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Vaginal Preparation in Cesarean Delivery to Decrease Surgical Site Infections: A Benchmark Study

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Vaginal Preparation in Cesarean Delivery to Decrease Surgical Site Infections: A Benchmark Study

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Contents

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Executive Summary

This benchmark project intends to decrease the rate of surgical site infections related to cesarean procedures with vaginal preparation through an evidence-based approach. *Vaginal preparation* is a simple technique that cleanses the vaginal walls by removing microorganisms. The goal of the benchmark project is to promote the implementation of a vaginal preparation policy across any healthcare facility that performs cesarean procedures. Vaginal preparation is intended for scheduled cases, add-on cases, and urgent cases. The benchmark study does not include emergent cesarean deliveries, as vaginal preparation is at the discretion of the physician in those cases.

The topic of surgical site infections has been around for more than a decade. However, with the increasing number of cesarean deliveries, the rate of surgical site infections is also increasing. Many efforts have been made to decrease the incidence of surgical site infections in cesarean delivery; however, evidence shows that further work is still needed. Improved operating room ventilation, sterilization methods, barriers, surgical techniques, and antimicrobial prophylaxis are advances that have been made to promote infection control (ACOG, 2018). According to Berríos-Torres et al., (2017), approximately half of surgical site infections are deemed preventable using evidence-based strategies.

In 2021, approximately 1,174,545 babies were born in the United States via cesarean delivery (Osterman et al., 2023). Although most who undergo the procedure do not face complications, a significant percentage do. One of the complications associated with cesarean deliveries is surgical site infections post-delivery. Maternal sepsis is a life-threatening condition that causes systemic organ dysfunction during pregnancy, birth, post-abortion, and post-partum (World Health Organization, 2021). Infections that are related to maternal sepsis include but are

not limited to infection at the surgical site, urinary tract infections, and endometritis (World Health Organization, 2021). Exploring solutions to surgical site infections post-cesarean delivery is essential. There is great significance in skin preparation technique, duration, and dry time prior to the start of cesarean delivery. Perhaps, if the focus shifted to a combination of skin and vaginal preparation, the rate of surgical site infections would decrease. The developed PICOT question for the benchmark is: In patients undergoing cesarean delivery (P) how does vaginal preparation (I) compared to no vaginal preparation (C) impact surgical site infections (O) within a three-month timeframe (T)?

Vaginal Preparation in Cesarean Delivery to Decrease Surgical Site Infections

Imagine presenting to the hospital for a scheduled repeat cesarean delivery to a beautiful baby and, seventeen days later, being told a complication occurred. One could not help but wonder if everything was done to prevent the potential complication. This benchmark study explores the impact of vaginal preparation prior to cesarean deliveries. There is mounting evidence for the effectiveness of vaginal preparation and increased awareness of surgical site infections; however, it is unclear why this simple technique has not become a standard of care (Duffy et al., 2019).

Rationale for the Project

In the United States, cesarean delivery is the most common major surgical procedure, with nearly one in every three neonates delivered by cesarean (Duffey et al., 2019). Infectious morbidity post-cesarean delivery is a major health problem. The effects can lead to maternal health morbidities in addition to economic burden (Aref, 2019). Despite healthcare professionals' commitment to the care and improvement of human life, unfortunate and unpredictable events still occur. Every woman's childbirth experience is unique, and many factors, direct and indirect, can influence patients' perspectives. There is great importance in patients' experience while receiving medical treatment, especially during childbirth. The experiences during childbirth can be considered life-changing and have great significance on patients' perception of the healthcare system. The mistreatment of women during childbirth is a violation of women's fundamental human rights (Nilvér et al., 2017). Mistreatment can occur between the woman and health care provider and through systematic failures in health facilities and health systems (Nilvér et al., 2017). It is vital to ensure the trust of the maternal population, continuation of patient outcome improvement, and enhance the quality of care.

Literature Synthesis

Surgical site infections are a common complication that can happen after any surgical procedure. Recently, surgical site infections related to cesarean delivery have increased. Over the years, relentless efforts have been made to find an effective solution. For this benchmark study, twelve studies were identified to support the need for vaginal preparation before cesarean procedures. The evidence for the benchmark study includes a quasi-experimental study, systematic review, meta-analysis, quality improvement report, and randomized control trials. The research illustrates a compelling argument on why vaginal preparation is vital before cesarean delivery and how it can be accomplished.

