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Burnout in Care

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Burnout in Care

As critical care specialists, we are faced with strong physical and emotional challenges every day. The work in the intensive care unit (ICU) demands a constant high level of undivided concentration and a physical ability to stay alert for many hours. We are faced daily with numerous examples of human drama, from the critical condition or loss to the miraculous recovery of a patient. And as much as we may try to remain unaffected by this emotional side of our work, every person that comes for our care leaves a trace that is difficult to disregard. It is our job to be able to make the right life-saving decisions not later, not tomorrow, but immediately.

The result of this extremely stressful nature of the profession often leads to burnout of the staff – we become physically exhausted, emotionally weaker and more likely to make judgement mistakes or technical errors. Furthermore, burnout affects not only us as critical care professionals, but also it poses danger to our patients' safety and to our professional organizations' integrity. However, this is an issue that we can deal with, provided that we have and use the extensive knowledge, experience and desire to do so effectively. Burnout is a highly recognized problem in the critical care field and is also our main theme for this issue of **ICU Management**.

In our Cover Story section, Drs. Bion, Gupta and White provide an overview of foremost literature on the syndrome, addressing not only the nature and causes of the problem in general, but also its specific impact on staff and patients in the critical care environment, and the currently available methods for its amelioration. Drs. Dorman and Pauldine further explore the topic in their article entitled "Burnout Syndrome in the ICU" by taking a closer look at the elements of the syndrome and the different risk factors that need to be considered for its prevention. Both articles give emphasis to the methods of addressing the issue by positive management of the working environment. On a slightly different note, Dr. Pepe's article tackles the issue of short-term burnout of ICU staff during major disaster situations, a topic that has so far received less overall attention.

With these instructive articles **ICU Management** joins the community's efforts for prevention and management of burnout in the critical care profession. We hope that you will find this issue beneficial in your personal battle against burnout and for the life of your patients.

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

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News World

International action needed to increase health force

www.who.int

A new international Task Force was launched under the auspices of the Global Health Workforce Alliance (GHWA) in order to tackle the global shortage of health workers, announced the World Health Organization (WHO). The new Task Force will advocate the need for significantly increased investment in the education and training of health workers in developing countries, and will build international commitment to practical action. The Task Force is due to present its initial recommendations to the GHWA Forum in Autumn 2007.

News Industry

VIASYS Healthcare inc. assumes additional role of Group President, VIASYS NeuroCare

www.viasyshc.com

Having previously led the respiratory diagnostics and critical care businesses within VIASYS, Ed Pulwer has taken the position of Group President, VIASYS NeuroCare, announced the company. Randy H. Thurman, President and CEO, commented, "Ed has proven himself to be an outstanding leader who delivers on his commitments in product development, sales and marketing, and operational and financial performance. His early career included key leadership roles in sales and marketing. Most importantly, he has demonstrated his ability to build winning teams, integrate the best of all ideas and empower people of all levels."

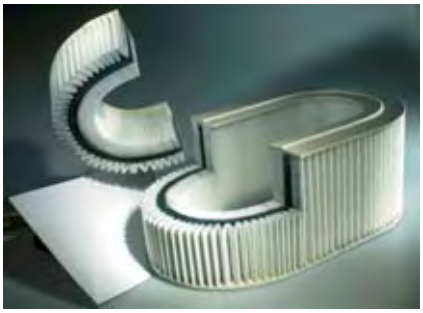
VIASYS wins 2006 AARC Zenith Award

www.viasyshc.com

VIASYS Respiratory Care received the American Association for Respiratory Care (AARC) Zenith Award for the fifth time at the 52nd Annual International Respiratory Congress held in Las Vegas, Nevada. The AARC established the Zenith Award program in 1989 to honor respiratory care product and service providers for exemplary service. Candidates for the award are judged by criteria, including: quality of delivered goods, accessibility and clinical helpfulness of the sales force, responsiveness and service record of the service group, and overall support provided by the company to respiratory care professionals.

MedicCleanAir introduces renewed website

www.mediccleanair.com

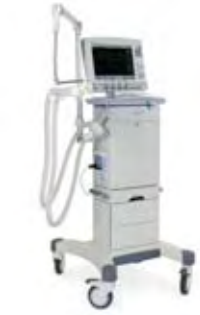


MedicCleanAir recently presented its renovated website, based on the company's years of experience in Infection Control. The website offers information about different airborne problems and their solutions. Attention is particularly drawn to the New Generation Mobile HEPA Units with computerized hygiene controls.

Maquet Critical Care receives FDA 510(K) clearance for its SERVO-I ventilator with NAVA

www.maquet.com

Maquet Critical Care announced that it has received 510 (K) clearance by the U.S. Food and Drug Administration (FDA) to market the company's SERVO-I ventilator with the NAVA (Neutrally Adjusted Ventilatory Assist) option. According to Maquet, NAVA is a new approach to mechanical ventilation which allows the patient's respiratory center to control the ventilator, thereby improving synchrony between patient and ventilator. SERVO-I with NAVA is intended for treatment and monitoring of neonatal, infant and adult patients. The improved synchrony helps minimize patient discomfort and agitation while it promotes spontaneous breathing. Signals from the respiratory control center in the brain are transmitted through the phrenic nerve to the diaphragm, where a catheter captures the electrical activity (EDI) and feeds it to the ventilator. The ventilator responds by providing the requested level of support to the patient. As the ventilator and diaphragm work with the same signal, the coupling between the two is virtually simultaneous.



In addition to being a distinct mode of ventilation, NAVA also enables a complete evaluation of the neural respiratory control by capturing the electrical activity of the diaphragm. The EDI signal can be used as a unique monitoring tool as it provides information on respiratory drive, volume requirements, effects of ventilatory settings and to gain indication for sedation and weaning.

Sales of SERVO-I with NAVA are expected to begin in 2007. Current SERVO-I users have the possibility of upgrading their system with the NAVA option as the only required additional equipment is NAVA software, an EDI module and an EDI catheter.

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Burnout in intensive care

Dr Ritu Gupta, FCA RCSI
Specialist Registrar in Anaesthesia

Dr Julian Bion, FRCP FRCA MD
Reader in Intensive Care Medicine

Dr Alfred White, FRCP
Consultant Psychiatrist

University Hospital Birmingham NHS Trust & University of Birmingham, UK

UniSecICM@uhb.nhs.uk

We have undertaken a literature review based on 55 publications of occupational stress and burnout, with a particular focus on intensive care. Occupational stress is a common and complex problem amongst healthcare professionals and can adversely affect patient safety. Intensive care units are a high-risk area, requiring attention by all members of the clinical team and management support. Successful intensive care units may have desirable characteristics that can serve as important models for other areas in the organization.

Introduction

The intensive care unit (ICU) and critical care services in general are a central component of any acute hospital, providing an important safety net for all acutely ill and emergency patients, as well as facilitating elective major complex surgery. Providing care for critically ill patients is an emotionally and physically challenging activity, and occupational stress-related illness amongst intensive care staff may have major adverse consequences, not only for the critical care service, but for the whole hospital. Staff support is thus an important responsibility for us all.

What is 'burnout'?

Burnout is a pathological syndrome, first described in relation to warfare, in which prolonged occupational stress causes emotional depletion and detachment (Fruedenberger 1974). It has been defined in terms of emotional exhaustion, depersonalization and a sense of reduced personal achievement (Glass et al. 1996; Hotopf et al. 1997; Maslach 1987). It may also present as depression, high absenteeism and sickness rates, drug and alcohol dependence or chronic physical complaints. Occupational stress and burnout are therefore important for the individual, and for work productivity and efficacy.

Incidence and importance

Occupational stress and burnout are common to all occupations and professions. Around 20% of individuals report high levels of stress at work, rising to over 40% for some occupations (AWIRS 1995; H&SE 2000). There is some evidence that this is an increasing problem (Croft et al. 2000; European Commission 2002; McCormick et al. 1995; Moncrieff et al. 2000; Stewart-Brown et al. 2000; Worrall et al. 2001). However, it is difficult to judge from these surveys whether this represents a more stressful work environment or the phenomenon of 'getting better but feeling worse' – a greater willingness to admit to stress, a diminished capacity for coping and a rise in expectations, despite improved social circumstances and better public health over the past century (Anon 1909; Barsky 1988; Verbrugge 1984). Indeed, some commentators have provocatively suggested that an excessive focus on stress may increase the problem and that the best approach might be to ignore it (Wessely et al. 2001). Common experience would suggest that some degree of stress is required for creativity and personal achievement. How various stressors result in burnout is, therefore, complex, involving interactions between individuals and the context in which they function: their work and home, their personality and coping strategies, their external supports and the nature of the stressor itself.

Causation and models

Common associations with burnout include high psychological demands in the workplace combined with low control over work processes (Tennant 2001), illustrated by the Karasek model (Karasek 1979; see figure 1) and measured by the Maslach Burnout Inventory (Maslach 1986), a 22-item questionnaire with subscales for emotional exhaustion,

Karasek "demand-control" model of work-related stress

		Psychological demands	
		Low	High
Decision latitude (control)	High	Low strain	Active work
	Low	Passive work	High strain

Figure 1: Karasek's model proposes that it is the combination of psychological demands and low worker control over work processes that creates stress and stress-related illness. Stressful situations are created when external factors prevent workers from responding optimally to high work demands, demonstrated in the figure by the lower right quadrant. The upper left quadrant indicates low-strain patterns (high control, low demands); the upper right quadrant indicates active work (high demands and high control), while the lower left indicates passive work (low demand, low control).

depersonalization and lack of personal accomplishment. Job insecurity and long hours are important contributing factors (International Survey Research 2000; Worrall et al. 2001). Attribution is complicated by reciprocity between work and social environment, differences between symptomatologies and individual responsiveness to contextual factors, and by the concept of normality – a benchmark against which stress and the outcomes of stress can be compared. This is an important issue for employers both in terms of staff welfare and potential litigation.

Stress in healthcare workers

Nurses appear to be more susceptible to stress-related disorders than the general population: a UK study found a relative risk of 1.5, more marked in front-line staff, especially women (Wall et al. 1997), who often have greater demands placed on them in achieving a balance between home and work (International Labour Organisation 2001). For doctors, there are differences determined by seniority (level of experience) and speciality, but the pattern of stressors can still be summarized as excessive work demands, inadequate control over work processes and work interference with home life (Cooper et al. 2000; Johnson 1995; Kapur et al. 1998; Revicki 1993; Rout et al. 1996). Doctors are also susceptible to alcohol and drug addiction, a common stress-related illness (McCarran 2003); figures for the USA suggest that up to 13% of doctors may have an addiction (Hughes et al. 1992).

The UK's recently established National Clinical Assessment Authority (NCAA) has reviewed 1,772 doctors, comprising 0.7% of the National Health Service's physician workforce, about whom performance concerns had been raised (Chief Medical Officer 2006). Of these, 10% required a full assessment. Of the first 50 cases so assessed, physical or mental health problems were identified in 28%, poor communication with colleagues in 76% and inadequate training or suboptimal continuing professional development in 48% (National Clinical Assessment Service).

Burnout in intensive care

Intensive care units (ICUs) are high-stress areas for patients, relatives and staff. Staff must contend with constant pressure on limited resources, rapid and usually irreversible decisions (e.g. rationing) and high mortality rates – not dissimilar to a theater of war in some respects. Such severely ill patients require expert care from fully trained intensivists (Health Resources and Services Administration 2005); however, in the USA, the Committee on Manpower for the Pulmonary and Critical Care Societies (COMPACCS) study projected a growing shortfall of intensivists unless changes are made to increase the number of physicians trained in critical care (Pingleton et al. 2001). Young and Birkmeyer (2000) estimated that 360,000 deaths occur every year in ICUs that are not managed by intensivists, and that intensivist staffing might save 54,000 lives annually. Retention, training and supporting critical care staff will be essential for any hospital which hopes to retain its status as an acute admitting facility.

We searched MEDLINE and EMBASE for English-language publications (1996 to January 2007) on burnout and related terms, and linked these to critical care. From a large number of articles, we found nine citations linking doctors with intensive care and burnout, and 68 for nursing staff. Of these, 55 provided useful material: 3 were case reports, 8 review articles, 2 editorials, 40 surveys, and 2 articles on management and retention of staff (for a complete list, please contact editorial@icu-management.org).

Nature of the problem

Occupational stress is more common in females than males (Fields et al.1995), younger, single or divorced nurses, and those working full-time (Chen et al. 2001). In doctors, stress is more likely to affect residents (Guntupalli et al. 1996; Thomas et al. 2004) and less experienced doctors (Nyssen et al. 2003). Personality, life-style intentions, isolation and coping mechanisms influence resilience to stress (Gopal et al. 2005; Lederer at el. 2006; Lorin et al. 2005; Wright et al. 1993). Long hours of work have a variable effect: some report an increase in stress with long hours (Fletcher et al. 2005), others little effect (Goitein et al. 2005; Martini et al. 2004). Lack of control over work (Hever et al. 1996; Poncet et al. 2006), conflicts, patient deaths (Poncet et al. 2006), isolation, compromised standards of care, management styles (Coomber et al.; Doering et al. 1990) and burnout affecting colleagues (Bakker et al. 2005) all have an impact. Workplace violence (Alexy-Eileen et al. 2006) and

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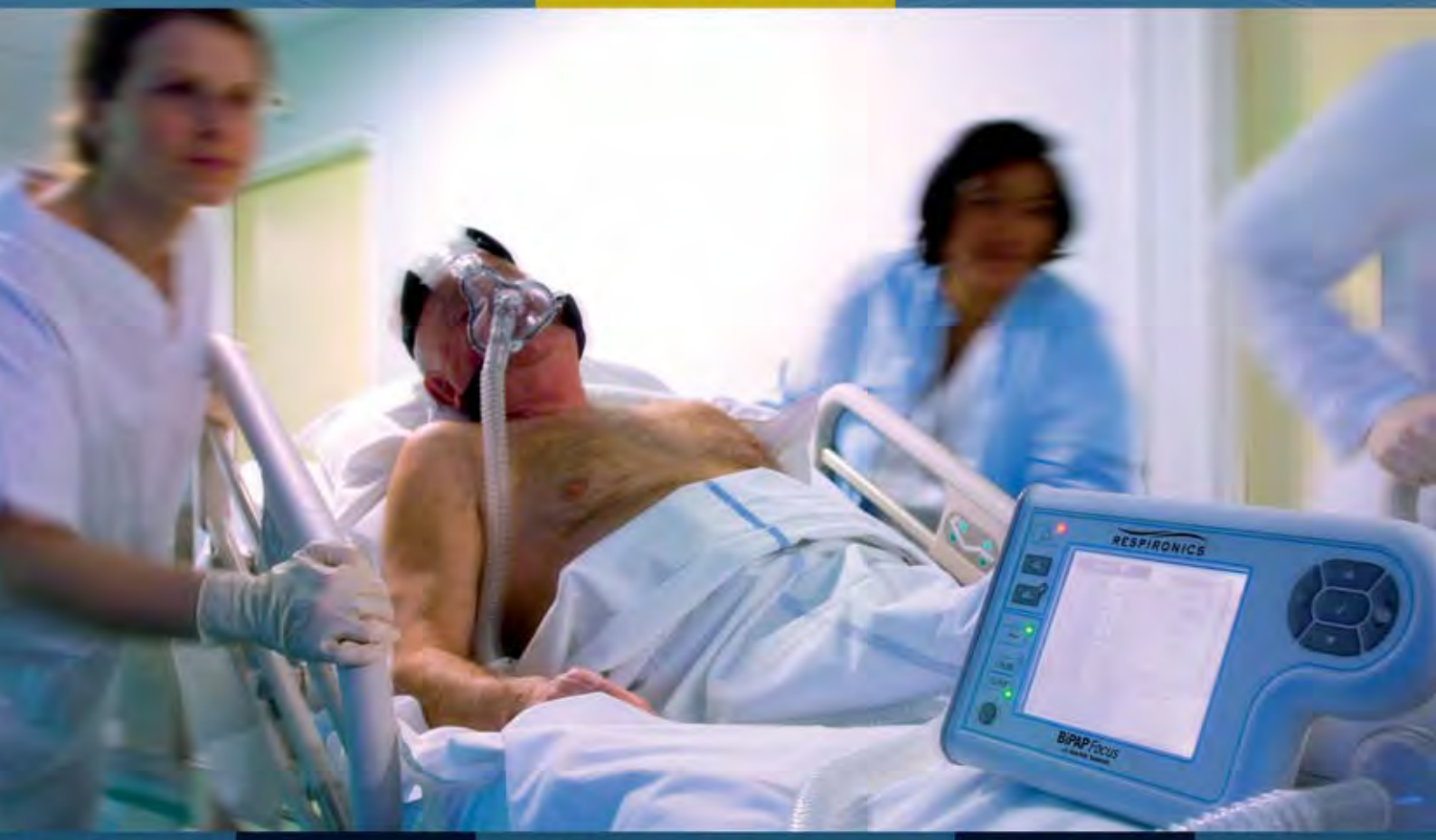


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bullying by senior managers substantially reduce reported job satisfaction (Quine et al. 1999). Staff working in burn ICUs (De Pew et al. 1999; Murji-Ally et al. 2006) and medical ICUs (Cubrilo et al. 2006; Pelosi et al. 1999) may be more at risk for burnout than other ICU personnel.

