

# Long-Term Acute Care Hospitals

L. Silvia Munoz-Price<sup>a</sup>

Medical Specialists, Munster, Indiana

Long-term acute care hospitals (LTACHs) are health care facilities that admit complex patients with acute care needs (eg, mechanical ventilator weaning, administration of intravenous antibiotics, and complex wound care) for a mean duration of stay of 25 days. LTACHs are different than nursing homes and were initially created in the 1990s in an effort to decrease Medicare costs by facilitating prompt discharge from intensive care units of patients with difficulty weaning mechanical ventilation; however, current admission diagnoses are quite broad. Patients admitted to these facilities have multiple comorbidities and are at risk for colonization with multidrug-resistant organisms. LTACH patients have been shown to have high rates of hospital-acquired infections, including central vascular catheter-associated bloodstream infection and ventilator-associated pneumonia. In addition, LTACHs have been implicated in various regional outbreaks of multidrug-resistant organisms. This review summarizes the limited amount of scientific literature on LTACHs while highlighting their infection control problems, as well as the role LTACHs play on regional outbreaks.

## BACKGROUND

Most US patients treated by physicians are seen either during outpatient visits or short-term hospitalization; however, there is a large group of patients who, because of their high medical needs, cannot return to their homes or nursing homes after acute care hospitalization. Institutions that accommodate these patients are known as postacute care providers [1]. Postacute care providers include long-term acute care hospitals, skilled nursing homes, inpatient rehabilitation facilities, and home health care services [2]. This review deals with long-term acute care hospitals, their infection control problems, and their impact on regional outbreaks.

**Definitions and history.** During the 1980s, long-term acute care hospitals (LTACHs), which are also called long-term care hospitals by Medicare [1], were created to facilitate prompt discharge of medically complex patients from acute hospitalizations, in an effort to decrease Medicare spending. LTACHs are not nursing homes; nevertheless, the terms are used interchangeably by physicians. Nursing homes, also known as long-

term care facilities (LTCFs), take care of more stable patients for longer periods of time than do LTACHs, sometimes serving as patients' lifetime residences. Confusion between LTACHs and LTCFs originates on the basis of similarities and misuse of their nonstandardized names and acronyms, as well as the post-acute care nature of both. Nevertheless, LTACHs need to comply with all the accreditations of acute care hospitals; in addition, LTACH patients are required to have "medically complex" situations, with a mean length of stay of  $\geq 25$  days.

In 1982, the Tax Equity and Fiscal Responsibility Act allowed Medicare to reimburse LTACHs on the basis of expenses incurred during each hospitalization, regardless of the initial diagnosis. The Medicare Payment Advisory Commission—an independent Congressional agency established by the Balanced Budget Act of 1997 to advise the US Congress on Medicare issues—believes that Tax Equity and Fiscal Responsibility Act constituted a strong incentive for the creation of additional LTACHs [3]. The result was that, from 1990 to 2004 the number of LTACHs quadrupled, causing Medicare's spending on these institutions to increase as well [3].

In 2002, on the basis of the increase of Medicare costs for LTACHs, the payment-per-service fee was instituted in an effort to decrease Medicare fees [3]. Under the current payment-per-service system, at the time of admission to an LTACH, patients are assigned admission diagnosis codes; Medicare payments are then calculated on the basis of these codes rather than on the basis of actual expenditures during hospitalization. Despite the institution of payment-per-service fees, the number of LTACHs

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<sup>a</sup> Present affiliation: Division of Infectious Diseases, University of Miami and Jackson Memorial Hospital, Miami, Florida.

Reprints or correspondence: Dr. L. Silvia Munoz-Price, 1611 NW 12th Ave., Miami, FL 33136 (simunozprice@gmail.com).

