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The Impact of the Hospital Acquired Conditions (HAC) Initiative for Catheter-Associated Urinary Tract Infections: Is It Really Improving Patient Care?

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THE IMPACT OF THE HOSPITAL ACQUIRED CONDITIONS (HAC) INITIATIVE

Abstract

This research study focuses on the CMS, pay-for-performance, inpatient initiative regarding hospital acquired conditions (HAC) and present on admission (POA) identification of illnesses and injuries and studies conducted upon the initiatives that have measured outcome since the implementation of the program. This study is a focused assessment of numerous studies regarding the overall outcome of the initiative thus far, which was implemented in 2007. The goal of this research is to ascertain the effectiveness of the HAC initiative and possible factors that have positively or negatively impacted the overall outcomes in regard to Catheter-Associated Urinary Tract Infections (CAUTI).

Keywords: hospital-acquired condition, HAC, present on admission, POA, catheter associated urinary tract infection, CAUTI

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The Impact of the Hospital Acquired Conditions (HAC) Initiative: Is It Really Providing Better Patient Care?

Chapter 1- Introduction

Hospital Acquired Conditions or injuries can have a large impact on the overall health of a patient, and can create a substantial additional cost for the consequential care. On October 1, 2007, Section 5001 (C) of the Deficit Reduction Act of 2005 was implemented which required that Medicare-participating hospitals were to begin reporting the secondary diagnoses that are present on the admission (POA) for patients discharged on or after October 1, 2007. The POA designation was implemented on all reporting as an additional data element for each diagnosis submitted on electronic claims.

A year-long initiative of awareness of the new policy was implemented and the CMS initiative mandated that any discharges that occurred after October 1, 2008 would not receive additional payment for patient stays where at least one of the selected conditions was not "present on admission," and therefore occurred as a result of the hospital stay, and would be paid as if the secondary diagnosis was not present (Centers for Medicaid & Medicare Services [CMS] 2013). Hospitals across the country were forced to implement new procedures and processes throughout their facilities in order to meet the demands of the program, or face devastating financial losses due to non-payment by CMS for hospital acquired conditions (HAC's) that were deemed not present on admission.

The original comprehensive list of HAC's which were implemented October 1, 2007 were as follows:

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1. Foreign object (such as sponge or needle) inadvertently left in patients after surgery

2. Air embolism - an air bubble that enters the blood stream and can obstruct the flow of blood to the brain and vital organs

3. Transfusion with the wrong type of blood

4. Hospital Acquired Pressure Ulcers (HAPU) – deterioration of the skin, due to the patient staying in one position too long, that has progressed to the point that tissue under the skin is affected (Stage III), or that has become so deep that there is damage to the muscle and bone, and sometimes tendons and joints (Stage IV)

5. Falls and trauma

6. Catheter-associated urinary tract infection (CAUTI)

7. Vascular catheter-associated infection

8. Manifestations of poor control of blood sugar levels

In 2008, the following HAC's were added to the list:

9. Surgical site infection following coronary artery bypass graft (CABG)

10. Surgical site infection following certain orthopedic procedures

11. Surgical site infection following bariatric surgery for obesity

12. Deep vein thrombosis (a blood clot in a major vein) and pulmonary embolism (blockage in the lungs) following certain orthopedic procedures

Although there are numerous HAC's currently tracked within the CMS initiative, based on the amount of previous studies and data currently available, this research study is being conducted to determine whether or not the HAC initiative has resulted in better patient care since the 2007 implementation, as it relates to catheter-associated urinary infections (CAUTI) (CMS 2013). The research will not consider the results of other HAC based studies, as the focus will remain primarily on CAUTI.

The research will analyze the results of (8) separate studies across multiple states and facilities to identify trends as to whether or not the occurrence of CAUTIs has reduced since the implementation of the HAC initiative began.