Impact on patients

A case report by Shojania et al. (2006) and reviews by others (Gawron et al. 2006; Goitein et al. 2005; Penson et al. 2000; Tillett et al. 2003; West et al. 2006) illustrate how high workload, poor supervision and inadequate teaching time lead to medical errors and suboptimal patient care. There is a complex interplay between these factors: high anxiety levels impair performance and increase error rates (Smith et al. 2001), while self-perceived medical errors worsen aspects of burnout, including anxiety (West et al. 2006). Surgical specialists are less likely to function as team-players and more likely to deny the effects of stress than anaesthetic consultants, residents and nurses (Sexton et al. 2000), despite the fact that recognizing the impact of stress reduces the likelihood of error (Helreich et al. 1984).

Impact on staff

Cortisol levels increase with stress; however, the effect is less pronounced for more experienced ICU staff (Fischer et al. 2000). Burnout increases resignations and early retirement (COMPACCS survey; Fields et al. 1995; Quine et al. 1999; Shanafelt et al. 2002), which in turn affects ICU staffing patterns. Long working hours increase the risk of car accidents or near-miss incidents (Barger et al. 2005; Murray et al. 2005). The alternative of shift work may be no better (Murray et al. 2005).

Many staff are reluctant to admit to personal problems (Sexton et al. 2000; White et al. 2006), and may initially lack insight into the problem (Harrison et al. 2006). Symptoms may be worse for those at risk (Lederer et al. 2006): personnel with high workload (Lindfors et al. 2006), trainees (Chen et al. 2001; Oehler et al. 1991) and staff with sleep deprivation resulting from on-call duties (Lindfors et al. 2006).

Methods of amelioration

Social support groups, bereavement teams and a supportive department are important elements in reducing stress (Heuer et al. 1996; Kerasiotis-Bernadina et al. 2004; Yam et al. 2001). Reduced working hours may diminish the risk of burnout (Gopal et al. 2005) and increase job satisfaction. Variable benefits have been reported for didactic presentations on stress, constructive feedback and career counselling (Gardiner et al. 2004; Shanafelt et al. 2002). In addition, Lindfors et al. (2006) recommended shortening on-call periods and frequency, allowing more free time and removing on-call obligations after the age of 50 years as methods to reduce stress.

National Aeronautics and Space Administration (NASA) field studies have shown that short periods of sleep (a 40 minute nap) improve performance by 34% and physiological alertness by 54% (Rosekind et al. 1994). Teaching doctors how to cope with night work (methods of improving daytime sleep) can reduce medical error and improve safety (Murray et al. 2005), and physical exercise may be beneficial (Murji-Ally et al. 2006; Shanafelt et al. 2002).

How does this literature relate to critical care? It is evident that adequate staffing and resources, supportive and social colleagues and a collaborative, team-based approach to patient care will do much to minimize the stress associated with such challenging work. Hospitals with "problem" departments or clinics should look to their successful ICUs as models for improvement: if an ICU can be a happy place to work, it must be doing something right.

Conclusions

Occupational stress is common in all health care professionals, especially younger and less experienced staff. Burnout not only affects the care provider, but also the patient and the organization. Intensive care is a high-stress area, and given current staffing problems and the need for expert clinicians, this discipline requires a particular focus by management to minimize risk factors and promote well-being both at work and home. Healthcare staff need to be aware of the risk factors for burnout and work with management to create effective organizational processes and a supportive work environment to minimize those risks. The responsibility for minimizing the risks and incidence of burnout lies with each and every one of us. ■

Complete references are available at editorial@icu-management.org.

Staff burnout in the intensive care unit during major catastrophes: The disaster "cascade"

Carol S. North, MD, MPE[2,4,5]

Barry A. Hong, PHD[6]

Paul E. Pepe, MD, MPH[1,3,4]

The School of Public of Health(1) and the Departments of Psychiatry(2), Medicine(3), and Surgery-/Division of Emergency Medicine(4) at the University of Texas Southwestern Medical Center; the North Texas Veterans Administration Health Care System(5), Dallas, TX; and the Washington University School of Medicine Departments of Psychiatry and Internal Medicine(6)

Paul.Pepe@UTSouthwestern.edu

Introduction

Catastrophic events can extract extraordinary physical and mental energy from care providers, not only at the actual disaster sites, but also in medical critical care settings. Extraordinary intensive care workloads can span hours, days, even weeks. Working around the clock and caring for countless critically ill persons, even the most veteran and tested professionals can be drained of their physical and mental reserves. Amplified by grotesque injuries, intense suffering and imminent deaths, disaster settings provide the essential ingredients for true, acute burnout.

Post-traumatic stress disorder (PTSD) is an anxiety disorder that develops in response to surviving or directly witnessing an event that threatens life or limb (American Psychiatric Association 2000), and considerable research has been conducted on PTSD among disaster survivors and disaster workers alike (Norris et al. 2002). But disaster burnout, which concerns the aftermath of prolonged stress and exhaustion after a catastrophic event, has received less attention. Most research into burnout has been conducted in relation to chronic work stress on firefighters, paramedics and critical care personnel in non-disaster settings. In these settings, burnout has been associated with factors such as duration of disaster work (Flannelly et al. 2005; Kinzl et al. 2006), patient care burden (Aiken et al. 2002; Poncet et al. 2006), lack of social support (Beaton et al. 1997; Embraico et al. 2007; Mitani et al. 2006; Poncet et al. 2006), conflicts with colleagues (Beaton et al. 1997; Embraico et al. 2007; Mitani et al. 2006), increasing age (Boscarino et al. 2004; Flannelly et al. 2005; Poncet et al. 2006), non-supportive work environment (Beaton et al. 2001; Boscarino et al. 2004; Kinzl et al. 2006), and ineffective leadership (Beaton et al. 2001). Little information is available on short-term burnout in intensive care units (ICUs) following mass-casualty situations, but, anecdotally, it does occur with frequency. Lacking sufficient data, experts currently must adapt suggestions for prevention and management of disaster burnout from the available literature on chronic burnout in ICU settings (Poncet et al. 2006; Embraico et al. 2007). Nevertheless, developing strategies sensitive to the unique demands of specific disaster phases in the ICU may provide pathways to help manage or even prevent acute burnout.

A suggested tool for preventing and managing disaster burnout may be found in P-FLASH II©, an empirically-based disaster mental health training program. The medical center-oriented component of P-FLASH II© (entitled, "MC-FLASH") summarizes disaster mental health issues likely to occur in hospital critical care settings and provides interventional strategies relevant to the specific phases of post-disaster situations. While, for the sake of brevity, only the leadership and managerial aspects of mental health from this program will be reviewed in this discussion, those interested in this topic should pursue the full MC-FLASH materials.

The disaster "cascade"

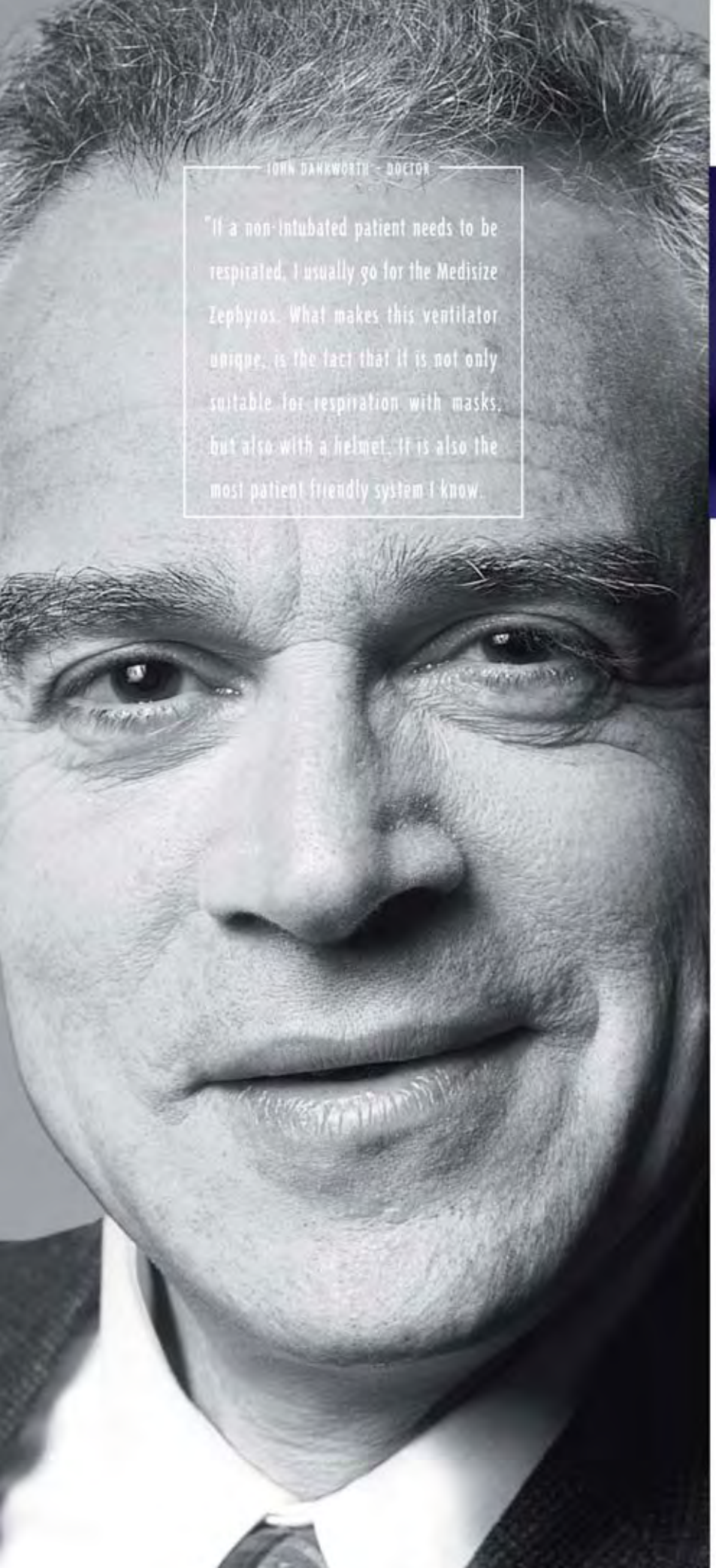
Consideration and evaluation of the specific demands and interventions appropriate to various specific post-disaster phases are essential for effective disaster preparedness in medical facilities. Although specific reactions to disaster vary, *MC-FLASH* describes five general, discernable phases of response, including: 1) the "Crisis" phase; 2) a "Later" phase; 3) an "Even Later" phase; 4) a "Long-Term" phase; and, 5) a "Preparation" phase. Although these names provide a conceptual template for five stages, it should be emphasized that these phases are not always distinct, consistent and universally applicable, nor are they invariably predictable or even sequential in every circumstance. The "disaster cascade" is a metaphor that likens the phases to travel over a waterfall and through its downstream runoff. The "Crisis" phase is a relatively brief period of minutes to hours when casualties mount and survival is of primary concern (the "waterfall"). The "Later" phase, typically lasting days, is like the initial whitewater rapids below the falls, where those involved try to stabilize after the chaos and attempt to inventory their losses. The "Even Later" phase, lasting weeks to months, finds much smoother currents for the initiation of healing processes. Then, in the "Long-Term" phase, continuing for months or years, there is emergence into calmer waters, enabling people to come to terms with the residual effects of the disaster. Coming full circle, the "Preparation" phase, which is symbolized by a lake behind a dam, reflects how we anticipate and prepare for the next (inevitable) event.

"Crisis" phase

During the free-fall of the immediate crisis, the first disaster-related mental health task is to pro-

For More Information

For more comprehensive information on other aspects of mental health issues related to disaster medical care, such as personal self care and community mental health issues, readers are directed to the MC-FLASH and P-FLASH II© presentations which are available from the authors. Information regarding the full P-FLASH II© and MC-FLASH materials and availability of trainings can be obtained from the authors via Dr. Carol North, Professor of Psychiatry and Surgery at the University of Texas Southwestern Medical Center, Dallas at Carol.North@UTSouthwestern.edu, or (214) 648-5375.



vide relevant information that will keep the ICU staff safe and informed about the safety of their loved ones. This task requires accurate, yet reassuring, risk communication. Leaders must skillfully defuse anxiety/fear-producing rumors with valid information. An attempt to triage the burdens of care is also needed when ICU personnel, already burdened with many critically ill patients, must suddenly take on the increased demands of many new injured/ill patients, and, at the same, worry about their personal safety and that of their loved ones. This may mean creation of a "safehouse" or protected, temporary nearby shelters. It may simply involve routine visitation mechanisms for loved ones where frequent visits can occur, especially to reassure staff.

"Later" phase

The main problems in this early, tumultuous phase are productivity issues, interpersonal interactions, personnel problems and sheer exhaustion. To prevent burnout, sufficient staffing is needed, not only to meet the increased clinical demand in the post-disaster setting, but also to increase opportunities for periods of downtime to improve effectiveness and provide emotional support. For those who feel compelled to serve above and beyond in a time of crisis, "assigned" downtime can be incorporated as an integral part of their "duties." At the same, managers need to treat and provide "care" for staff with the same compassion that they would "normally" provide for patients. Kind words, compassionate gestures, personal attention, food, even monetary compensation and time off are among the most powerful positive social reinforcement tools in the post-disaster workplace - as are access to mental health service and simple listening.

Some staff, particularly those with vulnerable family members, may feel pressure to leave (or not even arrive) for work, thus compounding the staffing needs. Others who decide to stay may need help balancing personal worries and self-care with their duties. Clearly stressed, some will want to vent to supervisors, even without expectations that the problems will be solved. Listening empathetically to individuals and groups at some length is a powerful tool, but such venting should not go on indefinitely in the face of high clinical demand and increased need for personal downtime. After listening, managers must gently attempt to inspire and direct people to develop positive solutions. In addition, information about the emotional healing process and normal reactions to disasters can facilitate emotional adjustment and guide people to seek appropriate treatment when needed. In addition, the turbulence of interpersonal issues can be infectious, and managers must approach interpersonal issues proactively, using their persuasive skills or their authoritative strength to mediate conflicts and enforce overall decorum and order.

"Even Later" phase

The issues in this downstream phase, spanning weeks to months, require a balance between post-disaster demands and the re-establishment of individual priorities. After a disaster, the re-stabilization of resources may have been too little and too slow. ICU leaders must be creative and flexible in re-prioritizing available resources and stress that interim interventions are expected only to be temporary solutions – such as reducing individual workloads to fit current priorities by adjusting their roles and responsibilities, understanding that many typical duties and needs may go unmet. Although the currents are relatively steadier, leaders will still need to serve as lightning rods for continued anger, blame and entitlement, which must be recognized as normal, universal coping behaviors. Leaders should appreciate that their task is to listen to problems without feeling defensive and that they are expected to solve problems (which are often clearly unsolvable). Nevertheless, setting gentle and compassionate limits on these venting behaviors may be appropriate and healthy.

"Long-Term" and "Preparation" phases

In the "Long-Term" phase, ICU staff members adjust and stabilize, though life and work may no longer be the same. Emotional healing continues into this more tranquil phase, and behavioral problems are more likely to represent longstanding, difficult, unresolved problems. People may want to blame everything that is wrong in their lives on the disaster, becoming embittered and negative about the event and not their own inherent issues. The main behavioral tasks in this phase are to move forward by removing barriers to progress, re-establishing support patterns, implementing active future planning and aspiring to make things even better than they were before the disaster.

Over the long term, authorities must combat collective attitudes of blame, entitlement and negative thinking through effective communication. Maintaining a problem-focused and positive, future-oriented approach is essential. For managers, fiscal planning contingencies for such "rainy day" events (staffing, shelters, downtime, support) must be anticipated and become line items in annual budgets.

