Abstract of thesis entitled

"Evidence-based guidelines on vaginal preparation with povidone-iodine solution to reduce post-cesarean endometritis in postnatal women"

Submitted by

Cheung Shing

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Cesarean delivery is currently one of the most common surgical procedures performed by obstetricians. Concern has been raised about global rise in cesarean delivery rate since the risk of morbidity and mortality is higher in cesarean delivery than in normal delivery. It is quite common manifested as infection or co-morbidities postoperatively for those women received cesarean delivery. It is found that the rate of post-cesarean infection rate is approximately 10 times higher than after vaginal delivery. Endometritis was reported as a frequent complications associated with cesarean delivery. Post-cesarean infection rates range from 7 to 20% leading to delay in recovery and prolonged hospitalization.
The objectives of this study were to systematically review and present the best evidence for the effectiveness of vaginal preparation with povidone-iodine solution in reducing post-cesarean endometritis in postnatal women, and to develop an evidence-based guideline for proper pre-operative vaginal preparation procedure.

Five eligible articles were retrieved after inclusion and exclusion criteria were applied. Data from the 5 studies have been extracted to a table of evidence. "Evidence-based practice guideline on proper vaginal preparation immediately prior cesarean delivery" was synthesized according to the findings of the reviewed literature.

By appraising and evaluating the evidences from the five RCTs, it is concluded that vaginal preparation with povidone-iodine solution preoperatively can reduce incidence of post-cesarean endometritis. The incidence of post-cesarean endometritis could be significantly decreased for those women who were scrubbed with both standard abdominal skin preparation and proposed new practice with povidone-iodine vaginal preparation, compared to those who received only standard abdominal preparation. Vaginal preparation could reduce the occurrence of post-cesarean endometritis. This is particularly applicable for post-cesarean women who had ruptured membranes and for those in labor.
By translating the reviewed evidence, an evidence-based guideline was established as a guidance to nursing staff and doctor for proper vaginal pre-operative vaginal preparation procedures. The implementation potential of the guideline was examined in terms of target setting, target audience, transferability of findings, feasibility and cost benefit ratio. It was found that the development of evidence-based guideline was feasible, cost-beneficial and transferable in current settings.

The established guideline focused on proper procedures of vaginal preparation to reduce post-cesarean endometritis in adult pregnant women who are undergoing cesarean delivery. For those pregnant women who are undergoing cesarean delivery with ruptured membrane or/and in labor, it is highly recommended to perform vaginal preparation.

An implementation plan included communication, pilot test and evaluation plan were developed to facilitate effective implementation and continuous improvement. A 12-month programme consisted of communication with administration and stakeholders of the innovation, training and education to staff and doctors, 2-month pilot study, implementation plan and evaluation plan will be carried out to facilitate an effective compliance and continuous improvement.
Evidence-Based Guidelines on Vaginal Preparation with Povidone-Iodine Solution to Reduce Post-cesarean Endometritis in Postnatal Women

by

Cheung Shing

RN, BNurs (Honours)

A thesis submitted in partial fulfillment of the requirement for the Degree of Master of Nursing at the University of Hong Kong.

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Declaration

I declare that this thesis represents my own work, except where due acknowledgement is given and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualifications.

Signed ___________________

Cheung Shing
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Chapter 1: Introduction

1.1 Background

Cesarean delivery is currently one of the most common surgical procedures performed by obstetricians. The increasing rate of cesarean delivery is well documented worldwide particularly in developed countries (Thomas & Paranjothy, 2001). In the United States, around one-third of babies are born via cesarean delivery. In the United Kingdom, the rate of cesarean delivery rose from 4% to 21.5% from 1970s to 2000s. From 11.1% in 1988 to 38.1% in 2000 in South Korea (Hong, 2007; Han, Song, Liu, Huo, Xu & Cui, 2011; Zhang, Liu, Meikle, Zheng, Sun & Li, 2008). In Asia, Tang, Li & Wu (2006) stated that the cesarean delivery rate among primiparous women rose from 18 to 39% and that close to two-thirds of urban women now give births by cesarean delivery between 1990 and 2002. Cesarean delivery rate rose from 4.7 to 22.5% over past three decades in Shanhai (Dobson, 2001; Lee, Khang, Yen & Jo 2005). In Hong Kong from years 1987 to 1999, cesarean delivery rate significantly increased from 16.6 to 27.4%. The total number of cesarean delivery in Hong Kong increased by 65% over 12 years. (Leung, Lam, Wan & Ho, 2001; Pang, Leung, Leung, Lai, Lau, & Chung, 2007).

Concern has been raised about global rise in cesarean delivery rate since the risk of
morbidity and mortality is higher in cesarean delivery than in normal delivery (Leone, Padmadas & Matthews, 2008; Victora & Barros, 2006; Murray, 2000). It is quite commonly manifested as an infection or co-morbidities postoperatively for those women who received cesarean delivery. Henderson & Love (1995) stated it is approximately 10 times higher post-cesarean infection rate than that after vaginal delivery.

Endometritis is an infection of the endometrium or uterus in the postpartum period. It was reported as a frequent complications associated with cesarean delivery (Henderson, 1995). Post-cesarean infection rates range from 7 to 20% leading to delay in recovery and prolonged hospitalization (Wilkinson & Enkin, 2008; Anorlu, Maholwana & Hofmeyr, 2008; Gungorduk, Yildirim & Ark, 2009).

Although the Healthcare Infection Control Practices Advisory Committee (HICPAC) from the Centers for Disease Control and Prevention (CDC) published the latest guideline for prevention of surgical site infection in 1999, vaginal preparation for reduce surgical site infection in cesarean delivery remain unresolved. Vaginal Preparation is not a standard patient care practice in United States to prepare the vagina with an antiseptic solution before cesarean delivery (Haas, Morgan &
Contreras, 2014). The same procedures are applied in Hong Kong, proper skin preparation of an incision site involves most commonly using antiseptic solutions such as povidone iodine and chlorhexidine with alcohol on lower segment of abdomen preoperatively but not including vaginal cleansing nor preparation.

The rationale behind vaginal cleansing immediately before cesarean delivery is to reduce the bacteria count, as this is a major etiology of postoperative endometritis (Haas et al., 2014). The pathophysiology of endometritis is an ascending polymicrobial infection of cervical and vaginal normal flora to infect uterus (Martens, Faro, Maccato, Riddle & Hammill, 1991). The bacterial species isolated in post-cesarean endometritis include gram-negative bacilli, aerobic and anaerobic gram-positive cocci, and anaerobic bacilli associated with bacterial vaginosis as cited in Starr, Zurawski & Ismail (2005). These bacterial species found can be reduced by vaginal cleansing with antiseptic like povidone-iodine solution.

1.2 Affirming Needs and Significance

With the current standard skin preparation applied, post-cesarean endometritis rates range from 6% to 27% (Haas, Pazouki, Smith, Podzielinski, Al-Darei & Golichowski, 2010; Yildirim, Gungorduk, Asicioglu, Basaran, Temizkan, Davas & Gulkilik, 2012).
Endometritis could result in peritonitis, intra-abdominal abscess, bactericidal and sepsis (French & Smaill, 2004), and surgical site infection (Normand & Damato, 2001) which were a common source of morbidity.

In Hong Kong, there is no sufficient stratified data showing the incidence of post-cesarean wound infection and endometritis. However, a study was conducted by Lam (2006) in a local acute hospital serving 1400 beds. Lam (2006) found 2.2% of post-cesarean women complicated with abdominal wound infection from the total samples of 2163 cesarean deliveries.

Endometritis, as one of the postoperative morbidity that influences recovery of postpartum women significantly (Haas et al. 2014), increase the length of hospitalization and increase risk of other acquired nosocomial infections (Hadiati, Hakimi, Nurdiati & Ota, 2014). Postoperative infection like endometritis after cesarean delivery also influence the postnatal women's return to normal function and potentially affect her bonding with her newborn baby (Haas et al., 2014). Post-cesarean women suffering from endometritis results in physiological and psychological consequences.
Complications and morbidities of post-cesarean women such as endometritis do not only influence surgical outcome of the women but also create extra burden to the healthcare system. Extended length of stay resulted from women with postoperative complications. More intense nursing care is required for the patient. Longer hospitalization, extra therapeutic procedures and nursing interventions introduce more risk of the post-cesarean women from getting nosocomial infections. These complications increased medical cost and burden to the healthcare setting.

It is important to seek an easy, inexpensive, feasible and evidence based intervention to reduce the risk of getting post-cesarean endometritis. As Haas et al. (2014) cited that previous studies Duignan (1975) and Haeri, Kloppers, Forder & Baillie (1984) evaluated the effectiveness of reducing the incidence of endometritis and wound infections by vaginal cleansing before a cesarean delivery with antiseptic solutions.

To minimize common normal flora of vagina and cervix, which contributes to major etiology of post-cesarean endometritis, a proper antiseptic preparation and disinfection practice is vital. Proper antiseptic preparation involves removal of physical dirt of the patient operation site preoperatively. Application of antiseptic solution to the operation site can reduce bacterial population to a minimal level
(Edwards, Lipp & Holmes, 2013).

There is currently no consensus for implementing vaginal preparation to reduce endometritis for post-cesarean women. In this study, evidences are evaluated to find out if vaginal preparation with povidone-iodine can reduce incidence of endometritis. Synthesized evidence do not only improve practice in Hong Kong but also worldwide practice to reduce post-cesarean women from getting post-cesarean endometritis. Ultimately this change of practice could impact public health by promoting surgical outcome, enhancing quality of care and patient safety.

1.3 Objectives and Research Question

The healthcare issue and significance were identified and demonstrated. The clinical question is formulated and discussed.

Aim of the Study:

This study aimed to gather and appraise evidence on the effectiveness of vaginal preparation with povidone-iodine solution to reduce post-cesarean endometritis.

Review Objectives:

- To identify gaps current practice in worldwide and in Hong Kong.
- To identify significance of the interventions.

- To search for relevant evidence from academic sources and conduct quality assessments.

- To systematically review the present best evidence to answer the research question.

- To summarize and synthesize the evidence from the selected research papers.

