Chlorhexidine Gluconate Bath Project: A Program Evaluation

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A DNP PROJECT

Chlorhexidine Gluconate Bath Project: A Program Evaluation

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by

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Dedications

This evaluation is wholeheartedly dedicated to my parents, Amar and Manju Crawford, who have been my constant inspiration source and gave me strength when I thought of giving up. They continually provided their moral, spiritual, emotional, and financial support. They have given me the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support, this project would not have been made possible.

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Abstract

Patients' safety outcomes are a reliable measure of how well a unit performs within any hospital. One of the most impactful patient safety factors is bloodline infections within the hospital. Blood line infections are associated with over 28,000 fatalities in the United States. The cost of central line bloodstream infection (CLABSI) in the United States is over $2 billion annually. Therefore, there is a need for a way to reduce CLABSI rates within care facilities. Considering the possible interventions, this program evaluation chose chlorhexidine gluconate (CHG) bathing to reduce infections. To establish the efficacy of the proposed solution, the program evaluation collected and analyzed data from 2015 to 2021. The data analysis suggested an association between CHG baths and reduced CLABSI rates. The program evaluation also surveyed nurses involved in the CHG program. The analysis suggested that nurses supported the protocol but expressed concerns about the support provided by the organization. This program evaluation made a report to the stakeholders, including management, nurses, and patients. The program evaluation featured quantitative and qualitative analysis contextualized by extant literature on patient safety, CLABSI within different units, and CHG bathing. The program evaluation concluded by restating the potential efficacy of CHG baths and recommending the adoption of the protocol within the entire project site. That stated, the program evaluation recommended that a program evaluation with an experimental set-up, better findings, and more robust data collection be conducted on the efficacy of CHG baths within different units in a hospital to justify the value of CHG baths further.

Keywords: central line bloodstream infection (CLABSI), laboratory-confirmed bloodstream infections (LCBI), chlorhexidine gluconate (CHG), CHG bathing, CHG protocol, oncology, and bone marrow transplant (BMT) patients, hematology/oncology/BMT unit

Chlorhexidine Gluconate Bath Project: A Program Evaluation

Healthcare-associated infections (HAIs) are a particular problem for medical practices (Al-Tawfiq & Tambyah, 2014; Shang, Needleman, Liu, Larson & Stone, 2019). These infections affect many service users across a range of healthcare contexts all over the globe, and they account for a significant number of costs and reduced health outcomes for patients in the United States and beyond (Haque, Sartelli, McKimm & Abu Bakar, 2018). These infections are associated with adverse healthcare outcomes, including increased length of stay and higher costs in many scenarios. Adverse outcomes such as these are part of why HAIs also have important, usually negative, economic implications for patients in and beyond the United States. The worsening of healthcare outcomes because of practice error is significant for patients especially vulnerable to the bloodstream and surgical site infections (Abbas & Sastry, 2016). An example of an HAI is the central-line associated bloodstream infection (CLABSI), which is a common and critical occurrence for patients who have been hospitalized. Against this backdrop, this paper is a proposal for a DNP scholar project that seeks to evaluate the effectiveness of a CLABSI-prevention program using chlorhexidine gluconate (CHG) bathing at a unit in the project site in North Florida.

To note, CLABSI infections are a significant source of hospital-acquired or healthcare-acquired infection, a leading cause of death in the United States (Reagan et al., 2019). Moreover, CLABSIs and other healthcare-acquired infections give rise to increased cost of healthcare provision for practitioners and administrators, in addition to higher prices and insurance premiums for patients and service users (Scott, 2009). Patients suffering from specific conditions related to hematology, oncology, and those undergoing bone marrow transplants are particularly at risk for CLABSIs because of the many central lines utilized in these practice areas (Alkilany,

2016). Moreover, there is a link between CLABSIs and neutropenia in these areas, adding to the potential for complications with an increased chance of adverse health outcomes (Alkilany, 2016).

The central line maintenance bundle is associated with the central venous catheter (CVC). The CVC is the dominant method of administering supply-infused solutions or medications intravenously (Reagan et al., 2019). While the central line catheter is effective for this purpose, it is also the primary vehicle through which healthcare-associated bloodline infections and CLABSI occur. The use of the central venous catheter necessitates skin damage during insertion, increasing the risk of introducing pathogens from the procedure. Thus, maintenance care bundles were introduced by the Centers for Disease Control and Prevention (CDC) to reduce CLABSI through distinct best practices. Research has focused on using these bundles in pediatric oncology and intensive-care settings (Duffy et al., 2015).

Background

It must be noted that CLABSI is a significant health problem with distinct pathophysiology that includes bacteremia. This occurs by virtue of infection through a pathogen that, appearing in blood culture, is not linked to an existing infection at another site (Duffy et al., 2015). This definition was revised in 2008 to exclude infection from a skin contaminant. CLABSI can be of the extra-luminal or intra-luminal variety. The latter involves bacterial contamination of the catheter and biofilm formation. Organisms or pathogens are commonly present at the insertion site for the extra-luminal case. Intra-luminal CLABSI occurs, by contrast, when the pathogens move from the colonization site at the catheter hub onto the catheter lumen (Duffy et al., 2015). Research suggested that the extra-luminal variety is most frequently associated with short-term catheters. The catheter hub is viewed as the most likely culprit for

long-term catheters in place between 7 to 10 days. The patient's skin flora may host a range of micro-organisms, including pathogens that cause such infections.

Another common source is unclean hands, in addition to environmental surfaces and sources (Myatra, 2019). A less common source for infection-causing pathogens is the contamination of intravenous medications, although this is less likely to affect healthcare practices in the developed world. CLABSI infections have been primarily attributed to various Gram-positive organisms, especially coagulase-negative staphylococci, several species of *Enterococcus*, and *Staphylococcus aureus*. In addition, a minority of CLABSIs were attributable to Gram-negative organisms, with the most common of these being because of various species of *Candida* (Strickler, Gupta, Doucette & Kohli-Seth, 2018). Bathing with chlorhexidine gluconate (CHG) is effective in reducing CLABSI.

Problem Description

Roughly 28,000 people die each year because of CLABSI, and the United States healthcare system spends $2.3 billion annually for this infection even if CLABSI is preventable (Reynolds et al., 2021). Notably, CHG bathing has been posited as a cheap, viable solution for HAIs (Abbas & Sastry, 2016). The use of this technique was associated with a significant decline in CLABSI rates, and the cost difference between 2% CHG-laden cloths and non-medicated bathing costs was pegged at just $4.10 in a recent program evaluation (Shah et al., 2016). The relatively low cost and high benefit of CHG bathing were underlined by a cost-benefit program evaluation suggesting that practices that adopted their use ended up saving significant expenditure overall (Reagan et al., 2019). The analysis was completed using mathematical modeling, which suggested an increase of 30% in CHG bathing adherence resulted in a modeled cost savings of $815,301.75 (Reagan et al., 2019). Alternatives to CHG bathing have been

explored in the literature, including using non-medicated cloths with increased safety and cleanliness protocols.

However, despite strong evidence for interventions to prevent CLABSI and reduce associated patient harm using daily CHG bathing, the latter's adoption in practice is poor (Frost et al., 2018; Reynolds et al., 2021). The problem at hand is that practitioners have identified several barriers that prevent regular use of CHG bathing, specifically for adult hematology, oncology, and bone marrow transplant patients. For example, even though nurses had been educated on using CHG bathing daily, they are unaware of the appropriate procedure for bathing, including how to clean over transparent central line dressings and six inches of the tubing (Reynolds et al., 2021). Other barriers discussed in the literature are lack of time, lack of motivation, and lack of perceived importance of CHG bathing in reducing infections (Reynolds et al., 2021).

Severity of the Problem at the State Level

The Florida CLABSI rates and costs were critical measures that showed the scale of the problem at the local level. The federal United States Department of Health and Human Services (USDHHS) had set goals for reducing CLABSI rates across all states, and Florida was yet to meet this goal. The state's rate of HAI from CLABSI in the third quarter of 2020 was 1.2, compared to the federal HHS goal for all states of 0.5 for CLABSI, specifically (Florida Department of Health [FDH], 2021). This also was much higher than the national rate for the remaining states (averaged) at 0.69 for CLABSI (FDH, 2021). This data was compiled using the standardized infection ratio (SIR). This measure, described as a risk-adjusted statistic, incorporates the magnitude of changes to HAIs, including CLABSI, and the direction of such changes from previous periods. Moreover, Florida experienced a substantial uptick in HAIs from

CLABSI in late 2020, perhaps because of the surge in COVID-19 cases. However, subsequent evidence indicates that MRSA led to a significant increase in HAI during this period rather than the COVID-19 pandemic (FDH, 2021).

Regardless of the cause, the state had recently begun to move backward after several quarters of reduction in HAI from CLABSI. This situation needed to be investigated further and will undoubtedly be clarified by CLABSI rates in future periods after the pandemic and its impacts ease. That could provide the relevant sites with the opportunity, time, and resources to return to basics and emphasize adherence to best practices and established protocols in the critical area. At any rate, it was clear from the above that the significance of the problem was very high. Rising CLABSI rates were mainly focused on practitioners and executive nurses alike in Florida. Interventions such as the one offered in the context of this Doctor of Nursing Practice (DNP) program evaluation were explicitly designed to implement simple solutions for reductions in CLABSI rates.

Significance of the Specific Problem at the Local Practice Site

CLABSIs are a critical health concern, especially in high-risk populations such as oncology and bone marrow transplant (BMT) patients (de Mooij et al., 2020). These groups frequently need central lines and are prone to prolonged severe neutropenia. Despite limited data in these specific high-risk groups, clinical evidence strongly supported the use of CHG bathing as a strategy to prevent CLABSIs. More significant data existed for other groups such as critical care and general hospital populations. Using evidence-based QI practices, a hematology/oncology/BMT unit (Unit) at one teaching health system in Florida used line care order bundles as a method to decrease the incidence of CLABSIs. These bundles included: enhanced dressing, line, and cap change protocols, use of sterile techniques for all line care

involving caps and dressings, and daily hygiene with CHG products. CLABSI occurrences were reduced but not eliminated.

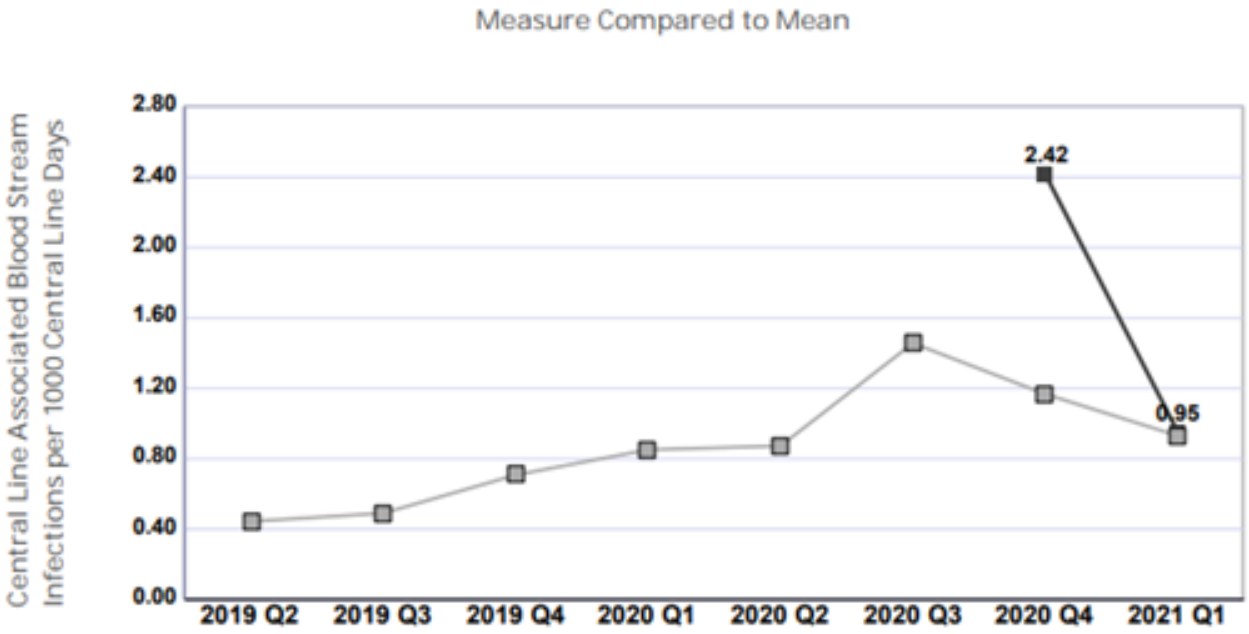
Current Performance and Benchmarks

The current performance of the practice site for this DNP project with respect to the problem could be analyzed by referencing statistics related to HAI. The data were provided in terms of CLABSI rates monthly for 2018 through early 2021. Moreover, data on laboratory-confirmed bloodstream infection (LCBI) CLABSI only rates and the hematology/oncology/BMT Unit's CLABSI standardized infection ratio (SIR) by quarter (QTR) was also provided to glean an evaluation of current performance and benchmarks. To recall, the Unit is the hematology/oncology/BMT unit at a teaching health system in Florida that used line care order bundles to decrease the incidence of CLABSIs. From a broad perspective, patient days with a CVC increased from 29,433 in 2018 to 32,860 in 2019 and again to 35,429 in 2020 at the DNP program evaluation site. As the numbers indicate, patient days with a CVC increased from 2018 to 2020 at the DNP program evaluation site. This also indicates increasing risks for CLABSI since CVC exposes a patient to CLABSI.

Furthermore, CLABSIs per 1000 central line days decreased from the second QTR of 2019 to the first QTR of 2021 among hematology-oncology patients in the Unit. This was seen in Figure 1. As indicated in Figure 1, measurement compared to means was done from the second quarter of 2019 to the first quarter of 2021. Figure 1 indicated that even though CLABSI numbers were reduced to the mean of 2.42, this rate was still concerning because the Unit's goal is to eliminate CLABSIs.

Figure 1

CLABSI among Hematology and Oncology Patients at Project Site

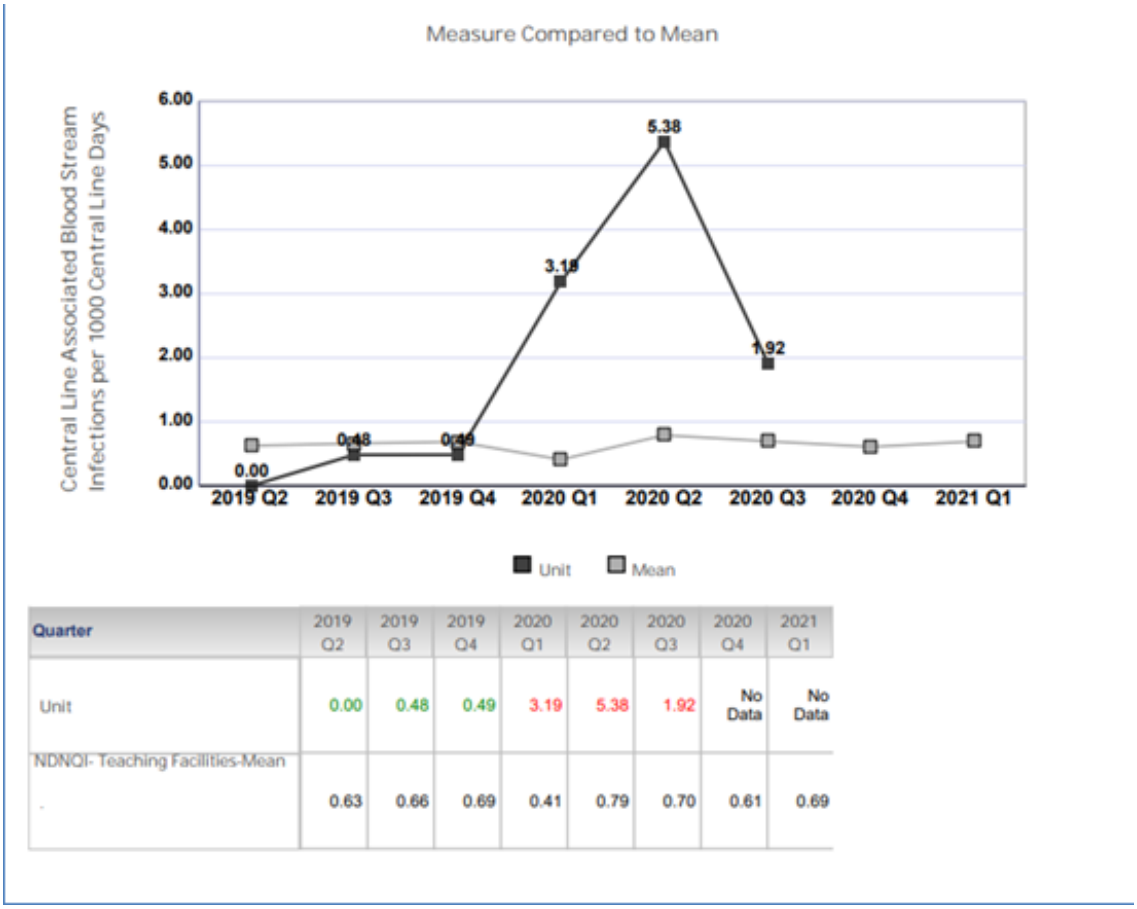


Quarter	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1
Unit	No Data	No Data	No Data	No Data	No Data	No Data	2.42	0.95
NDNQI- Teaching Facilities-Mean	0.44	0.49	0.71	0.85	0.87	1.46	1.17	0.93

In comparison, CLABSIs per 1000 central line days also decreased from the second quarter of 2019 to the first quarter of 2021 among bone marrow transplant patients, as seen in Figure 2. Although there was a significant reduction of CLABSI in the hematology/oncology/BMT Unit, it had not been a level lower than the mean facility rate.

Figure 2

CLABSIs among Bone Marrow Transplant Patients



Quarter	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1
Unit	0.00	0.48	0.49	3.19	5.38	1.92	No Data	No Data
NDNQI- Teaching Facilities-Mean	0.63	0.66	0.69	0.41	0.79	0.70	0.61	0.69

Despite these figures indicating a decrease, other metrics showed an increase in the incidence of CLABSIs (see Figure 3). Data on CLABSI rates in the intensive care unit (ICU) and non-ICU context was reported from 2018 through 2020. These data were reported monthly and included the metrics of bloodstream infections (BSI), patient days with a CVC, and BSI per 1000 patient days with a CVC. However, the reported data excluded mucosal barrier injury (MBI)-LCBIs. As defined by the CDC, a surveillance appropriate CLABSI event occurs when an infection has been confirmed by a laboratory in which a CVC has been in place for greater than two calendar days (de Mooij et al., 2020). The National Healthcare Safety Network (NHSN) provided additional evidence on performance and benchmarks. This data included the SIR ratio

for the hematology and oncology unit in the DNP Project site. The SIR data on CLABSI in this hematology/oncology/BMT unit between 2018 and 2019 (quarterly basis) was compared to a baseline rate for all acute care hospitals established in 2015.

Figure 3 shows the 2018-2020 CLABSI ICU and Non-ICU SIR Ratio Report Excluding BI-LCBIs in the DNP Project site. The primary metric used for comparison was the SIR ratio and the raw CLABSI infection count for each quarter. The data showed that the SIR ratio was only under the USDHHS recommended level for three out of eight possible quarters, namely in the last three quarters of 2019. This was a marked improvement for the site, which had experienced a SIR ratio as high as 2.162 during the third quarter of 2018.

Figure 3

2018-2020 Central Line-Associated Bloodstream Infection ICU and Non-ICU Project Site

2018-2019 Mayo Clinic in Florida
Central Line-Associated Bloodstream Infection ICU and Non ICU Report
(Excludes MBI-LCBIs)

2018	2019 Jan	2019 Feb	2019 Mar	2019 Apr	2019 May	2019 Jun	2019 Jul	2019 Aug	2019 Sep	2019 Oct	2019 Nov	2019 Dec	YTD Total

H2N	**BSI**	3	0	0	2	0	0	0	0	0	1	0	0	1	**4**
	PT Days with a CVC	3367	293	308	308	254	213	185	202	238	256	168	187	209	**2821**
	BSI/1000 Days with a CVC	0.9	**0.0**	**0.0**	**6.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.9**	**0.0**	**0.0**	**4.8**	**1.4**
H3N	**BSI**	10	1	2	0	0	1	0	1	0	0	0	0	1	**6**
	PT Days with a CVC	6548	531	571	672	634	690	582	687	689	689	730	648	681	**7804**
	BSI/1000 Days with a CVC	1.5	**1.9**	**3.5**	**0.0**	**0.0**	**1.4**	**0.0**	**1.5**	**0.0**	**0.0**	**0.0**	**0.0**	**1.5**	**0.8**
H3S	**BSI**	1	0	0	0	0	0	0	0	0	0	0	1	0	**1**
	PT Days with a CVC	3054	252	262	238	248	281	254	340	315	273	287	293	293	**3336**
	BSI/1000 Days with a CVC	0.3	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.4**	**0.0**	**0.3**
	BSI	6	0	0	0	0	1	0	0	0	0	1	0	0	**2**

H4N-MICU	**PT Days with a CVC**	3850	394	388	361	365	337	294	419	333	292	300	330	449	**4262**
	BSI/1000 Days with a CVC	1.6	**0.0**	**0.0**	**0.0**	**0.0**	**3.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.3**	**0.0**	**0.0**	**0.5**
H4S-SICU	**BSI**	1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	PT Days with a CVC	4991	355	410	412	373	380	380	398	313	271	294	288	345	**4219**
	BSI/1000 Days with a CVC	0.2	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H5N	**BSI**	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	PT Days with a CVC	1735	162	151	206	187	192	136	173	181	179	200	158	241	**2166**
	BSI/1000 Days with a CVC	1.2	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H5S	**BSI**	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

	PT Days with a CVC	638	64	50	88	121	91	68	52	72	34	71	50	54	**815**
	BSI/1000 Days with a CVC	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H7N	**BSI**	0	0	0	0	0	0	0	0	0	0	0	0	1	**1**
	PT Days with a CVC	46	12	108	100	134	203	136	190	154	160	152	155	231	**1735**
	BSI/1000 Days with a CVC	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.3**	**0.6**
H7S	**BSI**	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	PT Days with a CVC	2323	222	189	286	226	281	171	153	237	179	218	159	224	**2545**
	BSI/1000 Days with a CVC	0.9	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	BSI	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

H8N	**PT Days with a CVC**	888	82	86	98	105	94	60	92	67	82	116	63	79	**1024**
	BSI/1000 Days with a CVC	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H8S	**BSI**	1	0	0	0	0	0	0	1	0	0	0	0	0	**1**
	PT Days with a CVC	1993	158	157	170	155	209	150	160	169	206	160	210	229	**2133**
	BSI/1000 Days with a CVC	0.5	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**6.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**
Total	**BSI**	**26**	**1**	**2**	**2**	**0**	**2**	**0**	**2**	**0**	**1**	**1**	**1**	**3**	**15**
	PT Days with a CVC	**29433**	**2525**	**2680**	**2939**	**2802**	**2971**	**2416**	**2866**	**2768**	**2621**	**2696**	**2541**	**3035**	**32860**
	BSI/1000 Days with a CVC	**0.9**	**0.4**	**0.7**	**0.7**	**0.0**	**0.7**	**0.0**	**0.7**	**0.0**	**0.4**	**0.4**	**0.4**	**1.0**	**0.46**

Against this backdrop, this DNP Project, to be called CHG-BATHS Program Evaluation, sought to determine the effectiveness of CHG bathing implemented in the hematology/oncology/BMT unit from September 2018 to January 2019 in lowering the rates of CLABSI. For purposes of this project, the period of evaluation was limited from September 2018 to January 2019. However, after the evaluation period, the said program may or not have been continued in the hematology/oncology/BMT unit. Its continued usage was already beyond the scope of this research.