Urinary tract infections (commonly referred to as UTI) can encompass any part of the urinary tract. This includes the bladder, kidneys, urethra and ureters. Catheter-associated urinary tract infections have long been associated with patient care and are the most prevalent type of infection reported to the National Healthcare Safety Network (NHSN). In fact, of all the UTIs that are contracted within a hospital, it is estimated that 75% of them involve a urinary catheter. This is an important statistic as it is estimated that nearly fifteen to twenty-five percent of all patients who are hospitalized will receive a urinary catheter during their care in the facility (Centers for Disease Control, 2015) and therefore is a substantial basis of which to focus this study.

Through the study of the (8) focused research projects, multiple initiatives will be reviewed and discussed as it relates to clinical efficacy and overall outcomes. Any trends or consequential circumstances discovered will be vetted and discussed as appropriate.

Background of the Problem

Based on a 2010 Office of the Inspector General (OIG) study, it was estimated that 27% of Medicare patient stays resulted in hospital acquired illnesses and/or injuries which resulted in the following outcomes: prolonged hospital stays; mild to serious harm; life sustaining intervention, permanent disability; and in some cases, death. The HAC/POA initiative was put into place to minimize payments made to facilities for such conditions and to provide a focus on the administration of better patient care. However, an initiative of this size and specificity has required major changes with patient protocols and the way hospital departments are run. As with any initiative, there are good and bad examples of how such procedures are carried through. This study focuses on the outcomes of the HAC/POA initiative and factors that may affect the overall success of the initiative (Office of Inspector General, 2010).

Purpose of the Study

The purpose of the study is to determine the overall effectiveness of the HAC/POA initiative and whether or not it has indeed improved patient care as demonstrated as a decline of CAUTI during a hospital stay. The study will determine an overall conclusion as to whether or not the identified HACS CAUTI have correlating improved patient care, as provided by reported claim statistics.

Significance of the Study

As discussed previously, based on the research included within this study there is scientific indication that there is a correlation from the start of the HAC CMS initiative indicated by improved statistics for hospital acquired conditions as it relates to CAUTIs.

Conceptual Frame of Reference

This research is based on the works of multiple studies which focus on the overall effectiveness of the HAC/POA initiative as it relates to CAUTIs. The results are quantified and discussed individually, as well as on an overall consensus.

Research Questions

1. What type of HAC was researched?

2. Did the research contain overall results?

3. Did the research focus on years between2008-2013?

4. Was the research based on a state or national level, or individual facility?

5. What type of quantifying data was utilized?

6. What type of qualitative information was utilized?

7. What were limitations?

8. Who were the participants?

9. What variables were present in the study?

10. What were the results?

    a. Did patient care improve?

Definition of Terms

Below is a list of terms and definitions for clarification and use within the research:

1. Centers for Medicaid and Medicare Services (CMS): An agency within the United States Department of Health & Human Services which is in charge of the oversight supervision of a number of federal health care programs including Medicare, Medicaid, Children's Health Insurance Program (CHIP), Health Insurance Portability and Accountability Act (HIPAA) and the Clinical Laboratory Improvement Amendments (CLIA), among other services.

2. OIG- the Office of Inspector General of the U.S. Department of Health & Human Services (HHS)

3. Hospital Acquired Condition (HAC): A preventable illness or injury that occurred during an inpatient hospital stay.

4. Present on Admission (POA): An illness or injury that occurred *prior* to an inpatient hospital stay and was therefore present on admission.

5. Catheter-associated urinary tract infections (CAUTI): A urinary tract infection where an indwelling urinary catheter was in place for >2 calendar days on the date of event, with day of device placement being Day 1, *and* an indwelling urinary catheter was in place on the date of event or the day before. If an indwelling urinary catheter was in place for >2 calendar days and then removed, the UTI criteria must be fully met on the day of discontinuation or the next day.

6. Foley: A plastic, flexible tube (also referred to as a catheter) that is placed into the bladder for uninterrupted drainage.

