2023

Hospital-acquired Infections and Differences between Magnet and Non-Magnet Hospitals

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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by

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MSN/MBA, University of Phoenix, 2012

BSN, University of Phoenix, 2006

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Healthcare Administration

Walden University

May 2023

Abstract

Hospital-acquired infections (HAIs), specifically clostridioides difficile (CDI) and methicillin-resistant staphylococcus aureus (MRSA) bacteremia, increase mortality and length of stay and cost the United States billions of dollars each year. Though preventable, continued incidence demonstrates that infection prevention interventions remain challenging for health system administrators. The purpose of this quantitative study was to identify whether there was a significant difference between Magnet accreditation and non-Magnet accreditation and the frequency of HAIs, specifically, CDI and MRSA bacteremia. The independent variable was Magnet accreditation status; the dependent variables were CDI and MRSA bacteremia. The foundation of the study focused on Donabedian's framework of structure, process, and outcomes in improving quality care. Data from the Centers for Medicare and Medicaid in 2021, provided a combined sample size of 4,745. The standardized infection ratios (SIRs) for the dependent variables were categorized by Magnet status and were analyzed with a Mann-Whitney U test. Results demonstrated a significant difference in the mean rank of the SIRs between the Magnet accredited and non-Magnet accredited organizations ($p<.001$) for both research questions. Magnet accredited hospitals outperformed non-Magnet accredited hospitals for hospital-acquired MRSA bacteremia but performed worse than non-Magnet accredited hospitals for CDI. The study contributes to positive social change through the potential implementation of organizational strategies, which may decrease healthcare costs and HAIs, resulting in reductions in mortality and inpatient length of stay while improving quality patient outcomes.

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Dedication

I am dedicating this work to my family and friends who have encouraged me throughout this process. Thank you, Mikey, Melinda, and Jade, for supporting and listening to my trials and tribulations as this work progressed. A special thank you to my mentor who completed her dissertation mere months before me, Congratulations, Dr. Winn!! Finally, to my co-students who encouraged me to enter this program with them, thank you, Adrienne and Nancy, for the prodding, encouragement, support, and brainstorming sessions. I look forward to seeing you on the other side!!

Acknowledgments

I would like to take this opportunity to express my sincere thanks to my capstone committee, Dr. Ross, Dr. McGuire, and Dr. Hijazi for their expertise and support during this process. A very special thanks to my committee chair, Dr. Miriam Ross, for her patience, persistence, communication style, and motivational feedback during this experience. Dr. Ross, you've made this process so much more enjoyable than it would have been without you. I love how we would, so excitedly, discuss the next sections.

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Section 1: Foundation of the Study and Literature Review

Healthcare-acquired infections (HAIs) have remained a significant challenge in the United States and as such were a top priority for the Centers for Disease Control and Prevention (Centers for Disease Control and Prevention, 2021b). The 2020 National and State Healthcare-Associated Infections Progress Report demonstrated ongoing, year-over-year growths in healthcare-acquired infections with resultant increased length of stay (LOS), morbidity and mortality, and associated costs of $7.2 to $14.9 billion U.S. dollars (Forrester et al., 2022). Additional impacts included added pain and suffering for the patient, the need for post acute care that might otherwise have been unnecessary, and from the health system perspective, may have resulted in poor outcomes in quality and safety reporting that drove negative system reputation and decreased elective volumes with associated impacts to cost and revenue.

Having recognized the high negative impacts of HAIs (specifically *clostridioides difficile* [CDI] and *methicillin resistant staphylococcus aureus* [MRSA]), health systems strove for solutions toward prevention that were aimed at minimizing complications. Although there were many opportunities to reduce HAIs, each required the allocation of scarce resources. It is not uncommon for health system leaders to develop the structures required to achieve Magnet status to improve nurse-driven indicators such as HAIs even though there is insufficient and mixed literature supporting and/or contradicting success with this solution (Rodriguez-Garcia et al., 2020). Although a return on investment (ROI) has varied based on baseline and future state quality outcomes, Drenkard (2022) outlined factors to be considered by health systems when considering the Magnet journey to

achieve quality outcomes. Magnet accreditation required significant time and cost; an ROI required measurement of pre- and post-Magnet associated incremental costs and mortality rates (Drenkard, 2022). My study has provided information regarding any association between CDI and/or MRSA and Magnet versus non-Magnet hospitals, having provided health system leaders with valuable information for their challenges with HAIs.

Problem Statement

Of those HAIs reported by Forrester et al. (2022), 37% were related to CDI with the remaining 67% related to surgical site infections, ventilator-associated pneumonia (VAP), catheter-associated urinary tract infection (CAUTI) and central line bloodstream infection (CLABSI), of which, MRSA was a major contributor. In a study related to MRSA, HAIs within the United States Department of Veterans Affairs (VA) health system between 2007 and 2012, researchers identified the impact of positive MRSA findings on cost and utilization during the initial year following discharge (Nelson et al., 2018). Data were analyzed, demonstrating an associated increase in inpatient days by 6.6 (days) and a cost of $9,237 post discharge (Nelson et al., 2018).

Dierkes et al. (2021) demonstrated a 30% decrease for Magnet hospitals versus non-Magnet hospitals in pay-for-performance penalties related to hospital-acquired conditions (HACs). However, it was unclear whether a relationship existed between HAI outcomes and non-Magnet hospitals versus Magnet -Hospitals. A literature review demonstrated research between Magnet accredited hospitals and nurse-driven indicators such as CLABSIs and CAUTIs but there was a gap in the literature regarding potential

relationships between Magnet accreditation and MRSA and CDI rates (Rodriguez-Garcia et al., 2020).

Purpose of Study

The purpose of this study was to identify whether there was a significant difference between Magnet accreditation and non-Magnet accreditation and the frequency of HAIs; specifically, MRSA and CDI. HAIs were spread from patients, nurses, physicians, and other staff while having performed routine patient care. There are known interventions that might have prevented HAIs including adherence to hand hygiene protocols, cleansing of stethoscopes between patients, and having avoided ties and other objects that might have dangled in the clinical area (Centers for Disease Control and Prevention, 2021a). Additional preventative measures include strict aseptic technique during wound and dressing changes/line insertions and surveillance testing with isolation protocols for patients that had tested positive; however, compliance with these protocols was a challenge for many organizations as evidenced by the consistently increasing infection rates. Hospitals having undergone the approval process and having achieved Magnet status may have demonstrated highly reliable structures, processes, and outcomes with a resultant decrease in HAIs. The outcomes of this study may provide health systems with an important component of the information required when exploring available options aimed at reducing HAIs with Magnet recognition being among the primary contenders.

Independent Variable: Magnet Accreditation

Magnet represents an accreditation awarded through the American Nurses Credentialing Center (ANCC) based upon a framework that encompassed what the ANCC described as the *Forces of Magnetism.* The ANCC dated the origins of the Magnet program to 1983 with the original intent of the program to identify work environments that have attracted and retained nurses (American Nurses Association, n.d.). Those environmental characteristics defined an organizational culture that enjoyed not only high levels of recruitment and retention but also a culture that actively promoted superior patient outcomes.

A Magnet accredited facility demonstrates high levels of competency in the five Magnet model components including transformational leadership, structural empowerment, exemplary professional practice, new knowledge, innovation and improvements, and empirical quality results (American Nurses Association, n.d.). Magnet organizations have demonstrated a staff that is empowered to guide a nursing practice that promotes exceptional employee engagement and resultant patient outcomes through excellence, innovation, and interdisciplinary collaboration. Therefore, organizations that have demonstrated Magnet model competencies should have presented optimal patient outcomes. The purpose of this study was to identify whether there was a significant difference between Magnet accreditation versus non-Magnet accreditation and the frequency of HAIs; specifically, MRSA bacteremia and CDI. Importantly, although Magnet is a nursing award, the recognition provided is an organizational award,

understanding that successful patient outcomes could only have been achieved through interdisciplinary collaboration.

Dependent Variable 1: Methicillin Resistant Staphylococcus Aureus (MRSA)

In this study, MRSA is defined as a nosocomial staphylococcus infection that demonstrated resistance to methicillin antibiotics with resultant increased length of stay, cost per case, morbidity, and mortality (Forrester et al., 2022). These infections often resulted in pneumonia and/or bloodstream infections with resultant sepsis. MRSA may have also been acquired in the community setting but for the purposes of this study, the MRSA outcomes were isolated to hospital-acquired MRSA bacteremia. Kirwin et al. (2019) performed a retrospective cohort study of patients with hospital-acquired versus community-acquired MRSA and demonstrated an average incremental increase in LOS and cost per case even higher than those identified by Forrester et al., (2022) with incremental increases in hospital LOS of 35.2 days for hospital-acquired MRSA with associated incremental cost increases of $31,686 (normalized to Canadian dollars).

Dependent Variable 2: Clostridioides Difficile Infection (CDI)

CDI was defined in this study as an infection of the large intestines that resulted in extreme diarrhea, dehydration, pain, and unintended weight loss (Hall et al., 2019). Extreme cases may result in renal failure, toxic megacolon, bowel perforation, and death. There are associated surgeries, increased length of stays, and costs. Hall et al. (2019) reported that between 2001 and 2010, in the United States, more than 2.7 million patients demonstrated a discharge diagnosis of CDI, commenting that in some regions, CDI had

surpassed MRSA as the most common HAI. Bradley et al. (2019) cited an associated mortality rate for CDI varying from 19%-80%.

Research Questions and Hypotheses

RQ1: Was there a significant difference in the Centers for Medicare and Medicaid Services (CMS) patient safety indicators for HAIs, specifically, MRSA bacteremia scores that were Magnet accredited versus hospitals that were not Magnet accredited?

$H_0$1: There was not a significant difference in MRSA bacteremia scores for hospitals that were Magnet accredited versus hospitals that were not Magnet accredited.

$H_1$1: There was a significant difference in MRSA bacteremia scores for hospitals that were Magnet accredited versus hospitals that were not Magnet accredited.

RQ2: Was there a statistically significant difference in the CMS Patient Safety Indicators (PSI) for HAIs, specifically, CDI scores for hospitals that were Magnet accredited versus hospitals that were not Magnet accredited?

$H_0$2: There was not a statistically significant difference in the CDI infection scores for hospitals that were Magnet accredited versus hospitals that were not Magnet accredited.

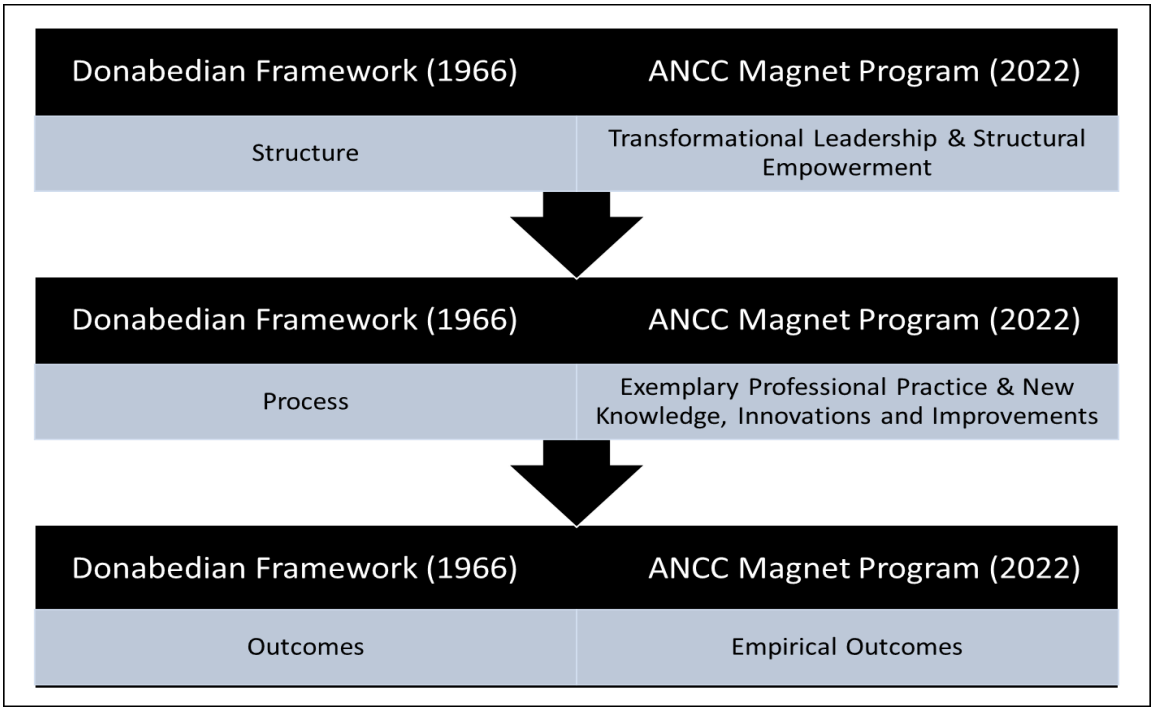
$H_1$2: There was a statistically significant difference in the CDI infection scores for hospitals that were Magnet accredited versus those that were not Magnet accredited.

