

Diagnostic Imaging Services in Magnet and Non-Magnet Hospitals: Trends in Utilization and Costs

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Abstract

Purpose: The purpose of this study was to better understand trends in utilization and costs of diagnostic imaging services at Magnet hospitals (MHs) and non-Magnet hospitals (NMHs).

Methods: A data set was created by merging hospital-level data from the American Hospital Association's annual survey and Medicare cost reports, individual-level inpatient data from the Healthcare Cost and Utilization Project, and Magnet recognition status data from the American Nurses Credentialing Center. A descriptive analysis was conducted to evaluate the trends in utilization and costs of CT, MRI, and ultrasound procedures among MHs and NMHs in urban locations between 2000 and 2006 from the following ten states: Arizona, California, Colorado, Florida, Iowa, Maryland, North Carolina, New Jersey, New York, and Washington.

Results: When matched by bed size, severity of illness (case mix index), and clinical technological sophistication (Saidin index) quantiles, MHs in higher quantiles indicated higher rates of utilization of imaging services for MRI, CT, and ultrasound in comparison with NMHs in the same quantiles. However, average costs of MRI, CT, and ultrasounds were lower at MHs in comparison with NMHs in the same quantiles.

Conclusions: Overall, MHs that are larger in size (number of beds), serve more severely ill patients (case mix index), and are more technologically sophisticated (Saidin index) show higher utilization of diagnostic imaging services, although costs per procedure at MHs are lower in comparison with similar NMHs, indicating possible cost efficiency at MHs. Further research is necessary to understand the relationship between the utilization of diagnostic imaging services among MHs and its impact on patient outcomes.

Key Words: Diagnostic imaging services, Magnet hospitals, utilization, costs

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INTRODUCTION

Diagnostic imaging services play a key role in the delivery of health care in the United States and have become essential components in identifying, treating, and managing most major medical conditions and diseases. The increased utilization of diagnostic imaging services has contributed to rising health care costs in the United States, accounting for more than 10% of total health care

costs [1-3]. Although overall utilization of diagnostic imaging services grew rapidly in the early 2000s, recent studies indicate a decline in imaging utilization in recent years [4-7]. However, little is known about utilization trends of diagnostic imaging services at Magnet[®] hospitals (MHs) and non-Magnet hospitals (NMHs) and the trends in associated costs of imaging.

MHs are known for their high quality of patient care, excellence in nursing practices, higher retention rates for well-qualified nurses, improved outcomes of care, and greater propensity to use evidence-based care [8-12]. As part of obtaining MH designation, MHs make large investments in resources [13], including high-cost resources such as diagnostic imaging services. Given access to greater resources and capabilities, MHs may be more likely to utilize high-cost services such as diagnostic imaging services in comparison with NMHs. Given the availability of resources at MHs, the question of interest

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would be whether MHs are more (or less) likely to utilize high-cost resources such as diagnostic imaging services in comparison with NMHs.

To date, 418 hospitals in the United States have been designated as MHs by the American Nurses Credentialing Center (ANCC), which was established by the American Nurses Association in the early 1990s [14]. The concept of MHs originates from an early study in the 1980s that found that a unique set of characteristics was responsible for attracting and retaining highly qualified nurses during a nurse shortage [14,15]. Many studies have examined the association between MH status and various outcomes of quality of care, such as mortality rates, length of stay, patient satisfaction, patient safety practices, and net patient revenue gains [8,11,12,16]. However, little is known about utilization trends for high-cost health care services such as diagnostic imaging services within MHs and NMHs and their impact on costs of care.

Because MHs invest heavily in the resources needed in the process of obtaining Magnet status, it is likely that MHs have better access to more advanced technological resources and procedures, such as diagnostic imaging services, than NMHs. Similarly, because of their reputation for providing high-quality patient care and excellence in nursing practices, MHs may also attract patients with severe conditions or complications. Generally, MHs tend to be larger in bed size in comparison with NMHs. Although these reasons could lead to higher utilization of diagnostic imaging services at MHs in comparison with NMHs in general, it would be interesting to investigate if MHs tend to have higher utilization and costs of care of diagnostic imaging services in comparison with NMHs when controlling for technological sophistication, severity of patients' conditions, and hospital size.

In this study, we explored trends in the utilization of diagnostic imaging services and associated costs of such services within MHs and NMHs using inpatient data from acute care hospitals across ten states in the United States from 2000 to 2006. Specifically, we examined trends in utilization and costs of care for three diagnostic imaging services at MHs and NMHs: CT, MRI, and ultrasound.

METHODS

The sample data set was created by merging hospital-level data from the American Hospital Association's (AHA) annual survey and Medicare cost reports (Healthcare Cost Report Information System [HCRIS]), Magnet recognition status data from the ANCC, and individual-level inpatient data from the Healthcare Cost and Utilization Project State Inpatient Databases (HCUP-SID). The AHA annual survey

data include information on hospital characteristics such as bed size, location, ownership, personnel information, and types of services provided. HCRIS data include information on costs of care at hospitals. The ANCC lists the hospitals that received Magnet recognition on its website, along with their addresses and the years they received Magnet status, as well as the follow-up years when they were recredentialed. The information from the ANCC website was collected in 2011 and was used to identify the MHs and the years they received Magnet status in the merged data set. The HCUP-SID data include information on individual inpatient utilization of health care services, including diagnostic imaging services. The AHA annual survey, HCRIS, and HCUP-SID data are widely used in many research studies.

The utilization of individual imaging services in HCUP-SID data was identified using International Classification of Diseases, radiologic procedure codes and were aggregated to the hospital-year level. These data were available for individual patient discharges. Cost data identifiable in the HCRIS database included MRI, CT, and ultrasound. We restricted the data sample only to urban hospitals because almost all MHs were located in urban areas. The final data sample included data from Arizona, California, Colorado, Florida, Iowa, Maryland, North Carolina, New Jersey, New York, and Washington from 2000 to 2006 because these are the only states and years for which data were accessible. These states are regionally diverse and include both MHs and NMHs. The total study sample included 178 MH observations and 5,030 NMH observations, a total of 5,208 observations. The unit of analysis was the hospital-year. It should be noted that we did not have a way to identify a hospital that may have had Magnet status during the study period (2000-2006) but lost its Magnet status by 2011 because the ANCC does not disclose this information.

Using the study sample, we examined trends in utilization and costs of three diagnostic imaging services, MRI, CT, and ultrasound, within MHs and NMHs from 2000 to 2006. We conducted statistical significance tests, using χ^2 tests for categorical variables and Student's *t* test for continuous variables, to investigate whether there were significant differences between the means of utilization and costs of imaging services at MHs and NMHs within each year. Similar significance tests were also carried out for other key hospital characteristics, such as ownership (1 = nonprofit, 0 = otherwise), percentage of Medicare and Medicaid discharges, total inpatient discharges, number of beds, membership in a system of hospitals (1 = system, 0 = otherwise), the degree of market concentration in the hospital's health care referral region (Herfindahl-Hirschman index) [17], the hospital's clinical

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