- To determine if perform vaginal cleaning with an antiseptic solution, povidone-iodine, before a cesarean delivery deceases the rate of post-cesarean endometritis in postnatal women.

- To translate the reviewed evidence in order to develop evidence-based guidelines to reduce post-cesarean endometritis in postnatal women.

- To develop a plan for implementation and evaluation of the evidence based guideline.

**Research Question:**

How does vaginal preparation with povidone-iodine solution compared to standard abdominal preparation without cleansing vagina reduce rate of post-cesarean endometritis in postnatal women?

PICO components were utilized to formulate research question facilitating searching
for relevant evidence.

(P) Patient population: Postnatal women undergone cesarean delivery

(I) Intervention: Vaginal preparation with povidone-iodine

(C) Comparison: Standard abdominal preparation without performing vaginal preparation.

(O) Outcome: The rate of post-cesarean endometritis
Chapter 2: Critical Appraisal

This chapter will examine the effectiveness of vaginal preparation with povidone-iodine solution to reduce post-cesarean endometritis in postnatal women.

By describing the search strategies of the related literature, the synthesized "Table of Evidence", the quality assessment of the methodology literature.

2.1 Search and Appraisal Strategies

Review content assessed: From 1st March to 1st August, 2014.

2.11 Inclusion Criteria:

Type of studies: Randomized Control Trial (RCT) and Quasi-Randomized Control Trial (Quasi - RCT)

Type of participants: Women undergone elective or emergency cesarean delivery

Type of interventions: Trials with intervention of vaginal preparation with povidone-iodine solution no more than one hour before cesarean delivery performed

Type of outcome: Trials that report data and results related to rate of endometritis with intervention implemented compared to standard abdominal preparation without cleansing vagina
2.12 Exclusion Criteria: Limit was set for human randomized control trials only. Only 5 trials found to meet inclusion criteria. No study is excluded. No language restrictions are applied.

2.13 Searching Strategies:

A systematic search of evidence was conducted on three electronic databases - CINAHL and PubMed from March to August 2014. Identical keywords were used based on PICO components identified. Keywords include "vaginal preparation"; "vaginal cleansing"; "cesarean section"; "cesarean delivery"; "postcesarean"; "infectious morbidity"; "endometritis"; "surgical site infection"; "postoperative infection"; "postoperative endometritis"; "post-operative endometritis". To respect different editorial preference and common spelling usage of the word "cesarean", keywords "postcesarean"; "caesarean section"; caesarean delivery" and "postcaesarean" were included for the search.

2.14 Searching Results:

The literature-searching PRISMA flowchart is shown for searching details in Appendix 1. With combination of keywords, one article was identified from CINAHL,
and fifteen articles from PubMed. While applied limitation to human clinical trials and randomized controlled trials; with screening of titles, abstracts and restricted to full text articles, one article remained from CINAHL and five articles from PubMed. After eliminating the duplications, five eligible articles were retrieved eventually after inclusion and exclusion criteria were applied.

2.15 Appraisal Strategies:

In this study, five selected studies were selected for review. Findings were extracted and illustrated in table of evidence (Appendix 2). The table of evidence included study type, level of evidence, detailed patient characteristics, sample size, intervention and comparison, length of follow up, outcome measures and effect size.

The quality assessment was conducted by using the methodological checklist for randomized controlled trials designed by the Scottish Intercollegiate Guideline Network (SIGN) (2012) shown in Appendix 3.

The internal validity and overall assessment of the selected studies were reviewed. The level of evidence for studies were graded according to the quality assessment based on the SIGN grading system, key to evidence and grades of recommendations. Key to Evidence and Grades of Recommendations were shown in Appendix 4.
Further grading of the individual reviewed study are stated as "++" with high quality, "+" with acceptable bias and "-" with high risk of bias.

2.2 Results

Results of the study are reviewed and detailed information illustrated in quality assessment table in Appendix 5. Each included study would be appraised according the methodological checklist for randomized control trials, designed by SIGN as follow:

2.21 Study Design:

Four RCTs (Haas et al., 2010; Reid, Hartmann, Mcmahon & Rey, 2001; Starr et al., 2005; Yildirim et al., 2012) and one controlled trial (Asghania, Mirblouk, Shakiba & Faraji, 2011) were reviewed. All studies graded level one in level of evidence. One study (Yildirim et al., 2012) is graded "1++". Two studies (Haas et al., 2010; Starr et al., 2005) are graded "1+". Two studies (Asghania et al., 2011; Reid et al., 2001) are graded "1-".

2.22 Research Questions and Sample Size:

All studies stated clearly with a well-defined research question and clearly stated
study objectives. Sufficient sample sizes were determined by power calculation in four out of five reviewed studies ranged from 308 to 670. It is considered with 80% power to detect a 50% decrease in the incidence of postcesarean endometritis (Asghania et al., 2011; Reid et al., 2001; Starr et al., 2005; Yildirim et al., 2012). One study done by Haas and colleagues (2010) with 300-sample size stated that the sample size did not meet the target because of unexpectedly slow recruitment.

2.23 Method of Randomization:

All subjects are selected and allocated with randomization in four studies (Haas et al., 2010; Reid et al., 2001; Starr et al., 2005; Yildirim et al., 2012). Three studies (Haas et al., 2010; Reid et al., 2001; Yildirim et al., 2012) had computer-generated randomization process. One study conducted by Starr et al. (2005) performed a randomization control trial, using random digit table for the same purpose. One controlled trial was conducted without randomization (Asghania et al., 2011).

2.24 Allocation Concealment:

Four trials (Haas et al., 2010; Reid et al., 2001; Starr et al., 2005; Yildirim et al., 2012) demonstrated low risk of selection bias with good allocation concealment by using sequential numbered, opaque sealed envelopes.
A study conducted by Asghania et al. (2011) was shown to have high risk of selection bias since the samples were allocated by alternating sequence. Alternating sequencing as the allocation scheme means that the allocation is not concealed but is open to all.

2.25 Blinding:

Four trials (Asghania et al., 2011; Haas et al., 2010; Reid et al., 2001; Starr et al., 2005) blinded outcomes assessors and most of the studies had some mechanism for blinding with low risk of bias. One study (Asghania et al., 2011) demonstrated better blinding mechanism with a double blinding method to subjects and assessors. Yildirim et al. (2012) did not blinded subjects nor the researchers.

2.26 Characteristic of Participants:

Four studies (Haas et al., 2010; Reid et al., 2001; Starr et al., 2005; Yildirim et al., 2012) well stated similar subjects’ characteristics between intervention group and control group without significant differences.

One study of Asghania et al. (2011), large differences of subjects’ baseline characteristics observed which prone to high risk of bias with intervention group with more preterm, more meconium presence, more number of vaginal examinations,
longer duration of labor, longer duration of premature rupture of membrane and longer duration of cesarean delivery. The differences are statistically significant. Apart from investigating intervention difference between groups, with or without performing vaginal cleansing with povidone-iodine solution, these significant subjects difference in characteristics may potentially influence research finding of the study. All studies indicated the intervention given is the only difference between control and intervention groups except Reid et al. (2001) study, which is not clearly stated.

2.27 Interventions of Studies:

All five trials performed the same vaginal preparation intervention using 10% povidone-iodine solution prior to cesarean delivery. For the comparison and control group, all studies demonstrated the same standard abdominal preparation without performing preoperative vaginal cleansing with povidone-iodine.

2.28 Length of Case Follow-up:

All subjects were followed-up from 2 to 6 weeks after cesarean delivery in four reviewed studies (Asghania et al., 2011; Haas et al., 2010; Starr et al., 2005; Yildirim et al. 2012). Subjects had been followed up in 6 weeks after cesarean delivery in studies of Asghania et al. (2011) and Starr et al. (2005). Outcome assessors followed
up subjects and diagnosed subjects with endometritis at 4 weeks period in Haas et al. (2010). In Yildirim et al. (2012), patient are followed up at 2 weeks and in 6 weeks time after operation for diagnosis of endometritis. No significant bias found for the 5 studies reviewed. In the study conducted by of Reid et al. (2001), chart review for all subjects were conducted by 2 members of outcome assessors (physician) for 3 months after patient discharge to find evidence of endometritis diagnosed.

2.29 Reliability and Validity:

Reliability and validity of outcome measures are well covered in all reviewed studies. Three reviewed studies were found with high risk of selective reporting bias from excluding women with chorioamnionitis and some other reasons. A non-significant reduction in endometritis after cesarean delivery was found in study of Reid et al. (2001). In Reid et al. (2001), sixty-eight subjects are excluded after randomization for those who had chorioamnionitis. Starr et al. (2005) and Asghania et al. (2011) excluded women with chorioamnionitis before enrollment. Ninety-two subjects were excluded in study of Starr et al. (2005) from randomization due to reasons such as lost of envelopes; violation of inclusion criteria and patient chart not found.

Dropout rate of studies is low in 4 studies (Asghania et al., 2011; Haas et al., 2010;
Starr et al., 2005; Yildirim et al., 2012). Haas et al. (2010) stated zero dropout rate throughout the study.

### 2.30 Generalizability and Applicability:

Generalizability of the study findings are high in Haas et al. (2010) and Yildirim et al. (2012) which conducted at multiple hospitals. Three studies (Asghania et al., 2011; Reid et al., 2001; Starr et al., 2005) involved one study site.

To summarize the appraisal results, 3 studies (Haas et al., 2010; Starr et al., 2005; Yildirim et al., 2012) are high quality RCTs. One study (Asghania et al., 2011) reported some risk of potential bias, which is a control trial. The findings of these 4 studies, vaginal preparation with povidone-iodine reducing rate of post-cesarean endometritis, is applicable to the targeted patient group, women receive cesarean delivery. Although study done by Asghania et al. (2011) found to have high risk biases in randomization, concealment method and differences of subject characteristics, significant research findings can be applicable to women receive cesarean delivery.

For study of Rein et al. (2001), a RCT consisted of high-risk bias in selective reporting and attrition bias due to post-hoc exclusion of large group of
chorioamnionitis subjects. Sixty-eight participants diagnosed with chorioamnionitis, an antepartum infection which known to be a risk of postpartum infection were excluded from the study. These leaded to the result may not be applicable to the target group nor to answer the research question.