Theoretical Foundation for the Study

Donabedian (1966/2005) described a framework for evaluating the quality of care through the examination of medical records. Care was taken to examine structure (facilities, equipment, policies, etc.), processes (appropriateness and thoroughness of care provided, direct observation of the care provided), and outcomes. Donabedian (1966/2005) noted the importance of selecting the appropriate outcomes (and measurements) that established the level of quality in the care provided. The Donabedian model supported this study because Magnet-recognized organizations demonstrated high competencies in structure, process, and outcomes via the five magnet components (see American Nurses Association, n.d.). Donabedian's discussion of structure in 1966/2005 aligned with the ANCC vision of a transformational leadership style that promoted structural empowerment with a culture of front-line staff engagement, collaboration, and the authority that created the processes that drove high-quality outcomes. The ANCC components of exemplary nursing practice and new knowledge, innovation, and improvements demonstrated alignment with Donabedian's (1966/2005) processes. Both, Donabedian (1966/2005) and the ANCC provide frameworks that stressed the importance of objective, standardized methodologies for the tracking, trending, analyzing, and reporting of outcomes, having noted that the outcomes were a result of the organizational structures and processes. Figure 1 illustrates the connections between Donabedian's framework and the ANCC Magnet model components.

Figure 1

Synergies Between Donabedian's Framework (1966/2005) and ANCC Magnet Model Components (2022)



Nature of the Study

In this quantitative study I used secondary data from CMS on the CDI and MRSA bacteremia standardized infection ratios (SIRs) by hospital. Those outcomes were compared between Magnet-recognized and non-Magnet hospitals. Although MRSA may be present anywhere in the body including blood, urine, lungs, and wounds, the CMS data file captured HAIs in these body sites but did not specifically report on MRSA. However, data on MRSA bacteremia was specifically collected and reported. For this reason, the numerator studied for MRSA was MRSA bacteremia and did not include other cases of hospital-acquired MRSA presenting outside of the bloodstream. The latest

CMS dataset available was from January 1, 2021, through December 31, 2021 (Centers for Medicare and Medicaid, 2022). The data from that timeframe was run against data from the ANCC listing all Magnet accredited hospitals including the year of initial accreditation as well as the years each organization was reaccredited (American Nurses Association, 2022). This study encompassed all hospitals included in the CMS data set for organizations that have reported CDI and/or MRSA bacteremia in the calendar year 2021, including 300 or more hospitals for each category of Magnet accredited hospitals and non-Magnet accredited hospitals. Descriptive statistics were performed to identify the mean and median of each of the groups. The normality of the data was assessed, demonstrating nonparametric data. I used a Mann-Whitney U test to identify whether there was a significant difference between Magnet accreditation and non-Magnet-accreditation and the frequency of HAIs, specifically MRSA bacteremia and CDI.

Literature Review

The literature review was focused on the independent variable, Magnet status, and the dependent variables, hospital-acquired MRSA bacteremia and CDI rates. This proved to be too narrow of a search; there were very few studies that examined Magnet status with these specific quality outcomes. I widened the search to include HAIs and further widened to incorporate pay-for-performance penalties and CMS value-based purchasing (VBP) outcomes. These programs provided the information required to support the need for a study that evaluated whether there was a significant difference between Magnet accreditation and non-Magnet accreditation and the frequency of HAIs, specifically MRSA bacteremia and CDI.

Literature Search Strategy

The literature search strategy for this study was exhaustive and included only full-text, peer-reviewed scholarly journals between the dates of 2018-2023. A search was performed for each of the variables: HAIs, MRSA, CDI, and Magnet. An additional search was performed on the study datasets through CMS (2020). Keywords included *methicillin resistant staphylococcus aureus, MRSA, hospital-acquired infection, HAI, HAIs, healthcare-acquired infection, nosocomial infection, Clostridioides difficile, Clostridium difficile, CDI, infection, CDI, outcomes, quality, effects, impacts, value-based purchasing program-based performance (VBPP), pay for performance, P4P, Centers for Medicare and Medicaid Services, CMS, hospital-acquired condition,* and *HAC(s)*. Databases used in this search included all providers including but not limited to ProQuest, MEDLINE with full text, CINAHL Plus with full text, Science Direct, and Journals@OVID.

Literature Review of Key Variables

HAIs are defined as infections that were not present upon admission (Monegro et al., 2022). They typically presented at least 48 hours following admission and include CLABSI, CAUTI, surgical site infections (SSI), hospital-acquired pneumonia (HAP), ventilator-associated pneumonia (VAP), and CDI (Monegro et al., 2022). Forrester et al. (2022) performed a retrospective analysis of the largest all-payer U.S. inpatient database (97% of the U.S. population), the Agency for Healthcare Cost and Utilization Project's 2016 National Inpatient Sample, for all diagnosis codes related to CAUTI, CLABSI, VAP, CDI, HAP and SSI, having combined incidence data with inpatient HAI costs so

that individual and collective HAI costs could be determined. Forrester et al. demonstrated HAI-associated costs ranging from $7.2B to $14.9B U.S. dollars in 2016 with CDI having been responsible for 56% and SSI (largely MRSA-related) having been responsible for 31% of those costs (CI 95%). Costs associated with HAIs were a result of the higher complexity of care and extended length of stay. Mortality rates were also impacted as was discussed in studies throughout this literature review.

Clostridioides Difficile (CDI)

CDI is especially problematic as it has a high incidence, mortality, and cost (Hirsch et al. 2022). Researchers performed a retrospective cohort study of adult patients that had been hospitalized in New York State with CDI between January 1, 2014, and December 31, 2016 (Hirsch et al., 2022). The primary focus of the study was to determine a 30-day readmission rate with secondary foci of 60, 90, 120, and 180-day readmissions. Also studied were 7, 15, 30, 180, and 360-day mortality, hospital LOS, and cost (in the form of total charges). The total sample volume was 3,714,486 total hospital discharges of which 28,897 patients demonstrated a de novo CDI diagnosis (rate = 0.78%; Hirsch et al., 2022). The researchers explained that data scrubbing resulted in a sample size of 28,874 patients with CDI exposures and were able to identify an equal sample volume (28,874) of matched patients with no CDI exposures. The study required a 6-month look back to ensure the CDI was de novo versus a recurrent infection. Results demonstrated a statistically significant increase in all endpoints (readmissions, mortality, LOS, and cost) each with a $p < 0.001$ at a 95% CI. There was a 360-day mortality increase

of 9.6% and an 84% increase in total charges for the CDI exposure group (Hirsch et al., 2022).

CDI is a multinational challenge. Kim et al. (2022) performed a retrospective chart review of all adult patients that underwent orthopedic surgery at an 850-bed tertiary-care, academic medical center between January 2016 and December 2017 in Seoul, Korea that determined the incidence, contributing factors, and associated impacts of hospital-acquired CDI on the orthopedic surgery population. This medical center performed approximately 4,000 orthopedic procedures each year (Kim et al., 2022). The researchers developed inclusion criteria requiring significant diarrhea plus a stool specimen testing positive for C. difficile or a positive real-time polymerase chain reaction for C. difficile toxin gene testing at >72 hours postadmission. An 8-week look-back eliminated any patients that had demonstrated positive assays within that timeframe or within 3 days following admission. Kim et al. demonstrated a similar nosocomial CDI rate to Hirsch (2022) with a rate of 0.7% (versus Hirsch at .79%). Results demonstrated an increase in adjusted LOS by 2.8 days and a mortality rate increase from 2.0% for patients without CDI versus 2.9% for the positive CDI group but 2.9% having consisted of only one patient. Additionally, the increases in LOS were only evident in patients >65 years of age, patients undergoing emergent surgery (versus elective), and those with a higher case mix index (CMI).

Banks et al., (2018) used national CDI surveillance data linked to hospital admission and mortality datasets on patients 15 years and older in Scotland between 2010 and 2016 having attempted to determine if hospital-acquired CDI demonstrated any

impact on LOS and/or mortality in this patient population. This was a retrospective cohort and case-control study. The European Center for Disease Prevention and Control (ECDC) provided the definitions for hospital-acquired CDI as the development of diarrhea >48 from admission through 4 weeks post discharge from a healthcare facility (Banks et al, 2018). ECDC further defined community-acquired (CA) CDI as the development of symptoms within 48 hours of admission to a healthcare facility or symptoms with no episodes of healthcare residency (Banks et al, 2018). Using the ECDC definition, patients that developed symptoms between 4- and 12 weeks post discharge from a healthcare setting were categorized as unknown (U-CDI). The researchers identified and successfully matched 13,154 patients across the datasets. Of those, 7,437 (64.3%) of the matched cases were attributed to the hospital-acquired CDI group. Overall, 30-day mortality, in the HA-CDI group was 21.8% (versus 8.3% for the CA-CDI group; $p<0.001$). Banks et al. (2018) identified a control group of 21,005 hospitalized patients without CDI, that were matched against the HA-CDI cases. Differences in mortality and LOS, between the groups, were studied. Results demonstrated a difference of an adjusted odds ratio (OR) for mortality of 2.67 for the HA-CDI group over the control group ($p<0.001$: 95% CI 2.42-2.94) with an increased adjusted LOS for the HA-CDI group of 22.3% ($p<0.001$: 95% CI 18.0-26.8).

Methicillin Resistant Staphylococcus Aureus (MRSA)

Like CDI, MRSA is either a CA infection or HAI. MRSA is responsible for many of the HAIs falling under the categories of CLABSI, CAUTI, pneumonia, and SSI, having demonstrated increased LOS, associated costs, and mortality (Centers for Disease

Control and Prevention, 2021a). Having used the provincial infection prevention and control database, Kirwin et al., (2019) performed a retrospective cohort study of adult patients (≥ 18 years at the time of discharge) between January 1, 2011, and December 31, 2015, having determined whether there was a difference in cost and LOS for patients acquiring MRSA during their inpatient stay. MRSA screening was performed upon hospital admission for patients having received hemodialysis, having resided within a correctional facility, or for patients that had been admitted to a hospital within the preceding 6 months. Kirwin et al., (2019) captured all MRSA cases across the 106 hospitals in the province of Alberta. Records were linked with the discharge records from the Discharge Abstract Database at Alberta Health. Cases were categorized as hospital-acquired MRSA versus community-acquired MRSA, and each was documented as either colonized or infected. Additionally, a MRSA-free cohort of 577,238 patients was used with an algorithm that matched cases based on 5-year age group, sex, urban type, Charleston comorbidity index (CCI), the number of procedures performed, and facility. Results demonstrated an estimated incremental cost for hospital-acquired MRSA to be $47,016 (Canadian dollars; $p<0.001$) with an incremental LOS of 35.2 days ($p<0.001$).

MRSA infections have demonstrated an exceptional mortality risk for patients with cancer. These patients have been placed in the high-risk category due to the use of central lines for infusion therapy combined with disease and treatment-induced immunodeficiency. Bello-Chavolla et al. (2018) performed a retrospective analysis of 450 patients from an oncology reference center, Instituto Nacional de Cancerologia (INCan), that demonstrated positive blood cultures for *staphylococcus aureus* for over 10

years from 2006-2015. The purpose of the study was to determine if patients with cancer and MRSA had demonstrated different LOS and mortality rates than patients that had been diagnosed with cancer and *methicillin-sensitive staphylococcus aureus* (MSSA). Of the 450 identified cases, 115 cases had been hospital-acquired (25.6%) and 95 of the 450 patients had tested positive for MRSA (21.1%) versus MSSA (78.8%). Results demonstrated that after having adjusted for terminal patients that chose discontinuation of care, the MRSA cohort demonstrated a higher LOS over the MSSA cohort ($p<0.001$). There had been an overall 30-day mortality rate of 16.7% in the combined MSRA and MSSA groups; the MRSA group had demonstrated a significantly higher 30-day mortality rate of 31.6% ($r^2=0.5596$) versus 12.7% for the MSSA group ($p<0.001$).

The United States VA has demonstrated the unique advantage of being the largest integrated health system in the United States and encompassing over 150 hospitals that have provided care for more than 6 million veterans each year (Nelson et al., 2018). Nelson et al. (2018) performed a retrospective cohort study on patients that had been admitted to a VA hospital between October 1, 2007, through December 31, 2012, with an inpatient stay of ≥2 days and <90 days to determine the extent of LOS and inpatient costs that should have been attributable to hospital-acquired MRSA versus the post discharge costs that should have been associated with hospital-acquired MRSA. Patients were excluded from the study if they experienced mortality during the index admission, demonstrated a positive MRSA culture before the index admission, or if there had been <365 days of preadmission observation data available for the patient. Patients who had not been enrolled in Medicare were also excluded from the study. Patients were identified

using results from MRSA screenings for all patients following admission to the IP facility, transfer to another IP unit, and upon discharge from the IP VA facility. Criteria that distinguished a HAI versus colonization required a positive culture from a sterile site such as blood, bone, or having received administration of an anti-MRSA antimicrobial within the 5 days before or after the positive MRSA result.

Analyses included the inverse probability of treatment weighting that balanced patient characteristics across MRSA positive versus MRSA negative results, and regression models were used to model cost probabilities (Nelson, 2018). The study design provided 152,687 patients having met the inclusion criteria. Of those, 3,436 tested positive for MRSA. Results demonstrated an overall increase in inpatient costs of $16,111 (95% CI: $13,119-$19,103) versus the MRSA colonized costs of $7,217 (95% CI: $6,432 - $8,002). Additionally, MRSA infection demonstrated an increased index average LOS of 16.7 days for the MRSA group versus 9.0 days for those that tested negative for MRSA. The researchers identified that most of the costs associated with MRSA had occurred as inpatients however, there was a significant cost associated with patients that sought outpatient care outside of the VA system.