Limitations

This research is subject to various limitations. For instance, each study utilized for this assessment contained its own set of limitations and some of the studies researched had limitations of the type of data reviewed as well as other impacting factors. For instance, five of the studies centered on a single facility, therefore the results may be limited to facilities that have a similar size and type. Six of the studies were conducted retrospective and without a control group. Of the large groups, one study conducted by Lee, Kleinman, Soumerai, Tse, Cole, Fridkin, Horan, Platt, Gay, Kassler, Goldmann, Jernigan, & Jha (2012) noted that although the study was large scale and involved over 41 states, the research did not include all U.S. hospitals. Two studies focused on facilities only within a particular state (Meddings et al & Stone et al). Additionally, among all studies reviewed, insurance type was not used as a variable and it is possible that the corresponding results indicate that the facilities in the study could have focused their efforts primarily on Medicare patients only. Additionally, consistent among some of the studies was the fact that bundles of care were implemented together (improvement initiatives) and there was no attempt made to ascertain which of the bundled elements contributed the most to the overall outcomes (Brilli, McClead, Crandall, Stoverock, Berry, Wheeler, & Davis, 2013).

In regard to notable data from the nursing study conducted by Wald, Richard, Vaughn-Dickinson, & Cazezuti (2012), the study was conducted based on data from facilities staffed with Nurses Improving Care of Health System Elders (NICHE). Historically, these hospitals have demonstrated a higher level of commitment to initiatives than non NICHE facilities. Therefore, overall results may be higher than in

non-Niche facilities. Other limitations noted during the research were in regard to the actual statistical occurrence data versus the facility personnel interviews (Wald et al). Moreover, accurate coding and billing procedures have been attributed to incorrect claims based data which could also be a limiting factor of the accurateness of each type of study conducted. The Stone et al study mentioned several possible limitations such as the fact that the research was conducted for only the state of California and therefore did not have a national result (Stone et al). One of the most interesting limitations identified in the research which noted poor physician documentation as a limitation and cause for incorrect data (Meddings et al). The study described that the greatest specificity of the CAUTI HAC was found in the nursing notes; however, physicians often did note document to the same detail and often did not document the needed information to qualify the diagnosis as occurring after admission. Therefore, there was a low instance of CAUTI's found in the study, although epidemiologic studies have shown that 59%-86% of UTIs are hospital acquired. Another limitation is that the research focused on only facilities in the state of Michigan (Meddings et al).

The limitations of this comprehensive study include the variance of time periods and types of measurement tools.

Chapter 2- Review of Literature

Since the implementation of the CMS HAC initiative there have been multiple studies conducted. Based on an initial literature review of all HACs there is scientific indication that there is a correlation from the start of the HAC CMS initiative indicated by improved statistics for hospital acquired conditions, although the information varies greatly by the specific type of HAC. For instance, the initial literature review performed on the same topic criteria indicated that the initiatives put into place at the studied facilities (thus far) for CAUTIs appear to require more vigorous implementation and awareness. Also noteworthy from the initial review is the perception of improvement by some of the personnel surveyed was greater than the actual resulting data occurrence, perhaps derivative of improved processes in the facilities. The data reviewed in relation to HAPU indicated a 61% reduction from 2008 to 2011. However, the HAPU data was based within only one facility and therefore could be limited due to lacking variables (McGuiness et al). Another study conducted with the focus on HAC of poor glycemic control utilized all cases of poor patient occurrences in the current staffing matrix in each facility. The study found that non-teaching facilities scheduled with "high" nursing staffing had a 16% decrease in poor glycemic control, but was not a factor at teaching hospitals (McHugh et al). Therefore, the initial studies reviewed indicate a mixed impact and outcome and warrant completion of a more in depth study (See table [1]).

