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A monthly update of developments in critical care and intensive care medicine

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Reducing Length of Stay Increases Cardiac Patient Readmissions

ABSTRACT & COMMENTARY

This study was conducted to determine whether utilization reviews that lead to reduced hospital length of stay (LOS) relative to days requested by an attending physician affect the likelihood of readmission among privately insured patients. Data were obtained from a private insurance company on utilization management (UM) decisions from 1989 through 1993. During this five year period, 39,117 inpatient reviews were conducted—4326 (11.1%) of them on patients with cardiovascular disease. All reviews on patients with cardiovascular disease were used in the analysis.

There were 2813 (58%) requests for medical admission and 1513 (42%) requests for surgical/procedural admissions. The five most common surgical reasons for hospital admission were cardiac catheterization (n = 456), coronary bypass surgery (n = 257), valve replacement (n = 88), carotid endarterectomy (n = 69), and head/neck vessel replacement (n = 47). The five most common medical reasons for admission were angina pectoris (n = 614), congestive heart failure (n = 416), cerebrovascular accident (n = 414), arrhythmia/conduction disturbance (n = 370), and acute myocardial infarction (n = 313). Data were obtained on the number of days of inpatient treatment requested and approved at time of admission, and the number of days requested and approved for continued stay. LOS reduction was defined as the difference between total days requested and total days approved by UM.

Requests for admission were rarely denied (medical = 1 denial; surgical = 4 denials; total = 4326 requests). LOS was reduced relative to that requested by the treating physician for 17% of medical and 19% of surgical admissions. Cumulative 60-day readmission rates were 9.5% for medical admissions and 12.3% for surgical admissions. There was no relationship between LOS reduction and the likelihood of readmission for medical admissions or for surgical patients whose LOS was reduced by one day (95% CI: 0.72 - 2.80; P = 0.30). However, surgical patients whose LOS was reduced by at least two days were 2.6 times more likely to be readmitted within 60 days com-

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pared to patients with no reduction in LOS (95% CI: 1.3-5.1; P < 0.005). Excluding patients admitted for cardiac catheterization did not change these results.

The vast majority (> 87%) of patients readmitted within 60 days of their index admission were readmitted with a cardiovascular medical diagnosis. The most common reasons were angina pectoris, acute myocardial infarction, congestive heart failure, arrhythmias, and stroke. Thirty-day readmission rates were also substantially greater for patients who had their care constrained by two days or more. However, the number of patients admitted after 30 days was small, and the differences did not reach statistical significance. (Lessler DS, et al. *Health Serv Res* 2000; 34(6):1315-1329.)

■ COMMENT BY LESLIE A. HOFFMAN, PhD, RN

The major findings of this study were that UM rarely denied requests for inpatient treatment of cardiovascular illness and that LOS reduction adversely affected clinical outcomes for some patients. UM decisions resulted in denial of hospital admission in a

very small minority of cases (5/4326). Consequently, it appears that this aspect of UM review saved no money and contributed substantial costs, considering the time required to process requests and prepare data for review.

In addition to reducing unnecessary hospital admissions, a second UM objective is elimination of unnecessary hospital days. To judge the effect of UM decisions, Lessler and colleagues examined the relationship between LOS reduction and 60-day readmission. The effect of LOS reduction on readmission was "dose dependent." A reduction in LOS of one day did not affect readmission rates, whereas a reduction of two days or more caused a significant increase in the rate of hospital readmission. Lessler et al chose to compare 60-day readmission rates, rather than the more commonly used interval of 30 days. Consequently, it could be argued that the problems that led to readmission were "new" and not the result of a shorter LOS. When 30-day rates were compared, the same trend was seen. However, numbers of patients readmitted at the 30-day interval was small, and the difference did not reach statistical significance.

There are several limitations to this study. Only one UM program was examined. However, the reviews were conducted by a well established UM firm, the same LOS profiles were used for all reviews, and criteria and profiles were updated annually. Lessler et al did not have access to information about the patient's clinical condition, or access to protocols used by the UM reviewers in conducting preadmission and continuing stay reviews. Therefore, it was not possible to deduce factors that might have increased risk for readmission.

The study analyzed a broadly representative sample obtained from a large commercial insurance carrier that represented private companies, union trusts, and public organizations in 47 states. However, study data were more than five years old and it is possible that findings would differ if a more recent sample were analyzed. Nonetheless, findings raise concerns. There was no evidence of any benefit from preadmission reviews and evidence of a potential adverse effect of UM on patient outcomes for patients who received LOS reductions. Additional studies are needed to confirm whether findings of this study are broadly applicable. In these studies, it would be helpful to include a comprehensive cost-benefit analysis that includes costs of implementing UM reviews, as well as costs related to hospitalization. ♦

Critical Care Alert, ISSN 1067-9502, is published monthly by American Health Consultants, 3525 Piedmont Rd., NE, Bldg. 6, Suite 400, Atlanta, GA 30305.

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GST Registration Number:

R128870672.