Magnet Status

As of June 2021, CMS was the single largest payer of healthcare in the United States with approximately 135 million beneficiaries (CMS, 2022). CMS-designed programs aimed at reducing HAIs, ultimately reducing LOS, cost, and mortality. Hospitals reported demographic, admission, and discharge data, as well as co-morbidities, length of stay, procedural, and complication outcomes for every patient

under the CMS payment plans at the hospital, patient, and physician level to CMS. This data was publicly sourced at the hospital and state levels. The CMS VBPP encompassed four domains including clinical care, patient and caregiver-centered experience of care/care coordination, safety and efficiency, and cost reduction. The domain of interest for this study was the safety domain that tracks HAIs. Additionally, CMS calculated a total performance score (TPS) based upon weighted results of the four HVBP domains: clinical care (30%), the patient and caregiver-centered experience of care/care coordination (25%, safety (20%) and efficiency and cost reduction (25%) (Spaulding et al., 2020).

Spaulding et al. (2020) performed a retrospective study that had been designed to determine whether Magnet hospitals demonstrated different CMS hospital value-based purchasing program-based program (HVPP) scores than non-Magnet hospitals. Data were obtained from the 2017 (HVPP) database and the ANCC listing of Magnet hospitals was used, having compared CMS HVPP outcomes between hospitals with and without Magnet accreditation. Propensity scoring with two non-Magnet accredited hospitals for every Magnet accredited hospital was used to reduce bias. Additionally, comparisons were made between Magnet hospitals that were awarded status with <2 years versus > 2 years as well as Magnet accreditation of <5 years versus >5 years. The study population encompassed 2,686 hospitals nationwide; 14% of the hospitals were Magnet accredited. This study provided mixed results; Magnet accredited hospitals demonstrated significant improvement over non-Magnet accredited hospitals in the clinical care score (54.9 vs. 33.3, $p<0.001$), the experience score (34.78 vs. 33.2, $P=.002$) and the efficiency and cost

reduction score (15.28 vs. 20.1, *p*=.001) (Spaulding et al., 2020). However, this study demonstrated no significance between the Magnet accredited and non-Magnet accredited hospitals for the overall TPS. The non-Magnet accredited hospitals scored better than the Magnet accredited hospitals for the safety score (53.14 vs. 54.54, *p*=.001) (Spaulding et al., 2020). Propensity scoring, however, demonstrated higher TPS scores in the Magnet accredited group (regression coefficient [RC], 2.21; 95% CI, 0.57-3.85) with no significance in the safety score. The mixed results of this study supported the need for additional research regarding whether the structures and processes achieved through the Magnet journey demonstrated any relationship with the CMS safety score that included HAIs, including MRSA and CDI.

Dierkes et al. (2021) performed a cross-sectional analysis of a national sample of hospitals from 2015-2017 that explored any potential differences between hospitals based on Magnet status pertaining to CMS pay for performance (P4P) programs including VBP, hospital readmission program (HRRP) and HACs. Datasets included the American Hospital Association (AHA) annual survey, CMS data that had been made publicly available by Advisory Board (National P4P Map), and the CMS Final Rule Impact File. As with other studies that compared Magnet hospitals with non-Magnet accredited hospitals, the dataset was obtained from the ANCC listing of all Magnet hospitals. At the time of this study, fewer than 10% of hospitals in the United States were Magnet accredited (Dierkes et al, 2021). One-to-one Magnet to non-Magnet hospital matching was performed, having used the geographical distance between the hospitals as the difference in the propensity scores. The authors commented that this methodology had

allowed for the similarity between other hospital characteristics (excluding the study variable, Magnet status, and associated structures and processes) (Dierkes et al., 2021). Results demonstrated no significant differences between the matched hospitals for overall P4P and HAC. There was, however, a significantly higher HRRP penalty rate in Magnet - accredited hospitals. Magnet hospitals demonstrated fewer HVBP penalties than their matched cohort 40% versus 49%; logistic regression analyses demonstrated an odds ratio (OR) of: (0.66, 95% CI: 0.48–0.92, $p < .05$).

Fischer and Nichols (2019) performed an observational study to examine a potential relationship between leadership practices (LDI), Magnet status, and nurse-sensitive patient outcomes that included falls with injury, CAUTI, CLABSI, and hospital-acquired pressure injury (HAPI). The researchers used the leadership practices inventory (LPI), a 30-question assessment developed by Kouzes and Posner in 1995. The LPI measured the frequency in which leaders engaged in five leadership practices that were reflective of transformational leadership as was seen in leaders within Magnet organizations. There was no direct measurement of MRSA or CDI, therefore the metrics of interest for this study included CAUTI and CLABSI as they were hospital-acquired infections with a probability of being secondary to MRSA. Participants included patients from two community hospitals and four tertiary hospitals in Michigan. Of the six hospitals, four were Magnet accredited. A request for nurse leader volunteers from the critical care, step-down, medical-surgical, and rehabilitation units of these hospitals resulted in a 78% participation rate; 50 leaders agreed and participated in the study. Descriptive and inferential statistics were used for the analysis of the LPI results,

demographics, and patient outcomes data. Multiple regression was instrumental in having predicted the relative weights of the LDI scores as they related to the nurse-sensitive patient outcomes scores. The *t* test was used to compare results between each of the nurse-sensitive outcomes, the LDI scores, and scores between Magnet and non-Magnet hospitals. Results demonstrated that there had been a significant increase in a subcategory of the LDI, 'create a shared vision' in the Magnet organizations (p=0.017) but there had been no other significant differences between the Magnet status and the LDI assessment. Magnet hospitals also demonstrated lower patient falls with injury (p=0.006), CAUTI (p<0.0001), and CLABSI (p=0.0013) than non-Magnet hospitals.

CMS Publicly reported Data

HAI information has been publicly reported through the CMS data sets (CMS, 2022). The data on hospital-acquired infections has been consistently categorized under *hospitals; complications & deaths* in the CMS dataset. The measures have been developed by the CDC and had been collected through the NHSN (Centers for Disease Control and Prevention, 2022c). CMS has consistently promoted the practice of CDC-recommended infection control steps for HAIs prevention. Therefore, HAIs have resulted in payment penalties through CMS pay for performance programs.

The HAI dataset provided frequency rates of hospital-acquired infections during the hospital stay. Acute care inpatients of all ages were included in the MRSA and CDI HAIs rates. Infection preventionists had been trained by the CDC to identify HAIs. Once identified as an HAI, the hospital-based infection preventionist reported the HAI to the NHSN and the NSHN submitted the information to CMS. Due to the manual processes

involved with HAI identification and reporting of HAI data, there was some variability between reporting entities and the accuracy of the data submitted (Centers for Medicare and Medicaid Services, 2022). CMS used a SIR to apply risk adjustments for each of the submitting hospitals including:

- MRSA:
- Admission prevalence rates of MRSA infections
- Average LOS
- Hospital affiliation with a medical school
- Type of hospital
- Number of ICU beds
- Amount of MRSA identified in the emergency department (ED) and/or observation areas
- CDI:
- Type of laboratory test used to identify CDI
- Whether or not the hospital collects stool sampling for CDI testing in ED or observation areas
- Bed size
- Number of ICU beds
- Hospital affiliation with medical school
- Admission prevalence of CDI
- Type of hospital

There was a calculated SIR for the state that was compared with the total national benchmark of the prior year's reported HAIs and a confidence interval was calculated following risk adjustment at the state level. Hospitals and states reporting SIRs with a lower limit that is >1.0 were classified as, *worse than the national benchmark* and facilities and states reporting SIRs with an upper limit that was <1.0 were categorized as, *better than the national benchmark* (Centers for Medicare and Medicaid Services, 2022). If the reported CI for the SIR was equal to the value of '1.0', there was no significant difference between the facility and/or state and the national SIR and the classification was *no different than the national benchmark* (Centers for Medicare and Medicaid Services, 2022).

Gaps in the Literature

In 2018, Rodriguez-Garcia et al., (2020) queried databases CINAHL, ProQuest, PubMed, and La Biblioteca Cochrane Plusper for current and relevant studies that looked for nursing, patient, and organizational outcomes in Magnet versus non-Magnet - accredited hospitals. Of 163 studies identified, only 21 studies met eligibility for the review. Of those studies, all were performed in the United States, 14 studies were retrospective, five were cross-sectional descriptive, one study was longitudinal, and one was a cost-benefit analysis. Each of the studies used secondary data sources including the National Database of Nursing Quality Indicators, the American Hospital Association's Annual Survey Database, and the CMS Hospital Compare datasets. The ANCC Magnet Program database was used to identify Magnet hospitals.

The review completed by Rodriguez-Garcia et al. (2020) categorized nursing-related outcomes with levels of job satisfaction, turnover, burnout, work environments, and nurse-patient ratios. Organizational outcomes included falls and mortality. The category of interest as it pertained to this study was the patient outcomes category that collected information on patient falls, pressure ulcers, mortality, CLABSI, CAUTI, MRSA, and CDI. Results regarding MRSA and CDI had been limited and mixed. Of the 21 studies reviewed, one study demonstrated that Magnet hospitals performed better than non-Magnet accredited hospitals regarding MRSA but performed worse with CDI (Pakyz et al., 2017). An additional study demonstrated lower CLABSI rates in Magnet hospitals but did not specify the infection bacteria (Barnes et al., 2019)

The latest review on this subject, prior to Rodriguez-Garcia et al., (2020) was performed in 2009 by Salmond et al. Of the studies reviewed by Rodriguez-Garcia et al., (2020), information regarding any relationship between Magnet-accreditation, CDI, and MRSA had been limited to fewer than two studies and demonstrated mixed results. Additional work was going to be required to study specifically study Magnet-accreditation, CDI, and MRSA.

Literature Review Conclusion

HAIs, specifically MRSA and CDI, extended LOS, increased morbidity and mortality, and increased healthcare costs in the United States by billions of dollars (Forrester et al., 2021). Research measuring HAI outcomes between Magnet and non-Magnet organizations was limited to widely scoped research that did not specifically detail MRSA and/or CDI except for two studies with mixed results (Rodriguez-Garcia et

al., 2020). The Donabedian Framework for Evaluating the Quality of Care (1966/2005) demonstrated alignment between the framework around structure, process, and outcomes and the Magnet framework of transformational leadership, structural empowerment, exemplary professional practice, innovations, new knowledge, and improvements (American Nurses Association, 2022). CMS provided a comprehensive, risk-adjusted dataset that allowed for the measurement, reporting, tracking, trending, and benchmarking of MRSA bacteremia and CDI at the hospital, state, and national levels. This allowed end-users to study outcomes over time and between organizations and states. Magnet accreditation had been demonstrated to be costly, effort, and time-consuming (Drenkard, 2022), literature informing any relationship between Magnet accreditation and HAIs allowed for expert decision-making.

Definitions

American Nurses Credentialing Center (ANCC): A subsidiary of the American Nurses Association that provides credentialing for individuals, programs, and organizations (American Nurses Association, 2022).

Catheter-associated Urinary Tract Infection (CAUTI): An infection caused by a urinary tract catheter; CAUTI is the most common type of HAI (Centers for Disease Control and Prevention, 2021d).

Centers for Medicare & Medicaid Services (CMS): The largest payer of health services in the United States and is a branch of the Department of Health and Human Services (HHS) (Centers for Medicare and Medicaid Services, 2022).

Clostridioides Difficile Infection (Clostridium Difficile, CDI, CDI): Inflammation of the colon that was caused by Clostridioides difficile. This infection caused severe diarrhea that often led to a sequence of events that might have been life-threatening (Centers for Disease Control and Prevention, 2022).

Hospital-acquired Condition (HAC): Medical conditions that were not present upon admission but occurred during hospitalization for an unrelated reason. HACs are preventable and may cause significant patient harm that could result in significant morbidity and/or mortality (Agency for Healthcare Research and Quality [AHRQ], 2022).

Hospital-acquired Infection(s) (HAIs): Infections that were not present on admission but occurred during an inpatient hospital admission. HAIs are preventable and may cause significant harm with an increased risk of morbidity and mortality (AHRQ, 2022). MRSA and CDI are commonly encountered HAIs.

Methicillin-resistant Staphylococcus Aureus (MRSA): A bacterial infection that is either community or hospital-acquired. Hospital-acquired MRSA was preventable and might have increased cost, LOS, morbidity, and mortality. Hospital-acquired MRSA rates are reported to CMS for tracking and implementation of programs aimed at a reduction. (Centers for Disease Control and Prevention, 2019a).

MRSA Bacteremia: A bacterial infection of the bloodstream. Hospital-acquired MRSA bacteremia is deemed preventable and has increased cost, LOS, morbidity, and mortality rates. Hospital-acquired MRSA bacteremia rates are reported to CMS for

tracking to implement programs aimed at a reduction. (Centers for Disease Control and Prevention, 2019a).

