% pneumatic	Yes	Yes	Yes	Yes
Yes, low pressure supply, no battery needed	Yes	Yes	Yes	Yes
Not specified	Yes	Yes	Yes	Yes
Acoustic and visual alarms	Acoustic and visual alarms	Leakage, flow sensor	Exhalation valve, flowsensor insertion, leakage	Exhalation valve, flowsensor insertion, leakage
No	No	No	No	No

Healthcare Product Comparison System

	ECRI RECOMMENDED SPECIFICATIONS[1]	Dräger medical A Dräger and Siemens Company	MAQUET	PULMONETIC SYSTEMS
MODEL	**BASIC TRANSPORT VENTILATOR**	**Evita XL**	**Servo-I**	**LTV 800**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
PATIENT TYPE	Adult, pediatric, infant, neonatal	Adult, paediatric, neonatal	Adult, pediatric, neonates	Adult, pediatric
CONTROLS				
Pressure level, cm H_2O	0-50	0-95	0-120; Infant 0-80	No
Pressure ramp		yes	Not specified	Not specified
Tidal volume, mL	100-2,000	3-2,000 with NeoFlow	100-4,000; infant 2-350	50-2,000
Breath rate, br/min	0-50	0-300	0-150	0-80
Insp time, sec	0-2	0.1-30	0.1-5	0.3-9.9
PEEP, cm H_2O	0-20	0-50	0-50	0-20
Pressure support		0-95	Yes	No
FiO_2 , %	21-90	21-100	21-100	No
I:E	1:1 to 1:3	1:300 to 300:1	1:10 to 4:1	1:4 to 4:1
Trigger mechanism	Flow or pressure	Flow (pressure)	Pressure, flow	Pressure
Panel lock	Yes	Yes	Yes	Yes
OPERATING MODES				
Assist/control				
Volume breaths	Yes	Yes, AutoFlow	Yes	Yes
Pressure breaths	Yes	Yes	Yes	No
SIMV				
Volume breaths	Optional	Yes	Yes	Yes
Pressure breaths	Yes	Yes	Yes	No
Pressure support	Yes	Yes	Yes	No
Spontaneous/CPAP				
Pressure support	Yes	Yes	Yes	No
Apnea-backup vent	Yes	Yes	Yes	Yes
Other		SmartCare (knowledge based weaning system), PCV+,AutoFlow, MMV, bilevel / APRV, automatic-tube compensation (all patient ranges) including nCPAP, all modes have noninvasive (NIV) delivery option, optional independent lung ventilation	Pressure-regulated volume control; NIV; Volume Support; Bi-Vent; Automode, Nasal CPAP	None specified
MONITORED PARAMETERS PEEP	Yes		Yes	0-99 cm H_2O
PEEP		Yes		
PIP	Yes	Yes	Yes	0-120 cm H_2O
MAP	Yes	Yes	Yes	0-99 cm H_2O
Exhaled tidal volume	Optional	Yes	Yes	No
Exhaled minute volume	Optional	Yes	Yes	No
Other		MV spont, MV leak, FiO_2, RR, T insp, T exp, I:E, CO_2, R, C, Temp.		
PATIENT ALARMS O_2	Yes		Yes	Yes
FiO_2		Yes		
Lo/hi minute volume	Optional	Yes	Yes	No
Low insp pressure	Yes	Yes	Yes	Not specified
High pressure	Yes	Yes	Yes	Yes
Loss of PEEP	Optional	Yes	Yes	Not specified
Apnea	Optional	Yes	Yes	Yes
Inverse I:E	Optional	Yes	Yes	Not specified
High continuous pressure/occlusion	Yes	Yes	Yes	No
High resp rate	Optional	Yes	Yes	Yes
EQUIPMENT ALARMS				
Gas-supply failure	Yes	Yes	Yes	Yes
Power failure	Yes	Yes	Yes	Yes
Vent inoperative	Yes	Yes	Yes	Yes
Low battery	Yes	Yes	Yes	Yes
Self-diagnostic	Yes	Yes	Yes	Yes
Other		Exhalation valve, flowsensor insertion, leakage	Pre-Use Check of all systems	Disconnct/ sense line
MRI COMPATIBLE	Preferred	No	Yes, with special agreement	No
POWER	Standard		100/110/120/220/240, 50/60 Hz	Not specified

PULMONETIC SYSTEMS	VIASYS HEALTHCARE	PNEUPAC	PNEUPAC	PNEUPAC
LTV 900 : LTV 950 : LTV 1000	**AVIAN**	**transPAC-2 : TransPAC-2D**	**ventiPAC V200D**	**babyPAC B100**
Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	No	Yes	No[3]
Yes	Yes	Yes	Yes	Yes
Adult, pediatric	Pediatric, adult	Adult, child	Adult, child	Neonatal, infant
1-99	0-100	Not specified	Not specified	12-70
Not specified	NA	Not specified	Not specified	Not specified
50-2,000	50-2,000	20-960	50-3,000	0-330
0-80	0-150	8-40	7-60	10-120
0.3-9.9	0.1-3	0.6-2.9	0.5-3	0.25-2
0-20	External PEEP valve on breathing circuit	NA	Optional, 0-20	0-20
1-60 cm H_2O	NA	Not specified	Not specified	Not specified
NA : NA : 21-100	Varies	45-100	45-100	21-100
1:4 to 4:1	Calculated, not set parameter	0.1 : 1.6	Infinitely variable	Infinitely variable
Flow	Pressure -2 to -8 cm H_2O	Not specified	In demand mode	Not specified
Yes	NA	Not specified	Not specified	Not specified
Yes	Yes	No	In CMV	No
Yes	Yes	No	No	No
Yes	Yes	No	In CMV (SMMV)	No
Yes	Yes	No	No	Via IMV/CPAP
No : Yes : Yes	No	No	No	Via CPAP
Yes	Yes	Not specified	Not specified	Via CPAP
Yes	Yes	Not specified	Not specified	Not specified
None specified	None specified	None specified	Demand, CMV/demand	IMV/CPAP, CPAP
0-99 cm H_2O	Yes	Not specified	On P200DEP version	On manometer
0-120 cm H_2O	Yes	Not specified	Via manometer	On manometer
0-99 cm H_2O	Yes	Not specified	Via manometer	On manometer
0-4,000 mL	No	Not specified	Not specified	Not specified
0-99.9 L	No	Not specified	Not specified	Not specified
Yes	On accessory blender	Optional	Not specified	Not specified
Yes	NA	Not specified	Not specified	Not specified
Not specified	Off, 2-50 cm H_2O	Not specified	Yes	Yes
Yes	1-100	20-80	Yes	Yes
Not specified	Yes	Not specified	Visual on manometer[2]	Visual on manometer
Yes	Yes	Not specified	Not specified	Not specified
No	Inverse	Not specified	Not specified	Not specified
No	NA	Not specified	Yes	Yes
Yes	30 sec	Yes	Not specified	Yes
Yes	On accessory blender	Not specified	Yes	Yes
Yes	Yes	Not specified	Yes	Yes
Yes	Yes	Not specified	Not specified	Not specified
Yes	Yes	Not specified	Yes	Yes
Yes	NA	Not specified	On switch on	On switch on
Disconnct/ sense line	None specified	None specified	Normal function	Normal function
No	No	Optional	Yes	Yes
Not specified	100-125/200-250 VAC 11-30 VDC, internal battery	Pneumatic	Pneumatic	Pneumatic

continued from p. 12

Isolates	Location	Penicillin	Ampicillin	Ampi/Sulba	Mezlocillin	Piperacillin	Pip/Tazobac	Oxacillin	Cefalotin	Cefuroxim	Cefotaxim	Ceftazidim	Cefepim	Imipenem	Meropenem	Gentamicin	Tobramycin	Amikacin	Ofloxacin	Ciprofloxacin	Clindamycin	Fosfomycin	Erythromycin	Rifampicin	Vancomycin	Teicoplanin
Acinetobacter baumanii	bc/rt/s/w		R	I	R	R	R/I		R	R	R			R		R		R	R							
Aeromonas hydrophilia	w		R	R	I	R	R			R		R	S	R	R	I/S	S	I	S	I/S						
Aeromonas veronii	w		R			R	R			R		R	R	S	S	R	R	I	R	I						
Alcaligenes xylooxydans	bc/rt/s		R			S	S			R		S	S	S	S	R	R			R						
Bacillus species	w	R	R	R				R	R	R		S		S		I			S		S	R	S	R	S	S
Bacteroides caccae	bc/s/w																									
Bacteroides species*	w																									
Burkholderia cepacia	rt		R			S	S			I		S	I/S	R	S	R	R	R	S	M						
Clostridium septicum	bc/s																									
Corynebacterium striatum	w	R	R					R	I					S		R			R		R	R	R	R	S	S
Enterobacter aerogenes	w		R	R	S	S	S		R	R	S			S		S		S	S							
Enterobacter cloacae	w		R	R	S	S	S		R	R	S			S		S		S	S							
Enterococcus faecalis	bc/rt/s/w	R	S	S					R	R	R			S		R			R/I/S	R	R	R/S	R/S		S	S
Enterococcus faecium	bc/rt/s/w	R	R	R					R	R	R			R		R			R	R	R	R	R/I		S	S
E.coli (ESBL +)	bc/s/w		R	R	R	R	R		R	R	R			S		R		S	I							
Klebsiella pnemoniae	rt		R	R	R	R	R		R	R	R			S		R		I	R							
Morganella morganii	w		R	R	S	S	S		R	R	S	S	S	S	S	S	S			S						
Proteus mirabilis	w		S	S	S	S	S		S	S	S			S		S		S	S							
Proteus vulgaris	w		R	R	R	R	R		R	R	R			S		I		I	S							
Pseudomonas aeruginosa	bc/s/w		R	R	R	I	I		R	R	R	R	I	S	S	R/I/S	R		I	S						
S. aureaus (MRSA)	bc/rt/s/w	R	R					R	R	R				R		R			R		R	S	R	S	S	S
Stenotrophomonas maltophilia	bc/rt/s/w		R			R	R			R		R	R/I	R	R	R	R	R	S	I						

Legend
bc - blood culture
rt - respiratory tract
s - serum
w -wound
R - resistant
I - intermediate sensitivity
S - sensitive

Table 1: Pathogens, locations and resistances

continued from p. 14

things will suddenly change and hospitals will effectively cooperate with each other is unreasonable. Impromptu cooperation without an effective plan for coordination ensures limited success at best. There must be an enforceable mandate and support from governmental authorities for inter-hospital cooperation and planning, before a disaster occurs.