Periodical postage rate paid at Atlanta, GA.

POSTMASTER:

Send address changes to *Critical Care*

Alert, P.O. Box 740059, Atlanta, GA 30374.

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One-Day Course for Residents Reduces ICU Vascular Catheter Infections

ABSTRACT & COMMENTARY

Synopsis: After a one-day "hands on" course on infection control practices was integrated into the yearly training provided for house staff, the rate of catheter-related infection in ICUs decreased from 4.51 infections per 1000 patient days to 2.92 infections.

Source: Sherertz RJ, et al. *Ann Intern Med* 2000; 132:641-648.

This study was conducted in response to the observation that, despite conventional bedside and didactic instruction, physicians-in-training were not using optimal infection control practices. Consequently, Sherertz and associates developed a one-day course that included lectures on basic infection control principles (1 hour) and blood and body fluid precautions (1 hour) and a series of one-hour stations at which participants received 5-15 minutes of didactic instruction followed by hands-on instruction and practice.

Training received during the hands-on portion of the course included: 1) blood draws through vascular lines (taught by oncology nurses); 2) arterial punctures for ABGs (taught by RRTs); 3) insertion of arterial catheters and central venous catheters (CVCs) (taught by critical care faculty and fellows); 4) urinary catheter insertion (taught by nurse instructors); 5) lumbar puncture (taught by an oncologist); 6) peripheral venous catheter insertion (taught by nurse instructors); and 7) phlebotomy (taught by physician faculty). All participants practiced phlebotomy on each other and participants started peripheral IV lines first on mannequins and then on another participant. The course was taught several times so that groups were relatively small (~ 50 per group).

Pre- and post-course outcomes were assessed in several ways. The hospital's purchasing department recorded requests for CVCs and full-size sterile drapes. Sherertz et al determined the number of catheter-related infections and primary bloodstream infections in six general medical-surgical ICUs and the associated step-down ICU. Employee health recorded the number of injuries that involved blood and body fluid exposure.

The perceived need for full-size sterile drapes during CVC insertion (an intervention proven to reduce

the risk for CVC-related infection) was 22% in the year before the course and 73% six months after the course ($P < 0.001$). The perceived need for small sterile towels at the insertion site decreased reciprocally ($P < 0.001$). Documented use of full-size sterile drapes increased from 44% to 65% ($P < 0.001$). The rate of catheter-related infection decreased from 4.51 infections per 1000 patients days before the first course, to 2.92 infections per 1000 patient days 18 months after the first course (mean decrease, 3.23 infection per 1000 patient days; $P < 0.01$). There was no change in the number of blood and body fluid exposures (15% pre; 19.3% post).

Over the study period, it was estimated that 39 primary bloodstream infections were prevented. Course costs were estimated to be \$74,081 for supplies and faculty time. Cost savings were determined in two ways. Based on CDC data for the cost of a primary bloodstream infection (\$3517), cost savings were \$63,082 after expenditures. Based on a higher-end estimate (\$28,690 per ICU survivor) and an estimated 80% survival, attributable cost savings were \$815,309 after expenditures.

■ COMMENT BY LESLIE A. HOFFMAN, PhD, RN

Vascular catheter infections are a substantial cause of morbidity and mortality in hospitalized patients, with an attributable cost as high as \$29,000 per episode. As many as 90% of these infections are believed to originate from CVCs. In teaching institutions, physicians-in-training insert essentially all CVCs and arterial catheters. In addition, they perform numerous other invasive procedures that place patients at risk for infection.

Prompted by the observation that optimal infection control practices were not being used, Sherertz et al developed a course that combined didactic and hands on instruction. The benefits were impressive. There were changes in participant practice and patient outcomes, reflected in a significant decrease in the rate of catheter-related infections per 1000 patient days. Cost savings for the 18-month observation period ranged from \$63,000 to \$800,000 depending on the method used to estimate the cost of each infection.

There were several unique aspects of the course that may have facilitated change in practice. Skills were taught by experienced practitioners using a small group, hands-on format. These practitioners included nursing instructors, attending physicians, fellows, and respiratory therapists, dependent on the skill station. Course participants had little prior experience performing these skills and were likely receptive to learning. The course

was included as part of house staff orientation, a time when participants expected to learn new skills.

A total of 92 physicians took the course the second year. Prior to taking the course, the median number of procedures performed in medical school was five arterial punctures, one blood draw through a line, one CVC insertion, five peripheral line insertions. Thus, participants had limited prior experience performing these skills. In this institution, as in many teaching institutions, training in infection control practices was not standardized prior to course implementation. Findings suggest that failure to provide standardized instruction may predispose patients to increased risk of infection. If findings of this study can be replicated in other institutions, this instructional program should be adopted as a model for teaching infection control practices. ❖

Special Feature

Hyperbaric Oxygen Therapy

By Jun Takezawa, MD

Hyperbaric oxygen therapy (hbot) has long been accepted as a primary treatment for decompression sickness with and without air embolism, and the indications for its use have been expanding to various other diseases and pathological states. However, its effectiveness has not been thoroughly validated in terms of a risk-adjusted outcome.