National Health and Safety Network (NHSN): A subsidiary of the CDC widely used for tracking healthcare-associated infections. The NHSN tracks data over time by the provider (hospital) and state levels to identify trends. Information from the NHSN is used to measure progress in prevention efforts (Centers for Disease Control and Prevention, 2022c).

Standardized Infection Ratio (SIR): A defined risk adjustment statistic that was used to allow for comparison of actual to predicted infections across organizations and states over time (Centers for Disease Control and Prevention, 2022c)

Assumptions

There was an assumption that the rates of hospital-acquired MRSA and CDI were impacted by staff and provider compliance rates with infection control procedures such as hand washing and appropriate personal protective equipment (PPE) use (see Centers for Disease Control and Prevention, 2021). Magnet organizations used transformational leaders that drove cultures that supported structures and processes that focused on the delivery of high-quality care (American Nurses Association, n.d.). Additionally, it had been assumed that hospitals with certain characteristics were positioned more optimally than others in supporting the practices required to prevent HAIs. However, the data I used in this study that was provided by CMS had mitigated potential variations related to hospital type, size, affiliation with medical school, LOS of the patients, patient acuity,

and community rates of MRSA and CDI via use of the SIRs (see Centers for Medicare and Medicaid Services, 2022).

Scope and Delimitations

The scope of this study included information on hospital-acquired MRSA bacteremia and CDI from hospitals that had received CMS payments. Community-acquired CDI and MRSA, as well as any HAIs other than CDI and MRSA bacteremia, were excluded from this study. Data from hospitals that did not receive CMS funding were not visible to CMS and were, therefore, excluded from this study. The list of participating hospitals had been obtained from the CMS dataset and exclusions were isolated to hospitals without sufficient data in the CMS dataset (Centers for Medicare and Medicaid Services, 2022). Magnet status was obtained from the ANCC list of Magnet hospitals for the calendar year 2021; no consideration had been given to the amount of time each hospital had maintained Magnet status however, it had been expected that this information posed importance for the expansion of additional studies with wider scopes of study. Active Magnet status for the entire study year was required.

Limitations

A limitation of this study data was that reporting of hospital-acquired MRSA and CDI was a manual process that allowed for some variability based on the competency of the individual infection preventionists in the NHSN (Centers for Disease Control and Prevention, 2022c). Some mitigations ensured the accuracy and completeness of the data, including CDC-defined definitions and standardized training for the hospital-based infection preventionists responsible for reporting infections to the NHSN (Centers for

Disease Control and Prevention, 2022c). Additional considerations included hospitals that might not have undergone the Magnet journey but instead (or in tandem), invested in programs that promoted standardization, process improvement, and control structures that ensured high-quality outcomes, such as Lean Six Sigma (LSS) or High-Reliability training (HRO). Logical next steps included the inclusion of these topics as expansions of this study.

Significance

The CDC (2021) described HAI reduction as a top priority. MRSA and CDI were responsible for preventable extended LOS, morbidity, mortality, and a significant portion of the $7.2 - $14.9 billion U.S. dollar annual costs attributed to HAIs (Forrester et al., 2021). Health systems focused heavily on processes, structures, and programs aimed at the reduction of HAIs that would have provided high-quality outcomes. The question that surrounded Magnet accreditation and that all chief nurse executives asked was, 'Was it worth the cost and effort?' This study provides some insight into whether there was a significant difference between Magnet-accreditation versus non-Magnet-accreditation and the frequency of HAIs, specifically MRSA and CDI. This allowed for informed decision making regarding the usefulness of the Magnet program for several of the hospitals' largest priorities.

Summary and Conclusions

A thorough review of the literature provided evidence of the immense financial, morbidity, and mortality costs associated with hospital-acquired MRSA and CDI. Healthcare administrators have been challenged with the identification of solutions for

the prevention of HAIs and though there have been effective recommendations that have eliminated some of the spread of MRSA and CDI, these infections have continued to occur (Centers for Disease Control and Prevention, 2022). As a solution, many healthcare administrators investigated the possibility of the implementation of programs that promoted the development and execution of hardwired structures and processes that drove high-quality patient outcomes.

Magnet accreditation has been a recognition program that boasted positive patient outcomes through structures and processes that engaged the workforce and drove quality care (ANCC, n.d.). Current literature provided mixed support for the relationship between Magnet hospitals and quality outcomes with minimal literature that specifically studied any relationship between Magnet accreditation and MRSA and/or CDI. Fewer than 10% of the hospitals in the United States have become Magnet accredited (see Dierkes, 2021). To accommodate the need for data allowing for significant results, I used the data from the entire CMS data set for CDI and MRSA bacteremia in the 2021 calendar year in this study. Results from this study provided healthcare leaders with information regarding whether there was a relationship between Magnet accreditation and the SIR of CDI and MRSA bacteremia infections across the country.

Section 1 provided a thorough review of the literature related to the problem, purpose, and research questions. Additionally, the Donabedian framework was described along with the relationship to the variables associated with the study. Section 2 provided the research design, information about the population, methodology, and operationalization of the variables.

Section 2: Research Design and Data Collection

In this study, I explored the alignment between the Donabedian framework for evaluating the quality of care that had been originally published in 1966 (Donabedian, 1966/2005) and the ANCC components of magnetism that identified a significant difference between Magnet-accreditation versus non-Magnet accreditation hospitals and the frequency of HAIs, specifically MRSA and CDI. MRSA and CDI have demonstrated significantly extended LOS, and increased cost, and have contributed heavily to morbidity and mortality (Forrester et al., 2022). These preventable HAIs (Centers for Disease Control and Prevention, 2021) required standardized and controlled structures and processes that were supportive of CDC-recommended precautions, that required a strong focus from healthcare leaders.

Challenges to infection prevention strategies are multifactorial and result in poor compliance with CDC-recommended infection prevention procedures with resultant *worse than expected* CMS risk-adjusted, SIRs (Centers for Disease Control and Prevention, n.d.). Magnet organizations use the five components of magnetism to engage and empower the front-line staff that theoretically allow for hardwired structures and processes that drive high-quality outcomes (American Nurses Association, n.d.). In this study, I compared the mean SIRs in all hospitals in the United States that provided available data in the CMS HAI database that identified whether there was a significant difference between Magnet accredited hospitals and non-Magnet accredited hospitals for hospital-acquired MRSA bacteremia and/or hospital-acquired CDI. Understanding the relationship, if any, between Magnet status and hospital-acquired MRSA and/or CDI

outcomes can provide health system leadership with the information required to drive optimal outcomes.

Research Design and Rationale

Operationalization of Variables

The dependent variables for this study were the SIRs for hospital-acquired MRSA bacteremia and hospital-acquired CDI (see Table 1). CDC recommended interventions, when integrated into structures and processes through transformational leadership practices, mitigate the risks of transmission of each of these preventable, hospital-acquired infections. SIRs are embedded with risk-factor adjustments at the hospital and state levels, which allows for a calculation of predicted outcomes by the hospital. Hospitals with SIRs >1 demonstrated *worse-than-expected* and risk-adjusted results (Centers for Medicare and Medicaid Services, 2022). Organizations that demonstrated SIRs of <1 were also risk-adjusted however, performance was *better than expected* (Centers for Medicare and Medicaid Services, 2022). Hospitals that demonstrated SIRs equal to 1 demonstrated outcomes *as expected* based on the risk adjustment and predictive algorithms (Centers for Medicare and Medicaid Services, 2022).

The independent variable for each of the research questions was Magnet status. Each organization had been coded as Magnet accredited or non-Magnet accredited. All organizations coded as Magnet accredited had been reported by the ANCC (American Nurses Association, 2022) as Magnet facilities during the entire 2021 year. If awarded Magnet accreditation at any time in 2021 or later, the variable was coded as not-Magnet accredited because the organization would not have been Magnet accredited for the entire

reporting period. The longevity of Magnet-accreditation per organization was not a consideration in this study; it was, however, considered a logical next step in future research.

Table 1

Description of Operationalization of the Variables

Research Questions	Independent Variables	Dependent Variables	Analysis
RQ 1	Magnet Status (Magnet accredited/not-Magnet accredited)	Hospital-acquired MRSA Bacteremia SIRs	Mann-Whitney U Test, comparison of median rank
RQ 2	Magnet Status (Magnet accredited/not-Magnet accredited)	Hospital-acquired CDI SIRs	Mann-Whitney U Test, comparison of median rank

Methodology

The methodology for this study included a comparison of ranked medians between two independent groups for each of the dependent variables. The population, sampling procedures, instrumentation and operationalization of constructs, data analysis methodology, and data analysis plan are described within this section. External, internal, and construct validity are explored.

Population and Sampling Procedures

The population for this study encompassed all hospitals within the United States that reported data on HAIs through CMS. Specifically, data regarding standardized infection ratios for hospital-acquired MRSA bacteremia and hospital-acquired CDI were abstracted from the CMS data file for the dates ranging from January 1, 2021, through

December 31, 2021. The populations within the datasets included patients of all ages. A dataset published by the ANCC was used and identified the hospitals in the CMS HAI file that had been Magnet accredited throughout the dates for the study data, January 1, 2021, and December 31, 2021.

Power Analysis and Sample Size Estimation

I used G*Power software was used and identified the appropriate sample sizes for each of the variables required for this study. Using this software and adhering to the recommended sample sizes mitigated type I and type II errors associated with under- or oversampling. G*Power required four inputs that facilitated the determination of sample sizes for the Mann-Whitney U test. The research questions in this study required two tails. An alpha error probability of 0.05, combined with a sample size allocation ratio of .28 and .15, combined with a small effect size (.20) could not achieve a power of .95. Therefore, the power was set to .90. The G*power output recommended total sample sizes of at least 1,612 for research question 1 and 2,428 for research question 2 (see Table 2).

Table 2

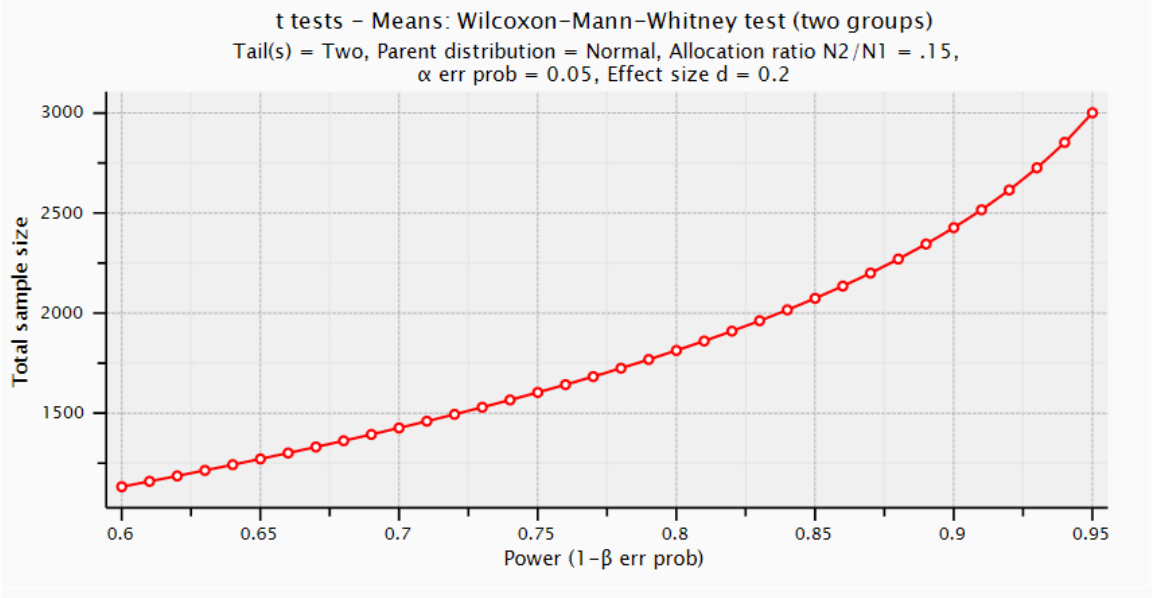
Mann-Whitney U Test for MRSA Bacteremia and CDI Power Analysis using G Power*

Dependent Variable Available Population Sizes		
Subgroups	MRSA bacteremia	CDI
Magnet accredited	379	399
Non-Magnet accredited	1350	2619
Total	1729	3018
G*Power inputs for 2 independent sample, nonparametric		
Tails	2	2
Effect size	0.2	0.2
Alpha error probability	0.05	0.05
Power	0.9	0.9
Allocation ratio	0.28	0.15
G*Power outputs: Required sample sizes		
Subgroups	MRSA bacteremia	CDI
Magnet accredited	353	317
Non-Magnet accredited	1259	2111
Total	1612	2428

Figure 2 demonstrates the X-Y plot for the CDI dataset from G*Power. This graph demonstrates that with the available population sizes and a small effect size, .9 was the maximum achievable power. To achieve a power of .95 without increasing the effect size, a total population size of 3,000 would have been required.

Figure 2

X-Y Plot for the Range of Values by Sample Size for Mann-Whitney U Test for CDI Power Analysis Using G Power*



Instrumentation and Operationalization of Constructs

Secondary Data Analysis Methodology

In this study I used three sets of secondary data. The CDI and MRSA Bacteremia data sets were obtained from CMS.gov. The latest data set that was available at the time of this study was January 1, 2021 – December 31, 2021, and this is the one I used. All three data sets were open-sourced, and none required permission for use in this study. Each of the data sets provided the risk-adjusted SIRs at the hospital and state levels; facility-level data was used. In some instances, the CMS file demonstrated that some of the data was missing. Hospitals with SIRs that were coded as data not available from the CMS dataset were removed from the denominator and were not used in this study.