6. **Making available budgetary resources work** - The cost of effective disaster planning and response is enormous. It is not realistic to expect budget-constrained facilities to absorb these additional costs, and yet, relief from governments will not fill the gap. Therefore, it seems reasonable to seek economies of scale. For example, to increase ICU surge capacity during a disaster, existing Medical Emergency Teams (MET) could, with little additional training, provide a highly effective adjunctive capability when critical care units are full and additional ICU services are required. In addition, patient safety programs require surveillance, tracking, education, ongoing risk assessment and so forth. Is there sufficient overlap to merge some of the planning, education and practice of hospital patient safety and some aspects of disaster medical response? I think that the answer is "yes."

Summary

We have much to do. This brief essay outlines the disaster response-related problems that hospital and critical care units must solve. Fortunately, there are potential solutions. However, no single solution is comprehensive by itself. A functional solution set will consist of a "patchwork" of these measures, adjusted and quilted according to local needs. This will require some degree of central coordination by governmental agencies, as well as the development of civil critical care response teams. Disasters will continue to occur, hospitals and critical care units will respond, and the general populace expects them to be ready. ■

Use of severity scores in clinical practice

Maurizia Capuzzo, MD
Department of Surgical, Anaesthetic and Radiological Sciences
Section of Anaesthesiology and Intensive Care
University Hospital of Ferrara, Italy
Italian representative in the Council of European Society of Intensive Care Medicine
Deputy chair of the Section on Health Services Research and Outcome
cpm@unife.it
www.hsro-esicm.org

Severity scores may be used to take a snapshot of a patient's current clinical status or to make a film of the dynamic process of the patient's clinical course over time.

Severity scores can be defined as a quantitative approach to provide an objective measure of severity of illness and, eventually, probability of survival for patients admitted to an intensive care unit (ICU). Moreover, multipurpose models, suitable for patients with different illnesses, allow some risk stratification of ICU patients. There are two main ways to use severity scores in clinical practice: as static or dynamic measurement systems.

When used as static measurement systems, severity scores are computed at a fixed point in time, so we can say that they take a "photograph" of the patient's medical status. The Acute Physiology And Chronic Health Evaluation (APACHE II) (Knaus et al. 1985) and the Simplified Acute Physiology Score (SAPS II) (Le Gall et al. 1993), which are the most widely used static severity scores, are computed according to the most deranged values of the variables specifically defined for each score, which are collected during the first 24 hours after ICU admission. In addition to providing a snapshot of a patient's clinical situation, these severity scores can be used to calculate the probability of hospital mortality in a given ICU patient population for use in ICU performance analysis and comparison between ICUs (benchmarking). For study purposes, APACHE II and SAPS II are used to describe patient population at the time of ICU admission or patient enrolment in a study, as APACHE II was used in the Protein C Worldwide Evaluation in Severe Sepsis (PROWESS) study (Bernard et al. 2001).

Recently, the largest prospective multicentre, multinational database available at the present (Metnitz et al. 2005) has developed SAPS 3, which is calculated on admission (Moreno et al. 2005). The new, SAPS 3 score is computed on data collected within one hour of ICU admission and conceptually dissociates evaluation of the individual patient from the evaluation of ICU.

One significant limitation of multipurpose models computed at a fixed point in time is that they do not give information about clinical changes during an ICU stay. To measure changes in the clinical course of the ICU patient over time, the patient's clinical picture needs to be captured daily, to make a "film" of the dynamic process of clinical improvement or deterioration. APACHE II and SAPS II could be computed repeatedly, even daily, but their computation is time consuming. Therefore, other, simpler severity scores have been proposed for repeated measurements.

Initially, dynamic severity scores only considered the presence or absence of organ dysfunction or infection daily (Fagon et al. 1993; Knaus et al. 1985). Subsequently, however, several dynamic severity scores, such as the Multiple Organ Dysfunction (MOD) Score (Marshall et al. 1995), the Logistic Organ Dysfunction (LOD) System (Le Gall et al. 1996) and the Sepsis-related Organ Failure Assessment (SOFA), later named the Sequential Organ Failure Assessment (Vincent et al. 1996; Vincent et al. 1998), have been published. All of these scores measure the level of dysfunction in the same six systems (respiratory, renal, hepatic, cardiovascular, haematological and central nervous) and have to be computed daily.

Among these dynamic severity scores, SOFA is unique, especially in its assessment of the cardiovascular system. The SOFA score measures the

System	MOD	LOD	SOFA
Respiratory	PaO_2/FiO_2	PaO_2/FiO_2 Ventilation	PaO_2/FiO_2 Ventilation
Renal	Creatinine	Creatinine Diuresis Urea	Creatinine
Hepatic	Bilirubin	Bilirubin Prothrombin t.	Bilirubin
Cardiovascular	HR Mean AP CVP	HR Systolic AP	Amines Mean AP
Haematological	Platelets	Platelets WBC	Platelets
C.N.S.	GCS	GCS	GCS
N. of variables	8	12	8

Table 1: Variables used in the dynamic severity scores considered, according to the six systems assessed.

severity of dysfunction according to arterial pressure and/or use, type and dose of vasoactive amines, which makes it useful in assessing the physiologic derangement of the cardiovascular system in light of the degree of therapeutic intervention. This is, possibly, the reason for the widespread use of SOFA scores, as testified by the continuous increase in the number of articles including SOFA scores since 2000.

The total maximum SOFA score and delta SOFA quantify the degree of dysfunction/failure that appears during the ICU stay and the cumulative insult suffered by the patient (Moreno et al. 1999). Accordingly, the SOFA score on a patient's last ICU day can be used as a tool to describe residual dysfunctions at ICU discharge. In addition, Cabré et al. recently proposed using SOFA scores, according to minimum, maximum and trend over first five days in ICU, as a decision-making tool (Cabré et al. 2005).

Although both static and dynamic severity scores offer useful images of a patient's clinical situation, they both have their limitations. Despite the widespread use of static severity scores in the comparison of patient groups or ICUs, their use in individual patients remains difficult, if not impossible, as severity scores cannot always accurately predict an individual patient's survival (European Consensus Conference 1994). Dynamic severity scores do not allow medical personnel to identify new illnesses or clinical complications at their onset, as they encompass only those dysfunctions developed enough to be measured, and they cannot detect changes of values already at the top of the score (ceiling effect).

Medicine has been an art working to become a science for centuries. Severity scores enhance our ability to paint accurate images of a patient's medical situation. At the same time, they offer a quantitative tool that will help advance medicine further down the path of science. ■

Motivating staff

Motivational incentives often are equated to financial or other material reward for performance; however material reward alone is rarely a sufficient motivating factor in achieving top performance. Long-term motivation is considerably more complex. In this article, we will review factors that frequently influence individual performance and discuss techniques that are useful in creating and sustaining a motivational environment for the entire ICU team.

Todd Dorman, M.D. FCCM
Johns Hopkins University School of Medicine
Baltimore
tdorman@jhmi.edu

Ronald Pauldine, M.D.
Johns Hopkins Bayview Medical Center
Baltimore
rpauldi1@jhmi.edu

Introduction

The ability of ICU managers to positively motivate team members has vast potential to impact the quality of care delivered, the environment of care and individual team member satisfaction, thereby influencing retention and recruitment of team members. Creating a motivational environment is an art that requires managerial skill, an understanding of factors that are important to different groups of professionals as well as individual team members and compelling leadership.

Why motivation matters

The importance of understanding the principles of motivation for the ICU team is underscored by the influence a motivated staff has on a number of issues that are central to running a smooth and efficient ICU. This is especially true in the context of today's highly competitive, resource-limited and workforce-depleted critical care environment. As we will see, a motivated staff should be a happy, satisfied and productive staff. If the motivational needs of the staff are met, retention and recruitment are likely to be enhanced. This, in turn, leads to savings in the cost and time associated with recruitment and training, lost productivity while searching for replacements, lost productivity while training replacements and the problems associated with resolving staffing issues while searching for new staff.

What really motivates staff?

Incongruity between what managers and employees view as motivating factors has been well described. In past studies, managers frequently cited factors such as wages and job security as the key influences on their staff, while employees identified factors such as being appreciated and participating in meaningful work as the most significant issues to them (Thiedke 2004). This principle seems to hold true for healthcare workers as well, as money appears not to be the primary issue in physician turnover and dissatisfaction in both the United States and United Kingdom (Pearson et al. 2004; Weber 2005).

Understanding the factors that motivate employees is based on understanding fundamentals of human nature. Existing data appears to demonstrate that it is not really possible to directly motivate another person. Unfortunately, it is possible to de-motivate another person. It is therefore important to create working conditions under which an individual's inherent motivation can surface and become explicitly expressed.

In general, the main force behind lasting motivation (and avoiding de-motivation) involves meeting the psychological needs of the individual, rather than providing material rewards. Factors that contribute to a positive work environment include: capable leadership, decent physical surroundings, acceptance of the individual into the team, individual recognition as a partner on the team, fair treatment, job security, knowledge and understanding of the effect on one's efforts in meeting the organizational goals, knowledge and understanding of the organizational policies and procedures, recognition of special effort or achievement, respect regarding religious beliefs or cultural differences, assurance that all on the team do their fair share and fair monetary compensation (McConnell 2005). The extent to which these variables have importance and value to individual team members will vary considerably. Therefore, understanding the value system of individual team members can help the manager match motivating factors to the individual to optimize the environment for self-motivation and achievement.

