Hospital at Home: The Right Place for the Right Patient

Hospitals have existed for centuries, linked to religious beliefs in ancient times, then shifting focus to care for the poor and sick, before evolving into the modern beacons of health care with dense concentrations of specialty care, expertise, and technologic advances. For the very ill, optimal or best care became synonymous with care in a hospital, and the model of health care shifted from home visits by the lone practitioner to treatment in the hospital by many. However, this bastion of medical care has come under intense scrutiny, as hospitalization may also increase the risk of adverse events and worsen outcome. It is estimated that nearly 100,000 deaths occur annually due to medication errors.[1] Nosocomial infections affect 5–10% of all hospitalized patients and significantly increase duration of stay, costs, and mortality, resulting in up to 90,000 deaths annually.[2] In addition to the medical burden, the costs of health care are skyrocketing, predicted to increase from a 2000 level of 13.2% to 23% of the United States gross domestic product by 2011.[3]

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These issues have spurred examination of alternative models of health-care delivery, specifically the delivery of health-care services in the home setting. The American Thoracic Society has recognized specific areas of home health care for patients with respiratory disorders, and outlined broad categories of care in home-care equipment, episodic home heath care, hospice home health care, and long-term home care.[4] While primarily directed at subacute management, there has been increasing interest in expanding episodic home health care to provide hospital-level care at home, often referred to as "hospital-at-home" care. In addition to management of acute conditions, this umbrella also includes patients who are discharged early from the hospital with continuation of hospital-level care at home—an arena previously reserved for subacute skilled nursing and long-term care facilities such as nursing homes.

The hospital-at-home approach has gained increasing interest for a variety of conditions.[5] There are a host of potential benefits for all parties involved, including lowering the demand for hospital beds, decreasing operating costs, reducing the risk of hospital-acquired complications, preserving some semblance of patient independence, and permitting recovery in the familiar home setting. It is obvious that this can enhance quality of life and patient satisfaction. Of course, there are also limitations to what can be delivered in the home setting, specifically with respect to technology-dependent diagnostics or treatment, and home care carries the risk of delaying optimal treatment.

The vast majority of investigations and experience in the hospital-at-home approach have occurred in Europe, where there is intense pressure for the use of a limited supply of hospital beds. Investigators have even been able to conduct prospective randomized trials in Europe and Australia,[6–8] whereas the experience in the United States has been primarily limited to efficacy trials.[9] Reasonable expectations for hospital-at-home care include outcomes comparable to those of hospital care, preferably reduced costs without cost-shifting to other providers, and patient and caregiver satisfaction with this care.[5]

Hospital-at-home care of patients with exacerbations of underlying chronic obstructive pulmonary disease (COPD) has undergone the most investigation among respiratory conditions, both because of the frequency of COPD exacerbations and because of a relatively straightforward approach to treatment.[6,10–13] These trials generally involve the patient seeking treatment at a central facility as an entry condition, meeting admission criteria, and being assigned either to home or hospital treatment. Treatment typically includes bronchodilators, corticosteroids, antibiotics, and oxygen. Nurses make home visits daily, sometime twice daily, to monitor patient progress and to facilitate hospital admission if necessary. While touted as hospital-at-home studies, some are actually better characterized as an early-discharge (within 48 h of admission) approach,[12] and some early-discharge studies were also included in the meta-analysis of hospital-at-home care for COPD patients.[8] Additional health-care support (eg, physical therapy, occupational therapy) was also provided by some. While there were deaths and hospital admissions in the hospital-at-home groups, these accounted for $< 10\%$ of patients under investigation. Other outcomes, such as spirometry values, subsequent exacerbation rate, hospitalization, and mortality were not different between the home groups and the hospital groups. As might be expected, patients did prefer their hospital-at-home care, and costs of care were lower, although the latter was not a uniform finding.[14]

There may still exist some skepticism about hospital-at-home management, because the concept suggests a fo-

cus on and success in patients with a lower severity of illness. While there are criteria for the hospital admission of COPD patients,[15] some of these patients would probably do well with intensive hospital-at-home therapy, but identifying that subgroup of patients remains a challenge. In review of these investigations, treatment unique to a hospital was not provided at home. Administration of hospital unique care and services would represent further evolution of the hospital-at-home model.