Conclusion

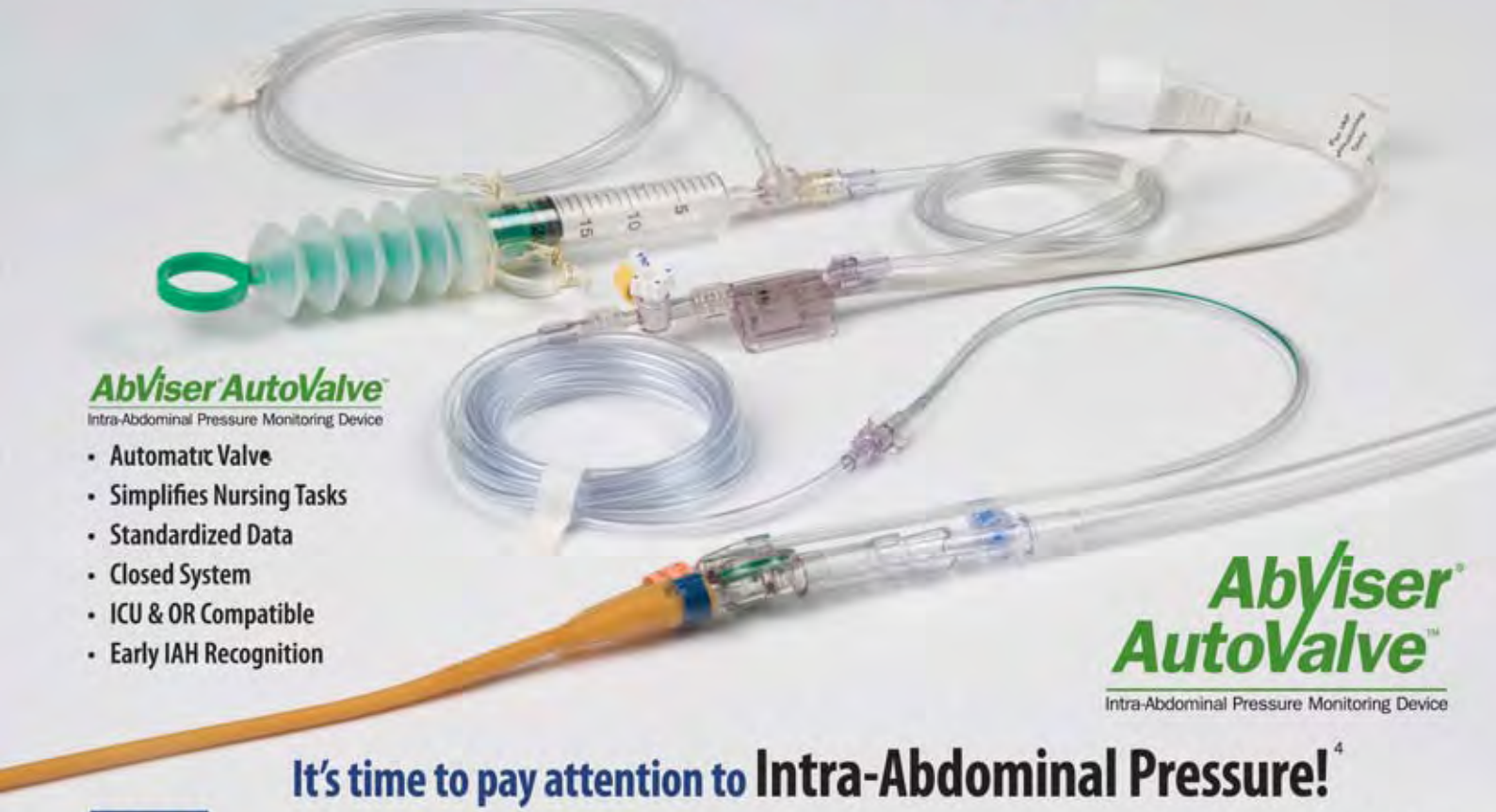
To prepare and appropriately counteract burnout in the ICU, knowledge about the various psychological phases of post-disaster situations and their potential effects on care providers and institutions is required. Having available strategies for managing them may lessen the threat of ICU burnout in the post-disaster phase. ■

- Have you ever had an ICU patient become progressively more swollen and edematous after fluid resuscitation?
- Have you ever had an ICU patient develop progressive renal failure and need dialysis?
- Have you ever had an ICU patient develop multiple organ failure and die?

What was their Intra-Abdominal Pressure?

Sepsis/SIRS + Volume Resuscitation = Intra-Abdominal Hypertension[1]

Monitoring IAP + Intervention = Reduced Organ Failure[2-3]



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Burnout Syndrome in the ICU

Ronald Pauldine, MD
Assistant Professor
Department of Anesthesiology and Critical Care Medicine
Johns Hopkins Bayview Medical Center
Baltimore

Todd Dorman, MD, FCCM
Associate Professor
Department of Anesthesiology and Critical Care Medicine
Johns Hopkins University School of Medicine
Baltimore
tdorman@jhmi.edu

Introduction

Burnout syndrome is a psychological response to chronic emotional and interpersonal stressors at work and includes three dimensions; overwhelming exhaustion, cynicism or detachment from the job and inefficiency or a sense of lack of accomplishment (Maslach et al. 2001). Burnout has been described since the mid-1970s, and it is now well recognized that burnout syndrome can occur in a variety of occupational environments. However, the intensive care unit puts personnel at particular risk. For instance, it is underscored by a 33% incidence of burnout syndrome in ICU nurses in France (Poncet et al. 2006). We will briefly review elements of, and risk factors for burnout, as well as strategies for preventing burnout.

Elements of Burnout

When workers complain about burnout, they usually refer to the exhaustion component. Not surprisingly, this aspect is associated with work overload, which includes emotional overload, conditions common in the ICU. The second element of burnout is depersonalization or cynicism, which is usually an adaptive response to exhaustion. The third element, inefficiency, may result sequentially from exhaustion and cynicism or occur concurrently, especially where there is a lack of resources (Maslach et al. 2001). Some aspects of burnout resemble depression. However, burnout is specifically related to work, whereas depression is a generalized disorder. Burnout and depression remain separate entities, but they can precede each other.

Risk Factors

Prolonged exposure to chronic stressors is a risk factor for burnout. Environmental factors have been implicated in increasing staff stress. These include the poor ergonomic design of many units, less than ideal lighting, positioning of equipment resulting in the familiar "spaghetti syndrome" and the ever present audible alarms (Donchin and Seagull 2002). The emotional workload in the ICU is considerable, given the general nature of critical care, intense interaction with families, and relative frequency of dealing with end-of-life issues. Other stressors include those associated with shift work and the variable quality and effectiveness of communication. Outright conflict between stakeholders in the ICU can contribute.

Burnout is more strongly related to stress in the work environment than to specific individual factors. However, burnout is more common in people who exhibit Type-A behavior, low levels of hardiness, individuals maintaining an external locus of control and those with passive, avoidant coping styles (Maslach et al. 2001). In addition, trainees may be especially vulnerable (Thomas 2004).

Significance

The negative impact of burnout on daily operations in the ICU can be dramatic. Studies have documented a relationship between burnout and substandard patient care provided by trainees (Shanafelt et al. 2002) and irrational thinking patterns in nurses (Balevre 2001). Burnout increases physical complaints resulting in the use of sick leave (Toppinen-Tanner et al. 2005). The attitudes of burned-out staff may influence other staff members negatively further degrading the work environment (Bakker et al. 2005). These factors contribute to turnover and create problems with recruiting, training and retention of staff.

> "Burnout is more strongly related to stress in the work environment than to specific individual factors."

Prevention and Intervention

Efforts to prevent burnout can be directed at modifiable environmental and individual factors. Those factors most commonly are centered on the physical work environment, communication and fairness. It is important to have an ICU culture that supports the staff at all levels with material and emotional resources and allows for professional growth. Organizational support can be provided in areas such as proper training, orientation, peer and supervisor support and provision of attainable rewards (Taormina and Law 2000). Individual factors can be addressed through attempts to improve coping skills, which can modify the response to stress but cannot remove it. Ultimately, creating a positive work environment with adequate support for staff appears to be the best approach to preventing burnout and avoiding its deleterious effects on ICU care. ■

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*Ornato JP et al. American Heart Association Annual Meeting, 2005.

Management of massive operative blood loss

Andreas Pape[1]
Harry Kertscho[1]
Jens Meier[1]
Bernhard Zwissler[1]
Oliver Habler[2]

1) Clinic of Anaesthesiology, Intensive Care Medicine and Pain Control, Johann Wolfgang Goethe University Hospital, Frankfurt/Main, Germany

2) Clinic of Anaesthesiology and Intensive Care Medicine, Nordwest-Krankenhaus, Frank-furt/Main, Germany

a.pape@em.uni-frankfurt.de

Introduction

A massive blood loss is defined as the loss of 100 % of circulating blood volume within 24 hours, 50% of circulating blood within 3 hours, 150mL/min or 1.5mL/kg/min over at least 20 minutes (Erber 2002; Hiippala 1998; Stainsby et al. 2000). Therapeutic goals are the maintenance of: (1) normovolemia, (2) adequate tissue oxygenation, (3) sufficient coagulatory function, (4) normothermia, (5) electrolyte balance and (6) acid base balance (Pape et al. 2006a).

Normovolemia

When a loss of 30% of the circulating blood volume remains unresuscitated, hypovolemic shock is imminent (Peitzman et al. 1995). Therefore, any blood loss should be treated initially by the infusion of crystalloid and colloidal solutions, in order to provide normovolemia and nutritive tissue perfusion.

Tissue Oxygenation

Acellular fluid resuscitation implies the dilution of the cell mass remaining in the vasculature (hemodilution) with a corresponding dilutional anemia, or decrease of Hb-concentration and arterial O_2-content (CaO_2). Although hemodilution initially improves tissue perfusion (Messmer and Sunder-Plassmann 1974), progressive dilutional anemia requires the elevation of CaO_2 to maintain adequate tissue oxygenation. The first step to achieve this goal is to elevate the inspiratory O_2 fraction (FiO_2) to 1.0 (hyperoxic ventilation, HV). Although frequently underestimated, the efficacy of HV to provide adequate tissue oxygenation even in critical normovolemic anemia has been demonstrated repeatedly (Meier et al. 2004; Pape et al. 2006b).

A definitive increase of CaO_2 will be achieved by the transfusion of pRBCs. Generally, pRBC transfusion management should aim to keep Hb-concentration above 6g/dL in otherwise healthy patients and above 8-10g/dL in patients with elevated cardiovascular risk (Weiskopf 1996). Although a healthy organism may tolerate Hb-concentrations beyond 6g/dL, Hb-levels lower than 6-8g/dL should be avoided, since the dynamic of blood loss is often difficult to anticipate.

The transfusion of allogeneic blood is still associated with risks for the recipient, such as "clerical error", transmission of infectious diseases, immunomodulation or transfusion-related lung injury (TRALI) (Spahn and Casutt 2000). However, the concept of intraoperative cell salvage and autologous retransfusion has been demonstrated to be highly effective in reducing the need for allogenic blood transfusion (Dai et al. 2004).

Coagulation

During massive operative bleeding, coagulatory function is impaired by: (1) wash-out of platelets and clotting factors (dilutional coagulopathy), (2) hypothermia and acidosis and (3) disseminated intravascular coagulation (DIC, consumptive coagulopathy). After exchange of one circulating blood volume with acellular solution and RBCs, plasmatic coagulatory factors are diluted to 37% of the initial value. Fibrinogen is the first factor to decrease in this situation, so that the severity of dilutional coagulopathy can be estimated from fibrinogen-concentration, if other reasons for decreased fibrinogen (e.g. DIC) are excluded (Erber 2002). Fresh frozen plasma (FFP) represents a physiological composition of all coagulatory factors and plasma proteins. During massive bleeding, sufficient bolus-doses of FFP (i.e. 5-20mL/kg) are recommended to achieve adequate concentrations of coagulation factors (Hiippala 1998). When FFP-transfusion becomes insufficient to provide adequate levels of fibrinogen-concentration and factor activities, the additional substitution of fibrinogen-concentrates and/or prothrombin complex concentrates (PCC, FII, FVII, FX, FIX) may become necessary (Blauhut 1999).

The majority of massively bleeding patients becomes thrombocytopenic after the exchange of two circulating blood volumes (Hiippala 1998). Platelet transfusion should aim at PC>50000; for intracranial surgery, PC>100000 is recommended (Weiskopf 1996). Although presently only approved for the treatment of haemophiliac patients, recombinant activated factor VII (rVIIa) has been successfully applied in non-haemophiliac patients suffering otherwise untreatable bleeding (Gowers and Parr 2005; O'Connell et al. 2003). A "last-ditch-use" of rVIIa in profound dilutional coagulopathy, however, seems ineffective (Clark et al. 2004).

Hypothermia

The rapid replacement of massive blood losses frequently induces hypothermia, which impairs platelet function and plasmatic coagulation.

continued on p. 39

There is something in hospital air

Mart Geraerts
Senior Consultant: Indoor Air Quality in Medical Facilities
Economist: Walsberghe NV - Europe
hmlg@xs4all.nl

It is a known fact that tuberculosis, aspergillus, chicken pox, measles and MRSA-containing particles float around in the indoor air of most hospitals. Numerous publications on hospital hygiene confirm this state of affairs. H5N1 might join them in the near future.

Airborne infection transmission causes severe human, social and financial problems. Moreover, the numbers of these infections are increasing as reported by the WHO on Tuberculosis and the H5N1 pandemic.

But this is not the point. The point is: "Can we do something about it?" The answer is: "Yes, we can clean the indoor air". Is it that simple? Yes it is, but it requires an open mind and commitment from various departments in healthcare organizations.

A number of issues have to be considered first.

The **hygiene department** should look further than the debate on which form of transmission is most important and rather focus on all the parameters, such as contact, droplet or airborne that result in the transmission of infections. By linking contact, droplet and airborne, preventive measures will result in the one supporting the other. Consider the idea that whatever is not in the air, cannot drop and contaminate the furniture or medical devices and, more importantly, cannot be inhaled.

The **technical department** should look further than the (theoretical) technical details of the HVAC system and have an open mind with respect to new, innovative solutions and options that can support their existing ventilation system, options that contribute to a safer hospital environment.

Management should make a cost-benefit analysis based on all the criteria, facts and figures and consequences, as commercial companies would do. The cost of an infection, in relation to the cost of a preventive measure, should also be considered in view of potential savings in financial, patient outcome and reputation.

But, let us look at some known examples first.

1. It was established that airborne MRSA-concentrations are always present in a patient's room (~ 6 cfu/m^2) and that higher concentrations occur during bed-making (~ 116 cfu/m^2). This means that high concentrations of MRSA (~ 100 cfu/m^2) would have fallen on surfaces such as medical instruments, furniture and the floor. Consequently, the result of other preventive measures like sterilization or hand hygiene will be diminished. Additionally, a part of the MRSA particles remains airborne (~ 6 cfu/m^2) and will be spread by the indoor air to other areas in the hospital.

2. The risk of HCWs being infected with tuberculosis is higher in general departments, such as First Aid, ICU and autopsy (non-isolation), than in equipped departments (isolation rooms).

3. Mobile HEPA Pro Units completely eliminated invasive aspergillosis infections in patients undergoing (allogeinic) bone marrow transplants.

Airborne infection transmission has no limits or boundaries and the majority develops inside the hospital facility.

What are the technical options available to reduce the risk of airborne infection transmission? The options are:
- replacing all inadequate HVAC-installation; and/or
- installing HVAC-systems with HEPA filters in all the potential risk areas.

These options are fine when building a new facility or when costs are not an issue. However, both are demanding, as they require building activities with all the associated consequences including disturbances both to the department and patients.

A workable and feasible option is to install specifically designed and developed, high efficiency HEPA filter units (preferably mobile units) that filter/clean the indoor air by eliminating airborne infection transmission at the source. (This would include MRSA and/or TB and virtually all other infectious airborne particles.)

What are the considerations when trying to establish which HEPA filter unit should be used? Which questions should be asked? Which device should be chosen? The most important criteria are:
- the effectiveness of the unit;
- whether the unit achieves the level of filtration required; and
- whether the information from the manufacturer is correct.

The only reliable answers come from international healthcare providers faced with the dangers of airborne infection transmission, as airborne infection transmission in hospitals is an international issue.

Also, consider proven scientific confirmations published by esteemed scientific organizations such as hygiene institutes in university hospitals, which have worked with and tested a specific mobile HEPA unit for a long period of time, preferably months or even years. Only a unit that has offered significant results (a significant reduction or the total elimination of airborne infection transmission: CFUs) should be deemed reliable.

The technical demands for an efficient (mobile) HEPA unit are:
- double airflow (one airflow to take in contaminated air and one airflow to return cleaned air);
- air intake should be at an effective, horizontal (breathing) level, from 1m and over 360º (air intake at floor level is useless, as people do not breath at this level);
- the air outlet should be over 360º diagonally upwards to create airflow in the room (air outlet at floor level is dangerous, CFUs on the floor are made airborne again);
- HEPA 14 filtration with leak test (no risk can be taken with infectious diseases);
- the casing should be polished stainless steel (to prevent contamination adhesion);
- no or limited maintenance (the unit has to function around the clock, all year round);
- the electronics have to meet maximum safety standards;
- little or no occupation of floor space (floor space is limited in hospital rooms); and
- key remote control (only hospital staff can control the unit).