Of the twelve selected studies, eleven found that vaginal preparation reduces infectious morbidity, endometritis, fever, and wound infection in patients undergoing a cesarean procedure (Ahmed et al., 2017; Fadlalmola et al., 2022; Guzman et al., 2002; Hass et al., 2020; Jakes et al., 2020; Kanza, 2021; Kawakita et al., 2019; Lakhi et al., 2019; Liu et al., 2023; Ogah et al., 2021; Roeckner et al., 2019). One study suggests further research is needed to definitively recommend vaginal preparation prior to cesarean delivery (Reid et al., 2001).

Different methods of vaginal preparation were completed throughout the evidence. Fadlalmola et al., (2022) states that povidone-iodine had the highest reduction of only endometritis. In contrast, Roeckner et al., (2019) argues that povidone-iodine effectively reduces the rate of endometritis, wound infection, and post-operative fever rates. However, Fadlalmola et al., (2022) claims chlorhexidine and normal saline are more effective for reducing wound infection, fever, and hospital duration. Nevertheless, Kanza (2019) states that vaginal preparation with normal saline or povidone-iodine significantly reduces post-operative pain, fever, CRP levels, endometritis, and surgical site infections. Furthermore, wound infection was significantly

lower with chlorhexidine compared to povidone-iodine in patients undergoing cesarean delivery. (Lakhi et al., 2019). Four of the twelve studies did not decipher specific cleansing agents for vaginal preparation but found an overall reduction in surgical site infections (Ahmed et al., 2017; Hass et al., 2020; Liu et al., 2023; Ogah et al., 2021).

A quality improvement project was implemented for a year at a large hospital and was found to reach the lowest rate of surgical site infections in the last six years (Jakes et al., 2020). One study utilized a surgical bundle that included vaginal preparation to decrease surgical site infections in cesarean deliveries (Kawakita et al., 2019). Additionally, two studies (Ahmed et al., 2017 & Ogah et al., 2021) utilized a control and intervention group, which found a reduction for the intervention group. Infectious morbidity in the control group was reduced from 24.4% to 8.8% in the intervention group (Ahmed et al., 2017). Consequently, the control group in Ogah et al., (2021) had a reduction in infectious morbidity from 36.8% (control) to 12.0% (intervention).

Project Stakeholders

The benchmark study includes many stakeholders. The chief nursing officer (CNO), director of women's services, unit manager, and policymakers will be involved in the decision-making process. The facilities' process and procedures impact the success of the benchmark study, along with the organizations' culture towards evidence-based practice. Each stakeholder is expected to participate in the benchmark study and provide critical elements. Other stakeholders include allied health professionals, regulatory representatives, and insurance companies. The nurse educator, a supply chain member, and certified scrub technicians will also be involved in the benchmark study. The key stakeholders for the benchmark study are patients, staff nurses, vaginal preparation super users, charge nurses, and evidence-based practice mentors.

Implementation Plan

The need for this project is derived from a synopsis of the synthesized data. Increased surgical site infections in obstetrics can be decreased with improvements in pre-delivery hygiene. Implementation will be conducted in different phases. First, collaboration will be established between administrators, clinicians, and staff. The specific goal of decreasing surgical site infections by performing a vaginal cleansing before cesarean delivery will be emphasized. Everyone involved must agree on the goal of the project. Vaginal preparation before cesarean delivery will be carried out on the OB/GYN unit at a large metropolitan acute care hospital. Second, permission will be obtained for the benchmark project from the women services director. Gaining administrative support will play a vital role in the success of implementation.

Gathering other allies who support and help with vaginal preparation before cesarean deliveries will be beneficial. The perinatal program manager, chief obstetrician and gynecologist, and clinical educator will have recourse to the implementation phase. Understanding the organization's day-to-day workflow is vital to implementing a new process. Collaborating with the manager will provide effective communication between individuals carrying out vaginal preparation prior to cesarean deliveries.

Prior to implementation, data will be collected that includes a combination of total cesarean deliveries, post-delivery fevers, prolonged hospital stays due to antibiotic therapy, surgical site infection readmits, and cases of maternal sepsis that require a transfer to a higher level of care. A chart of the difference in cost for someone who acquires a surgical site infection versus someone who does not will be created. This data provides evidence of the need for this benchmark project and will be available to personnel interested in reading the research.