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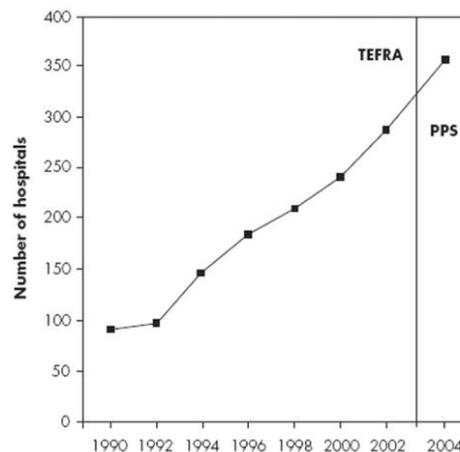
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continued to multiply, approaching 400 in 2007 (figure 1) [3]. Moreover, Medicare expenses swelled exponentially, constituting 73% of the LTACH's reimbursements. As a consequence, Medicare implemented a 3-year moratorium on all expansions and creations of new LTACHs. A new "25% rule" is also in effect, which limits the number of patients transferred to an LTACH from any single acute care hospital down to 25% in any given quarter [4].

According to a 2008 Medicare Payment Advisory Commission's Report to the Congress, 58% of LTACHs are for-profit organizations, two-thirds of which are owned by either Kindred Healthcare or Select Medical [3]. LTACHs are unevenly distributed across the United States, concentrating primarily in the midwestern and eastern side of the country (figure 2) [5]. This explains why so many American doctors may not be aware of the role of or even existence of these facilities. There are 2 types of LTACHs: hospital-within-the-hospital and free-standing LTACHs. The former comprises 47% of all facilities and consists of LTACHs that lease a portion of preexisting acute care hospitals but that function as complete separate entities, retaining their own administrations and ancillary services. Free-standing LTACHs, as the name implies, are entities geographically independent from acute care hospitals [3, 5].

Regarding patient safety at LTACHs, the Medicare Payment Advisory Commission compiled Medicare discharge data from 2004–2006 on 4 different patient safety indicators, revealing an increase in the rate of complications in all but one (table 1) [5]. LTACHs are licensed both by the state and Medicare; however, LTACHs can electively undergo additional certification by the Joint Commission, just as can any acute care hospital. Nursing staffing at LTACHs, with either registered nurses or licensed practical nurses, is regulated by state authorities. Ratios of nurses to patients also follow state regulations and vary depending on the acuity mix of patients; the ratio can be as low as 1:1 in select cases. Interestingly, full-time or part-time infection preventionists are not required for licensure purposes by all states.

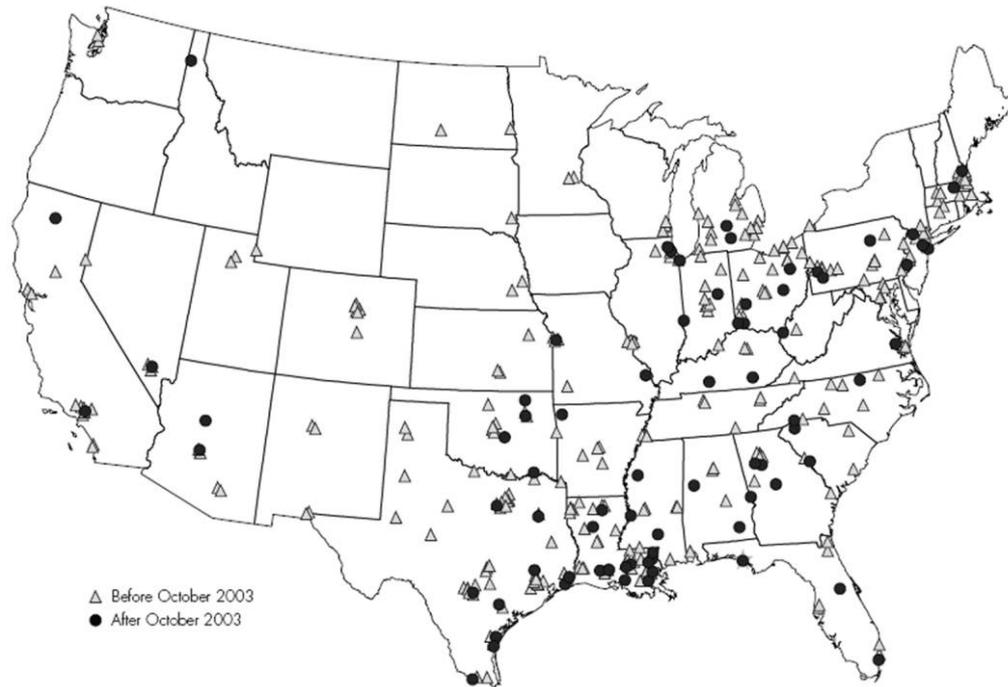
**Patient characteristics.** Originally, LTACHs were intended for patients in need of prolonged weaning of mechanical ventilator use [6, 7]; however, present admission diagnoses encompass a wide range of diseases (table 2) [5]. Patients who are admitted to LTACHs have complex situations, multiple comorbidities, and acute medical needs; comorbidities include respiratory failure that requires weaning of mechanical ventilator, recent surgeries, presence of gastrostomy tubes, diabetes, receipt of total parenteral nutrition, presence of bladder catheters or central vascular catheters, decubital ulcers, and malnutrition [8]. It is important to note that a large number of LTACH patients have had long-length stays at their acute care hospitals of origin, including stays at intensive care units (ICUs). All of these characteristics place patients who are trans-