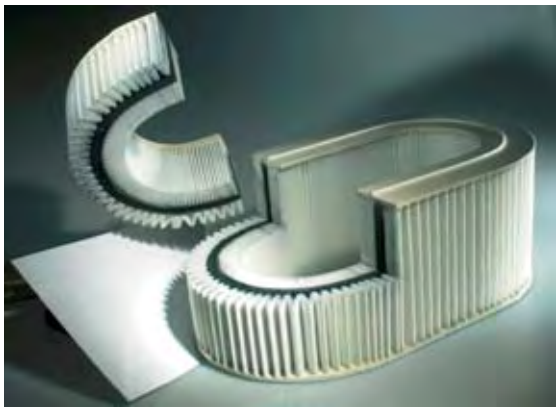
The discussion regarding the socially acceptable level of the infection rate is not that relevant as even one infection – which could have been prevented – is one too many. It would make more sense to look at the financial implications of an infection.
- The cost of an MRSA infection is between €10,000 and €36,000.
- Tuberculosis (non-resistant) costs a minimum of €10,000.
- Treatment of invasive Aspergillosis costs around €35,000.
- Preventive medication against invasive Aspergillosis, for all patients at risk, costs around €30/day per patient amounting to around €600/day for a ward.

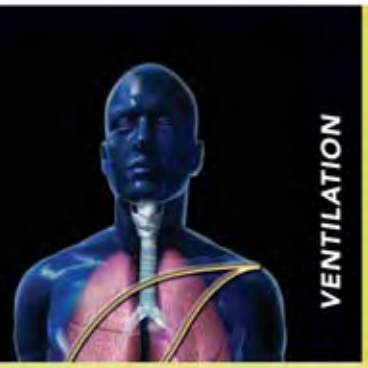
Bearing these figures in mind, we should ask ourselves how we can guard against potential infection as a result of airborne infectious particles and the crippling associated costs. The answer is simple as the costs to implement an effective (mobile) HEPA concept pales into insignificance when compared with the cost of an outbreak of an airborne infection.
- An efficient mobile HEPA unit that protects healthcare workers, patients and visitors all year round, costs substantially less than €10,000 and is a once-off investment.
- The initial budget estimate, to create an isolation room or patient safe room with air-cleaning and pressure difference (positive or negative) is approximately €1,000.

Apart from that, a professional isolation room with negative pressure (for tuberculosis /H5N1) or positive pressure (for immuno-compromized) is installed in less than a day.

Finally, once you have decided to implement an effective and efficient (mobile) HEPA filter device/unit, make sure that the unit has been double-checked and its validity confirmed by medical, clinical and laboratory studies, published by esteemed medical organisations.

Only then you can be sure that there is nothing "bad" in the air and breath easily. ■





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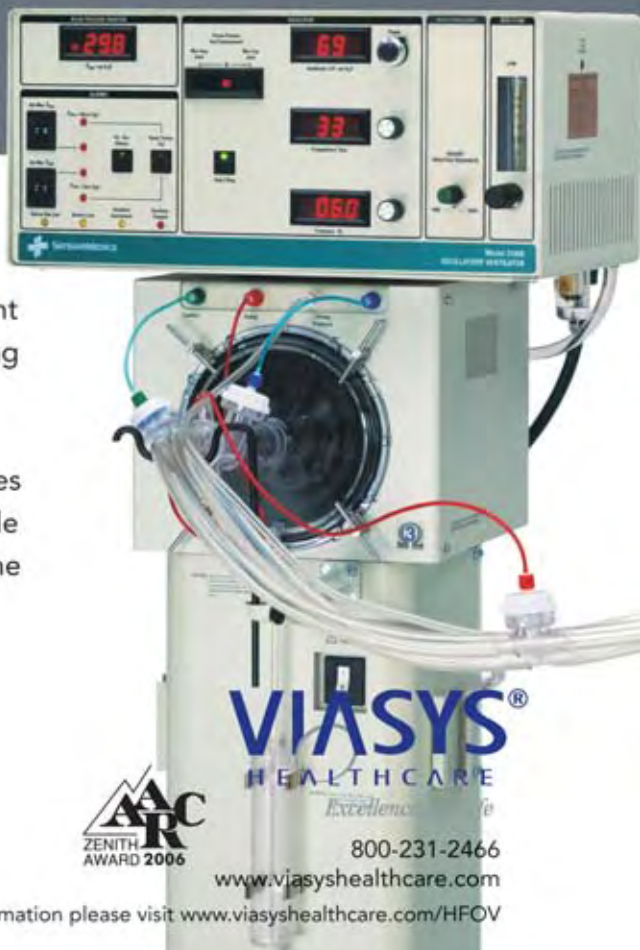

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ECRI is pleased to provide readers of **ICU Management** with sample information on positive pressure ventilators, designed for use in critical care from its Healthcare Product Comparison System (HPCS), which contains over 280 reports. The HPCS reports contain extensive information about the technology, its purpose, its principles of operation, stage of development specifications and reported problems. The ventilators for critical care comparison charts include ECRI's 'Recommended Specifications' (generic templates) which can be used for comparison and tendering purposes. The comparative tables overleaf are extracted from from ECRI's 2005 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.

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

Healthcare Product Comparison System

	ECRI RECOMMENDED SPECIFICATIONS[1]	RESPIRONICS
MODEL	**BASIC IC VENTILATOR**	**Esprit**
WHERE MARKETED		Worldwide
FDA CLEARANCE		Yes
CE MARK (MDD)		Yes
CONTROLS		
Tidal volume, mL	50-800	50-2,500
Inspiratory flow, L/min	3-180	3-140 (compliance compensated, actual to 200)
Inspiratory pressure, cm H_2O	0-80	0-100
Respiratory rate, breaths/min	6-120	1-80 (adult, pediatric), 1-150 (neonatal)
Inspiratory time, sec	0-3 pause	0.1-9.9 (0.1 resolution)
Expiratory time, sec	1-8	0.15-59.9
IE ratio	1:4 to 4:1	1:599 to 4:1
Inspiratory hold/plateau	0-3 sec	0-2 sec (0.1 sec resolution)
Expiratory hold	0-3 sec	Yes
FiO_2, %	30-90	21-100
Manual breath	Yes	Yes
PEEP/CPAP, cm H_2O	0-45	0-35
Pressure support, cm H_2O	0-45	0-100 (relative to PEEP)
Nebulizer	Optional	Optional
Trigger mechanism	Pressure, flow , both	-20 to -0.1 cm H_2O (adult, pediatric), 0.5-20 L/min (adult, pediatric), 3.3-10.3 cm H_2O (neonatal), 0.1 cm H_2O resolution
Bias/base flow range, L/min	1-20	3.5-23 (adult, pediatric), 3.3-10.3 (neonatal)
Pressure slope/ramp adjustment	Yes/yes	0.1-0.9 sec (adult, pediatric), 0.1-0.5 (neonatal)
Sigh; 100% O_2	Optional; N/A	No; Yes (120 sec duration)
Others		None specified
OPERATING MODES		
Assist/control		
Volume breaths	Yes	Yes
Pressure breaths	Yes	Yes
SIMV		
Volume breaths	Yes	Yes
Pressure breaths	Optional	Yes
Pressure support	Yes	Yes
Spontaneous/CPAP		
Pressure support	Yes	Yes
Apnea-backup vent	Yes	Yes
Others	User preference	Spontaneous/timed (NPPV), FlowTrack (VCV)
MONITORED PARAMETERS		
Pressure		
PIP; MAP; PEEP	Yes; Yes; Yes	Yes; Yes; Yes
Volume		
Tidal; Minute	Yes; Yes	Yes; Yes
Spontaneous minute	Optional	Yes
FiO_2	Yes	Yes
Respiratory rate	Yes	Yes
Inspiratory time	Yes	No
Expiratory time	Yes	No
IE	Yes	Yes
Others	Based on user requirements	% leak, spontaneous and total minute volume, spontaneous rate, measured end expiratory pressure, RSBI, TiTot, others

Footnotes used in pages 21 to 24

1. These recommendatons are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.
2. Bilevel VG not currently available in Canada and USA
3. Designed to increase the user's situational awareness.
4. Draeger has also **Evita 2 dura** and **Oxylog 3000** available in ventilators, intensive care

Healthcare Product Comparison System

	ECRI RECOMMENDED SPECIFICATIONS[1]	[4] Dräger medical	Dräger medical	Dräger medical	
MODEL	**BASIC IC VENTILATOR**	**Evita 4**	**Evita XL**	**Carina Home**	
WHERE MARKETED		Worldwide	Worldwide	Worldwide	
FDA CLEARANCE		Yes	Yes	No	
CE MARK (MDD)		Yes	Yes	Yes	
CONTROLS					
Tidal volume, mL	50-800	3-2,000 with NeoFlow	3-2,000 with NeoFlow	100-2,000	
Inspiratory flow, L/min	3-180	6-180	6-180	N/A	
Inspiratory pressure, cm H_2O	0-80	0-80	0-95	5-50	
Respiratory rate, breaths/min	6-120	0-150	0-300	0-50	
Inspiratory time, sec	0-3 pause	0.1-30	0.1-30	5-50	
Expiratory time, sec	1-8	0.1-30	0.1-30	N/A	
IE ratio	1:4 to 4:1	1:300 to 300:1	1:300 to 300:1	1:3 to 2:1	
Inspiratory hold/plateau	0-3 sec	Yes	Yes	No	
Expiratory hold	0-3 sec	Yes	Yes	No	
FiO_2, %	30-90	21-100	21-100	N/A	
Manual breath	Yes	Yes	Yes	Yes	
PEEP/CPAP, cm H_2O	0-45	0-35	0-50	3-20	
Pressure support, cm H_2O	0-45	0-80	0-80	3-40	
Nebulizer	Optional	Yes	Yes	Yes	
Trigger mechanism	Pressure, flow , both	Flow (pressure)	Flow (pressure)	Flow change, volume, pressure	
Bias/base flow range, L/min	1-20	Not specified	Not specified	Not specified	
Pressure slope/ramp adjustment	Yes/yes	Yes/yes	Yes/yes	Yes	
Sigh; 100% O_2	Optional; N/A	Yes; Yes	Yes; Yes	No; No	
Others		None specified	None specified	None specified	
OPERATING MODES					
Assist/control					
Volume breaths	Yes	Yes, AutoFlow	Yes, AutoFlow	Yes	
Pressure breaths	Yes	Yes	Yes	Yes	
SIMV					
Volume breaths	Yes	Yes	Yes	Yes	
Pressure breaths	Optional	Yes	Yes	Yes	
Pressure support	Yes	Yes	Yes	Yes	
Spontaneous/CPAP					
Pressure support	Yes	Yes	Yes	Yes	
Apnea-backup vent	Yes	Yes	Yes	Yes	
Others	User preference	APRV, MMV, AutoFlow, PCV+, automatic-tube compensation (all patient ranges) including nCPAP; all modes have noninvasive delivery option; optional independent lung ventilation	SmartCare (knowledge-based weaning system), APRV, MMV, AutoFlow, PCV+, automatic-tube compensation (all patient ranges) incl. nCPAP, noninvasive delivery option, optional independent lung ventilation	1:E ratio 1:3 to 2:1, LPO only, no oxygen control, 13 hr external battery extends battery operation time	
MONITORED PARAMETERS					
Pressure					
PIP; MAP; PEEP	Yes; Yes; Yes	Yes; Yes; Yes	Yes; Yes; Yes	Yes; No; No	
Volume					
Tidal; Minute	Yes; Yes	Yes; Yes	Yes; Yes	Yes; No	
Spontaneous minute	Optional	Yes	Yes	No	
FiO_2	Yes	Yes	Yes	No	
Respiratory rate	Yes	Yes	Yes	Yes	
Inspiratory time	Yes	Yes	Yes	No	
Expiratory time	Yes	Yes	Yes	No	
IE	Yes	Yes	Yes	No	
Others	Based on user requirements	Optional occlusion pressure, NIF, RSBi, capnogram, new sensor, no calibration data, remote fault, transducer fault, resistance, compliance, breathing gas temperature, leak rate for minute volume		Not specified	

	Dräger medical	VIASYS HEALTHCARE	VIASYS HEALTHCARE	GE Healthcare	GE Healthcare
	Savina	**Avea**	**Vela Comprehensive**	**Centiva/5 (12"Screen)**	**Engström Carestation**
	Worldwide	Worldwide	Worldwide	Worldwide[2]	Worldwide
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	50-2,000	2-2,500	50-2,000	20-2,000	3-2,000
	Not specified	0.4-30, 1-75, 3-150	10-140/180 spont max	2-99.6, 180 maximum peak flow	2-160, 200 maximum peak flow
	0-99	0-80, 0-90	0-100	1-59	1-98
	2-80	1-150, 1-120	2-80	4-100	3-150 for control modes, 1-60 for support modes
	0.2-10	0.15-3, 0.2-5	0.3-10	0.06-13.6, set via rate and I:E ratio	0.1-15
	Not specified	Depends on rate	Depends on rate	0.2-13.6, set via rate and I:E ratio	0.25-59.75
	1:150 to 150:1	APRV allows 30:1	APRV allows 30:1	1:9 to 4:1, 9:1 in bilevel	1:9 to 4:1, 9:1 in bilevel
	Yes	0-6 sec	Off, 0.1-6 sec	Yes	Yes
	No	3-20 sec	0-6	No	Yes
	21-100	21-100	21-100	21-100	21-100
	Yes	Yes	Yes	Yes	Yes
	0-35	0-50	0-35	Off, 2-35	Off, 1-50
	0-70	0-80 neo/0-90 ad/ped	Off, 1-60	0-59	0-60
	Yes	20 min	Off, 1-60 min	Pneumatic, sync., compensated	Built-in Aeroneb Pro Nebulizer System
	Flow (pressure)	Flow, pressure	Flow w/press backup	Flow	Pressure, flow
	Not specified	0.4-5	10-20	3-30	2-10
	Yes/yes	0-9 relative scale	No	Rise time adjustment for inspiratory pressure and pressure support	Rise time adjustment for pressure, flow, and pressure support
	Yes; Yes	Yes; Yes	Yes; Yes	No; Yes, suction maneuver	No; Yes, suction maneuver
	5-200 mbar/sec flow acceleration			None specified	None specified
	Yes, AutoFlow	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Bilevel	Yes
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Bilevel	Yes
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	AutoFlow, PCV+, nCPAP, all modes have noninvasive delivery option	APRV/BiPhasic, TCPL, PRVC, Vsync, heliox	APRV BiPhasic w/PSV & time sync, w/volume limit, loops/trends, MIP/NIF, Vsync, non-invasive	Bilevel, bilevel with Volume Guarantee[2]	Bilevel, Pressure Control Ventilation with Volume Guarantee
	Yes; Yes; Yes	Yes; Yes; Yes	Yes; Yes; Yes	Yes; Yes; Yes	Yes; Yes; Yes
	Yes; Yes	Yes; Yes	Yes; Yes (VTI, VTE)	Yes; Yes	Yes/Yes
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	No	Yes
	Yes	Yes	Yes	No	Yes
	Yes	Yes	Yes	No	Yes
	Plateau time, compliance, resistence, breathing gas temperature, leak rate for minute volume	Vti/kg, Vte/kg, spont Vte	High and low PIP, high rate, safety valve open, spont & mandatory minute and tidal volumes, Ti (sec), Te (sec)	Compliance, resistance, Pmin, RSBI, PEEPi, 12-day data, ventilator settings and alarm settings trends, alarm and event log	Functional Residual Capacity, Spiro-Dynamics, Auxiliary pressure, patient flow, CO_2, compliance, resistance, RQ, VO_2, VCO_2, RSBI, energy expenditure, 14-day trending, alarm logs