2.3 Summary and Synthesis

2.3.1 Primary Outcome:

Vaginal preparation with preoperative providone-iodine solution preoperatively can reduce the incidence of post-cesarean endometritis. Four trials (Asghania et al., 2011; Haas et al., 2010; Starr et al., 2005; Yildirim et al., 2012) found positive primary outcome with 1846 randomized subjects and found that vaginal preparation with providone-iodine solution reduce incidence of postnatal endometritis. The evidences are relatively consistent and applicable to clinical healthcare setting and to the present target group.

Three studies (Asghania et al., 2011; Starr et al., 2005; Yildirim et al., 2012) showed statistically significant results for primary outcome to decrease rate of endometritis with good effect size. Effect size is 36 cases in reduction of subjects developing endometritis between control and intervention group. Asghania et al. (2011) found 6
cases reduction of endometritis between groups (p = 0.03). Starr et al. (2005) found 14 cases reduction of women in endometritis with intervention performed (p = 0.045). Yildirim et al. (2012) showed positive primary outcome with effect size 16 in reduction of women with endometritis (p = 0.04). According to the result of these three studies, total 36 cases in reduction of women developing endometritis between control groups with 70 subjects (n=760) and intervention groups with 34 subjects (n=786). Haas et al. (2010) suggested the same finding but statistical non-significant with 4 effect size in reduction of women in endometritis between control group with 4 cases and intervention group with 1 case (p = 0.053).

Recent research done by Yildirim et al. (2012) suggested that a significant decrease in post-cesarean endometritis that performed povidone-iodine vaginal cleansing compared between control group. (6.9% vs 11.6%; Relative Risk = 1.69; 95% CI = 1.03-2.76). Further findings from the study of Yildirim et al. (2012) suggested that no statistically significant reduction in the rate of endometritis between intervention and control group of subgroup of women who were not in labor (9.2 vs 8.6%; RR=1.05; 95% CI=0.58-1.90). It is also suggested that no significant differences were found between intervention group and control group of subgroup of women who had ruptured membrane (9.6% vs 6.7%; RR=1.39; 95% CI = 0.78-2.47). Yildirim et al.
(2012) found that intervention is applicable to women who had amnion membrane rupture and for those who were in labor prior cesarean delivery.

Reid et al. (2001) stated different findings showing intervention group with povidone-iodine solution increase risk of developing endometritis. In subgroup of subjects who with no labor and had vaginal preparation, effect size with 7 cases more (increase 2.8%) between control and intervention group developed postpartum endometritis (p <0.13).

2.32 Secondary Outcomes:

Four studies (Asghania et al., 2011; Haas et al., 2010; Starr et al., 2005; Yildirim et al., 2012) investigated secondary outcomes including wound infection and febrile morbidity. All studies found insignificant finding for both wound infection and febrile morbidity can be reduced by vaginal preparation with povidone-iodine solution preoperatively for women receiving cesarean delivery.

Individual trial of Haas et al. (2010) included co-morbidities such as wound separation and seroma, hematoma or need for debridement. Outcome measure also extended to composite infectious morbidity with fever and sepsis or readmission to
hospital or wound complication. No significant findings were obtained from the results.

In study of Haas et al. (2010), wound separation, seroma and hematoma, or need for debridement were studied between control group and intervention group. Results showed insignificant reduction with 6 effect size between groups of women in developing the wound complications ($p = 0.17$).

Reid et al. (2001) focused in outcome measure of wound separation but not including other wound complications. It was found that there is reduction of percentage between control group and intervention group of women in developing wound separation is 2.9%. Relative Risk: 0.6 95% CI (0.3, 0.3). Results showed 18 cases in control group developed wound separation versus 12 cases of wound separation in intervention group who receive vaginal preparation of povidone-iodine solution preoperatively.

From systematically reviewed five RCTs, it is suggested that vaginal cleansing with povidone-iodine solution immediately before cesarean delivery reduces incidence of post-cesarean endometritis. The subgroup analysis done by Yildirim et al. (2012) suggested that post-cesarean endometritis is significantly reduced in subgroup of
women who had ruptured membrane and in labor prior to cesarean delivery.

Women who had ruptured membrane or in labor prior to cesarean delivery are the known risk factors for post-cesarean morbidity for instance surgical site infection, wound separation, endometritis, etc (Haas et al, 2014; Yildirim et al. 2012).

2.33 Synthesis of the evidence:

Three good quality studies (Haas et al., 2010; Starr et al., 2005; Yildirim et al., 2012) were reviewed and it is suggested consistent results showing vaginal preparation with povidone-iodine solution preoperatively reduces incidence of post-cesarean endometritis. One study (Yildirim et al., 2012) is graded "1++". Two studies (Haas et al., 2010; Starr et al., 2005) are graded "1+".

There is one study (Asghania et al., 2011) suggested the same positive result with "1-" level of evidence and the discussed potential bias. There is one contradictory finding from study of Rein et al. (2001) with "1-" level of evidence.

Study of Haas et al. (2010) does have limitations. Due to unexpected slow recruitment, total size of sample not reaching the optimal number. Sample size is 401 consisting 145 subjects in control group and 155 in intervention group. More than half subjects
with no labor (n = 204) and more than half with intact membrane without ruptured (n = 224) which contributed an additional limitation of the study. The limitations of the study introduced a potential bias which may influence findings might represent a certain populations but not generalizable to the target group. Effect size is -7 with reduction percentage of endometritis case by 5.2% between control group and intervention group. Although the reduction is not statistically significant (p=0.053), the result is consistent to the other present studies (Asghania et al., 2011; Starr et al., 2005; Yildirim et al., 2011). The result of this study is applicable to the target group.

Study of Starr et al. (2005) found similar positive result with effect size -14 and percentage in reduction 7.5% of endometritis case between groups (p=0.045). The findings of this particular study are applicable to the target group and to answer the present research question. Some limitation from the study including potential selective reporting bias observed. 23% subjects are excluded from the randomization process with no outcome data for the excluded. Excluded subjects belonged to 54 from intervention group and 38 from control group. It introduced a potential bias and impact of the findings is unclear. Subjects with chorioamnionitis were excluded from the study, which introduce another potential bias to the study.
Asghania et al. (2011) found the similar result with effect size decrease in 6 with reduction percentage 2.1% compared between groups (p = 0.03). Level of evidence is not the highest due to the study design and some potential bias observed. The study is a quasi-RCT design without performing adequate randomization. Large differences observed with many significant variables between groups. Although logistic regression model used to control the effect of the confounding variables and it is reported vaginal preparation was the only independent factor affecting primary outcome within the model, it is subjected with potential bias and that influence the study finding is not the highest level of evidence (1-). The result can be applicable to the target group but with some potential bias.

Reid et al. (2001) excluded women undergoing emergency cesarean delivery and for those with chorioamnionitis. 68 subjects are excluded with chorioamnionitis. An incomplete outcome measure and potential high risk of bias observed. It suggests a questionable finding of the results of the study. The study finding is not applicable to answer the present research question and to apply to our target group.

Recent study done by Yildirim et al. (2012) included subjects with ruptured membrane and for those in labor. The study did not exclude women with
chorioamnionitis. Intervention group and control group with similar risk factors to the increase post-cesarean endometritis representing a high level of evidence of the study finding. With the highest level of evidence, low risk of bias and the significant positive findings of the study (p = 0.04), effect size with reduction of 16 cases (4.7%) between intervention and control group, the finding is applicable to the target group. Study of Yildirim suggested and narrowed down the research finding to the particular subgroup of women. With a more significant results finding for the subgroup with ruptured membrane (p = 0.03) and for those were in labor (p = 0.03) It was strongly suggested to perform vaginal preparation to women who are with ruptured membrane and for those are in labor.

2.4 Implications for practice

Appraising and evaluating the evidences from the five RCTs concluded that vaginal preparation with povidone-iodine solution preoperatively can reduces incidence of post-cesarean endometritis. The incidence of post-cesarean endometritis can be significantly decreased for those women who were scrubbed with both standard abdominal skin preparation and proposed new practice with povidone-iodine vaginal preparation, compared to those who received only standard abdominal preparation. Vaginal preparation can reduce the occurrence of post-cesarean endometritis. It is
particularly applicable for post-cesarean women who had ruptured membranes and for those who were in labor.

Risk of getting post-cesarean morbidity such as endometritis by implementing a relatively inexpensive and feasible intervention, vaginal cleansing with povidone-iodine solution can be reduced. The invention is relatively safe without adverse effect. No adverse events were reported from reviewed 5 trials. Patient safety can be enhanced by reducing the adverse effect of post-cesarean endometritis. Women who undergone cesarean delivery can be beneficial by reduced risk of getting endometritis from the proper intervention of vaginal cleansing. Endometritis rate can be diminished leading to decrease length of stay and decrease necessity of intense nursing care. Relieving medical burden and better allocation of medical resources can be done for improve healthcare system.

Worldwide healthcare providers not limited to those in Hong Kong should consider to perform this inexpensive and relatively simple intervention with preoperative vaginal cleansing by using povidone-iodine antiseptic solution before undergoing cesarean delivery especially for women who had ruptured membrane and for those for were in labor.
Chapter 3: Implementation Potential and Clinical Guideline

After reviewing the evidence available from the five studies, it was concluded that vaginal preparation with povidone-iodine solution pre-operatively could reduce incidence of post-cesarean endometritis. The incidence of post-cesarean endometritis was significantly decreased for women who were scrubbed with both standard abdominal skin preparation and with povidone-iodine vaginal preparation (Yildirim et al., 2012; Haas et al., 2010; Starr et al., 2005; Asghania et al., 2011).

3.1 Implementation Potential

An evidence based guideline of proper pre-operative vaginal preparation for cesarean women will be established and discussed. Before guideline implementation, implementation potential of the guideline will be accessed with reference to evaluation checklist of Polit & Beck (2004) including target audience, target setting, transferability of the findings, feasibility and cost-benefit ratio of the innovation.

