A COMPARISON OF LONG-TERM CARE HOSPITALS PHYSICIAN COVERAGE AND OUTCOMES

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ABSTRACT

Long-Term Care Hospitals (LTCHs) provide post-acute care for individuals stabilized in the short-stay hospital but requiring an extended inpatient stay for recovery. The Centers for Medicare and Medicaid Services (CMS) and the Medicare Payment Advisory Commission (MedPAC) have questioned the appropriateness of LTCH admissions and recommended the development of criteria to determine need for LTCH hospitalizations. This study examines the effects of one possible facility level criterion, the on-site availability of a physician on a 24 hour per day, 7 day per week basis, on the outcomes of mortality, discharges to acute care hospitals and short stay outlier reimbursement. This research utilized data from the 2009 Rate Year MedPAR Limited Data Set (LDS) file and the results of a new questionnaire designed and administered by the author to determine the level of physician coverage available in the LTCH setting. The MedPAR LDS file provided 139, 861 cases that were aggregated to provide outcomes data for 416 LTCHs, of which 16 were removed for insufficient data and an additional 18 were no longer in operation and were eliminated, resulting in a final data pool of 382 LTCHs for analysis. Data was analyzed using t-tests, chi-square and multiple regressions. The results failed to demonstrate any significant differences between LTCHs with 24/7 on-site physician coverage and those without, for the outcomes of mortality, discharges to acute care and short stay outliers. Significant differences were discovered between LTCHs operating as hospitals in hospitals (HIH) and freestanding LTCHs. These findings indicate that the level of physician coverage would not be a useful facility criterion for LTCH

admission. Additional research is required to explore the differences between HIH and freestanding LTCHs and the attributes that provide for better outcomes.

INTRODUCTION

As the debate continues on ways to reduce the federal deficit, programs of non-discretionary spending such as Social Security and Medicare will be targets of increased scrutiny. Long-Term Care Hospitals (LTCH's) account for a small portion of Medicare spending, but their growth in the number of facilities and spending per fee for service beneficiary has caught the attention of policy makers. In 2009 there were 404 hospitals operating as LTCH's accounting for approximately $4.9 billion in Medicare spending. By contrast, Medicare spent $114 billion for approximately 3,600 short-term care hospitals (STCH), $24.1 billion for approximately 15,000 skilled nursing facilities (SNF), and $6.07 billion for approximately 1200 inpatient rehabilitation facilities (IRF) in operation in 2009.(1) Total Medicare payments in 2009 amounted to $491,553 billion .(2) Attempts to control Medicare expenditures on this level of care have focused on regulatory solutions without thoroughly investigating the components of care that may lead to cost-effective outcomes. Although categorized as post-acute care (PAC) services, LTCH's are certified as acute care hospitals and must meet the Centers for Medicare and Medicaid Services' (CMS) Conditions of Participation (CoP) to be reimbursed under the Medicare system.(3) In this regard, the LTCH duplicates some of the Medicare covered services provided at the short-term hospital while also providing an appropriate discharge option for patients in need of lengthier hospitalizations. Originally, the only statutory distinction between a short-term care hospital and a long-term care hospital was the LTCH's required average

length of stay of greater than 25 days for Medicare beneficiaries.(4) The Medicare, Medicaid, and SCHIP Extension Act of 2007(MMSEA) changed the definition of LTCH to include the following requirements:

- A patient review process that screens patients both before admission and regularly throughout their stay to ensure appropriateness of admission and continued stay,
- Active physician involvement with patients during their treatment, with physician on-site availability on a daily basis to review patient progress and consulting physicians on call and capable of being at the patient's side within a period of time determined by the Secretary, and
- Interdisciplinary treatment teams of health care professionals, including physicians, to prepare and carry out individualized treatment plans for each patient.

Little research has been published describing the characteristics of services available in the LTCH setting. The Medicare Payment Advisory Commission (MEDPAC) in its 2004 Report to the Congress recommended that facility and patient characteristics be developed to ensure that LTCH's were appropriate for patients admitted to this setting.(3) This same report also suggested the level of physician availability as a facility-level criterion that Medicare could use as an example of a necessary component of LTCH services. The commission suggested that the Secretary (of Health and Human Services) determine if twenty-four hour physician availability was necessary in this setting.

This dissertation investigated the existing body of knowledge regarding LTCHs and answers the following questions:

- What level of physician coverage currently exists in the LTCH setting?
- Does the level of physician coverage impact mortality in the LTCH setting or the discharge of LTCH patients into the short-term hospital?
- Does the level of physician coverage impact LTCH Medicare reimbursement by reducing Short Stay Outlier (SSO) payments?

Medicare administrative data can be used to compare services and outcomes at the facility level. Medicare Provider Analysis and Review (MedPAR) files contain data on the discharge DRG and disposition of each Medicare discharge in a particular cost-reporting year. This existing data was combined with original research to produce answers to the questions posed and add to the current knowledge regarding the LTCH setting of care. Policymakers' and consumers' expectations of publicly funded, post-acute care should include the most cost effective care, delivered in the most appropriate clinical setting. This research provides additional information to policy makers and clinicians regarding the effect of a specific facility characteristic on patient outcomes.

BACKGROUND

LTCHs Defined

Since implementation of the Inpatient Prospective Payment System (IPPS) for acute care hospitals in 1983, Long Term Care Hospitals have played an increasingly important role as Medicare providers of post-acute care. While the LTCH designation was initiated by CMS in 1983, some LTCHs can trace their origins back to the tuberculosis hospitals established at the beginning of the twentieth century. At least 30 hospitals currently designated as LTCHs were certified by Medicare prior to 1983.(5) An outgrowth of the chronic care hospitals required for the care of tuberculosis and polio patients, these hospitals have evolved into facilities designed to manage respiratory failure, ventilator weaning, chronic wounds, antibiotic resistant infections and medical conditions complicated by comorbidity. Using a blend of high-tech critical care medicine and a multidisciplinary clinical approach, LTCHs care for acutely ill patients with multiple comorbidities and those with chronic critical illnesses. In 2009, LTCHs treated approximately 116,000 Medicare beneficiaries.(1)

All LTCH's must first meet the minimum requirements of the Medicare Conditions of Participation for Acute Care Hospitals to become a Medicare provider and be eligible for reimbursement from the Medicare program. After successfully entering the Medicare system as an acute care hospital, the facility then has to demonstrate an average length of stay for Medicare patients of greater than 25 days. The hospital typically limits Medicare patient

admissions during this period. Medicare reimbursement during this proving period is based on the Inpatient Prospective Payment System (IPPS) which was not designed to cover the expenses of a patient remaining in the hospital for over 25 days. The hospital can operate at a considerable loss during this time, because while the hospital is caring for Medicare patients for an extended period of time, they are becoming outliers under IPPS reimbursement, and the hospital is receiving reimbursement less than costs. The hospital may offset this loss by admitting non-Medicare funded patients who do not contribute to the Medicare average length of stay. After a period of time, usually six months, the hospital can submit an abbreviated cost report to the fiscal intermediary and request to be classified as an LTCH based on a Medicare length of stay of greater than 25 days. Once recognized as a LTCH, the hospital begins to receive Medicare reimbursement under the Long-Term Care Prospective Payment System (LTC-PPS), which was designed to recognize the costs of resources utilized during the longer stay. The coding scheme is identical for both IPPS and LTC-PPS hospitals. The patient's episode of care is coded using the International Classification of Diseases-9th Edition-Clinical Modification (ICD-9-CM) methodology which leads to the episode being categorized into one of over 700 MS-LTC-DRGs.

IPPS vs. LTC-PPS

Although the coding and descriptions are the same for the IPPS and LTC-PPS systems, Medicare reimbursement differs between short-term hospitals and LTCH's based upon the different weighting assigned to the two

systems and differences in the federally determined base rate for each setting. For the federal fiscal year ending September 30, 2011, the base rate for hospitals reimbursed under IPPS was $5,164, while the base rate for hospitals reimbursed under the LTC-PPS was $39,600. The relative weighting of DRG's between the two systems (IPPS vs. LTC-PPS) reflects the expected resource utilization between the two settings. For example, DRG 207, Respiratory system diagnosis with ventilator support greater than 96 hours, is one of the most common LTCH discharge DRG's. The relative weight assigned to this DRG in the LTC-PPS is 2.0259, with a geometric mean length of stay of 33.4 days, while the relative weight assigned under the IPPS is 5.2068, with a geometric mean length of stay of 12.6 days. Reimbursement under IPPS also includes adjustments for disproportionate share payments for hospitals that qualify, and indirect medical education payments for hospitals that provide physician training. Reimbursement under both systems is also affected by the regional wage index and outlier payments. Both the IPPS and LTC-PPS reimbursement systems utilize DRGs and are based on the average episode of care for a particular diagnosis. In the above example, the patient admitted to the short stay acute hospital has respiratory failure and requires mechanical ventilation for a period greater than 96 hours. Under IPPS, it is expected that this patient's acute clinical problems would be resolved in approximately twelve days. The patient may then be discharged to a level of care lower and less expensive than the short stay acute hospital. If the patient's condition fails to improve and continued acute care services are

necessary, the patient may be appropriate for admission to a LTCH. Referring again to the above example, this patient would be admitted to the LTCH with respiratory failure and the need for greater than 96 hours of mechanical ventilator support in the LTCH, with an expected LOS to resolve the clinical issues of approximately 33 days. At this time, if clinically appropriate, the patient would be discharged to a lower level of care. In this scenario, the short stay hospital would receive a full payment from Medicare based on the IPPS reimbursement, and the LTCH would receive a full payment from Medicare based on LTC-PPS reimbursement. The cost to Medicare is then the combined cost of the Short Term Care Hospital (STCH) and LTCH reimbursement. An alternative scenario would be that the patient remains in the STCH for the entire episode of care. Depending on the resources utilized and the charges incurred, the STCH may or may not receive additional reimbursement, even though the patient remained in the hospital for much longer than the IPPS average LOS.

The LTCH only exists because the IPPS reimbursement methodology is used to pay the STCH. The LTCH is reimbursed under the LTC-PPS, which allows it to continue to receive payments for care for the longer stay patients that would have remained in the STCH as outliers.

An example of expected Medicare reimbursement under both systems is provided in Appendix 1.

Evolution of LTCH payment under Medicare

While acute care hospitals were transitioned to a PPS methodology in 1983, LTCHs were reimbursed under the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982. TEFRA established limits on the cost reimbursement allowed per discharge. TEFRA also set targets for the rate of increase in Medicare costs per discharge equal to an inflation factor plus one percentage point. Hospitals exceeding the target were initially penalized 75% of the costs above the target amount.(6) In the third year of the plan, hospitals exceeding the target amount were penalized the entire amount over the target.

As an incentive to encourage efficiency, LTCH hospitals were also eligible for bonus payments if their actual costs and rate of increase in costs were below the target values. The bonus payment was half the difference between actual costs and the target, to a maximum of 5% of the target.

An LTCH's target amount was determined by the costs incurred during the facility's base period, usually the hospital's first year of operation as a Medicare certified LTCH. This system provided a perverse incentive to load as much cost into the initial base period and establish a high target amount. Costs could then be drilled down in subsequent years, maximizing the profit margin. At this time capital expenditures were a pass through item. This system also proved inequitable as newer LTCHs began participating in the Medicare system. LTCHs in existence prior to the implementation of TEFRA had their cost limits determined by their 1983 operating costs as reported on their Medicare cost report. LTCHs joining the Medicare system after

implementation of TEFRA had the opportunity to manipulate their base year costs and inflate their target limit for future years. Additionally, some LTCHs were allowed to elect which cost year, out of the first three years of operation, would be used to determine their target limit.

Many of the payment issues caused by the TEFRA methodology were addressed in the Balanced Budget Act of 1997 (BBA). Most notably, the BBA established caps on the target amounts for LTCHs for cost reporting periods beginning on or after October 1, 1997 through September, 30, 2002. LTCHs in operation prior to implementation of the BBA were held to a target limit set at the 75th percentile of all LTCHs' limits. New LTCHs joining the system after October 1, 1997, received the lesser of either the operating costs per case or 110% of the national median target amount adjusted for differences in average wage levels. The 110% national median target amount for LTCHs joining the Medicare system after implementation of the BBA was $18,324 per discharge, as published in the August 29, 1997 Federal Register.(7) This amount was subsequently increased to $21,494 in the final rule. LTCHs participating in the Medicare program prior to October 1, 1998, could receive reimbursement up to $36,449 per discharge. The BBA also reduced capital payments from a straight pass through to 85% of the capital cost. LTCHs in operation prior to 1991 were allowed to rebase their target limit based on the average of their five most recent cost reports. Calculation of the bonus payment was changed to the lesser of 15% of the difference between the operating costs and the ceiling or 2% of the ceiling. Prior to the BBA, LTCHs that exceeded their

ceiling limit were allowed relief up to 10% of the ceiling. The BBA limited relief payments to 110% of the new ceiling limit. Finally, the BBA directed the Secretary of Health and Human Services to submit to Congress, not later than October 1, 1999, a report regarding different payment methodologies which would be feasible for reimbursing LTCHs under the Medicare program.

The implementation of the Prospective Payment System for acute care hospitals encouraged the growth of all sectors of post-acute care. As acute care hospitals struggled to manage the care of Medicare beneficiaries within the framework of DRGs, the LTCH offered an appropriate discharge option to provide a level of care not found in other post-acute venues. Consequently, LTCHs experienced a steady growth pattern from the 1980's through the present. The characteristics of the LTCH facilities changed through this period of growth. New LTCHs entering the system were increasingly owned by for-profit organizations and there was an increase in the number of LTCHs entering as "hospitals in hospitals" (HIHs). According to the March, 2011 list of long-term acute care hospitals compiled from CMS's Online Survey Certification and Reporting (OSCAR) System, approximately 72% of existing LTCHs are for-profit and 30% are HIHs.(5)

Throughout the 1990's, LTCHs capitalized on a federal regulation that allowed for the establishment of a "hospital within hospital" (HIH); a separate hospital with a separate Medicare provider number on the campus or within the walls of an acute care hospital (the host hospital). To qualify as an HIH, the LTCH was required to meet certain criteria for separateness from the

acute care hospital that shared the same location. These criteria included: separate governing body, separate chief medical officer, separate medical staff, and a chief executive officer. In addition, the HIH had to satisfy one of the following criteria: (1) performance of basic hospital functions independent of the host hospital, (the HIH could accomplish this "through the use of employees or under contracts with entities other than the hospital occupying space in the same building or on the same campus, or a third entity that controls both hospitals"), (2) the cost of services obtained from the host hospital or a third entity that controlled both hospitals could not be more than 15% of the HIHs total inpatient operating costs, or (3) the HIH's inpatient population is limited to 25% of patients that were referred from the host hospital. Only HIHs in existence prior to October 1995 were exempt from the organizational or financial independence criteria.

A rule change published in May of 2004 removed the operating cost option and mandated a phase in of the so called "25% rule".(8) Beginning with the 2006 cost year, all HIHs were required to gradually limit admissions from their host facility to 25% of the total inpatient population over a three year period. The threshold was to be reduced by 25% each subsequent year until the HIH reached the 25% threshold. HIHs located in host hospitals designated as rural or that qualify as the predominant Medicare provider in the metropolitan statistical area had a relaxed threshold of 50% admissions from the host. A small number of HIHs operating prior October 1, 2004, were grandfathered, and exempted from this new rule. Despite an active lobbying

campaign, including comments against implementation of the arbitrary thresholds of this new rule from elected representatives, trade organizations and individuals, the new rule began effecting HIHs after October 1, 2005. Several HIH LTCHs have elected to relocate to freestanding buildings to avoid penalties imposed by failing to meet the 25% threshold. It should be noted that there is no similar threshold rule in effect for any of the other post-acute venues of care.

The co-location of an LTCH within the walls or on the same campus of an acute care hospital can promote an environment leading to manipulation of the Medicare system. Conceivably the acute care hospital could discharge a patient to the LTCH before completing a course of therapy, decreasing the LOS, but allowing the hospital to collect reimbursement for the full acute DRG. The remaining course of treatment would then be completed during the LTCH stay. This would increase the costs to Medicare by generating two bills for the same spell of illness. Rules governing the early discharge of patients with specific DRG's to Medicare reimbursed post-acute settings were enacted to discourage the acute care hospital from profiting from the early discharge. Another potential abusive situation is the discharge of the LTCH patient referred from the host hospital, back to the host hospital, and then readmitting back to the LTCH. In this case, a separate Medicare payment would be issued for each discharge. Regulations limiting the host to LTCH readmission rate to 5% were enacted by CMS to guard against inappropriate patient transfers of this nature. Additionally, the Readmissions Reduction Program

began reducing payments to IPPS reimbursed hospitals with excess readmissions in October, 2012.

The rapid growth of the long term care hospital industry and the potential for

abuse of the Medicare reimbursement system raised concerns with policy makers in Congress and the Department of Health and Human Services. These concerns were outlined in a July, 2004 report from the Office of the Inspector General, Department of Health and Human Services.