Specifically, the CHG-BATHS Program Evaluation sought to answer these questions pertinent to CHG bathing in the unit:

1. Were program resources used efficiently?
2. Did the program obtain the desired level of outcomes?
3. Were desired program outcomes obtained?
4. Were there unintended side effects of the program?
5. What were the strengths and weaknesses of the CHG program?
6. What were the challenges encountered by RNs and (PCT)s who undertook the CHG bathing?

To determine the effectiveness of CHG bathing, comparisons were made between pre- and post-implementation. In order to answer these questions, the DNP scholar collected and analyzed quantitative and qualitative data. Quantitative data pertained to patient data relative to CLABSI numbers in the Project site's ICU and non-ICU departments. However, it was emphasized that such quantitative data does not provide sufficiently deep insight for a DNP scholarly project. It was necessary to probe deeper through a survey questionnaire to address the

evaluation questions. The survey was administered to the health professionals involved in CHG bathing in the unit studied for the CHG-BATHS Program Evaluation.

Meanwhile, a qualitative method would provide more profound insight into evaluating CHG bathing. Two open-ended questions were incorporated into the survey instead of conducting a separate interview for the same participants. Overall, with its two open-ended questions, the survey tackled important information to the CHG-BATHS Program Evaluation that patient data did not allow. Among the variables in the survey were the effectiveness of CHG bathing in helping patients and reducing CLABSI; strengths, weaknesses, and challenges of the CHG bathing implementation; adequacy of support for implementing staff; and CHG bathing documentation.

Available Knowledge

This literature reviewed current literature on the use of CHG bathing to prevent CLABSIs to determine the current consensus of the effectiveness of CHG bathing within the context of central line maintenance bundles. In addition to the primary outcome of CLABSI rate reductions, the literature review also incorporated studies on training and education interventions to improve adherence of Registered Nurses (RNs) to patients' central line maintenance bundles.

Search Process

To ensure the quality of this literature review, inclusion and exclusion criteria were used in the selection of articles to be reviewed. A program evaluation was included in this literature review if it (a) was published in the English language; (b) used a scientific method; (c) focused on CLABSI or CHG bathing; (d) was available in full-text; and (e) published in a peer-reviewed journal. On the other hand, a program evaluation was excluded from this literature review if it (a) was in full-text, not translated to English; (b) was published before 2016; and (c) not published

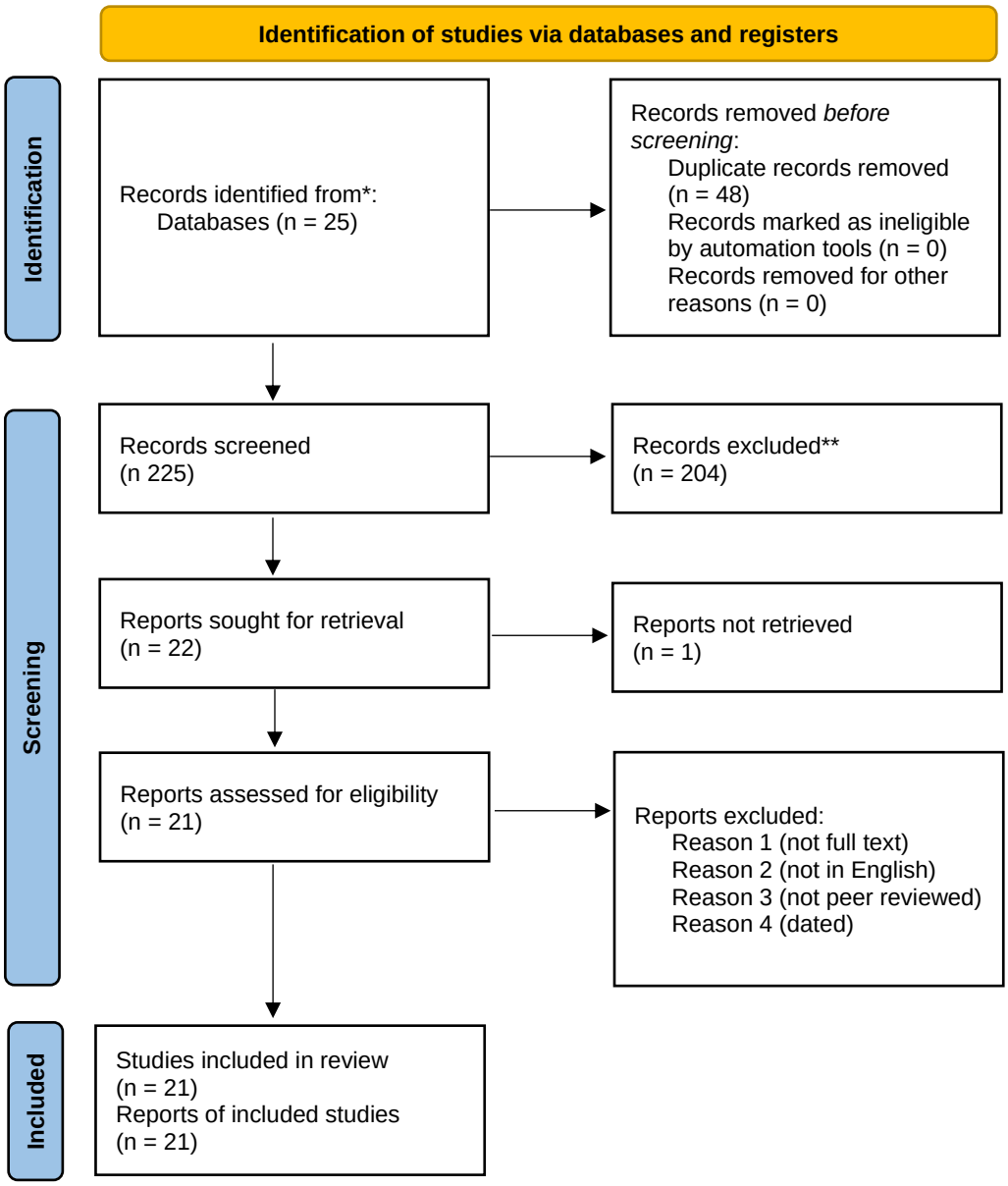
in a peer-reviewed journal. Other articles cited in this paper are used as cross-references outside of the literature review. The articles to be reviewed were accessed through electronic databases such as EBSCOhost, ScienceDirect, Wiley, NCBI, Pub-Med, CINAHL Plus with Full Text, Academic Search Complete, Wiley, and ProQuest.

Search terms included various combinations of the following: *central line-associated bloodstream infection, CLABSI, chlorhexidine gluconate, central line maintenance bundle, compliance, education, adherence, costs,* and *saving.* The current literature includes quality improvement (QI) studies, randomized controlled trials, and qualitative and quantitative observational studies. The literature is presented here across the themes of the safety impact and risk factors of CLABSI, general CLABSI prevention strategies, CHG baths and their impact on infection rates, and compliance promotion through education and training interventions.

Meanwhile, an initial search using the terms *CLABSI* and *chlorhexidine gluconate* further limited search results to full text, peer-reviewed publications, and the English language. This yielded 19 articles. The article abstracts were then reviewed for relevance and focus on inpatient nursing. Relevant articles were then read in full for further refinement, resulting in a final ten articles for the review. A literature review matrix abstracted each selected article for critical appraisal, quality analysis, and evidence synthesis. A hand search was done in the reference pages of relevant publications, yielding two articles. No seminal works were done for this Literature Review. Figure 4 below is a PRISMA diagram showing the search strategy and eliminating findings.

Figure 4

Literature Search Strategy and Elimination Process



Critical Appraisal and Summary of Evidence

Extensive literature pertinent to the program evaluation encapsulated in the DNP scholar's proposed CHG-BATHS Project. The most important studies that adhered to inclusion criteria were discussed. The John's Hopkins evidence appraisal toolkit was used to determine the level of evidence of EACH program evaluation.

Safety Impact and Risk Factors

One of the main risk factors for CLABSI was the use of CVCs in acute care and other settings. In particular, CVCs were often a necessary measure in pediatric medical care, as they aided in rapid fluid infusion, hemodynamic monitoring, and delivery of hyperosmolar medications (Duesing et al., 2016; Jusino-Leon et al., 2019). The Level III program evaluation conducted by Duesing et al. (2016) was a literature review. Jusino-Leon et al. (2019) conducted the Level V program evaluation was a project program evaluation on implementing CHG bathing at the Emory University Hospital to reduce CLABSIs. The project focused on educating and training staff and nurses on the current practices of CHG bathing and identifying barriers.

The drawback of central access was that infection risk could be high, mainly when limited access to vessels leads to a higher risk for error. Infections led to high financial costs along with morbidity and mortality. The cost of each CLABSI was estimated to be $56,000 per incident, and estimates of annual costs of CLABSI range from $296 million to $2.3 billion (Duesing et al., 2016). However, per-incident cost estimates vary widely. In a Level II program evaluation using the literature review method, Denny and Munro (2017) estimated a cost of $16,550 per incident. Even at the low end of the spectrum, CLABSI incidents represented a high cost. Moreover, the mortality rate was approximately 15-25 percent (Denny & Munro, 2017).

Healthcare providers could use several methods to reduce the risks of such incidents, including single lumens, adherence to insertion and maintenance bundles, ultrasound guidance, and ethanol locks. Additionally, tunneled catheters have lower infection rates than non-tunneled CVCs and thus represented a viable alternative when possible. They carried the added benefits of ease of use for patients and home care providers, more durability for long-term use, and a lower risk of dislodgment (Duesing et al., 2016). Despite the availability of such alternatives, CVCs were sometimes unavoidable, but they continue to be used in situations wherein safer options could be used.

In addition to acute care situations, CVCs were often used for routine blood work, which was an avoidable usage of the technology and thus represented an unnecessary increase of the risk of CLABSI. One Level V quality improvement initiative sought to decrease CVC dependency for routine blood work using an educational intervention with nursing staff (Kuriakose, 2020). This QI program evaluation by Kuriakose (2020) analyzed the initiative's impacts using a care bundle approach on CLABSI rates. The post-intervention results indicated that when CVCs were used less frequently for routine blood draws, the risk of CLABSI measurably decreased among patients (Kuriakose, 2020). Moreover, the intervention supported the feasibility of training and education as intervention strategies for reducing the risk of CLABSI by improving compliance to protocols, a theme discussed in more detail in the final subsection below.

CLABSI Prevention Strategies

The rationale for focusing the intervention on CHG instead of alternatives included the particular effectiveness of such baths. In a Level III program evaluation, Miller and Maragakis (2012) explained that much of the significant success in reducing the incidence of CLABSI and

corresponding central line infection rates had been attributed to increased use of CHG baths, among other measures. Another reason for focusing on CHG baths is that they were cost-effective and straightforward measures when supplemented with existing infection control measures aimed at reducing rates of CLABSI (Miller & Maragakis, 2012).

However, research also identified several measures to address CLABSI and institute successful prevention measures. General improvement of central line insertion and maintenance practices, or special attention to following already established best practices, was a common refrain in one recent meta-analysis and literature review (Miller & Maragakis, 2012). Additional research in the context of intensive care units found that daily chlorhexidine bathing may cause a reduction in rates of both methicillin-resistant Staphylococcus aureus and MRSA, as well as of vancomycin-resistant Enterococcus (VRE) (Climo et al., 2009).

The research established the effectiveness of various interventions for the reduction of CLABSI. One Level III program evaluation presented results suggesting that following the Centers for Disease Control (CDC) guidelines for CLABSI prevention with respect to daily chlorhexidine gluconate bathing was practical for the marrow transplant population (Boubekri, 2013). A Level I meta-analysis along similar lines focused on nonrandomized controlled trial-based studies and one randomized controlled trial program evaluation in the intensive care unit setting (O'Horo et al., 2012). Results from the meta-analysis suggested that chlorhexidine bathing daily effectively reduced these bloodstream infections.

Other than CHG baths and avoidance of CVCs, when possible, several prevention strategies were developed to reduce the risk of CLABSI. The CDC has recommended evidence-based bundles for CLABSI risk reduction. The CDC arrived at this determination based on

evidence from the MHA Keystone Program evaluation, a statewide initiative launched in 2003 in Michigan to prevent CLABSI in 103 ICUs, using a "bundle" of best practices.

These bundles tended to include a wide range of risk mitigation approaches, including training, decision-making based on risks and benefits, ultrasound guidance, minimizing the number of ports for catheter placement, replacement of emergency catheters within 48 hours, prompt removal of non-essential catheters, sterile barrier precautions, proper skin preparation, and care and maintenance (Duesing et al., 2016). For example, these bundles recommended preparing the skin before insertion and dressing changes, using a solution with 2% CHG and 70% isopropyl alcohol (IPA) (Duesing et al., 2016). Additionally, the dressing should be transparent, semipermeable, sterile, and replaced at least as frequently as every seven days.

Additionally, in a Level V program evaluation, Williamson et al. (2017) explained that comprehensive programs had been implemented to eliminate the use of CVCs in blood draws and have achieved significant reductions in CLABSI. In one interdisciplinary QI initiative, a group of healthcare providers developed the No Central Blood Line Draw Program. This program was developed and implemented in Penn State Hershey Medical Center, where the 49-bed medical-surgical unit used central lines for post-transplant medications, I.V. vesicants and antibiotics, and total parenteral nutrition. The program comprised a "staff education plan targeting physicians, nurses, patients, and families to improve competency on ordering practices, nursing workflow, and phlebotomy" (Williamson et al., 2017, p. 42). This interprofessional team implemented guidelines and made recommendations for reducing central line access. The team collaborated to establish the No Central Blood Line Draw program and used the Plan-Do-Check-Act (PDCA) QI model "to implement changes in physician ordering practices, phlebotomy and nursing workflow, patient education, and charge nurse competency in central line blood draws"

(Williamson et al., 2017, p. 42). Meanwhile, the team's council members designed an education plan to educate all staff about the risks for infection when a central line is accessed.

For two years after implementing this program, no participating patient experienced a CLABSI (Williamson et al., 2017). Before implementing the program, the hospital group's infection rate was 2.99 per 1,000 central line days. Additionally, the facility significantly reduced the frequency of contaminated or mislabeled specimens being sent to the laboratory (Williamson et al., 2017).

CHG Bathing as a CLABSI Prevention Strategy

As noted above, CHG was commonly used as a prevention strategy for CLABSI and other HAIs. CHG is a topical antiseptic solution that reduces the cutaneous microbial content and has been used as a preventative measure against infections since the 1950s (Denny & Munro, 2017). CHG works against gram-positive and gram-negative bacteria and works by binding to the bacterial cell wall, thereby changing the osmotic equilibrium and reducing skin flora for up to six hours (Denny & Munro, 2017). Given the safety and simplicity of this solution, it was used as a preventive measure against CLABSI, and other infections have steadily increased since its adoption in the 1950s, including the use of CHG baths. A systematic review reported that CHG baths were associated with significant reductions in MSRA and VRE infections, along with significant decreases in the likelihood of hospital-acquired infections such as CLABSIs (Denny & Munro, 2017).

The literature containing strong evidence derived from program evaluations and QI approaches overwhelmingly supported the conclusion reached by Denny and Munro (2017) regarding the use of CHG bathing in critical care settings. Another Level V program assessment program evaluation on a QI initiative was conducted by DePrez et al. (2019). The program

implemented CHG bathing to reduce HAIs and decrease BSIs such as CLABSI and CAUTI for patients in the ICU. The CHG bathing protocol was implemented at a community hospital in southeast Tennessee at the adult medical and surgical ICUs. A QI committee approved the implementation plan. These consistently reflect significant reductions in hazard ratios for CLABSIs and catheter-associated urinary tract infections (CAUTIs) in an ICU setting. A QI intervention by the researchers achieved similar results. Before the six-month intervention, the hazard ratio for CLABSI was 0.48, while the ratio for CAUTI was 1.4. Unfortunately, DePrez et al. (2019) discussed their approach before the CHG bathing protocol. Nevertheless, during the intervention, which included education and staff training to ensure adherence with CHG bathing protocols, no CLABSIs or CAUTIs were reported (DePrez et al., 2019). This outcome aligned with the results reported by Williamson et al. (2017), as cited above.

In one of the largest-scale studies, the current literature, Dicks et al. (2016) conducted an interrupted time series analysis of the efficacy of CHG bathing in 17 hospitals' ICUs, while 16 hospitals were observed as control sites. This Level I program evaluation provided robust evidence on the effectiveness of CHG bathing in reducing CLABSI because it was conducted over many sites. The results indicated a statistically significant downward trend in CLABSI numbers: an incidence rate ratio of 0.96; 95% confidence interval of 0.93-0.99), ICU primary BSI at IRR of 0.96, 95% CI at 0.94-0.99, VRE CLABSIs at IRR of 0.97 and 95% CI at 0.97-0.98) (Dicks et al., 2016). All combined VRE infections had an IRR of 0.96 and 95% CI at 0.93-1.00). These mean a reduction in incidence rates of CLABSIs, other BSIs, and all combined VRE infections. However, the results did not reflect any significant trend change in MRSA infection rates (Dicks et al., 2016). The lack of a significant effect for MRSA was observed in

non-critical care settings using CHG bathing, as Huang et al. (2019) explained in their Level II program evaluation.

Studies That Provided Lower or No Significance

Some studies raised doubts about the efficacy of CHG bathing for certain types of CLABSIs. While most of the research focused on CLABSI reduction in general, fewer studies pinpointed the respective effects of CHG bathing on gram-negative and gram-positive infections. To address this gap in the research, Patel et al. (2019) conducted a Level I systematic review and meta-analysis of observational and randomized studies on the impact of CHG bathing on infections with gram-negative bacteria. The evidence from this article was strong, based on observational and randomized studies comparing daily bathing with and without CHG. Data were combined using a random-effects model and pooled relative risk ratios (RRs), deriving 95% CIs (Patel et al., 2019). Across 15 eligible studies, the literature demonstrated no significant reduction of the risk of gram-negative infections, specifically those caused by *E. coli*, *Enterobacter*, *Acinetobacter*, or *Pseudomonas* spp. (Patel et al., 2019), with daily bathing with CHG.

Along with the gram-negative or gram-positive status of the infections, questions were also raised around the setting-specific benefits of CHG bathing. Mimoz and Guenezan (2019) noted in their Level V literature review that the benefits of CHG bathing outside of critical-care units had not yet been convincingly demonstrated. The authors found that the literature did not indicate a risk reduction benefit for all-pathogen bloodstream infections or multidrug-resistant organisms for non-critical care patients. Mimoz and Guenezan (2019) highlighted the ABATE Infection Trial conducted by Huang et al. (2019). This cluster-randomized trial of hospitals sought to compare two QI strategies in reducing MRSA and HAIs in non-critical care units.

Huang et al. (2019) explored two strategies, namely (a) the use of routine care for bathing; and (b) decolonization using chlorhexidine as routine soap for bathing of all patients. In this program evaluation, the researchers enrolled 339,902 patients in a 21-month intervention to compare the effects of CHG bathing to routine care for non-critical care patients. The results reflected improvements in risk reduction, but those improvements were not significant enough to justify the strategic adoption of the method for reducing multidrug-resistant or all-pathogen bloodstream infections, particularly MRSA carriers or vancomycin-resistant enterococcus clinical cultures (Huang et al., 2019). Specifically, the intervention group that underwent CHG bathing had a hazard ratio of 0.79 compared to 0.87 in the routine care group (Huang et al., 2019). While these results were deemed insufficiently significant, they bear a marked contrast to an earlier program evaluation using Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) by Huang et al. (2016). In this Level I program evaluation by Huang et al. (2016), 15 investigations, including three randomized controlled trials and 12 quasi-experimental studies, it was found that daily CHG bathing reduced catheter-related bloodstream infection with RR of 0.44 and 0.32 to 0.63 significance with 95% CI. CHG bathing also reduced catheter-associated urinary tract infection at RR of 0.68 and significance of 0.004 (Huang et al., 2016). It also reduced ventilator-associated pneumonia (RR, 0.73; 95% CI, 0.57 to 0.93; $p = 0.01$), acquisition of MSRA (RR, 0.78; 95% CI, 0.68 to 0.91; $p = 0.001$) and vancomycin-resistant Enterococcus (RR, 0.56; 95% CI, 0.31 to 0.99; $p = 0.05$) (Huang et al., 2016).

The non-significance of results in non-critical care settings may have been a function of the low baseline rate of CLABSIs and other HAIs in these contexts. This conclusion was supported by Dicks et al. (2016), who noted in their program evaluation that most of the 16 hospitals in the control group already had low baseline rates of CLABSIs, CAUTIs, primary

BSIs, and MRSA infections. These conditions factored into their decision not to implement the CHG bathing intervention. Dicks et al. (2016) reasoned that hospitals with low ICU utilization might not need to implement CHG bathing if this low utilization rate is associated with low baseline infection rates, but they argued that further research would be necessary to reach a firm conclusion on these questions.

While low baseline infection rates may have deterred hospitals from implementing CHG bathing, the literature did not provide a reason for concern about the development of CHG-resistant bacteria after implementing antiseptic bathing procedures. Marolf et al. (2017) studied samples of nosocomial *Staphylococcus aureus* to gauge whether the bacterium underwent any change in susceptibility to chlorhexidine associated with the widespread use of the antiseptic. The program evaluation's setting had introduced CHG bathing for six months, ceased the practice for one year, then resumed for another six-month period, which provided viable conditions for comparing the effects of the practice. This experimental program evaluation analyzed samples of freezer-banked S aureus bloodstream isolates recovered from patients hospitalized for more than 72 hours.

Further evidence supported the safety of CHG bathing, even for neonates and infants. A small-scale, albeit Level I experimental program evaluation by Chandonnet et al. (2019) observed ten infants from 36 to 48 weeks postmenstrual age who had received twice-weekly CHG baths with a 2 percent concentration. The program evaluation found that all participating patients had evidence of CHG absorption at higher than previously reported rates, including seven patients with CHG levels of 100ng/mL or higher. However, liver and renal function remained within safe reference limits, and no patients experienced adverse reactions (Chandonnet et al., 2019). The authors noted that further research would be necessary to

determine any long-term effects of CHG absorption but found the results promising to indicate the safety of CHG bathing for infants.

Promoting Adherence through Education

Implementing and sustaining the benefits of CHG bathing depends on the effective planning and education of all staff involved. Several QI studies examined methods for QI initiatives to adopt proper and regular CHG bathing procedures. Jusino-Leon et al. (2019) used the Engage, Educate, Execute, and Evaluate sequence to implement and evaluate a comprehensive CLABSI prevention program in an ICU. First, meetings and motivational interviewing were used to engage and motivate the staff. Second, education and training were conducted, followed by several rounds of observation and auditing to confirm staff competency. Subsequently, the execution stage entailed creating a CLABSI control team and another round of documentation audits. Finally, the evaluation stage measured staff awareness, adoption, and adherence to CHG bath protocols (Jusino-Leon et al., 2019). Pre-intervention, the hospital had 5.28 CLABSI events per 1,000 central line days. The intervention did not achieve the target of one CLABSI event per 1,000 central line days, as the three non-preventable MBIs factored into the post-intervention rate of 5.86 per 1,000 central line days. However, the two months after the intervention had zero CLABSI events on the unit (Jusino-Leon et al., 2019). One of the significant barriers identified by Jusino-Leon et al. (2019) was a gap between providers' and patients' respective understanding of the rationale behind the implementation of regular CHG bathing. Some patients refused the CHG baths because they found the experience unpleasant.