3.11 Target Audience:

The target audiences are women who are undergoing elective or emergency cesarean delivery. Regardless of elective or emergency cesarean delivery, povidone iodine vaginal preparation would do benefit and decrease post-cesarean women from getting
endometritis. (Yildirim et al., 2012)

3.12 Target Setting:

The target local setting is the sub-acute private hospital in Hong Kong with around 120 beds and 10 beds for obstetric patients. The total number of cesarean delivery yearly is approximately 270 cases. There are four operating rooms. Total nursing staff is around 250. In the local hospital there are one in-house obstetric surgeon and 62 active visiting obstetric surgeons.

3.13 Transferability of the Findings:

According to the evaluation checklist designed by Polit & Beck (2004), four criteria should be considered and determined for evaluating the transferability of the findings. Firstly, the target populations of the reviewed studies and target setting should be similar for implementation. Secondly, the aim and objectives of the proposed innovation and guideline are similar to the philosophy of care for women receiving cesarean delivery. Thirdly, the proposed innovation would be benefiting sufficient number of patients and clients. Moreover, the period for proposed innovation implementation and evaluation is appropriate and reasonable to the proposed timeframe.
Table 1: Characteristics of target population in the reviewed studies and the target setting

<table>
<thead>
<tr>
<th>Characteristics of target population</th>
<th>Reviewed Studies</th>
<th>Target Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>Mean age ranged from 26.7 to 28.8 years old</td>
<td>Mean age of clients: 30 years old (Obstetrics ward in local setting)</td>
</tr>
<tr>
<td><strong>Elective or Emergency cesarean</strong></td>
<td>Including elective and emergency cesarean delivery</td>
<td>Including elective and emergency cesarean delivery</td>
</tr>
<tr>
<td><strong>Rupture of amnion membrane</strong></td>
<td>Including women who had ruptured amnion membrane before cesarean delivery and those did not</td>
<td>Including women who had ruptured amnion membrane before cesarean delivery and those did not</td>
</tr>
<tr>
<td><strong>In labor or not in labor</strong></td>
<td>Including women who are in labor and not in labor</td>
<td>Including women who are in labor and not in labor</td>
</tr>
</tbody>
</table>

3.14 Homogeneity of target population and setting:

The demographic comparison (Table 1) of the reviewed studies and the target setting
are similar. Age group of the five reviewed studies is similar to the target setting. Mean age of the reviewed studies ranged from 26.7 to 28.8 years old. The mean age of the target setting for the obstetric ward, is 30 years old. The reviewed studies involved cesarean women who are in labor and those who are not in labor. Innovation would be promoted to the same population involve women who are in labor and who are not. Both setting of reviewed studies and target setting involved cesarean women who had ruptured amnion membrane and also included for those did not. In the reviewed studies, Yildirim et al. (2012) and Haas et al. (2010) included elective and emergency cesarean delivery cases. While Asghania et al. (2011), Starr et al. (2005) and Reid et al. (2001) included only elective cesarean delivery. In the target setting which is a sub-acute hospital, proposed innovation would be applied to elective and also emergency cesarean deliveries.

3.15 Philosophy of care:

Both settings of reviewed studies and the target setting share the similar principles and philosophies of care, both aiming to provide a high quality and excellent healthcare services to the clients and patients. The mission of the target setting is to provide premier ethical, safe and quality healthcare services to clients and patients. Therefore, infection control measures are one of our priorities of care, it is obligated to prevent
cesarean women from nosocomial infection such as surgical site infection and more specifically, related to the proposed innovation for reducing incidence of endometritis.

3.16 Number of patients benefiting from the innovation:

According to the statistical record of the target setting, total number of cesarean delivery including elective and emergency deliveries are 270 in 2014. They were all at risk of nosocomial infection such as surgical site infection or endometritis after cesarean delivery. The number of people that would be potentially benefited from the proposed innovation is sufficient to support implementation and evaluation.

3.17 Duration of implementation and evaluation:

It is planned to implement and evaluate the innovation with preoperative povidone-iodine vaginal preparation for cesarean women in a one-year period. It is reasonable and considered as sufficient for implementation and evaluation of the proposed innovation. According to the set timeframe (Table 2), first 2 months would be provided for briefing and explanation of proposed innovation and guideline to the administration and in various committee meetings.
For any proposed guideline related to infection control and change of practice for operation, it is required to seek approval through Infection Control Committee, Surgical Committee and Administrative Council.

The third and fourth months would be spent for training and education to related department heads and staff of operating room and obstetric ward. Subsequent training and education would also be done for the obstetrics surgeons mainly involve one in-house obstetrician and other 62 active visiting obstetric surgeons.

A pilot study and innovation trial would be performed in the fifth and sixth months. And the remaining half-year period would be utilized for implementation and continuous evaluation for the proposed innovation and guideline.
Table 2: Timeline for the preparation, implementation and evaluation of proposed guideline

<table>
<thead>
<tr>
<th>No. of month</th>
<th>Briefing to administration and in various committee meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Training and Education to related departments heads, staff and doctors</td>
</tr>
<tr>
<td>2</td>
<td>Pilot study in operating room and obstetric ward</td>
</tr>
<tr>
<td>5</td>
<td>Implementation and continuous evaluation of proposed guideline</td>
</tr>
</tbody>
</table>

3.18 Feasibility:

In order to effectively promote, implement and evaluate the proposed innovation and guideline, the support from administration level and getting consensus through various committees are very important. Through explanation of innovation and guideline, training and education would bring more understanding to departmental level, frontline and doctors. Evaluation would be done as one mean to review feasibility of the proposed innovation and guideline.
3.2 Proposed change in the evidence-based innovation

The proposed innovation will change current practice from not only applying skin preparation to incision line for cesarean delivery women but also applying povidone-iodine vaginal preparation for 30 seconds immediately before operation. The vaginal preparation is around 30 seconds, which will be done before skin preparation. Therefore, time consumed for this additional step is minimal. Also, there is no requirement for changing the routine supine position for operating cesarean delivery due to addition of vaginal preparation. No extra equipment is needed. Moreover, only few more gauzes will be needed for vaginal preparation. The same person performing skin preparation to the incision site of the cesarean women would perform vaginal preparation, so no extra manpower is needed. In terms of the degree of practice change is minimal, it is feasible to perform the proposed innovation.

3.21 Administrative level support:

Getting administrative members support is always the first step and ultimate step to success. It is important to seek formal approval and leadership from the administrative members for implementing a new practice and proposed guideline. Major involvement of administration members consists of Vice President of Medical Affairs (VPMA), Chief of Medical Staff (COMS), Director of Nursing (DON), Clinical
Change of practice and guideline establishment is more effective from top-down than that from bottom-up approach. A proposed guideline would be drafted by infection control nurse and to explain and brief to administration level and proposed for approval. Procedures involved briefing, discussion and approval of the new proposed guideline through various committee meetings. Committee members and invitees would sit together to discuss the possible issue raised related to the proposed guideline and vote for approval.

3.22 Consensus from various committees:

Briefing, discussion and approval through various committee meeting for the proposed innovation and guideline are required for introduction of new practice and hospital wide infection control guideline. Committees involved Infection Control committee, Surgical Committee, Nursing Operation Committee and the highest level of administration committee meeting - Administrative Council. Key members involved VPMA, COMS, DON, Chairmen of Infection Control Committee and Surgical Committee, Infection Control Nurse, Directors of Pharmacy and Laboratory
Department. In Administrative Council, involvement of Chief of executive officer and Chief of operation officer and the rest of hospital vice president.

Key visiting obstetricians who are actively visiting the hospital would be invited as invitees of the Surgical Committee Meeting. By joining the meeting, they would understand more about the innovation and proposed guideline.

Discussion and approval sequence would be done firstly through Infection Control Committee, and to the Surgical Committee and Nursing Operation Committee respectively. Finally senior management team and hospital administrative members would discuss and vote for approval of the new proposed guideline.

3.23 Departmental support:

The target setting had adopted the culture of evidence-based practice with infection control committee and surgical committee for review, establish and evaluate policies, protocols and guidelines. Most of the nurses in operating room and obstetric ward are bachelor or master degree holders. They are capable of reviewing and understanding the new evidence-based innovation and proposed guidelines. Through comprehensive training and education taught by Infection Control Nurse, proposed innovation and guideline can be implemented smoothly.
All staff is responsible and accountable for taking initiatives to minimize the risk of patient from getting nosocomial infection. Infection prevention and control is everyone's business. Infection control link nurses and persons are responsible to promote the proposed innovation and guideline within their departments through monthly departmental meeting. Particularly for link nurse from operating room and obstetric ward would help for disseminate the message. Apart from the "link nurse" and "link nurse" promotion and information dissemination. Nursing Department Heads are responsible to facilitate the promotion and proposed agenda to discuss the new proposed guideline through their own monthly departmental meetings.

3.24 Potential friction among doctors and staff:

Some degree of potential friction due to misunderstanding will be foreseen among visiting doctors and nursing staff. A certain number of doctors and staff may disagree and challenge the proposed innovation even for the new available evidence. In the various committee meetings, key obstetricians and administration members such as VPMA, COMS and Clinical Director of Obstetrics and Gynaecology are involved and invited to join the meeting for discussion, that is why seeking administration support, explanation, discussion and guideline approval through various committee meetings are so important.
To avoid possible misunderstanding, a notification letter and new approved guideline would be sent from Chairman of Infection Control Committee to all staff and all in-house doctors, visiting doctors. Infection Control Nurse would provide training and education sessions to in-house and visiting doctors, and nursing staff.

### 3.3 Cost-benefit ratio of innovation

#### 3.31 Material Cost:

The cost-benefit ratio of the innovation affected the implementation potential.

According to Gilson, Kephart, Izquierdo, Joffe, Qualls & Curet (1996), treatment of endometritis in post-cesarean women is the chief reason for extended length of stay for patients who have cesarean delivery and contributes the most to the total patient costs. Costs for the infected and non-infected patients were US$6164 and US$3828 in 1996. As suggested by several studies, post-caesarean infection rates range from 7 to 20% leading to delay in recovery and prolonged hospitalization (Wilkinson & Enkin, 2008; Anorlu et al, 2008; Gungorduk et al., 2009).

The basic information of the target setting and the estimated cost of infected post-cesarean women are summarized in Table 3. The cost of infected patients with endometritis estimated $22,604. The extra cost for infected post-cesarean patient per
year is $462,456.