After receiving authorization for the benchmark project, A presentation reflecting the need to foster evidence-based practice in the clinical environment will be presented to the unit.

Vaginal preparation education, instructions, necessary resources, and expectations of the project will also be provided. To increase staff knowledge, communication of the project will include an organizational email and also be presented during staff meetings. Included in the instructional materials will be a patient scenario (including graphic images) with maternal sepsis. This will motivate staff to implement vaginal preparation. To foster a smooth and effective transition, collaboration with unit staff members will be utilized to focus on the ultimate goal. Not only does collaborating with unit members promote teamwork, but it also provides an opportunity for feedback.

A mandatory in-service session with a manufacturer representative and an online health stream module will be required. The in-service sessions will be available to night and day shifts at varying times. The due date for the online education module will be prior to the start date of implementation. To ensure staff are competent with vaginal preparation, every employee will need a skills check-off. Flyers will be posted around the unit identifying the skills check-off and in-service complementation deadline. Vaginal preparation will also be required in the annual ongoing competencies skills check-off.

The cleansing agent must be added to the unit supply room prior to the start date. The specific quantity will depend on how many cesarean deliveries are completed on average per month and how many cleansing agents will be required per patient. However, the location of the solution will be discussed and shown during the check-off.

Following the start date, establishing compliance is key. The ultimate goal of compliance is ninety percent or greater during implementation. In addition, creating a documentation tool for vaginal preparation must be designed. It is essential to consider whether the tool is on paper or within the software during implementation. Next, the documentation expectation will be

announced to staff members to avoid compliance fallouts. To ensure staff compliance, vaginal preparation will be added to the pre-operation checklist, and super users will be on the unit to enforce compliance. Chart audits will be conducted at random, and missed opportunities will result in verbal coaching to recurrent offenders.

Finally, one must anticipate barriers to implementing vaginal preparation prior to cesarean deliveries. Although vaginal preparation can be accomplished within minutes, some physicians with weak beliefs about the value of evidence-based practice may opt to give a verbal order to bypass the vaginal cleansing step. In an attempt to avoid this barrier, physicians will be provided with data that supports the benchmark project. The final approach to minimizing the barrier is to empower the nursing staff to utilize the CUS communication tool. Nurses can express concern about not completing the required vaginal preparation by stating that they are uncomfortable. Deliberately skipping over vaginal preparation can be identified as a patient safety violation and ultimately put the patient at risk for surgical site infection. It is imperative to not only support staff members throughout the change but also walk through the change process with them.

Patients' electronic medical records will be reviewed to analyze the benchmark project results. However, informed consent, a HIPAA authorization, and an approved waiver must be obtained first. After access has been granted, medical records will be sorted, and data will be attained. During the results collection, post-partum readmits and patients with signs/symptoms of post-operative surgical site infection will be sought out. Surgical site infection includes redness, swelling, discharge, unusual pain at the incision site, and fever. Chart reviews will occur weekly for the remainder of the benchmark project.

Timetable/Flowchart

The benchmark study will be conducted over fifteen weeks. Each week will have a designated task to be completed to ensure the steps are completed on time. First, the data will be reviewed, and a project blueprint will be created. These two components should be completed within the first two weeks of the study. Evidence will be presented to stakeholders, and approval will be gained. Next, an implementation plan strategy will be created and executed. Each specific detail will be conducted in a step-by-step manner. Two weeks will be focused on providing vaginal preparation education. Vaginal preparation will go live the following week and be continued for three months. Next, enforcing compliance will occur. After compliance is established, data will be gathered. Data review will be conducted next, and the results will be provided to stakeholders. Finally, the results will be disseminated into practice, and standard practice will be changed.