The number of LTCHs has grown rapidly and consistently from 39 in 1984 to 404 in 2009. (Figure 1) The growth of LTCHs is reflected in the costs to the Medicare program. Medicare spending on LTCH services increased from $398 million in 1993 to $4.9 billion in 2009. Despite the continued increase in the number of LTCHs, their geographic dispersion is still unevenly distributed. (Figure 2) Texas has the largest number of LTCHs with 74, while four states (Maine, New Hampshire, Vermont, and Wyoming) have none. When comparisons are based on the number of LTCH beds per 10,000 population greater or equal to age 65, the District of Columbia leads all the states with 37.6. The District of Columbia is followed by Massachusetts, Rhode Island and Louisiana. (Figure 3) Establishment of new LTCHs in particular states may be influenced by Certificate of Need regulations, state's laws regarding development of proprietary hospitals or sufficient patient population to anticipate profitable LTCH operations.(9)

Implementation of LTCH-PPS

As directed by the Balanced Budget Act of 1997, a prospective payment system for LTCHs was implemented beginning on October 1, 2002 to replace the cost based reimbursement system covered by TEFRA. The premise of the PPS was reimbursement based on a per case basis determined by the discharge DRG. Specifically, LTCHs are reimbursed according to the discharge Long Term Care-Diagnostic Related Grouping (LTC-DRG). LTC-DRGs followed the same coding criteria and conventions as the IPPS DRGs but the relative weighting was adjusted to reflect the resources used in the LTCH setting and average and geometric mean lengths of stay (ALOS, GMLOS) were published for each LTC-DRG. Theoretically, efficient hospitals would be rewarded and inefficient hospitals would become more efficient under a PPS reimbursement methodology. The new LTCH PPS was designed to be budget neutral. Total LTCH payments during the first year of implementation were to equal the costs to Medicare had the new system not been implemented. A complete description of the technical development of the LTC-DRGs can be found in the Federal Register.(10)

Reimbursement under the LTCH PPS methodology begins with the unadjusted published federal rate. This rate is calculated to cover the operating and capital related costs of providing LTCH services. The rate is adjusted by a wage index to account for regional variation in the prevailing wage rates. The adjusted rate is then multiplied by the relative weight of the specific LTC-DRG to obtain the LTCH PPS payment. This payment can be further modified by case specific adjustments for short stay outliers (SSOs),

interrupted stays, or high cost outliers (HCOs). Unlike the IPPS, LTCHs are not eligible for additional payments for disproportionate share, indirect medical education costs or geographic reclassification.(10)

Short stay outliers are defined as cases discharged before reaching 5/6 of the average length of stay for the specified DRG. Medicare pays the least amount of one of three methodologies for cases classified as SSOs. The first payment option is payment of the full LTC-DRG. A second option is payment of 120% of the estimated cost calculated from total covered charges and the LTCH's cost to charge ratio (CCR). The third option is payment of 120% of the LTC-DRG per diem payment amount multiplied by the actual LOS.(11) Short stay outliers accounted for thirty seven percent of all LTCH discharges in 2004. Raising concerns that LTCHs were inappropriately admitting patients that did not require an extended period of acute hospitalization, changes were made to the SSO reimbursement rules. Beginning on October 1, 2006, LTCH SSO payments are the lesser of:

- The full LTC-DRG payment;
- 100% of the estimated cost of the case (reduced from the 120% payment in effect since the implementation of LTC-DRGs);
- 120% of the LTC-DRG per diem payment amount multiplied by the actual LOS;
- A blend of the IPPS DRG comparable per diem payment and 120% of the LTC-DRG per diem amount. The blended amount is determined by calculating the actual stay proportion of the 25 day threshold or the 5/6

threshold, whichever is less. The balance of the proportion, up to 100% is then attributed to the IPPS DRG amount. A blended payment is then paid, made up of the LTC-DRG proportion and the IPPS DRG proportion.

Another type of case adjusted payment is the interrupted stay. This case occurs when a patient is discharged from the LTCH to another Medicare covered inpatient setting (acute hospital, Inpatient Rehab Facility (IRF), Skilled Nursing Facility (SNF)) and then returns to the same LTCH within a specified number of days. This specific number of days is called the fixed day period and is determined by the type of facility that accepts the patient from the LTCH. (Table 1 gives the fixed day periods for the three different settings.) If a case returns directly to the LTCH within the fixed day period for that setting, the LTCH will only receive one Medicare payment for the LOS prior to discharge and the days after returning to the LTCH. The interrupted stay policy was developed to prevent Medicare from making multiple payments to the LTCH for incomplete provision of services. The interrupted stay policy does not apply to patients that are discharged from the LTCH to another level of care and then to another provider prior to readmission to the same LTCH. In this scenario a patient could be discharged from the LTCH to a SNF, be admitted to an acute care hospital and then discharged back to the original LTCH within a matter of days. Under the original interrupted stay policy, all three venues would receive Medicare payments, and the LTCH would receive one LTC-DRG payment for the first discharge and another

separate LTC-DRG payment for the subsequent discharge. This policy was changed in the May 7, 2004 Final Rules for LTCH PPS. The new policy maintained the fixed day period for interruptions greater than three days. However, cases that were discharged to any venue and returned to the same LTCH within three days resulted in one LTC-DRG payment to the LTCH. Additionally, the LTCH was responsible for any Medicare provided services which occurred during the three day interruption.

Table 1

Fixed Day Periods for Determining LTCH Interrupted Stays

Inpatient Acute Care Hospital	Between 4 and 9 days
Inpatient Rehabilitation Facility	Between 4 and 27 days
Skilled Nursing Facility	Between 4 and 45 days

One exception to the less than three day interruption of stay was for those cases that required a surgical procedure. Since most LTCHs are not designed to provide higher level surgical interventions, LTCH patients requiring surgery are transferred to an acute care hospital specifically for surgical treatment. Between July 1, 2004 and June 30, 2006, if a LTCH patient was discharged to an acute care hospital, and the acute care hospital could code the services provided under a surgical DRG, the acute care hospital could bill Medicare directly for the episode of care and the LTCH did not have to be responsible for covering the acute care stay if the patient returned to the LTCH within three days of discharge.(12) This surgical

exemption to the less than three day interrupted stay rule was removed beginning on July 1, 2006.

The third type of case adjusted payment occurs with high cost outliers (HCOs). A high cost outlier occurs when the case exceeds the usual costs for a specific LTC-DRG. The HCO adjustment is based on the difference between the full LTC-DRG payment and the estimated cost of the case determined with the facility's CCR. A predetermined fixed loss amount is added to the full LTC-DRG amount to determine a high cost outlier threshold.(13) Eighty percent of the estimated cost above the HCO threshold is then added to the full LTC-DRG. The HCO adjustment is designed to dissuade the hospital from providing a reduced level of services to the high cost patient. The LTCH's loss is limited to the fixed loss amount and any costs above the LTC-DRG payment. The fixed loss amount implemented during the initiation of the PPS was $24,450. Adjusted each year, the fixed loss amount announced for the rate year beginning on October 1, 2010 was $18,785.

All of these payment schemes were developed to prevent the LTCH from unfairly profiting from the LTCH Prospective Payment System. Policy-makers and legislators had reason for concern regarding the profitability allowed by the new payment system. During the implementation of the PPS for LTCHs, facilities had the one time option of electing full conversion to the PPS or a five year phase in, converting from cost-based payments to PPS. Almost every LTCH operating elected the full conversion to PPS during the first year of implementation. Medicare payments per case to LTCHs increased

from $22,452 in 2001, the last year of TEFRA based reimbursement, to $30,180 in 2004, the second year of PPS.(14) Prior to implementation of PPS, the average Medicare margin was below or near zero. After implementation of PPS, Medicare margins rose to 5.2% in 2003, a high of 11.9% in 2005, and 5.7% in 2009. Total Medicare spending for LTCHs increased from $1.7 billion in 2001 to $4.9 billion in 2009. Summary reviews of the methods of payment for LTCH services have been provided in various publications.(9, 15, 16, 17, 18)

Medicare payments to LTCHs have steadily increased as have the number of facilities participating in the system. Since implementation of the LTCH PPS, Medicare margins have been consistently positive, ranging from 3.5% to 11.9%. In contrast, Medicare margins for short-stay hospitals reimbursed under IPPS have been negative for the past five years. Policy makers have raised concerns as Medicare payments to LTCHs and the number of LTCHs participating in the system has continued to grow after implementation of LTC PPS. The number of facilities certified as long term care hospitals increased from 90 to 404 between 1990 and 2009. There were approximately 131,000 Medicare discharges from LTCHs in 2009. Medicare expenditures for care delivered in this setting grew from $398 million in 1993 to $2.7 billion in 2003 and an estimated $4.9 billion in 2009.(19) Average Medicare payments per LTCH discharge increased from $22,452 in 2001 under TEFRA, to $37,465 in 2009 under LTC PPS. By comparison, the average spend per STCH discharge in 2009 was $14,800. The current

Medicare LTCH spending per fee for service beneficiary amounted to $139 in 2009. This compares to $3,337 per fee for service enrollee for Medicare short stay inpatient hospital spending. Although LTCH services comprise the smallest Medicare reimbursed expense in relation to other post-acute settings, the rapid growth in the number of facilities and Medicare expenditures has focused the attention of policymakers on this setting of post-acute care. (Figure 4)

Recent legislation has been enacted to control the growth of this venue of post-acute care by imposing a moratorium on the creation of any new LTCH bed capacity.(20) Despite this moratorium, the number of LTCHs continued to increase due to an exemption process that allowed LTCHs in development at the time of the implementation of the moratorium to continue to be developed. This moratorium expired at the end of 2012.

Characteristics of LTCHs

Although categorized as post-acute services, LTCHs are certified as acute care hospitals and must meet the CMS CoP to be reimbursed under the Medicare payment system. The CoP are a set of minimum standards that must be met in order for a facility to qualify for Medicare hospital reimbursement. Hospitals may be deemed to comply with the Medicare CoP's by attaining accreditation from one of three organizations granted deeming status by CMS; the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), the American Osteopathic Association (AOA), or Det Norske Veritas (DNV). The Medicare CoP's for hospitals can be found

online.(21) While all LTCHs must comply with the minimum set of standards provided for in the CoP's, many LTCHs may provide additional services to meet the specific needs of their patient population or to enhance their position in their specific market. Examples of optional clinical resources that may be provided by LTCHs include on-site radiologic diagnostics, hyperbaric oxygen treatment, infusion of chemotherapeutic agents and intensive care or high observation units. Many short term acute care hospitals may also provide these same services.

Post-Acute Care settings are sometimes characterized by the frequency and type of physician visitation and coverage. Discussion of institutional post-acute care settings generally includes skilled nursing facilities, inpatient rehabilitation facilities and long-term care hospitals. Physician coverage in the LTCH setting is typically provided by an internist who visits the patient on a daily basis. A range of specialists may also be on the LTCH medical staff; the complexity and diversity usually dependent on the type of patients the LTCH admits. IRFs require a physiatrist to oversee care of the patient and internists and specialists may be available for medical oversight. Physician visits in the SNF setting are much less frequent and a range of specialists is usually not available on-site. While Medicare payments for physician visits in the SNF setting are comparable to LTCH and STCH setting payments, Medicare only dictates a physician visit every 30 days for the first 90 days in the SNF setting.(22)

In addition to the visits provided by the attending physician and specialty consultants, LTCHs may provide additional physician coverage for situations that arise when the attending physician is not on-site. These arrangements are usually provided under contract with a host hospital, physician group or individual physicians. A study performed by RTI found that in general, physician visits occurred more frequently in LTCHs (daily) in comparison to IRFs (2-3 visits per week) or SNFs (every 14 – 30 days).(23) One of the aims of this research is to describe the level of physician coverage available in the LTCH setting.

Other Venues of Post-Acute Care

The concept of a "continuum of care" includes all the settings in which a patient may be treated and is usually categorized according to the acuity level the setting can manage, the intensity of services available in that setting and the independent activity of the patient in the setting. The progression of patient movement for those covered by the Medicare system is often dictated by the reimbursement received by the treatment setting of these patients. Movement through the continuum of care is not necessarily linear and patients may move back and forth between settings before reaching a stable endpoint. Appendix 2 identifies care settings within the continuum of care and lists some common characteristics. The goal of an efficient healthcare system should be to have patients treated in the most appropriate setting for the patient's needs at a particular point in time at the most reasonable cost. Our current system of post-acute care allows for significant overlap among the three major settings

of SNF, IRF and LTCH. Attempts have been made to assure that patients are treated at the most appropriate setting and instruments have been developed to qualify patient admissions to the IRF and SNF setting. The Deficit Reduction Act of 2005 directed the Centers for Medicare & Medicaid Services (CMS) to develop a Post-Acute Care (PAC) Payment Reform Demonstration. One of the goals of that mandate was the development of a universal assessment tool, appropriate for all post-acute settings. LTCHs began using the Continuity Assessment Record and Evaluation (CARE) tool in October, 2012.(24)

Medicare's costs for these different post-acute settings are related to the number of beneficiaries utilizing the setting and the resources consumed at each setting. Total Medicare spending for post-acute care services was estimated at $54.4 billion for 2009. Skilled nursing facilities, with estimated Medicare reimbursement at $25.5 billion, account for the largest Medicare expenditure in post-acute care. SNFs are followed by home health agencies at $18.3 billion, IRFs at $5.7 billion and LTCHs at $4.9 billion.(25) Accurate cost comparisons between these categories of care provision are made difficult because each category is reimbursed by Medicare under a different methodology and utilization does not include beneficiaries covered under Medicare Advantage plans in the fee-for-service data collected during the period of investigation. Direct comparisons between post-acute care settings are inappropriate based on the differences in resources devoted to patient care in each setting. However, LTCH is clearly the most expensive form of

post-acute care on a per-case basis. In 2008, the average LTCH per-case cost to the Medicare program was $35,200 with an average length of stay of 26.7 days. By comparison, the per-case cost. for IRF was $16,649 with an average length of stay of 13.3 days and the per admission cost for SNF was $9,497 with an average length of stay of 27 days. Since the majority of SNF's are also certified as nursing homes, it is likely that patients may have spent more time at the facility, but the additional days are not covered by the Medicare program.

These post-acute venues of care also differ in the types of diagnoses that are typically cared for in each setting. A significant portion of patients in the LTCH setting are admitted for conditions related to either respiratory symptoms and diagnoses or musculoskeletal, connective tissue, and skin diagnoses. The latter are related to the high volume of patients treated for significant wounds and decubitus ulcers. By rule, 60% of admissions to the IRF setting must be related to one of thirteen conditions. The most common diagnoses of patients immediately preceding admission to the SNF setting are related to major joint and limb procedures (hips and knees), heart failure, pneumonia, stroke, infection and renal failure. Appendix 3 details the admission diagnoses differences between these three post-acute care settings. To date, there are no published studies comparing the clinical outcomes between the settings of LTCH, IRF and SNF. Most reports of outcomes in the LTCH setting have focused on respiratory failure and weaning from mechanical ventilation.(9, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35)

A recent study performed by the National Association of Long Term Hospitals (NALTH) was reportedly designed to make an empirical determination whether considering a combined short term acute care hospital (STCH) and LTCH episode of care, cost to the Medicare program is less when patients are admitted from a short term acute care hospital to an LTCH, rather than remaining in the short term acute care hospital for the episode of illness.(36) This research utilized the patient specific MedPAR file to follow patients from the STCH to the LTCH. The study constructed a single STCH stay by combining the STCH and LTCH stay into a single episode from the 2005 file and rebasing payment to 2010 dollars. According to NALTH, the cost to Medicare would have been increased by $252 million in 2010 dollars if Medicare patients had remained in the STCH for the combined STCH-LTCH stay. The NALTH study assumed that without an LTCH admission, the STCH stay would have equaled the combined STCH-LTCH LOS; that services provided in the single STCH stay would have been the same as those provided in the separate STCH and LTCH stays; that all services were medically necessary; and that cost outlier payments to the STCH could be accurately estimated utilizing the specific STCH cost to charge ratios. The study concluded that for those cases with a high case mix index, high utilization of procedures, significant use of ICU or CCU during the STCH stay, or were cost outliers in the STCH, the cost to Medicare would have been reduced if the patient had been discharged to an LTCH rather than remained in the STCH for the entire episode of care. While this study does not compare

patient outcomes between STCH and LTCH, it does attempt to determine the financial impact between a continued episode of care in the acute care setting versus a combined stay in the STCH and LTCH.(36)

Research Triangle Institute International (RTI) was commissioned by the CMS in 2004 to perform a “LTCH Payment System Monitoring and Evaluation”. Among the many aspects of this study was the evaluation of the feasibility of developing facility and patient specific criteria for LTCH to distinguish LTCHs from the other acute care hospitals as recommended by MEDPAC.(23) RTI found that many LTCH patients overlap with those treated in other settings but LTCHs provide a specialized set of services for a small group of patients, particularly those with severe respiratory conditions or multisystem complications. The full set of RTI recommendations is included in Appendix 4.

The Medicare, Medicaid and SCHIP Act (MMSEA) of 2007 required the Secretary of Health and Human Services to conduct a study on the establishment of national LTCH facility and patient criteria for determining medical necessity, appropriateness of admission, continued stay and discharge from LTCHs and to provide a report on the results of this study to Congress together with recommendations for legislation and administrative action.(37) The Secretary issued her report to Congress through a letter of transmittal dated March 9, 2011. This letter stated that the Secretary did not recommend the development of any additional patient and facility level criteria

for LTCHs. The letter further stated that “it is not possible (nor desirable) to develop criteria defining patients who can be cared for exclusively in LTCHs”.

While none of the aforementioned reports examined the effect on patient outcomes of the availability of physician coverage, it seems logical that a valid differentiation of the services provided in PAC venues would include the availability of physician coverage to manage the clinical needs of the patients.

Quality Measures of LTCHs

CMS’s concern about the quality of services delivered to its beneficiaries is evidenced by the programs of incentives and penalties, such as the Hospital Value Based Purchasing Program, that have been implemented or are scheduled for implementation. The Patient Protection and Affordable Care Act (PPACA) of 2010 directs LTCHs to report quality measures to HHS beginning in rate year 2014.(38) The first quality measures to be reported were defined in the 2012 Final Rules for LTCH.(39) The initial measures that must be reported to CMS are: catheter associated urinary tract infections (CAUTI), central line associated blood stream infections (CLABSI) and hospital acquired decubitus ulcers. Additional measures proposed for future monitoring are: unplanned readmissions to acute care hospitals, weaning from mechanical ventilation, functional improvement, mortality, hospital acquired infections, falls causing injury, polypharmacy, and ventilator associated pneumonia(VAP). Beginning in 2014, failure to report the selected quality measures will result in a financial penalty to the LTCH. This reporting

requirement will be the first instance of capturing comparative quality data from all LTCHs participating in the Medicare program.

Public Sources of Facility Characteristics

LTCHs may provide a diverse selection of clinical resources. Information on the resources available in the LTCH setting has been collected by various sources, but each source collects different types of data and there has been no consolidation of this information. NALTH promotes the NALTH Health Information System, a web-based data repository designed in collaboration with the Lewin Group specifically for LTCHs. Information from this proprietary program is available to subscribers who also submit their LTCH data for comparison. In addition to the LTCHs participating in data submission, the Lewin Group uploads data from publicly available Medicare files of non-participating LTCHs.