**Figure 1.** Change in the number of long-term acute care hospitals across the United States, 1990–2004. Adapted from Medicare Payment Advisory Commission analysis of provider of service files for Centers for Medicare Services [3]. PPS, prospective payment system; TEFRA, Tax Equity and Fiscal Responsibility Act of 1982.

ferred to LTACHs at high risk of colonization with multidrug-resistant bacteria. A couple of studies have examined the colonization rates for patients at the time of admission and during LTACH stay. Gould et al [9] compiled active surveillance data at the time of LTACH admission and found that 64% of patients were colonized or infected with methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococci, or both. A recent study developed a cumulative database that included 4 years of results of surveillance admission cultures at a midwestern LTACH; the study revealed that, of 1905 patients screened, 55% were infected or colonized with multidrug-resistant organisms at any site; vancomycin-resistant enterococci and extended-spectrum  $\beta$ -lactamase-producing gram-negative organisms were found in 33% and 9% of rectal cultures, respectively. Of 1708 wound cultures, 16% yielded vancomycin-resistant enterococci, and 6% yielded imipenem-resistant *Acinetobacter* species [10].

**Antibiotic use, devices, and colonization rates.** Gould et al [9] also evaluated the antibiograms and antibiotic purchasing data from 45 LTACHs during the period 2002–2003. They found that the rate of carbapenem and vancomycin use at LTACHs was higher than the 50th percentile of ICU use reported by the National Nosocomial Infections Surveillance system; fluoroquinolone use at those LTACHs was comparable to the 90th percentile for use at ICUs. A composite antibiogram for all facilities revealed that 84% of *S. aureus* isolates were methicillin resistant and that 60% of *Pseudomonas aeruginosa* isolates were fluoroquinolone resistant. In addition, central lines were found to be present for one-half of the duration of stay for all patients, and mechanical ventilators were required during 20% of patient-days. High rates of device use were also



**Figure 2.** Geographical distribution of long-term acute care hospitals across the United States. Adapted from Medicare Payment Advisory Commission analysis of provider of service files for Centers for Medicare Services [5].

documented by a group from Emory University who found that 74% of patients at 2 LTACHs in Atlanta, Georgia, had central vascular catheters in place [11]. To date, to my knowledge, there have been no studies of compliance with hand-washing and isolation precautions at LTACHs.