Table 3: Basic information of the target setting

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of nursing staff in the target setting including operating</td>
<td>50</td>
</tr>
<tr>
<td>room and obstetric ward</td>
<td></td>
</tr>
<tr>
<td>Total number of target patients/clients admitted to target setting yearly</td>
<td>270</td>
</tr>
<tr>
<td>Estimated rate of endometritis of target setting based on available</td>
<td>~20%</td>
</tr>
<tr>
<td>evidence (Wilkinson &amp; Enkin, 2008; Anorlu et al. 2008; Gungorduk et al.</td>
<td></td>
</tr>
<tr>
<td>2009))</td>
<td></td>
</tr>
<tr>
<td>Estimated number of endometritis case of target setting</td>
<td>270 x 20% = 54</td>
</tr>
<tr>
<td>Average unit cost per day of hospital stay based on record of target</td>
<td>$4,680</td>
</tr>
<tr>
<td>setting</td>
<td></td>
</tr>
<tr>
<td>Average cost per admission for cesarean delivery of the target setting =</td>
<td>$4680 x 3 = $14,040</td>
</tr>
<tr>
<td>unit cost per hospital stay x 3 days</td>
<td></td>
</tr>
<tr>
<td>Cost for the infected post-cesarean patients = 1.61 x</td>
<td>$14040 x 1.61 = $22,604</td>
</tr>
<tr>
<td>Cost for the non-infected post-cesarean patients</td>
<td></td>
</tr>
</tbody>
</table>
(Gilson et al. 1996)

| Extra cost for infected post-cesarean patients compared to the non-infected | $8,564 |
| Extra cost for infected post-cesarean patients per year | $8564 \times 54 = $462,456 |

Material cost has to be considered when determining cost-benefit ratio before implementing the proposed innovation. Materials cost estimated and summarized in Table 4. Cost included mainly for manpower cost of the trainer and the trainees, which costs $9,636 per year. Another cost is the manpower utilized for training and education PowerPoint production that is $454. Total material cost is $10,150.

**Table 4: Annual material cost estimated for implementation of the proposed innovation**

<table>
<thead>
<tr>
<th>Resources required</th>
<th>Annual cost</th>
</tr>
</thead>
</table>
| Nursing training and education | Infection Control Nurse: $227/hour x 5 hour = $1,136  
Nursing staff: $170/hour x 1 hour x 50 staff = $8,500 |
Medical staff (Obstetrician): $0 spending own time
Total manpower cost: $1,136 + $8,500 = $9,636

Training and Education

**PowerPoint preparation by**

Infection Control Nurse: $227/hour x 2 hour = $454

**Total material cost**

$10,150

Annual expenses saved after implementation of the proposed innovation and guideline is illustrated onto Table 5. The annual expenses saving after innovation implementation is estimated $452,306.

<table>
<thead>
<tr>
<th>Annual expenses saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra cost for infected post-cesarean patients per year - Total material cost</td>
</tr>
<tr>
<td>$462,456 - $10150 = $452,306</td>
</tr>
</tbody>
</table>

**Table 5: Annual expenses saved after implementation of the proposed innovation**

3.32 Non-material cost and benefit:

Non-material cost and benefit should also be considered during striking a balance the
pros and cons for implementing the proposed innovation. Staff morale, multidisciplinary relationship among organization, continuous quality improvement culture among organization can be improved during preparation, implementation and evaluation of the proposed innovation.

The target setting shared to the similar population and setting with the reviewed studies. The proposed innovation is entrenched with the common philosophy of care between the reviewed studies and the target setting. The planned timeline is sufficient and reasonable for the proposed innovation and guideline implementation and evaluation.

The innovation is feasible, cost-beneficial and transferable, in order to provide higher quality of healthcare service to patient and client by preventing post-cesarean women getting infection like endometritis.

### 3.4 Developing a EBP Guideline

After reviewing the implementation potential of the proposed innovation and guideline, it was concluded that the development of an evidence-based guideline (EBP) on proper vaginal preparation immediately prior cesarean delivery is feasible,
cost-beneficial and transferable.

The EBP guideline was written to provide guidance and recommendations to surgeon and nursing team. The recommendations and rationales were synthesized and integrated from current state of evidence. The level of evidence and grading of recommendation were rated according to SIGN (2012), key to evidence statements and grades of recommendations (Appendix 4).
3.41 Evidence-based practice guideline:

| Evidence Based Guideline on Proper Vaginal Preparation |
| immediately prior cesarean delivery                 |

**Intended Users:**
The guideline is intended to provide guidance and recommendations to surgeon and nursing team for proper vaginal preparation to women undergoing cesarean delivery.

**Aims:**
The guideline aims to provide evidence-based recommendations for reduction of incidence of endometritis of post-cesarean delivery by performing vaginal preparation immediately prior cesarean delivery.

**Objectives:**
1. Formulate clinical practice instructions and recommendations for implementing the proper vaginal preparation for cesarean women.
2. Summarize strategies to perform proper vaginal preparation immediately prior cesarean delivery.
3. To increase awareness and understanding of importance of proper vaginal preparation for preventing endometritis in post-cesarean women.
4. To prevent and reduce the incidence of post-endometritis of cesarean women.

**Target Group:**
The target population consists of adult pregnant women who aged 18 or able to complete informed consent by herself.

**Overview of Interventions:**
The use of proper vaginal preparation with povidone-iodine solution immediately prior cesarean delivery to reduce post-cesarean endometritis in postnatal women.
Recommendation 1:

Standard abdominal preparation conjunction with vaginal preparation prior cesarean delivery should be performed for all women undergoing elective/emergency cesarean delivery. [Grade A]

Rationale:

- Vaginal preparation with povidone-iodine solution prior cesarean delivery reduces the risk of postoperative endometritis (Haas et al., 2014) [1++] ; (Haas et al., 2010) [1+] ; (Starr et al., 2005) [1+] ; (Asghania et al., 2011) [1-].

Recommendation 2:

Standard abdominal preparation conjunction with vaginal preparation prior cesarean delivery must be performed particularly for women undergoing elective/emergency cesarean delivery with ruptured membranes. [Grade A]

Rationale:

- The benefit of vaginal preparation reducing incidence of post-cesarean endometritis
is particularly realized for women undergoing cesarean delivery with ruptured amnion membrane (Haas et al., 2014) [1++]; (Yildirim et al., 2012) [1++].

Recommendation 3:

Standard abdominal preparation conjunction with vaginal preparation prior cesarean delivery must be performed particularly for women undergoing elective/emergency cesarean delivery who were in labor. [Grade A]

Rationale:

- The benefit of vaginal preparation reducing incidence of post-cesarean endometritis is particularly realized for women undergoing cesarean delivery who were in labor (Yildirim et al., 2012) [1++].

Recommendation 4:

Vaginal preparation should be performed with 10% aqueous povidone-iodine antiseptic solution. [Grade A]
Rationale:

- Benefit of aqueous iodophor vaginal preparation as compared to no vaginal preparation in cesarean section (Haas et al., 2014) [1++] ; (Yildirim et al., 2012) [1++] ; (Haas et al., 2010) [1+] ; (Starr et al., 2005) [1+] ; (Asghania et al., 2011) [1-].

- Aqueous iodine/iodophors kill micro-organisms including gram-positive and gram-negative bacteria, fungi and virus (Larson E., 1988) [1++]

Recommendation 5:

Standard abdominal preparation conjunction with vaginal preparation should be performed immediately prior cesarean delivery in operating room. [Grade A]

Rationale:

- Vaginal preparation with povidone-iodine solution immediately before cesarean delivery reduces the risk of postoperative endometritis (Haas et al., 2014) [1++] ; (Yildirim et al., 2012) [1++] ; (Haas et al., 2010) [1+] ; (Starr et al., 2005) [1+] ; (Asghania et al., 2011) [1-].

Recommendation 6:

Vaginal preparation should be performed with two to three sponges stick soaked with
10% aqueous povidone-iodine solution. Scrubbing encompassed anterior, posterior and lateral walls including all fornices by rotation of 360 degree for approximately 30 seconds. [Grade A]

Rationale:

Two to three pre-packed with povidone-iodine solution were inserted into the vagina and rotated 360 degree in the vaginal cavity for approximately 30 seconds. (Yildirim et al., 2012) [1++]; (Starr et al., 2005) [1+] ; (Asghania et al., 2011) [1-].
Chapter 4: Implementation Plan

In D1 and D2 it was concluded that the implementation of an evidence-based guideline for reducing post-cesarean endometritis was highly feasible, cost beneficial and transferable. In a bid to achieve the proposed innovation, a comprehensive implementation and evaluation plans are developed and illustrated before implementation of the innovation in the target setting.

4.1 Communication Plan

Performing good communication with related stakeholders can facilitate effective implementation of proposed innovation. Good communication allows sufficient input and sharing from stakeholders, to promote the sense of belongings and to get them involved as a team for long-term implementation.

In a bid to disseminate and promote the proposed innovation and contents of the evidence-based practice (EBP) guideline to all stakeholders and potential users in the hospital, a comprehensive communication plan should be developed.

4.11 Identification of stakeholders:

Related stakeholders of the proposed EBP guideline includes hospital administrators,
in house and visiting obstetricians, Administrative Council members, Infection
Control Committee members, Surgical Committee members, Nursing Operation
Meeting members, Infection Control link nurses, nursing department managers and
frontline staff.

To effectively implement and to have a long-term sustainability, a top-down
organizational support is crucial (Polit & Beck, 2012). Majority of hospital
administrators are involved in the implementation and communication plans. The
hospital administrators included Vice President of Medical Affairs (VPMA), Chief of
Medical Staff (COMS), Director of Nursing (DON), Clinical Director of Obstetrics
and Gynaecology, and Chairmen of Infection Control Committee and Surgical
Committee. Sixty-three of the hospital in house obstetrician and visiting obstetricians
were included in the communication plan as well. Laboratory Director, Pharmacy
Director and representatives of obstetrician and anaesthesiologist are included in the
mentioned committees. Ward Manager, Advance Practice Nurse (APN) and frontline
staff of operating room and obstetric ward were included in the communication plan.
Table 6: Timeline for the preparation, implementation and evaluation of proposed guideline

Table 7: Timeline for communication plan of the innovation
4.12 Communication process and initiation of change:

A top-down approach, administrative to frontline, was used as mentioned. The communication process were conducted in 16 weeks guided by the timeline illustrated in Table 7.