Healthcare Product Comparison System

	ECRI RECOMMENDED SPECIFICATIONS[1]	HAMILTON MEDICAL	HAMILTON MEDICAL	HAMILTON MEDICAL
MODEL	**BASIC IC VENTILATOR**	**Hamilton-G5**	**Galileo Gold**	**Raphael XTC**
WHERE MARKETED		Worldwide	Worldwide	Worldwide
FDA CLEARANCE		510K submitted	Yes	Yes
CE MARK (MDD)		Yes	Yes	Yes
CONTROLS				
Tidal volume, mL	50-800	2-2,000	2-2,000	50-2,000
Inspiratory flow, L/min	3-180	1-180	1-180	0-180
Inspiratory pressure, cm H_2O	0-80	0-100	0-100	0-50 above PEEP/CPAP
Respiratory rate, breaths/min	6-120	0.5-120	0.5-120	0-99
Inspiratory time, sec	0-3 pause	0.1-10	0.1-10	0.1-9.6
Expiratory time, sec	1-8	0.2-59.9	0.2-59.9	0.2-59.9
IE ratio	1:4 to 4:1	1:9 to 4:1, 150:1 in DuoPAP mode	1:9 to 4:1, 150:1 in DuoPAP mode	9.9:1 to 1:9.9, 150:1 in DuoPAP mode
Inspiratory hold/plateau	0-3 sec	0-70% cycle time	0-70% cycle time	0-70% cycle time
Expiratory hold	0-3 sec	10 sec maximum	10 sec maximum	N/A
FiO_2, %	30-90	21-100	21-100	21-100
Manual breath	Yes	Yes	Yes	Yes
PEEP/CPAP, cm H_2O	0-45	0-50	0-50	0-35
Pressure support, cm H_2O	0-45	0-100	0-100	0-50 above PEEP/CPAP
Nebulizer	Optional	Yes	Yes	Yes
Trigger mechanism	Pressure, flow , both	Pressure, flow	Pressure, flow	Flow
Bias/base flow range, L/min	1-20	1-30, automatic	1-30, automatic	Automatic
Pressure slope/ramp adjustment	Yes/yes	25-200 msec	25-200 msec	50-200 msec
Sigh; 100% O_2	Optional; N/A	Yes; Yes	Yes; Yes	Yes; Yes
Others		% tube resistance compensation, tube type/size, patient height	% tube resistance compensation, tube type/size	% tube resistance compensation, tube type/size
OPERATING MODES				
Assist/control				
Volume breaths	Yes	Yes	Yes	Yes
Pressure breaths	Yes	Yes	Yes	Yes
SIMV				
Volume breaths	Yes	Yes	Yes	Yes
Pressure breaths	Optional	Yes	Yes	Yes
Pressure support	Yes	Yes	Yes	Yes
Spontaneous/CPAP				
Pressure support	Yes	Yes	Yes	Yes
Apnea-backup vent	Yes	Yes	Yes	Yes
Others	User preference	ASV closed-loop ventilation, APRV, DuoPAP, NIV, APV, CMV/IMV	ASV closed-loop ventilation, APRV, DuoPAP, NIV, APV, CMV/IMV	ASV closed-loop ventilation (not available in the US), DuoPAP, DuoPAP+, NIV
MONITORED PARAMETERS				
Pressure				
PIP; MAP; PEEP	Yes; Yes; Yes	Yes; Yes; Yes	Yes; Yes; Yes	Yes; Yes; Yes
Volume				
Tidal; Minute	Yes; Yes	Yes; Yes	Yes; Yes	Yes; Yes
Spontaneous minute	Optional	Yes	Yes	Yes
FiO_2	Yes	Yes	Yes	Yes
Respiratory rate	Yes	Yes	Yes	Yes
Inspiratory time	Yes	Yes	Yes	Yes
Expiratory time	Yes	Yes	Yes	Yes
IE	Yes	Yes	Yes	Yes
Others	Based on user requirements	Novel graphical user interface (Ventilation Cockpit) incorporating intelligent panels to display information on lung mechanincs, patient activity and ventilation status in an integrative and dynamic format.[3]	Static compliance, in-/expiratory resistance, in-/expiratory time constant, patient trigger, PO.1, RSBI (f/VT), WOB, pressure-time product, air trapping, aux. and min. pressure, Vleak, % O_2	Inspiratory peak flow, compliance, expiratory resistance

Aren't there already more monitoring parameters available than most users ever need? The new HAMILTON-G5 ICU ventilator was designed to be simpler for the user and safer for the patient. Rather than bringing you even more curves and loops, its new Ventilation Cockpit™ integrates complex data into intuitive graphics that answer two essential questions:

- What is my patient's lung condition, and what kind of ventilation do they need?
- When should I take my patient off the ventilator?

Aren't a dozen ventilation modes more confusing than helpful? The HAMILTON-G5 features ASV closed-loop control, providing easy-to-use and extremely safe ventilation for virtually all intubated patients, whether active or passive, and regardless of disease. ASV employs lung-protective strategies and tailors ventilation to your patient's specific needs.

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www.hamilton-medical.com/G5

HAMILTON MEDICAL

Improving Situational Awareness in the ICU: the Ventilation Cockpit

by Josef X. Brunner, PhD, Director of Innovation and Marketing, Hamilton Medical AG/Switzerland

For years, ventilator manufacturers have prided themselves on bringing new modes of ventilation to the market – even when nobody asked for such modes. New lung function indices were invented and added to the wealth of information on the screen. A proliferation of waveforms and loops appeared thanks to the availability of high-resolution graphical displays. As a result, nobody today can say that patients cannot be ventilated adequately, nor that information to treat patients and to find causes of problems with tubing, hoses, and cables is missing. And yet, some patients are still dying on ventilators because of user errors and not because of illness.

The major factors contributing to ventilator-related deaths and injuries were found to be inadequate orientation and training, plus communication breakdown among staff members (Sentinel Alert of Joint Commission on Accreditation of Healthcare Organizations 2002). The root causes were not missing alarms nor unavailable data, but rather failure of the human operator to confront reality, to become aware of the actual situation. In aviation circles and the military, this aspect of human nature has been discussed in detail for years and is known as the problem of "situational awareness". For example, an analysis of U.S. air accidents indicates that perceptual factors, in particular "fail-

Figure 1: The newly released graphical user interface (Ventilation Cockpit) on the HAMILTON-G5 ICU ventilator.

ure to monitor", were the leading cause of accidents (Jones and Endsley 1995). Information was available to the crew, but it was not heeded for some reason.

What is needed, then, is not more data displayed by ventilators but a fundamental breakthrough in presenting the data. The new HAMILTON-G5 (see figure 1) offers such a breakthrough with its Ventilation Cockpit.

The first Ventilation Cockpit panel, the Dynamic Lung (see figure 2), shows the status of the lungs and airways (stiff lungs, bronchospasms, etc.), using animation to represent the actual movement of the gas in and out of the lungs. Previously unrelated events, such as disconnections, trigger attempts, and/or tachypnea, are combined into one, integrated picture, making problems immediately visible.

A second panel, the Vent Status (see figure 3), depicts the patient's need for mechanical respiratory support. Unlike displays on other ventilators, the Vent Status panel integrates user settings and measured values in the same graph. The "weaning zone" visualizes the target ventilatory treatment, including the clinician's settings and the patient's responses to those settings. If all parameters fall within the weaning zone, discontinuation of mechanical ventilation can be considered.

Wes Ely (NEJM 1996) has documented that if the respiratory function of patients is assessed daily and the physician actually monitors that status, duration of mechanical ventilation can be reduced. In the past, this task was not easy, because numeric data had to be collected from different tables and screens on ventilators. With the Ventilation Cockpit, such assessment becomes intuitive.

The Ventilation Cockpit breaks with tradition to present data in a brand new and unprecedented combination. The goal is to improve situational awareness at the patient's bedside and to allow clinicians to assess their patients much faster, resulting in fewer complications and better outcomes, fewer errors and reduced costs.

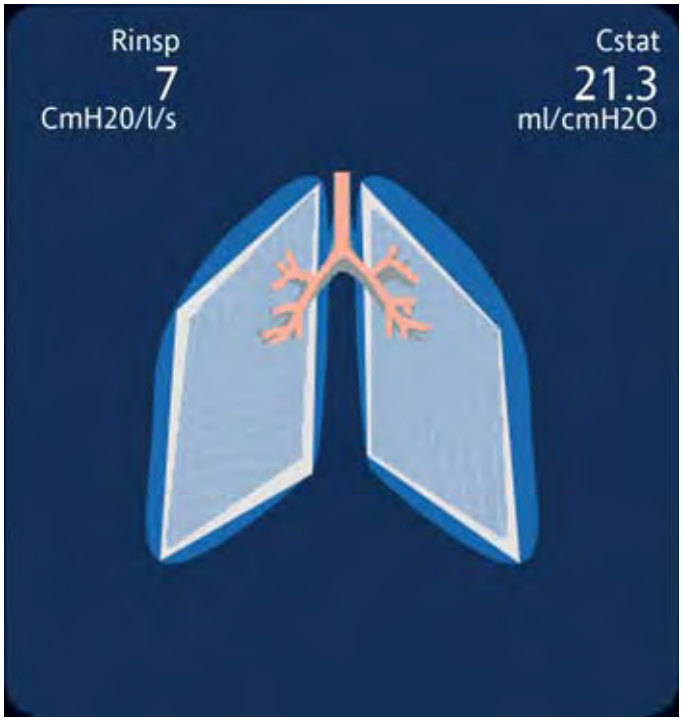

Figure 2: Traditional pressure and volume waveforms are translated into dynamic lungs. The lung movement is synchronized with the breath rate of the actual lungs, and the size of the lung graphic is proportional to the actual volume. The "deformed" lung shape indicates a stiff lung.

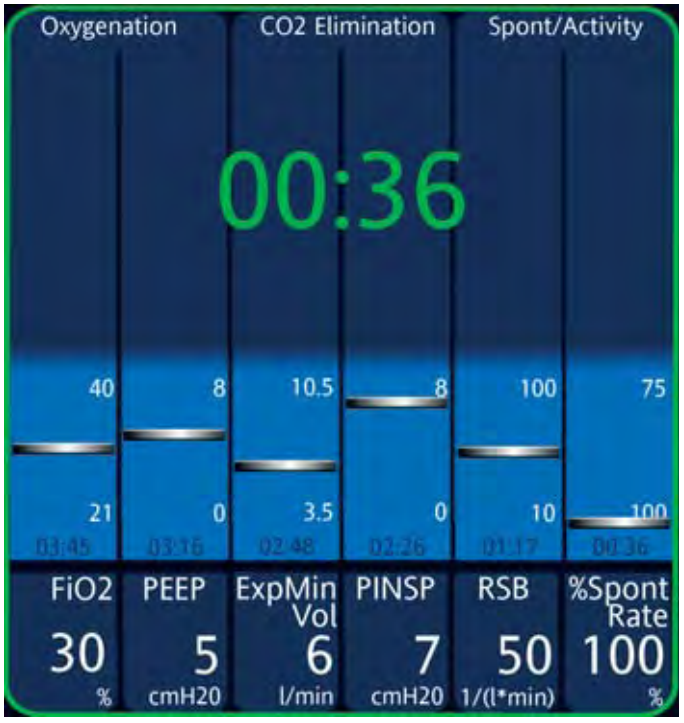

Figure 3: The Vent Status panel is an attempt to combine measured parameters with clinician-set parameters. In this figure, all parameters are inside the light blue "weaning zone". A green frame is shown, and a timer is activated to indicate that the patient may no longer need the ventilator.

Medical informatics improves quality of care in the intensive care unit

Vitaly Herasevich, MD, PhD
Research Fellow

Ognjen Gajic, MD, MSc
Assistant Professor of Medicine

Department of Internal Medicine
Division of Pulmonary and Critical Care Medicine
Mayo Clinic
Rochester, Minnesota, USA
Gajic.Ognjen@mayo.edu

Advances in medical informatics and widespread implementation of electronic medical records facilitate the implementation of evidence-based practices and improve quality of care in the intensive care unit.

Introduction

Quality of care is an important goal in modern medicine. In the last decade, reports from the US National Academy of Sciences' Institute of Medicine noted an unacceptable rate of medical errors in hospitalized patients. (Kohn et al. 1999). Both errors of commission (treatment administration) and, more frequently, errors of omission are particularly common in the fast paced environment of the intensive care unit (ICU). Recent advances in medical informatics and widespread implementation of electronic medical records can greatly facilitate the implementation of best practices and improve the quality of care in the ICU (see figure1).

Education and decision support at the point of care

Web-based education allows all critical care providers (physicians, nurses, pharmacists, respiratory therapists) easier access to medical information and may facilitate modest care improvements (Belda et al. 2004). However, decision support is more effective if provided as near to the bedside as possible, and at the time of medical decision-making. The integration of decision support within Computerized Provider Order Entry (CPOE) may be an effective way to achieve this goal. For example, a simple algorithm developed by an interdisciplinary team of local experts (intensivists, anesthesiologists, surgeons, transfusion specialists and ICU nurses) effectively decreased unnecessary transfusions and transfusion complications in our institution (Rana et al. 2006). The teaching of complex processes, such as shock resuscitation or mechanical ventilation, may be facilitated by medical simulation using sophisticated, realistic scenarios, debriefing and feedback.

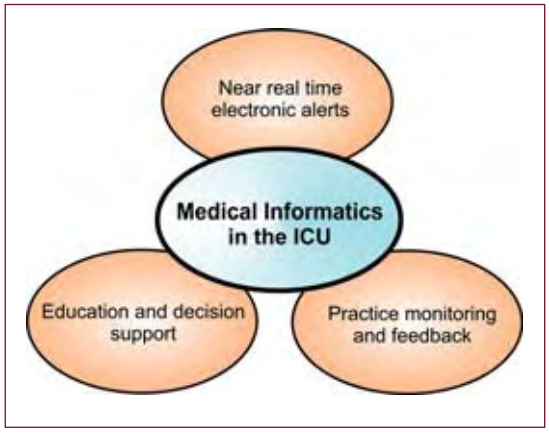

Figure 1: Medical Informatics Tools for ICU Quality Improvement

Practice monitoring using relational databases

The implementation of the best practices at the bedside is most effective when coupled with regular monitoring of outcomes, processes of care and timely feedback to the providers (see table 1). While administrative databases may allow crude assessment of quality of care in hospitalized patients, multiple shortcomings preclude its use in the critical care setting (Rubenfeld 2004). Administrative databases do not track ICU-specific syndromes (shock, sepsis and acute lung injury), processes of care (goal-directed resuscitation, low tidal volume ventilation) and outcomes (ventilator associated pneumonia). ICU-specific databases, such as the Acute Physiology and Chronic Health Evaluation (APACHE), are more useful, allowing for estimates of severity adjusted mortality and resource utilization (Afessa et al. 2005). Ultimately, electronic medical records are the richest source of ICU-specific information. Thus far, their uses to this end have been limited because of the different structures of specific data sources (laboratory, pharmacy and clinical notes), the absence of standardized coding and overall complexity, greatly limiting effective electronic database queries. Beginning March 21, 2005, the medical records of all new patients coming to Mayo Clinic in Rochester, Minnesota, are in electronic form. Moving to an integrated electronic medical record has been a large, multi-phased, eleven-year project. The benefits of the electronic medical record are already being recognized in the care of patients and the efficiency of operations.

Rule-based systems and electronic alerts

The availability of electronic data close to real-time allows for the development of specific rules and alerts aimed at preventing medical errors and facilitating evidence-based practices. A simple rule-based system that combines pharmacy orders

with microbiology sensitivities has been successfully used for more than five years to facilitate adequate antibiotic treatment throughout Mayo Clinic, Rochester, hospitals (Wilson et al. 2005). Furthermore, the development of specific electronic alerts ("data sniffers") can not only prevent drug allergies and drug-drug interactions but can also facilitate recognition of specific ICU syndromes and adverse events, for both quality improvement and clinical research (Finlay et al. 2005).

Conclusion

In conclusion, advances in information technology and medical informatics have the potential to facilitate best practices, prevent medical error, and greatly enhance the quality of care in the ICU. ■

Type of database	Advantages	Disadvantages
Administrative	Readily available	Designed for billing, not for quality Limited severity of illness ICU-specific diagnoses and processes inadequately tracked
ICU-specific databases (APACHE III)	Severity of illness adjustment	Expensive ICU-specific diagnoses and processes inadequately tracked
Electronic medical records	The richest source of ICU-specific information	Complex and difficult to query

Table 1: Advantages and disadvantages of various databases. Adapted from Rubenfeld GD. (2004)

Changing the organization of ICUs in American Combat Support Hospitals

LTC Kurt W Grathwohl, MD, FS, FCCP
Anesthesiology Service
Department of Surgery
Brooke Army Medical Center
Fort Sam Houston, USA

kurt.grathwohl@amedd.army.mil

MAJ Jason Adyellote, MD
Anesthesiology Service
Brooke Army Medical Center
and Department of Surgery
Fort Sam Houston, USA

Charles Wade, PhD
Anesthesiology Service
United States Army Institute
of Surgical Research
Fort Sam Houston, USA

The rapid development of novel diagnostic and therapeutic technology found in the evolving state-of-the-art intensive care unit (ICU) requires specialized knowledge, training and skills. Since the inception of the first ICUs in the 1960s, several studies have identified significant improvements not only in mortality, but also in hospital/ICU length of stay (LOS) and resource utilization in intensivist-directed or closed ICU models (Blunt and Burchett 2000; Brown and Sullivan 1989; Carson et al. 1996; Hanson et al. 1999; Manthous et al. 1997; Pronovost et al. 1999; Pronovost et al. 2002). Pronovost et al. evaluated the effect of ICU organizational characteristics and found that a large factor in mortality was the lack of intensivist ICU rounds (Pronovost et al. 2002). He noted a threefold increase in deaths, as well as increased risk of cardiac arrest, acute renal failure, septicemia, platelet transfusion and reintubation (Pronovost et al. 2002). Despite these studies, the role of intensivists in organizational models continues to be debated.

The role of intensivists in organizational models is less clear in the modern American Combat Support Hospital (CSH), the highest level of American medical care available in a combat zone. The CSH must manage the full spectrum of combat injuries, including resuscitative surgery, damage control surgery, postoperative care and evacuation for coalition troops, as well as care for host nation personnel. The modular CSH is transportable by semi-trailer, railcar, air cargo or ship and include ICUs that can be configured for as many as 96 patients (Burris et al. 2004). Despite the large critical care bed capacity, current organizational characteristics of the CSH do not include critical care physicians and equipment for advanced critical care monitoring. Until recently, the optimal organizational model for a CSH ICU during war operations had not been evaluated.