Aversion and misunderstanding as barriers to implementation were also noted by Musuuza et al. (2016). In this Level V program evaluation, the authors tested the efficacy of direct observation of CHG bathing as a method for ensuring adherence to prescribed protocols.

The program evaluation using the direct observation method found that trainee observers quickly attained the reliability of experienced observers after simple, standardized training. Similar results were reported by Bell and O'Grady (2017) in a Level V QI initiative designed to improve overall CVC safety, which included the insertion and sterilization techniques along with CHG bathing. The authors reported that third-party observers enhanced adherence to procedures.

Both studies' high inter-rater reliability (IRR) had two critical implications. First, observers were highly reliable to ensure staff and patient adherence to CHG bathing protocols. Second, the training methods might be adapted to achieve similar adherence outcomes if insufficient staff members conduct in-person, direct observation. Musuuza et al. (2016) reasoned that the high IRR was attributable to the carefully executed protocol for training the new observers. In this light, using a standardized training process may have supplemented the engagement and education strategies described by Jusino-Leon et al. (2019).

While observation and standardization of protocols successfully improve adherence to protocols, the most salient recurring theme in the literature was the importance of comprehensive education programs to achieve and sustain the intended efficacy of CHG bathing to reduce CLABSIs. Beaudry and Scotto Dimaso (2020) implemented an education program targeting the nursing staff for comprehensive CLABSI prevention using pre-tests, two-hour classes, and post-tests. After the brief education program, staff knowledge and understanding of central line maintenance and CLABSI prevention increased by 16 percent. However, this pretest-posttest program evaluation did not include data on actual adherence. Therefore, it was unclear whether or to what extent the improved knowledge and understanding translated to better adherence to CLABSI prevention protocols.

By contrast, Kamity et al. (2021) carried out a more comprehensive, Level III education-based QI initiative tailored to patients and families in a pediatric ICU while also incorporating staff training and education. This intervention used “K-cards,” which were portable checklists reminding staff of the CLABSI prevention bundle items to be reviewed with frontline staff in the course of central line maintenance, CHG bathing, and other preventive measures. This QI intervention improved on a standard checklist model like the studies above by incorporating direct observation and documented audits. Moreover, the intervention directly engaged pediatric patients and their parents by supplying them with their K-cards to engage them in the process and improve their understanding of infection prevention. The maintenance bundle adherence rate improved from 87.9 percent to 97.1 percent between pre-intervention and post-intervention measurement, and the unit’s CLABSI rate decreased from 1.71 per 1,000 central line days to 0.63 per 1,000 central line days (Kamity et al., 2021). Moreover, participating families reported being satisfied with the process and more confident in their ability to help prevent infections.

These findings had necessary implications in comparison with other research reviewed here. First, the multifaceted nature of the educational intervention by Kamity et al. (2021) achieved a CLABSI rate below the one per 1,000 central line days target established by the Agency for Healthcare Research and Quality (AHRQ), which reflects significantly more success than the results reported by Jusino-Leon et al. (2019). Secondly, the results challenge the observation by Dicks et al. (2016) that facilities with low baseline rates of CLABSI may not benefit from CHG bathing. While Kamity et al. (2019) conducted their intervention in a facility with a relatively low baseline rate, they still achieved significant reductions in the incidence of infections.

Summary

As this review indicated, there were six publications at Level I, two at Level II, four at Level III, one at Level IV, and eight at Level V. Overall, 21 sources were included in the evidence appraisal. The levels of evidence in this set of studies range from I to V using the Johns Hopkins Nursing Evidence-Based Practice (2017) Evidence Level and Quality Guide. The evidence reviewed in the ROL was the following:

- The six studies at Level I were Chandonnet et al., 2019; Climo et al., 2009; Dicks et al., 2016; Huang et al. 2016; O'Horo et al., 2012; Patel et al., 2019.
- The two studies at Level II were Denny & Munro, 2017; Huang et al., 2019).
- The four studies at three Level III were Boubekri, 2013; Duesing et al., 2016; Kamity et al. 2021; Miller & Maragakis, 2012.
- The only program evaluation at Level IV was Bell & O'Grady (2017).
- The eight studies at Level V were Beaudry & Scotto Dimaso (2020); Bell & O'Grady (2017). DePrez et al. (2019); Jusino-Leon et al. (2019); Kuriakose (2020); Mimoz and Guenezan (2019); Musuuza et al. (2016); Williamson et al. (2017).

This ROL provided that CVCs represented the most significant risk factor for CLABSIs and other HAIs, and prevention strategies include reduced use of CVCs where possible. When CVCs were necessary, as was often the case in acute care settings, CLABSI prevention depends on adherence to central line maintenance bundles, most notably adherence to proper procedures for CHG bathing. The literature reflected mixed opinions on the efficacy of CHG baths for gram-negative infections, non-critical care settings, and settings with low baseline rates of CLABSI. However, the most in-depth examples of educational interventions achieved significant improvements in CLABSI prevention even when the low pre-intervention CLABSI rate. Given

the costs and patient safety risks associated with CLABSIs, reductions in the infection rate justify the investment of resources in training staff to adhere to proper CHG bathing protocols.

Meanwhile, Lee, Cho, Jeong, Kim, Han, and Song (2018) conducted a program evaluation to assess the effects of central line (CL) bundle compliance on CLABSIs in different departments of the same hospital, including the ICU and other departments. The four components of the CL bundle were hand hygiene, use of maximal sterile barrier precautions, CHG bathing, and selection of an appropriate site for venous access (Lee et al., 2018). Compliance for the CL bundle and CLABSIs were measured for every department, namely, emergency room, ICU, general ward, and operating room. A total of 1672 patients were included over three years. Lee et al. (2018) found that completing all CL bundle components thoroughly is crucial for preventing CLABSIs. Thus, the researchers recommend that customized education be provided to professionals implementing the bundle based on specific weaknesses.

Synthesis of Evidence — Overall Strength and Quality

The strength of the evidence presented by the literature was evaluated based upon a scale that privileges systematic reviews, meta-analyses, evidence-based approaches, and randomized controlled trials at the highest echelon of quality (Ingham-Broomfield, 2016). In addition, the Johns Hopkins Evidence-Based Appraisal tools were used to determine the strength and quality of the evidence presented in the included studies (Buccheri & Sharifi, 2017). Other, less experimental program evaluation methodologies were considered lower quality in the evidence they may have provided in the context of the program. However, several QI and other intervention studies were included because of their direct relevance to this program evaluation. How many studies included in the review satisfied the demands for Level I, with meta-analyses comprising large numbers of experimental studies being the norm. As a result, these studies also

included enough participants and well-selected samples primarily to support increased levels of generalizability. More recent studies that satisfied the highest evidence strength and quality criteria included a meta-analysis by Patel et al. (2019). One factor in favor of its strength was its utilization of randomized controlled trial studies, with which the researchers supplemented several observational studies.

Two publications were included in the review that did not satisfy the highest level of strength of evidence. However, these studies were included because they comprise QI and nursing intervention studies directly relevant to the DNP topic. This group of studies broadly fell into the Level V group of strength. Some of the studies had qualitative components, including QI and nursing intervention studies and a systematic review of relevant RCTs, to better understand subjective aspects of the nursing staff that may have contributed to program evaluation and intervention outcomes. Thirteen out of the 21 studies were considered good quality because the researchers properly contextualized the research and described data collection methods clearly, as called for in the Johns Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal Tool (Dang & Dearholt, 2017).

An additional Level V program evaluation presented in Beaudry and ScottoDiMaso (2020) utilized a pre-test administered to nursing staff to poll practices in a hematology and stem cell transplant unit. This data was used to evaluate the impact of a comprehensive education program to improve central line care. The researchers properly contextualized the program evaluation and enunciated the problem, and met all other quality criteria. As a result, the program evaluation should have been included in the DNP evaluation project. An additional essential Level II program evaluation identified 23 peer-reviewed, meta-analysis studies for inclusion.

This program evaluation was directly related to CHG bathing and reduction of CLABSI and satisfied all the appropriate quality criteria. Thus, it should also be included in the project.

The rationale for including such a bifurcated range of evidence strength levels was as follows. First, the DNP project leader sought to determine the balance of literature on the effectiveness of CHG bathing for reducing CLABSI rates in specific practice contexts. This aspect required the highest quality of evidence, namely meta-analyses of randomized controlled trials and other forms of experimental program evaluation. Second, QI studies, including some qualitative data collection and presentation, were necessary to understand better the dynamics of adherence to efforts and protocols aimed at reducing CLABSI in the practice areas.

Recommendations for Program Evaluation

The review of available literature combined with the evidence appraisal yielded several recommendations for the CLABSI prevention and CHG bathing program evaluation. The first of these recommendations was to glean the degree of support among staff to implement a large-scale and inclusive staff education program, in line with the intervention examined by Williamson et al. (2017). The inclusive aspect of this intervention plan was to target the education program to all relevant staff, patient families, and patients to maximize the competency and awareness of all stakeholders. As noted in the literature review, similar interventions achieved a dramatic reduction in CLABSI rates, and this reality may have been conveyed to staff to underline the importance of the program and their potential to improve outcomes through self-efficacy.

The second recommendation was to evaluate the extent to which leaders emphasize the efficacy of CHG bathing as a CLABSI prevention strategy. This would include showing staff up-to-date, evidence-based results on the extent to which CHG bathing has reduced rates of

CLABSI and other HAIs in various practice contexts. In particular, the literature has consistently reaffirmed the use of CHG bathing in the context of critical care settings, including in a recent systematic review by DePrez et al. (2019). This information was combined in education programs with data suggesting the enduring safety of CHG bathing, even for the most vulnerable of patients across various care settings, including data presented in a program evaluation by Chandonnet et al. (2019).

The literature was univocal in promoting CHG bathing adherence through education. As suggested above, inclusive education programs that targeted all involved staff were recommended. Such approaches specifically included tactics like the Engage, Educate, Execute, and Evaluate framework presented and evaluated in Jusino-Leon et al. (2019). This framework added some novel elements to the education program, an additional recommendation for the program. These elements added a motivational component and engagement activities to prime the staff for the education and knowledge they were to receive on the topic. This priming was recommended to motivate staff to improve upon the problem and be better positioned to receive and assimilate the requisite knowledge.

The DNP project leader intends these recommendations for program evaluation to be in line with the general types of program evaluation and their associated purposes. For the present DNP evaluation, the summative and outcome evaluation, cost and benefits, and the impact evaluation types were most relevant. Therefore, the recommendations focus on determining whether the program, in its actual implementation, had been effective in achieving the intended goals. In this case, the intended goal is adherence to a CHG bathing protocol and associated measures to achieve a substantial reduction in CLABSI at the relevant care site. Initial communication with the project site's stakeholders indicates that an evaluation of the CHG

bathing program needs to be done because the CLABSI rates continue to be high. This program was implemented in the unit, and although the results of the CHG bathing program were good, the rest of the project site is not performing daily CHG baths. To note, CHG bathing was implemented only at the Unit at the project site. If the CHG bathing program is appropriately evaluated, recommendations can be made to adopt this approach to the rest of the project site. This program evaluation will be the CHG-BATHS Project, which will evaluate the effectiveness of the CHG-bathing at the aforementioned units from September 2018 to January 2019.

In terms of impact evaluation, the recommendations are intended to glean the extent to which the program reduced CLABSI rates and increased adherence to protocols among the staff. In other words, the evaluation of the CHG bathing protocol focused on the implementation and effectiveness of the program, part of which was implementation adherence. An important aspect of the CHG-BATHS Project is to determine whether or not there was adherence with CHG bathing and to demonstrate adherence or non-adherence. One way this could be done was to measure CLABSI numbers before and after implementation of the intervention and associated staff education program.

Fit, Feasibility, and Appropriateness for DNP Program Evaluation Project

The fit, feasibility, and appropriateness of the DNP program evaluation project determined with high accuracy whether the program evaluation was relevant and successful. According to the CDC (2013), program evaluation is the “examination of the worth, merit, or significance of an object.” Aligned with the CDC (2013) perspective of program evaluation, the term “program” refers to “any set of organized activities supported by a set of resources to achieve a specific and intended result.” This DNP program evaluation project was a good fit because it directly relates to everyday practice and the challenges of integrating practice-relevant

changes into daily practice, particularly among staff. The project had a high level of feasibility because the CHG bathing done for the Unit is measurable and addresses a relevant problem to be tackled by executive nursing leaders. As a result, the practice site would likely motivate staff and executive nursing leaders to carry out the CHG-BATHS Project. The program also addressed the need to optimize the nursing practice to increase patient safety.

As with other similar projects, the current project presented executive leaders with insight into how the program can be extended and enlarged for further utility and applicability to additional sites. As noted, the project and associated practice program addressed health outcomes for many service users in Florida and beyond. The program allowed for the critical evaluation of program implementation and outcomes, a critical distinguishing factor in the quality of a DNP project (Roush & Tesoro, 2018). It was also appropriate because it leverages the knowledge of RNs concerning the problem of CLABSI with their self-efficacy in professional daily practice to have had an impact on a practice problem creatively. The DNP scholar, in this case, made use of existing literature to inform the program evaluation, mainly by providing the evidence-based context for the practice problem and the rationale for the intervention design and execution at the practice site.

The evaluation could also play a vital role in adapting the program to related programs already in use. Current HAI-prevention programs at the project site were hand-washing and proper disposal of gowns and gloves. Meanwhile, CHG bathing was feasible because the program scope is sufficiently targeted considering the time and resources available to achieve completion. Another factor considered was the role of guerrilla theorizing and the efforts of staff and stakeholders to conceive of and create novel solutions to challenges that arise during program implementation. Guerrilla theorizing was an approach to problem-solving involving

creative thinking based on practice and required flexibility and innovation (Moran et al., 2019). The DNP scholar, in this case, made use of a similar approach by integrating experience from nursing practice with findings from up-to-date literature on the topic and using both to formulate the DNP program evaluation project. The QI programs presented in the literature on CLABSI were envisioned in specific practice environments of which the DNP scholar had the experience to understand better the likelihood of anticipated challenges and challenges reported in these studies within the literature.

Fit, Feasibility, and Appropriateness of Recommendation(s)

In line with recommendations for the CDC, the CHG-BATHS Project evinced the following points. It is important to determine whether the CHG bathing at the project site was implemented as planned and whether it was effective. Based on these determinations, the recommendation can be made about implementing CHG bathing at the rest of the site. Recommendations were also made regarding the role of stakeholders, areas of practice focus, and outcomes.

The CHG-BATHS Project also looked at the CDC recommendations for fit, feasibility, and appropriateness that were applied to the rest of the program evaluation site considering intended goals and objectives to be established with the help of CHG-BATHS Project stakeholders. Recommendations to ensure this was the case include regularly testing adherence and trends in CLABSI rates for the rest of the program evaluation site. The CDC recommendations also guided the evaluation of the CHG bathing implemented in the unit, particularly regarding the correct usage of available resources. The CHG-BATHS Project can achieve this by surveying key internal stakeholders in the Unit, particularly nurse leaders and the

RNs and PCTs who performed the CHG bathing. Attention was given to assessing adherence with strict timelines for implementation and staff uptake of practice procedures.

Next, the CDC recommended that the benefit of achieving program goals represents a more excellent value than the cost of achieving these goals. This was a crucial area of analysis in the CHG-BATHS Project, especially since the CDC guidelines are challenging to evaluate in terms of feasibility. Nonetheless, evaluating this aspect of the CHG bathing in the Unit is essential because costs must be balanced with outcomes. The CHG-BATHS Project must also look at how the nurse leaders were educating colleagues to integrate CLABSI-related efforts into regular working hours and not take on extra duties to implement the program. This assessment and its results can help ensure that this program evaluation does not incur additional costs for the site outside of what is appropriate for regular continuing training and education that it already institutes. Finally, the CDC recommended that any progress on the criteria used to evaluate the program are linked to the program itself, rather than to any factors outside the program that may positively impact (in this case) CLABSI and adherence. This CDC recommendation again guided the CHG-BATHS Project. The CLABSI numbers reported in the CHG-BATHS Project were supported by explanations about how the Unit listed and considered other factors that would impact adherence to protocols and CLABSI rates. Compilation of a list of outside factors as exhaustive as possible would aid in determining the true impact of CHG bathing in the Unit that, in turn, informed CHG-BATHS Project recommendations for intervention and staff education programs pertinent to CHG bathing.

Needs Assessment

This project was a program evaluation of the CHG-BATHS Project. It must be emphasized that the CHG bathing protocol had already been implemented in the unit being

studied for the DNP scholar's project. The CHG-BATHS Program Evaluation evaluated the CHG bathing protocol in the hematology/oncology/BMT unit for effectiveness. One way of doing this was to compare CLABSI rates in the site's hematology/oncology/BMT unit being studied before and after implementing a CHG bathing program to address CLABSI. Overall, the goal of the CHG-BATHS Project was to measure the effectiveness of CHG bathing in addressing CLABSI in the studied Unit.

The needs assessment for the CHG-BATHS Project comprised two sets of activities before implementing the Project. The first part entailed developing a logic model that served as the roadmap for the CHG-BATHS Project. The second part of the needs assessment included an email survey of RNs, PCTs, and nurse leaders about the implementation of the CHG bathing policy to determine its strengths, weaknesses, challenges.

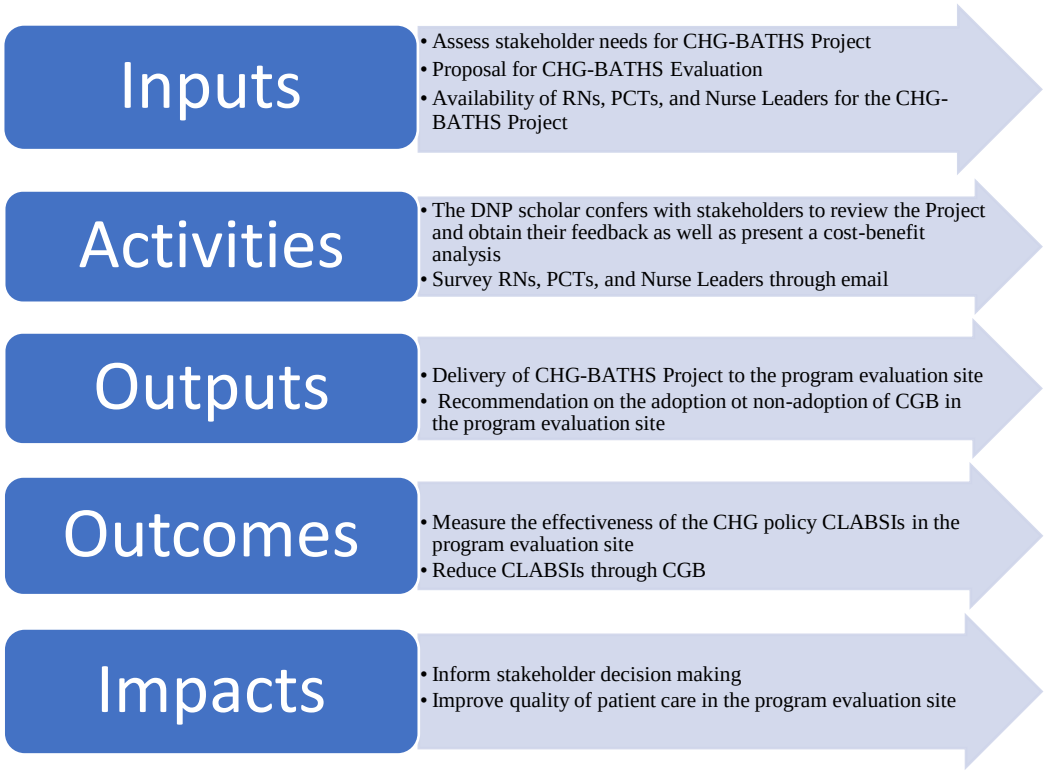
Logic Model

Effective program planning harnessed the logic model as a tool to support implementation and performance (Mills, Lawton & Sheard, 2019). For the project, the logic model (a) contained graphical and textual representations of how the program was planned to work and (b) links program processes and theoretical assumptions with program outcomes (Hayes, Parchman & Howard, 2012). Shown in Figure 5 is the logic model for the CHG-BATHS Project, serving as a roadmap of what the CHG-BATHS Program Evaluation is supposed to accomplish and its intended outcomes. Figure 1 contains "if, then" relationships between the logic model components to meet desired outcomes. In other words, the Logic Model described the relationships between inputs or resources, activities, and results or outcomes and impacts. Notably, for the CHG-BATHS Project, (a) the stakeholders were health professionals in the infection prevention and control department and the nursing education in the

hematology/oncology/BMT unit at the project site, collectively to be called "Unit," and (b) the target population are RNs and PCTs in the Unit.

Figure 5

CHG-Baths Evaluation Logic Model



As seen in the Logic Model, the CHG-BATHS Project roadmap is comprised of five stages. These stages are discussed in the following paragraphs.

Step One: Inputs

To conduct the CHG-BATHS Program Evaluation, inputs were needed. Notably, the DNP scholar organized the CHG-BATHS Program Evaluation for the DNP scholarly program evaluation. The DNP scholar met with the stakeholders to comprehensively assess their CHG-BATHS Project needs. Notably, an initial dialogue between the Unit stakeholders and the DNP scholar initially happened to assess the feasibility of a CHG-BATHS Program Evaluation. To

recall, the CHG-BATHS Project was the DNP scholar's program evaluation of CHG bathing at the Unit in the project's site. The stakeholders for the CHG-BATHS Project were health professionals in the infection prevention and control department and nursing education of the same Unit. The Unit stakeholders requested the CHG-BATHS Program Evaluation.

The CHG-BATHS Program Evaluation was undertaken in the program evaluation site's hematology/oncology/BMT unit. This is the same unit wherein the CHG bathing program was implemented. The program had not been previously evaluated for effectiveness. Initial data indicated that CLABSI numbers decreased at the time of the program but were not eliminated. The spikes in rates indicated in figures 1 and 2 supported the need to evaluate this program's effectiveness for reinstatement and wider implementation. The effectiveness of the CHG bathing program was evaluated from September 2018 to January 2019. The target audience of the CHG-BATHS Program Evaluation was RNs and PCTs in the Unit and program evaluation site who implemented the CHG bathing program and agency clinical decision-makers. Therefore, the DNP scholar's CHG-BATHS Project had three essential inputs: assessment of stakeholder needs for CHG-BATHS, a proposal for the CHG-BATHS Project, and RNs, PCTs, and Nurse Leaders participating in the CHG-BATHS Project.

However, it must be emphasized that data should support the assessment with stakeholders. The CHG-BATHS Evaluation Project entailed resources that translated to costs, including the time of the DNP researcher and program evaluation participants. The literature review in this proposal attested that CLABSIs are a costly problem and that daily CHG baths can help prevent them. However, in the program evaluation site, it was essential to determine whether the daily CHG baths would have been effective in preventing CLABSIs and, by extension, whether stakeholders could support the costs for the CHG-BATHS Project. The third

Input was the availability of RNS, PCTs, and Nurse Leaders who were in charge of conducting the daily CHG baths because they served as participants in the program evaluation. If they were not available for the survey component of the CHG-BATHS Project, then the latter would not be a comprehensive analysis of the effectiveness of CHG bathing in the Unit.