In order to effectively motivate individual staff members, one must consider that each team member has unique motivational drivers, values and biases, as well as a different perspective on reasonable expectations and returns (Nicholson 2003). It is important to recognize that motivational factors may differ between groups such as physicians, nurses, respiratory therapists, patient aides and other support staff, and that the individuals within each group will likely weight specific factors differently. While the

temptation may be to target strategies at specific groups, the value of understanding and knowing your employees as individuals cannot be underestimated.

Creating the motivating environment

It is evident from the above discussion that an understanding of the factors that motivate specific groups and individual employees is central to helping them meet their motivational needs, thereby helping to meet the needs of the organization. It may be desirable for the ICU manager to initiate changes in policies, procedures, work environment and leadership style with input from the team, in order to address issues that affect motivation and, indeed, issues contributing to de-motivation in the organization.

There are several factors that a manager must consider when instituting a culture of motivation in the ICU. It is important to create an environment that allows professional staff to achieve professional satisfaction and development, including clinical advancement, teaching or faculty rank considerations, research or opportunities for administrative and leadership duties. For many employees, an organizational culture that allows them to take pride in the organization through a mission and values that are centered on honesty and integrity will be important (Anonymous 2003). For professional staff in the ICU, as in other areas of healthcare, meaning is inherently obvious in the work. However, it is important to care for those at all levels of the organization and provide information on how their work matters and contributes to the end product (Shenkel and Gardner 2004). Open, accurate and frequent communication contributes to an environment where the efforts of the team are clearly valued and feedback is provided on how member contribution impacts the organization. Managers should consider whether the practice model and administrative support for the ICU team could be better aligned with employee expectations. Fairness and equity in compensation between peers is another area of concern. Some issues may be beyond the immediate control of the ICU manager, such as family issues related to geographic location or the ability to find satisfaction in the local community (Weber 2005). However, understanding these factors may be beneficial to the ICU manager when designing a motivational work environment.

Several principles apply to implementing and evaluating the effort to create a motivational environment. Remember that reinforcement of behavior will encourage repetition and that faster responses to behavior will have a stronger effect on behavior in the future. Also bear in mind that positive incentives exert a stronger effect than negative incentives, or disincentives. Finally, it is critical to acknowledge that the importance of any particular motivational factor is subjective, and reactions will vary from one individual to another.

Special considerations

The fact is that most of your top people are self-motivated and are not likely to respond to external incentives, but will be most likely motivated by addressing the factors discussed above. It is the ability to engage the less motivated players that creates the challenge and often proves to be labor and time intensive. Since change comes from within, it is the responsibility of the manager to understand the individual values of these potential problem employees (Nicholson 2003). What motivates them? What interferes with their motivation? Are you, as their boss, part of the problem? It is important to communicate directly and to carefully consider the array of possible outcomes. Remember that it may not be possible to meet the motivational needs and expectations of everyone.

Meanwhile, do not forget the needs of your most motivated team members. Obstacles to performance can create an environment that is de-motivating (Britt 2003). Make every attempt to set your people up for success. Provide the necessary resources and sufficient room for your staff to be creative and take chances without negative ramifications. Set the bar high, but have realistic expectations. Be careful to ensure that these highly motivated, valuable team members do not overwork themselves, in order to avoid burn out. The effective leader will help create an environment that recognizes good work and rewards excellence.

Concluding thoughts

Creating the optimal motivating environment for the ICU team is a complex task, requiring a detailed understanding of the myriad of factors that specific groups and individuals value and to which they respond. While difficult, the effort will be rewarded with a motivated, happy staff, leading to increased productivity, a positive work environment and improved recruitment and retention of ICU team members. Data from non-healthcare settings demonstrates that when staff motivation is high, outcomes are enhanced, and there is no reason to believe that the same results would not be true in healthcare. Future research should aim to confirm this relationship. ■

Evidence-based design supports evidence-based medicine in the ICU

Peter Pronovost, MD, of Johns Hopkins, lost his father to a medical error while in medical school and went on to experience the disturbing preventable loss of a child in his intensive care unit (ICU). Josie King died of dehydration in one of the world's premier academic hospitals. This has made Pronovost a tireless and widely recognized crusader for evidence-based improvements in critical care (Miller 2002). It is difficult to imagine that making medical decisions on the basis of the best available credible research findings would not lead to improved outcomes. This concept has been spreading since the early nineties.

"Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients." (Sackett et al. 1996)

As an architect specialized in the design of medical environments, including critical care, I propose that evidence-based design is an obvious analog to evidence-based medicine. Evidence-based design is the conscientious and judicious use of current best evidence, and its critical interpretation, to make significant design decisions for each unique project. These design decisions should be based on sound hypotheses related to measurable outcomes. I have previously published a description:

"Evidence-based designers make critical decisions, together with an informed client, on the basis of the best available information from credible research and the evaluation of completed projects." (Hamilton 2003)

Healthcare facility designs based on the findings of research are developed in an attempt to create environments that improve care by enhancing patient safety and being actively therapeutic, supportive of family involvement, efficient for staff performance and restorative for workers under stress. There is a clear compatibility of common themes between the design of healthcare environments based on research and the practice of evidence-based medicine in those physical settings.

There is a growing body of credible research relating the care environment to clinical outcomes. Environmental psychologists Roger Ulrich, PhD, of Texas A&M University and Craig Zimring, PhD, of the Georgia Technical Institute, together with their students, were funded by the Center for Health Design and the Robert Wood Johnson Foundation to produce a meta-analysis of the credible research in this area (Ulrich et al. 2004). They found more than 650 rigorous studies that dealt with patient and staff safety issues, the environment's impact on stress and the care environment's relationship with clinical quality.

An interesting and related example of application in the field comes to us from the Neuro ICU at Emory University in Atlanta. Dr. Alan Samuels, the unit director, found himself less than satisfied with proposed plans for a replacement ICU. He approached Zimring at nearby Georgia Tech to ask whether there was evidence relating clinical outcomes to design of critical care environments. They involved graduate students in a study which led to a design charrette, or intensive design session, with the architects. On the basis of the evidence collected, the ICU was redesigned. Samuels plans to study outcomes when the project is completed and report his results. I look forward to their publication.

More serious research relating critical care environments and outcomes is needed to answer important questions. In the area of safety, we need better research on the environment's role in spreading or preventing the spread of infection, as well as the efficacy and design of hand hygiene locations. We need to know which designs are associated with reduced error and injury. We know that daylight, artificial lighting, temperature, humidity, odor and noise all have physiological impact on the building's occupants, but we need to know much more about how they impact clinical outcomes in the ICU. Since communication is a major issue in the ICU, we need design research to discover better ways to encourage and enhance it. If productivity, performance and alertness are issues for management, then research can help identify effective ways in which the physical setting can be designed as an enabler of the work process, rather than a barrier. The range of relevant studies is nearly infinite.

Clinicians who subscribe to the tenets of evidence-based practice in critical care should become champions of collaboration with architects and designers who are also working in an evidence-based model. Both must collaborate with researchers who can answer key questions for them. They are each, after all, seeking the same thing. The synergistic results will speak for themselves. ■

D. Kirk Hamilton, B.Arch, MSOD, FAIA, FACHA,
is an Associate Professor of Architecture and a Fellow of the Center for Health Systems & Design at Texas A&M University for which he currently serves as Interim Director. His research area is the relationship of evidence-based health facility design to measurable organizational performance. He has chaired the ICU Design Committee of the Society for Critical Care Medicine (SCCM) and currently serves on the boards of the Center for Health Design (CHD) and the Coalition for Health Environments Research (CHER). Hamilton is the past president of both the American College of Healthcare Architects (ACHA) and the AIA Academy of Architecture for Health.

Inside the ESA with
Sir Peter Simpson

Sir Peter Simpson is the 2006 - 2007 President of the European Society of Anaesthesiology (ESA). In this interview with Amanda Heggestad, during Euroanaesthesia 2006, Sir Peter Simpson discusses his experiences with the ESA so far, as well as his goals for the ESA going forward.

Can you briefly describe how the ESA came to be?

The ESA formed when three existing European anesthesiology societies – the European Academy of Anaesthesiology, the Confederation of European National Societies of Anaesthesiologists, and the European Society of Anaesthesiologists – merged into a consolidated organization. The ESA draws on the strengths of these component organizations, so that we are now able to offer quality education, training and professional development initiatives; an impressive annual meeting on anesthesiology in Europe; a journal covering current anesthesiology issues; and a means to bring together the various European national anesthesiology societies. In addition, we are particularly proud of our European diploma in anesthesiology, a first step toward a coordinated, international standard in anesthesiology. In uniting these formerly independent organizations and their services, the ESA provides a common platform for Europeans to discuss anesthesiology education, management and practice.

How would you describe the ESA's role in anesthesiology?

The success of any organization lies in its relevance. The ESA promotes high-quality and safe patient care within the constraints of the resources and laws of its member countries. The ESA's job is to support the development of quality anesthesiology in all countries, no matter what resources are available, and to foster dialogue between member countries about best practices, optimal use of resources and standards of care. Our member country delegates, training opportunities, and the European diploma that we offer, in particular, are key to this international exchange. As the ESA considers expanding and diversifying our activities in the future, we will need to maintain a clear focus on our goals as an organization.

How does the ESA support critical care medicine?

Critical care is a major subspecialty of anesthesiology, and the ESA is very supportive of critical care practitioners. There is an inexorable demand for critical care in recent years, and the public often equates critical care with quality care. The ESA needs to continue supporting the place and status of critical care medicine. Much of our work already focuses on critical care. My hope is that we will be able to cater even better to the needs of our member critical care specialists going forward.