The American Hospital Association (AHA) collects data through an annual survey of hospitals conducted through its Health Forum affiliate. Reporting is performed on a voluntary basis. Reporting hospitals provide information on a variety of financial and operational subjects including facility codes describing 145 individual programs or services. Review of the 2009 edition of the AHA Guide revealed that as of May 31,2008, 341 hospitals were identified as LTCHs, but only 162 (48%) participated in voluntary reporting. Information on on-site physician coverage was not among the data collected in this survey.(40)

CMS maintains the quarterly Provider of Service (POS) file which describes facility characteristics for 19 different types of facilities. This file is created from the Online Survey and Certification Reporting System (OSCAR) database. The file is produced quarterly and individual facility data are updated each time the facility undergoes a licensing survey. The POS file does indicate the number of physicians employed by a facility but does not indicate the amount of physician coverage available on a daily basis. The facility characteristics collected in this survey are available in Appendix 5. No previous studies have compared facility characteristics with patient outcomes. One of the goals of this research proposal is to describe the current availability of on-site physician coverage in the LTCH setting and determine if any inferences related to quality can be drawn from the collected information.

LITERATURE REVIEW

A literature search was performed utilizing the Pubmed, Health Services, Technology, Administration and Research, Health Services Research Projects in Progress and Proquest Dissertations and Theses databases. Searches were limited to English language publications between 1982 and the present, searching for the following terms anywhere within the document: *"ltac" or "long term acute care" or "long term care hospital" and either "physician staffing" or "physician coverage".* These searches returned no results for the LTCH setting. There is no current published information on the level of physician coverage provided in the LTCH setting or the effect of physician staffing on quality outcomes in the LTCH setting.

The current literature regarding LTCHs has focused primarily on the care and outcomes of the mechanically ventilated patient but has not addressed the variability of available resources within the LTCH segment of post-acute care. The majority of LTCH patients are admitted directly from an acute care hospital; often from an intensive care unit setting. LTCHs require their patients to be seen by a physician on a daily basis. Unlike the LTCH patient's previous hospital setting, the LTCH may not maintain a physician on-site to immediately manage patient emergencies. Although many LTCHs employ nurses and therapists trained in advanced life support techniques, a physician may only be available telephonically in the event of an emergency. The unavailability of on-site physician coverage to manage emergent

situations may lead to readmission to the acute care hospital and subsequent increased cost to the Medicare system.

Mechanical Ventilation in the LTCH Setting

One of the first published reports describing the capabilities of the LTCH was provided by Lundberg in her 1990 article describing care for the ventilator dependent individual.(27) Ten years later, articles by Hotes and Kalman and Liu, et al, provided comprehensive reviews of the evolution of the modern LTCH.(9, 26) These articles describe the evolution of LTCHs from chronic care hospitals and the LTCH focus on providing respiratory care and rehab with emphasis on patients that failed to wean from mechanical ventilation in the acute care setting. They cited the complexity of illnesses and acuity of patients as factors that differentiated the LTCH from other venues of post-acute care such as inpatient acute rehab or skilled nursing settings.

Numerous articles have focused on LTCH care of the mechanically ventilated patient who failed to wean in the acute care setting. They report results on weaning outcomes, mortality, and the weaning process.(28-35, 41-44) A 1998 publication of Bach, Carson and Leff, studied the difference between university based and community based physicians in their care of 118 patients in the LTCH setting. Their findings were that the patients followed by university based physicians had faster times to wean, were more readily withdrawn from life support and were managed at less cost than the patients managed by community based physicians.(41) Another study by Carson, Bach and Brzozowski, et al, studied 133 mechanically ventilated

patients admitted to LTCHs. Their findings were that 66 patients (50%) died before discharge, 70% of those discharged were weaned from mechanical ventilation and by one year post admission, 77% had died.(28) Scheinhorn et al, authored multiple articles between 2001 and 2007 describing the extent of prolonged mechanical ventilation in the U.S., weaning protocols used at one LTCH, outcomes and characteristics from 23 LTCHs, and characterizing the population of ventilator dependent patients admitted to 23 LTCHs. In the multicenter outcomes study, involving 23 LTCHs, a successful wean rate of greater than 50% was reported.(30, 32, 33, 34) Dematte D'Amico studied risk assessment for survival in the LTCH population. The study was a retrospective review of 300 LTCH admissions and the findings demonstrated a significant inverse relationship between patient age, organ system failure, and survival.(42) In another study, Seneff found that mechanically ventilated patients had high mortality and that 6 month outcomes were not significantly different between those patients transferred to LTCH and those that remained in acute care.(35) An article published by Votto, et al. compared outcomes and costs between a control group of medically complex patients that remained in the STCH for the entire episode of care and a study group of patients admitted directly from a STCH to the LTCH and discharged from the LTCH. This analysis concluded that clinical outcomes were better and costs of care were lower for the study group.(45) An editorial by Carson listed the lack of standardization in LTCHs as a reason for the wide variation in outcomes. The author cautioned clinicians to be aware of the diversity of

practices and outcomes in the LTCH setting.(42) An article by Kahn created a stir among LTCH organizations and providers when his conclusions showed a poor one year survival rate (50%) for patients transferred to LTCH after critical illness.(29) Finally, Eskildsen's review of the literature expressed the difficulty in making comparisons between providers due to the lack of standardization.(44) Only one article specifically mentioned the availability of on-site physician coverage.(31)

Infection Control in the LTCH Population

There is increasing interest in the prevention and control of infectious disease in the LTCH setting. Due to the longer lengths of stay, the common need for antibiotics, and the frequent use of tubes, catheters and intravenous lines that bypass the body's natural defenses; the LTCH can become a reservoir for existing and new strains of infectious organisms. Separate articles by Endimiani et al, Furuno et al, Gould et al and Stephens et al all focus on the emergence of drug resistant organisms in the LTCH.(46-49) Walkey et al discusses the epidemiology of ventilator associated pneumonia (VAP) and multi-drug resistant organisms (MDRO) in a single LTCH.(50) Buczko, using data from the 2004 cost year, examined all LTCH Medicare discharges who received mechanical ventilation and discovered that nearly 25% acquired VAP.(51) Several reports have been authored by Munoz-Price et al, discussing the role of LTCHs in regional outbreaks, effectiveness of infection prevention methods and the degree of MDRO colonization.(52, 53, 54) Goldstein et al studied the incidence of C. difficile infection in a California

LTCH and concluded that carriage and unsuspected infection occurs and may serve to create a reservoir for further infection.(55) The potential for cross contamination between LTCHs and acute care hospitals is discussed in an article by Weaver et al.(56)

Available LTCH Resources

The RTI International report authorized by the CMS in 2004 was published in 2007. This study was commissioned to assist CMS in developing criteria for appropriate and cost-effective use of LTCHs. MedPAC issued the following recommendations in its June 2004 Report to the Congress:

"The Congress and the Secretary should define long-term care hospitals by facility and patient criteria that ensure that patients admitted to these facilities are medically complex and have a good chance of improvement.

- *Facility-level criteria should characterize this level of care by features such as staffing, patient evaluation and review processes, and mix of patients.*
- *Patient-level criteria should identify specific clinical characteristics and treatment modalities.*

The Secretary should require the Quality improvement Organizations to review long-term care hospital admissions for medical necessity and monitor that these facilities are in compliance with defining criteria."

Following these MedPAC recommendations regarding development of patient and facility-level criteria to distinguish the role of LTCHs, RTI worked with the American Hospital Association (AHA), the National Association of Long Term Hospitals (NALTH), the Acute Long Term Hospital Association (ALTHA), and the American Medical Rehabilitation Providers Association (AMPRA) to evaluate criteria and identify options.

The Medicare Conditions of Participation define the minimum capabilities a facility must have in order to qualify as an acute care hospital.(21) Additional

facility resources for acute care hospitals above these minimums are captured in the Medicare Provider of Services files. Some LTCHs (which are classified as acute care facilities) may provide on-site surgical services, complete laboratory or radiologic diagnostics on-site, or contract for physician or physician extender coverage beyond that provided by the attending physician. However, this information is not reported in a comprehensive manner in any public documents. The AHA Annual Survey includes information on some LTCHs, but it is a self-reporting system and does not capture all LTCHs.(57). The AHA Annual Survey of Hospitals for 2009 listed 341 hospitals classified as LTCHs with 162 of those hospitals reporting. NALTH in association with the Lewin Group, offers a proprietary database which includes data from participating LTCH members. This database uses information available from CMS to include non-participating hospitals, but it is not available to non-participants.(58) This database currently includes self-reported information from 57 participating LTCHs with additional information from the non-participating LTCH's Medicare cost reports entered by the Lewin Group. The current literature fails to describe the level of physician availability in the LTCH setting. The impact of physician staffing patterns has been studied in the intensive care unit setting and significant effects have been reported. A systematic review of physician staffing patterns and clinical outcomes conducted by Pronovost, et al. concluded that physician staffing patterns are associated with hospital and ICU LOS and hospital and ICU mortality.(59) This research provides some insight into the availability of physician coverage

in the LTCH setting and explores the relationship between on-site physician availability and mortality and readmissions to the acute care setting. The current literature fails to describe the level of physician coverage available in the LTCH setting and what effect, if any, physician coverage has on quality outcomes.

DATA AND METHODS

a. Overview

Medicare expenditures for LTCH services increased from $3.98 million in 1993 to $4.9 billion in 2009. As CMS moves towards a policy of paying for quality over quantity, it is important to identify the factors involved in providing better outcomes for Medicare beneficiaries. The objective of this research is to describe the availability of physician coverage in the LTCH setting and to examine the relationship between the availability of on-site physician coverage and selected outcomes. There have been no previous studies focused on the availability of physician coverage and outcomes in the LTCH setting. This research focused on three facility-level outcomes from the LTCH setting; mortality, discharges to acute care hospitals, and discharges resulting in short-stay outlier payments to the LTCH. This section describes the methodology and data used to determine if the on-site presence of a physician affects outcomes in the LTCH setting.

b. Theoretical framework

Physician staffing patterns have been shown to have a significant effect on quality and costs in the ICU setting of STCHs. It is possible that physician availability impacts the areas of cost, care coordination and outcomes in the LTCH setting.

Licensed and equipped as hospitals, LTCH's manage a higher acuity than other post-acute care settings. The theoretical proposition is that LTCHs with greater physician presence (on-site versus on-call) would have better

outcomes based on immediate access to physician level expertise and assessment than LTCHs without on-site physician coverage. This research addresses the following four questions:

1. What level of on-site physician coverage currently exists in the LTCH setting?
2. Is there a relationship between the availability of on-site physician coverage and LTCH mortality?
3. Is there a relationship between the availability of on-site physician coverage and discharge of LTCH patients to the STCH setting?
4. Does the availability of 24/7 on-site physician coverage affect the occurrence of short-stay outliers?

On-site physician coverage was coded as a binary independent variable in the regression models developed to explore the relationships in the following hypotheses:

1. There is no difference in mortality for LTCHs with 24/7 on-site physician availability.
2. There is no difference in the frequency of discharge to the STCH setting for LTCHs with 24/7 on-site physician availability.
3. There is no difference in the rate of short stay outlier reimbursement for LTCHs with 24/7 on-site physician availability.

c. Study Design and Data sources

This research utilized a retrospective, observational design to analyze an administrative data set combined with new information on physician coverage obtained from a questionnaire distributed to all current LTCH administrators. The use of administrative data is justified in this research because it provides the only publicly available, comprehensive data base on this population. Data compiled by Medicare contains valid demographic and clinical information on a large population base. The information used to create Medicare data set on patients in LTCH is taken from individual hospital cost reports. Although administrative data sets may provide information on large populations, in this case 139,861 discharges from LTCHs, they have several limitations. Because they are not collected for research purposes, data not associated with the main purpose of the database may be misclassified, inaccurate or missing. These limitations in the use of Medicare administrative data can be avoided if the variables used for research are required in Medicare reporting or impact payment. The variables used in this research are demographic or related to DRG coding which determines facility reimbursement and is likely to be more accurate.

Patient-level LTCH hospitalization data has been obtained for this study from the Centers for Medicare and Medicaid Services (CMS) in the Medicare Provider Analysis and Review Long-Term Care Limited Data Set LTCH MedPAR LDS)file for Fiscal Year 2009. This file contains demographic and clinical data on all Medicare beneficiary discharges from the 416 LTCHs for RY 2009, resulting in 139,861 discharges. The file has been stripped of any

individual patient identifiers. All data for the construction of variables to be used in the study except the independent variable of physician coverage have been drawn from this publicly available data set. Patient outcomes were consolidated based upon the facility provider number to develop measures of facility level characteristics on the dependent patient outcomes variables and predictor and control variables. All data of interest was matched with the questionnaire responses based on the facility provider number. Facilities were only identified for the questionnaire matching process and then all research results were reported in aggregate. Facilities were coded as with physician coverage, without physician coverage or non-responding. No individual patient or facility identities were reported.

The LTCH MedPAR LDS file contains up to sixty-five data fields which can describe over 100 individual data elements for each case. There are no patient level identifiers linked to this file. No individually identifiable data was disclosed in this research. Patient level characteristics found in the RY 2009 MedPAR file are displayed in Appendix 6. CMS has a formal process for requesting this data and ensuring that the data is only used for approved purposes. CMS encourages the use of its administrative data for research through a contractor arrangement with the Research Data Assistance Center at the University of Minnesota. The investigator and the committee chair entered into a Data Use Agreement with CMS and this file is in the possession of the investigator. CMS allows use of the data for specifically described purposes for terms of one year, but researchers may request to continue to

use the database on an annual basis. Instructions for obtaining the LTCH MedPAR LDS file are available on the CMS website.(60) In addition to the DUA with CMS, the study protocol was reviewed and approved by the Tulane University Biomedical IRB.

Facility-level data containing the facility name, address, provider number and date of entry as a Medicare certified LTCH were also obtained from the CMS list of LTCHs as of March 2011. Individual facilities can be identified by their unique provider number, however, this identifier was only used during data analysis and results were reported in aggregate. As part of this dissertation research, a questionnaire described below, will be administered electronically to all LTCHs in the March 2011 CMS listing. The American Hospital Association Annual Survey of Hospitals and individual LTCH websites were used to obtain contact and email information on the current administrator of each LTCH for submission of the electronic questionnaire to the facility.

Patient level outcomes data used to construct the facility outcomes variables, the dependent variables in the analysis, were obtained from patient discharge information in LTCH MedPAR LDS. The dependent variables include 1) percentage of discharges resulting in death in each LTCH, 2) percentage of discharges to acute care hospital, and 3) percentage of discharges resulting in a short stay outlier (SSO) payment. These dependent variables were calculated by taking the total deaths, discharges to acute care

and short stay outliers for each facility and dividing by the total discharges for that facility during the year.

The independent variable of interest is the 24/7, on-site presence of a physician. This variable was created from the results of the survey administered to each LTCH administrator. Additional independent variables included as controls in the analysis were facility case mix index (CMI), LTCH location, LTCH annual volume of discharges, the weighted average age of the LTCH population, average surgical and diagnostic codes per case , and facility average length of stay (ALOS).

The LTCH MedPAR LDS file contains information on the Medicare-Severity-Long-Term-Care-Diagnosis-Related Groups (MS LTC DRG) coding for each case, but does not include the relative weights associated with each DRG. Relative weights were obtained from another publicly available CMS file.(61) These weights were matched with the DRG for each case in the MedPAR file and a case mix index was developed for each facility according to the following procedure: For each facility the individual case weights associated with each discharge's DRG were added and the resulting sum was divided by the total number of discharges for that facility.

The LTCH location variable is a categorical variable developed by assigning each facility to one of four categories based upon the geographic location of the LTCH. The four categories are made up as follows: Category 1, representing the Northeast (CT, MA, RI, NJ, NY, DE, DC, MD, PA, VA, WV), Category 2, representing the South (AL, FL, GA, KY, MS, NC, SC, TN,

AR, LA, NM, OK, TX), Category 3, representing the Midwest (IL, IN, MI, MN, OH, WI, IA, KS, MO, NE), and Category 4, representing the West (CO, MT, ND, SD, UT, AZ, CA, HI, NV, AK, ID, OR, WA). LTCH volume is the number of discharges for each facility. The patient level MedPAR file contains a categorical variable to define the age of each discharge case into one of nine categories. Since the range of age for each category is not equal, a weighted average age was developed for each facility. The median was determined for each age category. The median for each category was then multiplied by the number of cases for that age category and the product was divided by the total cases for the facility to develop a weighted average age for each facility. The MedPAR file contains the number of surgical codes and diagnostic codes for each discharge from a facility. The number of surgical codes was summed and divided by the total cases to develop the variable of surgical codes per case. The variable of diagnostic codes per case was developed in the same fashion. Average length of stay was developed by combining the individual discharge LOS by the total discharges for each facility. The research hypothesis is that on-site physician presence is positively associated with less mortality, less discharge to acute care and less short stay outlier payment. Descriptive statistics for dependent and independent variables are displayed in Table 2 below.

Table 2 Descriptive statistics for variables from 400 LTCHs included in the data analysis

Statistic	% deaths	% discharge to acute	% short stay outlier	CMI	Case volume	Weighted age group	# surgical codes	# diagnostic codes	ALOS
Mean	13.59	12.19	32.09	1.091	348.7	70.797	2.135	8.742	31.45
Median	12.80	10.75	31.20	1.076	258.5	71.100	1.975	8.870	27.13
SD	7.936	7.885	9.244	.2120	287.3	3.478	1.150	.5393	28.67
Min	0	0	8.9	.4554	62	49.9	0	1.50	15.67
Max	88.6	73.2	86.6	1.938	2115	77.7	5.73	9.00	463.7

The dependent and independent variables were developed from the MedPAR patient level file for each LTCH as described above. The MedPAR patient level file contains information on 416 LTCHs, but LTCHs with less than 60 discharges were excluded from the analysis. This left 400 LTCHs remaining and Table 2 is presented to show the range of values for each variable that will be used in this study.

The second source of information for this research was the results of a questionnaire distributed electronically to the administrators of all LTCHs listed in the March 2011 CMS listing of LTCHs. The results from this questionnaire were linked by facility provider number to the information in the MedPAR file. Again, facility identifiers were only used for data analysis; no individual facility results were disclosed. All facilities responding to the questionnaire will

receive the results of this research at its conclusion. It was hoped that sharing the results of this research would encourage participation by the hospital administrators. There is no business advantage to withholding information on physician coverage. On the contrary, advertising the availability of physician coverage as a patient resource is a positive marketing strategy.