The ANCC file of Magnet hospitals had been current through the year-to-date 2022 and was compared with the CMS file of participating hospitals. Health systems might have had one or more of their facilities Magnet accredited and others not accredited. Additionally, some health systems provided a central address for an accredited hospital versus the actual street address of the Magnet accredited facility. Care was taken to ensure that the ANCC listing of the Magnet accredited facility and the street address matched before listing the organization as ‘Magnet accredited’ or ‘non-Magnet accredited'. In the event of any potential misinformation, the hospital in question was removed from the denominator and was not used in the study.

Proposed Data Analysis Plan

The file containing the CMS and ANCC data was scrubbed for missing fields, 'data not available', and ensured that the hospitals included in the study were all located within the United States. Ensuring that no errors in transcription occurred when the Magnet organizations were identified, both files (CDI and MRSA Bacteremia) demonstrated the same number of each category ('unknown', 'accredited', and 'not accredited') in each of the CDI and MRSA files. Once scrubbed, the Excel file containing the CMS CDI and MRSA Bacteremia data by the hospital was saved as a CSV file and uploaded into the latest version of SPSS.

The SPSS software allowed for descriptive analysis (i.e., total sample volumes, mean, and median SIRs by category). Test of normality demonstrated nonparametric data, therefore, the Mann-Whitney U test of the median rank of the SIRs was run between the ‘Magnet accredited’ and ‘non-Magnet accredited’ groups for each of the dependent

variables (MRSA bacteremia and CDI) that was used to identify whether there was a significant difference between Magnet accreditation and non-Magnet accreditation hospitals and the frequency of HAIs; specifically, MRSA and CDI.

Threats to Validity

External Validity

The CDC had been reliant upon hospital self-reporting for the calculation of the MRSA bacteremia and CDI rates, by the organization (Centers for Disease Control and Prevention, 2021). Measures were taken to standardize the identification of hospital-acquired versus community-acquired (or present upon admission) infections, however, this reporting was an individual, manual process and it was assumed that some levels of errors have occurred and have threatened external validity to some extent. Mitigation strategies included ongoing, updated, standardized training programs for all reporting infection preventionists.

Internal Validity

A threat to internal validity may have occurred because of any assumptions that Magnet accreditation was the only methodology for ensuring standardized and hard-wired structures and processes that had provided resultant education and competency for CDC recommended infection prevention strategies combined with high compliance and resultant quality outcomes. Hospital administrators might have chosen programs such as high-reliability organization (HRO) or Lean Six Sigma (LSS) toolkits and implemented standardized and controlled structures and processes with resultant high infection prevention compliance and low SIRs. A second consideration was that health executives

would have prioritized resources and objectives each year; MRSA and CDI might have been prioritized at a lower level than critical staffing shortages or other individual hospital priorities. Either of these scenarios might have failed to demonstrate a difference between Magnet and non-Magnet hospital CDI outcomes. This was an introductory study, and the results of this study would have guided the direction of future research.

Construct or Statistical Conclusion Validity

Ares of concern included the disparate sample sizes for each of the dependent variable subgroups as well as the nonparametric data. The ‘non-Magnet accredited’ populations were much larger than the ‘Magnet accredited’ populations with a .28 (RQ 1) and a .15 (RQ 2) ratio. These challenges were mitigated with the availability of the G*Power-recommended total sample sizes and by using the Mann-Whitney U test to compare SIRs mean rank instead of mean SIRs.

Ethical Procedure

All data accessed, calculated, graphed, and reported in this study was publicly sourced by CMS.gov and was at the hospital level; there was no access to nor reporting of individual health-protected information at the patient level. Each of the three data sets were open-sourced and none of the data sets required permission for use. All professional, institutional, and federal standards for conducting this research were reviewed by the Walden University Institutional Review Board's (IRB) ethical procedures committee.

Summary

In summary, hospital-acquired infections were considered preventable, and costly and have resulted in extended LOS with increased morbidity and mortality. Hospitals that were Magnet accredited demonstrated competencies in transformational leadership, nurse empowerment, innovation, excellence, and high achievement in empirical outcomes secondary to the implementation of strong structures and processes. The purpose of this study was to identify whether there was a significant difference between Magnet accredited and non-Magnet accredited hospitals and the frequency of HAIs, specifically, MRSA bacteremia and CDI.

CMS provided a risk-adjusted standardized infection ratio for each hospital. These SIR scores represented secondary, continuous data that was entered into SPSS software with the independent variable of Magnet status. A Mann-Whitney U test was performed to identify whether there was any difference in the SIRs between Magnet accredited versus non-Magnet accredited hospitals and the frequency of CDI and/or MRSA bacteremia. G*Power was used to calculate appropriate sample sizes that allowed for a 0.05 level of significance with a 0.9 power. This was an introductory study; it was expected that future studies would have used information gained from this study to determine the next steps in research with focus toward any potential relationship between Magnet status and quality outcomes. Section 3 provides the results and any findings of the descriptive analyses and Mann-Whitney U test.

Section 3: Presentation of the Results and Findings

This study provides information regarding whether there is a relationship between the independent variable of the ANCC Magnet-accreditation status and the dependent variables of hospital-acquired MRSA bacteremia and/or hospital-acquired CDI. The results of this research may provide healthcare leaders with information to improve health outcomes related to hospital-acquired infections, specifically, MRSA bacteremia and CDI. HAIs, though largely preventable, contribute heavily to increases in mortality, LOS, and cost per inpatient stay (Centers for Disease Control and Prevention, 2021).

The independent variable for this study is ANCC Magnet accreditation status. The dependent variables are the SIRs for hospital-acquired MRSA bacteremia and hospital-acquired CDI. Magnet status aligns with the Donabedian framework, demonstrating the importance of structure and process on outcomes (American Nurses Association, n.d.; Donabedian, 1966/2005). The CDC maintains the prioritization of HAIs due to their role as drivers in mortality, LOS, and billions of U.S. dollars per year in cost (Centers for Disease Control and Prevention, 2021). Hospitals in the United States are provided evidence-based recommendations for interventions required to prevent hospital-acquired MRSA bacteremia and hospital-acquired CDI (Centers for Disease Control and Prevention, 2021). I explored whether there is a relationship between U.S. hospitals demonstrating excellence in structure and process through Magnet-accreditation and U.S. non-Magnet accredited hospitals and whether there were differences in hospital-acquired MRSA bacteremia and/or hospital-acquired CDI SIRs.

Research Questions

RQ1: Is there a significant difference in the CMS PSIs for HAIs, specifically, MRSA bacteremia scores that are Magnet accredited versus hospitals that are not Magnet accredited?

$H_0$1: There is not a significant difference in hospital-acquired MRSA bacteremia scores for hospitals that are Magnet accredited versus hospitals that are not Magnet accredited.

$H_1$1: There is a significant difference in hospital-acquired MRSA bacteremia scores for hospitals that are Magnet accredited versus hospitals that are not Magnet accredited.

RQ2: Is there a statistically significant difference in the CMS PSIs for healthcare acquired infections (HAIs), specifically, CDI scores for hospitals that are Magnet accredited versus hospitals that are not Magnet accredited?

$H_0$2: There is not a statistically significant difference in the hospital-acquired CDI scores for hospitals that are Magnet accredited versus hospitals that are not Magnet accredited.

$H_1$2: There is a statistically significant difference in the hospital-acquired CDI scores for hospitals that are Magnet accredited versus those that are not Magnet accredited.

In Section 3 I explore, in detail, the secondary data collection processes, statistical testing methodologies, analysis, and results of this study.

Data Collection of Secondary Data

The secondary datasets used for the dependent variables in this study were open sourced and were obtained from the CMS data.gov site. CMS is the largest payer of healthcare services in the United States covering more than 135 million beneficiaries as of June 2021 (Centers for Medicare and Medicaid Services, 2022). Every participating hospital in the United States provides infection data to the NHSN. The NHSN applied a predetermined calculation to these data that provided a risk-adjusted SIR for each infection type by hospital. The SIRs were reported back to CMS and populated the open-sourced CMS databases (see Table 3). Within these datasets, SIRs scores provide a continuous variable with <1 *being better than expected*, 1 being *as expected*, and >1 being *worse than expected*. I compared the median SIRs of Magnet accredited hospitals against the median SIRs of non-Magnet accredited hospitals within the hospital-acquired MRSA bacteremia and hospital-acquired CDI categories.

Time Period of Collection and Discrepancies in Secondary Data

The datasets used for this study encompass January 1, 2021, through December 31, 2021, which were the latest datasets available at the time of this study. The independent variable used a data set obtained from the ANCC that provided the names and locations of all Magnet accredited hospitals including the dates of accreditation and reaccreditation (American Nurses Association, 2023). This allowed me to insert a column into the CMS hospital-acquired MRSA bacteremia and hospital-acquired CDI data files to include the categorical variable of Magnet accredited or non-Magnet accredited. Data

were validated by ensuring that the name and location of the hospital matched the CMS data files and the Magnet status file.

Discrepant data included hospitals that were unable to be clearly identified as either Magnet accredited through all of 2021, or non-Magnet accredited due to variations in hospital name or location between the CMS and ANCC Magnet accredited files. All discrepant organizations were removed from the data prior to any statistical analysis. Additionally, hospitals reporting 'data not available' in the CMS datasets in the SIRs columns have also been removed from the data analysis.

Table 3

Data Sources for Independent and Dependent Variables

	Independent variable	Dependent variable for Research Question 1	Dependent variable for Research Question 2
Output	Magnet status during 2021	Hospital-acquired MRSA bacteremia SIRs for each hospital in the United States	Hospital-acquired CDI SIRs for each hospital in the United States
Data source	American Nurses Association, 2023	Centers for Medicare and Medicaid Services, 2022	Centers for Medicare and Medicaid Services, 2022

Descriptive Characteristics

The CMS hospital-acquired infection dataset for 2021 consists of a total of 4,845 hospitals as seen in Table 4. Three of the hospitals within this dataset were located outside of the United States and 13 hospitals demonstrated discrepant data. There were 435 Magnet accredited hospitals for the entire year of 2021 and 4,394 organizations were not Magnet accredited. When the MRSA bacteremia and CDI data were abstracted from

this source dataset, all 16 of the facilities with discrepant data were removed, allowing the remaining 4,829 hospitals for use in the analyses for this study. This section provides full descriptive characteristics and sample population information for RQ1 and RQ2.

Table 4

Number of Hospitals for Research Questions 1 and 2

Category	Number of Hospitals
Non-U.S. locations (removed from data)	3
Discrepant data (removed from data)	13
Magnet accredited	435
Non-Magnet accredited	4394
Total	4845
Total hospitals used in the analyses	4829

Table 5 shows that of the 4,829 hospitals within the United States and with no discrepant data, a total of 1,729 hospitals demonstrated available SIRs for hospital-acquired MRSA bacteremia. The hospital-acquired CDI population provided 3,018 hospitals with available SIRs. Of those, 22% hospitals from the hospital-acquired MRSA and 13% from the hospital-acquired CDI populations were Magnet accredited, leaving much higher non-Magnet accredited population sizes as compared with Magnet accredited population sizes. These low accreditation percentages were expected since the overall national Magnet accreditation rate is only 9.96% (American Nurses Association, 2023).

Table 5

Number of U.S. Hospitals by Magnet Status and with Available SIRs by Diagnoses

Hospitals	Total U.S. with accreditation Information	MRSA Bacteremia available SIRs	Percentage by accreditation (MRSA)	CDI available SIRs	Percentage by accreditation (CDI)
Magnet accredited	435	379	0.22	399	0.13
Non-Magnet accredited	4394	1350	0.78	2619	0.87
Total	4829	1729		3018	

Descriptive statistics demonstrated lower means for the SIRs in the Magnet accredited groups for both dependent variables as seen in Table 6. Lower SIRs for the dependent variables indicated better performing than those scoring higher SIRs for these variables. Normality testing was performed to identify the appropriate statistical testing to determine whether there is a significant difference between SIRs for the Magnet-accredited and non-Magnet accredited groups.

Table 6

Descriptive Statistics for the Dependent Variables

Dependent variable	Accreditation status	*N*	Mean
MRSA Bacteremia	Magnet accredited	379	0.98375
	Non-Magnet accredited	1350	1.18384
CDI	Magnet accredited	399	0.49927
	Non-Magnet accredited	2619	0.52494

Normality Testing

I used SPSS (v. 28) to test each of the data sets for normality via the Kolmogorov-Smirnov and Shapiro-Wilk tests. As shown in Table 7, both tests demonstrated non-normal distribution for each of the sets of variables and groupings as follows: MRSA bacteremia provided a skewness of 1.75 [Kolmogorov-Smirnov, D(1729) =.096, *p*=<.001; Shapiro-Wilk = .88, *p*=<.001]; CDI provided a skewness of 2.49 [Kolmogorov-Smirnov, D(3018) =.14, *p*=<.001; Shapiro-Wilk = .81, *p*=<.001].