Upon the initial literature review, it appears that there is a correlation from the start of the HAC CMS initiative and resulting improved statistics for hospital acquired conditions. It is important to note that this information varies greatly by the specific type of HAC. For instance, the review indicated that the initiatives put into place thus far for CAUTI's appear to require a more vigorous implementation and awareness (or at least in the facilities studied). Also noteworthy from the study is the perception of improvement by some of the personnel surveyed was greater than the actual resulting data occurrence, perhaps derivative of improved processes in the facilities. Additionally, the study could arrive at a stronger conclusion if perhaps only one HAC is researched as each hospital acquired condition appeared to have its own process issues and variables. Therefore, it will be necessary to move to a focused study that is conducted on only one HAC with similar data types such as clinical outcome data. See Table (1).

Table (1): Initial Literature Review			
Author(s), Year	**Participants, Survey Method**	**Variables**	**Results**
McGuinness, Persaud-Roberts, Marra, Ramos, Toscano, Policastro, & Epstein (2012)	• Neuroscience Unit of 14 bed intensive care units and 18 floor beds • Quantitative data collection of HAPU occurrences over a 3 year period	• Type of ICU patient (High risk ICU patients and vented & immobile patients) • Differing skin care methodologies for staged pressure ulcers	• 48% reduction of HAPU in 2009 •57% reduction of HAPU in 2010 •61% reduction of HAPU in 2011
McHugh, Shang, Sloane, & Aiken, (2010)	• Adult patients $\geq$ 18, with diabetes • Patients treated in inpatient care • Admin discharge abstracts for CA pts • AHA Annual Survey	• Gender • Major dx group MDC •Severity of illness DRG • Teaching vs. non-teaching facility • Staffing	• Non-teaching hospital 16% decrease of glycemic control event in facilities w/ high nursing staff
Meddings, Reichart, Rogers, M., Saint, Stephansky, & McMahon (2012)	• CAUTI review of Non-obstetric adults discharged in 2007 and 2009 (before and after study) • Adult patients $\geq$ 18, with hospital stay of greater than 1 day • Paired T-Test utilized for comparison of 2007 & 2009 data	• All payer population •96 nonfederal acute-care Michigan hospitals with $\geq$ 200 adult discharges • Staffing	•Non-payment for hospital acquired CAUTI lowered payment for 25 of 781,343 hospitalizations in 2009. • CAUTI discharges =0.09% in 2007 and 0.14% in 2009 • Overall no effect
Stone, Pogorzelska, Graham, Jia, Uchida, & Larson (2011)	• 200 hospitals (non specialty acute care facilities in California) with adult intensive care unit • Two web based surveys (before & after) regarding CAUTI, CLABSI and VAP procedures and outcomes • Qualitative & quantitative •Longitudinal mixed-method study	• Type of ICU (cardiothoracic, neonatal, & other) • Medical ICU vs. Medical / Surgical ICU • Type of setting (urban/suburban etc) • Number of beds • Teaching status • Staffing	• CLABSI decreased from 2.3 median time 1, to 1.1 median time 2 in medical/surgical ICU •CAUTI showed almost no change (3.4 to 3.2 median) medical surgical ICU • VAP decreased from 2.6 to 1.3 median medical /surgical ICU
Wald, Richard, A., Vaughn-Dicksonson, & Cazezuti (2012)	• 14 NICHE hospitals • Qualitative descriptive design • Semi structured interviews of facility CNO regarding CAUTI & CLABSI procedures and outcomes	• Type of setting (urban/suburban etc) • Number of beds • Teaching status • Staffing • Ownership (profit vs non profit) •Geographic location • Qualifications of interviewee	• Increased attention and resources for QI activities • Increased implementation of activities for enhanced screening, documentation, collaboration, and surveillance of HACs

Chapter 3- Method

Methodology

This research will be conducted by the quantification and analysis of multiple research studies utilizing various electronic journal articles such as the International Journal for Quality, Surgical Neurological International, Annals of Internal Medicine, Policy Politics Nursing Practice, and Implementation Science from the following databases: PubMed, ScienceDirect, and Oxford Journals. The research will include the utilization of search criteria such as hospital-acquired conditions, HAC, catheter-associated urinary tract infections, CAUTI, present on admission, POA, and quality initiatives.