Email address information for the LTCH administrators will be obtained from several sources. The first source was the AHA Annual Survey of Hospitals. This is a publicly available listing of hospitals in the United States. All hospitals are not required to report to the AHA survey, so additional sources of information were used. Several proprietary LTCH organizations control the majority of LTCHs. These companies list contact information on the individual hospital websites, and email addresses were obtained from these websites. A final source of contact information was the investigator's personal contact with LTCH administrators gained through participation in professional organization events.

The questionnaire consisted of the following questions formatted as follows:

1. Does your LTCH provide 24/7, on-site physician coverage? Yes or No.

Answer yes only if there is a physician, available to respond in person to the LTCH patient's needs, within the building or campus that houses the LTCH, on a 24 hour, 7 days per week basis.

2. If your LTCH provides on-site physician coverage less than 24/7, what is your level of coverage? Please select from the choices below:
    a. Less than 4 hours per day
    b. At least 4 hours to less than8 hours per day
    c. At least 8 hours to less than 16 hours per day
    d. At least 16 hours to less than 24 hours per day
    e. Other (please specify)
3. What level of on-site physician coverage was in effect any time during: (Please answer for each time period)
   Hours of on-site coverage per day:
   (<4), (≥4 <8), (≥8 <16), (≥16 <24), (24)

    a. October 2007-September 2008
    b. October 2008-September 2009
    c. October 2009-September 2010
    d. October 2010-September 2011

The draft questionnaire was vetted for appropriateness by individuals with significant LTCH experience who were not currently in the administrator position at any LTCH facility and thus, would not be participants in this study. The questionnaire was distributed to all LTCHs, however only LTCHs with greater than 60 cases were included in the analysis of outcomes. Based on preliminary analysis of the data, there are 400 LTCHs that met these inclusion criteria. LTCHs with less than 60 cases were treated as start-up hospitals and not appropriate for inclusion in this research. This removed 16 facilities from the research on outcomes, but all hospital responses were used to describe the availability of physician coverage in the LTCH setting.

The questionnaire was sent out to all LTCHs listed in the March 2011 facility listing from CMS. The questionnaire has been developed and was sent using the Survey Monkey application; a web-based survey tool available in the public domain (surveymonkey.com). Participants were informed that this research is being performed to meet the investigator's dissertation requirement for Tulane University, that the investigator is also currently the administrator of a LTCH, that no individual patient or facility level data would be disclosed and that all participants would receive the results of the questionnaire.

Two weeks after the initial questionnaires were distributed, a reminder email was sent to any non-respondents. At the end of 30 days, follow-up phone calls were made to all non-responding hospitals. The goal of this research was to achieve at least a 40% response rate which would result in 160 responses. Studies have demonstrated that this is a reasonably expected response rate for an internet based questionnaire, considering the number of questions, pre and post questionnaire follow-up and salience of the inquiry to the study population.(62) The sample size required for statistical significance was determined according to Cohen, to achieve an α of 0.05 and a power of 0.80 assuming a medium effect.(63) The required sample size was determined to be 64 responses from each group of hospitals Thus, sufficient statistical power would be achieved with at least 64 responses from each group of hospitals.

d. Preliminary Analysis

All data was analyzed using SPSS version 19 (IBM SPSS, IBM Corporation, Somers, NY). Sample size allowed for analysis under an approximately normally distributed population according to central limit theorem. Tests of statistical significance between the means of hospitals with physician coverage and those without physician coverage were accomplished with T tests. Multiple regression analysis was employed to investigate relationships between the independent variables (facility characteristics) and the dependent variables (outcomes of interest). *Y* Outcome (expired) = B_0+B_1(age)+B_2(CMI)+B_3(surgery codes)+B_4(diagnostic codes)+B_5(volume)+B_6(location indicator)+B_7(ALOS)+B_8(on-site physician)+*e*

Y Outcome (d/c to acute) = B_0+B_1(age)+B_2(CMI)+B_3(surgery codes)+B_4(diagnostic codes)+B_5(volume)+B_6(location indicator)+B_7(ALOS)+B_8(on-site physician)+*e*

Y Outcome (SSO) = B_0+B_1(age)+B_2(CMI)+B_3(surgery codes)+B_4(diagnostic codes)+B_5(volume)+B_6(location indicator)+B_7(ALOS)+B_8(on-site physician)+*e.* A secondary logistic regression analysis was used with the presence or absence of 24/7 on-site physician coverage, coded as 0 or 1, as the dependent variable with the independent variables of age, diagnostic and surgical codes, location, case volume, CMI. LTCHs were classified as free-standing or hospitals within hospitals and the results were coded for inclusion as an independent variable in the analysis.

The purpose was to determine the predictability of a facility having 24/7 on-site physician coverage based on categorization as free-standing or HIH.

Both the investigator and advisor have completed programs in research ethics provided by the Collaborative Institutional Training Initiative as required by the Tulane Human Research Protection Program. This research protocol was submitted and approved by Tulane Office of Human Research Protection Institutional Review Board.

RESULTS

A total of 139,861 records were matched to the 416 LTCHs listed as the providers of service. Data from 382 LTCHs were retained for analysis. Exclusions from analysis were due to inadequate numbers of cases for newer facilities or facility closures occurring prior to March, 2011. Data collection from the distributed questionnaire began the second week of October, 2012 and continued through the end of December, 2012. Attempts were made to contact all LTCH providers from the MedPAR data file that were still active according to the March, 2011 list of LTCHs from the CMS website. Responses were received from 134 LTCHs. The initial email query resulted in 19 responses and a second email request acquired five additional responses. The remaining 110 responses came from telephone follow-up queries. The final response rate was 35%.

Non-Respondent Characteristics

Descriptive statistics, using chi-square, and t test comparisons of the characteristics of responding and non-responding LTCHs were obtained and the results are summarized in Table 3. The table displays the means and percentages for the responding group (N=134) and non-responding group (N=248) for each independent variable including number of beds (77 vs 71), volume of cases (314 vs 379), case mix index (1.11 vs 1.09), average length of stay (34 vs 30), diagnostic codes per case (8.78 vs 8.74), surgical codes per case (2.26 vs 2.08), weighted age (70.6 vs 70.9), HIH status (31% versus 36%), location in the Northeast (21 vs 38), the South (60 vs 136), the Midwest

(31 vs 50), and the West (22 vs 24) and for the dependent (or outcome) variables of mortality (13.37 vs 13.82), number of discharges to acute care (13.43 vs 11.29), and short stay outliers (33.13 vs 31.32). Among the independent variables, the only difference between respondents and non-respondents that was statistically significant was case volumes with respondents having a smaller number of cases than non-respondents. The non-respondent LTCH group cared for an average of 65 more cases than the respondent group. Among the three outcome variables, discharges to acute care showed a statistically significant difference ($p<.05$) with respondents discharging an average of 2.15 more patients to acute care hospitals than non-respondents. Thus respondents as a group appear to have lower volumes and more discharges to acute care hospitals than non-respondents.

Table 3 Characteristics of Responding and Non-Responding LTCHs

	LTCH Respondents to Questionnaire		Non-Respondents to Questionnaire		Respondents (N=134) vs. Non-Respondents (N=248)				
					t Test for Equality of Means			95% CI	
	N =134		N = 248		t	Sig.(2 tailed)	Mean difference	Lower	Upper
Outcome Variable	**Mean**	**SD**	**Mean**	**SD**					
Mortality	13.37	9.753	13.82	6.781	-0.532	0.595	-0.4533	-2.129	1.222
Discharge to Acute	13.43	7.888	11.29	6.783	2.786	*0.006	2.1478	0.6322	3.663
Short Stay Outlier	33.13	8.921	31.32	8.703	1.921	0.055	1.8087	-0.0423	3.659
Predictor Variable	**Mean**	**SD**	**Mean**	**SD**					
Beds	76.74	101.8	70.77	135.2	0.447	0.655	5.973	-20.28	32.22
volume	314.11	239.9	378.86	313.58	-2.083	*0.038	-64.75	-125.87	-3.626
CMI	1.113	0.2223	1.087	0.2041	1.114	0.266	0.0251	-0.0192	0.0695
ALOS	33.881	38.8583	30.281	22.4567	1.147	0.252	3.5999	-2.5688	9.7686
Dx Codes	8.777	0.3786	8.741	0.5492	0.67	0.503	0.0356	-0.0689	0.1402
Surg Codes	2.26	1.202	2.076	1.0822	1.526	0.128	0.1841	-0.0531	0.4213
Weighted Age	70.61	3.511	70.92	3.439	-0.853	0.394	-0.3169	-1.0473	0.4135
	Responding		Non-Responding		Chi Square			Sig.	
HIH	42	31%	89	36%	0.797			0.372	
LTCH location									
Northeast	21	16%	38	15%	0.008			0.928	
South	60	45%	136	55%	3.526			0.06	
Midwest	31	23%	50	20%	0.46			0.498	
West	22	16%	24	10%	3.732			0.053	

CMI=case mix index, ALOS=average length of stay, Dx codes=diagnostic codes per case, Surg codes=surgical codes per case

HIH=Hospital within Hospital, * Significant @ p<.05

Respondent Characteristics

The primary focus of this research was the determination of any difference in outcomes associated with the presence or absence of a physician on-site in the facility. On-site availability 24/7 was defined as a physician physically present in the LTCH or within the building that housed the LTCH and was immediately available to respond to the needs of the LTCH patient twenty-four hours per day, seven days per week. Among the 134 respondents, 70 LTCHs (52.2%) reported having 24/7 in-house physician availability, while 64 LTCHs (47.8%) indicated that they had less than 24/7

coverage. Descriptive statistics on responding hospitals grouped by physician availability are shown in Table 4. Although hospitals with 24/7 physician coverage had higher mortality (14.91 vs 11.69) than hospitals with less physician coverage, this difference was not statistically significant at $p < .05$ ($p = .055$). The small observed differences in discharges to acute care (13.50 vs 13.37) and short stay outliers (34.05 vs 32.12) were not statistically significant at the $p < .05$ level. Other independent variables that could influence outcomes were also compared across Group 1 and Group 2 facilities with the following results: hospitals with 24/7 physician coverage had more beds (81.6 vs 71.4), no difference in volume (315 vs 313), higher case mix index (1.154 vs 1.068), higher average length of stay (37 vs 30), no difference in diagnostic codes (8.78 vs 8.78), no difference in surgical codes (2.25 vs 2.27), no difference in weighted age (70 vs 71), were more frequently located in the Northeast (15 vs 6) and South (32 vs 28), and less frequently in the Midwest (13 vs 18) and West (10 vs 12), and were more likely to be an HIH (49% vs 13%). The analysis was also run substituting the median length of stay for the average length of stay to lessen the effect of any extreme high or low values. Making this change narrowed the gap between the two hospital groups from 6.7 using the ALOS to 2.1 using the median length of stay. However, the new result was not statistically significant. Only the higher case mix index and being an HIH were statistically significant for facilities with 24/7 coverage at $p<.05$.

Table 4 Characteristics of LTCHs with and without 24/7 on-site physician availability

	Respondents with 24/7 on-site Physician Availability		Respondents with < 24/7 on-site Physician Availability		24/7 Coverage (N=70) vs. Less than 24/7 Coverage (N=64)				
					t Test for Equality of Means			95% CI	
	N =70		N =64		t	Sig.(2 tailed)	Mean difference	Lower	Upper
Outcome Variable	**Mean**	**SD**	**Mean**	**SD**					
Mortality	14.91	11.42	11.69	7.238	1.932	0.055	3.226	-0.0765	6.529
Discharge to Acute	13.5	8.677	13.37	6.991	0.096	0.924	0.1312	-2.577	2.839
Short Stay Outlier	34.05	8.086	32.12	9.716	1.256	0.211	1.938	-1.111	4.979
Predictor Variable	**Mean**	**SD**	**Mean**	**SD**					
Beds	81.59	122.9	71.44	72.66	0.575	0.566	10.14	-24.76	45.06
volume	314.67	253.5	313.5	226.26	0.028	0.978	1.171	-81.23	83.57
CMI	1.154	0.2096	1.068	0.2287	2.267	*0.025	0.0858	0.0109	0.1607
ALOS	37.1	53.21	30.35	7.9	1.004	0.317	6.748	-6.54	20.04
Dx Codes	8.779	0.3618	8.775	0.399	0.068	0.946	0.0044	-0.1255	0.1344
Surg Codes	2.248	1.118	2.274	1.296	-0.123	0.902	-0.0256	-0.4383	0.3871
Weighted Age	70.09	4.129	71.17	2.597	-1.781	0.077	-1.073	-2.264	0.1185
	With 24/7 coverage		W/O 24/7 coverage		**Chi Square**			**Sig.**	
HIH	34	49%	8	13%	20.215			*<.001	
LTCH location									
Northeast	15	11%	6	5%	3.676			0.055	
South	32	24%	28	21%	0.052			0.819	
Midwest	13	10%	18	13%	1.716			0.19	
West	10	8%	12	9%	0.486			0.486	

CMI=case mix index, ALOS=average length of stay, Dx codes=diagnostic codes per case, Surg codes=surgical codes per case

HIH=Hospital within Hospital, * Significant @ p<.05

A secondary goal of this research was to explore relationship between 24/7 coverage and the three outcomes of mortality, discharges to acute care hospitals, and short stay outlier reimbursement after adjusting for the influence of the other independent variables using multivariate regression analysis. Descriptive statistics, histograms and boxplots were produced for the respondent data set and repeated with outlier cases removed to determine the need for transformations to achieve normality in the dependent variables. Based upon these results, the outcome “Mortality” was transformed to a square root function. This transformation resulted in marked improvement in the shape of the histogram and this was also confirmed by a reduction in

skewness and kurtosis from 3.728 and 25.710 to .216 and -.477 respectively. Transformations provided no additional benefit to the remaining outcomes. Using the data set of all responding hospitals, ordinary least squares regressions were run on each outcome variable. In addition to the independent variable measuring physician on site coverage, the model included controls for weighted age, case mix index, average number of surgical codes and average number of diagnostic codes per discharge, facility volume, region, and hospital within hospital status. Results are reported in Tables 5A, 5B and 5C.

Table 5A Model Summary for Mortality (Square Root)

Model	R	R Square	Adj R Square	SEE
1	0.577	0.333	0.278	0.84736

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	43.407	10	4.341	6.045	0.000
Residual	86.879	121	0.718		
Total	130.286	131			

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
Model	B	Std. Error	Beta	t	Sig.	Lower	Upper	Zero order	Partial	Part
(Constant)	3.933	2.209		1.781	0.077	-0.44	8.306			
Wtd Age	0.027	0.028	0.084	0.970	0.334	-0.029	0.083	0.037	0.088	0.072
CMI	2.257	0.404	0.502	5.591	*.000	1.458	3.056	0.413	0.453	0.415
Surg Codes	-0.013	0.069	-0.016	-0.191	0.849	-0.15	0.123	0.134	-0.017	-0.014
Dx Codes	-0.589	0.235	-0.225	-2.506	*.014	-1.054	-0.124	-0.029	-0.222	-0.186
Volume	0.000	0.000	-0.005	-0.055	0.956	-0.001	0.001	-0.120	-0.005	-0.004
Neast	-0.004	0.287	-0.001	-0.014	0.989	-0.572	0.564	-0.088	-0.001	-0.001
South	0.378	0.229	0.189	1.653	0.101	-0.075	0.832	0.229	0.149	0.123
Midwest	-0.121	0.238	-0.052	-0.510	0.611	-0.593	0.35	-0.177	-0.046	-0.038
24/7	0.018	0.172	0.009	0.105	0.916	-0.322	0.358	0.179	0.01	0.008
HIH	0.385	0.193	0.181	1.992	*.049	-0.002	0.768	0.350	0.178	0.148

Wtd Age=weighted age, CMI=case mix index, Surg Codes=average surgical codes per case

Dx Codes=average diagnostic codes per case, 24/7=around the clock coverage, HIH=hospital within hospital

Table 5B Model Summary for Discharge to Acute Care

Model	R	R Square	Adj R Square	SEE
1	0.538	0.29	0.232	6.4527

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2074.398	10	207.44	4.982	0.000
Residual	5079.758	122	41.637		
Total	7154.156	132			

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
Model	B	Std. Error	Beta	t	Sig.	Lower	Upper	Zero order	Partial	Part
(Constant)	8.332	16.199		0.514	0.608	-23.736	40.399			
Wtd Age	-0.184	0.187	-0.088	-0.982	0.328	-0.554	0.187	-0.137	-0.089	-0.075
CMI	2.409	3.100	0.073	0.777	0.438	-3.727	8.545	0.113	0.070	0.059
Surg Codes	0.262	0.519	0.043	0.504	0.615	-7.66	1.289	0.033	0.046	0.038
Dx Codes	1.910	1.764	0.099	1.083	0.281	-1.582	5.402	0.116	0.098	0.083
Volume	-0.002	0.003	-0.064	-0.704	0.483	-0.007	0.004	0.017	-0.064	0.054
Neast	2.931	2.223	0.143	1.319	0.190	-1.469	7.331	0.155	0.119	0.101
South	-3.450	1.712	-0.234	-2.015	*.046	-6.839	-0.061	-0.446	-0.180	-0.154
Midwest	2.167	1.811	0.125	1.196	0.234	-1.419	5.752	0.303	0.108	0.091
24/7	0.894	1.306	0.061	0.684	0.495	-1.692	3.48	-0.024	0.062	0.052
HIH	-4.530	1.475	-0.287	-3.070	*.003	-7.451	-1.609	-0.331	-0.268	-0.234

Wtd Age=weighted age, CMI=case mix index, Surg Codes=average surgical codes per case

Dx Codes=average diagnostic codes per case, 24/7=around the clock coverage, HIH=hospital within hospital

Table 5C Model Summary for Short Stay Outlier

Model	R	R Square	Adj R Square	SEE
1	0.381	0.145	0.075	8.3584

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1448.409	10	144.841	2.073	0.032
Residual	8523.202	122	69.862		
Total	9971.611	132			

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
Model	B	Std. Error	Beta	t	Sig.	Lower	Upper	Zero order	Partial	Part
(Constant)	44.411	20.949		2.120	0.036	2.941	85.881			
Wtd Age	-0.570	0.242	-0.228	-2.352	*.020	-1.049	-0.09	-0.140	-0.208	-0.197
CMI	6.932	3.982	0.177	1.741	0.084	-0.951	14.814	0.218	0.156	0.146
Surg Codes	0.582	0.670	0.080	0.868	0.387	-0.744	1.907	0.165	0.078	0.076
Dx Codes	1.588	2.287	0.069	0.694	0.489	-2.94	6.116	0.104	0.063	0.058
Volume	0.010	0.004	0.240	2.530	*.013	0.002	0.017	0.088	0.223	0.212
Neast	1.057	2.817	0.044	0.375	0.708	-4.519	6.634	-0.069	0.034	0.031
South	2.470	2.216	0.142	1.115	0.267	-1.916	6.856	0.002	0.100	0.093
Midwest	3.714	2.348	0.181	1.582	0.116	-0.934	8.361	0.123	0.142	0.132
24/7	-0.333	1.693	-0.019	-0.197	0.844	-3.684	3.017	0.092	-0.018	-0.016
HIH	2.549	1.896	0.137	1.345	0.181	-1.204	6.302	0.113	0.121	0.113

Wtd Age=weighted age, CMI=case mix index, Surg Codes=average surgical codes per case

Dx Codes=average diagnostic codes per case, 24/7=around the clock coverage, HIH=hospital within hospital

Just over one quarter of the variability in mortality was predicted by the independent variables as shown by the adjusted R^2 of .278. R for regression was significantly different from zero, F(10,121)=6.045, p<.001. The variables of case mix index (Unstandardized coefficient B=2.257, t=5.591, p<.001, 95% Confidence interval 1.458 to 3.056), average number of diagnostic codes (Unstandardized coefficient B= -.589, t= -2.506, p<.05,95% Confidence interval -1.054 to -.124) and hospital within hospital status (Unstandardized coefficient B= .385, t= 1.992, p<.05, 95% Confidence interval -.002 to .768) were statistically significant at p < .05. Thus having sicker patients (a higher case mix) in the facility increased the likelihood of mortality among patients, while average number of diagnostic codes per discharge (while controlling for patient acuity) was associated with lower mortality. Being a hospital within a hospital increased the number who died in the facility. These three variables accounted for .229 of the R^2 of .333. However, 24/7 physician coverage was not associated with facility differences in mortality. The outcome variable of mortality was transformed to the square root to improve the normality of the variable prior to performing the regression analysis. Using the transformed variable resulted in an unstandardized coefficient of 2.257 for the independent variable, CMI. To properly interpret this coefficient requires that it be reverse transformed by squaring the result to produce a value of 5.09. Using this reverse-transformed result, the regression can be interpreted to show that for every unit increase in the case mix index (CMI), the mean mortality rate can be expected to increase by 5.09 points.