Table 7

Tests of Normality for the Dependent Variables

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Hospital-acquired MRSA Bacteremia	0.096	1727	0.000	0.881	1727	0.000
Hospital-acquired CDI	0.142	3018	0.000	0.810	3018	0.000

a. Lilliefors Significance Correction

The histograms in Figures 3 and 4 illustrate the nonparametric distribution of each of the dependent variables. Figure 3 demonstrated the hospital-acquired MRSA

bacteremia data with a right-sided skew. The minimum data point showed a SIR of 0 with a mean of 1.14 and isolated outliers from four to eight.

Figure 3

Histogram of the SIRs for MRSA Bacteremia

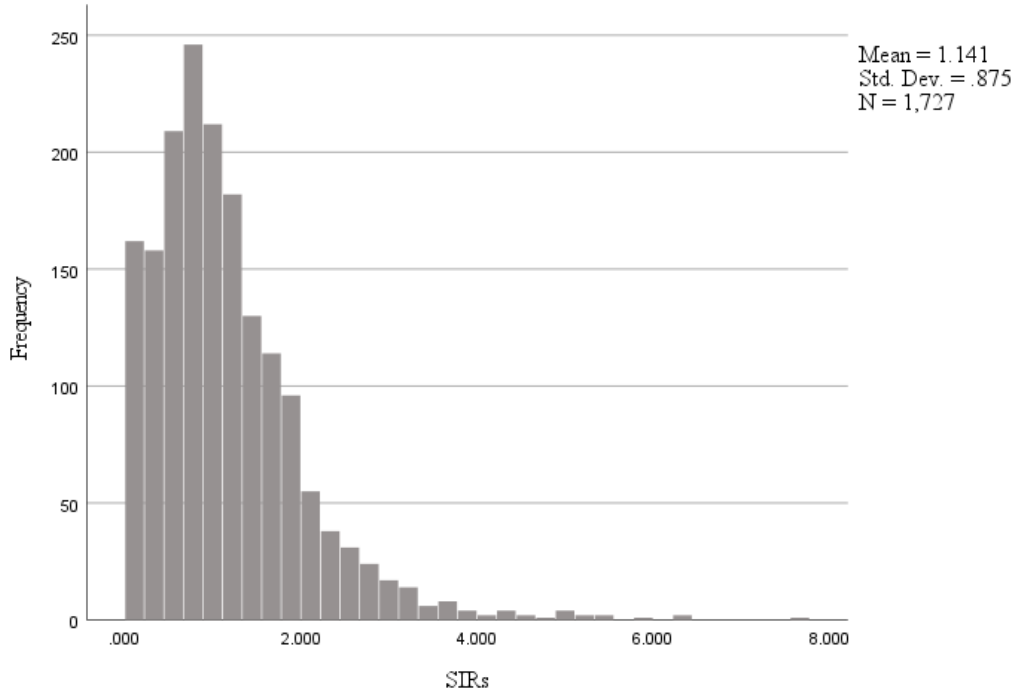
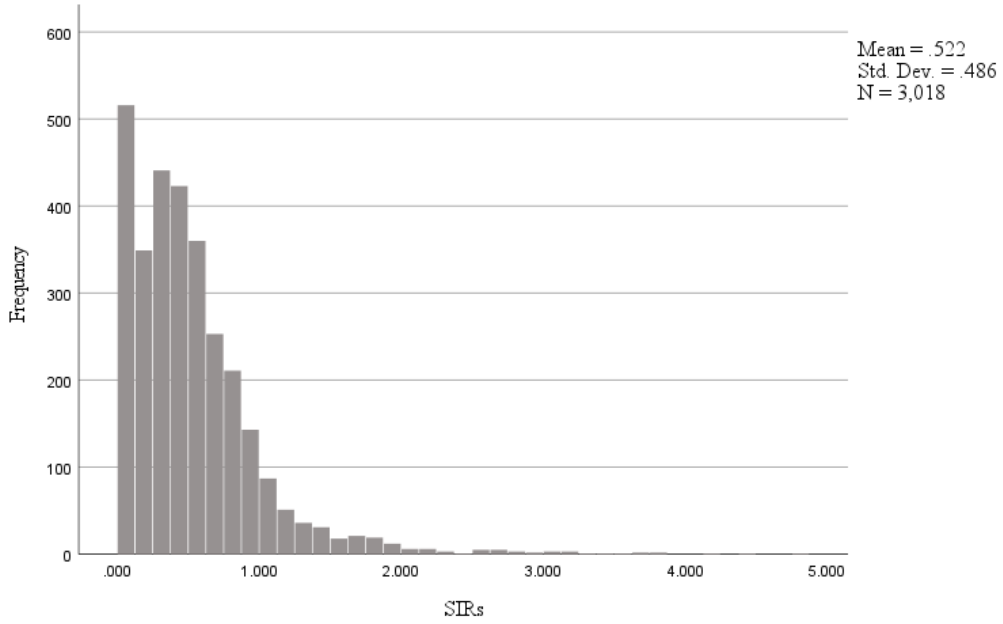


Figure 4 demonstrated the hospital-acquired CDI data with a right-sided skew. The minimum data point showed a SIR of zero with a mean of 0.52 and isolated outliers from two to four. It is important to note the overall low mean SIR for this variable as well as the lower SIRs of the outliers. The combined hospital groups demonstrated an overall mean score that is close to 50% below the expected SIR.

Figure 4

Histogram of the SIRs for CDI



Although my original intent for this study was to run a comparison of means using independent *t* tests, the data was shown to be nonparametric with significant right-sided skewing and unequal sample sizes. These findings demonstrated that a more appropriate test strategy was to perform the Mann-Whitney U test and compare the mean ranks.

Study Results

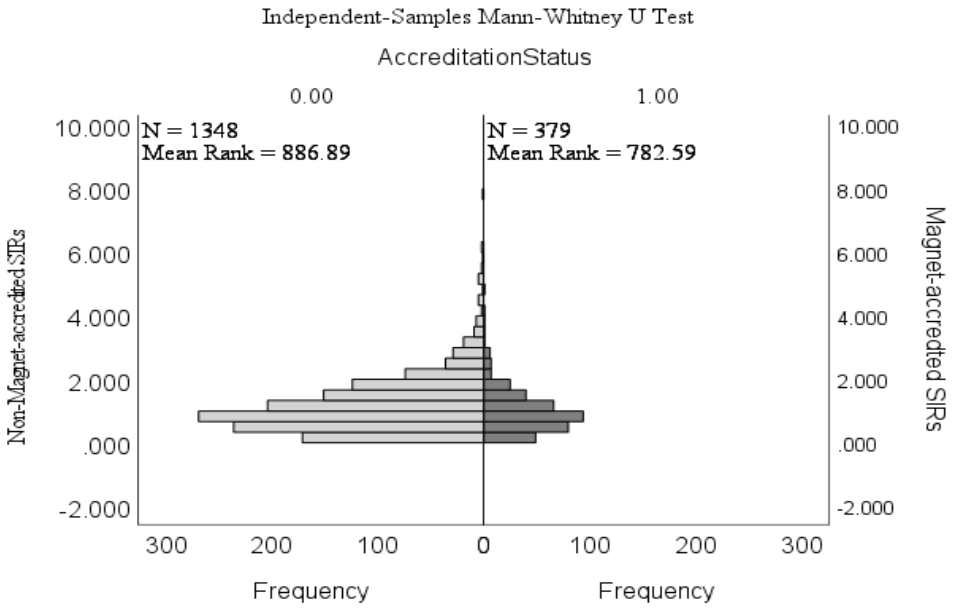
The study results section describes the assumptions of the statistical testing used to determine whether there was any relationship between Magnet-accreditation status and hospital-acquired infections, specifically, MRSA bacteremia.

Statistical Assumptions and Results of Statistical Analysis for Research Question 1

The dataset for research question 1 met the required variable criteria and independence of observations assumptions. The shape of the Magnet accredited group for the hospital-acquired MRSA bacteremia variable demonstrated a similar distribution to the non-Magnet accredited group for research question 1 however, the shape of the Magnet accredited group was much smaller than the shape of the non-Magnet accredited group due to differing population sizes as seen in Figure 5. Therefore, when analyzing the results of the Mann-Whitney U test for research question 1, although median SIRs were calculated, results were based upon the mean ranks for each of the variables.

Figure 5

Independent-Samples Mann-Whitney U Test for RQ 1; Hospital-acquired MRSA Bacteremia



The Mann-Whitney U Test was used to identify whether there was any significant difference in the CMS Patient Safety Indicators for HAIs, specifically, MRSA bacteremia SIRs for hospitals that are Magnet accredited versus hospital-acquired MRSA bacteremia SIRs for hospitals that are not Magnet accredited. Table 8 demonstrates significant differences in the MRSA bacteremia SIRs of Magnet accredited hospitals (Median = .89, n = 379) and non-Magnet accredited (Median = 1.00, n = 1348), U = 224592.50, z = -3.60, $p<.001$, r =11.54. The null hypothesis was rejected. The median SIRs for the Magnet accredited group demonstrated better than expected outcomes with a median SIR <1. The median SIR of '1' for the non-Magnet accredited group reached the threshold of *as expected*. Importantly, when all the SIRs within the two groups were placed in rank order, the mean rank of the Magnet accredited group was significantly lower than that of the non-Magnet accredited group as seen in Table 8. Although additional testing is required to demonstrate causation between Magnet-accreditation and hospital-acquired MRSA bacteremia, this study demonstrated that Magnet accredited hospital in the United States performed significantly better than non-Magnet accredited hospitals in the United States, in 2021 for hospital-acquired MDSRA bacteremia SIRs.

Table 8

Mann-Whitney U Test for Hospital-acquired MRSA Bacteremia

Hospital-acquired MRSA Bacteremia SIR Ranks

Accreditation Status		N	Mean Rank	Sum of Ranks
SIRs	Non-Magnet accredited	1348	886.89	1195525.50
	Magnet-accredited	379	782.59	296602.50
	Total	1727		

Hospital-Acquired MRSA Bacteremia SIR Descriptives

Magnet Status	Median	N
Magnet-accredited	0.89	379
Non-Magnet accredited	1.00	1348
Total	0.97	1727

Hospital-acquired MRSA Bacteremia SIR Test Statistics[a]

	Score
Mann-Whitney U	224592.50
Wilcoxon W	296602.50
Z	-3.60
Asymp. Sig. (2-tailed)	0.00

a. Grouping Variable: AccreditationStatus

Summary Results of Research Question 1

Magnet accredited hospitals in the United States demonstrate a median SIR score of .89 versus 1.0 for non-Magnet accredited hospitals. The *p* value of <.001 demonstrates a statistical difference between the groups with the *r*=11.54 demonstrating a small effect. These results prompt the researcher to reject the null hypothesis and demonstrate that there is a significant difference in the CMS Patient Safety Indicators for HAIs,

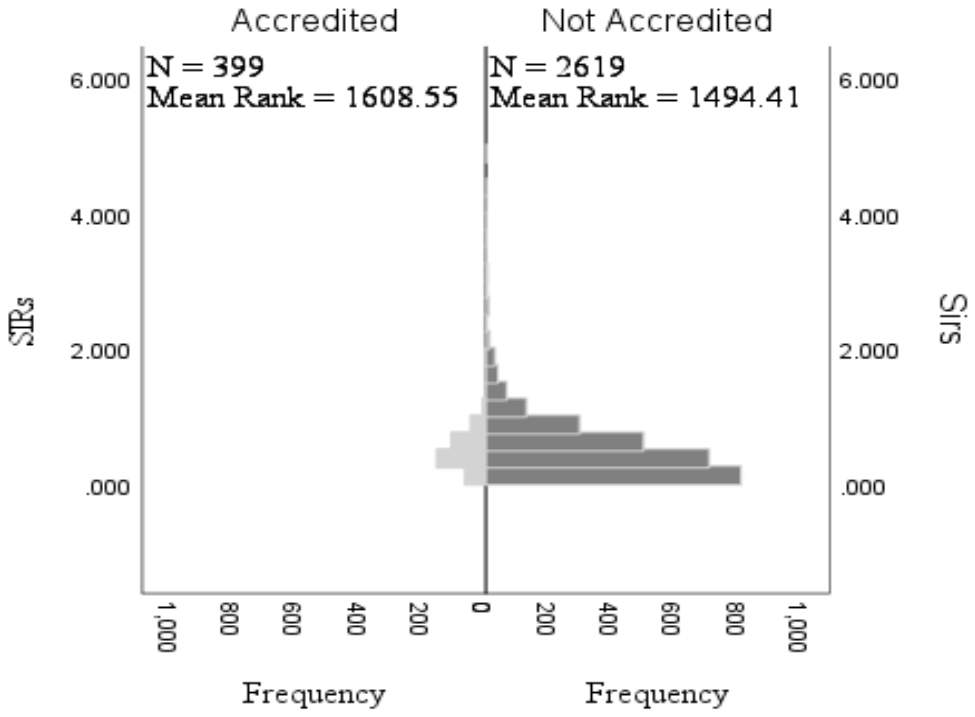
specifically, MRSA bacteremia scores for hospitals that are Magnet accredited versus MRSA bacteremia scores for hospitals that are not Magnet accredited. Magnet accredited hospitals demonstrated significantly lower SIRs (better than) non-Magnet accredited hospitals.