Step Two: Activities

As mentioned earlier, a logic model uses an "if, then" relationship between its components. For Step Two, if all of the inputs were agreed upon by the DNP scholar and the stakeholders, actual activities could be planned. The activities were required to have met the needs of the target audience, the RNs, and PCTs of the Unit. The DNP scholar once again conferred with stakeholders to obtain their feedback and, at the same time, present a cost-benefit analysis of the CHG-BATHS Project. The cost-benefit analysis would serve to guide the development of the CHG-BATHS Project. To recall, one of the inputs in the CHG-BATHS Logic Model was to propose the CHG-BATHS Evaluation/Project to the identified stakeholders. Understandably, the stakeholders may not have thoroughly evaluated the proposal in one sitting and need to talk about it. Therefore, during Step Two, stakeholders were asked about their feedback on the CHG-BATHS proposal. Expressly, the DNP scholar conferred with stakeholders who, at this time, would already have reviewed the proposed CHG-BATHS Project and obtained their feedback as well as presented a cost-benefit analysis. This was the best way to align this Needs Assessment with the strategic and stakeholder priorities of the program evaluation site.

After approval for the CHG-BATHS Project had been obtained from the stakeholders, the actual project commenced. The first part included data collection on the numbers of CLABSIs before and after implementing the daily CHG baths in the Unit. Moreover, if the stakeholders approved the proposal, the second component of the CHG-BATHS Project was the email Likert-

type survey, wherein participants were de-identified. The participants were RNs, PCTs, and nurse leaders, and they were being asked to complete an anonymous survey sent through email based on the effectiveness of the CHG bathing program in the Unit. The participants responded to nine questions according to a Likert scale. The DNP scholar designed the survey questions based on knowledge discerned from the initial engagement with Unit stakeholders and extant literature.

The following was the sample survey instrument distributed to participants through email. The questions had face validity because they measured what the questionnaire sought to measure.

Instruction: Please answer the following questions by encircling the most appropriate answer where: 1=Strongly Disagree; 2=Disagree; 3= Neither Agree nor Disagree; 4= Agree; 5=Strongly Agree.

Questions	Responses				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree.
1. I was thoroughly educated about the chlorhexidine gluconate bathing to be used in the unit.					
2. I successfully implemented chlorhexidine gluconate bathing according to protocol.					
3. I can identify the strengths of the chlorhexidine gluconate bathing protocol.					
4. I can identify the weaknesses of the chlorhexidine gluconate bathing protocol.					
5. I can identify the challenges of the chlorhexidine gluconate bathing program.					

6. I was given sufficient support to implement chlorhexidine gluconate bathing.					
7. chlorhexidine gluconate bathing helped patients with CLABSI.					
8. I documented all instances of chlorhexidine gluconate bathing.					

Through these Likert scale questions, the DNP scholar determined how RNs and PCTs viewed the program's preparation, implementation, and effectiveness. Meanwhile, the DNP scholar asked the participants two open-ended questions in a Comments Section provided after the survey questions. These questions were: (a) what have been the roles, tasks, and responsibilities of the RNs, PCTs, and nurse leaders in the CHG bathing protocol, and (b) how did program evaluation site leaders and administrators provide support to internal and external stakeholders concerning the benefits and procedures of CHG bathing.

It must be emphasized that the preparation of survey questions and the CHG-BATHS Project occurred before the DNP scholar’s submission of this project’s proposal. In other words, the details of the actual project, the identification of target RNs and PCTs who delivered the training, the survey items were ready before Step One. The survey questions pertained to the strengths, weaknesses, challenges, and perceived effectiveness of the CHG. Once all of the activities had been completed, a comparison of CLABSI numbers before the CHG program was implemented and after it concluded was made. The results of these activities helped assess the need for further CHG baths in the other units of the program evaluation site.

Step Three: Outputs

An Evaluation Report to Stakeholders was the intended deliverable specific to the CHG-BATHS Project due to the planned activities. If all of the planned activities were performed

smoothly, then a measurement of the effectiveness of the CHG baths used for the Unit became possible. If this approach was effective, then the DNP scholar could make a data-driven recommendation to administrators of the program evaluation site to adopt CHG baths in the other units. Thus, recommendations on whether CHG bathing should be adopted in the rest of the program evaluation site based on findings of effectiveness or non-effectiveness were encapsulated in the Evaluation Report to Stakeholders. Aside from the recommendations, the Report to Stakeholders showed answers to the evaluation questions and insights into how CHG bathing can be improved upon in the rest of the program evaluation site based on the Unit's experiences. The Report to Stakeholders was a significant deliverable. To do this, program data had to be accessed to be evaluated along with inputs from participants of the program and the leaders, using an email survey.

Step Four: Outcomes

The outcome was the intended impacts and change planned for each activity and input. The outcomes for the CHG-BATHS Project were in terms of short-term outcomes of one year. These were to (a) evaluate the effectiveness of the CHG bathing in the Unit and (b) make recommendations to the stakeholders considering reimplementation of the CHG-BATHS program. It cannot be overstated that the most challenging aspects in the preparation component of the CHG-BATHS Logic Model were in determining the activities, outputs, and outcomes, particularly ascertaining that these three were linked to each other. For the CHG-BATHS, developing meaningful outcomes could be helpful for reports and publications. These three were also the most challenging to execute. The researcher was cognizant of the possibility that the initial Logic Model would be disseminated, discussed, and revised by stakeholders before the final model was approved.

Step Five: Impacts

It was anticipated that the CHG-BATHS Project could impact the program evaluation site. Specifically, the CHG-BATHS Project could help improve the delivery of quality care in the program evaluation site. If the CHG bathing approach were practical for the Unit and survey participants revealed minimal challenges and weaknesses that could be improved, then CHG bathing would be recommended for the entire program evaluation site. Overall, the positive impacts of the CHG bathing would accrue to patients not limited to the Unit only but the entire program evaluation site.

Nature of the Gap/Challenge

The Unit's CHG bathing initiative in the relevant period may have been challenging to implement. The CHG-BATHS Project had not had a complete program evaluation to determine effectiveness. Generally, program evaluations led to program improvements, accountability for the organizers and health professionals involved, judgments of significance; and, ultimately, as seen in the CHG-BATHS Logic Model, the promotion of positive health outcomes (Gargani & Miller, 2016).

The "challenges" variable in the survey for key participants was crucial. This was because undertaking clinical work is demanding (Moye, 2017). Extra resources were needed to undertake program evaluation, usually on the part of stakeholders seeking that evaluation. However, there was a need to systematically assess health programs, such as the CHG bathing in the Unit, to clearly define what the Unit was doing well and doing wrong and evaluate the extent and limits of the program's effectiveness. As substantiated by the Logic Model for the CHG-BATHS Project, it was vital to share knowledge from the evaluation and bring it to the "real

world" to benefit patients, healthcare professionals, and even researchers interested in conducting studies to address challenges.

For the Unit's CHG bathing initiative, a potential problem would be low adopting rates and low adherence rates among patients. Here, education about CHG bathing and its effectiveness was not limited to Unit staff but patients and their family members to improve compliance and adherence. Nurse leaders educating RNs and PCTs should give RNs and PCTs sufficient time to practice CHG bathing. However, this could be challenging in light of a persistent staffing shortage. In this regard, the alignment between needs assessment and stakeholder priorities in the Unit was utterly important to ensure RNs and PCTs for the CHG-BATHS Project. In addition to these, if CHG bathing compliance had been low for the Unit, surveying RNs and PCTs would be challenging because their responses would reveal insights that would hold them accountable for poor performance. In this regard, stakeholder support was essential in ensuring the participation of intended survey participants.

Context

Setting

The setting for the healthcare program was in Northeast Florida at a multisite teaching healthcare system, and in the project site, the specialties considered to most benefit from the program in terms of the prevalence of CLABSI infections. The specific setting of the CHG bathing program that would be evaluated in the DNP scholarly project was a hematology/oncology/BMT unit (Unit) at a teaching health system in Florida that used line care order bundles as a method to decrease the incidence of CLABSIs.

Target Population

The target population for the program was RNs and PCTs at the site who were instrumental in serving central line patients and who was best positioned to provide patient education on the matter. The clinic location was within Florida, United States, and this locale has experienced significant rates of CLABSI and, notably, an uptick in infection rates through the COVIDd-19 pandemic-affected year of 2020.

Governance Structure

The team and stakeholders for the program included RNs and PCTs for whom most of the program activities were targeted and nurse leaders that supervised them. These stakeholders all worked together in the Unit. In addition, the patients of the relevant specialty care Unit were also key stakeholders, as their health outcomes were directly implicated in staff-focused program activities, and they were the target group for significant patient-education program activities. The program focused on the activities in the Unit or site that was locally based, and thus, the target of program activities was site-based and local in geographic scope.

Program Focus

The CHG bathing program was impacted by rising rates of CLABSI and lack of adherence to guidelines establishing the effectiveness of CHG bathing for its prevention at healthcare sites around the United States. There were also implications in analyzing the program's impact and feasibility in a healthcare environment still dealing with the impact of Covid-19.

The program adapted existing healthcare programs and paradigms to address the identified problem of CLABSI infection rates and CHG adherence. In particular, we used the model for change to evidence-based practice established by Rosswurm and Larrabee (1999; Lee,

2016) and elements of the Health Belief Model (McKenna, 2018) to identify and eliminate barriers to compliance with CHG bathing protocols in the Unit.

SWOT Analysis

The following was a SWOT Analysis of the CHG bathing program at the Unit.

Strengths

One of the strengths of the target site was the determination of Unit stakeholders to seek evaluation of the CHG bathing program. Seeking to determine the effectiveness of the CHG bathing in the Unit is advantageous because it can achieve various purposes, including program improvement, accountability and decision making, improvement of patient outcomes, and ultimately, promoting social welfare (Gargani & Miller, 2016). Another strength of the Unit's CHG bathing program is that the stakeholders were willing to set aside finances and other resources to support its evaluation.

Weaknesses

Initial talks with the Unit stakeholders indicated that documentation of CHG bathing and its impacts challenges were seriously lacking. Communication was also problematic among those involved in the CHG bathing initiative, including communication with patients. Although education and training were provided to all the participants of CHG bathing in the Unit and although the staff was willing to adopt CHG bathing in the Unit, there was little knowledge as to whether the said education and training were effective.

Opportunities

The most important opportunity here was the evaluation of CHG bathing in the Unit to determine effectiveness. Equally important for the Unit was evaluating its CHG bathing and training using scientific methods such as those that would be used in the CHG-BATHS Project.

Threats

A threat for the CHG-BATHS Project was the relatively unknown variable of the Unit's patients. This could lead to the failure of any evaluation initiative. This was also revealed during the exploratory talks with the Unit stakeholders. Moreover, because education and training on CHG bathing were not measured for effectiveness, it was challenging to determine patients' response to the program that, in turn, affects adherence. Just as importantly, the COVID-19 pandemic may have resulted in a surge of patients at the program evaluation site, which could halt the CHG-BATHS Project.

Program Evaluation Management Strategies

The DNP Scholar sought a rigorous evaluation of the CHG bathing in the Unit through appropriate program evaluation management strategies. Effective management of CHG-BATHS was utterly crucial, especially since CHG bathing could be potentially adopted in the entire program evaluation site should the evaluation find that it had been influential in the Unit. The success of CHG-BATHS hinged upon learning how best to implement the intervention to the rest of the program evaluation site and how it might affect outcomes. Therefore, a critical step in managing CHG-BATHS was planning and implementation (Agency for Healthcare Research and Quality [AHRQ], 2014). Of particular importance here was the availability of resources to facilitate the CHG-BATHS Project.

In the initial engagement with the Unit stakeholders, the latter committed help in identifying and committing needed resources, primarily funding, personnel who would participate in CHG-BATHS, help in disseminating the CHG-BATHS Evaluation Report, information materials, technical assistance, and all pertinent data in the CHG bathing program in

the Unit. These resources were necessary because they impacted the degree to which CHG bathing can be adopted in the rest of the project site and the size of expected effects. Meanwhile, the DHP scholar will expend one's own resources and capabilities but will require ongoing support for the evaluation from the Unit stakeholders and internal staff participating in CHG-BATHS. A Cost Analysis for CHG-BATHS is discussed in detail in the Implementation section of this paper.

Specific Aims

Purpose Statement of DNP Scholarly Project

The DNP Scholarly Project aimed to evaluate the effectiveness of a CHG at the Unit in a project/program evaluation site located in Florida, United States. The CHG bathing program at the Unit was established and implemented to reduce CLABSIs through CHG bathing. The CHG bathing program was implemented at a high level to target and improve practices that resulted in higher adherence to CHG bathing in the local unit. This was undertaken to improve health outcomes for patients in the Unit and validate practices and interventions that could be more generally applicable across various practice sites with similar characteristics. These characteristics included a relatively large proportion of central line patients and patients vulnerable to CLABSI. They also include sites with the resources to readily and relatively cheaply implement similar measures to address either high rates of CLABSI or low rates of GHC bathing adherence. In sum, the CHG bathing program at the Unit targeted operational changes that would have an outsize impact on central line patient health outcomes and satisfaction with care. The program was designed to permit a high level of attribution so that the DNP scholar and healthcare professionals could more generally draw sound and practice-relevant conclusions about the program's value in addressing the stated problem.

Finally, the DNP Project was undertaken to recommend the rest of the program evaluation site to develop and implement CHG bathing protocols based on practical, accurate, practice-relevant, and evidence-based information.

Deliverables to Stakeholders

The DNP Project was deemed completed after it delivered an evaluation report on the effectiveness of the CHG bathing at the Unit. Another equally important deliverable was making recommendations as part of the evaluation report, directed towards administrators of the project site. The recommendations were on whether or not to adopt CHG bathing for the entire project site according to the strengths, weaknesses, and challenges relative to the approach used in the Unit.

The final evaluation report relayed information to CHG-BATHS stakeholders to support program improvement and decision-making (CDC, 2013). This report was a communication method in conveying evaluation results. However, it had to be transparent regarding assessing the CHG bathing program in the Unit and stakeholders, resources provided, CHG-BATHS evaluation design, activities, results, and recommendations. These types of information were useful in facilitating support for continued or enhanced program adoption of CHG bathing in the rest of the program evaluation site. The Evaluation Report also created awareness of and demonstrated success or lessons from program failures and promoted sustainability. For CHG-BATHS, there were three important reasons for reporting evaluation results. First, it built awareness and/or support and provides the basis for asking questions about the viability and effectiveness of CHG bathing in the Unit if adopted at the site level. Second, the report could facilitate the growth and improvement of health services delivered at the site. Third, the report demonstrated the results of the CHG bathing in the Unit so that its internal stakeholders can be

held accountable for results. Based on these, it cannot be overstated that developing the final evaluation report had to be done in cooperation with Unit stakeholders and program evaluation participants, fostering collaboration and a sense of shared purpose.

Presentation of Report to Stakeholders

The report discussed the primary intended use and users of the CHG-BATHS report. The intended use of the Report was to evaluate the effectiveness of the CHG bathing at the Unit. Therefore, the Unit stakeholders have access to evaluation results and commit to helping disseminate the Report. When the Report was presented to the Unit stakeholders, it encompassed a theory of change to drive future use of CHG bathing. This theory of change was discussed in succeeding subsections of this project and pertained to Kotter's model of change. Also, the presentation of the Report came with both a narrative description and a presentation of data.

Rationale — Conceptual Framework

The conceptual framework for the DNP project included several academic models and evidence-based research, theoretical context on the program, and gaps addressed. Change management and evidence-based practice were conceptualized and modeled by applying the Health Belief Model (McKenna, 2018) and frameworks presented by Rosswurm and Larrabee (1999; Lee, 2016). The Health Belief Model was utilized to create and implement the DNP project primarily through its use for understanding how RNs, PCTs, and nurse leaders managed patient-related factors during the CHG bathing, such as patient compliance. Consequently, de-identified and aggregated retrospective patient data were collected relative to patient compliance with CHG bathing as analyzed according to Health Belief Model.

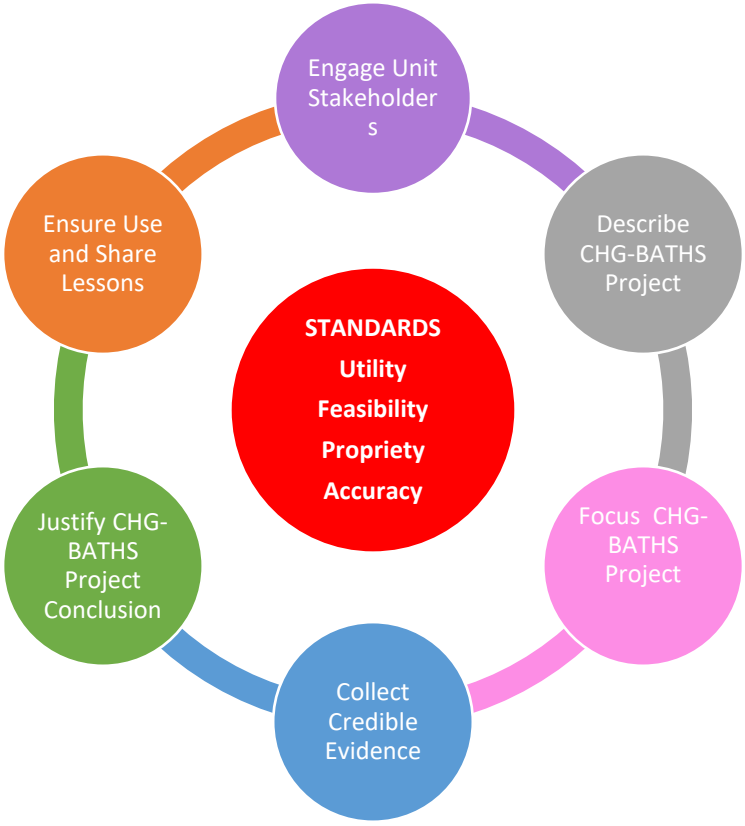
Program Development and Evaluation Models

The CHG-BATHS Project was developed according to the CDC's (2020) Framework for Program Evaluation in Public Health (CDC Framework). Notably, the CDC Framework was a series of linked steps that would serve as the starting point to tailor fit the CHG-BATHS Project to the needs of the Unit Stakeholders. Figure 5 below shows the Program Development for the CHG-BATHS based on the CDC Framework.

As seen in Figure 5 below, at the heart of the CDC Framework were four standards that helped the DNP scholar determine if the CHG-BATHS Project provided the information that its stakeholders need and administrators of the project site for which recommendations were made. The Feasibility standard helped ensure that the CHG-BATHS Project was "realistic, prudent, diplomatic and frugal" (CDC, 2021). The Propriety standard helped ensure that CHG-BATHS were undertaken in manners that are legal, ethical, and in consideration of the welfare of Unit staff and patients and those that would be impacted by the Project, namely, staff and patients in the rest of the project site. Finally, the Accuracy standard helped ascertain that the CHG-BATHS Project uncovered and conveyed technically sufficient information, particularly regarding the merit of the Unit's CHG bathing initiative.

Figure 6

Program Development and Evaluation Model



As mentioned earlier, the CDC Framework that guided the development of CHG-BATHS had six connected steps that served as starting points for the Project development. All six steps were discussed in the succeeding sections. Based on the CDC Framework, the first three steps can be undertaken in any order and may be repeated several times. These first three steps were the foundation for the latter three steps of the CHG-BATHS Project development.

First Step: Engage Stakeholders

The primary stakeholders for the CHG-BATHS Project that needed to be engaged were health professionals in the infection prevention and control department and the nursing education in the Unit. They were the key stakeholders for CHG-BATHS because they helped organize the Project, they were involved in the implementation of the CHG bathing initiative, and they were affected by recommendations under the CHG-BATHS Project. In other words, these

stakeholders have vested interests in the Feasibility and Utility Standards, especially concerning resource allocation and helping ensure that CHG-BATHS is conducted ethically. At this point, stakeholders for the CHG-BATHS Project had been adequately identified, although formal agreements had to be made regarding costs of the Project and availability of resources as explained in the Logic Model. It was essential to ensure no conflicts of interest between stakeholders.

Second Step: Program Description

Before the CHG-BATHS Project was undertaken, its purpose activities, and components, were clearly described, including its intended outcomes. This was accomplished through the CHG-BATHS Project Logic Model discussed earlier and other sections in this DNP proposal.

Statement of Need. The Unit stakeholders saw the need to evaluate the CHG bathing initiative, particularly in light of the continued high numbers of CLABSI cases on the project site. The CHG bathing program was implemented only in the Unit of the project site and produced good results according to the stakeholders' perspective. However, the rest of the project site had not been performing daily CHG baths since the approach used in the Unit was not made into a policy. By evaluating the CHG bathing program, crucial questions about the effectiveness of the CHG bathing approach used in the Unit could be determined. Once the effectiveness was known, recommendations could be made to the project site administrators on whether the CHG bathing used in the Unit can be applied to the rest of the project site. According to initial talks with Unit stakeholders, the CLABSI numbers were exacerbated with the surge of COVID-19 in the project site. The Unit stakeholders hoped that COVID-19 would be considered in the CHG-BATHS Project, especially in terms of recommendations since the COVID-19 pandemic occurred after CHG bathing protocols in the Unit.

Stage of Development. The CHG bathing program was undertaken more than a year ago in the Unit. In other words, the program had already concluded. On the other hand, the rest of the project site had yet to implement CHG bathing.

During initial talks with the Unit stakeholders, the latter shared important data that further warrants a program evaluation. For example, from Sept 2018 to January 2019, 143 charts were audited by the Unit leaders and found a 56% to 76% compliance bathing with the peak in October 2018. Of the 143, 87 patients were audited for CHG use, all of whom had IV access types. More than 70% of patients had central lines during that time. However, patient refusal to cooperate with CHG was a problem in the Unit, with the highest documented patient refusals occurring a month after CHG bathing was introduced in the Unit. Roughly 24% to 60% of patients had complied by November. By January 2019, CLABSI numbers began declining January 2019. It must be emphasized that decreased compliance indicates that patients are bathing, although it is either no CHG bathing or were not documenting CHG bathing. The Unit stakeholders, during these initial talks, drove three main points. First, patients had sufficient time to bathe, and said PCTs and RNs taught them.

Moreover, RNs and PCTs reported performing the baths with patients (and patients attest to this), although these are not sometimes documented. A possibility here was that Unit staff had to target central line patients for compliance. The second important point was that Unit staff were comfortable teaching patients how to bathe using CHG, and patients were generally satisfied with the staff's efforts. The third important point was that documentation of CHG bathing in the Unit lacked consistency and needs streamlining. According to the Unit stakeholders, staff needed to further educate patients about CHG bathing, especially those who refused CHG bathing.

Third Step: Evaluation Design Focus

The third step was to focus on the design of the evaluation. The focus was essential for evaluation design because it helped identify the evaluation's end goal and the activities needed to achieve it. The plan considered the intended uses of the CHG-BATHS findings and, based on this, developed and implemented strategies to ensure that the Project results would be helpful to feasible, ethical, and accurate. The two standards that helped in focusing an evaluation were utility and feasibility.

Utility. To recall, the Utility standard ensured that the CHG-BATHS program evaluation would serve the information needs of intended users. The target population of the CHG-BATHS is comprised of administrators of the project site. If the CHG-BATHS Project found that the CHG bathing program at the Unit was effective, it could be applied to the rest of the project site units.

Feasibility. Because the CHG-BATHS Project was undertaken as a scholarly DNP project, feasibility issues were anticipated. These issues included time, money, and effort to surmount challenges. The Faculty Chair and advisors can help address these issues, particularly support and guidance.

Description of Evaluation Questions. Evaluation questions for CHG-BATHS were described according to the type of evaluation/methodology, which was a summative assessment. Therefore, the evaluation questions determined the effectiveness of the CHG bathing approach in the Unit from September 2018 to January 2019.