The development of optimal ICU models, however, has recently been highlighted secondary to interests and efforts dedicated to developing a combat theater trauma system. Probably as a result of improved personal protective equipment and the development of a trauma system, killed in action (KIA) rates, which during previous conflicts ranged from 15-25%, have decreased to less than 12% during Operation Iraqi Freedom (Holcomb et al. 2006). Unfortunately, the number of patients who died of wounds (3-6%) may be increasing and now account for over 20% of all casualties (Holcomb et al. 2006). Today, as a consequence of decreased KIA rates, larger numbers of critically ill patients survive to the CSH. Proportionally increased numbers of casualties subsequently die of potentially preventable death from battlefield injuries in the ICU. In a recent study we performed, the rate of ICU admissions from trauma-related combat injuries was 35% (Grathwohl et al. 2006). By contrast, in civilian centers that manage trauma primarily related to motor vehicle crashes, stab wounds and lower-velocity gunshot wounds, less than 20% of civilian trauma patients are admitted to the ICU (Grathwohl et al. 2006). These factors make optimal ICU care in the CSH imperative to realize continued improvements in survival of combat injured patients.

As a result of this imperative, we also compared organizational differences at a CSH in Iraq to evaluate mortality. First, we compared the effectiveness of both intensivist consultation and intensivist-directed teams to a total lack of intensivists. We found that mortality decreased more than 10% when an intensivist consultant model was implemented and almost 15% with an intensivist-directed ICU team model. Additionally, compared to the no-intensivist group, ICU length of stay was decreased by two days with the presence of an intensivist-directed ICU team. The resultant reduction in mortality was over 35% when ICU-directed teams were compared to an intensivist consultation (Grathwohl et al. 2006). While many surgical and medical therapies occur simultaneously, and it is difficult to definitively determine which of these resulted in improved outcomes, undoubtedly the presence of an intensivist makes a difference. As a result, intensivists are now deployed to the busiest CSHs to act as consultants or develop teams and have also been included in the organization of the medical re-engineering intitative (MRI) CSH, scheduled to deploy in 2010.

The Army is also exploring alternative solutions in the future to provide optimum care on the battlefield, including adopting novel technologies such as the electronic ICU (eICU) and remote presence, wireless robotic telemedicine technology. High acuity, utilization of important resources and optimum care provision makes the organizational characteristics of the ICU an important factor in the continued development of an Iraqi Theater Trauma system. ■

Critical Tests for Critical Times

Critical care environments often demand quick decisions based on available facts. Two of the most important tests in these settings are glucose and hemoglobin.

Critically ill patients often suffer from insulin resistance and hyperglycemia. Intensive insulin treatment based on accurate glucose values can dramatically reduce mortality and morbidity in these patients.

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An interview with

Dr. Gilberto Felipe Vazquez de Anda

Dr. Vazquez de Anda is the Coordinator of Critical Care Medicine at ISSE-MYM Medical Center, Toluca, Mexico – a publicly funded, high-care, specialty, university/teaching hospital with approximately 28,000 patients per year. In this interview with Amanda Heggestad, Dr. Vazquez de Anda shares his experiences and vision for the future of management of critical care.

Can you briefly describe your professional history?

I received my certificate as a Medical Doctor, specialist in critical care medicine from the Mexican Board of Critical Care Medicine. My Master's degree was in Clinical Research. In 2000, I completed my PhD studies at the Department of Anesthesiology, Erasmus University Rotterdam under the supervision of Prof. Dr. B. Lachmann. Back in Mexico, I was promoted to Head of the Respiratory Care Service at the Hospital de Especialidades del Centro Medico Nacional Siglo XXI, Mexico City. In 2003, I was nominated to my current position. Presently, I am a member of the National Research System, of the Mexican Academy of Sciences, and of the National Academy of Medicine. I am also Professor in the Clinical Research Master Program at the medical faculty of the State of Mexico Autonomous University. My continuous research work focuses on Acute Respiratory Distress Syndrome, monitoring of lung function, ARDS, severe sepsis, quality system in critical care, and costs in critical care.

What does your typical day look like?

My typical day as Coordinator of the Critical Care Division (Emergency Department, Intensive Care Unit and Respiratory Care Service) starts at 07h30 with a cup of coffee and a review of the nightshift reports followed by a quick round to check the patients who were admitted at the ICU and the critical care area in the ER. At 8h00, I usually attend meetings at the Director's office to participate in several committees. At 9h00,I complete paperwork and then I have a supervision visit at the ER and ICU to verify all kinds of process errors during the last 24 hours and to discuss clinical cases with attending physicians. At noon, the chief of nurses and I go on a checking round with a particular check list which includes items such as patient's head position at 30°, prophylaxis for deep venous thrombosis, insulin therapy, sedation, antibiotics, ventilator-associated pneumonia, presence of multiresistant Pseudomonas, vancomycin resistant Staphylococcus aureus, etc. Between 14h00 and 16h00 I spend time on research work for discussions and revisions. On Thursdays and Fridays, in the afternoon, I attend meetings with representatives of the pharmaceutical industry. In addition to these activities, the costs of the ICU are monitored during the whole week. Once a month we also have a "Quality" meeting to discuss errors during the processes and to suggest recommendations for improvement. Every six months our hospital is audited by an external, private company in order to meet the ISO 9000-2001 certification requirements.

What management issues take up most of your time?

We keep our records on paper and all data are registered by hand (audit books) so most of our time is expended on checking and updating our database for the Quality System and reminding all staff members to keep recording our Quality Processes.

What sort of personnel issues do you deal with on a regular basis?

Communications skills. Under my supervision I deal with highly educated people (doctors, masters, specialists), professionals (nurses, engineers), technicians (respiratory technicians, paramedics), and also with people with basic education. There have been communication problems in the whole team and for that reason, recently, we (the whole staff of the ER and ICU) had our first meeting on improvement of communication. We have learned that every person plays an important role in the process of patient care and that effective care depends on our teamwork and communications skills.

Describe in more detail your quality control/performance assessment procedure

We follow the International Organization for Standardization (ISO) 9000-2001, which focuses on the customer (patients and relatives) satisfac-

tion. The ISO quality management system strives to achieve defined targets with continuous improvement and certified by a third party.

Our hospital follows two macro processes (ER and external consultation) with 16 micro processes (laboratory, ICU, supplies, etc). In our ICU we follow five main processes of Quality Management: admission to the ICU-Mortality Rate, blood transfusion, nosocomial infection, commitment in surviving sepsis campaign, and cost. As improvement, we are working on mechanical ventilation, full equipment function and a hand-washing program, among others.

We measure these processes on a daily basis. Every month we measure the customer satisfaction and every four months we perform an internal audit. We also perform error management and data analysis in order to be able to take corrective measurements and improve the process and to establish preventive policies during patient care.

What are your goals for your ICU/Emergency Department?

In the short term, we aim to establish full control over our quality processes and in the long term, to reach high quality according to the international standards by improving patient safety and reducing professional malpractice, ER and ICU length of stay, mortality rate and costs of attention.

Are there particular areas in which you feel your department excels?

In Mexico, our hospital and department have earned a good reputation concerning our standard of treatment mainly in quality care, severe sepsis and mechanical ventilation.
Why? We are one of the few hospitals certified with the ISO 9000-2001 Quality System. To keep such certification we need to keep full records of our processes and to show control and improvement. The track of every patient in the ER and the ICU has been recorded and followed-up on since our opening in January 2003. This database is our main tool for comparison with other Mexican ICUs. Our results have been presented at national and international meetings.

Please give examples of two extremes that you face during your work?

The first example would be trying to introduce the change from the traditional way of working in the ICU to a better organized, teamwork care and secondly, keeping the balance between administrative and clinical work while lowering mortality rates and keeping cost efficiency in mind. For example, in the last six months we have decreased our mortality rate from 27% to 20% with less expenditure than in the first semester of 2005.

What is the hardest decision you have had to make as an ICU/Emergency Department manager?

To accept when I am doing something wrong, to slow down when I am going too fast, and to correct things on time.

What has been your most satisfying experience as head of your department?

The most satisfying experience has been seeing the results of the three and a half years work in a team of young and enthusiastic people - from designing and planning a brand new ER/ICU with the latest equipment and medications for critically ill patients, to developing a working quality culture that has decreased our mortality rate at lower costs.

What skills do you feel are most essential to being an ICU manager?

Knowledge, vision and leadership.

What are the most important issues that you feel the ICU community currently needs to address?

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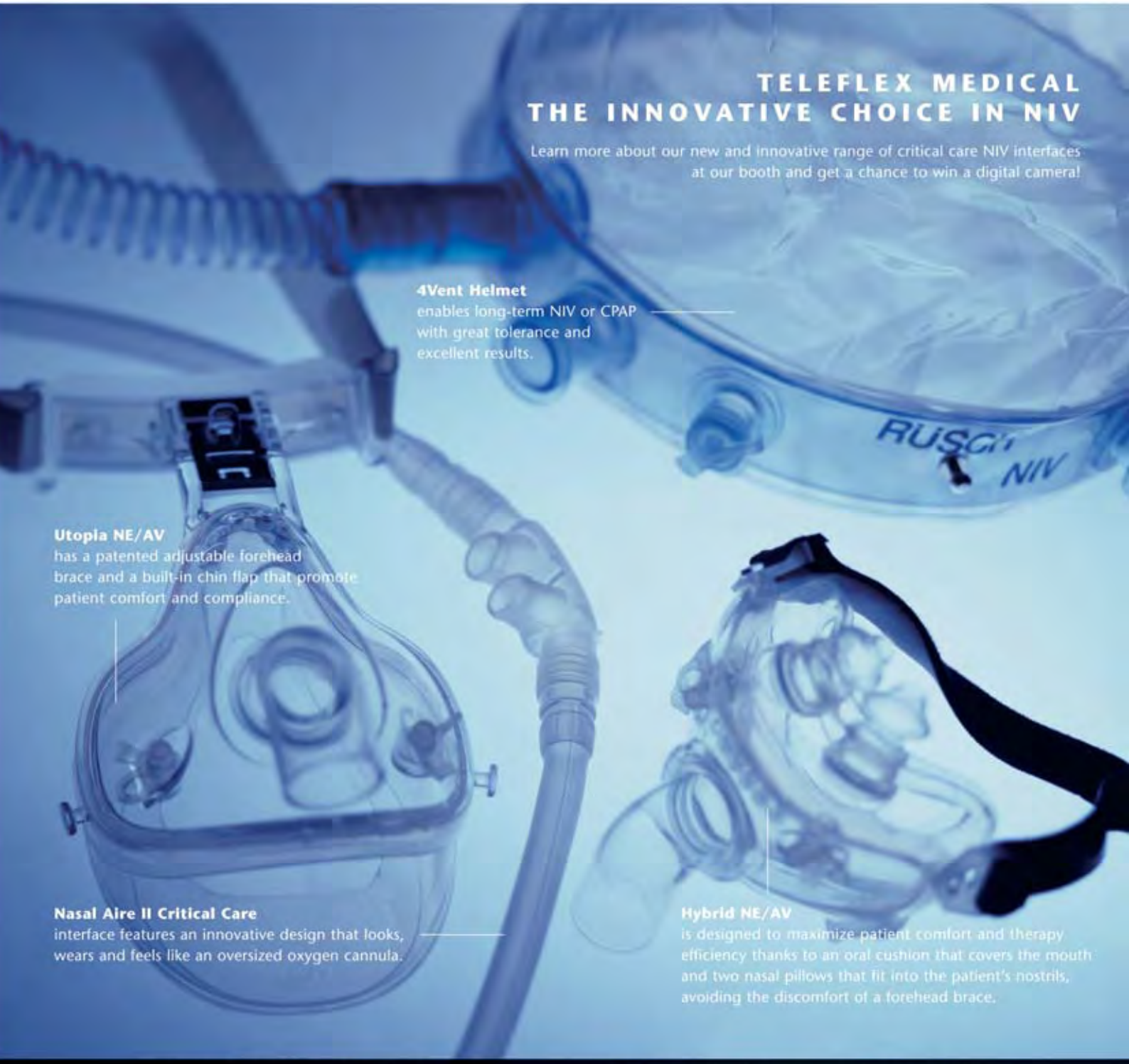

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An overview of the healthcare system in Australia

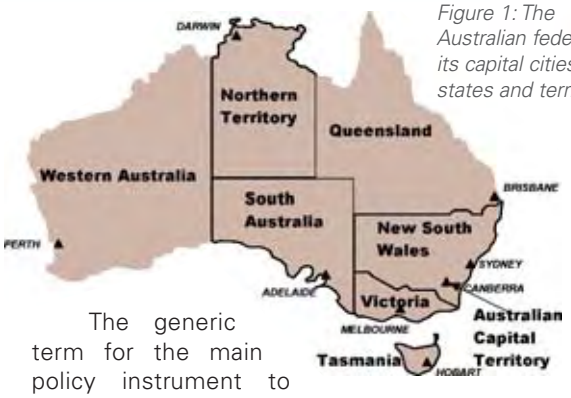


Figure 1: The Australian federation, its capital cities, states and territories

Jeffrey Braithwaite, PhD
Director
Centre for Clinical Governance Research, Faculty of Medicine, University of New South Wales, Sydney, Australia
Professor
School of Public Health and Community Medicine, Faculty of Medicine, University of New South Wales, Sydney, Australia
j.braithwaite@unsw.edu.au

Introduction

To understand the Australian healthcare system requires a consideration of core problems facing every healthcare system – the financial and structural arrangements, perceived weaknesses and strengths, how performance compares internationally, what future challenges are likely to be faced and how challenges can be tackled. Australia is a large, federated country of nine jurisdictions. It occupies a continent, has a population of 20 million and a developed economy with a gross domestic product (GDP) per capita of US $34,660 in 2006. This places Australia in the world's wealthiest fifteen countries (World Bank 2006).

Australia's healthcare system is a mixed public-private model, lying somewhere between the largely monolithic public systems exemplified by the National Health Service (NHS) of England on the one hand and the more privatized arrangements characterizing healthcare in the United States of America (USA) on the other. Beneath that over-simplification lies considerable detail that needs to be filled in to provide an adequate description of the unique Australian healthcare configuration.

Financing and structural arrangements

Expenditure on healthcare in Australia, at 9.7% of GDP, is above the Organisation for Economic Co-operation and Development (OECD) average. Health expenditure has tended to rise in recent decades in OECD countries, including Australia, driven primarily by the costs of population ageing and of advancing, and increasingly expensive, medical technology (OECD 2006). Around two-thirds (68%) of the GDP consumed by Australian healthcare is public expenditure, and the remainder (32%) is non-government, private expenditure. The Australian government contributes 45% of total funding, principally through taxation, and directly funds pharmaceuticals, general practitioners and medical services. States and territories provide funding in conjunction with the Australian government and directly manage public hospital services and various community, prevention, public health, health education and health promotion programs. Local governments have responsibility for environmental issues such as garbage disposal, health inspections and some home-care and preventive services.

The generic term for the main policy instrument to achieve these service arrangements is Medicare. The vehicle used to contract the jurisdictions to their part of the bargain in sharing federal, state and territory responsibilities for public hospitals are called the Australian Health Care Agreements (Department of Health and Ageing 2006). The states and territories manage services via area, district or regional health service arrangements, which are geographically-based administrative units responsible for the health of a population of perhaps half a million people. Medicare enshrines the principle that all resident Australians are entitled to free public hospital care if they exercise the choice to be public patients.

Private patients meet their costs via private health insurance or personal contributions. The Australian government has recently encouraged increased membership in private health insurance funds. About half the population is covered by elective, government-subsidized private health insurance. Most out-of-hospital medical services are provided by private doctors, and, alongside salaried medical practitioners, these doctors perform a considerable proportion of hospital services (Department of Foreign Affairs and Trade 2006).