Statistical Assumptions and Results of Statistical Analysis for Research Question 2

The dataset for research question 2 met the required variable criteria and independence of observations assumptions. The shape of the Magnet accredited group for the hospital-acquired CDI variable demonstrated a similar distribution to the non-Magnet accredited group for research question 2 however, as was true with research question 1, the shape of the Magnet accredited group was much smaller than the shape of the non-Magnet accredited group due to differing population sizes as seen in Figure 6. Therefore, when analyzing the results of the Mann-Whitney U test for research question 2, although median SIR scores were calculated, results were based upon the mean ranks for each of the variables.

Figure 6

Independent-Samples Mann-Whitney U Test for Research Question 2; Hospital-acquired CDI



The Mann-Whitney U Test was used to identify whether there was any significant difference in the CMS PSIs for HAIs specifically, CDI SIRs for hospitals that are Magnet accredited versus CDI SIRs for hospitals that are not Magnet accredited. Table 9 demonstrates significant differences in the CDI SIRs of Magnet accredited hospitals (Median = .46, n = 399) and non-Magnet accredited (Median = .43, n = 2619), U = 482968, z = -2.44, *p*=.01, r = 22.51. The null hypothesis was rejected. It is also noted that

the mean rank of the non-Magnet accredited group is significantly lower than the Magnet accredited group for research question 2 as shown in table 9.

Table 9

Mann-Whitney U Test for Hospital-acquired CDI

Hospital-Acquired CDI SIR Descriptives

Magnet Status	Median	N
Magnet accredited	0.46	399
Non-Magnet accredited	0.43	2619
Total	0.43	3018

Hospital-Acquired CDI SIR Ranks

Accreditation Status		N	Mean Rank	Sum of Ranks
Score	Magnet accredited	399	1608.55	641813.00
	Non-Magnet accredited	2619	1494.41	3913858.00
	Total	3018		

Hospital-Acquired CDI SIR Test Statistics[a]

	Score
Mann-Whitney U	482968.00
Wilcoxon W	3913858.00
Z	-2.44
Asymp. Sig. (2-tailed)	0.01

a. Grouping Variable: AccreditationStatus

Summary Results of Research Question 2

Magnet accredited hospitals in the United States demonstrate a median SIR of .46 versus .43 for non-Magnet accredited hospitals for hospital-acquired CDI. The p value of .01 demonstrates a statistical difference between the groups with an r = 22.51

demonstrating a small effect. The null hypothesis was rejected; there is a statistically significant difference in the hospital-acquired clostridioides difficile SIRs for hospitals that are Magnet accredited versus hospitals that are not Magnet accredited. Additional research is necessary to identify some of the reasons why non-Magnet accredited hospitals would demonstrate lower hospital-acquired SIRs than hospitals demonstrating proficiency with the structures and process associated with Magnet accredited hospitals. One factor may be that the SIRs for the hospital-acquired CDI population are so far below the expected threshold of '1' that there is too little opportunity for the Magnet-associated benefits to impact the overall outcomes. Other considerations might include the efforts that all hospitals place on ensuring compliance with isolation procedures for patients with CDI versus other types of infections.

Summary

Hospital-acquired infections data was obtained from hospitals in the United States that received payments from CMS during January 1, 2021, through December 31, 2021. Organizations reporting hospital-acquired MRSA bacteremia and hospital-acquired Clostridioides Difficile were categorized into groups identifying them as 'Magnet accredited' or 'non-Magnet accredited.' Normality testing demonstrated non-normal data distributions, prompting the use of the Mann-Whitney U test for both research questions. This study provided mixed results with each of the research questions demonstrating statistical significance and the null hypotheses were rejected. However, research question 1 demonstrated that Magnet accredited hospitals performed better than non-Magnet accredited hospitals. Research question 2 demonstrated that Magnet accredited hospitals

performed worse than non-Magnet accredited hospitals. However, analysis is complicated because both groups for research question 2 performed well- below (better than) the threshold of as ‘expected’.

Section 4 provides an analysis and interpretation of the findings and provides discussion regarding integration of the findings to current literature and Donabedian’s framework of structure, process and outcomes, limitations of this study and implications for professional practice and social change.

Section 4: Application to Professional Practice and Implication for Social Change

The cost of HAIs in the United States is a higher length of stay, morbidity, and mortality increasing the cost of care by a range of $7.2 to $14.9 billion U.S. dollars (Forrester et al., 2022). These challenges impact health systems and professional practice with strong implications for social change across the country. HAIs are preventable for health systems through implementation of the prevention strategies recommended by the CDC (2022). The risks to hardwiring and sustaining the behaviors necessary to prevent HAIs include but are not limited to staffing shortages, conflicting priorities, and failure to develop the standardized structures and procedures that would prevent these infections. Chief nursing officers (CNOs) demonstrate interest in achieving Magnet-accreditation because the ANCC boasts improved staff recruitment, retention, and quality outcomes through the journey and achievement of Magnet-accreditation (American Nurses Association, n.d.).

Interpretation of the Findings

I designed the research questions for this study in order to explore whether there a significant difference in the CMS PSIs or HAIs, specifically, MRSA bacteremia and CDI SIRs for hospitals that are Magnet accredited versus MRSA bacteremia and CDI SIRs for hospitals that are not Magnet accredited. The results of this study can provide valuable information to healthcare leaders including CNOs who are considering the commitment of the effort and cost associated with achieving Magnet-accreditation to improve quality outcomes including hospital-acquired MRSA bacteremia and CDI. I compared the mean ranks of SIRs for two HAIs, MRSA bacteremia and CDI. In this

section I explore the results, limitations of the study, and analysis for each of the research questions, discuss the findings to literature and the Donabedian framework, and discuss the implications for professional practice and social change.

Research Question 1 Analysis

Results from the SPSS the Mann-Whitney U Test demonstrated a significant difference in mean rank of the SIRs between the Magnet accredited and non-Magnet accredited organizations ($p<.001$) with a small effect ($r=11.54$) for hospital-acquired MRSA bacteremia. Magnet accredited hospitals demonstrated significantly lower median SIRs than non-Magnet accredited hospitals (.89 vs. 1.00 respectively). The null hypothesis was rejected. There is a significant difference in hospital-acquired MRSA bacteremia SIRs for hospitals that are Magnet accredited versus hospital-acquired MRSA bacteremia SIRs for hospitals that are not Magnet accredited. Hospitals that are Magnet accredited demonstrated a score that was better than expected and significantly better than hospitals that were not Magnet accredited. The study dataset included all hospitals reporting to CMS, so the sample was large, but the private-payer population was excluded from these outcomes. Though additional studies would be required to demonstrate causation, the results of this study support the ANCC Magnet framework of structure, process, and metric monitoring on outcomes (see American Nurses Association, n.d.) as well as the Donabedian framework for quality (see Donabedian, 2005/1966).

Research Question 2 Analysis

Results from the SPSS Mann-Whitney U Test demonstrated a significant difference in the mean rank of SIRs between the Magnet accredited and non-Magnet accredited organizations (p=.01) with a small effect (r=22.51) for hospital-acquired CDI. Non-Magnet accredited hospitals demonstrated a significantly lower median SIRs score than non-Magnet accredited hospitals (.43 vs. .46 respectively). It is important to note that both groups of the CDI dependent variable achieved SIRs well-below the SIR of 1 (*better than*). The null hypothesis was rejected. There is a significant difference in hospital-acquired CDI SIRs for hospitals that are Magnet accredited versus CDI SIRs for hospitals that are not Magnet accredited. As with the hospital-acquired MRSA bacteremia dataset, the hospital-acquired CDI dataset included the entire large CMS population, but the private-payer group was excluded from this study. Because both groups of the CDI variable performed so well, it is difficult to say, from these results, whether this study supports the ANCC Magnet framework of structure, process, and metric monitoring on outcomes. Further studies would be needed to explore the reasons for both groups performing well-below threshold and to study causation for the differences in median SIRs between the two groups.

Findings to Literature

The literature review strongly supported the negative impacts to mortality, LOS, cost, and readmissions as seen in Table 10. Bello-Chavolla et al. (2018) performed a retrospective analysis of 450 patients with staphylococcus aureus from 2006-2015. Results demonstrated significantly higher mortality rate for patients with MRSA over

patients with MSSA (p=<.05) (Bello-Chavolla et al., 2018). In 2019, Kirwin et al. published a retrospective study examining cost and LOS for patients with hospital-acquired MRSA. The researchers demonstrated an estimated incremental cost for hospital-acquired MRSA to be $47,016 (Canadian dollars; p<0.001) with an incremental LOS of 35.2 days (p<0.001) (Kirwin et al., 2019). Additional researchers have contributed information to the cost, LOS, and mortality rates of hospital-acquired infections through studies regarding CDI. Hirsch et al. (2022) performed a large retrospective cohort study of adult patients hospitalized in New York state with CDI demonstrating a statistically significant increase in readmissions, mortality, LOS, and cost, each with a p-value of <0.0001 at a 95% CI. The researchers demonstrated a 360-day mortality increase of 9.6% and an 84% increase in total charges for the CDI exposure group (Hirsch et al., 2022). Data from Kim et al. (2022) supported these results with a retrospective chart review to determine the incidence, contributing factors and associated impacts of hospital-acquired CDI on the orthopedic surgery population. Results demonstrated an increase in adjusted LOS by 2.8 days and a mortality rate increase of .9% for the positive CDI group over the CDI negative group (Kim et al., 2022).

Table 10

Current Literature Demonstrating Statistically Significant Negative Impacts of MRSA and CDI on Mortality, Cost, LOS, and Readmissions

Authors	Year published	Mortality	Cost	LOS	Readmissions
Banks et al.	2018	X			
Nelson et al.	2018		X	X	
Bello-Chavolla et al.	2018	X			
Kirwin et al.	2019		X	X	
Hirsch et al.	2022	X	X	X	X
Kim et al.	2022	X		X	

There was no current research that I found exploring Magnet accredited and non-Magnet accredited hospitals specific to hospital-acquired MRSA bacteremia or hospital-acquired CDI SIRs that allowed for comparison with this study. However, various studies outlining other quality outcomes comparing Magnet accredited and non-Magnet accredited facilities through programs such as payer-based pay-for-performance and CMS value-based purchasing (VBP) outcomes were reviewed and provided mixed outcomes. The CMS VBP program domain of interest is the safety domain that tracks HAIs, including MRSA and CDI (Spaulding et al., 2020). Additionally, CMS calculates a total performance score (TPS) that includes HAIs under the 'safety' category (Spaulding et al., 2020). Spaulding et al. (2020) performed a retrospective study to determine if Magnet hospitals demonstrated different CMS HVPP scores than non-Magnet hospitals. Results demonstrated mixed outcomes because Magnet accredited hospitals demonstrated significant improvement over non-Magnet accredited hospitals in the clinical care score (p<0.001), the experience score (p=.002) and the efficiency and cost reduction score

(p=.001), each of which may be influenced by HAIs. However, there was no significance between the groups for the TPS which is much more important to this study. The non-Magnet- accredited hospitals scored better than the Magnet accredited hospitals for the safety score which includes HAIs (p=.001) (Spaulding et al., 2020). Therefore, Spaulding et al. (2020) demonstrated no difference for the TPS group that includes hospital-acquired MRSA bacteremia and CDI and demonstrated non-Magnet accredited outperformed Magnet accredited for the safety category including hospital-acquired MRSA bacteremia and CDI.

Dierkes et al. (2021) also demonstrated mixed results in a cross-sectional analysis of a national sample of hospitals from 2015-2017 with no significant differences between the matched hospitals for overall P4P and HACs and there was a significantly higher penalty in the HRRP in Magnet accredited hospitals. Magnet hospitals did demonstrate fewer HVBP penalties than their matched cohort (p<.05) (Dierkes et al., 2021). In comparison with this study, hospital-acquired CDI and MRSA bacteremia influence the safety, TPS, HAC, and HRRP scores. As seen in Table 11, there was no difference in outcomes between the Magnet accredited and non-Magnet accredited hospitals for TPS and HAC; non-Magnet accredited hospitals outperformed Magnet accredited hospitals in safety and HRRP.

Table 11

Studies Comparing CMS Quality and Value-based Purchasing Outcomes between Magnet Accredited and Non-Magnet Accredited Hospitals

		CMS Hospital Value-based Purchasing			Other CMS Quality Programs	
Authors	Year Published	Safety (includes HAI rates)	Total Performance Score (TPS)	Pay for Performance	Hospital-acquired Conditions	Hospital Readmission Rate Program
Spaulding et al.	2022	**non-Magnet Accredited	No difference			
Dierkes et al.	2021			No difference	No difference	**non-Magnet accredited

*Magnet-accredited outperformed non-Magnet accredited hospitals
**non-Magnet accredited outperformed Magnet-accredited hospitals

There was an older study that provided the same results as this study, demonstrating that Magnet accredited hospitals performed better than non-Magnet accredited hospitals regarding MRSA with that same study demonstrating worse CDI outcomes for Magnet accredited hospitals over non-Magnet accredited facilities (see Pakyz et al., 2017). Pakyz et al. (2017) did not provide information on whether the CDI groupings performed below threshold for SIRs, which would have provided useful insights for healthcare leaders. Fischer and Nichols (2019) performed an observational study exploring a potential relationship between leadership practices, Magnet status, and nurse-sensitive patient outcomes including falls with injury, CAUTI, CLABSI, and hospital-acquired pressure injury (HAPI). The metrics of interest for this study include CAUTI and CLABSI as they are HAIs that were potentially caused by MRSA and would have required the same prevention tactics as hospital-acquired MRSA bacteremia. Results demonstrated a significant increase in a subcategory of the LDI, *create a shared*

vision in the Magnet organizations (p=0.017) that supports the ANCC efforts toward transformational leadership and nurse empowerment. Magnet hospitals demonstrated lower patient falls with injury (p=0.006), CAUTI (p<0.0001), and CLABSI (p=0.0013) than non-Magnet hospitals as shown in Table 12 (see Fischer and Nichols, 2019).