There are 259 hyperbaric oxygen facilities with 344 monoplace chambers in the United States, and 4000-5000 patients are annually treated with HBOT. In Japan, there are 857 hyperbaric oxygen chambers with 799 mono-place chambers, and approximately 200,000 patients receive HBOT. It is surprising when realizing the differences between these countries.

The first systematic critical appraisal of published papers describing the effectiveness of HBOT was attempted by Genevieve Gabb, a medical student at Stanford University and Eugene D. Robin, in 1987.¹ In this paper, they reviewed 61 papers and found that HBOT was claimed to be indicated in 132 diseases and pathologic states. However, when they re-evaluated the scientific basis for its indication, no randomized, controlled clinical trials (RCTs) were found to validate it, and most papers were case consecutive study and those without controls. They concluded that history of HBOT

was characterized by unscientific and uncritical pragmatism, and HBOT was looking for diseases that might benefit from it. Furthermore, the risks of adverse effects of HBOT were rarely questioned.

Since the original criticism of HBOT by Gabb and Robin, significant effort has been placed to conduct RCTs for re-evaluating the effectiveness of HBOT. In the following summary, the effectiveness of HBOT as indicated in various diseases is re-evaluated based on the published results of RCTs.

Decompression Sickness

Approximately 500 recreational divers suffer from decompression sickness per year in the United States. HBOT reduces bubble size and corrects hypoxemia with improving hemostasis, endothelial damage, and neutrophil activation. HBOT at 2.5-3.0 atmospheres absolute (ATA) for 2-4 hours is indicated within six hours after the onset of symptoms. However, no RCT with normobaric oxygen as a control has been carried out. Nevertheless, HBOT is indicated to decompression sickness without supportive evidence made by RCT because of strong physiological basis and extensive experiences.

Multiple Sclerosis

Three double-blind RCTs were reported. Wood et al randomized 41 patients with multiple sclerosis into two groups;² 21 patients who received HBO and 20 patients receiving placebo gas mixture. A full 100% O₂ was given at two ATA for 20 sessions of 90 minutes for one month. No benefits in terms of functional and claimed improvement were confirmed in the HBO group. Confavreux et al carried out another RCT on multiple sclerosis.³ Seventeen patients received HBOT 100% O₂ at 1.5 ATA for 90 minutes, five days a week, for one month. The patients were followed-up for one year. There was no better improvement in patients of the HBOT group in terms of Kurtzke disability status score. Barnes et al reported the results of an RCT, which enrolled 120 patients.⁴ The patients with HBOT received 100% O₂ at two ATA for 90 minutes daily for 20 sessions. HBOT did not alter disease progression as measured by the Kurtzke disability status score. Reversible retinal damage was significantly higher in the HBOT group. (See Table 1.)

Gas Gangrene and Clostridial Infection

An alpha-toxin produced by clostridium causes myonecrosis and shock, resulting in extreme pain and tissue gas. Treatment includes surgical decompression/excision and penicillin administration.

Table 1 The RCTs for Multiple Sclerosis			
Investigator	Year	Intervention	Outcome
Barnes	'87	2 ATA O ₂ 1 ATA NA	NS
Haper	'86	1.75 ATA O ₂ 1.75 ATA 12.5% O ₂	NS
Wiles	'86	2 ATA O ₂ 1.1 ATA NA	+
Confavreux	'86	1.5 ATA O ₂ 1.1 ATA NA	NS
Wood	'85	2 ATA O ₂ 2 ATA 10% O ₂	NS

Although HBOT has been used as an adjunctive therapy, there has been no RCT where 100% O₂ at one ATA was used as a control.

Diabetic Foot Ulcer

Four RCTs on diabetic foot ulcer were reported. Leslie et al conducted RCT on diabetic foot ulcer using topical HBOT.⁵ They enrolled 28 patients; 12 for topical HBOT group and 16 for the control group. Ulcer size did not significantly change between the groups on days 7 and 14. The topical HBOT was not effective in treating diabetic foot ulcer. Faglia et al enrolled 70 diabetic patients with foot ulcer;⁶ 35 patients received systemic HBOT and 33 did not. The risk reduction for amputation

in the treatment group was 0.26 (95% CI 0.08-0.84), markedly decreased the risk of amputation. Other trials with small patients' numbers revealed no beneficial effect of HBOT. However, a further RCT with a larger observational number of patients is definitely required. (See Table 2.)

Closed Head Trauma

Rockswold et al randomized 168 patients with closed head trauma (GCS < 9) into two groups;⁷ 84 patients who received 100% O₂ at 1.5 ATA every eight hours for one hour, for two weeks, and 82 control patients. Although the mortality rate tended to be smaller in the treated group (17% in HBOT vs 32% in control), the number of favorable outcomes in the treatment group did not increase significantly.