Regressing the outcome of discharges to acute hospitals on the same independent variables resulted in a slightly less predictive model, with an adjusted R^2 .232, F(10,122)=4.982, p<.001. Two predictor variables were statistically significant: being located in the South (Unstandardized coefficient B= -3.450, t= -2.015, p<.05, Confidence interval -6.839 to -.061) and hospital within hospital status (Unstandardized coefficient B= -4.530, t= -3.070, p<.05, Confidence interval -7.451 to -1.609). Both were associated with a lower number of discharges to acute care hospitals. Physician coverage had no independent influence on this outcome measure.

The model was least predictive for the outcome of short stay outlier status, with an adjusted R^2 of .075. The weighted age variable (Unstandardized coefficient B= - .570, t= -2.352, p<.05, Confidence interval -1.049 to -.090), and the volume variable (Unstandardized coefficient B= .010, t= 2.530, p<.05, Confidence interval .002 to .017) were the only variables associated with short stay outliers in the facility. Having older patients reduced the number of short stay outliers and having a higher volume of patients increased the number of short stay outliers. Physician coverage variable did not explain variation in short stay outliers.

A second multivariate model was run using a broader measure of physician coverage. The variable of 24/7 on-site physician availability was amended to include those hospitals with dedicated on-site physician night coverage. Combining the two groups increased the number of hospitals classified as having 24/7 coverage from 70 to 101. Analysis with this changed

physician coverage variable, shown in Tables 6A,B &C, made no difference in the explanatory power of the model for mortality. However, this model had improved the explanatory power for the outcomes of discharge to acute care and short stay outlier. The adjusted R^2 improved to .240 from .232 for the outcome of discharges to acute care but in this model only HIH status was significant at $p<.001$ indicating that HIH status of the LTCH reduced percentage of patients discharged to acute care. The results for the outcome of short stay outlier also improved with the adjusted R^2 increasing from .075 to .085. In this model only volume was a statistically significant variable at $p<.05$, increasing the likelihood of a short stay outlier. Thus while the second measure of physician coverage improved the overall explanatory power of the model slightly, physician coverage continued to have no independent effect on patient outcomes.

Prior to undertaking this research, a minimum sample size of 64 responses per group was determined to achieve a power of .80. Splitting the sample of LTCHs with less than 24/7 on-site coverage reduced the sample of LTCHs with only "on-call" coverage to 33. Thus the power of this analysis was greatly reduced. However, this analysis was undertaken only to determine if the results were affected by a different measure of physician coverage.

Table 6A Model Summary for Mortality (Square Root) with new variable of combined coverage

Model	R	R Square	Adj R Square	SEE
2	0.578	0.334	0.279	0.84681

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	43.518	10	4.352	6.069	*<.001
Residual	86.769	121	0.717		
Total	130.286	131			

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
Model	B	Std. Error	Beta	t	Sig.	Lower	Upper	Zero order	Partial	Part
(Constant)	3.769	2.243		1.680	0.096	-0.672	8.21			
Wtd Age	0.032	0.030	0.098	1.051	0.295	-0.028	0.092	0.037	0.095	0.078
CMI	2.238	0.403	0.498	5.558	*<.001	1.441	3.036	0.413	0.451	0.412
Surg Codes	-0.009	0.069	-0.011	-0.137	0.892	-0.147	0.128	0.134	-0.012	-0.010
Dx Codes	-0.608	0.240	-0.233	-2.535	*<.05	-1.083	-0.133	-0.029	-0.225	-0.188
Volume	0.000	0.000	-0.016	-0.180	0.858	-0.001	0.001	-0.120	-0.016	-0.013
Neast	0.000	0.282	0.000	0.001	0.999	-0.559	0.56	-0.088	0.000	0.000
South	0.391	0.230	0.196	1.698	0.092	-0.065	0.846	0.229	0.153	0.126
Midwest	-0.113	0.239	-0.048	-0.471	0.638	-0.585	0.36	-0.177	-0.043	-0.035
Com. Cover	0.085	0.208	0.037	0.407	0.685	-0.327	0.496	0.109	0.037	0.03
HIH	0.367	0.190	0.172	1.931	0.056	-0.009	0.742	0.350	0.173	0.143

Wtd Age=weighted age, CMI=case mix index, Surg Codes=average surgical codes per case

Dx Codes=average diagnostic codes per case, Com. Cover=either 24/7 or night coverage , HIH=hospital within hospital

Table 6B Model Summary for Discharge to Acute Care with new variable of combined coverage

Model	R	R Square	Adj R Square	SEE
2	0.545	0.297	0.24	6.4196

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2126.423	10	212.642	5.16	*<.001
Residual	5027.733	122	41.211		
Total	7154.156	132			

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
Model	B	Std. Error	Beta	t	Sig.	Lower	Upper	Zero order	Partial	Part
(Constant)	5.447	16.316		0.334	0.739	-26.852	37.745			
Wtd Age	-0.107	0.198	-0.051	-0.540	0.590	-0.5	0.285	-0.137	-0.049	-0.041
CMI	2.131	3.081	0.064	0.692	0.491	-3.968	8.229	0.113	0.062	0.052
Surg Codes	0.339	0.521	0.055	0.651	0.516	-0.692	1.37	0.033	0.059	0.049
Dx Codes	1.530	1.786	0.079	0.857	0.393	-2.006	5.065	0.116	0.077	0.065
Volume	-0.003	0.003	-0.098	-1.027	0.307	-0.009	0.003	0.017	-0.093	-0.078
Neast	3.221	2.182	0.157	1.476	0.143	-1.099	7.541	0.155	0.132	0.112
South	-3.076	1.719	-0.209	-1.790	0.076	-6.479	0.326	-0.446	-0.160	-0.136
Midwest	2.389	1.809	0.138	1.321	0.189	-1.192	5.97	0.303	0.119	0.100
Com. Cover	2.066	1.569	0.122	1.317	0.19	-1.039	5.172	0.112	0.118	0.1
HIH	-4.809	1.443	-0.305	-3.333	*<.05	-7.665	-1.952	-0.331	-0.289	-0.253

Wtd Age=weighted age, CMI=case mix index, Surg Codes=average surgical codes per case

Dx Codes=average diagnostic codes per case, Com. Cover=either 24/7 or night coverage , HIH=hospital within hospital

Table 6C Model Summary for Short Stay Outliers with new variable of combined coverage

Model	R	R Square	Adj R Square	SEE
2	0.392	0.154	0.085	8.1361

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1534.298	10	153.43	2.219	*<.05
Residual	8437.313	122	69.158		
Total	9971.611	132			

	Unstandardized Coefficients		Standardized Coefficients			95% Confidence Interval for B		Correlations		
Model	B	Std. Error	Beta	t	Sig.	Lower	Upper	Zero order	Partial	Part
(Constant)	39.389	21.073		1.869	0.064	-2.327	81.106			
Wtd Age	-0.438	0.257	-0.175	-1.708	0.090	-0.946	0.07	-0.140	-0.153	-0.142
CMI	6.089	3.955	0.155	1.540	0.126	-1.74	13.918	0.218	0.138	0.128
Surg Codes	0.730	0.673	0.100	1.085	0.280	-0.602	2.063	0.165	0.098	0.090
Dx Codes	1.023	2.318	0.045	0.441	0.660	-3.567	5.612	0.104	0.040	0.037
Volume	0.008	0.004	0.201	2.016	*<.05	0	0.016	0.088	0.180	0.168
Neast	0.960	2.758	0.040	0.348	0.728	-4.5	6.42	-0.069	0.032	0.029
South	2.799	2.223	0.161	1.259	0.210	-1.602	7.201	0.002	0.113	0.105
Midwest	3.941	2.345	0.192	1.681	0.095	-0.701	8.583	0.123	0.150	0.140
Com. Cover	2.298	2.031	0.115	1.132	0.26	-1.721	6.318	0.221	0.102	0.094
HIH	1.658	1.859	0.089	0.892	0.374	-2.022	5.338	0.113	0.080	0.074

Wtd Age=weighted age, CMI=case mix index, Surg Codes=average surgical codes per case

Dx Codes=average diagnostic codes per case, Com. Cover=either 24/7 or night coverage , HIH=hospital within hospital

DISCUSSION

The primary purpose of this research was to describe the current level of on-site physician coverage available in the LTCH setting and determine if around-the-clock on-site physician availability affected the outcomes of mortality, discharges to acute care hospitals, or the occurrence of short stay outliers. The study used the CMS LTCH MedPAR Limited Data Set for Rate Year (RY) 2009, from which data was obtained on a targeted population of 416 LTCHs that submitted cost reports for the rate year of 2009. The sample was reduced to 382 LTCHs after removing new start-ups with limited data and LTCHs no longer operating as of March, 2011.

An original survey was distributed to all 382 LTCHs based upon the CMS list of operating LTCHs as of March, 2011. A combination of email and telephone responses resulted in a sub-sample of 134 LTCHs providing information on the availability of physician coverage currently and during the 2009 RY. This information was then matched with the LTCH MedPAR data using the facility Medicare Provider Number as the common link between the two files. Descriptive statistics were used to characterize the sample populations. The t test was used to evaluate the existence of a non-random difference in the characteristics and outcomes of responding LTCHs and non-responders and then between LTCHs reporting 24/7 on-site physician availability and those reporting a lower level of physician coverage. Finally, multivariate regression was employed to assess the association between the selected independent variables, including physician coverage, and outcomes.

Responding hospitals differed from the non-responding hospitals in only one of the three outcomes—discharges to acute care hospitals. The percentage of patients discharged to acute care hospitals was higher by two points in the group of LTCHs that responded to the survey (13% versus 11%). This difference was statistically significant at $p<.05$. The only independent variable with a statistically significant difference between the two groups was the mean volume of cases. Responding hospitals had a mean volume of 65 cases fewer than the non-respondents. The lower response rate by LTCHs with fewer discharges to acute care and a higher average volume of cases indicates that respondents to the survey are not representative and the results may not be generalizable to all LTCHs. Greater physician coverage is expected to reduce the need to discharge to an acute care facility controlling for patient volumes. Thus if non-responding hospitals also have higher levels of 24/7 physician coverage and this coverage helps them to better manage their patients, their omission from the sampled hospitals could bias downward the results on this outcome variable using only the sample of responding hospitals. However, differences in physician coverage among non-respondents cannot be ascertained to examine this possible bias.

The higher level of discharges to acute hospitals observed among responding hospitals could affect their ability to market their services and result in decreased case volumes. Anecdotal evidence in the field suggests that LTCHs with a reputation for sending patients back to a higher level of care lose the confidence of referral sources which would result in a lower volume of

cases admitted. Also a lower volume of cases could result in poorer financial performance which could limit resources available to treat patients at the LTCH without a need for discharge to acute care. Thus LTCHs have an incentive to avoid discharges to acute care.

Discharges back to acute care hospitals may be categorized as planned or unplanned. Planned discharges may typically occur when the LTCH patient requires a certain amount of recovery or treatment prior to returning to the acute hospital for a follow-up surgical procedure. Unplanned discharges to acute hospitals are usually the result of an emergent episode that the LTCH is not equipped to manage or that a physician is uncomfortable treating in the LTCH setting, or a lack of communication between providers regarding the patient's plan of care. If the LTCH's reputation is affected by a higher level of unplanned discharges to acute care, we would expect to see an associated lower volume of cases. In this study, it was not possible to determine whether discharges were planned or unplanned, however.

Significant differences in the case mix index (indicating patient acuity), the number of surgical codes (indicating the number of surgical procedures performed), or the number of diagnostic codes (indicating patient comorbidities) could help explain the difference in discharges to acute hospitals between responding and non-responding hospitals. However, these variables were not significantly different between the two groups. Hospital within hospital status could imply the availability of increased resources to manage acute conditions among patients in the LTCH, but this variable was

also not significantly different between responders and non-responders. Other variables that may influence discharges to acute hospitals, such as patient preference, availability of medical specialists in the LTCH, and surgical or intensive care capabilities were not available through the MedPAR data file and could not be measured in this study.

The volume of cases in a facility could be limited by bed capacity, but number of beds did not show a significant difference between responders and non-responders. Thus given no difference in bed size, higher volumes could reflect lower excess capacity and greater need to discharge appropriately to free up beds. Also LTCHs could have similar numbers of beds, but may have significantly different staffing capabilities which could limit or enhance the ability to take more cases. It is possible that facilities with limited staffing capabilities have less ability to adjust staffing to meet changing clinical situations and this could necessitate the discharge of patients to the acute care setting. This study did not measure staffing capacity, and although there was no significant difference in bed capacity, it is unknown whether the facilities staffed for the full complement of beds.

The second level of analysis was limited to the 134 LTCHs that responded to the survey and provided data related to the level of on-site physician coverage. The responding LTCHs were subdivided into two groups. Group 1 included 70 LTCHs that reported that they had a physician available on-site, 24 hours per day, 7 days per week during RY 2009. Group 2 included 64 LTCHs that indicated that they did not provide 24/7, in-house physician

availability during that time. Approximately half (33) of the group of hospitals without 24/7 physician coverage said that they relied on the attending physician or an alternate to be “on-call” when not physically present in the LTCH. Physician response times or how frequently physicians were required to return to the LTCH to attend to a patient’s needs were not measured in this study. The initial premise of this study was that the immediate availability of a physician in-house would provide a resource that would decrease mortality, decrease discharges back to the acute care setting by clinically managing problems in the LTCH, and better monitor the patients’ lengths of stay to avoid short-stay outlier reimbursement. Based on descriptive statistics, patient outcomes in LTCHs with 24/7 coverage were no different than those observed in facilities without such coverage. Thus the results of this study failed to refute the null hypothesis that there are no differences in outcomes between the LTCHs with 24/7 physician availability and those with less coverage.

Only one independent variable, case mix index (CMI), was significantly different ($p<.05$) between groups with LTCHs that had 24/7 coverage having a slightly higher mean (1.154 vs. 1.068). The case mix index reflects the weighting assigned to the diagnostic related groups (DRG) and can serve as a proxy for the resources required to care for a particular group of patients. Thus, this difference in CMI between groups indicates that LTCHs with around the clock physician availability have patients with a slightly higher acuity who are more costly to treat. Case weights of the assigned DRG directly impact the LTCH’s reimbursement. Higher case weights result in higher Medicare

reimbursement. LTCH managers assess and admit patients on an elective basis and may control the clinical makeup of the population they serve. The ability to accept and manage the needs of higher acuity patients may be made possible by the increased presence of in-house physicians, offsetting the effect of patient acuity on outcome variables. In other words, the decision to care for higher acuity patients may have also encouraged LTCH managers to provide 24/7 physician coverage in order to be successful in their market.

The results of a logistic regression predicting the likelihood that a LTCH would have 24/7 physician coverage is displayed in Table 7. Facilities that reported having 24/7 coverage were coded as a 1or did not report having 24/7coverage were coded as a zero. Higher CMI increased the likelihood of having 24/7 coverage but the result was not statistically significant. Only being a hospital in a hospital (HIH) was a statistically significant predictor of having 24/7 physician coverage and the results indicate that being an HIH increased the likelihood that a LTCH administrator would report having 24/7 coverage by almost seven fold.