Search criteria will be the focus of all journal articles that were published during the years 2008-2013 to assure relevance as the CMS initiative began in the summer of 2007 and will focus only on the hospital-acquired conditions (HAC): Catheter-associated urinary tract infections (CAUTI).

After a focused literature review regarding CAUTI, the research was narrowed down to eight studies which all revolved around the topic of the HAC CAUTI and the correlating impact of patient care. The CAUTI research studies included:

1. *Reduction in Healthcare Acquired (HA) Catheter Associated Urinary Tract Infections (CAUTIs) in a Community Hospital…How Did We Get There?* (Zabriskie).

2. *Successful reduction in catheter-associated urinary tract infections: Focus on nurse-directed catheter removal* (Parry, Grant, & Sestovic).

3. *Evaluation of an Evidenced-Based, Nurse-Drive Checklist to Prevent Hospital Acquired Catheter-Associated Urinary Tract Infections in Intensive Care Units* (Fuchs, Sexton, Thornlow, & Champagne).

4. *Effect of Non-Payment for Preventable Infections in U.S. Hospitals* (Lee, Kleinman, Soumerai, Tse, Cole, Fridkin, Horan, Platt, Gay, Kassler, Goldmann, Jernigan, & Jha).

5. *A Comprehensive Patient Safety Program Can Significantly Reduce Preventable Harm, Associated Costs, and Hospital Mortality* (Brilli, McClead, Crandall, Stoverock, Berry, Wheeler, & Davis).

6. *Designing a protocol to reduce catheter-associated urinary tract infections among hospitalized patients* (Gokula, Smolen, Gaspar, Hensley, Benninghoff, & Smith).

7. *Preventing catheter-associated urinary tract infections in the zero-tolerance era* (Marra, Camargo, Goncalves, Sogayar, Moura, Guastelli, Rosa. Victor, & Santos)

8. *Impact of non-payment for hospital-acquired catheter-associated urinary tract infection: A statewide analysis* (Meddings, Rogers, Saint, Stephansky, & McMahon, 2012);

Based on the preliminary research findings, the same criteria will be utilized for the ongoing research project; however, the research and topics will be expanded to include an overview of findings by each study to identify whether or not improvement trends exist.

Population and Sample Design

The population information utilized for the research utilized will focus primarily on patients in the United States, 18 years of age or older, who had an inpatient hospital experience between 2008-2013, in relation to a procedure or condition that was a denominating factor of a hospital-acquired condition relating to the hospital-acquired condition CAUTI based on clinical outcomes of each study.

Data Collection Instrument & Data Collection Procedures

As available research methodologies vary, the survey methods utilized for the (8) studies utilized within this research range from quantitative data collection (Meddings et al, 2012), paired T-Test for comparative analysis (Meddings et al, 2012) qualitative and quantitative (Zabriskie, 2015) (Stone et al, 2011), longitudal mixed-method study (Stone et al, 2011), linear regression data analysis (Parry et al, 2013) (Marra et al, 2011), quantitative statistical analysis of diagnostic outcomes (Fuchs et al, 2011), (Lee et al, 2012), (Brilli et al, 2013), (Gokula et al, 2012), and semi structured interviews (Wald et al, 2012). Data collection was focused on studies which focused primarily on CAUTI outcomes and which quantified patient occurrence data by diagnostic outcome for determination of improvements or regressions.

Data Analysis

Response Rate. The response rate of the sample studies was irrelevant given that the study focused upon the clinical outcome of patient stays.

Representativeness of Sample. In order to obtain a non-biased random analysis, the samples utilized in this study represent a large variance of acute care center, both large and small, of variance patient demographics. The sample included findings from various facilities located across the country covering over 40 states.   Acuity varied greatly among the sample sites and all studies were selected at random.