What professional interests led to your involvement with the ESA?

My clinical interests revolve around anesthesiology and perioperative care for neurosurgery and invasive neuroradiology. I am also extremely interested in medical training and workforce issues. Due in part to my interest in the postgraduate training of anesthesiologists, I played a key role in establishing the European Diploma of Anaesthesiology and Intensive Care in 1984, and I continued to support this initiative as Chairman of the Examination Committee until this year. I have also been heavily involved in the Royal College of Anaesthetists' training activities. In addition, during my time as Medical Director with the National Health Service, I developed a major interest in workforce issues, including the causes of and potential solutions for poor performance in medical staff. I am excited about the potential impact that the ESA will have on all these issues during my term as President.

How has your experience as ESA President been so far?

So far, my term as ESA President has been both very exciting and challenging. This position requires a wide range of skills, and I have drawn on them all – from interpersonal communication skills to knowledge of government relations. Most

importantly, as ESA President, I must be ready to communicate in an open and constructive way on nearly any issue. I have to be accessible to anybody who wishes to speak with me, and I try to make sure that I do take the time to listen to everyone who approaches me. I even respond to all of my e-mails personally. It is very important to me to maintain open, personal contact with ESA members and the public.

This sounds very demanding. Where do you find the time?

Sometimes, it is difficult to balance private life with the demands of this public role, but in the end, it is my duty to take everyone's concerns into consideration. When I committed to serve as ESA President, I committed, within reason, to making myself available at all times. And, I really enjoy the work. So, for the term of my Presidency, my ESA duties come first.

What are your personal goals for the ESA?

When I assumed my role as ESA President, I produced a strategy paper to guide the ESA through its transition to a consolidated organization. I am keen to try to develop a European identity for anesthesiology, without sacrificing national identities. We need to establish some consistency in standards and education, particularly given the mobility of healthcare workers within the European Union. I would like to coordinate more in this area with the European Union of Medical Specialists. In addition, we need to encourage academic anesthesiology. Anesthesiology is sometimes considered a "safe" service rather than a science, and, as a result, there is not as much research activity in our field as there should be. The ESA can and should take a lead in promoting anesthesiology research. Finally, I also hope to expand and refine our communication efforts – expand our professional networks, tailor our journal to our readers' needs, and increase our media involvement to raise public awareness of anesthesiology.

What are the biggest challenges facing the ESA going forward?

The transition to a consolidated organization with an elected board was a difficult process, but I believe it has been a great success. One of the biggest challenges we will face in the future is keeping everyone on board and maintaining people's enthusiasm for the ESA in its new, consolidated form. We will need to deliver some quick results to maintain the momentum behind our impact on patient care, without forgetting our longer-term initiatives. We will also need to remain accessible to our members and to the public. I feel that we are off to a great start.

What is your best experience as ESA President so far?

My best experience has been, undoubtedly, the enthusiasm of everyone involved in formation of a consolidated ESA. Everyone wants it to work, and our members have been very generous with their time in order to make it happen. Ultimately, I am very pleased to know that the ESA has something that people want.

And, finally, what has been your worst experience so far?

During the merger, we had to make some tough decisions about the consolidated organization. This was particularly difficult, because some people were unhappy with certain decisions, and I do not like to see people upset. I always aim for consensus. In the end, though, everyone involved was willing to embrace the larger goal of a consolidated organization with coordinated objectives. Thanks to everyone's input and cooperation, I am happy to say I believe that the formation of the ESA has been a complete success. ■

Dr. Peter Simpson's Current Key Appointments:

- Consultant Anaesthetist, North Bristol NHS Trust (Frenchay Hospital)
- President, European Society of Anaesthesiology, 2006-2007
- Knight Bachelor, Queen's Birthday Honours List 2006, for Services to the NHS
- President, Royal College of Anaesthetists, 2003-2006
- Deputy Chairman, Postgraduate Medical Education and Training Board (PMETB)
- Vice-Chairman, Specialist Training Authority (STA)
- Past-Chairman, National Confidential Enquiry into Patient Outcome and Death (NCEPOD)
- Past-Chairman of Examinations Committee, European Society of Anaesthesiology

European Court of Auditors

Ilze Raath
Editor European Affairs

The European Court of Auditors (the Court) is the external audit institution of the European Union (EU) and acts as its "financial conscience". Founded in 1977 in Luxembourg, the Court is independent from other EU institutions. Its task is to keep track of EU funds, making sure that the Commission manages them properly. Based on the Court's Annual Report, the European Parliament gives the Commission final discharge for the execution of every annual budget.

Overview

Established on 22 July 1975 by the Treaty of Brussels, the Court started operating as an external Community audit body in October 1977. Since the signing of the Treaty of Maastricht, the Court has been recognised as one of the five institutions of the European Communities.

Main role

The Court independently audits the collection and spending of EU funds by the institutions, European Development Funds and other EU agencies and bodies. Furthermore, the Court investigates whether financial operations have been properly recorded, legally and regularly executed and managed to ensure efficiency and transparency.

The Court's role, as external auditor, is to assess the financial management of the EU's budget as a whole. In practice, this means that the Court examines the paperwork of any organisation handling EU income or expenditure. Any irregularities are reported to the European Parliament and Council. The Court's audit responsibilities have been extended to Community funds managed by outside bodies and by the European Investment Bank.

One of the Court's most important functions is to assist the budgetary authority (European Parliament and Council) by issuing an Annual Report on the previous financial year. The content of this report plays an important role in the Parliament's decision whether or not to approve the Commission's handling of the budget. If approved, the Court sends the Council and Parliament a statement of assurance that European taxpayers' money was judiciously spent. Before the EU's financial regulations are adopted, the Court gives its opinion. It may comment at any time on specific issues or give an opinion at the request of an EU institution. Other important Court reports include opinions, Specific Annual Reports on EU bodies, and reports on subjects of particular interest.

Court officials

Members

According to the European Community Treaty, the Court consists of one Member from every Member State. These Members are appointed by the Council, after consultation with the European Parliament based on nominations by every Member State. Members of the Court are chosen on the basis of having worked for an auditing institution in their country of origin or their specific qualifications. They work full-time for the Court for a six-year, renewable term.

The Members sit as a college that is the main decision-making body of the Court. The annual work programme sets out the tasks that every Member is responsible for implementing. Specialised audit staff assists them. For the sake of efficiency, "chambers" (with a limited number of Members each) can be set up to adopt certain types of reports or opinions.

A President, whom the Members elect from amongst their number, heads the Court. The President's term of office is three years and is renewable. His/her role is that of *primus inter pares*: first among equals. S/he has to chair Court meetings and ensure that decisions are implemented and that all the institution's activities are properly carried out. Furthermore, the President is responsible for the legal service and the external relations department, regarding the discharge authority, other EU institutions and the supreme audit institutions of the Member and beneficiary States.

Secretary-General

The Secretary-General, the most senior official in the institution, is appointed by the Court. His/her duties include managing the Court's staff and administration, such as professional training and translation service (a unit for every official language) and the Court's secretariat.

Human resources

The entire Court staff comprises about 760 auditors, translators and administrative support. The Court employs nationals from all the Member States to ensure a balanced spread of linguistic and professional skills. Staff come from a wide range of backgrounds: from the public and private sectors, e.g. accountancy practice, internal and external audit, law and economics. The recruitment policy follows the general principles and employment conditions of the EU institutions, and its workforce comprises both permanent civil servants and staff on temporary contracts.

Internal organisation

The Court operates as a collegiate body with its Members adopting audit reports and opinions by majority vote. Meetings are not open to the public. The Court draws up its own rules of procedure governing its internal operation, which are then submitted to the Council for approval.

The auditors are divided into audit groups that are sub-divided into various specialised units, which cover the different areas of the budget. The Court assigns each Member to a group, which is chaired by a "Dean". Members of the group elect the Dean from amongst their number for a renewable, two-year term. The Dean's role is to ensure the smooth running of the group and its divisions in agreement with all the Members of that group.

The Administrative Committee, composed of Members representing the audit groups, takes care of administrative matters requiring a formal decision by the Court. Since 2004, the Court may adopt documents without discussion based on a two-third decision of the Members of an audit group or the Administrative Committee.

The Court also appoints an Internal Auditor, who reports to the Audit Committee (comprised of three Members of the Court and an external expert).

The budget

The Court is financed from the general budget of the EU. The budget amounted to about 95 million euros in 2004, representing 0.1% of the total expenditure of the EU and 1.6% of the total administrative expenditure of the EU institutions and bodies. At the Court's behest, an external audit firm audits its financial statements. These results are communicated to the European Parliament and the Council and published in the Official Journal and on the Court's website.

Audit scope

The Maastricht Treaty requires the Court to audit the implementation of the general budget of the EU, the European Development Funds, as well as the financial statements of the EU bodies and agencies. The scope of audits ranges from financial statements to detailed examinations of specific budgetary areas or management topics. These audit tasks are divided into:

- Recurrent audit tasks, which have to be done every year, such as the financial statements of the EU, the European Development Funds, and of all other bodies and agencies set up by the EU; and
- Selected audit tasks. in which the Court selects budgetary areas or management topics of specific interest for detailed audit.

The Court works independently of national governments and other EU institutions. The Court is free to decide on topics, what it wants to audit and when it wants to present its observations and publicise findings. The Court selects a number of

Fraud & OLAF

Every year, the Court reports on the management of the budget, any irregularities and suspected fraud. The European Commission and the Member States are primarily responsible for preventing, detecting and investigating errors and irregularities. The Court's task is to assess how well they have fulfilled their duty, then suggest improvements.