Data Collection

After completing the benchmark study, data will be collected for six months following implementation. The collection method for the benchmark study includes chart reviews and audits. The patient and facility will grant access to the electronic medical record prior to the start of data collection. To determine if vaginal preparation was successful in reducing surgical site infections, specific criteria will be assessed. An Excel spreadsheet will be utilized to sort and contain the data collected. Included in the spreadsheet will be the patient's initials, date of cesarean delivery, vaginal preparation agent and technique (if applicable), length of hospital duration, hospital readmission, surgical site infection symptoms, and antibiotic therapy. Vaginal preparation, length of hospital duration, and date of delivery will be available within a week of the procedure. Hospital readmission, surgical site infection symptoms, and antibiotic therapy may occur within thirty days of the procedure. Each chart will be assessed for fever, complaints

of purulent discharge, redness, unusual incision pain, and swelling. Suppose antibiotic therapy is utilized in the post-partum period. In that case, further examination will determine if it results from a surgical site infection or if the antibiotic was used to treat other conditions, such as chorioamnionitis. A second analyzer will review the collected data to ensure all information is received and all components are adequately reviewed.

Evaluation

Comparing the rates of surgical site infections in patients who received vaginal preparation compared to those who did not will then take place. Vaginal preparation will be considered effective if there is either a decrease in patients with post-operative fever, antibiotic use, and infection symptoms. Once vaginal preparation has been declared effective in the reduction of surgical site infections, dissemination of this knowledge will begin.

Cost/Benefit Analysis

According to de Lissovoy et al. (2009), hospital-acquired infections are among the top ten leading causes of death in the United States of America. Of the hospital-acquired infections, more than 20% are attributed to surgical site infections (de Lissovoy et al., 2009). From a national perspective, surgical site infections were associated with an additional 406,730 hospital days and costs exceeding $900 million (de Lissovoy et al., 2009). Implementing vaginal preparation before cesarean delivery is estimated to be low costing and within budget. Although the actual cost is currently unavailable, the anticipated price is low. A pre-operative vaginal cleansing agent is far less expensive than the associated costs of surgical site infection. Due to the risks associated with surgical site infections, the cost of a vaginal preparation agent should not be in great question. Surgical site infections represent financial and opportunity costs to

hospitals and suggest, along with the implication for patient care, a continuing need for cost-effective quality improvement and infection prevention programs (Boltz et al., 2011).

In addition to the financial cost, surgical site infections impact patients' quality of care, especially in new mothers. Increased pain and temporary loss of function can hinder the ability of a new mother to care for and bond with her baby. The post-partum period can be a challenging experience even if no complications arise. Adding surgical site infections during the post-partum period adds a new level of stress and anxiety. Surgical site infection is a burden for the patient and has a relevant impact on the patient's satisfaction with healthcare (Strobel et al., 2022).

Discussion of Results

Implementing the benchmark study was not feasible due to the short time frame of the academic semester. Patient and facility approval for chart review required a significant length of time and would not be possible. Although it remains uncertain, the benchmark study is expected to be successful in the reduction of surgical site infections. There is an abundance amount of solid evidence that supports vaginal preparation prior to cesarean procedures. After vaginal preparation is implemented into standard practice, the goal will be to sustain and make adjustments as needed.

The best leadership strategy for the benchmark study is transformational leadership. Promoting vaginal preparation before cesarean deliveries is valuable and creates positive change. Utilizing influence, inspiration, motivation, and individual consideration is vital to the benchmark study. The goal will be to utilize the benchmark study as an example to empower future leaders to promote change through evidence-based practice. A small group of individuals who are passionate about evidence-based practice and procedures will be formulated with the hope of continuing to improve patient outcomes and adjusting practice standards.

Conclusions/Recommendations

Surgical site infections related to cesarean deliveries are a growing concern in today's world and warrant an immediate practice change. Surgical site infections are costly, increase patient mortality, increase hospital admission duration, and negatively affect patients' perspectives. Vaginal preparation has been proven to decrease the incidence of surgical site infection and improve patient outcomes. This benchmark study, along with other evidence, supports the need to implement vaginal preparation into standard practice. Further research is needed to explore vaginal preparation techniques and specific solution agents that are the most effective. Although rare and very unlikely, further research is also indicated to determine if vaginal preparation has any possible harmful side effects.

There is hope for the future with surgical site infections related to cesarean deliveries. Now is the opportunity to make a difference, advocate for our patients, and improve outcomes. The objective is to apply vaginal preparation into standard practice with the hopes of decreasing surgical site infections.