Profile of Sample or Population. The majority of the research was conducted upon previous studies which did not utilize patient demographics a variable. Therefore, the results are varied based on population.

Reliability of Scales in Instrument. The reliability of scales in instrument is reliant upon accurate data from the previous studies.   For the overall analysis (see Table [3]) a comparison of outcome statistics was utilized).

Research Questions. The following research questions were utilized during the data collection method process when qualifying a study for this research:

1. Does the research contain specific data regarding patient outcomes (CAUTI occurrences)?

2. Does the research revolve around the HAC initiative and patient outcomes?

3. Is the data measurable?

Level of Significance. The level of significance of the method of data collection is significant as it provides inclusion of a relevant research study as it relates to the overall effectiveness (cause and effect) of the CMS HAC initiative.

Chapter 4- Results

The results of this study were tracked in table format for comparative purposes (see Tables [2&3]). Based on the results, (6) of the studies researched indicated favorable outcomes with the reduction of CAUTI since the implementation of the CMS HAC initiative. Two of the studies, based on multiple facilities indicated no change, or slight worsening in CAUTI occurrences.

Each of the (8) studies provided clinical occurrence data that was measurable by comparative analysis. The length of the study varied from ongoing studies from 6-8 months (i.e., Fuchs et al) up to 2 ½ years (Parry et al) to two sets of data from two different points in time (Gokula et al & Marra et al).

The study was based on static clinical outcome data; therefore there is no response rate for the population. The reliability of the results remains solely within the findings of each study.

Table 2

Table (2) RESULTS							
#	Name of Study	Improvement?	Type of Study	Authors	Duration	Sample Size	Steps taken for improvement	Limitations
1	Reduction in Healthcare Acquired (HA) Catheter Associated Urinary Tract Infections (CAUTI's) in Community Hospital…How Did We Do It?	2011 Rate= 1.9 2013 Rate = 0.9 48% improvement	Quantitative clinical diagnostic outcome	Zabriskie	2011 to 2013	Presentation- no size given. Single facility results	Nurse driven protocol for removal of catheter implemented. Root Cause Analysis (RCA) tool was used for each CAUTI identified and special attention placed on identified areas.	Single facility – no control group
2	Successful reduction in catheter-associated urinary tract infections: Focus on nurse-directed catheter removal- Stamford Hospital in Connecticut	2009 Rate =0.223 2011 Rate- 0.112 50.2% improvement	Linear regression analysis	Parry et al	36 mos. Study	300 bed facility, Stamford, Southwest Connecticut. 181,785 patients	Implementation of nurse removal of urinary (Foley) catheters protocol. Checklist implemented for each UC patient. CPOE requirement of documentation by physician and device tracking mechanism added to EMR to prompt providers to document on daily basis in progress notes.	Lack of statistical significance in CAUTI reduction on individual units because of small number of symptomatic CAUTIs. Measurement of catheter-days from EMR abstraction was dependent on accurate nursing documentation.
3	Evaluation of an Evidenced-Based, Nurse-Drive Checklist	Beginning of study2.88 per 1,000 catheter days End of study 1.46	Descriptive statistics and Quantative	Fuchs et al	6-8 months, rates were per 1000 catheter days	924 bed facility	CAUIT prevention initiative put into place developed by	Single site study, large tertiary academic teaching facility,