Crush Injury

Bouchour et al randomized 36 patients with crush injuries into two groups within 24 hours after surgery.⁸ Eighteen patients received HBOT (100% O₂ at 2.5 ATA for 90 minutes, twice daily over 6 days), and 18 patients for placebo group. No significant differences in LOS, number of wound dressings complete healing, and additional surgery were observed between the groups. Subgroup analysis suggested that HBOT might provide patients younger than 40 years old receive severe (grade III) crush injury with less additional surgery and less improvement in wound healing.

Burn

Brannen et al conducted RCT on patients with burn who were referred to a burn center.⁹ The 125 burn patients admitted within 24 hours of injury. HBOT was

Table 2 The RCTs for Diabetic Foot Ulcer				
Investigator	Year	Points	Intervention	Outcome
Leslie	'88	12	1 ATA O ₂	NS
		16	1 ATA NA	
Faglia	'96	35	2.5 ATA O ₂	Fewer Amputations
		33	1 ATA NA	
Hummarlund	'94	8	2.5 ATA O ₂	NS
		8	2.5 ATA NA	
Zamboni	'97	5	2.0 ATA O ₂	NS
		5	1 ATA NA	

Table 3 RCTs for Carbon Monoxide Poisoning				
Author	Year	Pts	Control	Outcome
Raphael	'89	343	100% O ₂ 1 ATA	NS
Thorn	'95	65	100% O ₂ 1 ATA	NS
Duchess	'95	26	100% O ₂ 1 ATA	?
Weaver	'95	50	100% O ₂ 1 ATA	NS
Mathieu	'96	575	100% O ₂ 1 ATA	NS (1 yr.)

provided at two ATA for 90 minutes, twice daily, greater than 10 treatments. No significant differences were observed in mortality, number of operations, and LOS for the survivors.

AMI (HBOT MI Study)

Stavitsky et al randomized a total of 112 patients with AMI to receive r-TPA or STK with HBOT, and r-TPA or STK alone.¹⁰ Although there was a trend in improving EF and time to relief chest pain in the HBOT group, other outcomes showed no difference between the groups. HBOT is not indicated in a patient with AMI.

Stroke

Nighoghossian enrolled 27 patients with MCA occlusion within 24 hours, and randomized them into two groups;¹¹ 100% O₂ 1.5 ATA (14) vs. NA 1.5 ATA (13). Although Orgogozo scale at one year was better in HBO, no difference in Rankin score at six months and one year was observed between the groups.

Acute Carbon Monoxide (CO) Poisoning

Several RCTs were conducted from 1989 to 1996. However, all failed to prove any beneficial effect of HBOT in patients with CO poisoning. (See Table 3.)

Recently, Scheinkestel et al randomized 191 patients with various severity of CO poisoning into two groups;¹² patients who received HBOT with 100% O₂

at 2.8 ATA for 60 minutes for three days and the patients who received normobaric O₂. More patients in the HBOT group received additional treatments, and HBOT patients had worse outcomes in the learning tests. There were no benefits in patients who received HBOT.

Summary

In summary, as shown in Table 4, there are a few indications of HBOT; decompression sickness and diabetic food ulcer. However, at present, so many patients with different diseases are treated with HBOT. The RCTs on these disease entities are urgently required to prove its effectiveness. ❖

References

1. Gabb G, Robin ED. Hyperbaric oxygen-A therapy in search of diseases. *Chest* 1987;92:1974-1982.
2. Wood J, et al. A double-blind trial of hyperbaric oxygen in the treatment of multiple sclerosis. *Med J Aust* 1985;6:238-240.
3. Confavreux C, et al. Ineffectiveness of hyperbaric oxygen therapy in multiple sclerosis. A randomized placebo-controlled double blind study. *Presse Med* 1986; 15:1319-1322.
4. Barnes M P, et al. Hyperbaric oxygen and multiple sclerosis: Final results of a placebo-controlled, double blind trial. *J Neurol Neurosurg Psychiatry* 1987;50: 1402-1406.
5. Leslie CA, et al. Randomized controlled trial of topical hyperbaric oxygen for treatment of diabetic foot ulcers. *Diabetes Care* 1988;11:111-115.
6. Faglia E, et al. Adjunctive systemic hyperbaric oxygen therapy in treatment of severe prevalently ischemic diabetic foot ulcer. A randomized study. *Diabetes Care* 1996;19:1338-1343.
7. Rockswold GL, et al. Results of a prospective randomized trial for treatment of severely brain-injured patients with hyperbaric oxygen. *J Neurosurg* 1992;76:929-934.
8. Bouachour G, et al. Hyperbaric oxygen therapy in the

Table 4 Current Indications of HBOT						
	Decompression Sickness	Embolism	Gangrene	Multiple Sclerosis	Diabetic Food Ulcer	Head Injury
RCT	-	-	+	+	+	+
Indication	+	?	-	-	+	-
	Crush Injury	Burn	Acute MI	Stroke	CO Poisoning	
RCT	+	+	+	+	+	
Indication	-	-	-	-	-	

management of crush injuries: A randomized double-blind placebo-controlled clinical trial. *J Trauma* 1996;41:333-339.