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Appendix A

NURS 5382 Capstone Evidence Table

Citation: (i.e., author(s), date of publication, & title)	Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Strength of the Evidence (i.e., level of evidence + quality [study strengths and weaknesses])
Author, Year, Title	Theoretical basis for study Qualitative Tradition		Number, Characteristics, Attrition rate & why?	Independent variables (e.g., IV1 = IV2 =) Dependent variables (e.g., DV =) Do not need to put IV & DV in Legend	What scales were used to measure the outcome variables (e.g., name of scale, author, reliability info [e.g., Cronbach alphas])	What stats were used to answer the clinical question (i.e., all stats do not need to be put into the table)	Statistical findings or qualitative findings (i.e., for every statistical test you have in the data analysis column, you should have a finding)	• Strengths and limitations of the study • Risk or harm if study intervention or findings implemented • Feasibility of use in your practice • Remember: level of evidence (See PICOT handout) + quality of evidence = strength of evidence & confidence to act • Use the USPSTF grading schema http://www.ahrq.gov/clinic/3rduspstf/ratings.htm

Ahmed et al., (2017). Chlorhexidine vaginal wipes prior to elective cesarean section: does it reduce infectious morbidity? A randomized trial	Evaluate PO VP with antiseptic wipes on IM rate post-CD	Randomized control trial	218 pregnant women undergoing elective CS Term singleton pregnancies Divided by simple randomization Two different groups: study vs control	IV CS – surgically delivery of a baby through mother's abdomen DV VP – cleansing intravaginally with a solution IM – endometritis, would infection, febrile morbidity	Examined post-CD at time of hospital discharge and weekly till end of PP period	SPSS version 15 Qualitative data expressed as numbers and percentages Student t test and x^2 were used	Post-CS IM were reduced from 24.4% (control group) to 8.8% (intervention group)	Level of evidence: II Strengths: no side effects reported from VP, patients were chosen randomizied, a unique methodology manner, low cost internvetion Limitations: during follow up 7 intervention cases and 11 control cases were lost, lack of follow up to neaonatal outcomes, small sample size Feasibile for practice Conclusion/recommendation: complete longitudinal study, cleansing with chlorhexidine appears to decrease endometritis rates post-CD
Fadlalmola et al., (2022). Vaginal preparati	Investigate effect of vaginal solution	Systematic review and netwo	29 RCTs Total sample size: 9311	IV CS - surgically delivery of a baby	Comprehensive search retrieved 1663 records after	Used netmeta package in R softwar	Povidone-iodine had highest reduction of endometritis in post-CD	Level of evidence: I Strengths: using a network framework for direct and indirect comparisons, only included clincal trials published until end

on with different antiseptic solutions before cesarean section for preventing postoperative infections: A systematic review and network meta-analysis	s on reducing post-CD endometritis, WI, fever, hospital stay duration	rk meta-analysis Accomplished in agreement with "cochrane handbook for systematic reviews of interventions	women undergoing CD Patients undergoing CD whether elevtive, in labor, or emergent included Any VP solution included Restrided to RCTs only	through mother's abdomen VS – povidone-iodine, chlorhexiine, saline DV Endometrities, WI, fever – disease process at mircoscopic level effecting tissues Hospital stay duration – length of time admitted to hospital	omitting 429 duplicates, screened titles and abstracts of 1234 records, out of 46 records 29 RCTs were included	e version 4.1.2 Compared various solutions twice with and without accounting for dosage or concentrations Heterogeneity assessed using I^2 and p-value of chi-squared test	Chlorhexidine and saline had highest reduction of WI, fever, and hospital duration	of 2021, assessed most essential outcomes and publication bias, low cost intervention, cleaning agents are minimal Limitations: definitions of endometritis, post-CD fever and WI varied among RCTs, cannot eliminate confounding variables and selection biases, included studies that differed in type and time of administration of PO antibiotics Feasible for practice Conclusion/Recommendation: different vaginal solutons are associated with reduction in post-CD endometritis, WI, fever, and hospital stay duration, setting povidone-iodine as standard practice solution