Table 7 Logistic Regression

Model Summary

Step	-2 Log Likelihood	Cox & Snell R Square	Nagelkerke R Square
1	159.955	0.174	0.232

Observed		Predicted		
		24/7 On-site coverage		Percent Correct
		0	1	
24/7 coverage	0	51	13	79.7
	1	30	40	57.1
Overall Percentage				67.9

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
HIH	1.91	0.463	16.995	1	*<.001	6.751
volume	0.001	0.001	2.057	1	0.151	1.001
CMI	1.502	0.909	2.734	1	0.098	4.492
constant	-2.485	1.12	4.922	1	0.027	0.083

While there was no difference in the proportions of respondents and non-respondents that were operating hospitals within hospitals (HIH), analysis of respondents showed that around the clock, on-site physician availability was considerably more prevalent in the 42 responding LTCHs categorized as hospitals within hospitals as compared to the 92 freestanding LTCHs. Results are displayed in Table 8. Among the responding HIH, over 80% (34/42) reported having 24/7 physician availability. This led to an additional analysis comparing the LTCHs on the basis of HIH status. Statistically significant ($p<.05$) differences were found in the outcomes of mortality and discharges to acute care for HIH facilities as compared to freestanding facilities as well as in number of beds, volume of cases, CMI and average number of surgical codes per discharge. LTCHs classified as HIH were found to have higher mortality

rates (16.5 vs 11.9), lower discharges to acute care (9.6 vs 15.1), be smaller and care for sicker patients.

HIH have on average 63 fewer beds, 118 fewer cases, a .0997 points higher CMI, a .4 higher average number of surgical codes per discharge. Smaller bed size is consistent with the fact that many HIH LTCHs were developed in underutilized areas of existing acute care hospitals, usually taking over one wing or a floor for LTCH operations. Lower case volume could be a product of lower bed capacity, staffing capabilities, stricter admitting policies, available referral sources or marketing efforts. A higher CMI and greater number of surgical codes per discharge could reflect access to and utilization of resources not available in the freestanding LTCH, including physician availability in the hospital. Freestanding LTCHs may possess staff with the clinical expertise and competence to perform some surgical and treatment procedures, but the freestanding LTCH may not have the facilities available to provide those services.

Table 8 Characteristics of Hospital within Hospital (HIH) LTCHs and Freestanding LTCHs									
	Respondents classified as HIH		Respondents classified as freestanding		HIH (N=42) vs. Freestanding (N=92)				
					t Test for Equality of Means			95% CI	
	N =42		N =92		t	Sig.(2 tailed	Mean difference	Lower	Upper
Outcome Variable	**Mean**	**SD**	**Mean**	**SD**					
Mortality	16.5310	7.3443	11.9360	10.3945	2.5830	*<.05	4.5910	1.0764	8.1137
Discharge to Acute	9.6170	5.7265	15.1820	8.1457	-4.5410	*<.001	-5.5649	-7.9937	-3.1360
Short Stay Outlier	34.3900	7.1598	32.5580	9.5997	1.1040	0.272	1.8329	-1.4506	5.1164
Predictor Variable	**Mean**	**SD**	**Mean**	**SD**					
Beds	33.3800	10.0390	96.5300	117.6380	-5.1090	*<.001	-63.1520	-87.6970	-38.6060
volume	233.1700	103.5780	351.0700	273.7300	-3.6040	*<.001	-117.8990	-182.6140	-53.1830
CMI	1.1816	0.1698	1.0818	0.2369	2.7710	*<.05	0.0998	0.0284	0.1712
ALOS	28.2710	3.2875	36.4410	46.6997	-1.1300	0.26	-8.1700	-22.4692	6.1293
Dx Codes	8.7952	0.2245	8.7689	0.4320	0.3720	0.71	0.0263	-0.1136	0.1663
Surg Codes	2.5383	0.8358	2.1337	1.3210	2.1450	*<.05	0.4046	0.0310	0.7782
Weighted Age	70.7950	2.0233	70.5250	4.0195	0.4120	0.681	0.2702	-1.0274	1.5679
CMI=case mix index, ALOS=average length of stay, Dx codes=diagnostic codes per case, Surg codes=surgical codes per case									

The increase in mortality among HIH facilities may be related to the increase in CMI or it could reflect the patient selection criteria of the LTCH. The available patient population in the HIH LTCHs host facility could also influence the types of patients admitted to the LTCH and their outcomes. If profit maximization is not the primary purpose of the LTCH, the LTCH may consider a wider range of patient conditions and prognoses for admission. Some HIH LTCHs operate as part of larger health care systems, often the same systems that operate the LTCH's host hospital. In these situations, the LTCH's financial performance may be graded on the overall benefit provided to the system, rather than the results posted on the LTCH's income statement. Providing an earlier discharge option for the host hospital allows the host to avoid outliers and has the potential to improve the host hospital's financial performance. Less frequent discharges to acute care may reflect that the HIH

LTCH operates within the walls of an acute care hospital and may have access to all the diagnostic and treatment modalities available in that hospital. Thus a discharge to acute care may be avoided because the same level of services can be obtained in the LTCH without necessitating a discharge to the acute care hospital.

Finally, including the 24/7, on-site availability of a physician as an independent variable, the regression models were found to account for twenty eight percent of the variability in the outcome of mortality, twenty three percent of the variability in discharges to acute care hospitals and only seven percent of the variability in short stay outliers. The regression analysis was repeated replacing the variable of 24/7, on-site physician availability with a variable that combined 24/7 availability and night coverage. Changing the variable did not appreciably alter the results that physician coverage had no impact on any of these three outcomes of the LTCH.

LIMITATIONS

The strength of this research was contingent upon the response rate of the hospitals that were queried. An attempt was made to solicit a response, by either electronic or telephonic means, from every LTCH that was in operation during the 2009 rate year. While significant insights may be gained by examining the MedPAR file as it exists, the primary question of the impact of on-site physician availability relied on the hospital response rate. A minimum of sixty-four responses were required from each group of hospitals to achieve adequate power. At the conclusion of data collection, 64 responses were received from hospitals not claiming 24/7 on-site physician availability and 70 responses were received from those with around the clock physician availability. A perfect response rate would have captured responses from all 382 LTCHs eligible for study. The current study achieved a 35% response rate. The goal prior to beginning data collection was 40%. The lower response rate achieved during data collection may prevent this research from inferring a causal effect between the independent and outcome variables but still provides sufficient sample size to achieve adequate power. Less than expected response rate and the significant differences between responding and non-responding hospitals question the external validity of the research and its ability to be generalized to the entire population of LTCHs.

Contact information for the administrators of LTCHs was obtained from the AHA Annual Guide, facility web-sites and personal correspondence. Personnel in the role of LTCH administrator change often, and some of the

email addresses obtained were obsolete by the conclusion of data collection. Attempts to contact the current LTCH administrators by telephone were made difficult by administrative staff unwillingness to accept unsolicited inquiries and the increasing use of automated telephone systems which do not allow the ability to speak with a person.

The data files used in this analysis were provided by CMS and only contained information on cases reimbursed by the Medicare program. LTCH cases reimbursed by Medicare Managed Care plans, state Medicaid plans, commercial plans or individual payments were excluded from this research. It is possible that in some facilities, these non-Medicare cases may be significant and this analysis could have missed important inferences regarding this population and the use of physician coverage. The short stay outlier outcome reflects a reimbursement policy of CMS and only applies to cases covered by Medicare payments. The outcome has no financial relevance to non-Medicare cases.

Based on the premise that active involvement of intensivists provides more desirable outcomes in the ICU setting, the expectation of this research was that those LTCHs with constant and immediate access to physicians would have better outcomes related to mortality, discharges to acute hospitals and short-stay outlier payments. Not included in this study was coverage provided by physician extenders such as advanced practice nurses and physician assistants, a growing trend in some post-acute care venues. Nor was the use of telemedicine capability considered in this study.

This study focused on the availability of physician coverage and did not try to discern the specialty or sub-specialties of the physicians involved. Because LTCHs treat a high volume of patients with respiratory diagnoses, facilities utilizing pulmonary or critical care physicians may have an advantage over facilities that utilize fewer specialized physicians. This aspect of operations was not evaluated in this study but may be worthy of investigation in future research. Finally it is not clear whether facilities that choose to have an on-site, full-time physician make that decision based on their case mix, their HIH status, and their case volumes. As a joint decision, physician coverage may not be an independent variable but one that is largely determined by other independent variables in the model. Further, the physician variable may have errors in measurement because the responses were based on respondent recall for 2009.

The individual markets for LTCH services vary widely across the country. Several areas of the country have no LTCH presence while others have a high number of LTCHs per region. This was addressed in this research by considering the effects of location. The distribution of responding LTCHs was similar to the national distribution of all LTCHs operating in RY 2009. The regional distribution of responding LTCHs is compared to the distribution of all LTCHs as follows: North East 16% vs. 15%, South 45% vs. 51%, Midwest 23% vs. 21% and West 16% vs. 12%. However, the availability and capabilities of other post-acute care providers in the local market were not assessed in this study and may be significant in providing discharge options to

the short-stay acute care hospitals which could contribute to the explanatory power of this research. Depending on the admission policies used by the LTCH and the availability of alternate post-acute care venues, patients with very poor prognoses may be admitted to skilled nursing or hospice facilities in some markets. Markets without alternate post-acute care options may be more likely to admit to LTCHs or have those patients remain in the short stay hospital. Therefore, the options available in a particular market can impact the outcomes of interest in this study.

The quality of care provided by the facility was not assessed. Physician coverage may be associated with quality of care. At this point in time, there is no publicly available, comprehensive database for the comparison of quality in the LTCH setting. LTCHs operate as acute or chronic care hospitals but are considered post-acute care providers and are not included in Medicare Hospital Compare data. The CMS has recently implemented quality data reporting for LTCHs for three measures; central line associated blood stream infections, catheter associated urinary tract infections and development or worsening of pressure ulcers. This data is reported through the use of the CARE Data Set and all LTCHs were required to begin collecting data as of October 1, 2012. Failure to complete and submit the CARE Data Set will result in financial penalties beginning in 2014. As additional quality metrics are required, the CARE Data Set may become a valuable tool in evaluating the differences between LTCH providers.

Tracking the ultimate outcome of patients in the LTCH setting was beyond the scope of this project. While it would be beneficial to know the morbidity and mortality results of patients at three months and twelve months after discharge from the LTCH, the datasets used in this study did not contain that information. Therefore, this research only captures the immediate discharge status of LTCH patients. Discharges to an acute care hospital may mask mortality statistics for some LTCHs, especially if the patient expired in the acute care hospital immediately after discharge from the LTCH.

Finally this research did not distinguish between for-profit and not-for – profit status of the facility or its affiliation with a hospital system. As suggested above, these attributes of the LTCH may have affected managerial decisions regarding the employment of 24/7 physician coverage and their overall performance on patient outcomes. Future research should explore the role these organizational factors play in physician coverage.

CONCLUSIONS

The initial hypothesis of this research was that the continuous availability of a physician on the premises of the LTCH would impact the outcomes of mortality, discharges to acute care hospitals and short stay outlier reimbursement. Results of this study indicated that 52% of the responding LTCHs had around the clock access to an on-site physician in RY2009. This degree of coverage was often achieved through arrangements with one or more physician groups or through a purchased service agreement with the LTCH's host hospital in the case of LTCHs operating as "hospitals within hospitals". Contrary to expectations, this research has demonstrated that the 24 hour presence of a physician on-site was not associated with the outcomes of mortality, discharge to acute care, or short stay outlier reimbursement. During data collection some LTCHs indicated the provision of in-house night coverage. This was defined as less than 24/7 coverage but at least 8 to 12 hours of physician on-site availability. Too few of the respondents reported this level of coverage to create a separate category for analysis with the desired power.

Although failing to reject the null hypotheses that on-site physician availability has no affect on the outcomes of mortality, discharges to acute care or short stay outlier reimbursement, this study contributes several important findings to the body of knowledge on LTCHs. Mortality was found to be associated with HIH status, CMI and average number of diagnostic codes per discharge. The finding that LTCHs operating as HIH were associated with

higher mortality was unexpected. HIH LTCHs were seven times more likely to provide 24/7, on-site physician availability than freestanding LTCHs. As might be expected, the case mix index was positively related to mortality. CMI is a function of the cumulative relative weights assigned to each DRG coded to a discharged case, divided by the number of discharged cases. CMI is a measure of the relative resources utilized for each diagnoses and it is logical to expect that increased resource utilization equates to increased acuity which leads to a higher probability of death. The average number of diagnostic codes per discharge had an inverse relation to mortality. This study only considered the number of diagnostic codes per discharge as a measure of patient complexity. The MedPAR data set displays up to nine diagnostic codes per case. Coding procedures allow some discretion in the entry of diagnostic codes onto the Medicare claim form. Analyzing the specific diagnostic codes displayed in the data set was not performed in this research. A focus on the individual diagnostic codes rather than the number of codes per discharge may have provided greater insight into the mortality outcome.

While analyzing the outcome variable of discharges to acute care hospitals only HIH status and location in the southern region demonstrated a statistically significant association. Both variables were inversely related to the outcome variable. Since HIH LTCHs tend to have higher mortality and less transfers to acute care, it may be that HIH LTCHs are more comfortable managing higher acuity patients, whose conditions may often result in death, rather than sending the critical patient to an acute care hospital. This research

did not attempt to assess the quality of care in the LTCH setting and cannot determine if deaths within the facilities were avoidable. However, the implications for the Medicare system of a discharge to an acute hospital is that an additional DRG is being generated by another facility which will result in an additional spend for the system. The highest numbers of LTCHs are located in the southern region. This may lead to a more competitive market environment which may explain the negative association between discharges to acute care and LTCHs located in the south.

Short stay outlier reimbursement was associated with lower age and higher volume. Facilities with a younger age group of patients may experience a quicker healing and recovery rate in this population which could lead to earlier discharges, which are appropriate, but fail to meet the SSO threshold. The fact that LTCHs with higher volume are associated with higher SSO rates could indicate that they are achieving higher volumes by being less stringent in their admission policies and accepting patients less likely to require a length of stay necessary to reach the SSO threshold.

As early as 2004, MedPAC recommended the creation of facility and patient criteria to assure that only appropriate admissions to the LTCH setting would be reimbursed by the Medicare system. Congress commissioned RTI, International to research and determine if appropriate criteria could be developed to achieve this goal. RTI concluded that many LTCH patients are not unlike those cared for in step-down units of short stay hospitals and criteria have yet to be developed for LTCHs. CMS and MedPAC continue to call for

the development of LTCH criteria and the proposed Medicare LTCH PPS rule for FY 2014 includes language that outlines what it calls potential revisions of the LTCH PPS that would encourage LTCHs to admit patients fitting a Chronically Critically Ill profile. As MedPAC and CMS continue to move towards developing a criteria for LTCHs, the results of this study imply that the continuous presence of a physician on-site should not be considered a necessary component of that criteria

The variables contained in the current MedPAR Limited Data set only partially explain the variability in the outcomes of mortality and discharges to acute care hospitals. More research is necessary to identify the factors that lead to quality outcomes in this population. Significant differences were found between HIH and freestanding LTCHs. Future research should investigate the differences between HIH and freestanding LTCHs. What services are being utilized in the HIH? This study did not consider the differences between for-profit LTCHs and not-for-profit LTCHs. CMS' concern that HIH LTCHs would function as units of short stay hospitals but receive additional Medicare reimbursement resulted in the creation of the "25% rule" to arbitrarily limit admissions from a HIH LTCH's host hospital. This rule is now being extended to prevent all LTCHs from receiving more than 25% of their admissions from any one referral source. Additional research on the differences between LTCHs operating under the same organizational umbrella as their host hospital and those operating under the control of a totally dissociated entity from the host hospital should be undertaken and may lead to less arbitrary

rules which currently restrict Medicare beneficiaries' access based upon their location.

Market differences should be explored with an emphasis on discovery of differences in post-acute care provider availability. LTCHs are not evenly distributed by geography or population. MedPAC and CMS have assumed that similar patients cared for in LTCHs are cared for in acute care hospitals and skilled nursing facilities in areas without access to LTCHs. This assumption should be tested to determine if patients are receiving appropriate, quality care in venues less expensive to the Medicare system.

Published research on outcomes in the LTCH setting is limited and has mainly been focused on patients requiring mechanical ventilation. This research described the characteristics of LTCHs and explored the relationship between one of those characteristics, physician coverage, and outcomes. Medicare is the primary source of reimbursement for LTCHs and CMS has questioned the value that LTCHs provide to its beneficiaries. LTCHs are the most expensive per case venues for post-acute care, but few studies have been performed to show the benefit of this more expensive level of care. As our healthcare system continues to transform from a fee-for-service to a value-based reimbursement system, LTCHs must pool their data and support research to provide scientific evidence to support their cost to the Medicare system.

Appendix 1

Comparison of IPPS and LTC-PPS Payment Methodologies Using DRG 207 and RY 2011 rates as an Example

IPPS Payment Calculation of DRG 207 for Short Term Acute Care Hospital

Federal Base Rate $5164
Adjustment for Area Wage Index results in Adjusted Federal Rate = $5,164
Case Mix Adjustment for MS-DRG 207 = $5,164 X 5.2068 = $26,888
Adjusted for Capital Add On and Geographic Factors results in Adjusted Base Payment for MS-DRG 207 = $26,888
This total may then be adjusted for Indirect Medical Education or Disproportionate Share payments.
Finally, this payment may be adjusted if the case was a High Cost Outlier or if it fell under the Post-Acute Transfer Rule.

For this example the Short Term Acute Care Hospital would have received a Medicare payment of $26,888 minus the patient's responsibility for any copayment or deductible.
The geometric mean length of stay for this MS-DRG 207 would have been 12.6 days with an average Medicare per diem payment of $2,134 per day.