9. Brannen AL, et al. A randomized prospective trial of hyperbaric oxygen in a referral burn center population. *Am Surg* 1997;63:205-208.
10. Stavitsky Y, et al. Hyperbaric oxygen and thrombolysis in myocardial infarction: The 'HOT MI' randomized multicenter study. *Cardiology* 1998;90:131-136.
11. Nighoghossian N, et al. Hyperbaric oxygen in the treatment of acute ischemic stroke. *Stroke* 1995;26:1369-1372.
12. Scheinkestel CD, et al. Hyperbaric or normobaric oxygen for acute carbon monoxide poisoning: A randomized controlled clinical trial. *Med J Aust* 1999;170:203-210.

CME Questions

- 49. Utilization reviews that led to reduced hospital length of stay relative to days requested by a physician:**
- a. had no effect on 60-day readmission rates.
 - b. increased 60-day readmission rates for surgical patients.
 - c. had no effect on patient outcomes.
 - d. increased 60-day readmission rates for medical patients.
 - e. Both b and d above
- 50. Which of the following statements is true about utilization review that requires preadmission authorization and attempts to reduce length of hospital stay?**
- a. Preadmission authorization was frequently denied.
 - b. Length of stay for some patients was successfully reduced by two days or more.
 - c. Reducing length of stay decreased 30-day and 60-day readmission rates.
 - d. All of the above
 - e. None of the above
- 51. After a one-day course on infection control practices, there was a significant decrease in what?**
- a. Use of full-size sterile drapes
 - b. Rate of catheter-related bloodstream infections
 - c. Blood and body fluid exposures
 - d. Urinary tract infections
 - e. Ventilator-associated pneumonia
- 52. Which of the following is an indication for HBOT?**
- a. CO poisoning
 - b. Acute myocardial infarction
 - c. Decompression sickness
 - d. Stroke
 - e. Multiple sclerosis

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53. Randomized clinical trials of the efficacy of hyperbaric oxygen therapy have been carried out in which of the following conditions?

- a. Burns
- b. Crush injuries
- c. Acute MI
- d. Carbon monoxide poisoning
- e. All of the above

54. Hands-on skills taught to residents during a one-day course that reduced subsequent ICU line infections included:

- a. arterial line insertion.
- b. urinary catheter insertion.
- c. lumbar puncture.
- d. phlebotomy.
- e. All of the above

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After reading each issue of *Critical Care Alert*, readers will be able to do the following:

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- Cite solutions to the problems associated with those issues.

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4. Issue Frequency Monthly		5. Number of Issues Published Annually 12		6. Annual Subscription Price \$199.00	
7. Complete Mailing Address of Known Office of Publication (Not Printer) (Street, city, county, state, and ZIP+4) 3525 Piedmont Road, Bldg. 6, Ste. 400, Atlanta, Fulton County, GA 30305				Contact Person Willie Redmond Telephone 404/262-5448	
8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not Printer) 3525 Piedmont Road, Bldg. 6, Ste. 400, Atlanta, GA 30305					
9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do Not Leave Blank) Publisher (Name and Complete Mailing Address) Donald R. Johnston, 3525 Piedmont Road, Bldg. 6, Ste. 400, Atlanta, GA 30305 Editor (Name and Complete Mailing Address) Melissa Lafferty, same as above Managing Editor (Name and Complete Mailing Address) Glen Harris, same as above					
10. Owner (Do not leave blank. If the publication is owned by a corporation, give the name and address of the corporation immediately followed by the names and addresses of all stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, give the names and addresses of the individual owners. If owned by a partnership or other unincorporated firm, give its name and address as well as those of each individual. If the publication is published by a nonprofit organization, give its name and address.)					
Full Name		Complete Mailing Address			
American Health Consultants		3525 Piedmont Road, Bldg. 6, Ste 400 Atlanta, GA 30305			
11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check box. <input type="checkbox"/> None					
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Medical Economics Data, Inc.		Five Paragon Drive Montvale, NJ 07645			
12. Tax Status (For completion by nonprofit organizations authorized to mail at nonprofit rates.) (Check one) The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes: <input type="checkbox"/> Has Not Changed During Preceding 12 Months <input type="checkbox"/> Has Changed During Preceding 12 Months (Publisher must submit explanation of change with this statement)					
PS Form 3526, September 1998 See Instructions on Reverse					