						Egger test used		
Guzman et al., (2002), Post-cesarean related infection and vaginal preparation with povidone-iodine revisited	To ascertain whether VP with povidone-iodine before CD would reduce incidence of post CS related infections	Randomized, blinded, controlled, clinical trial	160 subjects, 80 cases, 80 controls Studies conducted between March 2000 and July 2001 at University Medical Center	IV VP – cleansing of vaginal walls with solution CD – surgical procedure delivering baby via incision through abdomen DV Endometritis – fever of > 100.4F on two separate occasions,	VP completed by scrub nurse while physicians were scrubbing and surgeons were not informed of which patient was randomized Outcomes analyzed by the attending physicians	Analyzed using Statistical program for the social sciences (SPSS) – version 8.0 Student t test, x2, or analysis of variance	VP with povidine-iodine before CD can decrease post-partum morbidity associated with endometritis	Level of evidence: II Strengths: finds appear consistent, even in patients with increased VE Limitations: number of factors can influence infection rates Conclusion/recommendation:VP with povidine-iodine prior to CD can decrease PP morbidity associated with endometritis, studies with larger patient populations are needed to conform obsercations

				6 hrs apart, > 24 hrs post-op				
Hass et al., (2020), Vaginal preparation with antiseptic solution before cesarean section for preventing postoperative infections	Determine if cleansing the vagina with an antiseptic solution before a CD decreases risk of maternal infection Also assessed vaginal cleansing solutions to determin	Systematic review	21 trials, reporting 7038 women evaluating effects of vaginal cleansing Included: RCTs and two quasi-RCTs Pregnant women who were about to receive a CD, includes elective laboring	IV VP was completed no more than one hour prior to the CD, VP including douches, wipes, sponges, with any type of antiseptic solution versus a placebo or no VP DV Post op fever, post	Cochrane Pregnancy and Childbirth's Trials Register, World Health Organization (WHO) International Clinical Trials Registry Platform and reference lists of retrieved studies	Three of the review authors independently assessed eligibility of the studies	VP prior to CD probably reduces the incidence of post CD endometritis, post op fever, and post op wound infection, no adverse effect were reported with vaginal cleansing	Level of Evidence: Level I Strengths: not specified Limitations: not specified Conclusion/recommendation: Further analysis suggested greater effect women in labour versus those not in labour (post-cesarean infection of uterus, post-op fever, post-op WI, wound complication or infection of the uterus) - needs to be investigated further in future trials

	e adverse events associated with intervention		and urgent CD	op WI, endometritis, post op wound seroma or hematoma				
Jakes et al., (2020), Implementation of vaginal preparation prior to caesarean section	Implement VP prior to CD at Guy's and St Thomas' Hospital NHS Foundation Trust and reduce rates of deep SSIs	Quality improvement report	Large, tertiary hospital located in central London Delivered roughly 6800 babies annually, CD rate is 35%	IV VP is the cleansing of the epithelium with an antibacterial solution, to reduce ascending genital tract infection VP can be completed with povidone-iodine or	SSI surveillance – in line with public health England recommendations Consist of surveillance forms, discharge questionnaire, telephone interviews Women were telephoned	No statistical analysis possible due to small number of women and short timescale observed	12 months following VP implementation, SSI rate is lowest recorded in last 6 years	Level of evidence: IV Strengths: Intervention is cheap, simple, and performed with readily available materials, inclusion criteria was expanded with clinical team once intervention was accomplished on >85% women, Limitations: low level evidence, no data analysis Conclusion/recommendations: VP prior to CD has been implemented at Guy's and St Thomas', involvement of stakeholders were key to success, intervention still being performed, has resulted in a

				chlorhexidine SSI – superficial incisional, deep incisional, organ/space infections SP CD within 30 days	at day 30 post CD with up to 3 attempts to make contact			reduction of SSI, continue SSi surveillance
Kanza, (2021), The effect of vaginal cleansing performed with normal saline solution or povidon	Determine effect of VP performed with solutions before elective CD on PP maternal morbidity and	Randomized controlled study	3 groups (saline – n=60, PI n=60, control group n=60)	IV VP – cleansing of vaginal walls with solutions to disinfect area CD – delivery of infant	N/A	Data were analyzed with the IBM SPSS V23	VP with normal saline solution or PI before CD significantly reduced post-op pain, fever, and CRP levels Cleansing vagina before CD clinically reduced number of post-	Level of evidence: II Strengths: microbiological measurements were performed Limitations: size of sample was small, only included primiparous women whose labor did not start Conclusion/recommendation: future studies should be conducted

e-iodine before elective caesarean section on postoperative maternal morbidity and infection; A prospective randomized controlled study	post-op infection			via surgery through abdominal incision DV Maternal morbidity – complications arising after surgical procedure of delivering baby Post-op infection- infection occurring after surgery			CD site infections and endometritis	