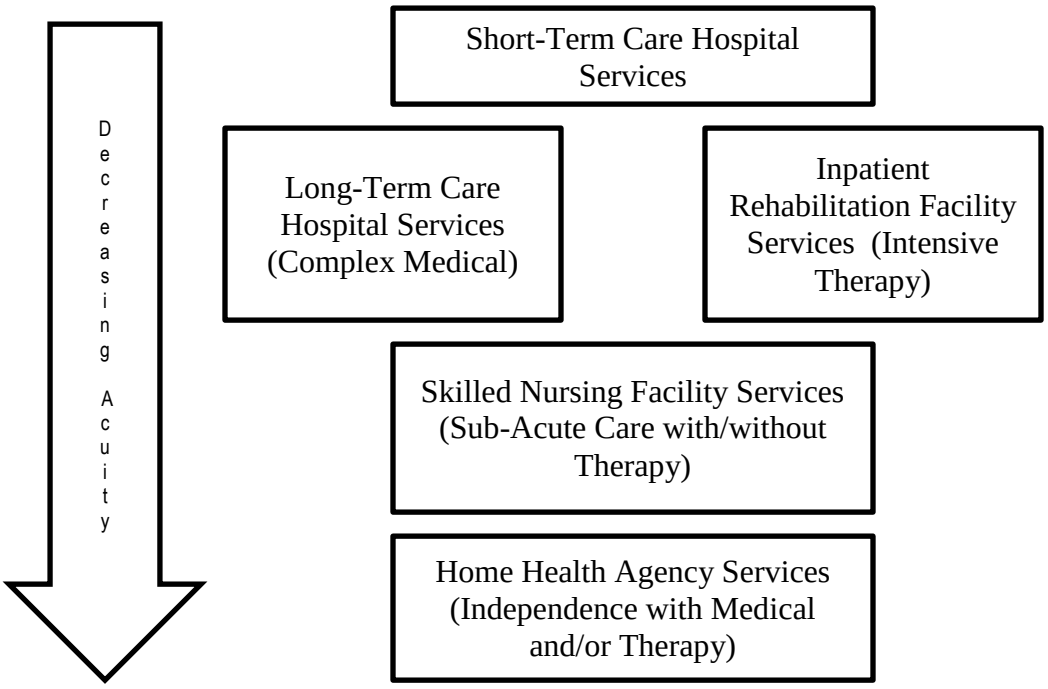
LTC-PPS Payment Calculation of LTC-MS-DRG 207 for Long Term Care Hospital

Federal Base Rate $39,600
Adjusted for Area Wage Index results in Adjusted Federal Rate = $39,600
Case Mix Adjustment for LTC-MS-DRG 207 = $39,600 X 2.0259 = $80,225
Adjustment for Budget Neutrality Factor results in Adjusted Payment for LTC-MS-DRG 207 = $80,225
This payment may be further adjusted if the case falls under High Cost Outlier or Short Stay Outlier status.

For this example the LTCH would receive a Medicare payment of $80,225 minus the patient's responsibility for any copayment or deductible. The geometric mean length of stay for this LTC-MS-DRG 207 would have been 33.4 days with an average Medicare per diem payment of $2,402.

Appendix 2

Continuum of Care Pathway



Comparison of Health Care Settings

Services Available	Short Stay Hospital ICU	Short Stay Hospital Med-Surg Area	Long Term Care Hospital	Inpatient Rehab Facility	Skilled Nursing Facility
Nursing Hours per patient day	12	4.5 – 6.5	7.5 - 12	6 – 6.5	3 - 4
Daily Physician Visits	yes	yes	yes	Seen by physiatrist daily	Typically once per month
Access to Consulting Specialtists	yes	yes	yes	Dependent on facility	Dependent on facility, typically not
Immediate access to diagnostics	yes	yes	yes	Varies by facility	no
Management of cardiac drips	yes	no	yes	no	no
Management of Mechanical Ventilatory Support	yes	no	yes	no	no

Appendix 3

Ten Most Common DRGs from Hospital Stays Preceding Admission to SNF

DRG	DRG of Preceding Hospital Stay
544	Major joint and limb reattachment of lower extremity
127	Heart failure and shock
89	Simple pneumonia and pleurisy, age>17, with CC
576	Septicemia without mechanical ventilation 96+ hours, age>17
210	Hip and femur procedures except major joint, age>17, with CC
320	Kidney and urinary tract infection, age>17, with CC
14	Intracranial hemorrhage and stroke with infarction
316	Renal failure
462	Rehabilitation
296	Nutritional and miscellaneous metabolic disorders, age>17, with CC

Thirteen medical conditions that must be met by 60% of IRF admissions

- Stroke
- Spinal cord injury
- Congenital deformity
- Amputation
- Major multiple trauma
- Hip fracture
- Brain injury
- Neurologic disorder
- Burns
- Three arthritis conditions unresponsive to appropriate aggressive and sustained outpatient therapy
- Joint replacement for both knees or hips when surgery immediately precedes admission, when BMI ≥ 50 or age > 85

Top 10 LTCH Discharge MS-LTC-DRGs

MS-LTC-DRG	Description
207	Respiratory system diagnosis with ventilator support 96+ hours
189	Pulmonary edema and respiratory failure
871	Septicemia or severe sepsis without ventilator support 96+ hours, with MCC
177	Respiratory infections and inflammations with MCC
592	Skin ulcers with MCC
949	Aftercare with CC/MCC
193	Simple pneumonia and pleurisy with MCC
593	Skin ulcers with CC
190	Chronic obstructive pulmonary disease with MCC
208	Respiratory system diagnosis with ventilator support < 96 hours

Appendix 4

Recommendations from Research Triangle Institute, International Study: Long-Term Care Hospital (LTCH) Payment System Monitoring and Evaluation

A. Patient-Level Recommendations

***Recommendation 1*:** Restrict LTCH admissions to cases that meet certain medical conditions, including having a primary diagnosis that is medical in nature, not function or psychiatric, and meeting a certain level of medical complexity that reflects severely ill populations.

Recommendation 2: Require LTCH Admissions to be discharged if not having diagnostic procedures or improving with treatment, such as those receiving long term ventilator management.

Recommendation 3: Develop a list of criteria to measure medical severity for hospital admissions.

Recommendation 4: Establish a Technical Advisory Group.

Recommendation 5: Establish a data collection mechanism to collect this information.

Recommendation 6: Require LTCHs to collect functional measures as well as physiologic measures on all patients receiving physical, occupational, or speech and language pathology services.

B. Facility Level Recommendations

Recommendation 7: Standardize conditions of participation and set staffing requirements to ensure appropriate staff for treating medically complex cases.

Recommendation 8*:* Keep the 25 day average length stay requirement in place to limit LTCH's incentives to unbundle and clearly delineate between general and long term acute patients.

C. Recommendations to improve consistency between general acute and long term acute hospital payment and certification policies.

Recommendation 9: Allow LTCHs, like general acute hospitals, to open certified, distinct-part rehabilitation and psychiatric units if CMS finds that restricting LTCH admissions to the medically complex cases results in access problems for IRF or psychiatric patient populations.

Recommendation 10: Require LTCHs to meet the same regulatory restrictions as general acute hospitals by limiting their allowance to only one of each type of distinct-part unit.

Recommendation 11: Establish payment rules that provide a disincentive for LTCHs to transfer cases early to other post-acute settings.

Recommendation 12: Conduct additional research to examine costs associated with different segments of an acute episode for medically complex patients. This should also include an examination of the IPPS margins for common types of LTCH cases.

D. Administrative recommendations.

Recommendation 13: Establish a provider identification code for satellite facilities and hospitals in hospitals (HIH).

Recommendation 14: Strengthen the requirement for parent facilities to report satellite locations by requiring them to be identified on the cost report.

Recommendation 15: Clarify QIO roles in overseeing appropriateness of admissions of LTCHS

Appendix 5

HOSPITAL CHARACTERISTICS CAPTURED IN THE MEDICARE PROVIDER OF SERVICE (POS) FILE

Total Beds
Certified Beds
CLIA number
Medical School Affiliation
Psychiatric Beds
Residency Program

PERSONNEL, NUMBER OF:

CRNA
Dietician
Licensed Practical Nurse
Med Tech
Nuclear Med Tech
Occupational Therapist
Physical Therapist
Physician Assistant
Psychologist
Radiology Tech
Registered Nurse
Registered Pharmacist
Resident
Respiratory Therapist
Speech Language Pathologist
Employed Physician
Social Worker

SERVICES:

Hemodialysis
Drug/Alcohol
Ambulance
Anesthesia
Audiology
Blood Bank
Burn Care
Cardiac Cath
CardioThoracic Surgery
Chemotherapy
Chiropractic
CT Scan
Dental
Dietary
Emergency Department
Gerontology
Home Health
Hospice
ICU
Laboratory
Long Term Care (Swing Bed)
MRI
Nursery
Neurosurgery
Nuclear Medicine
Obstetrics
Occupational Therapy
Operating Room
Organ Bank
Transplant
Outpatient
Pediatrics
PET Scan
Pharmacy
Physical Therapy
Post Anesthesia Recovery
Psychiatry
Diagnostic Radiology
Therapeutic Radiology
Rehabilitation
Lithotriptor
Social Work
Speech Therapy
Respiratory Therapy

Appendix 6

Patient characteristics of the RY2009 LTCH LDS MedPAR File

Patient Sex

	Frequency	Percent
Male	67514	48.3
Female	72347	51.7
Total	139861	100

Patient Age

	Frequency	Percent
< 25	208	.1
25 - 44	5318	3.8
45 - 64	26031	18.6
65 - 69	22485	16.1
70 - 74	19203	13.7
75 - 79	21366	15.3
80 - 84	21419	15.3
85 - 89	15415	11.0
≥ 90	8416	6.0
Total	139861	100

Patient Race

	Frequency	Percent
Unknown	339	.2
White	101820	72.8
Black	28132	20.1
Other	1919	1.4
Asian	1704	1.2
Hispanic	4988	3.6
North American Native	959	.7
Total	139861	100

Appendix 6 continued

Patient characteristics of the RY2009 LTCH LDS MedPAR File

Discharge Disposition from LTCH

	Frequency	Percent
Home or Self Care	14810	10.6
Short-Term Hospital	16025	11.5
Skilled Nursing Facility	41664	29.8
Intermediate Care Facility	3916	2.8
Designated Cancer Center or Children's Hospital	987	.7
Home with Home Health	29539	21.1
Left Against Medical Advice	950	.7
Expired	20226	14.5
DOD or VA Hospital	103	.1
Hospice/Home	1641	1.2
Hospice/Inpatient	2379	1.7
Swing Bed	140	.1
Inpatient Rehabilitation	5827	4.2
Long-Term Care Hospital	883	.6
Medicaid Nursing Facility	536	.4
Psychiatric Hospital	124	.1
Critical Access Hospital	11	0
Other Facility Not Defined	100	.1
Total	139861	100

Figure 1

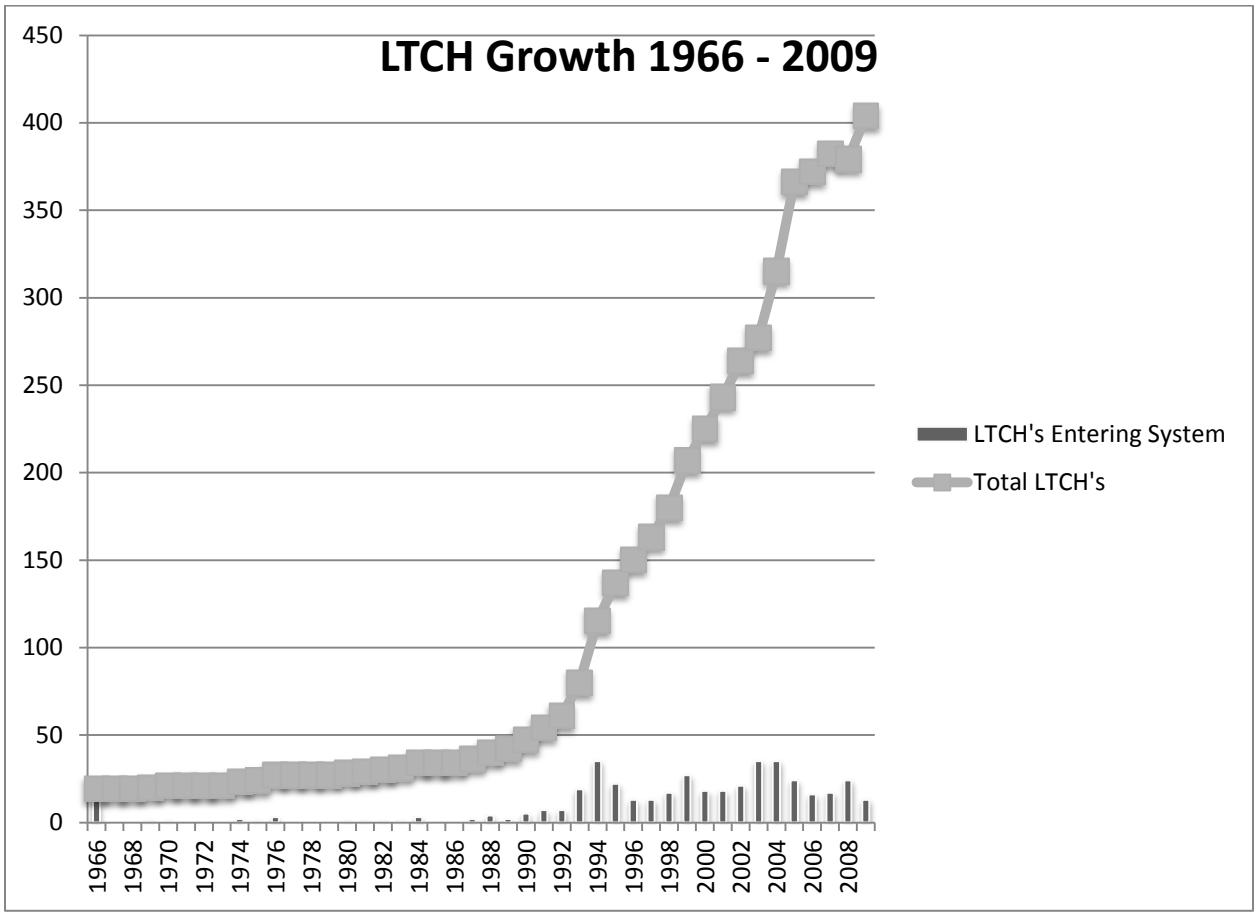

LTCH Growth 1966 - 2009
450
400
350
300
250
200
150
100
50
0
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
LTCH's Entering System
Total LTCH's