Weaknesses and strengths

Commentators have bemoaned the poor integration between general practice and hospitals and the apparent administrative and policy duplication attributed to the split responsibilities between the federal government and the states and territories (Leeder 1999; Duckett 2004). A bigger issue is whether we can call the health industry a system at all, given the various levels of divided responsibilities, fragmentation and its pluralist nature. Australian consumers and providers have considerable discretion and autonomy, and there is a complex mix of public-private concerns, state-federal politics and other intermittently strained, dichotomous interests, such as those representing clinicians and managers, the acute and community sectors, and medicine and nursing. Someone once likened the health system of the USA to "primordial ooze." The Australian healthcare system is not

		Australia %	Canada %	New Zealand %	UK %	USA %
Experiences of sicker adults with their health system[a]	Developed an infection while in hospital	8	7	10	10	7
	Doctors and nurses failed to communicate about your care to you	12	15	20	15	17
	Reported a medical mistake, medication error, or lab error	27	30	25	22	34
	Was given a plan to manage care at home	50	65	56	45	58
	Only minor changes needed to the health system, it works well	23	21	27	30	16
Experiences of randomized adults with their health system[b]	Overall rating of the quality of care received – excellent or very good	71	68	74	64	61
	Doctor makes clear the specific goals and plans for treatment	61	55	59	52	45

Notes: a) Schoen et al. 2005; b) Schoen et al. 2004

Table 1: Selected comparative international healthcare performance data, Commonwealth Fund members

- Ageing of the population: some 12.2% of the population is over 65 years in 1999; this is projected to be 18% of the population by 2021
- Shifts of emphasis toward community care, health prevention, promotion and education
- New models of care, e.g. birthing centers, day surgery, hospital in the home, and a shift away from institutionally based care, e.g. in mental health, disability and aged care
- Coordinated care – pooled funds and cooperation to provide services across a continuum
- Efficiency – the perennial goal
- Quality and safety, e.g. the NSW Quality Framework, Australian Council for Safety and Quality in Health Care
- Adverse outcomes – the quality in Australian Healthcare Study
- New communications technology
- New diagnostic and drug technology
- Clinicians as managers and clinical governance
- Systematicization and organization of clinical work
- Political dynamics of the separate responsibilities between the federal government and the states and territories
- New funding methods, e.g. case-mix funding
- Equity
- The knowledgeable consumer

Source: Adapted from Braithwaite and Cormack 2003

Table 2: Key challenges in the changing Australian healthcare landscape

quite so unstructured, but there are many species of provider, policy and lobbyist running around in the healthcare soup. Some of these are collaborators with other agents, others are isolates, while yet others compete vigorously for resources.

The other major weakness is the deplorable state of indigenous health, with extremely high prevalence of diabetes, obesity, alcohol abuse and drug problems amongst the Aboriginal population. Overall, life expectancy of Aboriginal people is 17 years below that of other Australians. Everyone wants this fixed, but progress has been painfully slow.

The strengths of the system are considerable. All in all, the Australian population, measured by the usual morbidity and mortality indicators, is relatively healthy and enjoys good life expectancy. Healthcare in Australia is well funded; clinicians, managers and policymakers are suitably trained; and equipment, buildings and technology are modern and well-resourced. The health policy settings are underpinned by effective research and are internationally well regarded, despite the fragmentation and difficulties in promoting integration at some points in the system. Plurality and diversity, though contributing to system fragmentation, can also bring strengths, particularly when they offer a wide range of different types of services, thereby creating choice for consumers. Having multiple perspectives and actors in a system tends to lead to greater innovation and improved results (Surowiecki 2004).

International comparisons

Internationally, Australia compares favorably with other countries on many measures of health system performance. Table 1 provides some selected comparative data, drawn from the Commonwealth Fund, a private, international research foundation (Commonwealth Fund 2006; Schoen, Osborn et al. 2004; Schoen, Osborn et al. 2005).

Future challenges

Braithwaite and Cormack (2003) have listed some of the major challenges facing Australian healthcare (see table 2). Improved quality of care, patient safety, efficiency and equity, better coordination of services and the search for new models of care are likely to be issues of concern to every health system.

But these are distal issues. Summarized, the proximal problems, not confined to Australia, seem to be affordability of new technology and funding the rapidly increasing treatment capabilities against a backdrop of population ageing and workforce shortages. A current debate (Braithwaite 2006; Podger 2006a; Podger 2006b) is whether structural responses are needed to address some of these challenges. For example, is it warranted to encourage greater competition, e.g. by separating the purchaser from the provider of health services and allocating healthcare funding through a competitive bidding process? Some economists prefer competitive models, but others are not convinced that structural-financial change, designed to induce more competition, will lead to a fundamental response to system deficits. Such structural debates, while important, do not guarantee any detectable change in patient outcomes. Time will tell, but the struggle to provide excellent services within limited resources is not likely to be resolved soon. ■

Overview of intensive care in Australia

Ken Hillman
Head Division of Critical Care
South Western Sydney
Clinical School, Sydney,
Australia
ken.hillman@
sswahs.nsw.gov.au

Introduction

Intensive care is a separately recognized specialty in Australia with specific post-graduate training and qualifications, which do not require prior specialty qualifications. This has led to a high-profile presence of the specialty in most Australian hospitals. Intensive care units (ICUs) are usually staffed by specifically trained intensive care specialists.

The intensive care specialty

Australia was fortunate in avoiding most of the political infighting that often accompanies the introduction of a new specialty. This smooth initiation can be attributed to the efforts of several committed clinicians, who were already practicing as full-time intensive care specialists in Australia and New Zealand during the 1970s. They resolved to establish a strong society of clinicians – the Australian and New Zealand Intensive Care Society (ANZICS). This same group of clinicians established separate training in intensive care within the Colleges of Physicians and Anaesthetists. A joint faculty of intensive care, separate from these colleges, has now been established to oversee training in intensive care. There are now common examinations and training requirements for intensive care specialists throughout Australia and New Zealand. These two countries were jointly the first in the world to establish specific post-graduate training in the specialty of intensive care, and the specialty's first graduate completed training in 1980.

Intensive care units

Every referral hospital and many larger rural and metropolitan hospitals now have intensive care units staffed by specifically trained intensivists. The intensive care units are largely single units managing medical, surgical and obstetric patients. Pediatric intensive care units are separate, and the clinicians managing them are specifically trained in pediatric intensive care. The ICUs are all operated on a "closed" basis, with patients admitted under the management of ICU intensivists or under joint management between the intensivists and a home admitting team. Hospitals may have separate specialist units for critically ill patients, such as those caring for burns, spinal injuries, neurosurgery and cardiac surgery, but these are often headed by intensivists or at least involve intensivists intimately in joint care.

The overall health system in Australia is based on a strong public system with parallel private healthcare. Private patients are managed in both public and private health facilities. The larger private hospitals have separate intensive care units, staffed by full-time specialists, as in the public system. There is a large overlap between both systems, with the same intensive care specialists often working in both systems.

The strengths of Australian intensive care

One of the strengths of Australian intensive care is the close cooperation between specialist doctors and nurses working full-time in intensive care. This has been a feature since the first initiatives to establish the specialty in the 1970s. The ANZICS annual conference, for example, has always been conducted and organized jointly by both medical and nursing specialists. This close cooperation acknowledges the special role of intensive care as a joint initiative, in which team efforts are crucial to achieve good clinical outcomes. In this way, Australian intensive care sets itself apart from other medical specialities, which often emphasize the skills of individual doctors, such as surgeons and physicians.

The intensive care specialty in Australia has developed a reputation for high clinical standards and recently established its credentials in research with the formation of the Clinical Trials Group (CTG) of the ANZICS, which oversees multi-center trials across Australia and New Zealand. As a result, research in intensive care now is equal to the standards of specialist training and clinical practice. Australia also has led the world in involvement in systematic ways to manage the seriously ill – whether they happen to be within the walls of the ICU or in other areas of the hospital. Furthermore, intensivists have a high profile in administrative roles, both within hospitals and at government levels. At the broadest level, Australian intensivists are involved with national planning of intensive care resources and standards.

For more information on ANZICS-CTG and its research activities, see the article submitted by Myburgh, Finfer and Bellomo, pages 43-44.

Conclusion

In summary, intensive care in Australia is a robust and separately recognized specialty, which has been widely accepted within the Australian healthcare system since its inception. It has developed high standards of clinical practice, training and research. By building on these strengths and sharing its experiences, the Australian intensive care community can contribute to worldwide efforts to improve critical care services. ■

The major challenges facing Australian intensive care over the next 10 years

This article outlines some of the challenges and opportunities for the Australian intensive care environment for the next 10 years.

Dr Arthas Flabouris, FJFICM
Staff Specialist
Intensive Care Unit,
Royal Adelaide Hospital

Clinical Lecturer
University of Adelaide
Adelaide, Australia

aflabour@mail.rah.sa.gov.au

Introduction

Significant gains are expected from current and future progress in genomic, protenomic and stem cell research and technology. These gains will have a significant impact upon intensive care medicine. There is a strong general public expectation of what such advances will achieve, especially in terms of survival and quality of life. Intensive care has, and will continue, to come at a large financial cost (Higlett et al. 2005). Managing public expectations and promoting the reality of what intensive care treatment can offer within a financially austere environment will be an important future challenge.

Clinical developments

So far, progress has occurred via small, incremental steps. There have also been failures. We have had to re-evaluate some of the basic principles upon which intensive care has been established - that is, not all therapies that improve physiological measures improve survival, and physiological surrogates of success may not reflect improved patient outcome. Examples of areas in which we have had to better examine our practice include: measures to achieve supra physiological oxygen delivery (Hayes et al. 1994), growth hormone administration (Takala et al. 1999), nitric oxide synthase inhibitor (Lopez et al 2004), deep and prolonged sedation (Kress et al. 2000), use of dopamine (Bellomo et al. 2000), albumin (SAFE 2004) and excessive blood transfusion (Hebert 1999). In part, this has resulted from national and international collaborative research both within our specialty and in conjunction with other medical disciplines (ANZICS website). The next 10 years will see an increase in such activity and more robust and timely research output. These and other factors will also continue to change our stance from being "closed" units to intensive care units (ICUs) "without walls" through the advent of high dependency units (Boots et al. 2002), outreach services (Esmonde et al. 2006) and rapid response teams (Hillman et al. 2005).

There will be significant changes in the ICU patient case mix. Drug development will improve the success of treatment for conditions such as hematological and other malignancies, serious infectious and autoimmune diseases. Fewer such patients will be excluded from the ICU because of poor prognosis. Death from coronary artery disease has decreased, affluence and ageing will be accompanied by an increase in morbidity from cardiac failure, diabetes, cerebral vascular accidents, degenerative joint disease and obesity (Australian Health and Ageing Factbook 2006), adding to the current complexity in which acute illness may arise. The life expectancy of women and men in Australia will be 86-87 years and 82-84 years, respectively by 2026 (Australian Bureau of Statistics website). Public hospital patient case mix will change. Over the last 6 years, acute public hospital admissions have increased by 11%, largely due to a rise in acute medical care, whilst admissions for surgical procedures have decreased and overall occupancy increased (Australian Health and Ageing Factbook 2006). Finally, the existing demand for organ procurement and transplantation will continue to escalate whilst the direction of public debate on stem cell research steers the future of tissue transplantation (National Health and Medical Research Council website).

Public health and prevention will be key future strategies. New vaccines will reduce or even eradicate certain diseases. Prevention of events such as ICU admission and exposure to futile ICU treatment, by identifying at-risk patients will become an increasingly important aspect of intensive care practice. Output from epidemiological, genomic and protenomic research, combined with current clinical initiatives such as outreach, rapid response and patient choice teams will lead to improved identification of at-risk patients.

Business developments

Public expectation is largely influenced through the filter of public media, and not medical peer reviewed information. Media reports that overstate medical breakthroughs and over-emphasize contradictions in medical understanding widen the public-clinician information gap, promoting on the one hand confusion, and on the other distrust, frustration and protective practices that deviate from what is suggested by the available medical evidence. There continues to be insufficient coordinated and objective debate surrounding these issues. The future will see a greater engagement by ICU staff directly with their "consumers" and a closer alignment with palliative care services to better deal with these issues.

ICUs are already at high capacity of 85% and staffing levels below desirable levels (Higlett et al. 2005). The current "war-on-terrorism" changes in the natural environment, globalization of trade and population place Australia at threat of chemical, biological, radiological and pandemic viral disease. Such episodes could cause enormous, if not unsustainable, pressure on maintenance of existing intensive care services, as staff balance the fundamental values of equitable allocation of resources, patient autonomy and safety.

Finally, the distribution of the Australian population is changing. Urban population density is increasing, and rural areas, though less densely populated, are geographically diverse (Australian Bureau of Statistics website). This will challenge the equitable delivery of intensive care services across the entire population and the need for patient transport services, especially medical retrieval. In the urban environment, there will be a trend towards geographical concentration of ICU services into fewer and larger ICUs and acute hospitals.

Technological developments

The ICU will remain a highly technology-dependent, data-rich environment. Exponential increases in computer processing power will allow for more compact and cheaper processing power and the expanded use of portable ultrasound as a diagnostic and monitoring tool (Lee 2000), portable radiology (Maher et al. 2004) and development of neural networks related to minimizing adverse events, measuring ICU quality, illness detection, treatment choice and monitoring (Bates 2000; Garg et al. 2005; Huang et al. 2006). Mechanical organ support, particularly mechanical ventilation (McMullen et al. 2006), would be more adaptable to individual patient physiological variation through enhanced processing of physiological measures, improved algorithms and more responsive mechanical output. As intensive care services become increasingly centralized, technology that supports telemedicine and remote monitoring will be more common (NSW Telehealth website; Rosenfeld et al. 2000). Adaptation of newer technology will be concentrated amongst the larger, centralized ICUs. Adaptation of new technology will be tempered by financial constraints and balanced with measurable patient benefits, other than just physiological improvements.

Summary

The intensivist of the future will require exceptional clinical, managerial and business skills. Decisions relating to patient selection and new technology in a financially austere environment will be more frequent and demanding than before. Clinical, teaching and research time will erode. Professional satisfaction will constantly be threatened. The intensive care community will take a stronger control and command of their environment and garner greater influence within acute hospitals as the severity of illness of the general acute hospital patient population increases. There will be greater ICU accountability and engagement with the public and with complimentary and competing health services. Such collaborations will lead to further clinical, organizational and professional achievements and a better preparation of our future leaders. ■

continued from p. 17

Moreover, hypothermia compromizes cardiovascular performance, O_2-transport (left-shift of Hb-dissociation-cure) and hepatic elimination of drugs. These unfavorable effects underline the necessity to keep the patient warm and to warm up all blood products and resuscitation fluids as effectively as possible (Sessler 1997).

Electrolyte and acid-base balance

Electrolyte disorders resulting from massive transfusion consist of hyperkalemia resulting from hemolysis and increased extracellular potassium in pRBC-units, as well as transient hypocalcemia related to the high citrate-content in pRBCs and FFP. Depending on severity, these disorders may require pharmacological intervention. Acidic pH of stored pRBCs and microcirculatory disorders frequently result in acidemia, which may be corrected by adjusting ventilation buffering (Na-bicarbonate or TRISS-buffer).

Outcome after massive transfusion

Although survival rates after massive transfusion have increased in recent decades, mortality of massive blood loss still ranges between 40% and 70% (Vaslef et al. 2002). Nevertheless, the reduction of mortality is predominantly attributable to improved logistics of blood supply and development of modern critical care systems, both enabling a goal-directed management of massive blood loss (Mikhail 2004). For patient survival, the most crucial treatment priority is the prevention of hemorrhagic shock through provision of adequate tissue oxygenation at all times. Additionally, restoration of homeostasis (normothermia, reversal of base excess and acidosis) and aggressive correction of coagulopathy contribute to improved survival (Cinat et al. 1999). Therefore, the best practices discussed in this article may help improve a patient's chance for survival following massive blood loss. ■

Palliative and intensive care

Ken Hillman
Head Division of Critical Care
South Western Sydney Clinical School, Sydney, Australia
ken.hillman@sswahs.nsw.gov.au

One of the important challenges for intensive care in Australia and, for that matter, in many other countries, is how we deal with the increasing number of patients being managed in intensive care for the last hours or days of life. Initially, intensive care units (ICUs) were developed in order to temporarily sustain life while a disease takes its natural course, as in Guillain Barré Syndrome, or while active intervention takes effect, such as antibiotic treatment or care after surgery. There was usually a large, potentially preventable acute component to the disease being managed in the ICU. However, hospitalized patients gradually became older, with co-morbidities and a high level of underlying chronic conditions. These patients often have a relatively minor acute component to their disease; most of the disease is chronic and irreversible. We are working with a relatively minor part of the patient's entire disease load, treating, for example, a minor infection in a chronic obstructive airways disease (COAD) patient or pulmonary edema in patients with chronic heart failure (CHF). At best, the patient is discharged from hospital, often severely incapacitated, with a prognosis similar to many forms of malignancy.

What are the reasons for placing these patients on a conveyor belt, taking them through the health system, resulting eventually in their admission to the ICU? Firstly, society is less comfortable with dying at home. Primary care physicians are less involved with total patient care, especially the often time-consuming process of providing care to patients dying at home and, at the same time, supporting relatives. It is easier to call an ambulance when a person becomes seriously ill, whether the illness is the result of an acute, reversible condition or part of a normal dying process. Ambulance personnel are not trained nor empowered to make decisions about whether the patient should be allowed to die at home or be admitted to hospital. Even physicians managing patients outside the hospital setting are discouraged from making end-of-life decisions (Rocker 2006). On arrival at the hospital's Emergency Department (ED), the patient is usually rapidly assessed, resuscitated and sent to an appropriate part of the hospital. It is not common for ED staff to make decisions about withdrawing or withholding life support. If the patient deteriorates on the general wards of a hospital, assistance is often sought from the ICU, even if the patient is obviously and inevitably dying. This is understandable, as patient response to resuscitation is difficult to predict, and there may be a relatively large, acute, reversible component of the disease with which to work.