When fraud, corruption or any illegal activity is identified, the matter is communicated to the European Anti-Fraud Office (OLAF). OLAF, which has special independent status, was given responsibility for conducting detailed administrative anti-fraud investigations, investigating prosecutions in Member and beneficiary States, and recovering EU funds.

budgetary and management topics every year, but does not audit every budgetary area in depth every year. As a basis for identifying audit tasks, the Court regularly undertakes a risk analysis of the entire audit field, considering issues such as known problems or weaknesses, financial significance and findings of previous audits. The Court ranks these potential tasks by priority based on the results of the risk analysis and the need to ensure a balanced coverage of the budgetary area. In addition, specific concerns of the European Parliament, the Council and the public at large are also considered before the final selection of audit tasks is made.

The Court's audit policies are largely based on INTOSAI Auditing Standards and International Standards on Auditing – issued by the International Federation of Accountants – that have been adapted to suit the EU context. Under the Maastricht Treaty, the Court has right of access to any information it requires to carry out its tasks. The auditors do on-the-spot checks at the various EU institutions at the premises of bodies or legal persons managing funds on behalf of the EU, including all levels of administration dealing with EU funds.

Audit procedure

Every audit is carried out in three main stages: planning, testing and reporting.

Planning

The Court's work programme is planned on a multi-annual and annual basis. The multi-annual plan entails defining and updating its strategy, whereas the annual plan details specific tasks for that year.

The auditors prepare an audit-planning memorandum for every audit undertaken. This memorandum sets out the audit scope, approach and audit objectives, as well as how these are to be achieved in the most efficient and cost-effective way. The memorandum is complemented by an audit programme that sets out the audit testing needed in detail. The audit planning memoranda and audit programmes are submitted for approval to the audit group responsible for that task.

Testing

Testing is done to obtain sufficient, relevant and reliable audit evidence that will allow the auditors to reach conclusions on the audit objectives. Teams of two or three collect evidence in accordance with the audit programme within the EU institutions and Member and beneficiary States. Audit evidence can be obtained in various ways: examining key supporting documentation, physical inspection, or enquiry. Methods for examining and testing systems and transactions include various techniques, such as statistical sampling. In some cases, external experts are engaged to provide specialist knowledge.

Reporting

Audit reports communicate the results of the Court's work to the auditee (European Commission or other EU institution concerned), the discharge authority and the general public. After completion of the audit work, the auditors draw up a draft audit report ("the Court's preliminary observations"), which contains audit observations and findings, conclusions on the audit objectives and recommendations for improvement.

The draft audit report is examined first by the audit group and then submitted for approval by the Court. The report is then sent to the auditee in the context of a bilateral discussion procedure. The auditee checks the report and sends an official reply – taking into account the reactions of the Member States – to the Court. The Court either maintains its original observations or changes them to correct any errors or ambiguities, depending on the reply. Finally, the auditee's reply is published with the audit report. At the end of the bilateral discussion procedure, the Court formally adopts the definitive audit report.

Benefits for the EU citizen

As the Court of Auditors is the final conscience of the EU, it stands to reason that citizens expect to see and reap the benefits of its existence. Both political scrutiny and close media attention – especially to cases of fraud or misuse – necessitate the European Court of Auditors' role as an external auditor of the European Union. As such, the Court plays a vital role:

- By publishing its reports, the Court helps promote transparency and accountability in the management of EU funds;
- Through its audit work, the Court helps ensure that EU funds are collected and used in accordance with the applicable rules and regulations;
- Its audit observations and recommendations help managers of EU funds improve their performance and contribute towards improving sound financial management; and
- Its audit reports serve as a basis for the democratic scrutiny of the utilisation of EU funds by the European Parliament and the Council.

Although not infallible, the Court strives to uphold its mandate by providing the best possible service in an expanding European Union. ■

An overview of the healthcare system in Portugal

Healthcare is on every country's political agenda, especially because of the need to find solutions to the continuing increase in cost while meeting the challenge, felt by every healthcare system, to guarantee more and better healthcare to its population. In order to explain today's healthcare system in Portugal and identify opportunities for restructuring, one must first understand how the system evolved and what factors have impacted its development.

Ana Luisa Jardim, MD
ICU – H. Capuchos,
Lisbon, Portugal
analuisajardim@gmail.com

Healthcare in Portugal during the era of democratic consolidation (1974-1985)

The implementation of the National Health Service (NHS) in 1979, which guaranteed "universal, general and free" healthcare, is linked to the democratization process in Portugal. At the time, two main features characterized the NHS: 1) It was funded by the State budget and 2) It integrated a number of different health services. Within a short time from the creation of the NHS, healthcare coverage of the Portuguese population went from 58% in 1974, to 100 % in 1980 (Barros and Simões 1999).

Healthcare in Portugal from 1985-1995

At the end of the 80s, debate arose regarding healthcare reform in Portugal and a number of other European countries. With public healthcare services' lack of efficiency and the public's difficulty in accessing these services, advocates increasingly defended introducing market-oriented and competition mechanisms into the system of healthcare provision. Here the private sector would take a more active role, while funding became more individualized and the NHS became subject to corporate management. Serious doubts were cast on centralized healthcare systems, such as those in the United Kingdom and Southern Europe.

In 1990, the Basic Law for Health was passed in Portugal, and then, in 1993, the NHS statute came out. Both were to play a pivotal role in this critical new healthcare strategy. The most far-reaching legislative measure was the creation of Regional Health Administrations (RHAs), which coordinate hospitals and healthcare centers over widespread geographic areas. Also at this time, Portugal underwent its first experience of private management of a public hospital.

From 1974 to 1995, there was overall improvement in health indicators, and the country progressively converged with the average health figures for Europe. Yet in tandem, there was a significant rise in healthcare spending, an increase in human resources deployed and an upswing in the indicators for use of healthcare services (OECD 2006).

Latest developments in the evolution of the healthcare system (1995-2006)

Particularly after 2002, a number of structural reforms were developed and implemented, some of which were innovative. Some of the more liberal principles from the previous period were incorporated (separating the funder from the provider), and providers were reorganized with a view to decentralization and increased flexibility of management. Some examples of this are the corporatization of a few public hospitals, and the creation of Integrated Centers of Responsibility in hospitals, which act as intermediate levels of administration, and third generation health centers.

The OECD's September 2004 Report (Economic Survey Portugal 2004) made a globally positive assessment of the reform underway and the legislation that had been passed. The key strategy for reform is combined national healthcare where public, private and social healthcare providers coexist and are regulated by an "independent and autonomous regulatory entity" that oversees issues of equity, accessibility, quality and rights of users.

According to the Ministry of Health (2004), 74% of hospital beds belong to the public network, while 23% belong to the private sector. 79% of the private sector beds belong to the private non-profit sector and 21 % to the for-profit private sector (Ministry of Health 2004). It should be stressed that, in 2001, the share of Portugal's GDP spent on healthcare was already 9.3% - while the European average was 9.0% (OECD 2006).

Hospital care

A new hospital management law was passed for all hospitals that called for heightened management

responsibility, upgraded efficiency, effective assessment of professionals and introduction of financial incentives. As a result, 34 hospitals were corporatized, with 31, more than 1/3 of all public hospitals, designated Public Corporate Entities (PCEs). In addition, two of the largest teaching hospitals have also recently been corporatized. This new legal framework allows for greater administrative autonomy and financial accountability in hospital management, while permitting greater leeway in purchasing equipment and materials and in hiring employees. PCE hospital employees are currently covered by in individual work contracts.

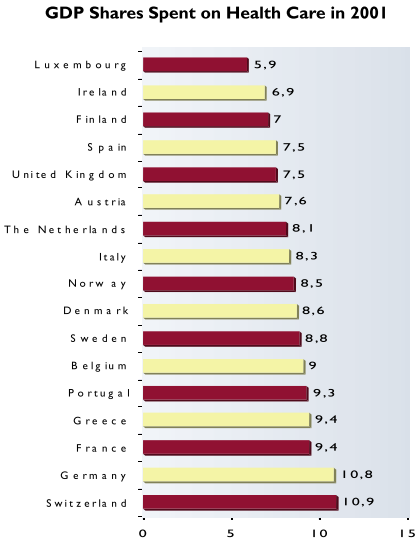

Figure 1: GDP Shares Spent on Health Care in 2001 (OECD 2006)

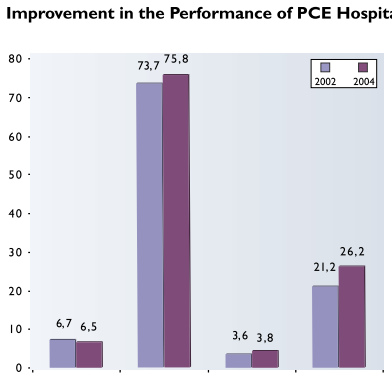

Figure 2: Improvement in the Performance of PCE Hospitals (Pereira 2005)

Other, non-corporatized public hospitals (the Public Administrative Sector hospitals, or PAS hospitals) are expected to follow suit, improving their overall performance by following the benchmarks set by the PCEs. Modern partnership models have also been adopted, in which public-private partnerships (PPPs) of the Private Finance Initiative type have been set up. This involves the construction, financing and operation of new public NHS hospitals by private entities.

Primary care

Legislation already published opens the way to the reform of primary healthcare by means of new organizational models. Specifically, heath centers will be restructured into family health units that are functionally and technically autonomous. Legislation also allows for the management of health centers by private, social or public entities under contract, with State payments for results benefiting the population. A payment scheme linked to performance was also introduced for general practitioners.

Continuing care

A national network of continuing care, especially aimed at the elderly, the chronically ill and people undergoing lengthy recoveries was also created. This project is still in its very early stages.