Current evidence, necessity of change, significance of post-cesarean endometritis, cost benefit and transferability of the new proposed guideline will be discussed and communicated with all stakeholders and frontline staff through briefing sessions and individual meetings.

Communication with Infection Control Nurse and administrators will be performed in the first week of communication plan. With support of the administrators, communication and approval of the new proposed guideline will be gone through in various committees including the highest level of administration committee called Administrative Council, Infection control Committee and Surgical Committee. Key visiting obstetricians who are actively visiting the hospital would be invited as invitees of the Surgical Committee Meeting. By gathering majority obstetricians including the Clinical Director of Obstetrics and Gynaecology and the frequently visiting obstetricians, fruitful discussion and more understanding of the proposed EBP
guideline can be achieved.

By official approval process of the new proposed guideline from administrators and various committees, further discussion with nursing department and related stakeholders will be performed. Discussion will then be brought to nursing operation meeting, which included all nursing unit managers. Discussion and approval process of the proposed guideline were to be achieved in the next 3 weeks.

After gaining departmental support from all nursing leaders and Advance Practice Nurse, individual meeting will be held with operating room manager and obstetric unit manager by a week. By these individual meeting, detailed implementation plan and potential obstacles will be discussed. Suggestions and feedbacks gained from the meeting can be benefited to polish the plan for more effective implementation. The following week Infection Control Link Nurse from different nursing departments will then be called for meeting to discuss and communicate with the new proposed guideline. Link nurses can facilitate the implementation process. They can act as advocate to promote and further disseminate the correct message of the new proposed EBP guideline.
Communication with frontline staff were to be conducted in the next 2 weeks. An in-service education talk will be held for disseminating the new innovation to initiate the change. The target audience of the talk are the frontline staff including APN, nurses of obstetric unit and operating room, and technician of operating room. Since discussions have been conducted with APNs, they can facilitate the sharing session and discussion during the talk and help for implementation. Since not all staff can be able to join the talk, a few more sessions will be held on-site in obstetric unit and operating room to disseminate the same to the rest of the staff.

Question and answer sessions will be scheduled right after the in-service education and sharing sessions which allow sufficient clarification and enquiries. The following 7 weeks will be provided sufficient communication with obstetricians and anesthesiologist on-site in obstetric unit and operating room. The Infection Control Nurse will perform the education talk and sharing sessions by meeting individually with the doctors. By prioritizing convenience of doctors, size of the meeting are planned to be set with small group of doctors or one individual.

The final week will be utilized to consolidate all the feedbacks and comments for further improvement of the new proposed guideline implementation. Evaluation forms
will be distributed to all participants in every talk and sharing sessions in order to
gather feedback and comments for further improvement and planning.

4.13 Sustaining the change process:

After initiating and guiding the change process of the new proposed guideline, it is
essential to plan and to ensure the change process can be sustained with no revert. The
top down support and facilitation also played a key role for sustainability of the new
proposed guideline.

A full understanding of rationale and our vision promoting patient safety are
important for sustaining the change process. Sufficient discussion and opportunities
for enquiries help for thorough understanding of the new evidence-based innovation.

Concerns and difficulties from frontline staff and doctors also can be addressed.

Resistance is common during change process. Adequate communication providing
evidence-based rationale to the frontline staff and doctors shall be performed in order
to minimize misunderstanding and resistance due to knowledge deficit.
4.2 Pilot test

After communication process initiated in the first 4 months, a pilot test will be conducted in the following 2 months time (Table 6).

A pilot test is an important fundamental phase of the research process. The purpose of conducting a pilot test is to examine the feasibility of an approach that is to be used in a larger scale practice. The result of a pilot study can inform feasibility and identify modifications needed for new proposed innovation implementation (Leon, Davis & Kraemer, 2010).

4.21 Study design, sample size and sampling strategies:

The pilot test will be performed in operating room and obstetric ward in the target setting, a sub-acute hospital. Based on the admission record of the target setting, the average operation of cesarean section is 30 per month. The target sample size of the pilot test is set to be 60. The pilot test is to be done in 2 months. All clients will be recruited to the pilot test for convenient recruiting.

4.22 Primary and Secondary measures of the pilot test:

1. The compliance of staff and doctors to new proposed guideline will be accessed.
2. The acceptability of staffs and doctors will also be evaluated.

4.23 Methodology for compliance audit:

The infection control nurse will review medical record of clients within the pilot test period. Pre-surgical skin preparation will be reviewed and evaluated for compliance audit. Pre-surgical abdominal skin preparation and povidone-iodine vaginal preparation provided to the cesarean women indicate compliance to the guideline. While no povidone-iodine vaginal preparation was done pre-operatively indicating non-compliance.

4.24 Compliance and acceptability of the new proposed guideline:

The compliance and acceptability of staff and doctors will be evaluated monthly. Results will be disseminated through monthly unit meeting in operating room and obstetric ward. Compliance rate of surgeons, frontline staff including nurses and operating room technician will be evaluated. In case of low compliance rate, route cause will be assessed and feed backed to departmental meeting. Low compliance rate might imply low acceptance of the new proposed guideline. Follow-up strategies and meeting with personnel will be held to promote guideline compliance and acceptance.
4.3 Evaluation plan

The evaluation plan was setup to determine if the proposed guideline was effectively implemented in the target setting. A good designed evaluation can conclude the effectiveness, feasibility and acceptability of the proposed guideline. Intervention outcomes, the nature of clients, sample size, and data collection and data analysis will be discussed.

4.31 Outcome identification:

Patient outcome

Reducing post-cesarean endometritis in postnatal women in the target setting is the major clinical outcome of the proposed guideline introducing pre-operative vaginal preparation with povidone-iodine. Medical follow up will be scheduled for post-cesarean women after 4-6 weeks undergone cesarean delivery. At the same time physician will diagnose endometritis if that is a case. The Infection Control Nurse will review all medical records for post-cesarean women 6 weeks after operation. Incidence of post-cesarean endometritis will be reviewed, monitored and recorded.

Healthcare provider outcome

Compliance rate of the pre-operative vaginal preparation with povidone-iodine for
cesarean women will be evaluated. Compliance rate of the intervention may imply the acceptance of the proposed guideline and reflect effectiveness of the implementation. During medical record review, pre-operative skin preparation, vaginal preparation and compliance rate of the new proposed innovation will be recorded.

**System outcome**

The estimated cost benefit ratio of the innovation was discussed in D2. During evaluation phase, the actual cost benefit ratio will be determined and reported at the end year after 6 months implementation (Table 6). The result can reflect the sustainability of implementation. It is also an important concern to be reported to administrators and various committees.

**4.32 Design and Nature of participants involved:**

All cesarean women operated during the implementation phase will be evaluated for endometritis and implementation compliance. The evaluation will be conducted with 6 months data from implementation phase (Table 6). Retrospective medical record review will be done by Infection Control Nurse for those cesarean delivery performed in the 6 months period before implementation. Average incidence of endometritis can then be determined with pre and post-implementation comparison. Outcome of
cesarean women with or without vaginal preparation with povidone-iodine can be compared.

4.33 Sample Size:

The sample size affects the statistical power. Test for one proportion will be used to evaluate primary outcome. A computer software developed by Lenth (2006), Piface, was utilized for sample size calculation for the evaluation study. The level of significance was 0.05, the power was 80% and the confidence interval was set at 95%. A sample size of 194 is calculated in order to achieve the statistical power.

According to the admission record in the targeting setting, average 30 cesarean deliveries were performed per month. In order to achieve the sample size calculated to achieve the statistical power, 194 cesarean women will be reviewed in approximate 6 months period. Primary outcome will be evaluated whether they were diagnosed with post-cesarean endometritis during medical follow-up.

4.34 Data collection:

The Infection Control Nurse should review all medical records after 6 weeks of post-cesarean women undergone operation. Primary outcome the incidence of
endometritis and compliance rate of innovation implementation will be assessed through medical record review.

**4.35 Data analysis:**

Data will be analyzed by Chi-square test in a bid to determine and evaluate whether the implemented innovation significantly reducing post-cesarean endometritis. Compliance rate of the innovation will be determined healthcare worker acceptance and compliance for providing vaginal preparation to cesarean women.

**4.4 Basis for implementation**

The result of the primary outcome and compliance of innovation and guideline will be discussed and disseminate through departmental meeting in obstetric ward and operating room 3 months later after implementation. The preliminary result after 3 months time will also be discussed in various committees. After 6 months implementation, the final result will be compared with pre-implementation data to review the effectiveness of the guideline in the target setting. More than 90% compliance rate of guideline compliance was expected and aimed to be achieving a effective implementation and patient safety.
In case of unsatisfactory result for instance, higher endometritis incidence or low compliance rate suggest a need for an ad-hoc infection control committee meeting to discuss further strategies.

**4.5 Conclusion:**

From reviewing the current research findings, the reduction of incidence of endometritis by vaginal preparation with povidone-iodine can up to 2.1% to 7.5% compared to those without vaginal preparation. (Yildirim et al., 2012; Haas et al., 2010; Starr et al., 2005; Asghania et al., 2011). From the systematic review of current evidence for the new proposed innovation, and with the guideline setup with high feasibility, cost beneficial and transferability, it is aimed to improve patient safety by effective implementation.
Appendices

Appendix 1: Literature Searching flowchart for identification of studies

Searching by keywords:
1. Vaginal preparation OR vaginal cleansing
2. Cesarean section OR cesarean delivery OR postcecarean OR caesarean section OR caesarean delivery OR postcaecarean
3. Infectious morbidity OR endometritis OR surgical site infection OR postoperative infection OR postoperative endometritis OR post-operative infection OR post-operative endometritis

CINAHL

PubMed

Individual keyword search

CINAHL
1. 25 articles
2. 12503 articles
3. 2199 articles

PubMed
1. 1388 articles
2. 53022 articles
3. 369749 articles

Searching keywords "1." AND "2." AND "3."