Fourth Step: Gather Credible Evidence to Evaluate the CHG Bathing

Accurate data was collected and subsequently analyzed to obtain findings on the effectiveness of the CHG bathing program at the Unit. In other words, these data and evidence

supported evaluation results and the recommendations that followed. It cannot be overstated that stakeholders' conclusions and recommendations based on credible evidence were trustworthy, believable, and relevant (CDC, 2020). A stakeholder's assessment of the credibility of evidence hinges upon factors that include the evaluation questions asked, the information sources that the DNP scholar used, "conditions of data collection, the reliability of the measurement, the validity of the interpretations, and the quality control procedures" (CDC, 2020).

The advantage of the CHG-BATHS Project was that stakeholders had initiated talks about the proper questions to be asked. This was an advantage because the DNP scholar did not collect and analyze data that the stakeholders did not like. Moreover, as seen in the CHG-BATHS Project Logic Model, the stakeholders had two engagements to discuss and obtain approval for data collection and analysis methods. In light of these, for the CHG-BATHS Project, evidence was strengthened by using multiple procedures to collect, analyze, and interpret data.

Fifth Step: Justify Evaluation Conclusions

The DNP scholar justified conclusions that would not be difficult for the fifth step if outstanding data collection and analysis were undertaken. The CHG-BATHS Project stakeholders had to find the conclusions trustworthy; otherwise, they would not confidently harness recommendations (CDC, 2020). To derive well-justified conclusions, the DNP scholar reviewed evaluation results from the viewpoints of different stakeholders, including experts in program evaluation, patients, and hospital administrators. The following steps were done to justify conclusions based on evidence in the CHG-BATHS Project.

1. Use standards to emphasize stakeholders' perspectives and values regarding CLABSI prevention through CHG bathing while developing conclusions.

2. Performing both analysis and synthesis based on the rationale that credible methods need to analyze and summarize evaluation findings.
3. Critical analysis was done in interpreting data analysis results. Efforts had to be made to discern what the CHG-BATHS Project truly meant and understand the findings' practical significance to stakeholders.
4. Judgment was based on evidence obtained through data collection and analysis. It must be emphasized that stakeholders used the evaluation results to make statements about the merit, worth, or significance of CHG bathing.
5. Based on the evaluation, sound recommendations were provided, considering stakeholders' values and supporting evidence (CDC, 2020).

Sixth Step: Disseminate Lessons Learned

The final step was to ensure that lessons were learned through the CHG-BATHS Project. The key findings of the CHG-BATHS Project were shared with a broad range of stakeholders to ensure that the evaluation achieves its purpose in enhancing CHG bathing as an intervention and improving CLABSI prevention. The following activities ensured that the CHG-BATHS Project results were used and that lessons were shared.

1. The evaluation was designed to meet stakeholder needs.
2. Stakeholders were provided with continuous feedback, including findings, interpretations, and decisions that might affect the likelihood of use.
3. As seen in the CHG-BATHS Project Logic Model, follow-up meetings were held with stakeholders and the target population to conclude actions or decisions.

4. The DNP scholar shared the procedures used for the CHG-BATHS Project, including the implementation plan and methodology. This was done through tailored communication that met stakeholder needs.
5. Common dissemination tools to share lessons learned and the evaluation results were peer-reviewed journals, presentations with project site administrators, and reports.

A publishable manuscript was created and targeted a broader nursing and healthcare professional audience. The goal of the dissemination was to share program elements, processes, outcomes, and lessons learned as derived from program evaluation. The manuscript will be submitted to a peer-reviewed scholarly journal by the end of 2021.

An abstract for a podium or poster presentation to a relevant professional conference would target nursing and healthcare professionals. The dissemination goals included sharing program elements, processes, outcomes, and lessons learned from program evaluation like the publishable manuscript. The format would depend on the platform the conference is offered in, such as face-to-face, virtual, or workshop. The goal is to submit the abstract before the end of 2021.

Finally, a final DNP scholarly project presentation would be delivered during the virtual final DNP Defense presentation forum. The target audience was JU faculty, students, interested community stakeholders, family members, and friends of the DNP Student. This presentation would include additional elements required of the KSON Graduate program and DNP scholarly project completion requirements.

Leadership Strategy/Style

The leadership style for the CHG-BATHS would be transformational leadership. Transformational leaders are trusted and respected by subordinates who feel motivated to

accomplish institutional objectives (Asif, Jameel, Hussain, Hwang & Sahito, 2019). The transformational leadership style has four key components. First, idealized influence in the CHG-BATHS Project means that the DNP scholar acted as a role model for participants in the program evaluation, showing utmost values of conduct, and expressing the organization's vision to gain employees' confidence and trust. The inspirational motivation was achieved by demonstrating the ability to articulate a vision for the CHG-BATHS Evaluation using images, symbols, and signs to motivate participants to perform in a better way. Intellectual stimulation was attained by demonstrating inquiry capabilities and, at the same time, discussing a wide range of ideas to address issues and make them available in the decision-making process. The fourth component, individualized consideration, was achieved by seeking participants' differences and challenges and then facilitating them with a mentor for proper guidance, training, and support to reduce issues and attain their maximum capacity (Asif et al., 2019).

Transformational leadership in CHG-BATHS encouraged nurse leaders through intellectual stimulation by contributing to the evaluation itself and the Evaluation Report. This promoted rational thinking and the growth of knowledge, attitudes, and abilities. The DNP scholar achieved this by encouraging staff by providing the required assistance, resources, and information at the workplace.

Design and Methodology

To recall, the CHG-BATHS Program evaluation aimed to answer the following questions:

1. Were program resources used efficiently? If no, why not?
2. Did the program obtain the desired level of outcomes? If no, why not?
3. Were desired program outcomes obtained? If no, why not?

4. What, if any, unintended side effects did the program produce?
5. What were the strengths and weaknesses of the CHG program?
6. What were the challenges encountered by RNs and PCTs who undertook the CHG bathing?

Summative Assessment

The CHG-BATHS Project used summative evaluation, particularly because the CHG bathing initiative in the Unit took place over a year ago. The summative assessment focused on a project, program, strategy, or policy (Kaczmarek & Romaniuk, 2020). A summative assessment studied the impact of a program on change in selected indicators. For the CHG-BATHS, the change being studied pertained to reducing CLABSIs through CHG bathing. The project's logic and abilities to see the difference between causation and coincidence became essential in this case. Here, it must be noted that the difference between performance evaluation and impact assessment was highlighted in the CHG-BATHS Project recommendations for stakeholders involved in the planning and implementation of the Project.

The DNP scholar paid attention to any unique situation that occurred as a result of the summative assessment. To note, summative evaluation characterized and quantified the impacts of an intervention on various outcomes (Smith & Hasan, 2020). It was done at the end of a program or intervention. Since the CHG bathing program at the Unit had already been concluded, summative evaluation was the appropriate methodology. Through summative evaluation, the CHG-BATHS Project used aggregated methods to assess the effectiveness of an implementation strategy on the adoption, delivery, and sustainment of evidence-based practice (EBP), as well as the cost associated with implementation (Smith & Hasan, 2020). The summative evaluation results helped decision-makers understand the overall worth of an

implemented program and whether to upscale, modify, or discontinue. Summative evaluation combined quantitative and qualitative methods. The choice of a program evaluation design to evaluate and implement strategy impacted the confidence in the association between a strategy and an observed effect. Therefore, CHG-BATHS used a robust design and methodologically robust to support the validity of the evaluations and provide evidence that the program evaluation site administrators will use. Quantitative methods were particularly important in exploring the extent and variation of change induced by the implemented program. As said earlier, this change referred to CLABSI numbers before and after CHG bathing had been implemented in the Unit. Methods for quantitative data collection for CHG-BATHS included administrative records, including CLABSI numbers, costs of implementing the program, and direct observation.

If the summative evaluation results were negative, the recommendations of the CHG-BATHS Project must necessarily lead to the initiation of formative activities to prevent and eliminate CLABSIs. Regardless of any digression, summative evaluation offered unique value for the CHG-BATHS Project stakeholders and the program evaluation site administrators because, by linking activities with achievements, summative evaluation permits inference about the effectiveness of implemented interventions (Kaczmarek & Romaniuk, 2020). Therefore, the formative properties of summative evaluation were also presented in a broader aspect, based on the fact that it provided the basis or evidence of effectiveness for continuing specific actions and programs or their termination.

Meanwhile, the overarching goal of the summative assessment was to determine whether the goals of the CHG bathing program at the Unit were achieved. In addition to these, the qualitative component of the CHG-BATHS Project data collection and analysis provided insight into whether the CHG bathing program has had unintended side effects. These unintended

outcomes were ineffectiveness because of conflicts between RNs and PCTs and staff resistance to implement CHG bathing.

Description of Program Evaluation Design/Method

Notably, most data analysis for CHG-BATHS was quantitative. However, descriptive data comparisons were undertaken before the CHG bathing in the Unit and after implementation. This included data comparisons of CLABSI SIR, LCBI, BSI in the Unit during and after the CHG bathing period. A consultation with the statistician was undertaken to compare the proportions of infections per CVC day and costs pre-and-post-CHG bathing and any other comparisons that have to be undertaken. Cost analysis was undertaken using data provided by Unit stakeholders, but no inferential statistical analysis was done.

Implementation Plan

The implementation plan for the CHG-BATHS Project was based on the CDC's (2011) evaluation plan methods grid. This tool helped align evaluation questions with methods, indicators, performance measures, data sources, roles, and responsibilities. Moreover, this tool also facilitated a shared understanding of the overall evaluation plan with stakeholders. Figure 6 below shows the grid for CHG-BATHS.

Figure 6

CHG-BATHS Evaluation Plan Method

Evaluation Question	Indicator or Performance Measure	Method	Data Source	Frequency	Responsibility
Were program resources used efficiently? If no, why not?	Unit RNs and PCTs availability for the CHG bathing initiative.	The number of RNs and PCTs trained for the CHG bathing initiative divided by the number of nurses who adhered to CHG bathing protocols in the Unit.	Tracking report to be obtained from Unit nurse leaders.	Post-program period.	CHG-BATHS Project scholar and Unit nurse leaders.

Did the program obtain the desired level of outcomes? If no, why not?	Reduced number of CLABSIs in the Unit attributed to CHG bathing.	Data analysis of CLABSI SIR, LCBI, BSI in Unit during the CHG bathing period.	The Unit leadership	Pre-and-post program period	CHG-BATHS Project scholar
Were desired program outcomes obtained? If no, why not?	Cost-efficiency, patient adherence	Cost analysis, guideline adherence by patients and Unit RNs and PCTs	The Unit leadership, RNs, PCTs	Pre-and-post program period	Unit nurse leaders CHG-BATHS stakeholders Project site
What, if any, unintended side effects did the program produce?	Patient compliance	Survey	Unit RNs, PCTs, and Nurse Leaders	Post-program period	Unit RNs, PCTs, and Nurse Leaders agree to be survey respondents DNP scholar obtains informed consent from participants and will conduct the survey
What were the strengths and weaknesses of the CHG program?	Themes and Categories	Survey Open-Ended Questions	Unit RNs, PCTs, and Nurse Leaders	Post-program period	Unit RNs, PCTs, and Nurse Leaders agree to be survey respondents DNP scholar obtains informed consent from participants and will conduct the survey
What were the challenges encountered by RNs and PCTs who undertook the CHG bathing?	Themes and Categories	Survey Open-Ended Questions	Unit RNs, PCTs, and Nurse Leaders	Post-program period	Unit RNs, PCTs, and Nurse Leaders agree to be survey respondents DNP scholar obtains informed consent from participants and will conduct the survey

Proposed Timeline and Milestones

Meanwhile, the following is the proposed timeline for the CHG-BATHS Project.

	Week											
Activities	1	2	3	4	5	6	7	8	9	10	11	12
Prepare DNP Project proposal												
Engage with stakeholders												
Collect data and evidence												
Conduct survey												
Analyze data												

Complete the program evaluation report												
Submit a draft of the report												
Provide the report to stakeholders												

In addition to these, an Evaluation Report was undertaken, as discussed previously in the Needs Assessment section of this proposal. Throughout CHG-BATHS Project, stakeholders were engaged weekly, and a needs basis on the part of the Unit stakeholders. Communication and engagement were done online, either through email or Zoom, when materials presentation had to be done. The milestones for the CHG-BATHS Project were as follows:

- Initial engagement with Unit stakeholders
- Submit the proposal to the DNP panel
- Obtain IRB approval
- Submit the proposal to Unit stakeholders
- Obtain approval of proposal from Unit stakeholders
- Conduct the CHG-BATHS Project
- Conclusion of CHG-BATHS Project
- Completion of Evaluation Report
- Presentation of Evaluation Report
- Dissemination of Evaluation Report

Evaluation Report

The Evaluation Report was discussed in the sub-section called Deliverable to Stakeholders.

Assessing Change

Stakeholder Support

As discussed earlier, one strength of the CHG-BATHS Project was that it had full stakeholder support. This stakeholder support could further be strengthened through a series of engagements to plan the CHG-BATHS Project as attested in the Logic Model.

Organizational Readiness and Culture

Regarding assessing organizational readiness, it cannot be emphasized enough that the surge in COVID-19 cases made it more critical for the CHG-BATHS Project to be undertaken. The stakeholders discussed this. Therefore, the motivation to evaluate CHG bathing is strong. In terms of culture, the program evaluation site and the Unit are receptive to interventions to prevent and eliminate CLABSIs. Supporting CHG-BATHS is a step toward the prevention and elimination of CLABSIs. The need to eliminate and prevent CLABSIs is strong. Since the Unit has already implemented CHG bathing, recommendations to adopt the same approach to the program evaluation site would be supported. Meanwhile, it is possible that minor changes would occur while the CHG-BATHS Project is being undertaken, especially since summative evaluation entails research into records and surveys with RNs, PCTs, and nurse leaders. Kotter's change model would be an effective approach to plan for this change.

Measures/Evaluation

Data Collection Strategy

In Figure 6 presented above, various measures were identified to measure processes and outcomes using quantitative and qualitative techniques. The specific measurements for processes are shown in Figure 7 below, based on Figure 6. As seen in Figure 7, all of the measures used are quantitative. Data comparison was made before and after the CHG bathing protocol was used for

(a) data analysis of CLABSI SIR, LCBI, BSI in Unit during the CHG bathing period; and (b) cost analysis, guideline adherence patients and Unit RNs and PCTs. Also, a quantitative method, a survey was administered to determine patient compliance from the perspective of RNs, PCTs, and nurse leaders who implemented CHG-bathing. Meanwhile, qualitative analysis was undertaken to determine themes and categories based on the responses to the survey.

Figure 7

Measurements for Processes

Evaluation Question	Indicator or Performance Measure	Method	Data Source
Were program resources used efficiently? If no, why not?	Unit RNs and PCTs availability for the CHG bathing initiative.	The number of RNs and PCTs trained for the CHG bathing initiative divided by the number of nurses who adhered to CHG bathing protocols in the Unit.	Tracking report to be obtained from Unit nurse leaders.
Did the program obtain the desired level of outcomes? If no, why not?	Reduced number of CLABSIs in the Unit attributed to CHG bathing.	Data analysis of CLABSI SIR, LCBI, BSI in Unit during the CHG bathing period.	The Unit leadership
Were desired program outcomes obtained? If no, why not?	Cost-efficiency, patient adherence	Cost analysis, guideline adherence by patients and Unit RNs and PCTs	The Unit leadership, RNs, PCTs
What, if any, unintended side effects did the program produce?	Patient compliance	Survey	Unit RNs, PCTs, and Nurse Leaders
What were the strengths and weaknesses of the CHG program?	Themes and Categories	Survey Open-Ended Questions	Unit RNs, PCTs, and Nurse Leaders
What were the challenges encountered by RNs and PCTs who undertook the CHG bathing?	Themes and Categories	Survey Open-Ended Questions	Unit RNs, PCTs, and Nurse Leaders

CHG-BATHS Project Cost Analysis

The estimated cost for the entire CHG-BATHS Project Evaluation was $500. These were the costs that the DNP scholar would meet, encompassing research, materials, communication, and transportation. On the other hand, the CHG-BATHS Project would entail costs on the part of the Unit, particularly the paid working time that survey participants would have to allocate for the Project.

This was a minimal cost compared to the benefits of evaluating the CHG bathing program at the Unit. Indeed, the target market of the CHG-BATHS Project was administrators of the project site based on the rationale that recommendations made through the Project would potentially result in an adoption of CHG bathing for the rest of the departments in the project site. The cost of preventing CLABSIs would be minuscule compared to the cost of CLABSI. Notably, the average cost of a CLABSI is $70,696, ranging from $40,412–$100,980. For the Unit's CHG bathing initiative, 2,187–2,419 CLABSIs were prevented. Moreover, 290–605 lives were saved during the project, assuming a 12–25% mortality rate. Applied to the rest of the project site's units, more money could be saved through CLABSI prevention, and more lives could be saved through CHG bathing.

Analysis

The proposed data analysis plan was consistent with the program evaluation aims and measures. To recall, the purpose of the CHG-BATHS Program Evaluation was to assess whether the CHG bathing program in the Unit was effective or not. To recall, the CHG bathing program at the Unit was implemented between September 2018 and January 2019 to reduce CLABSIs. There were two types of data collection methods: quantitative and qualitative.

Compared Means

Baseline data were used, provided by stakeholders of the CHG-BATHS Program Evaluation. The following were the baseline data that would allow comparisons in CLABSI numbers prior to and after the implementation of CHG bathing in the Unit, thereby allowing evaluation of program effectiveness.

- CLABSI Standard Infection Rate (SIR) by Quarter (QTR) from first QTR 2018 to fourth QTR 2019.
- 2018 CLABSI rates for ICU and non-ICU as measured by patient days with a CVC.
- 2018-2019 CLABSI rates for ICU and non-ICU measured by patient days with a CVC, excluding mucosal barrier injury laboratory-confirmed bloodstream infections (MBI-LCBIs)
- 2019 CLABSI rates for ICU and non-ICU measured by patient days with a CVC, excluding mucosal barrier injury laboratory-confirmed bloodstream infections (MBI-LCBIs)
- 2020 CLABSI rates for ICU and non-ICU measured by patient days with a CVC, excluding mucosal barrier injury laboratory-confirmed bloodstream infections (MBI-LCBIs)
- 2021 CLABSI rates for ICU and non-ICU measured by patient days with a CVC, excluding mucosal barrier injury laboratory-confirmed bloodstream infections (MBI-LCBIs)

Frequencies

A survey was administered to RNs, PCTs, and nurse leaders. The survey contained eight questions to be answered according to a Likert Scale. Data collected through the survey was analyzed statistically, particularly in frequencies. Using frequencies was not to derive conclusions right away but to determine which responses prevailed among participants. Examples of data that had already been collected from the unit are shown below.

a. CLABSI SIR, according to QTR

National Healthcare Safety Network CMS NHSN

SIR for Central Line-Associated BSI Data for Acute Care Hospitals (2015 baseline) - By OrgID

SIR Ratio for Unit 3N Hem/Onc

Date Range: BS2_CLAB_RATESALL summaryYQ 2018Q1 to 2019Q4 SIR Ratos are Quarterly Reports

if (((locationType = ""WARD_ONC"")))

orgID=17559 medType=M

orgID	ccn	summaryYQ	**infection Count**	numPred	numcldays	**SIR Ratio**	SIR_pval	sir95ci	SIR_pctl	**Months of CLABSI**
17559	100151	2018Q1	**2**	1.849	1568	**1.082**	0.8341	0.181, 3.574	81	Jan
17559	100151	2018Q2	**1**	1.827	1549	**0.547**	0.6159	0.027, 2.700	45	June
17559	100151	2018Q3	**4**	1.85	1569	**2.162**	0.1571	0.687, 5.215	97	July x 3 Aug x1
17559	100151	2018Q4	**3**	1.914	1623	**1.567**	0.4277	0.399, 4.266	91	Oct x2 Nov x1
17559	100151	2019Q1	**3**	2.092	1774	**1.434**	0.508	0.365, 3.903	90	Jan 1 & Feb 2
17559	100151	2019Q2	**0**	2.271	1926	**0**	0.1032	, 1.319	10	None
17559	100151	2019Q3	**1**	2.435	2065	**0.411**	0.3885	0.021, 2.025	33	Jul
17559	100151	2019Q4	**1**	2.428	2059	**0.412**	0.3906	0.021, 2.031	34	Dec

b. 2021 CLABSI rates for ICU and non-ICU measured by patient days with a CVC

2018-2021 Mayo Clinic in Florida
Central Line-Associated Bloodstream Infection ICU and Non ICU Report
(Excludes MBI-LCBIs)

		2018	2019	2020	2021 Jan	2021 Feb	2021 Mar	2021 Apr	2021 May	2021 Jun	2021 Jul	2021 Aug	2021 Sep	2021 Oct	2021 Nov	2021 Dec	YTD Total
H2N	BSI	3	4	1	0	0	0	0									0
	PT Days with a CVC	3367	2821	3591	275	258	296	272									1101
	BSI/1000 Days with a CVC	0.9	1.4	0.3	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H3N	BSI	0	0	0	0	0	1	0									1
	PT Days with a CVC	6548	7804	7706	752	682	664	565									2663
	BSI/1000 Days with a CVC	0.0	0.0	0.0	**0.0**	**0.0**	**1.5**	**0.0**									**0.4**
H3S	BSI	0	0	0	0	0	0	0									0
	PT Days with a CVC	3054	3336	3963	367	308	402	308									1385
	BSI/1000 Days with a CVC	0.3	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H4N-MICU	BSI	6	2	1	0	0	0	0									0
	PT Days with a CVC	3850	4262	3632	231	323	384	348									1286
	BSI/1000 Days with a CVC	1.6	0.5	0.3	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H4S-SICU	BSI	1	0	3	0	0	0	0									0
	PT Days with a CVC	4991	4219	5745	465	482	515	492									1954
	BSI/1000 Days with a CVC	0.2	0.0	0.5	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H5N	BSI	2	0	0	0	0	0	0									0
	PT Days with a CVC	1735	2166	2206	235	155	175	195									760
	BSI/1000 Days with a CVC	1.2	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H5S	BSI	0	0	0	0	0	0	0									0
	PT Days with a CVC	638	815	603	60	73	82	23									238
	BSI/1000 Days with a CVC	0.0	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H7N	BSI	0	1	2	0	0	0	0									0
	PT Days with a CVC	46	1735	1263	102	62	111	161									436
	BSI/1000 Days with a CVC	0.0	0.6	1.6	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
H7S	BSI	2	0	2	0	0	0	1									1
	PT Days with a CVC	2323	2545	2937	292	206	253	286									1037
	BSI/1000 Days with a CVC	0.9	0.0	0.7	**0.0**	**0.0**	**0.0**	**3.5**									**1.0**
H8N	BSI	0	0	0	0	0	0	1									1
	PT Days with a CVC	888	1024	1438	168	125	144	92									529
	BSI/1000 Days with a CVC	0.0	0.0	0.0	**0.0**	**0.0**	**0.0**	**10.9**									**1.9**
H8S	BSI	1	1	2	0	0	0	0									0
	PT Days with a CVC	1993	2133	2345	227	214	267	170									878
	BSI/1000 Days with a CVC	0.5	0.5	0.9	**0.0**	**0.0**	**0.0**	**0.0**									**0.0**
Total	BSI	**15**	**8**	**11**	**0**	**0**	**1**	**2**									3
	PT Days with a CVC	**29433**	**32860**	**35429**	**3174**	**2888**	**3293**	**2912**									12267
	BSI/1000 Days with a CVC	**0.9**	**0.2**	**0.3**	**0.0**	**0.0**	**0.3**	**0.7**									**0.24**

c. 2020 CLABSI rates for ICU and non-ICU measured by patient days with a CVC

2018-2020 Mayo Clinic in Florida
Central Line-Associated Bloodstream Infection ICU and Non ICU Report
(Excludes MBI-LCBIs)