In this issue of RESPIRATORY CARE, Banfi and colleagues, from Italy and France, further expand on hospital-at-home care.[16] They report the successful home management of 7 patients with restrictive lung disease (mean total lung capacity 50% of predicted) from severe kyphoscoliosis, who were receiving long-term ventilatory support and who developed respiratory tract infections and hypoxemic and hypercapnic respiratory failure (mean arterial pH 7.29, mean P_{aCO_2} 67 mm Hg, mean P_{aO_2} 49 mm Hg). All of the patients except one (who had a tracheostomy) were being managed with noninvasive ventilation when stricken with a febrile respiratory illness. The infrastructure was in place to permit a home visit by a physician and nurse, on-site arterial blood gas analysis, and sputum collection for culture. During the study period, Banfi et al had 8 patients who were eligible for the study, but one of those patients chose to be treated in the hospital, and this report focuses on the 7 patients who stayed at home.

Treatment consisted of increasing the daily duration of ventilatory support, from an average of about 12 h/d to over 20 h/d, with oxygen flow increased in 2 patients and oxygen added in 2 others, along with antibiotics (clarithromycin and ceftazidime) and bronchodilators. Patients had repeat arterial blood gas tests: initially after an hour of assisted ventilation, and then at regular intervals. Nurses visited the patients 3 times a day and as requested, and a physician visited twice a week. Three patients had *Pseudomonas aeruginosa* cultured from sputum, and 2 others had *Streptococcus pneumoniae*.

Whereas past experience with hospital-at-home care may have included patients with a borderline severity of illness, this group had advanced restrictive lung disease and a decompensation, characterized by worsening gas exchange and impending respiratory failure. In some centers these patients may have met criteria for admission to a monitored unit (a step-down unit if not an intensive care unit). It is also conceivable that some of these patients had pneumonia, but chest radiographs were not obtained. With thrice-daily nursing visits, twice-a-week physician visits, blood gas testing, and intramuscular antibiotics, their treatment exceeded that delivered by typical home health-care services in the United States. These patients also already had the equipment for and experience with noninvasive ventilation, which was instrumental in the treatment of their acute illness. The patients' experience with ventilatory support was advantageous because it facilitated the use and increased the likelihood of success of mostly noninvasive ventilation in these patients. When all elements of care are reviewed, it is clear that their care was very close to what would have been delivered in a hospital setting and further extends the spectrum of the hospital-at-home concept.

All 7 patients recovered without requiring hospitalization, and no unscheduled visits were required. Recovery to their baseline gas exchange required about 4 weeks, which is probably comparable to the duration of hospitalization for these patients if rehabilitation time is included. The estimated costs of their hospital-at-home approach represented less than 20% of a comparable hospital stay. This experience fulfills the basic requirements for an acceptable hospital-at-home program (comparable outcomes, lower costs), and provides further support for this approach.

These results are certainly encouraging, but must be viewed with some caution. After all, this is a case series of a very selected group of patients with a substantial support system. The patients were well versed in the use of noninvasive ventilation, so an increase in the hours of daily use was easily accomplished. Noninvasive ventilation would not have been applied to acutely ill patients naïve to this support in a home setting. Also, the on-site, point-of-care laboratory studies facilitated decision making, and the health-care service had the internal structure to permit thrice-daily nursing visits and regular physician visits. This obviously requires trained personnel, a fairly compact encachement area, and specialized equipment. In addition, unmentioned economic pressure and space pressure also provide incentives for this approach. And this experience comes from Europe, where universal health-care systems, high population density, and geographic proximity may lend themselves more readily to this model.

Banfi et al[16] made no mention about the patients' or caregivers' perceptions about the treatment. Other investigators have found higher satisfaction with home treatment. After all, there is a familiarity with one's surroundings and comfort that can be readily provided by family and friends. There is more opportunity for rest, less of a feeling of confinement, and fewer interruptions by the army of hospital staff, which is typical of any hospitalization. On the other hand, the burden of care can be overwhelming for family and friends, especially if the illness extends beyond a few weeks.