CINAHL
1 article

PubMed
15 articles

Limit to human, clinical trials, randomized controlled trials

Reviewed by titles, abstracts, full papers and reference lists

CINAHL
1 article

PubMed
5 articles

Total articles for review after elimination of duplication: 5 articles
Selection of Studies:

1. *Yildirim et al.* (2012)


The American College of Obstetricians and Gynecologists. Lippincott

5. Reid et al. (2001)

## Appendix 2: Table of Evidence of reviewed articles

<table>
<thead>
<tr>
<th>Bibliographic citation</th>
<th>Study Type &amp; Level of Evidence</th>
<th>Patient Characteristics</th>
<th>Intervention(s)</th>
<th>Comparison</th>
<th>Length of follow up</th>
<th>Outcome Measures</th>
<th>Effect Size (ES)</th>
<th>CG vs IG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yildirim et al., 2012</td>
<td>RCT (1++)</td>
<td>Women undergo elective or emergency cesarean delivery with gestational age greater than 38 weeks</td>
<td>2 pre-packed foam sponges that contained povidone-iodine solution. Both sponges were inserted into the vagina and rotated 360 degree for ~30 seconds (n=336)</td>
<td>Standard abdominal preparation without vaginal preparation</td>
<td>Follow up at 2 weeks and 6 weeks after operation</td>
<td>Primary outcome: 1. <strong>Postpartum endometritis</strong></td>
<td>Overall infectious morbidity 1. CG:39 (11.6%); IG:23 (6.9%); ES: -16, Reduction % = 4.7%, <em>P = 0.04</em> RR=1.69 95% CI (1.03-2.76) 2. CG:9 (2.7%); IG:6 (1.8%); ES: -3, Reduction % = 0.9%, <em>P = 0.60 RR=1.49</em> 95% CI (0.53-4.15) 3. CG:61 (18.2%); IG:55 (16.5%); ES: -6, Reduction % = 1.7%, <em>P = 0.61 RR=1.10</em> 95% CI (0.79-1.54)</td>
<td>Study outcomes in patients with rupture membranes 1. CG:12 (21.4%); IG:5 (7.4%); ES:</td>
</tr>
<tr>
<td>Study Outcomes</td>
<td>CG</td>
<td>IG</td>
<td>ES</td>
<td>Reduction %</td>
<td>P</td>
<td>RR</td>
<td>95% CI</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>-------------</td>
<td>----</td>
<td>-----</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>1. CG:17 (30.4%); IG:14 (20.6%); ES: -3, Reduction % = 9.8%, P = 0.22</td>
<td>17</td>
<td>14</td>
<td>-3</td>
<td>9.8%</td>
<td>0.22</td>
<td>1.47</td>
<td>(0.79-2.72)</td>
<td></td>
</tr>
<tr>
<td>2. CG:1 (1.8%); IG:0</td>
<td>1</td>
<td>0</td>
<td>-1</td>
<td>1.8%</td>
<td>0.45</td>
<td>2.91</td>
<td>(1.09-7.77)</td>
<td></td>
</tr>
<tr>
<td>3. CG:27 (27.8%); IG:24 (20.9%); ES: -3, Reduction % = 6.9%, P =</td>
<td>27</td>
<td>24</td>
<td>-3</td>
<td>6.9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Study outcomes in patients who were in labor:

1. CG:17 (17.5%); IG:9 (7.8%); ES: -8, Reduction % = 9.7%, P = 0.03
   RR=2.43
   95% CI (1.13-5.22)

2. CG:2 (2.1%); IG:2 (1.7%); ES: 0, Reduction % = 0.4%, P = 1.00
   RR=1.18
   95% CI (0.17-8.26)

3. CG:17 (17.5%); IG:9 (7.8%); ES: -8, Reduction % = 9.7%, P = 0.03
   RR=2.91
   95% CI (1.09-7.77)
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Intervention</th>
<th>Methodology</th>
<th>Outcome</th>
<th>Week(s) after Operation</th>
<th>Composite Infection Morbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asghania et al., 2011</td>
<td>Double blind Quasi-RCT (1-)&lt;br&gt;Women undergoing non-emergen t or laboring cesarean delivery</td>
<td>Two gauze sponges soaked in 10% povidone iodine solutions rotated 360 degrees for 30 seconds (n=284)</td>
<td>Standard abdominal preparation without vaginal preparation (n=284)</td>
<td>Review 6 weeks after operation</td>
<td>1. Endometritis&lt;br&gt;2. Wound infection&lt;br&gt;3. Febrile morbidity</td>
<td>1. CG:7 (2.5%); IG:1 (0.4%); ES: -6, Reduction % = 2.1%,&lt;br&gt;P = 0.03&lt;br&gt;2. CG:9 (3.2%); IG:10 (3.5%); ES: +1, Increase % = +0.3%,&lt;br&gt;P = 0.5&lt;br&gt;3. CG:17 (6.0%); IG:14 (4.9%); ES: -3, Reduction % = 1.1%,&lt;br&gt;P = 0.73</td>
</tr>
<tr>
<td>Haas et al., 2010</td>
<td>RCT (1+) Women undergo cesarean delivery over age 18 years old and able to give informed consent │ Three sponge sticks soaked in 1% povidone-iodine in a prepackaged sterile pouch. Scrubbing encompassed anterior, posterior and lateral walls, including all fornices.&lt;br&gt;(n=145)</td>
<td>Standard abdominal preparation without vaginal preparation (n=145)</td>
<td>Review 4 weeks after operation</td>
<td>1. Post-cesarean endometritis&lt;br&gt;2. Wound infection requiring antibiotics&lt;br&gt;3. Post-operative fever &gt; 38 degrees Celsius, &gt;24 hours after surgery</td>
<td>Composite infectious morbidity (overall)&lt;br&gt;CG:17 (11.7%); IG:10 (6.5%); ES: -7, P = 0.11&lt;br&gt;1. CG:4 (2.8%); IG:0;&lt;br&gt;ES: -4, Reduction % = 5.2%,&lt;br&gt;P = 0.053&lt;br&gt;2. CG:10 (6.9%); IG:7 (4.5%); ES: -3, Reduction % = 2.4%,&lt;br&gt;P = 0.52</td>
<td></td>
</tr>
</tbody>
</table>
4. Wound Separation, seroma, hematoma, or need for debridement.

5. Composite infectious morbidity outcome: either endometritis, fever, sepsis, hospital readmission, wound infection, or wound complication

3. CG:7 (4.8%); IG:2 (1.3%); ES: -5, Reduction % = 3.5%, P = 0.095
4. CG:12 (8.3%); IG:6 (3.9%); ES: -6, Reduction % = 4.4%, P = 0.17

5. Composite outcome for specific subgroups
   - Labor (n=95) CG:11 (22.0%); IG:4 (8.9%); ES: -7, Reduction % = 13.1%, P = 0.14
   - No labor (n=204) CG:6 (6.4%); IG:6 (5.5%); ES: 0, Reduction % = 0.9%, P = 1.00
   - Ruptured membranes (n=76) CG:8 (19.0%); IG:3 (8.8%); ES: -5, Reduction % = 10.2%, P = 0.21
   - Intact membranes (n=224) CG:9 (8.7%); IG:7 (5.8%); ES: -2, Reduction % = 2.9%, P = 0.39
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Women undergo non-emergency cesarean delivery</th>
<th>Treatment 1: Pre-packed 5% povidone-iodine solution for vaginal preparation for 30 seconds (n=166)</th>
<th>Treatment 2: Standard abdominal preparation without vaginal preparation (n=142)</th>
<th>Follow-up</th>
<th>Outcome 1</th>
<th>Outcome 2</th>
<th>Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1+)</td>
<td></td>
<td>(n=166)</td>
<td>(n=142)</td>
<td>1. CG:24 (14.5%); IG:10 (7.0%); ES: -14, Reduction % = 7.5%, P = 0.045</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. CG:2 (1.2%); IG:1 (0.7%); ES: -1, Reduction % = 0.5%, P = 0.403</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. CG:47 (28.3%); IG:34 (23.9%); ES: -13, Reduction % = 4.4%, P = 0.437</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1-)</td>
<td></td>
<td>(n=250)</td>
<td>(n=251)</td>
<td>1. CG: 12 (5.6%); IG:19 (8.8%); ES: +7, Increase % = +3.2%, RR:1.6, 95% CI (0.8, 3.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. CG: 18 (8.4%); IG:12 (5.5%); ES: -6, Reduction % = 2.9%, RR:0.6, 95% CI (0.3, 1.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. CG: 37 (17.5%); IG:44 (20.3%); ES: +7, Increase % = 2.8%, RR:1.2, 95% CI (0.8, 1.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CG: Control Group  IG: Intervention Group  RR: Relative Risk  CI: Confidence Interval
Appendix 3: SIGN Methodology Checklist Template:

Section 1:

<table>
<thead>
<tr>
<th>Methodology Checklist 2: Controlled Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study identification (Include author, title, year of publication, journal title, pages)</td>
</tr>
<tr>
<td>Guideline topic:</td>
</tr>
</tbody>
</table>

Before completing this checklist, consider:

1. Is the paper a randomised controlled trial or a controlled clinical trial? If in doubt, check the study design algorithm available from SIGN and make sure you have the correct checklist. If it is a controlled clinical trial questions 1.2, 1.3, and 1.4 are not relevant, and the study cannot be rated higher than 1+

2. Is the paper relevant to key question? Analyse using PICO (Patient or Population Intervention Comparison Outcome). IF NO REJECT (give reason below). IF YES complete the checklist

Reason for rejection: 1. Paper not relevant to key question □ 2. Other reason □ (please specify)