Waiting lists for surgery

To combat long waiting lists for surgery, the healthcare system created a per-patient incentive program, later replaced by the "Integrated System for Management of Patients Signed Up for Surgery," which makes the State more accountable to its citizenry. It also gives citizens greater freedom by guaranteeing that users of the healthcare system will undergo surgery within a clinically acceptable time period. Currently, after six months on a waiting list for surgery, patients have recourse to undergo the procedure at a private hospital at the expense of the NHS. The average waiting period for surgery in 2002 was 5.5 years. In 2004 this was significantly reduced to 8.7 months. (Pereira 2005).

Drug policy

Portugal holds first place for expenditure on drugs. The share of the GDP on pharmaceuticals in 2000 was 2.0% (OPSS 2001). However, certain measures have been taken to reduce this type of spending. For example, the generic drug market has expanded, with the market share for generics burgeoning from 0.34% in 2002 to 9.66% in 2004, although this is still lower than the figures for the rest of Europe. (Pereira 2005).

Funding of the NHS

More than 95% of NHS funding comes out of the State budget, with the rest made up of revenue from patient co-payments, subsystems and insurance. Hospital budgets absorb 53% of NHS funding and constitute the largest share of public spending on healthcare. NHS health centers make up 11% of economic resources allotted to health while pharmacies represent 24% (Pereira 2005).

A philosophy of paying hospitals for effective "production" of acts and services rendered to users has been introduced, as opposed to the former scheme of provisional twelfths of the State budget based on previous budget histories. Thus, greater emphasis has been placed on contractualization, involving agreements signed by the paying/contracting entity (the Portuguese State through its Ministry of Health) and units providing healthcare (hospitals, health centers).

Conclusion

All the structural measures affecting the healthcare system over the last few years – namely changes in the legal status of hospitals (hospital-corporation), the creation of public-private partnerships, the reform of primary healthcare and the promotion of generic pharmaceuticals – stand to bring about effective changes in Portuguese healthcare. However, it is still too early to tell how far-reaching their impact will be. ■

Intensive care medicine in Portugal

The first intensive care units (ICUs) in Portugal were created in the late 1950s in Coimbra (Rui Carrington da Costa) and Oporto (Armando Pinheiro). Lisbon, the capital of the country, just introduced the first mixed medico-surgical ICU in 1979, although some spaces dedicated to the care of trauma and surgical patients existed there before. In recent years, ICU has undergone significant change in Portugal.

Rui Moreno MD, PhD
Unidade de Cuidados Intensivos Polivalente (UCIP)
Hospital de St. António dos Capuchos
Centro Hospitalar d Lisboa (Zona Central)
Lisbon, Portugal
r.moreno@mail.telepac.com

In the last 15 years, Portuguese intensive care medicine (ICM) has been subjected to two movements that changed the way the country provides assistance to the critically ill patient. First, in the early 1990s, several new ICUs were created throughout the country, allowing all districts of the country to have mixed ICUs – a privilege, up to that date, reserved for the large cities. Second, in 1997, the National Medical Board accepted the creation of the sub-specialty of intensive care medicine. In our national model, to be recognized as an intensive care sub-specialist, doctors have to have a primary specialty (internal medicine, anesthesia, surgery, etc.) and then go through two years of full clinical training in intensive care medicine with a final examination. This model is still far away from completion.

Over time, several specialties have been involved in the process of creating the ICM sub-specialty in Portugal, with most intensivists coming from anesthesiology and internal medicine, as well as some from pneumology. The lack of a standardized, well-known and well-respected program for education and training in ICM until recently pushed a significant number of Portuguese doctors to stand for the European Diploma in Intensive Care Medicine. Portugal has had a significant number of specialists recognized by the European Society of Intensive Care Medicine (ESICM) since 1990. To date, Portugal has not developed a specialty or sub-speciality in critical care nursing.

According to the latest available data, Portugal has 52 ICUs in 41 hospitals, corresponding to around 394 staffed beds (440 installed beds). These numbers correspond to 3.9 mixed adult ICU beds per 100,000 inhabitants, but the beds are poorly distributed. For example, Alentejo has only around 2.8 beds per 100,000 inhabitants, and Algarve has 3.8 beds per 100,000 inhabitants during most of the year, but only 1.5 beds per 100,000 when the population reaches more than one million in the summer. Intensive care coverage is not available in all island areas (see table 1).

The Portugal Intensive Care Society, founded in 1975, is one of the oldest in Europe. The Society, with around 1,000 members, is a mixed society, with equivalent numbers of nurses and medical doctors. It holds mixed congresses, courses and other post-graduate activities. Portugal has always been active internationally, particularly with Spain and Brazil. The Society was a founding member of the World Federation of Societies of Intensive & Critical Care Medicine and of the Pan-American and Iberian Federation of Intensive Care Medicine, whose Congress we hosted in 1995. Lisbon has been also selected to host the 2008 Meeting of the European Society of Intensive Care Medicine.

In a country facing a poor economic situation, intensive care medicine is currently subjected to pressure to increase productivity and decrease costs. The government's lack of definition for what an ICU is and who can practice intensive care medicine threaten the development of our speciality. Also, the lack of emphasis on basic and clinical research, with most Portuguese hospitals (even university-affiliated) dedicating almost all their time and resources to a heavy clinical burden, prevents further developments in our field. However, the number of Portuguese intensivists taking post-graduate courses and fellowships abroad is increasing, as is the number and quality of published manuscripts.

Portugal, with a strong culture of intensive care medicine based on quality of care, where almost all ICUs have already adopted a closed model, our dedicated professionals will face up to the challenge of integrating research and teaching in this process in the coming years. The SPCI will certainly serve an important role by providing information and training to members, by creating spaces for the exchange of ideas and experiences and by starting and sustaining collaborations. This is our challenge. ■

Region	Hospitals	Mixed ICUs	Installed beds	Active beds	Inhabitants	Active beds / 100.000 inhabitants
North	14	9	100	120	3236006	3,1
Centre	9	9	74	87	2002305	3,7
Lisbon and Tagus River	21	15	166	179	3378967	4,9
Alentejo	3	3	13	13	461637	2,8
Algarve	2	2	15	15	395208	3,8
Azores	2	2	16	16	241000	6,6
Madeira	1	1	10	10	263000	3,8
TOTAL	**52**	**41**	**394**	**440**	**9978123**	**3,9**

Table 1: Access to care in Portugal

Intensive care medicine and emergency medicine in Portugal

Ricardo Matos, MD
Unidade de Cuidados Intensivos Polivalentes (UCIP)
Hospital de Santo António dos Capuchos
Centro Hospitalar de Lisboa (Zona Central)
Lisbon, Portugal
Ricardo.gmatos@mail.telepac.com

One of the most remarkable aspects of the evolution of medicine in Portugal in the last decade has been the growing development and recognition of emergency medicine.

Introduction

Portugal has always provided healthcare services to patients who, due to the high risk or seriousness of their clinical situation, have required an emergency approach. However, this work has never been as professional, as organised, as structured and, ultimately, as widely recognised as it is today (Marques and Almeida e Sousa 2004). This article highlights the most important contributing factors in the rise of emergency medicine in Portugal.

Pre-hospital medicine

The National Institute of Medical Emergency (*Instituto Nacional de Emergência Médica*, or INEM) was founded in 1981. With the approval of a new law in 2003 (Portuguese Government Publishing Service 2003a) and of a new internal set of regulations in 2004 (Portuguese Government Publishing Service 2004), INEM was restructured, increasing both its structure and resources. Its areas of action and coverage were also expanded, bringing INEM coverage to nearly all national territories.

In continental Portugal, INEM is responsible for an integrated medical emergency system that guarantees immediate and appropriate healthcare for accident casualties and victims of sudden illness. Among its many tasks, INEM provides initial medical help at the accident site, transportation of victims to the correct hospital and inter-hospital communication services. Through its European emergency call number (112), INEM has several means to respond effectively, at any time, to medical emergency situations (Portuguese Government Publishing Service 1997). In order to provide efficient medical assistance to victims of sudden illness or accident, we have the following emergency services, appropriate for different types of medical emergencies: Emergency Patient Coordination Centres (*Centros de Orientação de Doentes Urgentes*, or CODUs); the Emergency Patient Coordination Centre for Situations Occurring at Sea (*Centro de Orientação de Doentes Urgentes para situações ocorridas no mar*, or CODU-Mar); the Poison Information Centre (*Centro de Informação Antivenenos*, or CIAV); and the High Risk Neonatal Transport Subsystem (*Sub-sistema de Transporte de Recém-Nascidos de Alto Risco*).

CODU is the primary coordinator of emergency medical services and receives all requests for emergency assistance via the call number 112. CODU is staffed around the clock by doctors and central operators with specific training to answer the calls, perform triage and provide pre-emergency counselling. CODU can dispatch various emergency response resources, such as the INEM and CODU Ambulances, the Medical Emergency and Reanimation Vehicles (*Viaturas Médicas de Emergência e Reanimação,* or VMER), the Catastrophe Intervention Vehicles (*Viaturas de Intervenção em Catástrofe*, or VIC) and the Medical Emergency Helicopters. Using its telecommunications capabilities, CODU can dispatch and support these emergency response teams, then, based on clinical information from the field, prepare the appropriate hospital for the patient's reception.

The National Fire and Civil Protection Service (*Serviço Nacional de Bombeiros e Protecção Civil*, or SNBPC), subject to the Internal Affairs Minister, was created in 2003 (Portuguese Government Publishing Service 2003b). Its objective is to protect and assist people and property, by guiding and coordinating all the civil protection and emergency activities. SNBPC is responsible for preventing collective risks from serious accidents or catastrophes and minimising the impact of these situations when they occur. It also coordinates the activities of the fire services and lends technical and financial support to activities in all civil protection fields, as appropriate. SNBPC promotes, supports, and critiques the development of emergency plans at the national level. Finally, SNBPC fosters emergency and civil protection cooperation with national and international organisations, particularly within the European Union and lusophone diaspora.