13. Publication Name Critical Care Alert		14. Issue Date for Circulation Data Below November 2000	
15. Extent and Nature of Circulation		Average No. of Copies Each Issue During Preceding 12 Months	Actual No. Copies of Single Issue Published Nearest to Filing Date
a. Total No. Copies (Net Press Run)		1181	1249
b. Paid and/or Requested Circulation			
(1) Paid/Requested Outside-County Mail Subscriptions (Stated on Form 3541, (include advertiser's proof and exchange copies)		967	1049
(2) Paid In-County Subscriptions (include advertiser's proof and exchange copies)		0	0
(3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Non-USPS Paid Distribution		0	0
(4) Other Classes Mailed Through the USPS		0	0
c. Total Paid and/or Requested Circulation (Sum of 15b(1) and 15b(2))		967	1049
d. Free Distribution by Mail (Samples, Compliments, and Other Free)			
(1) Outside-County as Stated on Form 3541		0	0
(2) In-County as Stated on Form 3541		0	0
(3) Other Classes Mailed Through the USPS		0	0
e. Free Distribution Outside the Mail (Carriers or Other Means)		9	9
f. Total Free Distribution (Sum of 15d and 15e)		9	9
g. Total Distribution (Sum of 15c and 15f)		976	1058
h. Copies Not Distributed		205	191
i. Total (Sum of 15g, and h)		1181	1249
Percent Paid and/or Requested Circulation (15c divided by 15g times 100)		99	99
16. Publication of Statement of Ownership Publication required. Will be printed in the November issue of this publication. <input type="checkbox"/> Publication not required.			
17. Signature and Title of Editor, Publisher, Business Manager, or Owner Donald R. Johnston Publisher			Date 10/11/00
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In Future Issues:

Effect of Norepinephrine on the Outcome of Septic Shock

FCC Rule Causes Telemetry Quandry for Hospitals

To Switch Frequency Bands, or Not to Switch?

By Don Long

In the medical telemetry sector, it's been dubbed "the Baylor incident." On Feb. 27, 1998, much of the patient telemetry in a wing of the Baylor University Medical Center went down, totally blanked out by interference from a local TV station and catching hospital staff completely by surprise.

"What we saw was just solid Channel 9—just solid," says Richard Roa, now Vice President of Engineering for Welch Allyn/Protocol, Beaverton, Ore., but on the scene at Baylor in 1998.

Speaking at a recent meeting of the Georgia Biomedical Instrumentation Society, Roa acknowledged the most important question raised by the incident: "Why didn't we know it was going to happen?"

His answer: "We found out nobody knew it."

The incident had no tragic consequences, but it did put the industry on notice concerning the potentially fatal results of medical telemetry that could be shut down by something as simple as local TV. The result has been the Federal Communication Commission's (FCC) recent assignment of new medical channels, which Roa described as "protected bands"—and what he and others at the sessions described as a mixed blessing.

Specifically, the FCC established Wireless Medical Telemetry Service (WMTS), offering three blocks or bandwidths of radio frequency telemetry space. Additionally, telemetry can move to the industrial, scientific, and medical (ISM) spread spectrum at 2.4 GHz frequencies.

The WMTS band gives primary use to medical users; the ISM band does not. The WMTS band comes, however, with "significant restraints," according to Roa. And based on FCC timelines, hospitals must now make crucial decisions about moving to these frequencies. Vendors, in turn, will be altering their product mixes and marketing strategies to a market demanding both increased sophistication in technology and better guarantees against medical mishaps.

Hospitals and other telemetry users have the option of remaining on the existing, but increasingly threatened, VHF spectrum. But these users will be only those few in isolated areas not threatened by interference. And staying on this spectrum is not an alternative for the vast majority of hospitals in suburban and metropolitan areas, requiring many channels of telemetry. Their systems will be rendered obsolete, forcing new upgrades and installations.

Furthermore, the new WMTS bandwidth "is not a panacea," according to background information presented at the meeting by Welch Allyn/Protocol, since it comes with its own set of limitations. For instance, though medical applications will be the primary users on the system, this offers no guarantee against all interference. Additionally, the new bandwidths are narrow (only 6 MHz wide initially) and likely to be more crowded with medical vendors offering incompatible transmission schemes.

Also, according to the background information, the new FCC ruling "specifies limitations on this band that do not allow nonbiomedical applications such as voice and video"—applications that will be increasingly valuable to hospitals working in reduced-staff, managed care environments.

And the FCC rules do not block “proprietary, non-compatible, and potentially interfering systems within the band. Frequency use will need to be coordinated by third-party network administrators to avoid interference between biomedical devices,” according to the back-grounder.

The result is a major dilemma for both health care providers and telemetry manufacturers: On the one hand, “separate systems for each vendor within a hospital will increase cost, system complexity, and potential RF conflicts.” On the other hand, “standardizing on a single proprietary system limits the choice of manufacturers for specific clinical applications and impose high conversion costs as communication technologies improve.”

The fallout has already begun, with vendors scrambling to offer their solutions as the best, according to Arthur Gasch, who discussed new vendor positioning at an evening gathering of the Georgia group. Gasch is president of Medical Strategic Planning of Lincroft, NJ. Gasch has been encouraging hospitals to take a long-term view of the changes. And he sees growing market share for some smaller sector players that are doing the same.