In summary, the experience of Banfi et al further expands on the type of patients and severity of conditions that can be successful managed at home. Patients with severe kyphoscoliosis can be included along with the COPD patient as candidates for home management of acute respiratory infection, especially if they are already being regularly treated with noninvasive ventilation. With the proper support, patient care can mirror that provided in a hospital setting, with point-of-care testing and arterial blood

analysis; possibly titration of ventilator settings; and frequent nursing visits, upwards of thrice daily during an acute episode. As experience increases, the number, severity, and complexity of conditions treatable in a home setting can only increase. Of course, additional investigations are needed to better define the patients and conditions best suited for this model. The economic savings will further fuel this approach. There may come a time when hospital-at-home care is no longer an isolated approach and becomes a widespread and perhaps the first option, and one will not need to leave home for the hospital.

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REFERENCES

1. Kohn L CJ, Donaldson ME. To err is human: building a safer health system. Washington DC: National Academy Press; 1999.
2. Burke JP. Infection control: a problem for patient safety. N Engl J Med 2003;348(7):651–656.
3. Altman SH, Tompkins CP, Eilat E, Glavin MP. Escalating health care spending: is it desirable or inevitable? Health Aff (Millwood) 2003 Jan-Jun; Suppl Web Exclusives:W3-1–14.
4. American Thoracic Society. Statement on home care for patients with respiratory disorders. Am J Respir Crit Care Med 2005;171(12): 1443–1464.
5. Corrado OJ. Hospital-at-home. Age Ageing 2001;30 Suppl 3:11–14.
6. Shepperd S, Harwood D, Jenkinson C, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with inpatient hospital care. I: three month follow up of health outcomes. BMJ 1998;316(7147):1786–1791.
7. Wilson A, Parker H, Wynn A, Jagger C, Spiers N, Jones J, Parker G. Randomised controlled trial of effectiveness of Leicester hospital at home scheme compared with hospital care. BMJ 1999;319(7224): 1542–1546.
8. Ram FS, Wedzicha JA, Wright J, Greenstone M. Hospital at home for patients with acute exacerbations of chronic obstructive pulmonary disease: systematic review of evidence. BMJ 2004;329(7461): 315. *Erratum in: BMJ 2004;329(7469):773.*
9. Leff B, Burton L, Mader SL, Naughton B, Burl J, Inouye SK, et al. Hospital at home: feasibility and outcomes of a program to provide hospital-level care at home for acutely ill older patients. Ann Intern Med 2005;143(11):798–808.
10. Gravil JH, Al-Rawas OA, Cotton MM, Flanigan U, Irwin A, Stevenson RD. Home treatment of exacerbations of chronic obstructive pulmonary disease by an acute respiratory assessment service. Lancet 1998;351(9119):1853–1855.
11. Davies L, Wilkinson M, Bonner S, Calverley PM, Angus RM. "Hospital at home" versus hospital care in patients with exacerbations of chronic obstructive pulmonary disease: prospective randomised controlled trial. BMJ 2000;321(7271):1265–1268.
12. Ojoo JC, Moon T, McGlone S, Martin K, Gardiner ED, Greenstone MA, Morice AH. Patients' and carers' preferences in two models of care for acute exacerbations of COPD: results of a randomised controlled trial. Thorax 2002;57(2):167–169.
13. Hernandez C, Casas A, Escarrabill J, Alonso J, Puig-Junoy J, Farrero E, et al; CHRONIC project. Home hospitalisation of exacerbated chronic obstructive pulmonary disease patients. Eur Respir J 2003; 21(1):58–67.
14. Shepperd S, Harwood D, Gray A, Vessey M, Morgan P. Randomised controlled trial comparing hospital at home care with inpatient hospital care. II: cost minimisation analysis. BMJ 1998;316(7147):1791–1796.
15. Celli BR, MacNee W; ATS/ERS Task Force. Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. Eur Respir J 2004;23(6):932–946. *Erratum in: Eur Respir J 2006;27(1):242.*
16. Banfi P, Redolfi S, Robert D. Home treatment of infection-related acute respiratory failure in kyphoscoliotic patients on long-term mechanical ventilation. Respir Care 2007;52(6):713–719.

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