Hospital medicine

Portugal has recently built a number of new hospitals, replacing several old and less functional buildings and, at the same time, ensuring better coverage of the national territory. In addition, Portugal has created new emergency services, recognising emergency medicine's essential role within hospitals – a fact not always acknowledged

in the past, particularly in some central and university hospitals. Even now, many hospitals do not have a system to respond to internal emergencies, and where a system is in place, it is run on an exclusively volunteer basis.

Particularly during the 1990s, Portugal began opening more intensive care units (*Unidades de Cuidados Intensivos*, or ICUs) (Direcção-Geral da Saúde 2003), due to the broadening of indications for patient admission; better and faster intra- and extra-hospital assistance resources; and increased requirement of intensive care medicine (with the evolution of more aggressive surgical or medical therapeutics in several areas, like haematology, oncology and transplantation). With the introduction of additional ICUs, progressive and better communication developed between ICUs and other hospital areas, such as intra- and extra-hospital emergency services, surgery rooms, intermediate care units and departments facilitating fast-track patient admission systems.

Finally, the Health Ministry created the National Hospital Reference Network for Emergency (*Redes de Referenciação Hospitalar Nacional para a Urgência/Emergência e para os Cuidados Intensivos*) and promulgated suggestions for the development of intensive care in the framework of the National Health Service (*Recomendações para o desenvolvimento dos Cuidados Intensivos no quadro do Serviço Nacional de Saúde*), thus creating the essential conditions for the justification and planning of the financial and human resources, ensuring better national coverage of emergency medical services (Direcção-Geral da Saúde 2003; Ministério da Saúde 2004a; Ministério da Saúde 2004b).

Professional training

Several entities stand out for their work in emergency medical training in recent years:

INEM's Medical Emergency Training Department, in response to numerous requests from the population and in accordance with its mission, regularly offers courses to non-professionals and professionals alike, such as courses on adult basic life support (BLS) for laymen, paediatric BLS for laymen, BLS for health professionals and basic emergency techniques (http://inem.min-saude.pt).

The Portuguese Society of Surgery (*Sociedade Portuguesa de Cirurgia*, or SPC) has been offering Advanced Trauma Life Support® (ATLS) courses since 1999, in collaboration with the Committee on Trauma of the American College of Surgeons (www.atlsportugal.org/index.html). ATLS is a post-graduate medical training programme, which aims at improving the quality of initial medical help for the polytraumatised patient, trying to reduce the mortality and incapacity associated with "the 20th century epidemic"- trauma.

The Portuguese Society of Intensive Care (*Sociedade Portuguesa de Cuidados Intensivos*, or SPCI) offers a regular programme of courses, including Fundamental Critical Care Support (FCCS) and Fundamentals of Disaster Management (FDM), delivered by SPCI in partnership with the American Society of Critical Care Medicine (SCCM). FCCS is a two-day course for non-intensivists that teaches the fundamental principles of the first 24 hours of medical care for the critical patient. This course, offered at several locations throughout the country each year, has been very successful in Portugal, already having trained hundreds of professional doctors and nurses. The same can be said about the FDM course, which has been offered since 2004. It is a one-day course on disaster medicine, which has made possible a closer cooperation between the various entities of emergency medicine, such as SPCI, INEM and SNBPC. One of the most important contributions of SPCI to date was the development of the document "Guidelines for the transport of the critically ill patients", by an SPCI taskforce in 1997 (www.spci.org/index2.html).

The Portuguese Resuscitation Council (*Conselho Português de Ressuscitação*, or CPR) focuses on coordination and promotion of initiatives related to reanimation, normalisation of educational programmes to develop education and practice of cardio-respiratory reanimation techniques, in accordance with the European Resuscitation Council (ERC). It was created in 1997 and has been a member of the European Resuscitation School since 1999. CPR has certified seven schools of reanimation training in Portugal, which regularly deliver many courses in basic, intermediate and advanced paediatric and adult life support, as well as automatic external defibrillation courses and basic or advanced life support courses for instructors.

In addition to these key training sources, the Fire Services Corporations, Public Security Corporations, Schools, Societies (*Corporações de Bombeiros, Corpos de Segurança Pública, Escolas, Sociedades*) and the Portuguese Trauma Society (*Sociedade Portuguesa de Trauma*) contribute to emergency medical training activities. Portuguese universities are also involved in emergency medical training, such as Oporto University and its Faculty of Medicine, which offers a Master Degree in Emergency Medicine, and the Abel Salazar Biomedical Science Institute, which offers a Master Degree in Disaster Medicine.

Emergency medicine accreditation

In 2002, the National Executive Council of the National Medical Board (*Conselho Nacional Executivo, or CNE, da Ordem dos Médicos*, or OM) recognising the universal development of emergency medicine and its predictable and desirable national expansion, created the Competence in Medical Emergency (Ordem dos Médicos 2002). It established requisite technical-professional qualifications for doctors working in emergency medicine. At the same time, it issued best practice norms, aiming at improvement of healthcare service. Based on these new standards, several specialisations, such as surgery, internal medicine, anaesthesiology and paediatrics, were allowed to access this Competence, through adequate curriculum assessment by a committee appointed by the CNE.

Although the European Society for Emergency Medicine (EuSEM) promotes the creation of a Specialisation in Emergency Medicine (EuSEM 2002a,EuSEM 2002b), specialisation is not an option in Portugal. The Portuguese Medical Board considered it preferable to take advantage of the different experiences in basic training provided by a multidisciplinary staff working together in emergency medicine. Regardless of Portugal's preference for a Competence over a Specialisation, the country has made significant progress toward a clear curriculum definition and the establishment of excellence services, where high quality technical and scientific training can be done. The OM will be responsible for accreditation and certification in our country.

The role of intensive care medicine

Intensive care medicine has played an important part in the development of emergency medicine in Portugal. There is obviously a lot in common between the two disciplines,which share the common goal of providing medical care to severely ill or injured patients and are often only distinguishable from one another in where and when this care can be provided. However, the contribution that I deem most important is the training of emergency medicine practitioners, which occurs mostly in ICUs. This ICU training often develops the trainee's taste for emergency medicine, effectively recruiting trainees to the vocation. Several intensivists played an important role in the creation of the Competence in Emergency Medicine, and their interest in the field continues. Many intensivists are firmly committed to contributing to the training of those who provide healthcare to critical or emergency patients.

In Portugal, the intensivist has embraced the role of "older brother" to the emergency medicine practitioner. The intensivist arrived first, grew earlier, contributed decisively to the emergency practitioner's training and will, I am sure, continue to do so. But now they will work together, and their work will be more equitable, with mutual benefits for these complementary areas of medicine and for their patients. ■

Relevant Websites

- Instituto Nacional de Emergência Médica, *www.inem.min-saude.pt*
- Serviço Nacional de Bombeiros e Protecção Civil, *www.snbpc.pt*
- Sociedade Portuguesa de Cirurgia, *http://spcir.com*
- Sociedade Portuguesa de Cuidados Intensivos, *www.spci.org/index.html*
- Conselho Português de Ressuscitação, *www.cprportugal.net*

Intensive care training in Portugal

Since the inception of the first Portuguese intensive care unit (ICU) in the late fifties, significant (but still insufficient) progress has been made, with the installation of many ICUs and the training of staff, doctors and nurses for critical patients' care.

Teresa Fevereiro, MD
Luisa Amado, MD
Unidade de Cuidados Intensivos Polivalente (UCIP)
Hospital de Santo António dos Capuchos
Centro Hospitalar de Lisboa, Zona Central
Lisbon, Portugal
t.fevereiro@netcabo.pt

The rapid evolution of technical and scientific knowledge in the area of critical care brought about the need for a new specialisation for those working in intensive care, regardless of their previous studies. This need was first recognised in 1989 by our National Medical Board (*Ordem dos Médicos*, or OM), which is in charge of medical training. That year, the OM implemented the *Ciclo de Estudos Especiais em Medicina Intensiva*, or "Special Studies Cycle in Intensive Care Medicine", a two-year period of training for those desiring to work in critical care. In 2005, the OM recognised intensive care as a sub-specialty and established new requirements for qualification.

In Portugal, intensive care medicine is taught only at Coimbra University, one of Portugal's six medical schools. It is a four-month course with theoretical and practical training, included in the last year of the usual medical studies.

Intensive care training is now part of the residency curricula of medical and surgical specialties, its duration ranging from three to nine months and, if desired by the trainee, extended to the maximum of twelve months. This residency must be completed in a B-Level ICU. During this training period, the trainee must recognise, prioritise, and implement a procedure plan for every type of critical medical, surgical or trauma patient. After the training period, all candidates are evaluated in a theoretical and practical exam, qualifying with at least 10 out of 20 possible points.

The *Ciclo de Estudos Especiais em Medicina Intensiva*, initiated in 1989, is a two-year period of training for those wanting to specialise in intensive care. All candidates must have previous specialisation in internal medicine, general surgery, anaesthesiology or other medical or surgical specialities. Candidates are accepted to a programme in a B- or C-Level ICU after curricular evaluation. During this two-year training period, candidates work on a full-time schedule (42h/week) in the ICU, but candidates may also stay for short periods of time in other ICUs, focusing in more specific areas, like trauma, neurological, coronary or burn care ICUs. Candidates should acquire skills in the management of respiratory, cardiovascular, neurological, renal, haematological, gastrointestinal, obstetrics, burn, toxic syndrome and infectious disease cases. They must also be proficient in all the current ICU techniques. After the training period, candidates undergo a three-part exam, performed by members of the ICU staff, including curricular, theoretical and practical issues. After qualification, the OM certifies candidates as sub-specialists in intensive care medicine.