Kawakita et al., (2019), Reducing cesarean delivery surgical site infections: a resident-driven quality initiative	Examine association of resident driven quality initiative with CD SSI	Quasi-experimental	1,100 women CD at 23 weeks GA or greater between 2015-2018 Excluded emergency CD, chorioamnionitis, patients with purulent fluid from cervix	Surgical bundle including: antibiotics, skin preparation, clippers instead of razors, vaginal cleasing, placenta removal by umbilical cord traction SSI (superficial incisional, deep incisional, and organ or space surgical site infections)	Outcomes were compared in the pre-implementation and post-implementation phases	MedStar Institutional Review Board approved analysis ,Cochran-Armitage Trend test performed, Stata/IC 15.1, X2 test variables and student t-test	After implementing surgical bundle, a significant decrease in CD SSI was observed	Level of evidence: Level III Strengths: demonstration of successful resident-driven quality initiative, evidence-based bundle approach was standardized and reduced SSI by 50%, SSI defined by objective data Quality of evidence: high Limitations: Underestimated number os SSI, Information of a loss of follow up wasn't available, Unable to determine which specific intervention contributed to a reducation in SSI

				up to 6 weeks PP				
Lakhi et al., (2019), Vaginal cleansing with chlorhexidine gluconate or povidone-iodine prior to cesarean delivery: a randomized comparator-controlled trial	Determine whether VP with chlorhexidine results in fewer WI compared to PI	Randomized, comparator-controlled trial	1,114 patient met inclusion criteria (524 to the chlorhexidine group and 590 to the PI group) Both groups similar with regard to age, parity, BMI, gestational age at delivery	IV CD – delivery of infant through abdomen via incision VP – disinfecting vagina walls with solution DV SSI – infection that happens post delivery within 30 days (superficia	Follow up phone call for WI occurrence after DC via standard phone telephone interview, calls made 14-20 after DC	Power analysis for a c^2 test was conducted in G-POWER 3.1 (Faul and Erdfelder) Student t test or Mann-Whitney U test Categorical data was compared	Rate of wound infection was significantly lower in the chlorhexidine arm as compared with povidone-iodine	Level of evidence: II Strengths: no adverse reactions noted, Limitations: trial used at a single site, blinding not possible due to both solutions being different colors Conclusion/recommendation: larger sample size is neccessary

			Computer-generated calendar block randomization method utilized	l and or deep) Endometritis – infection effecting tissues Post-op fever – temp greater or above 100.4F		using c^2 or Fisher exact tests		
Liu et al., (2023), Different methods of vaginal preparation before cesarean delivery to prevent	Reivew clinical trials and summarize the most suitable VP for CD	Systematic review and meta-analysis	23 trials including 10,026 CD patient were included Excluded non-RCTs, no use of iodine or guanidine	VP methods include 19 iodine-based disinfectant and 4 guanidine-base disinfectants	2 reviewers independently extracted data and assessed risk of bias and certainty of evidence, effectiveness of prevention was assessed by	Statistical evaluation performed by funnel plot and Egger test, multiple subgrou	Overall VP significantly reduced risks of endometritis, post-op fever and WI	Level of evidence: Level I Strengths: systematic analysis of multiple outcomes was conducted, possible biases were assessed, extensive and systematic literature search was conducted including studies from multiple countries and languages, strict inclusion criteria were used Limitations: VP methods other than iodine and guanideine based

postoperative infection: a systematic review and network meta-analysis			-based disinfectants, no reporting of post-op infection outcomes		frrenquentist-based network meta-analysis models	p abalyses were performed		disinfectants were not used, conclusion of subgroup analysis is limited, different regions differ in certain aspects of surgical procedures Conclusion/reccomendations: VP reduced the risks of endometritis, post-op fever, and wound infection, 1% poviodone-iodine has outstanding effects
Ogah et al., (2021), Preoperative vaginal cleansing with chlorhexidine solution in preventing post-cesarean section infection	Evaluating the efficacy of preoperative VP in reduction of post-CD infectious morbidities	Randomized control trial	322 pregnant women who underwent emergency CD 2 groups – intervention and control group	IV Emergency CD – delivery of baby via surgery in an urgent manner VP – cleaning vagia with chlorhexidine	Diagonosed endometritis by fever, foul/offensive/purulent lochia, uterine fundal tenderness WI diagnosed by wound erythema, tenderness, purulent drainage	Statistical package for social science software version 22	IM was significantly reduced from 36.8% in control group to 12.0% in intervention group, fever was more common in control group	Level of evidence: II Strengths: not specified Limitations: not specified Conclusion/recommendation: use of chlorhexidine vaginal cleansing in at-risk women undergoing CS prioritize SSI control and surveillance in the study area