		2020 Jan	2020 Feb	2020 Mar	2020 Apr	2020 May	2020 Jun	2020 Jul	2020 Aug	2020 Sep	2020 Oct	2020 Nov	2020 Dec	YTD Total
H2N	BSI	0	0	0	0	0	0	0	1	0	0	0	0	**1**
	PT Days with a CVC	269	362	315	256	287	322	319	279	289	366	255	272	**3591**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**
H3N	BSI	1	0	0	2	1	3	1	0	1	0	1	0	**10**
	PT Days with a CVC	636	663	583	550	447	677	687	687	707	705	716	648	**7706**
	BSI/1000 Days with a CVC	**1.6**	**0.0**	**0.0**	**3.6**	**2.2**	**4.4**	**1.5**	**0.0**	**1.4**	**0.0**	**1.4**	**0.0**	**1.3**
H3S	BSI	0	0	0	0	0	0	0	0	0	0	0	1	**1**
	PT Days with a CVC	276	290	246	302	303	328	340	393	346	378	322	439	**3963**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.3**	**0.3**
H4N-MICU	BSI	0	0	0	0	0	0	0	0	0	1	0	1	**2**
	PT Days with a CVC	391	382	326	230	314	340	69	260	348	372	283	317	**3632**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.7**	**0.0**	**3.2**	**0.6**
H4S-SICU	BSI	0	0	0	0	0	0	0	1	1	0	1	0	**3**
	PT Days with a CVC	446	433	458	363	476	571	406	531	494	497	538	532	**5745**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.9**	**2.0**	**0.0**	**1.9**	**0.0**	**0.5**
H5N	BSI	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	PT Days with a CVC	210	185	114	220	159	210	216	179	165	224	160	164	**2206**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H5S	BSI	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	PT Days with a CVC	37	37	40	77	52	29	72	55	40	35	59	70	**603**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H7N	BSI	0	0	0	0	0	0	0	0	1	0	1	0	**2**
	PT Days with a CVC	152	134	114	2	45	93	139	156	128	103	102	95	**1263**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**7.8**	**0.0**	**9.8**	**0.0**	**1.6**
H7S	BSI	0	0	0	0	1	0	0	1	0	0	0	0	**2**
	PT Days with a CVC	181	236	266	210	262	244	317	301	240	283	196	201	**2937**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**3.8**	**0.0**	**0.0**	**3.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.7**
H8N	BSI	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	PT Days with a CVC	43	112	75	101	112	77	154	129	167	180	156	132	**1438**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
H8S	BSI	0	0	1	0	0	0	0	0	0	0	1	1	**3**
	PT Days with a CVC	169	167	231	195	200	212	151	180	214	269	192	165	**2345**
	BSI/1000 Days with a CVC	**0.0**	**0.0**	**4.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.2**	**6.1**	**1.3**
Total	BSI	**1**	**0**	**1**	**2**	**2**	**3**	**1**	**3**	**3**	**1**	**4**	**3**	**24**
	PT Days with a CVC	**2810**	**3001**	**2768**	**2506**	**2657**	**3103**	**2870**	**3150**	**3138**	**3412**	**2979**	**3035**	**35429**
	BSI/1000 Days with a CVC	**0.4**	**0.0**	**0.4**	**0.8**	**0.8**	**1.0**	**0.3**	**1.0**	**1.0**	**0.3**	**1.3**	**1.0**	**0.68**

As can be discerned in these quantitative data, it was impossible to tell whether the CHG bathing program had been influential on the staff who implemented the CHG bathing. The numbers did not provide sufficient insight that could inform the recommendation to adopt CHG bathing in the rest of the departments of the Project Site. In other words, the data did not show the perspective of those that implemented CHG bathing. It was essential to hear from them to determine whether implementation had been effective or not, as well as the program's strengths, weaknesses, and challenges. For these reasons, it was necessary to hear from the staff through a survey that contained two open-ended questions.

Themes and Categories

As mentioned earlier, the survey questionnaire contained two open-ended questions. Responses to these two questions were transcribed then analyzed through coding (categorizing) and thematic analysis. The codes reflected essences of important and essence-capturing aspects of the participants' responses. There were two coding cycles. The first coding was descriptive categorical codes, while the second coding cycle reflected patterns in participants' responses. Coding reflected any similarity, difference, frequency, sequence, correspondence, or causation discerned in participants' responses (Saldana, 2008). The themes were then extracted from the codes using the DNP Scholar's critical analysis. Triangulation with the quantitative program evaluation to ensure robust, valid, and reliable results was also done. Benchmarking was used for the processes being measured, using another hospital for the benchmark. Triangulation of data analysis results provided a detailed view of the program that, in turn, allowed for summative assessment and evaluation through the CHG-BATHS Program Evaluation.

Ethical Considerations

Intervention and Implementation

It must be emphasized that the CHG-BATHS Project was undertaken according to the highest ethical standards. The undertaking was part of the CHG-BATHS Project Logic Model. After being approved, the project's proposal was shared with the Unit stakeholders.

Formal Ethics Review

However, the review only occurred after the DNP proposal had been submitted to the University's Institutional Review Board (IRB) committee for approval. Informed consent was be obtained from no more than fifty participants of the CHG-BATHS Project, particularly since a survey with open-ended questions was conducted with RNs, PCTs, and nurse leaders. They were assured that none would be exposed to physical and psychological harm. There is no known conflict of interest affecting the CHG-BATHS Project. All data to be collected and all metrics have been defined in the Implementation Plan of this proposal. All clinical survey data were de-identified and stored in an encrypted drive shared only through encrypted JU email. The data will be stored for five years and then destroyed.

The CHG-BATHS program evaluation will be submitted to the Unit stakeholders who sought this evaluation. The DNP proposal will be submitted to the University Institutional Review Board (IRB) committee for approval of the project. Co-approval from the project site's IRB will be obtained. After these IRB approvals have been obtained, the logic model can be implemented.

Conflict of Interest

No conflict of interest was foreseen for the DNP project. The DNP scholar was not remunerated for the program evaluation and did not know any unit stakeholders personally.

Data Management, Security, Privacy, Confidentiality

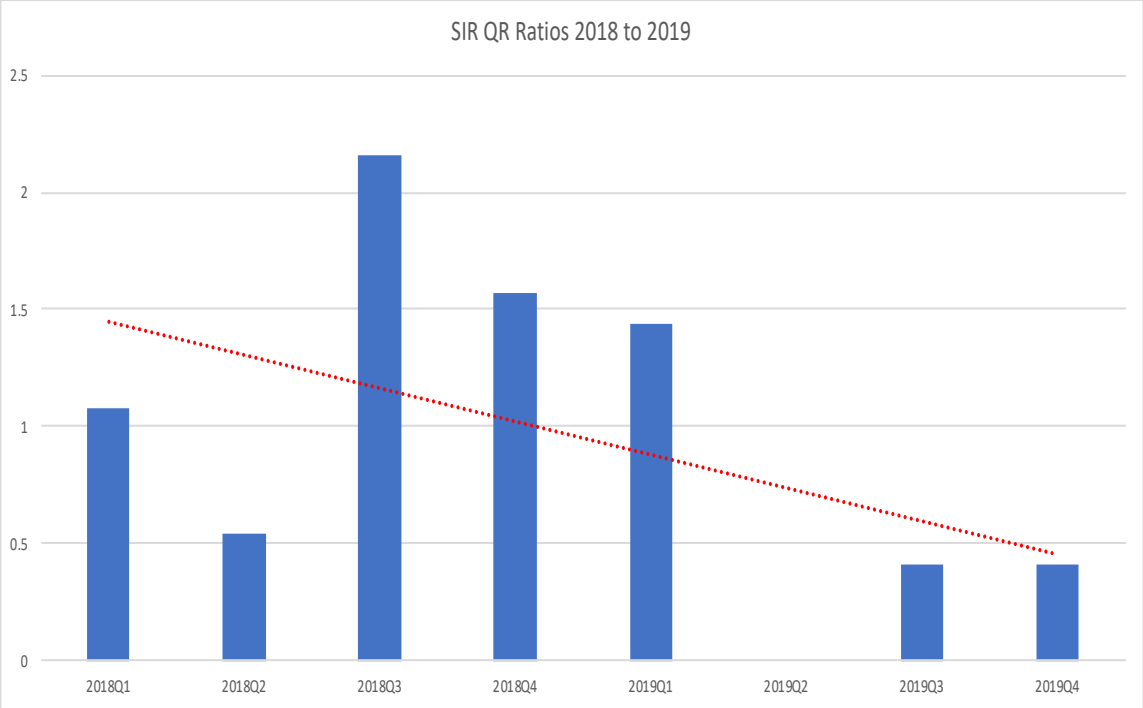
All data collected will be stored for five years in an encrypted drive that JU students can use along with JU email. The data will be destroyed after five years. No identifying information was obtained from CHG-BATHS Project participants, and all patient data was de-identified. All paper sources were kept under lock and key in the DNP scholar's office.

Analysis

Results

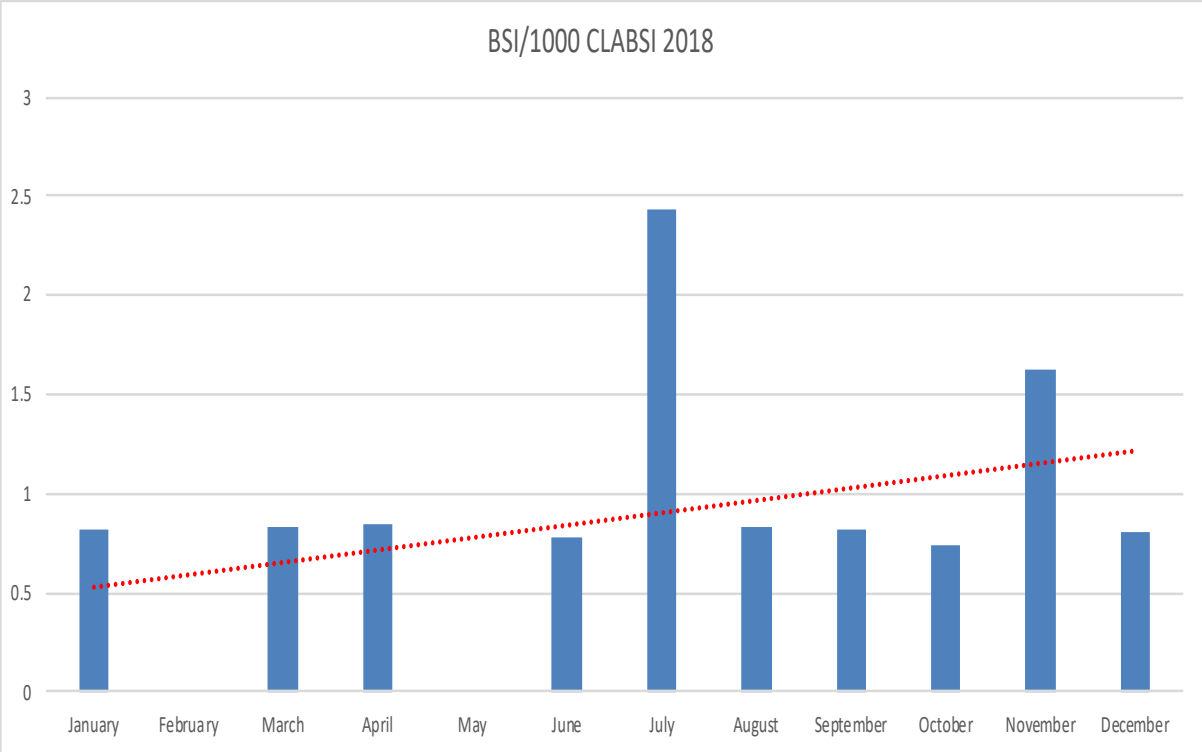
The data analysis sought to establish whether changes were noticed over time in contexts where CHG bathing was used against CLABSI. Statistics in CLABSI rates before the CHG baths were implemented would be considered to contextualize that data. The entire data collection is between 2015 and 2021. However, data on CHG bathing was collected between September 2018 and January 2019. CLABSI data collected for the analysis was quantitative. Comparative analysis was used to establish the pattern between SIR ratios, BSI/1000 measures, CLABSI, and LCBI measures. The analysis was captured in six graphs.

Graph 1: SIR RATIOS 2018-2019



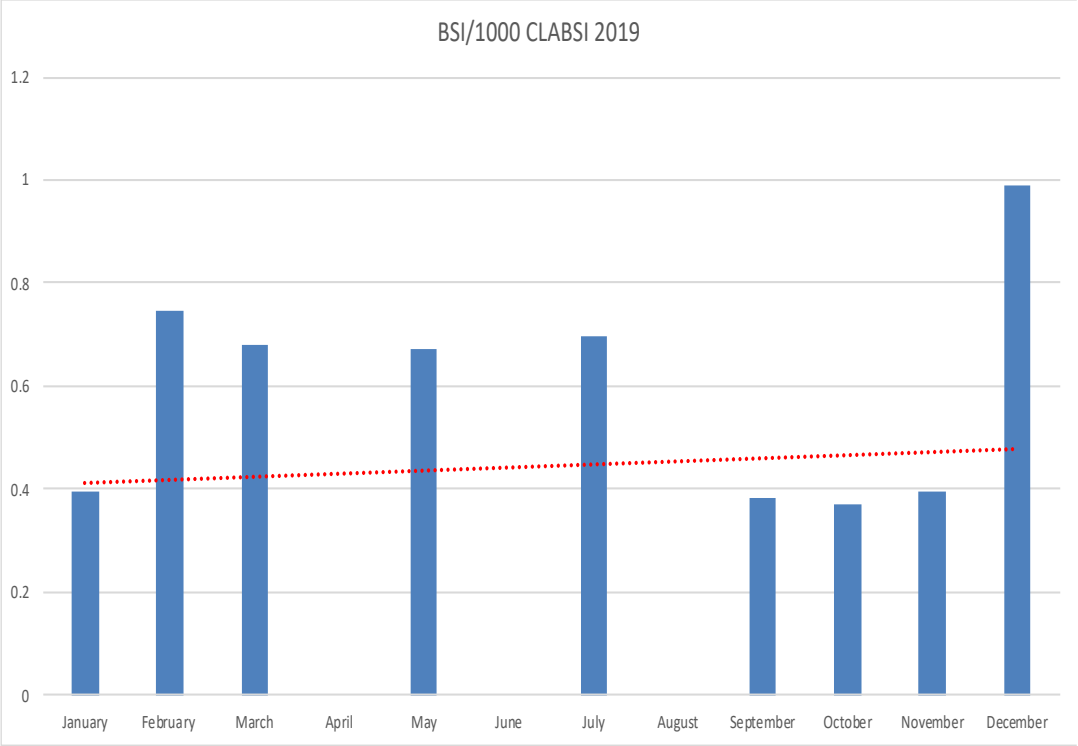
The graph suggests a decline in SIR ratios from 2018 to 2019. The general trendline shows that the infection rates dropped due to CHG bathing.

Graph 2: BSI/1000 CLABSI 2018



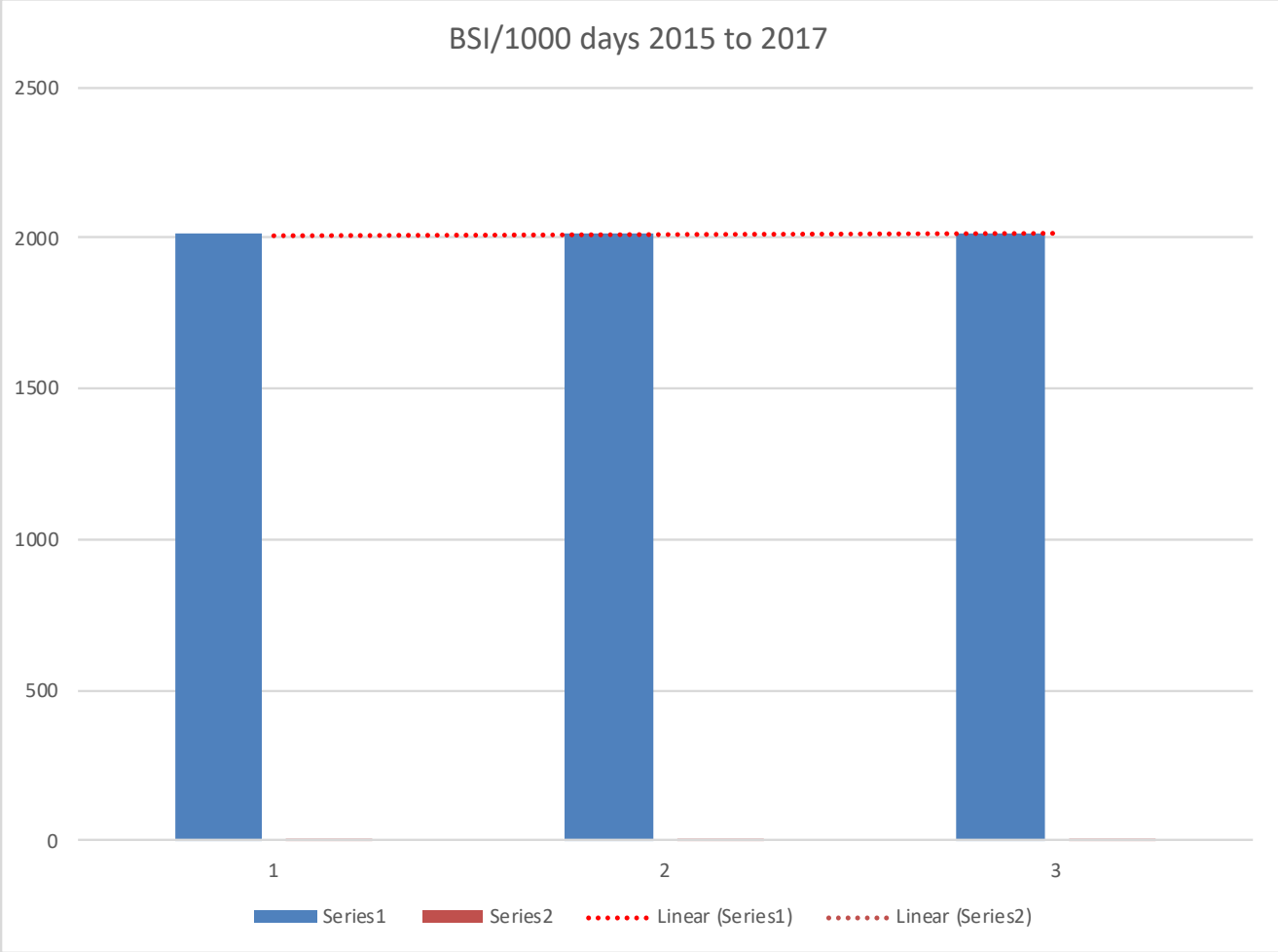
In 2018, the graph shows that the BSI/1000 for CLABSI rose. It is possible that the rate of BSI/1000 was affected by a variable that this analysis did not consider. Vetter and Mascha (2017) noted that the effect of a confounding variable could have an outcome on the dependent variable, thereby skewing expected data analysis results.

Graph 3: BSI/1000 2019



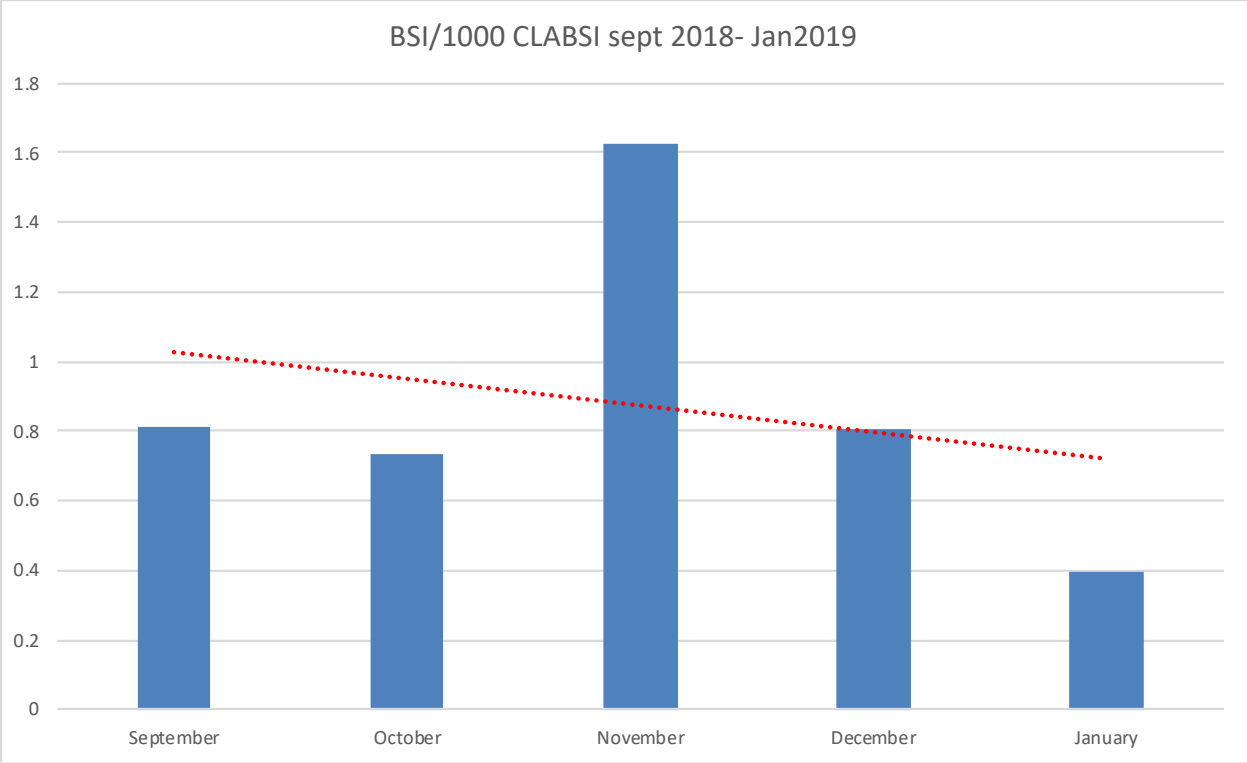
The graph for 2019 shows that the infection rates were rising slightly over the calendar year, despite the use of CHG baths in the facility. For example, a significant rise in the CLABSI rates was observed in December 2019.