	Table (2) RESULTS							
#	Name of Study	Improvement?	Type of Study	Authors	Duration	Sample Size	Steps taken for improvement	Limitations
	to Prevent Hospital Acquired Catheter-Associated Urinary Tract Infections in Intensive Care Units	CAUTI per 1,000 catheter days 50.6% improvement	clinical diagnostic outcome				Duke infection control outreach network (DICON). Implementation of checklist for all patients w/ Urinary catheter, implementation of procedure specific guidelines	results may be limited to similar size and type. Survey based, and only 42.2% response rate. Retrospective analsyis without a control group.
4	Effect of Non-Payment for Preventable Infections in U.S. Hospitals	No effect/improvement in fact, worsened slightly Before initiative 0.96 ratio up to 0.99 after initiative 3.03% worsened, increase of CAUTI	Statistical Analysis/ Quantitative diagnostic outcome	Lee et al	March 2006 through March 2011	398 Hospitals (14,817 to 28,339 hospital unit months combined)		Although large scale (41 states), study did not represent all U.S. hospitals. No insurance status was utilized, possible facilities focused efforts on only Medicare patients, effect of this CMS policy may have been mitigated by other ongoing initiatives.
5	A Comprehensive Patient Safety Program Can Significantly Reduce Preventable Harm, Associated Costs, and Hospital Mortality	17 CAUTI's in 2010 and only 9 in 2012 53% decrease/ improvement	Statistical Analysis/Quan titative diagnostic outcome	Brilli et al	2010 through 2012	Large free standing urban children's hospital 25,000 admits per year, 85,000 ED visits, 130,000 urgent care, 22,000 operating procedures	Critical mass education performed and increase in Q1 department from 8 to 33 personnel. Budget increased from $690K to $3.3M. Data analysts hired to provide information to providers on constant basis.	Study was conducted with QI methodology and no control group. Bundles of care were implemented together and no attempt was made to ascertain which bundle elements contributed the most to the overall effect. It is also unknown whether or not the

#	Name of Study	Improvement?	Type of Study	Authors	Duration	Sample Size	Steps taken for improvement	Limitations
			Table (2) RESULTS					
								implementation of a new EMR (electronic medical record)o played any part in the reduction.
6	Designing a protocol to reduce catheter-associated urinary tract infections among hospitalized patients	2.21 per 1,000 patient days vs. 0.435 per 1,000 patient days 80.32% improvement	Statistical Analysis/Quantitative diagnostic outcome	Gokula et al	Jan 1, 2007 to April 30, 2007 vs. Nov 1 through Dec 31, 2009	Midwest academic medical center with 319 beds	Foley Insertion Removal Maintenance (FIRM) protocol implemented; required demonstration by each nursing staff required of each participating nursing staff member	QI methodology, no control group
7	Preventing catheter-associated urinary tract infections in the zero-tolerance era	7.6 per 1,000 per catheter days to 5.0 per 1,000 catheter days in ICU, and SDU's saw 15.3 per 1,000 down to 12.9 1,000 after intervention 34.32% improvement	Linear model statistical analysis	Marra et al	June 2005 to 2007 vs. January 2008 to July 2010.	36,454 patient days 38 bed medical-surgical ICU and 2, 20-bed SDU's (step-down units)	ICU & Step Down Unit interventions via clinical practice techniques and new3 protocol via checklists and provider vs. nursing intervention, as well as the implementation of "bladder bundle" which was designed to reduce UTI. Results were tracked on monthly basis with feedback to providers on compliance and	Surveillance definition of National Healthcare Safety Network definition of CAUTI includes all UTI; and lacks specificity and overestimates true incidence of CAUTI because of the high prevalence of bacteriuria in patients with indwelling catheters. Trial was not randomized, rather a quasi-experimental study as a controlled study was not feasible. Data collected in small