s in a low resource setting: a randomized controlled trial				antiseptic solution DV Endometritis WI	from incision			
Reid et al., (2001), Vaginal preparation with povidone iodine and postcesarean infectious morbidity: A randomized controlled trial	Determine whether VP with povidone iodine before CS decreased incidence of PP IM	A randomized controll trial	Participants were randomly assigned to VP with PI (n= 247) or no preparation (n=251) No difference is maternal age, race, parity, education	IV CS – delivery of baby via surgical procedure VP – disinfecting vaginal walls with solutions DV IM – fever, endometrit	One of four physicians, masked to randomization assignment, reviewed the admission record and abstracted information	Greater than 80% power to detect such a difference if the outcome investigated was no more common than 23% (two-tailed ^{2}	VP with PI before CD had no effect on incidence of fever, endometritis, or WI	Level of evidence: II Strengths: avoiding possible potential to harm Limitations: Rarity of outcome events, strict definitions may have caused fewer cases of infection, did not seek validation that preparation was done correctly, intent-to-treat analysis Conclusion/recommendation:Meta-analysis could clarify association of VP related to infection post-CD, do not assert that VP does not provide benefit

			, payment status	is, wound separation		with 0.05). Anal-ysis was done using Stata Statistical Softwar e (Stata Corpor ation, College Station, TX)		
Roeckne r et al., (2019), Povidon e-iodine 1% is the most effective vaginal antisepti c for	Compar e efficacy of antisepti c formulat ions used for preparati on of	Syste matic revie w and netwo rk meta-analy sis	23 studies Included RCT with characteri stics of: studies that compared VP	IV vaginal cleansing-utilizing solution to kill bacteria intravagin ally	Computeriz ed software used user-written programs to assess con-sistency, inconsistenc y, ranking probabilities , and	DerSim onian-Laird random effects model Hertero geneity was tested	Presurgical VP with antiseptic solutions reduces infectious morbidity after CD PI was effective at reducing the rate of endometritis,	Level of evidence:Level I Strengths: use of a network framework for indirect comparisions haven't undergone head-to-head trials, extensive literature search with use of computerized databases, registered review that followed preferred reporting items for systematic review and meta

preventing post-cesarean endometritis: a systematic review and network meta-analysis	vagina before CD		solutions administered before CD with aim of reducsing post-CS infection, studies that compared VP solutions with each other or against placebo or	CD – delivery of newborn baby through abdomen, surgically DV Endometritis – infection of cells Infectious morbidity- effects of infection that can lead to other complications Post-op wound	graphing results	with the I2 index and the Cochrane's Q statistic Publication and related biases were assessed by examining funnel plots and the Eggar test	wound infection, and PO fever Various treatments are available although PI 1% appears to be the best treatment option VP has been shown to decrease the number of vaginal organisms	anyalysis guidelines, study quality assessment Limitations: potiential confounding factors and selection bias, trials varied in techniques of randomization, Cetrimide and metronidazole had a single study Feasibility of use of evidence Conclusion/recommendation: cost of agents is low, application time is minimal, reducing vaginal flora with the use vaginal antiseptics is plausible action in reducing endometritis

				infection – infection 30 days after surgery Readmission- being admitted back into hospital Fever – temp of greater than 100.4				

Legend: CS – cesarsean section, CD – cesarsean delivery, VP – vaginal preparation, VC – vaginal cleansing, IM – infectious morbiditiy, PP – post-partum, PO – preoperative, WI – wound infection, VS – vaginal solution, VE – vaginal exam(s), SSI – surgical site infections, SP – status post, PI – povidone iodine, DC - discharge

Please do not repeat the headings, just provide the data

Appendix B

Timetable/Flowchart for Implementation