With regard to colonization rates with multidrug-resistant organisms during LTACH stays, Furuno et al [12] performed a point-prevalence surveillance study at a 180-bed, university-affiliated LTACH in Maryland. Of 147 patients screened, 30% and 28% were found to carry methicillin-resistant *S. aureus* or *Acinetobacter baumannii*, respectively, at any site; however, none of the recovered *Acinetobacter* isolates were imipenem resistant. This finding contrasts with findings from 2 recent

outbreaks of *A. baumannii* infection in Ohio and Michigan, in which multidrug-resistant *A. baumannii* infections occurred both in acute care hospitals and in associated LTACHs; most isolates were respiratory in origin [13, 14]. In both studies, patients were “shared” among acute care hospitals and LTACHs, with identical isolates among facilities. A similar outbreak was experienced in 2005 in the greater Chicago, Illinois, area; the outbreak involved OXA-40 carbapenemase-producing *A. baumannii*, which spread among various university hospitals, LTACHs, and nursing homes in the region [15]. *Klebsiella pneumoniae* carbapenemase (KPC) *K. pneumoniae* infection was recently reported among 7 patients at a Florida LTACH [16]. At the time that I was writing this article, a multiple-facility out-

**Table 1. Safety Indicators at Long-term Acute Care Hospitals**

Patient safety indicator	Risk-adjusted rates per 1000 eligible discharges			Change in rate, 2005–2006, %	Observed adverse events in 2006	Total no. of patients in 2006
	2004	2005	2006			
Decubitus ulcer	98.49	137.56	152.30	10.7	16,593	103,975
Infection associated with medical care	21.41	24.98	25.57	2.4	2,442.44	91,934
Postoperative PE or DVT	35.61	38.89	34.79	–10.5	560	15,940
Postoperative sepsis	81.68	74.18	75.58	1.9	286	3,158

**NOTE.** To control for patient condition on admission to the long-term care hospital, eligible discharges include only those with a previous acute hospital stay. Because of a change in methodology, this chart cannot be compared with its counterparts in previous Medicare Payment Advisory Commission data books. Adapted from Medicare Payment Advisory Commission analysis of Medicare Provider Analysis and Review data from the Centers for Medicare Services [5]. DVT, deep vein thrombosis; PE, pulmonary embolism.

**Table 2. Most Common Admission Diagnoses to Long-term Acute Care Hospitals in 2006.**

Admission diagnosis (LTC-DRG) <sup>a</sup>	No. of discharges	Percentage
Respiratory system diagnosis with ventilator support (475)	15,698	12.1
Skin ulcers (271)	7056	5.4
Septicemia in persons aged >17 years (416)	6676	5.1
Pulmonary edema and respiratory failure (87)	6540	5.0
Respiratory infections and inflammation in persons aged >17 years with CC (79)	6061	4.7
Aftercare, without history of malignancy (466)	4835	3.7
Simple pneumonia and pleurisy in persons aged >17 years with CC (89)	4717	3.6
Aftercare, musculoskeletal system and connective tissue (249)	4613	3.5
Chronic obstructive pulmonary disease (88)	4594	3.5
Degenerative nervous system disorders (12)	4193	3.2
Skin graft and/or debridement for skin ulcer in persons with CC (263)	3921	3.0
Heart failure and shock (127)	3531	2.7
Rehabilitation (462)	2977	2.3
Postoperative and posttraumatic infections (418)	2663	2.0
Renal failure (316)	2500	1.9
Top 15 LTC-DRGs	80,575	61.9
Total	130,164	100

**NOTE.** Adapted from Medicare Payment Advisory Commission analysis of Medicare Provider Analysis and Review data from the Centers for Medicare Services [1]. Columns may not sum because of rounding. CC, complication or comorbidity; LTC-DRG, long-term care diagnosis related group.

<sup>a</sup> LTC-DRGs are the case-mix system for these facilities.

break of KPC-producing *K. pneumoniae* was occurring in the greater Chicago area and in neighboring northwest Indiana at tertiary care and community hospitals, LTACHs, and nursing homes [17]; the spread among hospitals appeared to follow the flow of colonized patients (figure 3) and was similar to what occurred during the 2005 outbreak of *A. baumannii* infection in Chicago [15]. As has been described elsewhere for nursing homes [18], it appears that colonization at the time of admission or during stay at an LTACH varies across the United States and may depend on regional flora [10, 12].