Table 12

Studies Comparing Non-CMS Program Outcomes between Magnet accredited and Non-Magnet Accredited Hospitals

		Non-CMS quality programs				
Authors	Year published	MRSA	CDI	CAUTI	CLABSI	Create a shared vision
Pakyz et al.	2017	*Magnet accredited	**non-Magnet accredited			
Fischer and Nichols	2019			*Magnet accredited	*Magnet accredited	*Magnet accredited

*Magnet accredited outperformed non-Magnet accredited hospitals

**non-Magnet accredited outperformed Magnet accredited hospitals

Overall, the literature provided limited similarities with my study. There is strong evidence supporting the negative impacts of HAIs including mortality, cost, LOS, and readmissions with resultant challenges for all healthcare administrators. There are too few studies that measure the quality outcomes for individual metrics versus overall programmatic scores to provide enough data toward the impact of Magnet-accreditation status on specific HAIs. Available research provided contradictory results that indicate the need for future studies with more direct variables. The journey to Magnet accreditation is an effort- and cost-consuming endeavor that takes several years to

implement (Dierkes et al., 2021). Compelling evidence of the effect of accreditation status on quality outcomes would be invaluable to healthcare leaders and clinicians.

Findings to Theory

Donabedian (1966/2005) identified that quality care required structures including appropriate facilities, equipment, and staffing, evidence-based policies with documented and hard-wired standard operating procedures, and monitoring, reporting, and cascading of outcomes. In the search for a solution for nurse recruitment and retention, the ANCC identified transformational leadership, nurse empowerment plus these same structure, process, and outcomes requirements as drivers of nurse engagement (American Nurses Association, n.d.). To test the influence of leadership to outcomes Fischer and Nichols (2019) performed an observational study to examine a potential relationship between LDI, Magnet status, and nurse-sensitive patient outcomes including falls with injury, CAUTI, CLABSI, and HAPI. Results demonstrated a significant increase in a subcategory of the LDI, *create a shared vision* in the Magnet organizations (p=0.017). Additionally, Magnet hospitals demonstrated lower patient falls with injury (p=0.006), CAUTI (p<.001), and CLABSI (p=.001) than non-Magnet hospitals.

For my study, organizations demonstrating competencies through Magnet-accreditation did show significantly lower SIRs than organizations that were not Magnet accredited for hospital-acquired MRSA bacteremia RQ1. The impact of the Donabedian framework for the hospital-acquired CDI research question is mixed because the non-Magnet accredited group achieved lower SIRs than the Magnet accredited group but both groups of the dependent variable achieved median results of at least 50% better than

expected. Of importance in both Donabedian's framework and the ANCC Magnet framework is the availability of metrics for goal setting, tracking, trending, and reporting of outcomes. As one of the forces of magnetism, Magnet accredited organizations have demonstrated strong competencies in sustaining a heavy focus on empirical outcomes as a tactic in driving quality care (American Nurses Association, n.d.). The public reporting of these CMS SIRs for HAIs promotes easy access to data outcomes to health systems and the American public (Centers for Medicare and Medicaid Services, 2023). This may function as an influencer in promoting improved health outcomes.

Limitations of the Study

There were three major limitations for this study. The population consisted only of patients from the Medicaid and Medicare payer systems. This narrowed the populations to patients that were either retired or with incomes lower than the Medicaid-eligible threshold. Future studies should consider including variables to capture any influence related to patient characteristics by payer types.

There were some concerns regarding the manual reporting process for HAIs because HAIs are infections that were not present upon admission. They typically present at least 48 hours (about 2 days) following admission (Monegro et al., 2022) and require a system in place that allows for infection preventionists to identify the infections and perform an investigation to determine whether the infection was hospital-acquired or present on admission. Reporting of hospital-acquired MRSA and hospital-acquired CDI was a manual process at the time of this study, allowing for some reporting variability based on the competency of the individual hospital-based infection preventionists

(Centers for Disease Control and Prevention, 2022). Mitigations for these challenges included standardized, CDC defined operational definitions, metrics, and training for the hospital-based infection preventionists who were responsible for reporting the hospital-acquired MRSA bacteremia and hospital-acquired CDI was a manual process at the time of this study, allowing for some reporting variability based on the competency of the individual hospital-based infection preventionists (Centers for Disease Control and Prevention, 2022). Mitigations for these challenges included standardized, CDC defined operational definitions, metrics, and training for the hospital-based infection preventionists who were responsible for reporting hospital-acquired MRSA and hospital-acquired CDI was a manual process at the time of this study, allowing for some reporting variability based on the competency of the individual hospital-based infection preventionists (Centers for Disease Control and Prevention, 2022). Mitigations for these challenges included standardized, CDC defined operational definitions, metrics, and training for the hospital-based infection preventionists who were responsible for reporting the hospital-acquired MRSA bacteremia and hospital-acquired CDI was a manual process at the time of this study, allowing for some reporting variability based on the competency of the individual hospital-based infection preventionists (Centers for Disease Control and Prevention, 2022). Mitigations for these challenges included standardized, CDC defined operational definitions, metrics, and training for the hospital-based infection preventionists who were responsible for reporting hospital-acquired infections to the NHSN (Centers for Disease Control and Prevention, 2022c).

Additional considerations included hospitals that invested in programs that promoted structures, process improvement, and control mechanisms to ensure high-quality outcomes, including Lean Six Sigma (LSS) or High-Reliability training (HRO) that have chosen not to undergo the Magnet journey. These hospitals would have presented under the non-Magnet accredited category but would have had Magnet-like processes in place, potentially skewing the data.

Recommendations

Recommendations for future research encompass mitigations for the limitations identified from this study. Future research should include additional programs that support structure, processes, and outcomes such as HRO and LSS programs as variables. Including these programs as independent variables would provide improved insight into any potential impact of structure, process, and the monitoring of metrics on outcomes.

Additional dependent variables should include metrics that nurses influence such as patient falls, surgical site infections, catheter-associated urinary tract infection (CAUTI), CLABSI, HAP, VAP, and hospital-acquired or worsened pressure wounds. Including these additional metrics would have provided a more complete picture. The results of this study were mixed because the two dependent variables provided conflicting information. Exploring the reasons for the overall success of the CDI metric through additional studies would provide valuable information for healthcare leaders in identifying potential solutions to other hospital-acquired conditions.

Implications for Professional Practice and Social Change

Hospital-acquired infections pose a major challenge for healthcare leaders who are trying to identify mechanisms for providing the highest level of care while innovating cost containment strategies. Forrester et al., (2022) estimate costs of $7.2 to $14.9 billion U.S. dollars related to the continued year-over-year growth in costs related to extended LOS, complications, morbidity, and mortality secondary to hospital-acquired conditions. Studies such as this are instrumental in identifying solutions based on evidence, providing healthcare leaders with the necessary information to implement effective strategies.

Professional Practice

This study aligned with recent literature that explored whether there is a relationship between Magnet status and HAIs specifically, MRSA bacteremia and CDI. There was evidence demonstrating that organizations that are Magnet accredited resulted significantly lower (better) SIRs for MRSA bacteremia, a major cause of hospital-related mortality. The evidence regarding hospital-acquired CDI versus Magnet status demonstrated significantly lower (better) SIRs in the non-Magnet accredited population, however, translating this information to practical use is complex because both groups of the dependent variable demonstrated excellent outcomes. Additional studies provided healthcare leaders with extremely useful information. This study duplicated the results of research by Pakyz et al. (2017) demonstrating that Magnet accredited hospitals outperformed non-magnet accredited hospitals for MRSA with non-Magnet hospitals outperforming Magnet accredited hospitals for CDI, though published six years ago.

Fischer and Nichols (2019) demonstrated that Magnet accredited hospitals were effective in creating a shared vision and outperformed non-Magnet accredited hospitals in CAUTI and CLABSI which are consistent organizational objectives for health systems.

The additional studies reviewed in the research provided information regarding bundled outcomes as part of payer programs. The results were not favorable for Magnet-accreditation, demonstrating either no significant difference between the Magnet accredited and non-Magnet accredited hospitals with the CMS TPS (Spaulding et al., 2022), P4P, and HACs (Dierkes et al., 2021) or with non-Magnet accredited hospitals outperforming Magnet accredited hospitals with the CMS-defined *safety* rates (Spaulding et al., 2022) and the HRRP (Dierkes et al., 2021). Additional research with individual quality outcome variables is required to identify, not only if there is a difference in those outcomes between Magnet accredited and non-Magnet accredited hospitals, but also, to explore the reasons for any identifiable differences. Considering the effort and cost associated with beginning the Magnet journey, healthcare leaders might use this information in their research to determine whether the Magnet journey is an appropriate next step for their organization. It is important to remember that although Magnet organizations boast excellent quality scores, the focus of the Magnet program is to promote structures and processes that drive nurse recruitment and retention (American Nurses Association, n.d.).

Social Change

Avoidable mortality is a major impact of HAIs that was demonstrated in studies from Banks et al. (2018), Bello-Chavolla et al., (2018), Hirsch et al., (2022), and Kim et

al. (2022). Cost was also heavily studied, with outcomes from Nelson et al., (2018), Kirwin et al., (2019), and Hirsch et al., (2022), each provided evidence citing millions to billions (depending on scope of research) of dollars per year related to HAIs. This study, and others, (Pakyz et al., 2017) demonstrated that Magnet accredited hospitals outperformed non-Magnet accredited hospitals in hospital-acquired MRSA. Fischer and Nichols, (2019) demonstrated that Magnet accredited hospitals outperformed non-Magnet accredited hospitals in CAUTI and CLABSI. Additional studies are required to identify the relationships between Magnet accreditation and other hospital-acquired conditions (if any exist). Understanding the potential influence of Magnet accreditation on HAIs would allow for the implementation of standardized structures and processes on a national level that would result in decreased HAIs and resultant decreased mortality, LOS, and cost. This study is an early step in demonstrating a significant reduction in hospital-acquired MRSA bacteremia for health systems that have achieved Magnet status over those that are non-Magnet accredited.

Conclusion

This was a valuable study for healthcare leaders seeking to improve hospital-acquired infections, specifically MRSA bacteremia and CDI, through the implementation of a Magnet initiative. Hospital-acquired infections, though preventable, increase morbidity and mortality, result in extended LOS, and cost the United States billions of dollars each year. The purpose of this study was to identify whether there is a significant difference between Magnet-accreditation versus non-Magnet-accreditation and the frequency of HAIs; specifically, MRSA and CDI. A literature review provided many

sources supporting the detriments of hospital-acquired infections with no direct, current literature exploring the outcomes specific to hospital-acquired MRSA bacteremia and/or hospital-acquired CDI SIRs between Magnet accredited and non-Magnet accredited hospitals.

Data was obtained from the publicly sourced CMS hospital-acquired infections dataset for the year 2021. The nonparametric dataset provided MRSA bacteremia and CDI SIRs for over 1,500 hospitals each and comparisons were made utilizing the Mann-Whitney U Test. Each of the datasets demonstrated significant differences in the SIRs between the Magnet accredited and non-Magnet accredited hospitals. The hospital-acquired MRSA bacteremia variable demonstrated a lower (better) median SIR in the Magnet accredited group than the non-Magnet accredited group (p=<.001), supporting the Donabedian theory (1966/2005) of the importance of structure, process, and outcomes on quality. However, with the hospital-acquired CDI variable, the non-Magnet accredited group demonstrated a median SIR lower (better) than the Magnet accredited group (p=<.001). Synthesizing this information is challenging because the entire hospital-acquired CDI group demonstrated SIRs favorable (by at least 50%) to the *as expected* metric of 1 for both groups of the dependent variable (p=<.001). This poses questions regarding any potential impact of Magnet accreditation in the SIRs for hospital-acquired CDI.

Obtaining Magnet-accreditation is costly and time-consuming. If evidence supports the efficacy of Magnet-accreditation on a positive impact on hospital-acquired infections, the effort and expense of obtaining Magnet-accreditation would demonstrate a

positive return on investment within one year, based on the evidence citing the cost of HAIs to hospitals and the United States. However, current studies have not demonstrated the clarity necessary to fully support Magnet-accreditation based solely on proposed HAI outcomes. Additional research is needed to determine whether there is a significant difference between Magnet accreditation versus non-Magnet accreditation and the frequency of all HAIs and other nurse-sensitive indicators. These studies will support healthcare leaders in identifying and implementing solutions to most of the challenges impacting cost, morbidity, and mortality in hospitals.

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