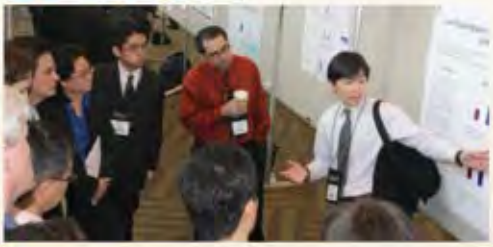
With increasing specialization, our colleagues often do not understand what the ICU can and, more importantly, what it cannot offer. They simply know that seriously ill patients require the attention of experts in acute medicine and that some patients who they thought would have died are, in fact, discharged from the ICU. It is not that our colleagues do not understand that the patient is seriously ill, but they are not familiar with the advances in and limitations of intensive care medicine.

There are other forces driving patients onto an inevitable conveyer belt to the ICU. Society has higher expectations of ICU services. Newspapers report daily on the latest medical miracles, and television shows rarely highlight failure and death in acute hospitals. Litigation has also been an important factor; death is often seen as a medical mistake, an opportunity for suing individuals and organizations. There is a common impression that people should no longer die in an acute hospital, surrounded by so much impressive technology.

With all of these forces operating, intensivists often do not feel empowered to refuse admission to the ICU. There is always uncertainty in medicine. Patients and their relatives want to be assured that everything is done for the patient; not that everything appropriate is done. This situation can often become perverse when relatives are asked what they would like done – it would take a brave and seemingly heartless relative to say at this emotional time they want less than everything. The 'everything' could, of course, involve admission to the ICU, mechanical ventilation, dialysis, inotropes and heart-lung transplantation, and death may, nonetheless, be inevitable.

How do we challenge this situation? Intensivists are probably best placed to confront this issue. Politicians and health administrators are unlikely to legislate on limitations to therapy – death in spite of the potential to sustain life for a short time can be an emotional area. Our colleagues do not understand what we can and cannot offer, and society has unreal expectations. Intensivists should be leading the debate around this issue. We should be honest with society about our limitations, as well as our successes.

Intensivists should learn more about how to introduce relatives and (when possible) the patients themselves to the inevitability of death, emphasizing continuing care and treatment appropriate for the condition – not just active interventions for treatment's sake. Relatives often find it difficult to



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deal with the burden of deciding whether to withdraw or withhold treatment and usually revert to the fallback position of continuing active management. The diagnosis that a patient is dying is made within the same limits of certainty and uncertainty as any other diagnosis. Withdrawing and withholding treatment can be open to discussion with relatives and friends, but the diagnosis of dying should not be a matter of choice, as with any other clinical diagnosis.

Intensive care clinicians are increasingly involved with the seriously ill outside of ICUs with systems such as the medical emergency team (MET) (Hourihan et al. 1995; Lee et al. 1995). These systems are often developed and run by staff in the ICU and are designed to recognize and resuscitate patients in the early stage of their disease, before serious complications and death occur. Many patients seen by these early intervention teams are seriously ill but do not have an obvious, reversible component to their disease and inevitably will die in the short term. Some patients with a 'do not resuscitate' (DNR) order are seen as part of a MET-type system before they suffer cardiac arrest, and the team must decide what active measures should be taken.

This type of system enables the intensivist, who is best acquainted with the potential benefits and limitations of ICU care, to be involved early in the dying process and offer an opinion on whether further treatment is appropriate. In other words, the intensivist is increasingly playing a palliative care role with the seriously ill, hospitalized patient. This can be a rewarding part of the expanding role of intensive care physicians and one where our specialty can lead research initiatives and public discussions and debates. ■

The Australian and New Zealand Intensive Care Society Clinical Trials Group

John A Myburgh PhD, FANZCA, FJFICM
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Immediate Past Chairman

Rinaldo Bellomo MD, FRACP, FJFICM
Inaugural Chairman

ANZICS Clinical Trials Group
Carlton, Australia

Introduction

The specialty of intensive care medicine in Australia and New Zealand (ANZ) is regarded as one of the most advanced in the world. This reputation has developed over the last 25 years, based on established high-quality training and certification programs currently administered through the Joint Faculty of Intensive Care Medicine (JFICM) of the Australian and New Zealand College of Anaesthetists and Royal Australasian College of Physicians. In addition, the Australian and New Zealand Intensive Care Society (ANZICS) has functioned as a cohesive bi-national society to further advance professional development and research. Whilst the focus of these bodies has been directed at ensuring best outcomes for patients managed in ANZ intensive care units (ICUs) through education, training, certification and quality assurance, research activities were, until recently, limited to unit-based, usually commercially-sponsored, initiatives and a small number of clinicians who completed higher degrees through ANZ universities. In order to increase research opportunities for the broader intensive care community and to capitalize on the collegiate and homogenous nature of intensive care practice in ANZ, a research initiative – the ANZICS Clinical Trials Group (ANZICS-CTG) – was established in 1994. The principal aims of the ANZICS-CTG were to:

1. Conduct high-quality, collaborative clinical trials directed at improving patient-centered outcomes.
2. Provide a forum for members to present research ideas and obtain feedback and advice from experienced researchers and colleagues.
3. Encourage smaller ICUs to join in research initiatives.

Early development and progress

In many ways, the environment to establish a collaborative research group in ANZ in 1994 was ideal. There was an abundance of energy and enthusiasm, a relatively unencumbered governance structure to conduct clinical research in public hospitals and a rich supply of patients from a wide range of ICUs. Furthermore, clinicians who voluntarily participated in the early ANZICS-CTG activities did so primarily for intellectual and altruistic reasons. At the time, almost all intensive care physicians were full-time, salaried and tenured clinicians, and therefore, the imperative to conduct research was not influenced by the need to "publish or perish" that exists in some countries. Nevertheless, there were many challenges in the early years, including a paucity of experienced researchers, and limited personnel, funding and equipment available for clinical research.

The focus of the ANZICS-CTG was to conduct investigator-initiated studies, independent of commercial influence, primarily to address clinically relevant questions. The first project conducted by the ANZICS-CTG was a point-prevalence study of the use of antimicrobials in ICUs in ANZ (Bellomo et al. 1998). This was followed by a randomized placebo-controlled trial of the use of "low dose" dopamine for the prevention of acute renal failure (Bellomo et al. 2000). Apart from the high-quality scientific results, the major benefit from these studies was the experience obtained by the fledgling ANZICS-CTG. The group was able to develop rigorous, effective protocols by dialogue and consensus, garner participation from more than 20 ICUs (some with no prior experience in multi-centered trials) and complete the studies in an acceptable timeframe with excellent protocol adherence, data quality and completion rates. The dopamine study, published in the Lancet in 2000, has become a landmark intensive care medicine manuscript, providing the ideal platform for the emerging ANZICS-CTG to conduct future large-scale trials.

Governance and consolidation

During the course of the dopamine study, a more formal administrative structure, policies and procedures were developed to assist the ANZICS-CTG in furthering its goals and to ensure good communication and collegiality within the group. The ANZICS-CTG Executive was constituted as a subcommittee of the ANZICS Board. The Executive is comprised of representatives from all Australian states and New Zealand, in addition to representatives from the ANZICS Adult Patient Database, Paediatric Study Group and the intensive care research co-ordinators group. The ANZICS-CTG also employs a full-time executive officer to coordinate its activities. The Executive meetings four times per year, two of which are held in conjunction with the three-day, annual ANZICS-CTG Meeting in Noosa, Queensland, and the ANZICS Annual Scientific Meeting. The ANZICS-CTG Noosa Meeting commenced in 1998 and has become a key part of the Australasian intensive care calendar. The format is very informal and designed to encourage discussion and free flow of ideas.

The establishment of the ANZICS-CTG Executive allowed the promulgation of a number of key policy documents, which have been integral in main-

taining the cohesion of the group. These policies, available online, include a mission, vision and values statement to which all ANZICS-CTG initiatives accord, publication and authorship policies for ANZICS-CTG studies, a policy on conflict of interest, site selection criteria for participation in ANZICS-CTG studies, conditions for researchers to conduct higher degrees through ANZICS-CTG initiatives and criteria for ANZICS-CTG endorsement of publications and grant submissions (www.anzics.com.au).

In 1996, ANZICS and the Intensive Care Foundation launched a bi-national strategy to reduce mortality in ANZ intensive care patients. Part of this strategy was to develop research initiatives in four key areas: acute lung injury/acute respiratory distress syndrome (ALI/ARDS), traumatic brain injury (TBI), sepsis and critical illness prevention. In response, the ANZICS-CTG developed a two-stage process to address this initiative. Based on our experience with the antibiotic point-prevalence study (Bellomo 1998), we conducted large-scale prospective epidemiological studies examining current practices and outcomes in sepsis (Finfer et al. 2004), TBI (Myburgh et al. 2006) and ALI/ARDS (Bersten et al. 2002). These studies have provided vital information that defines our patient populations and outcomes, and the data have facilitated the planning of future interventional trials in these areas – the second stage of the ANZICS-CTG strategy.

Collaboration and expansion

Since 1998, the ANZICS-CTG conducted a number of major interventional trials in the areas mentioned above. Foremost of these was the Saline vs. Albumin Fluid Evaluation (SAFE) study that was completed in 2004 (SAFE 2004). This study was conducted following a systematic review that suggested that administration of human albumin resulted in increased mortality in critically ill patients (Cochrane Injuries Group Albumin Reviewers 1998). Apart from providing a definitive result addressing the question posed by the systematic review, the SAFE study had a major impact on the research culture and experience within the ANZICS-CTG. Most importantly, the SAFE study was a collaboration between the ANZICS-CTG (including 16 ICUs in ANZ), the George Institute for International Health and the Australian Red Cross Blood Transfusion Service. This collaboration was integral in the success of the study, which enrolled 6,997 patients and was concluded ahead of schedule and within budget. Using web-based data acquisition hosted by the George Institute, the study was published one year following completion of enrolment and was described "not only as a landmark trial, but a milestone in the discipline of Critical Care Medicine" (Cook 2004). Another major collaborative study conducted by the ANZICS-CTG was the MERIT study – a cluster-randomized controlled trial analyzing the effect of the introduction of a medical emergency team on aggregate outcomes (MERIT 2005). This is the largest study of system change in intensive care published to date. The success and experience of SAFE and MERIT also facilitated the development and consolidation of other major interventional trials that are underway by the ANZICS-CTG. They did so by consolidating a track record for funding, protocol development, research coordinator experience and international collaboration.

Current initiatives underway by the ANZICS-CTG include a 6,000-patient study of 2 target ranges for blood glucose, conducted in collaboration with the Canadian Critical Care Trials Group (the NICE-SUGAR study); a 1,500-patient study comparing standard vs. augmented level renal replacement therapy (the RENAL study); a comparison of decompressive craniectomy standard therapy for intracranial hypertension in TBI (the DECRA study); and a study addressing compliance with evidenced-based feeding guidelines. A number of other initiatives in nutrition, adjunctive therapies for sepsis and outcome evaluations are underway or in advanced stages of development.

As a result of many of the successes outlined above, the ANZICS-CTG was awarded a federal grant in 2006 to establish a research methods center (the ANZIC Research Centre), based at the Monash University Department of Epidemiology and Preventive Medicine. This center will be an integral component of research outputs of the ANZICS-CTG for the next five years.

Conclusion

The ANZICS-CTG has had a major impact in critical care research in ANZ, with study results now published in major international journals. Much of the ANZICS-CTG's success is attributed to the collegiate and enthusiastic research culture that has been fostered within the ANZ intensive care community, the establishment of sound governance processes within CTG administration and consolidation of vital collaborations with other centers of research excellence. ■

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Jennifer M Hunter, MB ChB PhD FRCA
Chairman
Scientific Programme Committee, ESA
University Department of Anaesthesia
Clinical Sciences
Liverpool, UK
jennie@liv.ac.uk

Euroanaesthesia 2007 takes ESA members to the beautifully elegant Bavarian city of Munich for the first time this year. From June 9-12, 2007, this glorious city will host the ESA annual meeting. The German Society of Anaesthesiology and Intensive Care Medicine (DGAI), chaired by their President, Professor Hugo Van Aken, is our host. Professor Van Aken leads the National Organising Committee for the meeting, which includes Eberhard Kochs, Klaus van Ackern and Andreas Hoeft.

Scientific Program

Yet again, intensive care medicine is an important part of the scientific program. Our program reflects the international nature of ESA, with speakers from the United Kingdom, Germany, Turkey, France, the Netherlands, Denmark, Belgium, and more. Professor Gernot Marx is responsible to the Scientific Programme Committee (SPC) for this part of the meeting. Professor Marx will give a refresher course lecture on the kidney in sepsis, and Figen Esen will cover titration of fluid loading and vasopressor in septic shock. Claude Martin will give an update on selective digestive decontamination, and Benoit Vallet will detail the latest challenges of postoperative pneumonia. Ethical issues related to the critically ill will be addressed in refresher courses on "Medical Professionalism in Anaesthesia and Critical Care" (Beloucif); "Communication and Consent in Anaesthesiology and Critical Care" (Marie Shelly); and "Ethical Implications of Major Catastrophies" (Pollard).

One of the most interesting aspects of the intensive care program in Munich will be "Traumatic brain injury," a joint symposium with the Neurosciences Subcommittee of the SPC, which is chaired by Basil Matta. Contributors from throughout Europe will argue whether severe head injury should be dealt with at Level 1 Trauma centers or in community hospitals (Oakley, UK); consider the management of intracranial hypertension (Pannen, Germany); discuss neuromonitoring and neuroprotection (Kirkpatrick, UK); and consider the use of sedative drugs after brain trauma (Cremer, Netherlands). Other symposia will cover recent advances in hemodynamic monitoring, the rationale for crystalloids or colloids and mechanical ventilation.

Yet again in 2007, management of critical events using "live simulation" will doubtless be a popular aspect of the Euroanaesthesia meeting – remember to book your tickets for these very popular workshops early to avoid disappointment. Another thought-provoking workshop, organized by the Evidence based Practice and Quality Assurance Subcommittee, chaired by Andrew Fairley-Smith, will address "Evidence into practice in critical care: The Cochrane Anaesthesia Review Group." Topics will include Pulmonary Artery Flotation Catheters, (Sheila Harvey) and AT3 in Sepsis (Afshari). A symposium on "Goals and Monitoring End Points in Anaesthesia and Intensive Care" will be chaired by Buhre and will include contributions from Singer, Gotz and De Bacher.

The Pharmacology Subcommittee of the SPC, chaired by Meistelman, has arranged a workshop on TCI for ICU Sedation led by the European expert, Tom Schnider. This too will be popular – get your ticket early. This subcommittee has also organized a refresher course on "Drug Interactions in Anaesthesia and Intensive Care Medicine" given by Benoit Plaud. Dan Benhamou will chair a symposium on "The Pregnant Patient in the ICU" – an exceptional challenge we all meet on occasion.

Draeger Prize

For the first time in 2007, the ESA will award a Draeger Prize. The winner will be announced in Munich. This prize is to be awarded for the best article published in a peer-reviewed journal in 2006 by a European intensive care or anesthetic department on an intensive care topic. The award will be for €10,000, made annually for three years. The ESA is most grateful to Draeger for sponsoring this new award.

Abstracts

Abstract sessions at Euroanaesthesia 2007 will take on a new format. From now on, the abstract's first author will no longer make a short, verbal presentation using audiovisual aids. Instead, first authors will need to stand by their posters during their allocated session and answer questions from the chairmen of the sessions and the audience. Authors will be encouraged to provide a handout summarizing their abstract on a single A4 sheet. By changing the format of the abstract sessions, the SPC hope to attract a larger audience to each session.

There is plenty of scientific material to attract intensivists (if they need to be tempted) to attend the 2007 Euroanaesthesia meeting in Munich. I look forward to seeing you again there, at the spacious, bright and convenient International Congress Center, built on the old airport site. Have a good 2007!

Jennifer Hunter
SPC Chair, ESA

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Avenue Joseph Wybran, 40
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Fax +32 2 527 00 62
public@esicm.org
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Agenda

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 (ISICEM)
Brussels, Belgium
www.intensive.org

APRIL 2007

26-27 The Royal Oldham Hospital 4th Annual Critical Care Symposium
Manchester, UK
veerappan.chithambaram@pat.nhs.uk

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.euroanaesthesia2007.com

24-28 5th World Congress on Pediatric Critical Care
Geneva, Switzerland
www.pcc2007.com

SEPTEMBER 2007

5-8 3rd International Congress on Sepsis Multiorgan Dysfunction
Weimar, Germany

13-15 4th International Emergency and Rescue Congress
Hamburg, Germany
http://www.internationaler-kongress.de/

OCTOBER 2007

4-6 Emergency Medicine in the Developing World
Cape Town, South Africa
mcollin@curie.uct.ac.za

7-10 20th Annual Congress of the European Society of Intensive Care Medicine (ESICM)
Berlin, Germany
www.esicm.org

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ICU MANAGEMENT
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