							Table (2) RESULTS	
#	Name of Study	Improvement?	Type of Study	Authors	Duration	Sample Size	Steps taken for improvement	Limitations
							outcomes. Implementation of silver coated urinary catheters.	audits and not in continuous collection of data. Single medical center, may differ from other facilities with different staff size and patient populations.
8	Impact of Non Payment for Hospital Acquired Catheter Associated Urinary Tract Infections: A Statewide Analysis	Increase in CAUTI .09% 2007 Vs. .14% 2009 35.71% worsened CAUTI increased	Paired T-test , before and after study of claims data	Meddings et al	2007 vs. 2009	96 Michigan acute care hospitals 2007 vs. 2009 discharges w/ CAUTI occurrence	CMS initiative HAC recommendation	Claims data was used which incorporates error rate of coders and billers and omission of the UTI based on list of presenting problems by priority.
9	California's Hospitals' response to State and Federal Policies Related to Health care Associated Infections	Results not tracked, rather how well implementation went via interviews	Longitudal mixed-methods study using both qualitative and quantitative methods.	Stone et al	2008 (1st survey) vs. 2010 (2nd survey)	200 facilities in state of CA		State specific and may not represent facilities across the country.
10-Addendum	Chief nursing officers' perspectives on Medicare's hospital-acquired conditions non-payment policy: Implication for policy design and implementation	Results not tracked, rather how well implementation went via interviews				14 hospitals,		

Chapter 5- Summary, Conclusions and Recommendations

Discussion/Summary of Findings

Overall, there were many observations and patterns discovered during this research. In regard to spatial and temporal variations, there were no differences identified within the results as the studies were derived from facilities in varying populations and geographic locations across the country. However, a variance was identified between the small and large scale samples. For instance, among the five studies where the results were derived from individual facilities, the common result was a significant improvement in the reduction of CAUTI (see Table [3]). However, in the multi-facility studies (Lee et al & Meddings et al), both studies indicated either no improvement or an increase of CAUTIs across the facilities included within each study.

Table (3)

	CAUTI HAC IMPACT		
Study	Single or Multiple Facility Study?	Improvement Yes/No	Decrease (-) or Increase of CAUTI Determined by Study
Zabriskie	Single	Yes	-48.00%
Parry et al	Single	Yes	-50.20%
Fuchs et al	Single	Yes	-50.60%
Lee et al	Multiple	No	3.03%
Brilli et al	Single	Yes	-53.00%
Gokula et al	Single	Yes	-80.32%
Marra et al	Single	Yes	-34.42%
Meddings et al	Multiple	No	35.71%

Additionally, of the six facilities researched which had favorable outcomes, five of the studies contained a common denominator in the implementation process for CAUTI reduction initiatives which included the inclusion of nurse driven protocol for removal of the catheters (Zabriskie, Parry et al, Fuchs et al, Gokula et al & Marra et al). Additionally, four of the six facilities included data analysis and metric tracking and feedback to providers on an ongoing basis as one of the improvement initiatives (Zabriskie, Parry et al, Brilli et al, & Marra et al). Overall, the data shows that in facilities which implement nursing protocols and performance metric tracking, significant positive outcomes can be expected.

It is notable that the larger scaled studies (Lee et al & Meddings et al) included facilities across a much larger sample both found unfavorable results, albeit small. A generalization could be derived indicating that the smaller, single facility focused studies are more favorable due to the smaller size. However, additional research is required in order to qualify this assumption. What is not known of those facilities is whether or not the aforementioned nursing protocols and performance metric tracking was implemented within any of those facilities. Overall, based on the number of studies, the findings of this overall research agrees with the majority which is that CAUTI have been reduced since the implementation of the CMS HAC initiative. However, when comparing by actual occurrence data which is much vaster across the larger studies, the outcome is unknown.

Conclusion

Clearly, there is data available to indicate CAUTI reductions have diminished in some areas across the country (see Table [3]) which implies success, although not across

the board, has been achieved. A hindrance to the study is are the missing variables, i.e.,
what is *not* known regarding the actual steps taken by each facility to implement the
process as this cannot be used as a common variable across all studies. Particularly
among the studies with no change or negative outcomes, it is critical that all steps taken
to improve the clinical process have been identified and tracked for metric reporting
purposes.

Recommendations

It is recommended that a new study be conducted which focuses not only on a
site-by-site basis, rather than a quantitative approach across multiple facilities, the study
must include common initiative approaches and improvements implemented by the
administration in an effort to improve patient outcomes.

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