Specifically, he says hospitals will increasingly turn to companies such as Protocol, Criticare of Waukesha, Wis., and others. Symbol Technology of Holtzville, NY, will offer wireless products operating in the ISM band, at 2.4 Ghz.

Why? Because they are implementing the bi-directional transmission permitted—but not implemented by—any of the major monitoring companies in the WMTS bands. And, Gasch added, the ISM option offers greater scalability and options WMTS can’t offer: voice transmission, easy integration of IEEE 802.11 Wireless Ethernet with the hospital’s IT IEEE 802.3 cabled Ethernet structure. Because of the low power of the ISM devices, the hospital can control the ISM band and restrict it to standards-based devices only, thus avoiding potential interference.

By contrast, Gasch said, larger decided just to retune their existing UHF transmitters, rather than come up with new designs that take full advantage of the WTMS band. This leaves hospitals continuing with major vendors, with very limited choices for products and features they will need in the future.”

Gasch said the competition between “the big three and these smaller players forces hospitals to make some hard choices. Hospitals will have to ask, ‘Do I want to wait two to three years and hope those [big] companies come out and offer a fuller-featured, competitive solution that offers me the benefits I need, or go with a

smaller company that offers it today?’ “

“If you believe your telemetry is your solution through 2010 and only want to upgrade from UHF—or VHF—to WMTS, and you don’t need bidirectional [transmission], no additional parameters, no voice communication, then the big three companies are an OK solution, Gasch said. But, “if you believe you need the flexibility of patient-worn monitors, bidirectional communications, a nurse talking to the patient, and to other nurses—and not carry four different devices around, but integrate it in one device—ISM-band solutions look like a real winner.” ❖

Handheld Computers Making Life Easier in the ICU

Mini-Computers are Becoming a Doctor’s Best Friend

By Julie Crawshaw

Frank s. becker, md, assistant professor of medicine and a pulmonary and critical care physician at Northwestern University in Chicago, used to laugh at people who carried palmtop computers. “Then a friend lent me his PalmPilot and within 10 days I became completely addicted,” he says.

Becker now owns his own Palm, and he says it assists him with his “normal life” as well as with his practice of medicine. “When I’m in the intensive care unit, I don’t have access to my calendar or my patient list. Now I use my PalmPilot as my away-from-the office-database.”

Becker observes that critical care medicine before the miniature computer revolution involved carrying around books with tables, equations, and lists of side effects, many of which are now accessible from his handheld device.

“In the ICU, we used multiple drugs, all of which have potential interactions,” Becker says. Formerly, physicians had to look up the side effects and interactions in hard copy reference material. “Now,” he adds, “when we’re on rounds and a question arises about using a drug in a patient with a certain condition, everybody immediately whips out their PalmPilot and looks up the answer.”

The PalmPilot uses ePocrates qRX software, which provides physicians with information on more than 1600 drugs. Updated versions of the data can be periodically downloaded in the small device.

Another program Becker has downloaded is Medmath, a free downloadable application for medical equations. "When I used to carry a calculator to figure parameters like cardiac outputs, I'd look up the equation and try to do the hand calculations. There was always potential for hitting the wrong key and entering data that gave you the wrong answer."

With the Medmath system, Becker enters the data and the software automatically does the calculations. In addition to a lower potential for error, Becker thinks critical care physicians are doing more calculating these days. "Because it's easier to do an AA gradient, people will do it," Becker says. They'll do a cardiac output calculation as a quality control measure to see if the reading they're getting on their Swan-Ganz catheter is accurate."

Medmath currently has the following formulas:

- A-a O₂ Gradient
- Absolute Neutrophil Count
- Anion Gap (Serum)
- Anion Gap (Urine)
- Basal Energy Expenditure
- Body Mass Index
- Body Surface Area (Dubois)
- Cockcroft-Gault Equation
- Corrected QT (QTc)
- Corrected Serum Calcium
- Corrected Serum Phenytoin
- Corrected Serum Sodium
- Creatinine Clearance
- Fractional Excretion of Sodium
- Henderson-Hasselbalch Equation
- Hepatitis Discriminant Function
- Ideal Body Weight
- Mean Arterial Pressure
- Osmolality (Serum)
- Osmotic Gap (Stool)
- Reticulocyte Index
- Transtubular Potassium Gradient
- Water Deficit
- Winters' Formula

Becker estimates between 80-90% of physicians in his division use a Palm V. "Some of the Medmath programs can be downloaded from the Internet to your main computer and hot sync to the Palm, which will upload them," Becker says. "I got some of my programs from the infrared beaming, in which you point your Palm at somebody else's Palm that's got a program you like, hit a button, and the Palm with the program beams to the other Palm."

Becker syncs both at home and at work so all his computers are always up to date. "Let's say I enter some data on my home computer and the next day I do some-

thing at my work computer that involves the Palm software," he says. "When I put the palm device into the cradle and hit the button it will update everything, so that the most recent entry takes precedence over the prior ones. My address book, my schedule at home, and what's in my palmtop will be the same as what's in my office computer."