Figure 2

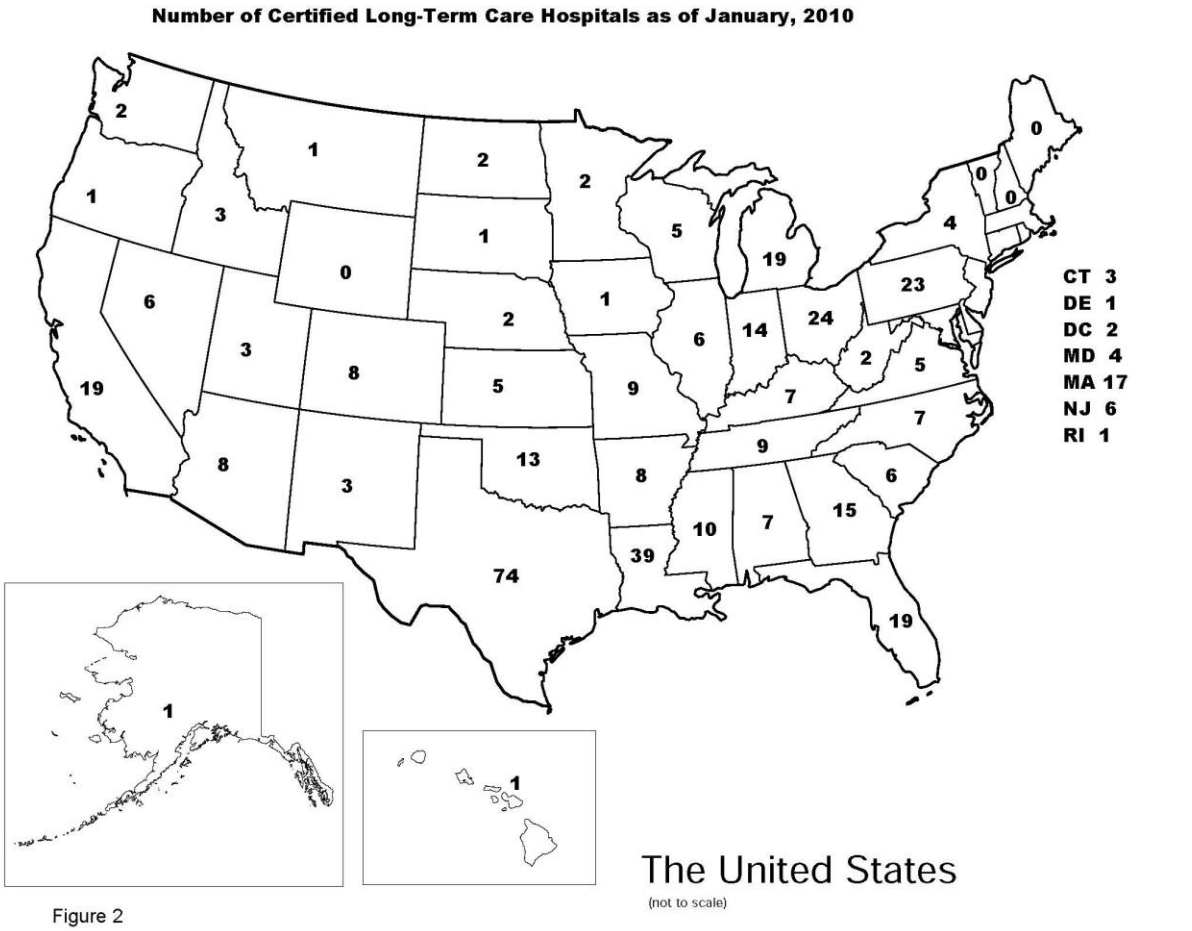


Figure 2

Source: www.cms.gov/longtermcarehospitalipps/08_download.asp

Figure 3

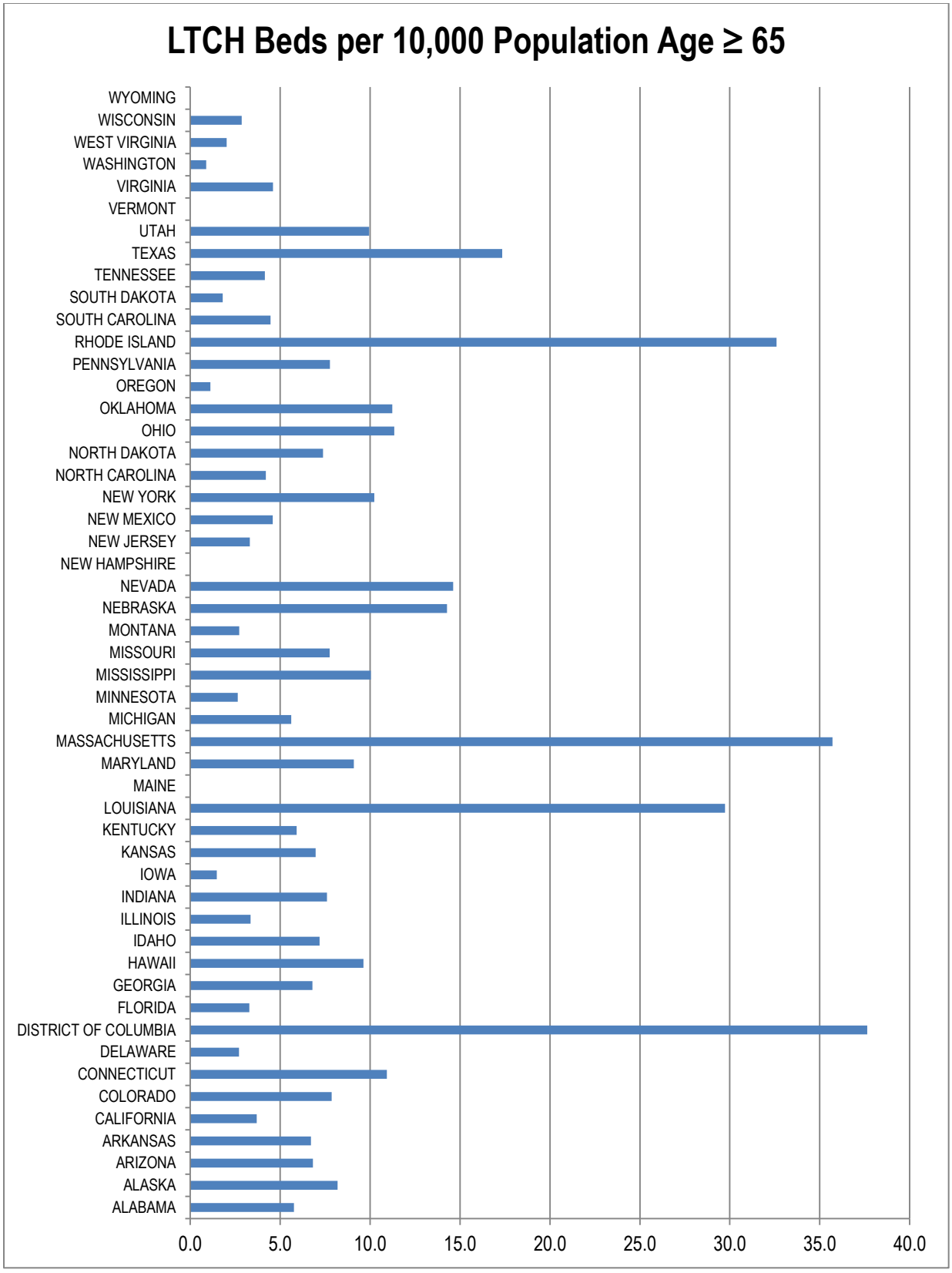
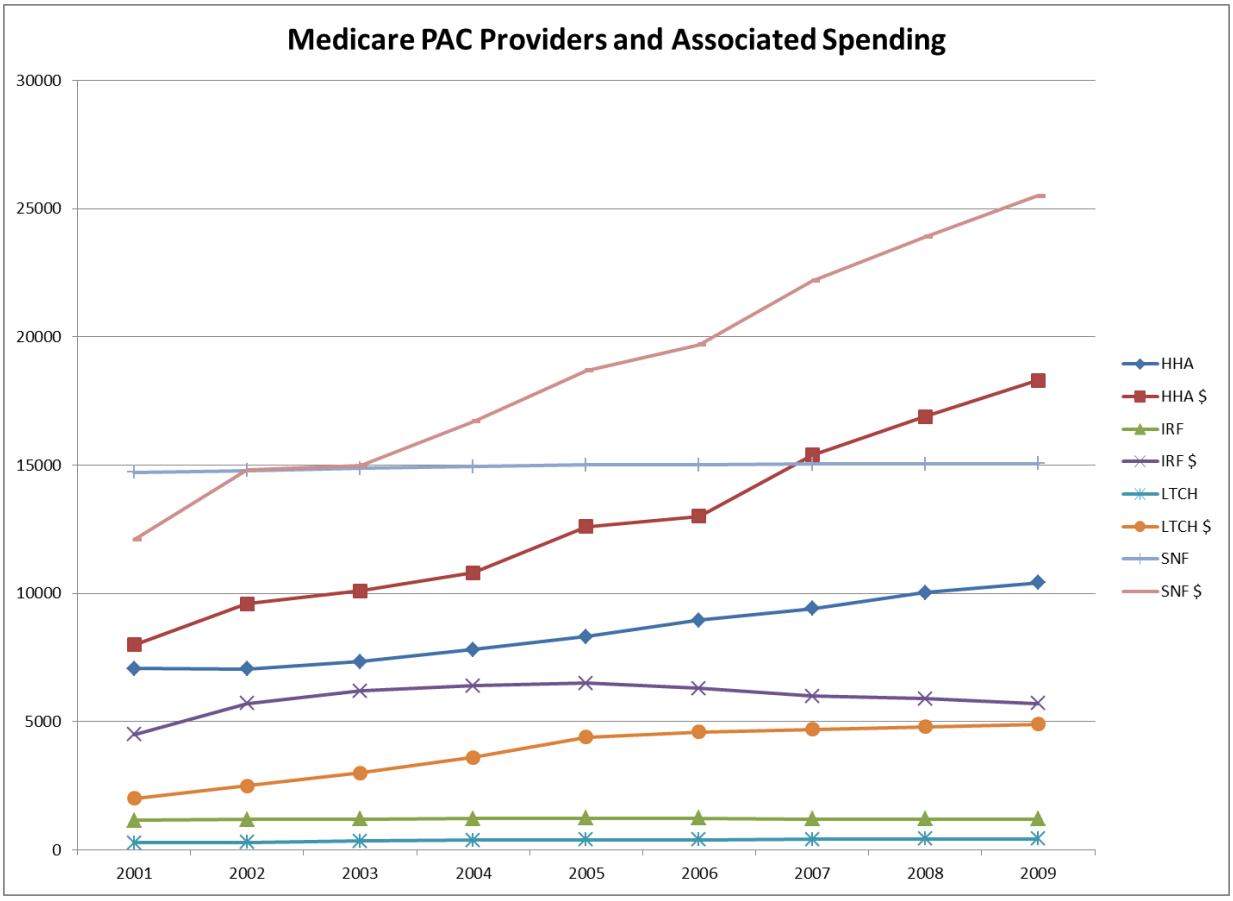

LTCH Beds per 10,000 Population Age ≥ 65
WYOMING
WISCONSIN
WEST VIRGINIA
WASHINGTON
VIRGINIA
VERMONT
UTAH
TEXAS
TENNESSEE
SOUTH DAKOTA
SOUTH CAROLINA
RHODE ISLAND
PENNSYLVANIA
OREGON
OKLAHOMA
OHIO
NORTH DAKOTA
NORTH CAROLINA
NEW YORK
NEW MEXICO
NEW JERSEY
NEW HAMPSHIRE
NEVADA
NEBRASKA
MONTANA
MISSOURI
MISSISSIPPI
MINNESOTA
MICHIGAN
MASSACHUSETTS
MARYLAND
MAINE
LOUISIANA
KENTUCKY
KANSAS
IOWA
INDIANA
ILLINOIS
IDAHO
HAWAII
GEORGIA
FLORIDA
DISTRICT OF COLUMBIA
DELAWARE
CONNECTICUT
COLORADO
CALIFORNIA
ARKANSAS
ARIZONA
ALASKA
ALABAMA
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0

Figure 4


Medicare PAC Providers and Associated Spending
30000
25000
20000
15000
10000
5000
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
HHA
HHA $
IRF
IRF $
LTCH
LTCH $
SNF
SNF $

REFERENCES

1. Medicare Payment Advisory Commission: Report to the congress: Medicare Payment Policy. Washington, DC, March,2011, pp 41, 149, 205-206, 240-242

2. http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/DataCompendium/15_2009_Data_Compendium.html accessed 10-10-2010

3. Medicare Payment Advisory Commission: Report to the congress: New approaches in Medicare. Washington, DC, 2004, pp 121-133

4. Code of Federal Regulations Title42 Chapter 4 Subpart B Part 412 Subpart B PROSPECTIVE PAYMENT SYSTEMS FOR INPATIENT HOSPITAL SERVICES —Hospital services subject to and excluded from the prospective payment systems for inpatient operating costs and inpatient capital-related costs. Washington, DC, 2010, pp 515-529

5. http://www.cms.gov/longtermcarehospitalipps/08_download.asp accessed 10/19/11

6. Federal Register. September 1, 1983. 48 FR 39746. Washington, DC,

   1983

7. Federal Register. August 29, 1997. 62 FR 45966-46140. Washington,

   DC, 1997

8. Federal Register. May 7, 2004. 69 FR 25674-25749. Washington, DC,

   2004

9. Liu K, Baseggio C, Wissoker D, et al: Long-term care hospitals under Medicare: Facility-level characteristics. *Health Care Financ Rev* 2001;23:1-18

10. Federal Register. August 30, 2002. 67 FR 55954-56090, Washington,

    DC, 2002

11. http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/LTCH-ShortStay.pdf accessed 12-20-12

12. http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/LTCH-IntStay.pdf accessed 12-20-12

13. http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/Downloads/LTCH-HighCost.pdf accessed 12-20-12

14. Medicare Payment Advisory Commission: Report to the congress: Medicare Payment Policy. Washington, DC, March, 2006, p 216

15. Federal Register 2003; 68:34493-34515, Centers for Medicare & Medicaid Services (CMS), HHS: Medicare program; change in methodology for determining payment for extraordinarily high-cost cases (cost outliers) under the acute care hospital inpatient and long-term care hospital prospective payment systems. Final rule
16. Federal Register 2010; 75:50041-50681, Centers for Medicare and Medicaid Services (CMS), HHS: Medicare program; hospital inpatient prospective payment systems for acute care hospitals and the long-term care hospital prospective payment system changes and RY2011 rates; provider agreements and supplier approvals; and hospital conditions of participation for rehabilitation and respiratory care services; Medicaid program: Accreditation for providers of inpatient psychiatric services. final rules and interim final rule with comment period

17. Medicare Payment Advisory Commission: Long-term care hospitals payment system. http://www.medpac.gov/documents/MedPAC_Payment_Basics_10_LTCH.pdf Edition. Washington, DC, 2010 accessed 9-10-2011

18. Hamme JM, Williams BS: Regulating long-term care hospitals in search of a roadmap to clarity. *Healthcare Financial Management* 2008;62:38-41.

19. Medicare Payment Advisory Commission: Report to the congress: Medicare payment policy. Washington, DC, 2010, pp 241-251

20. S. 2499—110th Congress, Medicare, Medicaid and SCHIP extension act of 2007. Washington, DC, 2007

21. http://www.gpo.gov/fdsys/pkg/CFR-2004-title42-vol3/pdf/CFR-2004-title42-vol3-part482-toc-id1457.pdf accessed 10-10-2010

22. http://www.gpo.gov/fdsys/pkg/CFR-2004-title42-vol3/pdf/CFR-2004-title42-vol3-part483-subpartB.pdf accessed 10-10-2010

23. Gage B, Pilkauskas N, Dalton K, et al: Long-term care hospital (LTCH) payment system monitoring and evaluation phase II report. Final Edition. Baltimore, MD, RTI International, 2007: 59

24. http://www.cms.gov/Medicare/Quality-Initiatives-Patient-assessment-Instruments/LTCH-Quality-Reporting/index.html accessed 8-13-2013

25. http://medpac.gov/documents/Jun12DataBookEntireReport.pdf accessed 8-13-2013

26. Hotes LS, Kalman E: The evolution of care for the chronically critically ill patient. *Clin Chest Med* 2001;22:1-11

27. Lundberg JA, Noll ML: The long-term acute care hospital: A new option for ventilator-dependent individuals. *AACN Clin Issues Crit Care Nurs* 1990;1:280-288

28. Carson SS, Bach PB, Brzozowski L, et al: Outcomes after long-term acute care. an analysis of 133 mechanically ventilated patients. *American Journal of Respiratory & Critical Care Medicine* 1999;159:1568-1573

29. Kahn JM, Benson NM, Appleby D, et al: Long-term acute care hospital utilization after critical illness. *JAMA* 2010;303:2253-2259

30. Scheinhorn DJ, Chao DC, Stearn-Hassenpflug M: Liberation from prolonged mechanical ventilation. *Crit Care Clin* 2002;18:569-595

31. O'Bryan L, Von Rueden K, Malila F: Evaluating ventilator weaning best practice: A long-term acute care hospital system-wide quality initiative. *AACN Clin Issues* 2002;13:567-576

32. Scheinhorn DJ, Chao DC, Stearn-Hassenpflug M, et al: Outcomes in post-ICU mechanical ventilation: A therapist-implemented weaning protocol. *Chest* 2001;119:236-242

33. Scheinhorn DJ, Hassenpflug MS, Votto JJ, et al: Post-ICU mechanical ventilation at 23 long-term care hospitals: A multicenter outcomes study. *Chest* 2007;131:85-93

34. Scheinhorn DJ, Hassenpflug MS, Votto JJ, et al: Ventilator-dependent survivors of catastrophic illness transferred to 23 long-term care hospitals for weaning from prolonged mechanical ventilation. *Chest* 2007;131:76-84

35. Seneff MG, Wagner D, Thompson D, et al: The impact of long-term acute-care facilities on the outcome and cost of care for patients

undergoing prolonged mechanical ventilation. *Crit Care Med* 2000;28:342-350

36. Kalman E: Law and Policy Report. *NALTH News* 2010;1(3):5,9

37. Letter from HHS Secretary Sebelius to Senator Biden and Representative Boehner, 3/9/2011

38. HR 3590—111th Congress, Patient protection and affordable care act. Washington, DC, 2010

39. Federal Register. 2011 August 18;76(160):51476-51846. Washington, DC,2011

40. AHA Guide to the Health Care Field 2009 Edition, Health Forum LLC

41. Bach PB, Carson SS, Leff A: Outcomes and resource utilization for patients with prolonged critical illness managed by university-based or community-based subspecialists. *Am J Respir Crit Care Med* 1998;158:1410-1415

42. Carson SS: Know your long-term care hospital. *Chest* 2007;131:2-5

43. Dematte D'Amico JE, Donnelly HK, Mutlu GM, et al: Risk assessment for inpatient survival in the long-term acute care setting after prolonged critical illness. *Chest* 2003;124:1039-1045

44. Eskildsen MA: Long-term acute care: A review of the literature. *J Am Geriatr Soc* 2007;55:775-779

45. Votto JJ, Scalise PJ, Barton RW, Vogel CA: An analysis of clinical outcomes and costs of a long term acute care hospital. *J Med Econ* 2011; 14:141-46

46. Endimiani A, Depasquale JM, Forero S, et al: Emergence of blaKPC-containing klebsiella pneumoniae in a long-term acute care hospital: A new challenge to our healthcare system. *J Antimicrob Chemother* 2009;64:1102-1110

47. Furuno JP, Hebden JN, Standiford HC, et al: Prevalence of methicillin-resistant staphylococcus aureus and acinetobacter baumannii in a long-term acute care facility. *Am J Infect Control* 2008;36:468-471

48. Standfast SJ, Michelsen PB, Baltch AL, et al: A prevalence survey of infections in a combined acute and long-term care hospital. *Infection Control* 1984;5:177-184

49. Stephens C, Francis SJ, Abell V, et al: Emergence of resistant acinetobacter baumannii in critically ill patients within an acute care teaching hospital and a long-term acute care hospital. *Am J Infect Control* 2007;35:212-215

50. Walkey AJ, Reardon CC, Sulis CA, et al: Epidemiology of ventilator-associated pneumonia in a long-term acute care hospital. *Infection Control & Hospital Epidemiology* 2009;30:319-324

51. Buczko W: Ventilator-associated pneumonia among elderly Medicare beneficiaries in long-term care hospitals. *Health Care Financ Rev* 2010;31:1-10

52. Munoz-Price LS: Long-term acute care hospitals. *Clin Infect Dis* 2009;49:438-443

53. Munoz-Price LS, Hota B, Stemer A, et al: Prevention of bloodstream infections by use of daily chlorhexidine baths for patients at a long-term acute care hospital. *Infect Control Hosp Epidemiol* 2009;30:1031-1035

54. Munoz-Price LS, Stemer A: Four years of surveillance cultures at a long-term acute care hospital. *Infect Control Hosp Epidemiol* 2010;31:59-63

55. Goldstein EJ, Polonsky J, Touzani M, et al: C. difficile infection (CDI) in a long-term acute care facility (LTAC). *Anaerobe* 2009;15:241-243

56. Weaver KN, Jones RC, Albright R, et al: Acute emergence of elizabethkingia meningoseptica infection among mechanically ventilated patients in a long-term acute care facility. *Infect Control Hosp Epidemiol* 2010;31:54-58

57. American Hospital Association: AHA annual survey database ™. http://www.ahadata.com/ahadata/html/AHASurvey.html Edition. Chicago, IL Washington, DC, Health Forum, LLC, 2010 accessed 8-13-2012

58. NALTH: NALTH health information system (NHIS). http://www.nalth.org/ Edition. West Hartford, CT, NALTH, 2010 accessed 4-15-2013

59. Pronovost PJ, Angus DC, Dorman T, et al: Physician staffing patterns and clinical outcomes in critically ill patients: a systematic review. *JAMA* 2002;288:2151-2162

60. http://www.cms.gov/Research-Statistics-Data-and-Systems/Files-for-Order/LimitedDataSets/LTCHPPSMEDPAR.html accessed 10-10-2010

61. http://www.cms.gov/medicare/medicare-fee-for-service-payment/longtermcarehospitalIPPS/ltcdrg.html accessed 10-20-2011

62. Sheehan K: E-mail survey response rates: a review. *Journal of Computer Mediated Communication* 2001;6 (2). Available online at: http://jcmc.indiana.edu/vol6/issue2/index.html accessed 9-17-2012

63. Cohen J: A power primer. *Psychological Bulletin* 1992;112 (1) 155-159