Graph 4: BSI/1000 CLABSI 2015 to 2017

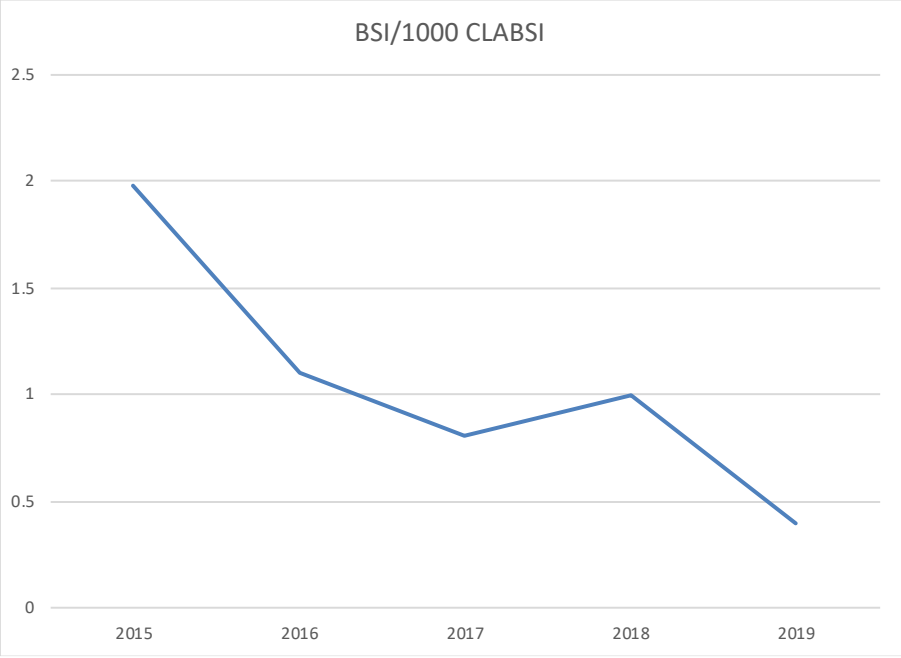


The BSI/1000 CLASI levels between 2015 and 2017, before implementing the CHG baths, show an essentially constant rate of infections.

Graph 5: BSI/1000 CLABSI September 2018 to January 2019



Graph 6:



Interpretation of quantitative results

The main graphs for the analysis were graphs 4, 5, and 6. Graph 4 showed no significant decline in infection rates in the unit between 2015 and 2017 before the CHG bathing was implemented. Graph 5 shows that total infections fell every year between September 2018 and January 2019. This coincides with the implementation of the CHG baths protocol.

The supporting graphs suggest that in 2018, there was a slight increase in the total number of infections. In 2019, the total number of infections fell sharply, but in 2020 there was a rise in the total number of infections. It could be that between 2015 and 2017, there was a stagnation in infection rates considering there was no CHG bathing. In 2018, it is possible that factors outside this program evaluation's scope affected the infection rates. In 2019 the rates were reduced, but 2020 featured a significant rise in the infection rates. The year 2020 was characterized by the incidence of COVID-19. It is possible that COVID-19 safety protocols that included reducing face-to-face interaction or body contact reduced the incidences of CHG baths. According to Sova et al. (2021), COVID-19 protocols affected CHG bathing due to safety fears for patients and nurses in different care contexts. It is possible that patients who could otherwise have benefited from CHG baths were not bathed because of the safety fears around COVID-19.

Graph 6 shows the trendline of infections between 2015 and 2019. Between 2015 and 2017, the rates were falling but not as significantly as between 2018 and 2019, where the decline in infection rates is steep. The inference is that a factor significantly impacted the infection rates, in this case, the CHG baths.

The general inference from the data analysis is that CHG baths are associated with a decline in CLABSI infections. This evaluation did not feature an experimental group, allowing

the program evaluation to make bolder statements on the association between CLABSI and CHG bathing. That notwithstanding, there is an apparent association between the decline in infection rates and the use of CHG baths.

Staff at the project's site were surveyed to establish how they felt about the CHG program. The first part of the survey was quantitative and aimed to collect responses to help determine how staff felt using a Likert Scale approach. The eight quantitative questions asked sough to establish the average employee sentiment on the program. The eight questions are included in the appendix. From the data visualization chart, it is apparent that most of the responses were in the strongly agree section of the Likert Scale. The trend in responses suggests that the average sentiments favored the CHG program. There were no responses in the strongly disagree section, for example. Tracing a virtual trend line showed that the survey participants were generally happy and knowledgeable about the CHG program.

The survey data was analyzed through Microsoft Excel to understand the responses further. Table 1 below and table 2 in the appendix show the analysis results. The Likert Scale legend used for the analysis was calibrated as follows:

Strongly Agree-5

Agree-4

Neither Agree nor Disagree-3

Disagree-2

Strongly Disagree-1

1. *I was thoroughly educated about the chlorhexidine gluconate bathing to be used in the unit.*

The analysis revealed that for the question on education on CHG bathing, the average response was 4.64, as shown in table 1. Guided by the legend, the average score from the respondents indicated that the staff members strongly agreed that they were thoroughly educated about CHG bathing. The associated standard deviation for responses to question 1 was 0.48. A low standard deviation suggests that the data coalesces around the mean (Sharma & Ojha, 2020). It, therefore, would be justifiable to state that the average responses did not stray significantly outside the average response, which is 4.64 representing strongly agree. The results in table 2 further reinforce the scoring. Table 2 shows that the percentage of responses supported the sentiment that staff members were thoroughly educated about the CHG baths was 63.64 percent.

2. *I successfully implemented chlorhexidine gluconate bathing according to protocol.*

For the second question on implementation, the average response, as shown in table 1, was 4.36. Guided by the legend, the responses on average suggested that the participants strongly agreed that they successfully implemented the CHG bathing according to protocol. The standard deviation for the question was 0.88. A high standard deviation suggests that not all responses were around the mean. Table 2 results for the second question indicated that 54.55 percent of the respondents strongly agreed that they successfully implemented the CHG bathing according to protocol. The discrepancy in the standard deviation and average percentage of responses can be explained by following Anderson-Cook's (2020) writings on the effect of the sample size on the standard deviation. Considering that the sample size was small, it is possible that the standard deviation was high due to the low number of surveyed participants.

3. *I can identify the strengths of the chlorhexidine gluconate bathing protocol.*

The third survey question sought to establish if the participants could identify the strengths of CHG baths. From table 1, one can determine that the average response was 4.36. The average response suggests that the respondents strongly agreed to identify the CHG bathing program's strengths. The standard deviation for the question was 0.98. Again, this is a high standard deviation, and a typical interpretation would suggest significant deviation from the mean. However, table 2, where the average response was 63.64 percent, suggests that a small sample size caused the standard deviation.

4. *I can identify the weaknesses of the chlorhexidine gluconate bathing protocol.*

The fourth survey question on the weaknesses of the CHG protocol returned an average response score of 4.45. The score suggested that respondents mainly felt they could identify the weaknesses associated with CHG bathing. The standard deviation for the question was 0.66. The average standard deviation, leaning on the high side, could have been due to the small sample size, considering that the average response in favor of the affirmative for the question was at 54.55 percent, as shown in table two.

5. *I can identify the challenges of the chlorhexidine gluconate bathing program.*

The fifth question sought to establish whether the staff members surveyed could identify the challenges associated with the CHG protocol. The average response on the Likert Scale scores for question five was 4.55. This high score corresponds to the strongly agree section of the Likert Scale legend. The associated standard deviation for the question was 0.66. This can be considered a high standard deviation but can be explained by the small sample size associated with this constrained program evaluation; a highly funded program evaluation can afford a bigger sample size, thereby reducing the effect of sample size on the standard deviation. The

percentage of responses lying in the strongly agree section was 63.64 percent, further reinforcing the assertion that staff members understood the challenges associated with the CHG program.

6. *I was given sufficient support to implement chlorhexidine gluconate bathing.*

The sixth question sought to determine if the staff members received enough support for the program. The average response was 3.91, which corresponds to an average response of agreed. While not as high as the preceding scores, the analysis still suggests that the staff members felt supported in the program. The standard deviation for the question was 1.08, indicating a high variance in the distribution of responses around the mean. Despite the small sample, this high standard deviation could result from highly varying responses, meaning that the staff members disagreed on the support they received. The observation supports that most respondents disagreed, as indicated by the 36.36 percent rate in table two.

7. *Chlorhexidine gluconate bathing helped patients with CLABSI*

Respondents strongly felt that CHG bathing helped patients with CLABSI. The average response score for the question was 4.27, suggesting that surveyed staff members strongly agreed with the efficacy of the intervention. The standard deviation of 0.86 was concerning but can be explained by the small sample size, especially considering that the average response in favor of the strongly agree score was 54.55 percent of the respondents.

8. *I documented all instances of chlorhexidine gluconate bathing*

The last quantitative survey question was on documentation of the CHG bathing. On average, the respondents strongly agreed that they documented their work. This was further reinforced by a low standard deviation of 0.49. The average response in favor of the strongly agreed opinion was 60 percent. This score suggests that a significant number of staff members did document all instances of CHG bathing.

Interpretation of Quantitative Survey Analysis

Two qualitative questions we also included in the survey. The two are:

'What were the challenges encountered by RNs and PCTs who undertook the CHG bathing?' and 'What were the strengths and weaknesses of the CHG program?'. Responses to the question on challenges encountered by RNs and PCTs who undertook CHG bathing included not knowing what quantities of CHG to use for patients with different body weights, exhaustion from the bathing, and a lack of hospital policy to guide the stages of a CHG bath. The responses to the question on strengths of the CHG program included the provision of enough documentation on the viability of CHG, thereby allowing RNs and PCTs to feel secure in their actions, availability of enough CHG at all times, cooperation from the patients due to positive outcomes. The main weakness cited was a lack of policy to guide the process of CHG bathing and policy protecting the RNs and PCTs from legal suits should the bathing result in an unintended outcome such as a dermatological reaction.

Summary

The quantitative analysis from the data suggested that the use of CHG baths was efficient in reducing the incidence of blood line infections in the unit. It was observed and inferred that the use of the intervention was correlated with a decline in infection rates between September 2018 to January 2019, compared to the period between 2015 and 2017 when any decline in CLABSI rates was not as significant. The survey data further reinforced the apparent efficiency of the intervention. Rather than focus on the outcomes, the survey data focused on the experience of the RNs and PCTs with the CHG program. Results and analysis indicated that the RNs and PCTs understood the program and were happy with its implementation but were unsatisfied with

the support they received from the hospital while implementing the protocol. The qualitative analysis showed that the RNs and PCTs were invested in the protocol.

Recommendations

The stakeholders for the current program evaluation are the hospital management, the patients, and the nurses. For each of these groups, there was an associated set of recommendations.

Management

Management is in charge of policy, decisions, and the authority to incur expenses. Without a budget, it is unlikely that any recommendations made to management will be implemented. As noted by Feriani et al. (2021), the use of CHG bathing is a highly affordable way through which CLABSI rates can be reduced within a unit in the hospital.

The survey analytics suggested that nurses already understand the use of CHG baths to reduce CLABSI rates in the unit. Further, it was established that nurses understand the strengths and weaknesses associated with the use of the CHG baths. Nurses surveyed also stated that they were sufficiently educated about using CHG baths to reduce CLABSI infections in their units. Further, the survey showed that the nurses consistently implemented the CHG protocols successfully. The survey analysis also showed that the nurses were convinced of the efficacy of CHG baths against CLABSI. Analysis of primary data collected from the nurses suggested uncertainty on the support offered. Nurses suggested that while there was support, it was not desired. Support for nurses involved in a CHG protocol includes providing safety equipment and protection from abuse by patients (Ulrich & Kear, 2018). Management should consider raising the implementation support levels for CHG programs within the hospital. This program

evaluation also established that nurses were inconsistent about the documentation. With the CHG protocol being new in the hospital, if adopted across all units, there is a need to document every event for summative analysis and subsequent adjustment towards better outcomes. Documentation is not easy for nurses or doctors because it involves clerical work; some health care workers feel that documentation takes away from the core care activities (Davenport & Kalakota, 2019; Meskó et al., 2017). The management can consider providing documentation support through automated report creation, allowing the nurses to enter essential information into pre-developed documentation templates.

The data analysis suggested that CLABSI rates have been falling with CHG bathing. Therefore, this program evaluation recommends that management adopt CHG bathing across all units in the hospital. Considering the relatively low cost of CHG bathing, it is rational and justifiable that management should introduce the necessary policy, financial, and capacity support to enable the adoption of CHG bathing within all units.

Nurses

The survey analysis revealed that the nurses in the unit were educated on the CHG protocol. The nurses were also supportive of the intervention because they felt they could make a difference in patient safety outcomes through CHG bathing. However, nurses reported that they did not enjoy sufficient support. Without establishing the support the nurses need, it would be difficult for management to address the support concerns. Considering that nurses are at the frontlines of the CHG bathing program, their concerns need to be addressed; the successful implementation of the program depends on the nurses. Some of the concerns that would need to be addressed include the labor concern. CHG bathing is a labor-intensive process (Abboud, 2021). Nurses in the US are already working more hours than they should be working (Bakhamis

et al., 2019). Adding a protocol that adds to the workload could affect the morale levels negatively. Low nurses' job satisfaction levels are associated with poor safety outcomes for patients (Bakhamis et al., 2019). It, therefore, would be imperative for management to consider the capacity issue and other associated nursing concerns on the implementation of CHG protocols.

That stated, nurses are professionals bound by a code of ethics. The code of ethics requires that nurses engage in patient advocacy, respect patients' autonomy, and always be beneficent, among other principles (Silva et al., 2018). It is the responsibility of the nurse to undertake their work to the best of their ability. This report recommends that nurses familiarize themselves with the importance of consistent documentation. It is a professional prerogative for nurses to work within professional best practices. The recommendation is based on the survey results that indicated inconsistent documentation.

Patients

The patients and their family members are essential stakeholders in the CHG bathing protocol implementation context. Patients have the right to self-determination, especially accepting or rejecting treatments (Bevilacqua et al., 2021). This program evaluation on the efficacy of CHG bathing for reducing CLBSI infections was not entirely scientific; the program evaluation did not feature a control group, for example. While the data analysis and survey analysis findings and inferences support the adoption of CHG bathing protocols, patients are not required to accept the treatment blindly. This report recommends educating patients on CHG bathing protocols' potential benefits. This is important for patients admitted to the hospital and those under care at home. Additionally, this report recommends that patients be educated on their privacy and data privacy rights. The hospital might have a policy on data privacy; patients should

know that they can decline to participate in the documentation around CHG bathing, for example.

With that stated, patients need to recognize the association between CHG bathing and reduced CBSI rates. Considering that CLABIS can cause poor financial and health outcomes, including death, it would be recommended that patients consider CHG bathing to prevent avoidable infections.

Conclusion

The selected facility provided a setup for a program evaluation to determine whether there is an association between CLBASI rates and CHG bathing. The program evaluation started by defining the challenge associated with CLABSI in the project site. A consideration of the extant evidence showed that while there are other interventions against CLASI, CHG bathing is among the most affordable. Quantitative data analysis showed that between 2015 and 2021, there have been falling rates of CLABSI where CHG baths have been used. A survey of nurses from the target project site also revealed support for the protocols.

Additionally, the survey analysis revealed opportunities for improving the protocol's implementation. The program evaluation does not claim conclusiveness; instead, it seeks to form part of the research that supports a better-funded program evaluation on the efficacy of CHG bathing for reducing CLABSI. The program evaluation recognized that it did not feature an experiential research design. The stakeholders were addressed through a dedicated section to support the implementation of the protocol even as further research is done.

Deliverables

A report and executive summary for the stakeholders and executives were included in the appendix. The executive summary was presented on February 2022 to the nursing executive at

the hospital. In the presentation, essential findings related to the efficacy of CHG baths were included, as were the findings from the data analysis and survey analysis. The report described the nature of the program evaluation, noting that despite the absence of full experimental features, the analysis provides compelling information enough to justify recommendations made towards the adoption of the CHG protocol across other units in the facility. The utility of the report was addressed to decision-makers in the facility. Tables, figures, and graphs were used to visualize data to make the report easy to read. The summary was constrained to three pages for ease of reduction.

Dissemination of findings plan

Having presented the report to the organization's leadership, a formal DNP project presentation was written and presented to faculty and peers at the Jacksonville University's Keigwin School of Nursing. The manuscript was also presented to the *Journal of Nurse Practitioners* for consideration for publication.

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Appendix A: Survey Questions

Instruction: Please answer the following questions by encircling the most appropriate answer where: 1=Strongly Disagree; 2=Disagree; 3= Neither Agree nor Disagree; 4= Agree; 5=Strongly Agree.

Questions	Responses				
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree.
1. I was thoroughly educated about the chlorhexidine gluconate bathing to be used in the unit.					
2. I successfully implemented chlorhexidine gluconate bathing according to protocol.					
3. I can identify the strengths of the chlorhexidine gluconate bathing protocol.					
4. I can identify the weaknesses of the chlorhexidine gluconate bathing protocol.					
5. I can identify the challenges of the chlorhexidine gluconate bathing program.					
6. I was given sufficient support to implement chlorhexidine gluconate bathing.					
7. chlorhexidine gluconate bathing helped patients with CLABSI.					
8. I documented all instances of chlorhexidine gluconate bathing.					

Appendix B: Consent Form

You have been asked to complete this online survey as part of a project evaluation conducted by Yavesh Crawford, a graduate student at Jacksonville University. Before you decide to participate in this survey, it is crucial that you understand why the project evaluation is being done and what it will entail for you. Please read the following information carefully. Also, please ask the researcher if there is anything unclear or if you need more information.

The Doctor of Nursing Practice (DNP) project is called Chlorhexidine Gluconate Bath Project: A Program Evaluation. The purpose of the project called CHG-BATHS Program Evaluation is to evaluate the effectiveness of a chlorhexidine gluconate (CHG) bathing protocol applied in the hematology/oncology/bone marrow transplant unit at a Northeast Florida teaching health system from September 2018 to January 2019 to lower rates of central-line associated bloodstream infection (CLABSI).

Completing the online survey may take 30 minutes. You might benefit from the CHG-BATHS Program Evaluation by improving your performance as a health professional dealing with patients who have central-line associated bloodstream infection CLABSI). Others like patients and the healthcare facility might benefit because it can potentially improve quality and safe care.

The risks associated with this evaluation are minimal, but there is always a chance that a loss of confidentiality may occur. To mitigate these risks, we have configured the survey so that your participation is anonymous, and no identifying information will be collected from you by the researcher. As such, responses cannot be linked back to you. Questions posed are not of personal or sensitive nature, but you are free to refuse to answer or skip any questions as necessary or to withdraw from completing the survey entirely.

Your participation in this Program Evaluation is voluntary, and this means that you have the liberty to decide whether or not to take part in this Program Evaluation survey. Should you choose to participate in this Program Evaluation survey, you will be asked to sign this consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason.

By completing and submitting the survey, you affirm that you are at least 18 years old and give your consent for Yavesh Crawford to use your answers in this CHG-BATHS Program Evaluation.

If you have any questions about this Program Evaluation before or after completing the survey, please contact Yavesh Crawford at Crawford.Yavesh@mayo.edu. If you have any concerns or questions about your rights as a participant in this survey, please contact the Jacksonville University Institutional Review Board at (904) 256-7151 or juirb@ju.edu.

Clicking on the “agree” button below indicates that you have read the above information, voluntarily agree to participate, and are at least 18 years of age.

If you do not wish to participate in the program evaluation, please click on the “disagree” button.

o Agree (include the survey URL)

o Disagree

Appendix C: Survey Tables

Table 1:

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	1. I was thoroughly educated about the chlorhexidine gluconate bathing to be used in the unit.	4.00	5.00	4.64	0.48	0.23	11
2	2. I successfully implemented chlorhexidine gluconate bathing according to protocol.	2.00	5.00	4.36	0.88	0.78	11
3	3. I can identify the strengths of the chlorhexidine gluconate bathing protocol.	2.00	5.00	4.36	0.98	0.96	11
4	4. I can identify the weaknesses of the chlorhexidine gluconate bathing protocol.	3.00	5.00	4.45	0.66	0.43	11
5	5. I can identify the challenges of the chlorhexidine gluconate bathing program.	3.00	5.00	4.55	0.66	0.43	11
6	6. I was given sufficient support to implement chlorhexidine gluconate bathing.	2.00	5.00	3.91	1.08	1.17	11
7	7. Chlorhexidine gluconate bathing helped patients with CLABSI.	3.00	5.00	4.27	0.86	0.74	11
8	8. I documented all instances of chlorhexidine gluconate bathing.	4.00	5.00	4.60	0.49	0.24	10

Table 2:

#	Question	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree		Total
1	1. I was thoroughly educated about the chlorhexidine gluconate bathing to be used in the unit.	0.00%	0	0.00%	0	0.00%	0	36.36%	4	63.64%	7	11
2	2. I successfully implemented chlorhexidine gluconate bathing according to protocol.	0.00%	0	9.09%	1	0.00%	0	36.36%	4	54.55%	6	11
3	3. I can identify the strengths of the chlorhexidine gluconate bathing protocol.	0.00%	0	9.09%	1	9.09%	1	18.18%	2	63.64%	7	11
4	4. I can identify the weaknesses of the chlorhexidine gluconate bathing protocol.	0.00%	0	0.00%	0	9.09%	1	36.36%	4	54.55%	6	11
5	5. I can identify the challenges of the chlorhexidine gluconate bathing program.	0.00%	0	0.00%	0	9.09%	1	27.27%	3	63.64%	7	11
6	6. I was given sufficient support to implement chlorhexidine gluconate bathing.	0.00%	0	18.18%	2	9.09%	1	36.36%	4	36.36%	4	11
7	7. Chlorhexidine gluconate bathing helped patients with CLABSI.	0.00%	0	0.00%	0	27.27%	3	18.18%	2	54.55%	6	11
8	8. I documented all instances of chlorhexidine gluconate bathing.	0.00%	0	0.00%	0	0.00%	0	40.00%	4	60.00%	6	10

Appendix D: Answers to the Open Ended Questions

Q2 - 9. What have been the roles, tasks, and responsibilities of the RNs, PCTs, and nurse leaders in the CHG bathing protocol?

RN's teach about CHG bathing on admission and reassess implementation daily/ teaching reinforcement. PCT's assist pt with bathng/ offer materials. Leaders teach staff and have done audits in the past.
Proper education
Providing the bathing and confirming that the documentation reflects the task complete
RNs/PCTs educated and implemented the CHG bathing protocol, Nurse leaders reinforced the CHG bathing when the patient was noncompliant.
Every patient on 3N receives a CHG bath daily
To educate, and help implement bathing daily with CHG
.
Educated patients about the CHG bathing protocols as a part of the treatment
providing education
charting , education , assistance.

Q3 - 10. How did study site leaders and administrators provide support to internal and external stakeholders concerning the benefits and procedures of CHG bathing?

Teaching staff (nursing and PCT). I do not believe providers are involved in the process.
Positive learning guidence
By providing education and guidance throughout training of the protocol
I am unsure of the role of site leaders and administrators, I know IPAC helped with the pilot.
Our unit makes a priority to decrease CLABSI and was in agreement with this study
Im not sure
.
education
providing education and supplies to this unit.

Appendix D: The Executive Report

Executive Summary of Program Evaluation

Chlorhexidine Gluconate Bath Project: A Program Evaluation

Background and Purpose

Healthcare-associated infections (HAIs) are a particular problem for medical practices (Al-Tawfiq & Tambyah, 2014; Shang, Needleman, Liu, Larson & Stone, 2019). These infections affect many service users across a range of healthcare contexts all over the globe, and they account for a significant number of costs and reduced health outcomes for patients in the United States and beyond (Haque, Sartelli, McKimm & Abu Bakar, 2018). An example of an HAI is the central-line associated bloodstream infection (CLABSI), which is a common and critical occurrence for patients who have been hospitalized. CLABSI infections are a significant source of hospital-acquired or healthcare-acquired infection, a leading cause of death in the United States (Reagan et al., 2019). Roughly 28,000 people die each year because of CLABSI, and the United States healthcare system spends $2.3 billion annually for this infection even if CLABSI is preventable (Reynolds et al., 2021). Finding an affordable way to reduce or eliminate CLABSI can significantly prove safety outcomes within care contexts. Against this backdrop, this DNP Project, called CHG-BATHS Program Evaluation, sought to determine the effectiveness of chlorhexidine gluconate (CHG) bathing implemented in the hematology/oncology/BMT unit from September 2018 to January 2019 in lowering the rates of CLABSI.