The intensive care sub-specialty will replace the *Ciclo de Estudos Especiais em Meidcina Intensiva* in the future. Candidates are subject to the same specialty requirements and are admitted to the training programme after curricular evaluation and an interview. The two-year training is done in a C-Level ICU, on a full-time (42h/week) schedule. The ICU continually evaluates candidates on their proficiency in the areas of critical care described above. After the training period, if the candidate qualifies with at least 10 out of 20 possible points in the continuous evaluation, he or she will undergo a three-part exam (curricular, theoretical and practical). This exam is administered by a board of five intensive care sub-specialists, three from other ICUs.

In Portugal, there are now about 170 intensive care sub-specialists. The majority of them are long-term intensive care practitioners, from internal medicine, pneumology and anaesthesiology. We expect that the coming years will bring many more sub-specialists and greater recognition of the importance of the specific training for those taking care of critically ill patients. ■

ICU Level	A-Level	B-Level	C-Level
Case Mix	×	> 10% medical, surgical, and urgent/ emergency patients	> 15% medical, surgical, and urgent/emergency patients (each), including coronary, neurological, and trauma patients
Years of Activity	×	> 2 years	> 5 years
Active Beds	×	> 6 beds	> 8 beds
Admissions/Year	×	> 150 admissions	> 200 admissions
Training	×	1 intensive care specialist in charge of medical training	> 5 intensive care specialists in charge of medical training
Other Requirements	Meets minimal criteria that must be fulfilled by every ICU, based on a report of ICU statistics and certified by an independent board.	Meets the above criteria and may train residents.	Meets the above criteria and offers a training programme and investigational projects. May train sub-specialists.

*Table 1: Portuguese ICU Requirements, by Level**

* These criteria are periodically revised and audited.

Sepsis and organ failure in Portugal

Isabel Miranda, MD.
Unidade de Cuidados Intensivos Polivalente (UCIP)
Hospital de St. António dos Capuchos
Centro Hospitalar de Lisboa (Zona Central)
Lisbon, Portugal
lisamiranda@sapo.pt

Sepsis, defined as the host response to an infectious process, is one of the most frequent diagnoses in the intensive care unit (ICU), and when associated with organ system dysfunction, remains one of the most common causes of mortality in critical care. This paper reviews some of its characteristics in Portuguese ICUs.

A Portuguese prospective and multicenter study from 15 ICUs, including 701 patients (58% of them of medical with mean SAPS 38 ± 41), showed that, at admission, 34% of the patients were infected (Moreno et al. 1999). ICU and hospital mortality (20% and 30%, respectively), were significantly related to sepsis and septic shock. Organ dysfunction at ICU admission, assessed by SOFA score, was significantly associated with infection. There was also a correlation between SOFA score and mortality, sepsis and septic shock at admission or during ICU stay. At the same time, there were a number of patients with high SOFA scores, but without SIRS, sepsis or septic shock criteria.

Recently, another prospective multicenter study about community-acquired sepsis (CAS) in Portugal, included 2,643 ICU patients from 17 ICUs; 606 (23%) had CAS, 41% of the CAS patients had severe sepsis and 48% had septic shock (Carneiro et al. 2006). Microbiologically documented infection was found in 40% of patients. Septic patients had a longer ICU stay and a higher mortality rate than the control group. The authors concluded that there are now more patients admitted with CAS and more severe sepsis and septic shock, compared to previous, similar studies.

There are also other, international epidemiological studies with Portuguese data about: incidence of infections and sepsis (Alberti et al. 2002; Vincent et al. 2006), their influence on outcome (Alberti et al. 2003; Alberti et al. 2005) and incidence of organ dysfunction in ICU patients (Vincent et al. 1998). However, Portugal is poorly represented in these studies, and data from some of these studies is not published separately according to country of origin. Nevertheless, we can see in the Alberti study that, in 514 patients from three Portuguese centers with ICU stay longer than 24 hours, there was a high rate of infection on ICU admission (291 patients, 57%) and ICU acquired infections (122 patients, 24%) (Alberti et al. 2002). The SOAP study, which included 69 patients from 6 Portuguese ICUs, shows that 50 patients (73%) had sepsis and that 64% of them had severe sepsis (Vincent et al. 2006). ICU and hospital mortality of septic patients was high (32% and 38%, respectively), as was SAPS score (46,2 ± 14,8). In this study, Portugal was the country with the highest frequency of sepsis and mortality.

The number of patients included in these studies is low and not representative of all Portuguese ICU patients. Nevertheless, Alberti et al. showed that, in Portugal, the rate of infection at ICU admission and during ICU stay is high, and the SOAP study observed a high rate of sepsis, severe sepsis and ICU and hospital mortality in Portuguese patients (Alberti et al. 2002; Vincent et al. 2006). How could we explain these results? Mortality rate in septic patients is almost double of that of nonseptic patients, because septic patients are generally more ill. However, this is not the sole explanation, because association between sepsis prevalence and mortality is stronger than between mortality and severity of disease measured by SAPS II (Warren and Ferguson 2006). The SOAP study's finding that there is an association between the degree of organ dysfunction and number of failing organs and mortality, already noted by Vincent (Vincent et al. 1998), suggests that organ failure was elevated in the Portuguese population, given the observed mortality in these patients. Differences in case-mix, admission criteria, pre-ICU and ICU resource utilization, widespread antibiotic use and subsequent impact on multiresistant microorganisms may also account for poor outcome in Portugal's septic patients.

In Portugal, there are few studies on the epidemiology of community, hospital and ICU-acquired infection and organ dysfunction in critical care patients. However, one can carefully state that there is a high severity of infection, sepsis and organ failure in this country that can not be explained just by differences in study protocols and methodology. Further research is needed to better identify the factors that contribute to this phenomenon and to take action in order to decrease mortality for severe infection and organ failure in Portugal. ■

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Simon Finfer, MD, MBBS, MRCP
Senior Staff Specialist in Intensive Care
Royal North Shore Hospital of Sydney
University of Sydney
Sydney, Australia
Plenary: Clinical Role of Albumin in the Critically Ill

Daren K. Heyland, MD, MSc
Associate Professor of Medicine
Kingston General Hospital
Queen's University
Kingston, Ontario, Canada
Plenary: Pharmaco-Nutrition: A New Emerging Paradigm

Patrick M. Kochanek, MD, FCCM
Director, Safar Center for Resuscitation Research
University of Pittsburgh Medical Center
Pittsburgh, Pennsylvania, USA
Plenary: Emergency Preservation for Resuscitation (EPR): Beyond CPR

Lucien L. Leape, MD
Department of Health Policy and Management
Adjunct Professor of Health Policy
Harvard School of Public Health
Boston, Massachusetts, USA
Plenary: Problem Doctors:
Is There a System–Level Solution

William J. Sibbald, MD, FCCM
Physician-in-Chief
Sunnybrook Health Sciences Centre
Professor of Medicine
University of Toronto
Toronto, Ontario, Canada
Plenary: Learning From Others: Best Practices in Leadership From Leaders Outside Healthcare

Jeffery S. Vender, MD, FCCM
Director, Medical Surgical ICU
Department Chair of Anesthesiology
Evanston Hospital
Professor of Anesthesiology
Northwestern University
Evanston, Illinois, USA
Plenary: Organizational Change: The Process of Moving Today Into Tomorrow

Hector R. Wong, MD
Director, Division of Critical Care Medicine
Cincinnati Children's Hospital Medical Center
Cincinnati, Ohio, USA
Plenary: Genome-Level Expression Profiles of Pediatric Septic Shock

Table 1: Keynote Addresses

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2-6 European Respiratory Society 2006 Annual Congress
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www.ersnet.org/ers/default.aspx?id=2078

24-27 19th Annual Congress of the European Society of Intensive Care Medicine
Barcelona, Spain
www.esicm.org

OCTOBER 2006

4-8 4th European Congress on Emergency Medicine
Crete, Greece
www.ecem2006.com

12-13 Cours d'Echocardiographie-Doppler en soins intensifs et réanimation
Brussels, Belgium
www.intensive.org

12-15 31st Australian & New Zealand Annual Scientific Meeting on Intensive Care
Tasmania, Australia
www.anzics.com.au

20-22 2nd International Emergency Medicine Conference and the 1st International Anesthesiology and Critical Care Conference
Pristina, Kosovo
basrilenjani@yahoo.com

NOVEMBER 2006

16-17 Cours d'Echocardiographie-Doppler en soins intensifs et réanimation
Brussels, Belgium
www.intensive.org

DECEMBER 2006

5-7 12th Postgraduate Refresher Course
Brussels, Belgium
www.intensive.org

FEBRUARY 2007

5-9 15th Winter Symposium on Intensive Care Medicine
Crans-Montana, Switzerland
www.intensive.org

18-21 36th Critical Care Congress of the SCCM
Orlando, USA
www.sccm.org

MARCH 2007

22-24 3rd World Congress Abdominal Compartment Syndrome (WCACS 2007)
Antwerp, Belgium
www.wcacs.org

27-30 27th Annual International Symposium on Intensive Care and Emergency Medicine
Brussels, Belgium
www.intensive.org

MAY 2007

22-24 15th World Congress on Disaster and Emergency Medicine
Amsterdam, The Netherlands
www.wcdem2007.org

JUNE 2007

9-12 Euroanaesthesia
Munich, Germany
www.euroanesthesia.org

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GUEST AUTHORS
S. Afifi, L. Amado, M. Ault, R.J. Brilli, M. Capuzzo, T. Dorman, A. Faltlhauser, J.C. Farmer, T. Fevereiro, D.K. Hamilton, A.L. Jardim, M. Maegele, R. Matos, I. Miranda, R. Moreno, L. Morris, S. Nasraway, S.M. Pastores, R. Pauldine, P. Simpson, B. Smith, A. Thomas, J.-L. Vincent

PUBLISHING HOUSE
Euromedical Communications s.a.
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Tel +32 2 286 8500
Fax +32 2 286 8508
E-mail office@icu-management.org
Website www.icu-management.org

PUBLISHER
Christian Marolt c.m.@icu-management.org

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Luk Haesebeyt marketing@icu-management.org

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