Many Palmtop Applications are Free

Writing in the *Internet Journal of Anesthesiology*,¹ J. Garman, MD, MS, notes that many of the downloadable software applications for the PalmPilot are free and almost all of them feature a free trial period.

He observes that though there are several drug programs available, physicians might as well get the free ePocrates first. The program takes up 0.9 MB and the developers of the website promise to keep the database current. "One good thing about this drug database is the ability to add your own notes to the drug entries. I am using it now and highly recommend it," Garman says.

Another drug and drug interaction database Garman lists is Apothecarium (www.skyscape.com/k2). This contains both LexiDrugs (1.7 MB) and Interact (1.0 MB) and sells for \$110. This program, if fully installed, will take up 2.7 MB of memory. It is a complete drug and drug-interaction database that is easy to use. You can also buy the LexiDrugs database alone at the same site for \$70. Garman considers AvantGo, a program that allows you to automatically download updated information from various web sites, to be one of the most exciting developments for handhelds. Avant's list of downloadable sites is growing quickly, and synchronizing a Palm with a desktop computer, AvantGo automatically makes the newest information current while deleting the old.

Other free downloadable medical applications many palmtop users have found extremely useful include Tarascon, a drug resource found at Medscape, and Medcalc, which has some equations Medmath does not.

Additional handheld applications web sites commonly recommended are:

- **Synapsesoft, Inc.**, features ProcLog and Rounder procedure and patient tracking software, both of which are integrated on the same database structure to eliminate duplicate data entry for the Palm platform;
- **Pen Computer Solutions** designs, programs, and integrates custom medical software applications for the PalmPilot, Palm III, IIIx, V, VII, and Symbol SPT 1500;
- **e-MedTools medical software** works for PalmPilot and Win95/98 and has several titles related to evi-

dence-based medicine, microbiology, medical records, and common calculations;

- **PocketMD software**, which enables a simplified and sophisticated patient database management system for students and physicians that includes 700+ drug database as a component of the program;
- **ePhysician** enables health care professionals to order lab tests and prescriptions and can provide mobile access to patient information;
- Medical Communication Systems produces **Mobile MedData**, which is a patient information manager application for the PalmPilot;
- **Handheldmed.com** is a virtual community that is designed to help physicians, medical students, and other health care professionals that covers medical uses for both Windows CE and PalmOS devices and includes forums, software archives, and reviews; and
- **MobileMed Forum** is a forum for Newton, PalmPC, PalmPilot, Windows CE, PSION, and other applications of medical mobile computer technologies.

Critical Care Physicians in Forefront

David Main, a partner in the health care group of the Washington, DC-based law practice of Shaw Pittman, says that physicians are generally slow to take advantage of new technology that changes their methods of practice. He finds an exception to this in critical care. As an example, Main points to the fact that many critical care physicians have used the Apache system and have had handheld devices for many years.

Violet Shaffer, Apache Systems chief operating officer, defines her company as a scientific and medical decision support company. "We provide information that helps physicians and nurses both predict patients' risk and better manage high-risk patients." Shaffer says that physicians with a palmtop device can enter patient data and access a display about that patient's risk.

"It gives information about the patient's risk for ICU length of stay and hospital mortality, upon admission and then daily, which helps to manage the ICU more effectively." Shaffer says the information Apache provides is frequently used to inform patients and their families about progress and risk that lends comfort and helps them make necessary decisions.

Apache's products range in cost from a few thousand dollars to six digit figures. All are routinely updated. "We continuously revalidate our science," says Shaffer. "Predictive equations need to keep up with medical practice."

Quick Date Means Good Decisions

More memory has bumped the information access

benefits of palmtops, which completely outstrips their data-entry features. Richard H. Savel, MD, critical care fellow at the University of California and a hospitalist at St. Luke's Hospital in San Francisco, Calif., has a long-standing interest in medical informatics and wanted to see what palm computers potential was to help physicians at bedside.

Savel says that he started using a palmtop to get rid of the little cards he had to carry around on all of his patients. "It worked but was difficult to use," Savel says. "It just wasn't as fast as scribbling something on a piece of paper."

Like Becker, Savel uses ePocrates. "It's very exciting to use a computer for something it can do well, which is storing data. I see patients from all over the country and they come in taking drugs prescribed for them elsewhere. I need to make sure those drugs don't interfere with each other." Savel observes that because the screen set on the PalmPilot is so small, a lot of thought has to be put into how the data is retrieved by the physician.

"I had some experience with this when I was a resident involved in medical informatics at Cornell Medical Center. The thing I like about the PalmPilot is that information retrieval is instantaneous."

Savel sees free palmtop applications as posing a potential problem for physicians. "If it's free, who's subsidizing it?" he asks. "If it's being paid for by a drug company, then it's important that be explicitly revealed. The physician has to know that any information retrieved is unbiased." ♦

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We look forward to hearing from you. ♦