Goals:

1) Evaluate the success of a CHG protocol in reducing CLABSI rates from September 2018 to January 2019.
2) Determine the attitude of nurses and PCTs involved in the protocol's implementation with a view of forming justification for the expansion of the protocol into other units.

Evaluation Methods

Both qualitative and quantitative data analysis were used to answer the following questions:

1. Were program resources used efficiently?

2. Did the program obtain the desired level of outcomes?
3. Were desired program outcomes obtained?
4. Were there unintended side effects of the program?
5. What were the strengths and weaknesses of the CHG program?
6. What were the challenges encountered by RNs and (PCT)s who undertook the CHG bathing?

Phase 1:

In order to answer these questions, the DNP scholar collected and analyzed quantitative and qualitative data. Quantitative data pertained to patient data relative to CLABSI numbers in the Project site's ICU and non-ICU departments. To determine the effectiveness of CHG bathing, comparisons were made between pre-and post-implementation. However, it must be emphasized that such quantitative data did not provide sufficiently deep insight for a DNP scholarly project.

Phase 2:

It was necessary to probe deeper through a survey questionnaire to address the research questions. Meanwhile, a qualitative method would provide more profound insight into evaluating CHG bathing. The survey was administered to health professionals involved in CHG bathing in the unit studied for the CHG-BATHS Program Evaluation. Two open-ended questions were incorporated into the survey instead of conducting a separate interview for the same participants. Overall, with its two open-ended questions, the survey tackled important information to the CHG-BATHS Program Evaluation that patient data did not allow. Among the variables in the survey were the effectiveness of CHG bathing in helping patients and reducing CLABSI; strengths, weaknesses, and challenges of the CHG bathing implementation; adequacy of support for implementing staff; and CHG bathing documentation.

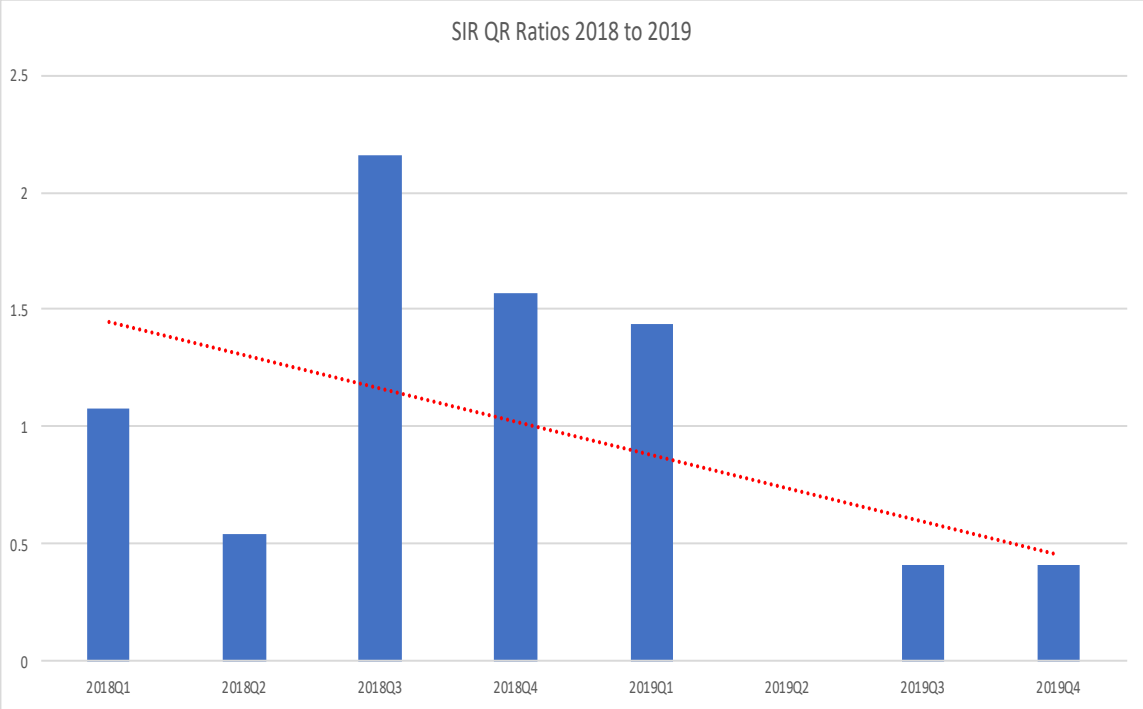
Measures for Evaluation:

- CHG protocol efficacy over the target years
- Nurses' and PCTs' perception of the program
- Laboratory-confirmed bloodstream infections (LCBI) and CLABSI Rates outcomes
- Nurses' and PCTs' opinions of the program

Results

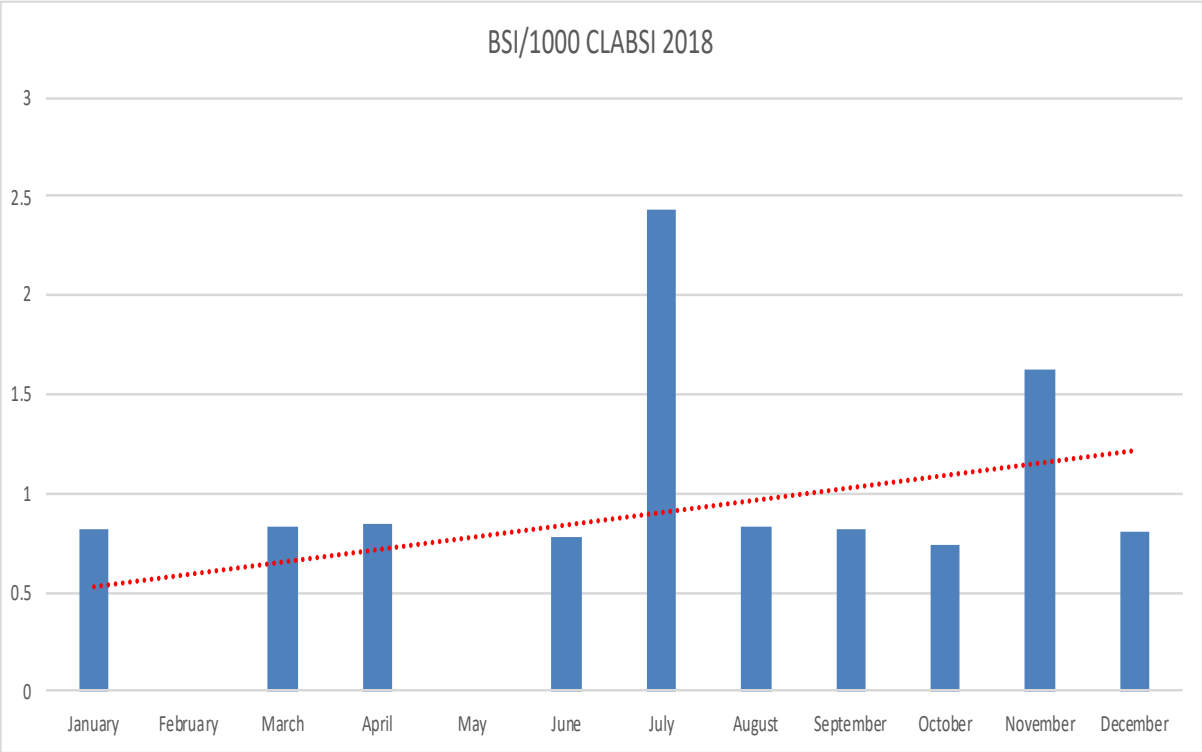
The data analysis sought to establish whether changes were noticed over time in contexts where CHG bathing was used against CLABSI. Statistics in CLABSI rates before the CHG baths were implemented would be considered to contextualize that data. The entire data collection is between 2015 and 2021. However, data on CHG bathing was collected between September 2018 and January 2019. CLABSI data collected for the analysis was quantitative. Comparative analysis was used to establish the pattern between SIR ratios, bloodstream infections (BSI)/1000 measures, CLABSI, and LCBI measures. The analysis was captured in six graphs.

Graph 1: SIR RATIOS 2018-2019



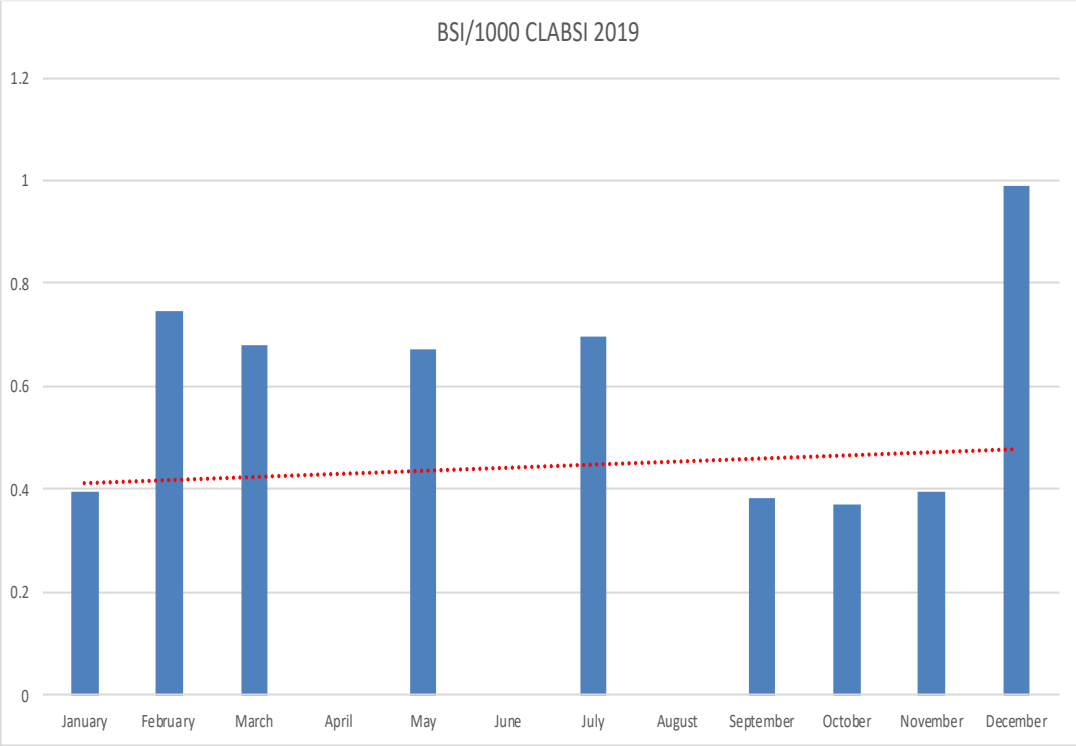
The graph suggests a decline in SIR ratios from 2018 to 2019. The general trendline shows that the infection rates dropped due to CHG bathing.

Graph 2: BSI/1000 CLABSI 2018



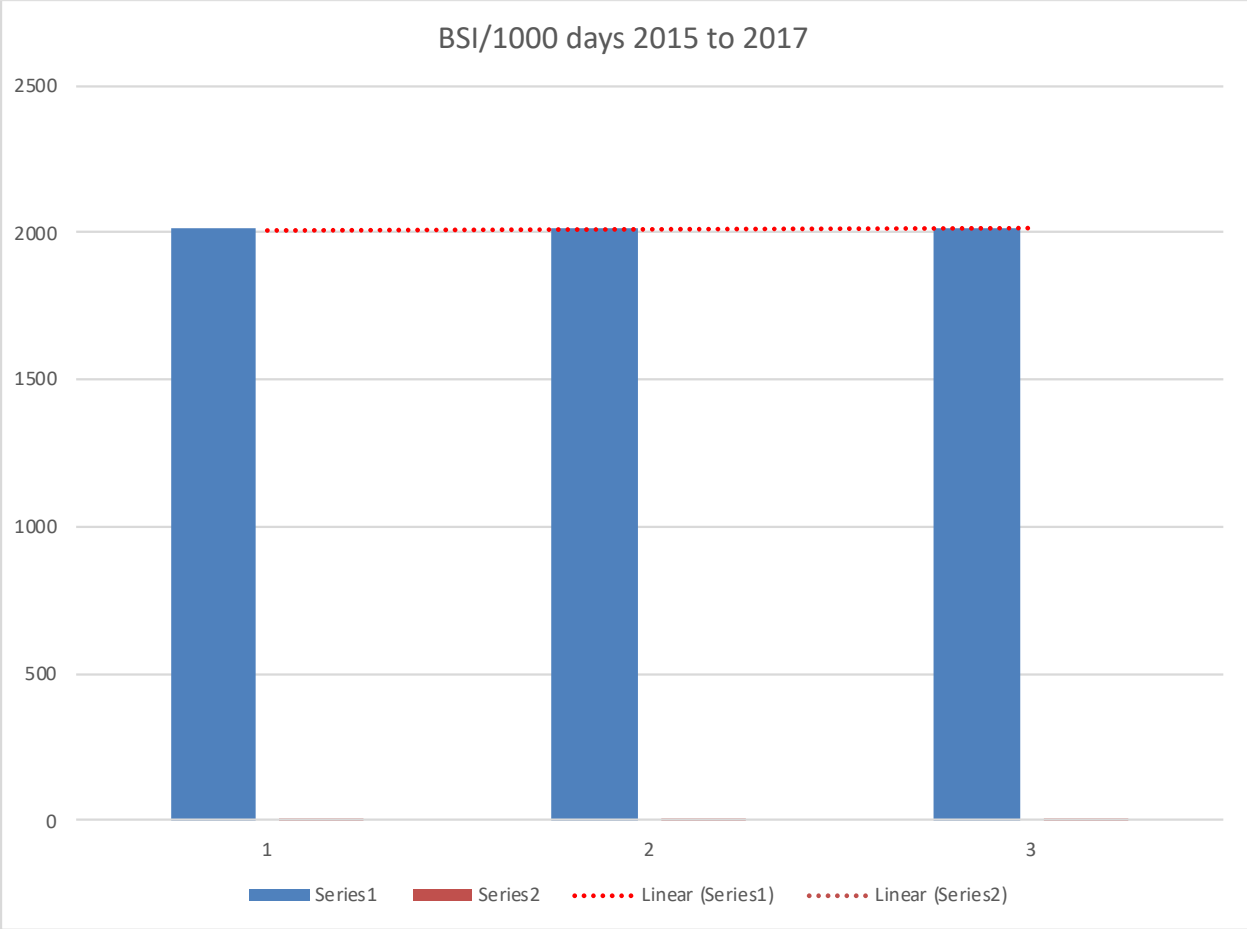
In 2018, the graph shows that the BSI/1000 for CLABSI rose. It is possible that the rate of BSI/1000 was affected by a variable that this analysis did not consider. Vetter and Mascha (2017) noted that the effect of a confounding variable could have an outcome on the dependent variable, thereby skewing expected data analysis results.

Graph 3: BSI/1000 2019



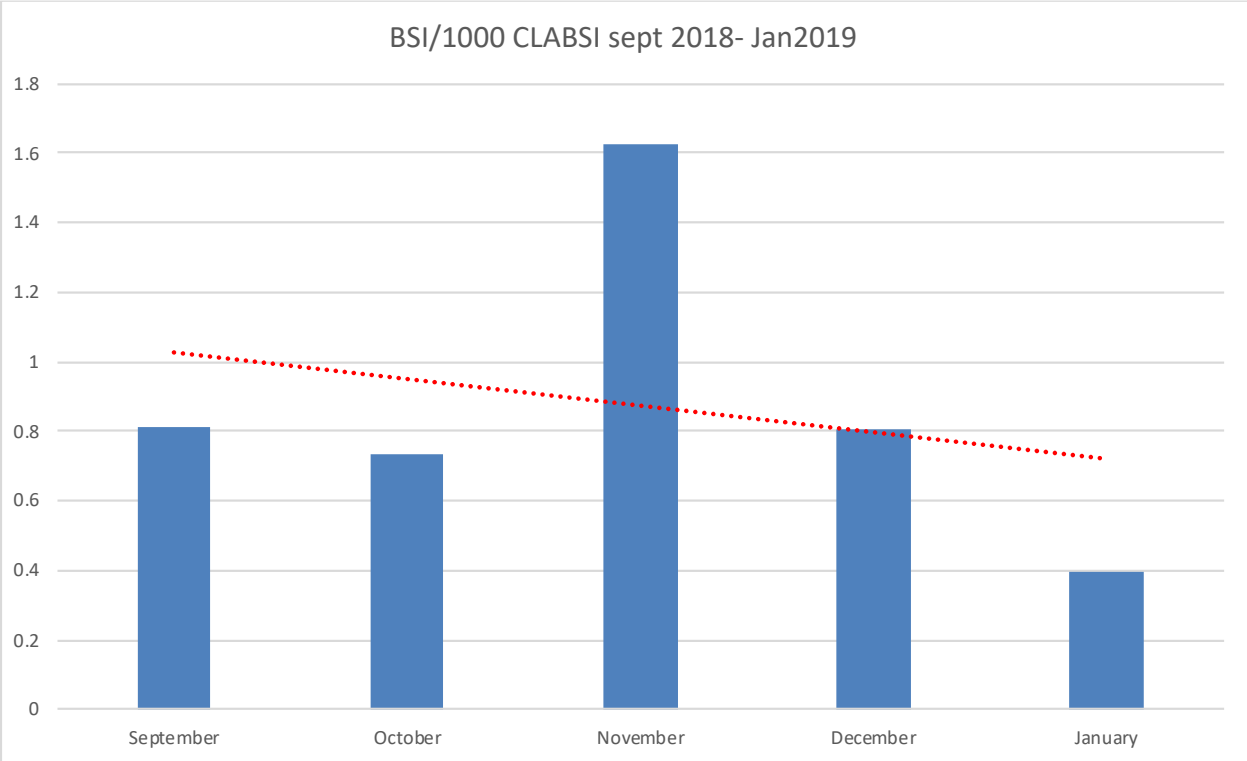
The graph for 2019 shows that the infection rates were rising slightly over the calendar year, despite the use of CHG baths in the facility. For example, a significant rise in the CLABSI rates was observed in December 2019.

Graph 4: BSI/1000 CLABSI 2015 to 2017

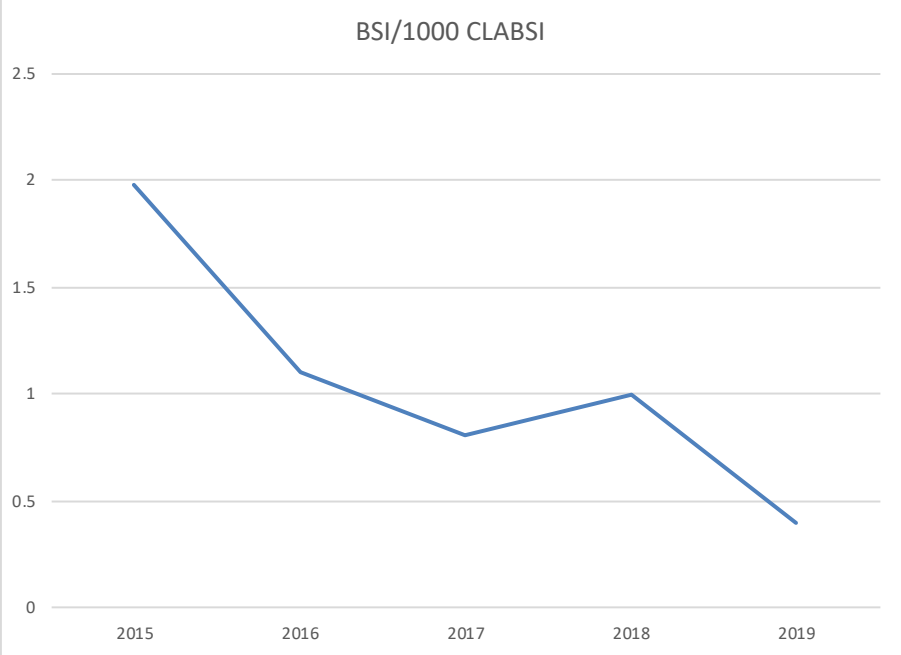


The BSI/1000 CLASI levels between 2015 and 2017, before implementing the CHG baths, show an essentially constant rate of infections.

Graph 5: BSI/1000 CLABSI September 2018 to January 2019



Graph 6:



Interpretation of Quantitative Results

The main graphs for the analysis were graphs 4, 5, and 6. Graph 4 showed no significant decline in infection rates in the unit between 2015 and 2017 before the CHG bathing was implemented. Graph 5 shows that total infections fell every year between September 2018 and January 2019. This coincides with the implementation of the CHG baths protocol.

The supporting graphs suggest that in 2018, there was a slight increase in the total number of infections. In 2019, the total number of infections fell sharply, but in 2020 there was a rise in the total number of infections. It could be that between 2015 and 2017, there was a stagnation in infection rates considering there was no CHG bathing. In 2018, it is possible that factors outside this program evaluation's scope affected the infection rates. In 2019 the rates were reduced, but 2020 featured a significant rise in the infection rates. The year 2020 was characterized by the incidence of COVID-19. It is possible that COVID-19 safety protocols that included reducing face-to-face interaction or body contact reduced the incidences of CHG baths. According to Sova et al. (2021), COVID-19 protocols affected CHG bathing due to safety fears for patients and nurses in different care contexts. It is possible that patients who could otherwise have benefited from CHG baths were not bathed because of the safety fears around COVID-19.

Graph 6 shows the trendline of infections between 2015 and 2019. Between 2015 and 2017, the rates were falling but not as significantly as between 2018 and 2019, where the decline in infection rates is steep. The inference is that a factor significantly impacted the infection rates, in this case, the CHG baths.

The general inference from the data analysis is that CHG baths are associated with a decline in CLABSI infections. This evaluation did not feature an experimental group, allowing the program evaluation to make bolder statements on the association between CLABSI and CHG bathing. That notwithstanding, there is an apparent association between the decline in infection rates and the use of CHG baths.

Interpretation of Qualitative Results

Qualitative data revealed the following key themes: *nurses and PCTs were educated on the protocol, nurses and PCTs supported the protocol, nurses and PCTS required more support*

- The survey analytics suggested that nurses already understand the use of CHG baths to reduce CLABSI rates in the unit
- Nurses surveyed also stated that they were sufficiently educated about using CHG baths to reduce CLABSI infections in their units.
- Management should consider ways to raise the implementation support levels for CHG programs within the hospital
- Considering the relatively low cost of CHG bathing, it is rational and justifiable that management should introduce the necessary policy, financial, and capacity support to enable the adoption of CHG bathing within all units

Nurses and PCTs:

- The survey analysis revealed that the nurses in the unit were educated on the CHG protocol
- The staff was supportive of the intervention.
- Nurses were inconsistent about the documentation
- Some of the concerns that would need to be addressed include the labor concern.

Management:

- CHG bathing is a highly affordable way to reduce CLABSI rates within a unit in the hospital.
- Analysis of primary data collected from the nurses suggested uncertainty on the support offered.
- Management should consider raising the implementation support levels for CHG programs within the hospital.
- Considering the relatively low cost of CHG bathing, it is rational and justifiable that management should introduce the necessary policy, financial, and capacity support to enable the adoption of CHG bathing within all units.

Recommendations:

- The use of CHG baths efficiently reduced the incidence of bloodline infections in the unit.
- RNs and PCTs understood the program and were happy with its implementation.
- Support from executive and transformational leaders would help move the program forward.