### LTACH-ACQUIRED INFECTIONS

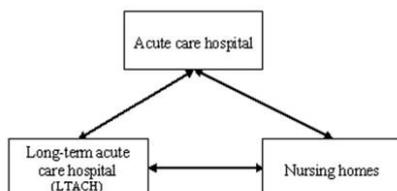
Studies of hospital-acquired infections at LTACHs are scarce. Wolfenden et al [11] found a rate of central vascular catheter (CVC)-associated bloodstream infection (BSI) of 16.44 cases per 1000 CVC-days. This rate is twice than the 90th percentile

for ICU rates, according to the National Nosocomial Infections Surveillance system. Enterococci and staphylococci were the most common pathogens isolated. A similar study at a greater Chicago area LTACH found a median CVC-associated BSI rate of 7.2 cases per 1000 CVC-days (monthly range, 1.9–16.5 cases per 1000 CVC-days). Of 136 episodes, 37% were polymicrobial. The most common organisms isolated were coagulase-negative staphylococci, enterococci, and *Acinetobacter* species [19, 20].

A different study from a 70-bed LTACH found a rate of ventilator-associated pneumonia (VAP) of 6.16 cases per 1000 ventilator-days. Gram-negative organisms—in particular, carbapenem-resistant *Acinetobacter* species—were the predominant organisms isolated [21]. Similarly, a recent publication that characterized VAP cases at LTACHs identified gram-negative rods as the causative organisms in 85% of all recovered sputum isolates [22]. Studies of device-associated urinary tract infections and *Clostridium difficile* infection are currently lacking.

### INFECTION CONTROL

Despite the high rate of device-associated infections, infection control interventions have been shown to positively affect infection rates at LTACHs. Universal chlorhexidine baths successfully decreased CVC-BSI rates by 99% at the end of the intervention period (9.5 vs. 3.8 CVC-associated BSIs per 1000 CVC-days) at a greater Chicago area LTACH [20]. In addition, a VAP bundle (elevation of the head of the bed, oral care every 4 h, and administration of proton pump inhibitors)



**Figure 3.** Patient flow among regional health care facilities. Outbreaks of infection with multidrug-resistant organisms have been found to follow the flow of colonized patients across institutions.

at an LTACH reduced VAP rates from 6.16 to 0.52 cases per 1000 ventilator-days [21]. Similarly, after the institution of a VAP bundle at a 207-bed LTACH, VAP rates decreased from 3.8 to 1.67 cases per 1000 ventilator-days [22]. In addition, a recent report showed a 43% reduction in antibiotic use at an LTACH after implementation of an antibiotic stewardship program [23].

Managing outbreaks of infection at an LTACH setting can be particularly challenging, given that outbreaks tend to be regional rather than “single-institution”; therefore, despite control measures, constant influx of patients colonized with multidrug-resistant organisms has been documented [17]. Control of additional horizontal spread within the institution has been accomplished by using bundles that include contact precautions (gowns and gloves), chlorhexidine baths, staff education, environmental cleaning, and cohorting [13, 24].

## CONCLUSIONS

LTACHs have been called the “perfect storm” [9], which seems like an appropriate description of these facilities, given that LTACHs concentrate patients with medically complex situations who have multiple comorbidities for long periods of time ( $\geq 3$  weeks); in addition, LTACHs admit patients who are already colonized with multidrug-resistant organisms and who have high rates of both antibiotic use and device use. Given all these factors, it should only be expected for these facilities to have high rates of infection with multidrug-resistant organisms. LTACHs, like other non-acute care facilities, appear to play a crucial role in regional outbreaks of infection with multidrug-resistant organisms by magnifying the colonization rates of a population [17, 24]; therefore, cooperation of LTACHs during regional outbreaks should be granted by their corporations rather than pleaded by local researchers. There are various questions pertaining to LTACHs that remain unanswered, such as questions about catheter-associated urinary tract infections and *C. difficile* colitis, as well as a need for more in-depth research on the importance of these institutions on the regional epidemiology of multidrug-resistant bacteria.

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