SECTION 1: INTERNAL VALIDITY

<table>
<thead>
<tr>
<th>In a well conducted RCT study...</th>
<th>Does this study do it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 The study addresses an appropriate and clearly focused question...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.2 The assignment of subjects to treatment groups is randomised...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.3 An adequate concealment method is used...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.4 Subjects and investigators are kept ‘blind’ about treatment allocation...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.5 The treatment and control groups are similar at the start of the trial...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.6 The only difference between groups is the treatment under investigation...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.7 All relevant outcomes are measured in a standard, valid and reliable way...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.8 What percentage of the individuals or clusters recruited into each treatment arm of the study dropped out before the study was completed...</td>
<td>Yes □ No □ Can’t say □</td>
</tr>
<tr>
<td>1.9 All the subjects are analysed in the groups to which they were randomly allocated (often referred to as intention to treat analysis)...</td>
<td>Yes □ No □ Can’t say □ Doesn’t apply □</td>
</tr>
<tr>
<td>1.10 Where the study is carried out at more than one site, results are comparable for all sites...</td>
<td>Yes □ No □ Can’t say □ Doesn’t apply □</td>
</tr>
</tbody>
</table>
### Section 2: Overall Assessment of the Study

<table>
<thead>
<tr>
<th>2.1</th>
<th>How well was the study done to minimise bias? <em>Code as follows:</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High quality (++) □</td>
</tr>
<tr>
<td></td>
<td>Acceptable (+) □</td>
</tr>
<tr>
<td></td>
<td>Unacceptable – reject 0 □</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.2</th>
<th>Taking into account clinical considerations, your evaluation of the methodology used, and the statistical power of the study, are you certain that the overall effect is due to the study intervention?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2.3</th>
<th>Are the results of this study directly applicable to the patient group targeted by this guideline?</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2.4</th>
<th><strong>Notes.</strong> Summarise the authors’ conclusions. Add any comments on your own assessment of the study, and the extent to which it answers your question and mention any areas of uncertainty raised above.</th>
</tr>
</thead>
</table>

---

File name: Checklist 2 – Controlled Trials
Version 2.0
28/05/2012

Produced by: Carolyn Sleith
Page 1 of 3
Review date: None
**Appendix 4: SIGN Key to Evidence and Grades of Recommendations**

**Key to evidence statements and grades of recommendations**

**Levels of evidence**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1++</td>
<td>High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias</td>
</tr>
<tr>
<td>1+</td>
<td>Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias</td>
</tr>
<tr>
<td>1-</td>
<td>Meta-analyses, systematic reviews, or RCTs with a high risk of bias</td>
</tr>
<tr>
<td>2++</td>
<td>High quality systematic reviews of case control or cohort or studies</td>
</tr>
<tr>
<td></td>
<td>High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal</td>
</tr>
<tr>
<td>2+</td>
<td>Well-conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal</td>
</tr>
<tr>
<td>2-</td>
<td>Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal</td>
</tr>
<tr>
<td>3</td>
<td>Non-analytic studies, e.g. case reports, case series</td>
</tr>
<tr>
<td>4</td>
<td>Expert opinion</td>
</tr>
</tbody>
</table>

**Grades of recommendations**

**A** At least one meta-analysis, systematic review, or RCT rated as 1++, and directly applicable to the target population; or

A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results

**B** A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or

Extrapolated evidence from studies rated as 1++ or 1+

**C** A body of evidence including studies rated as 2+, directly applicable to the
target population and demonstrating overall consistency of results; or

Extrapolated evidence from studies rated as 2++

Evidence level 3 or 4; or

Extrapolated evidence from studies rated as 2+

Good practice points

Recommended best practice based on the clinical experience of the guideline development group
## Appendix 5: Table of quality assessment of reviewed studies

<table>
<thead>
<tr>
<th>Bibliography Citation</th>
<th>Yildirim et al., 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Validity</strong></td>
<td><strong>Comments</strong></td>
</tr>
<tr>
<td>1. Appropriateness and clearly focused question</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Method of randomization</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Adequate concealment method</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Subjects and investigators blinding</td>
<td>Can't say</td>
</tr>
<tr>
<td>5. Similarity of intervention group and control group</td>
<td>Yes</td>
</tr>
<tr>
<td>6. Provision of treatment</td>
<td>Yes</td>
</tr>
<tr>
<td>7. Reliability and validity of outcome measure</td>
<td>Yes</td>
</tr>
<tr>
<td>8. Drop-out rate of groups</td>
<td>Adequately addressed</td>
</tr>
<tr>
<td>9. Intention to treat analysis (Attrition bias)</td>
<td>Yes</td>
</tr>
<tr>
<td>10. Involvement of multi-site</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Overall Assessment of the Study

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>1++</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty of overall effect due to study intervention</td>
<td>Significant reduction in postpartum endometritis. High quality research design with very low risk of bias.</td>
</tr>
<tr>
<td>Applicability of result to the targeted patient group</td>
<td>Yes, the result is applicable to women receive cesarean delivery.</td>
</tr>
<tr>
<td>Bibliography Citation</td>
<td>Internal Validity</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Asghania et al., 2011</td>
<td></td>
</tr>
</tbody>
</table>

### Internal Validity

| 1. Appropriateness and clearly focused question | Yes | Objective clearly stated: To determine whether the vaginal preparation with povidone-iodine prior to cesarean delivery decreased infectious morbidity including postpartum endometritis. |
| 2. Method of randomization | No | Quasi-randomized, alternating sequence for assigning subjects into groups. |
| Adequate concealment method | No | Quasi-randomized, alternating sequence for assigning subjects into groups. |
| Subjects and investigators blinding | Yes | Double-blinded approach. Outcome assessor are blinded. |
| Similarity of intervention group and control group | No | Large differences in baseline characteristics, more examinations, longer labor, more preterm, longer surgery duration in vaginal cleansing group (intervention group) |
| Provision of treatment | Yes | Same prophylaxis treatment and three doses of antibiotic postoperatively. |
| Reliability and validity of outcome measure | Yes | Clear primary outcome measures and stated in the study. |
| Drop-out rate of groups | Adequately addressed | Drop-out rate of Control group: 10/294 = 3%. Experimental Group: 7/291 = 2%. |
| Intention to treat analysis (Attrition bias) | Yes | Complete outcome data. |
| Involvement of multi-site | No | One site only |

### Overall Assessment of the Study

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>1-</th>
</tr>
</thead>
</table>

Certainty of overall effect due to study intervention: Significant reduction in postpartum endometritis. Quasi-RCT with high risk of bias. Applicability of result to the targeted patient group: Yes, the result can be applicable to women receive cesarean delivery.
<table>
<thead>
<tr>
<th>Bibliography Citation</th>
<th>Haas et al., 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Validity</strong></td>
<td><strong>Comments</strong></td>
</tr>
<tr>
<td>1. Appropriateness and clearly focused question</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Adequate concealment method</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>4. Subjects and investigators blinding</td>
<td>Can't say Low Risk</td>
</tr>
<tr>
<td>5. Similarity of intervention group and control group</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>6. Provision of treatment</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>7. Reliability and validity of outcome measure</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>8. Drop-out rate of groups</td>
<td>Well-covered Low Risk</td>
</tr>
<tr>
<td>9. Intention to treat analysis (Attrition bias)</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>10. Involvement of multi-site</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Overall Assessment of the Study**

<table>
<thead>
<tr>
<th><strong>Level of evidence</strong></th>
<th>1+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty of overall effect due to study intervention</td>
<td>Statistically insignificant to reduce risk of postpartum endometritis ($p = 0.053$). High quality RCT with very low risk of bias but barely statistically insignificant.</td>
</tr>
<tr>
<td>Applicability of result to the targeted patient group</td>
<td>Yes, the result is applicable to women receive cesarean delivery</td>
</tr>
<tr>
<td>Internal Validity</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td>1. Appropriateness and clearly focused question</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Method of randomization</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>3. Adequate concealment method</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>4. Subjects and investigators blinding</td>
<td>Can't say Low Risk</td>
</tr>
<tr>
<td>5. Similarity of intervention group and control group</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>6. Provision of treatment</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>7. Reliability and validity of outcome measure</td>
<td>Yes Low Risk</td>
</tr>
<tr>
<td>8. Drop-out rate of groups</td>
<td>Adequately addressed Unclear Risk</td>
</tr>
<tr>
<td>9. Intention to treat analysis (Attrition bias)</td>
<td>Can't say Unclear Risk</td>
</tr>
<tr>
<td>10. Involvement of multi-site</td>
<td>No</td>
</tr>
</tbody>
</table>

**Overall Assessment of the Study**

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>1+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty of overall effect due to study intervention</td>
<td>Significant reduction in postpartum endometritis.</td>
</tr>
<tr>
<td></td>
<td>High quality research design with low risk of bias.</td>
</tr>
<tr>
<td>Applicability of result to the targeted patient group</td>
<td>Yes, the result is applicable to women receive cesarean delivery</td>
</tr>
</tbody>
</table>
### Bibliography Citation
Reid et al., 2001

<table>
<thead>
<tr>
<th>Internal Validity</th>
<th>Comments</th>
<th>Support for Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Appropriateness and clearly focused question</td>
<td>Yes</td>
<td>Objective clearly stated: To determine whether the vaginal preparation with povidone-iodine prior to cesarean delivery decreased the incidence of postpartum endometritis.</td>
</tr>
<tr>
<td>3. Adequate concealment method</td>
<td>Yes Low Risk</td>
<td>Opaque sealed and numbered enveloped taped to abdominal prep packs.</td>
</tr>
<tr>
<td>4. Subjects and investigators blinding</td>
<td>Can' say High Risk</td>
<td>Not stated for participants and surgeons. High risk of potential the same surgeons who performed surgery and postoperative care. Lacking of blinding of care providers to intervention status. Outcomes assessor blinded.</td>
</tr>
<tr>
<td>5. Similarity of intervention group and control group</td>
<td>Yes Low Risk</td>
<td>They are similar for both group of subjects. Shown in study table 1. (Reid et al., 2001)</td>
</tr>
<tr>
<td>6. Provision of treatment</td>
<td>Yes Low Risk</td>
<td>No significant difference.</td>
</tr>
<tr>
<td>7. Reliability and validity of outcome measure</td>
<td>Can't say Unclear Risk</td>
<td>Relative Risk shown but incomplete statistic data. P value not provided.</td>
</tr>
<tr>
<td>8. Drop-out rate of groups</td>
<td>Adequately addressed High Risk</td>
<td>Drop-out rate of Intervention group: 30/247 = 12% Control group: 38/251 = 15%</td>
</tr>
<tr>
<td>9. Intention to treat analysis (Attrition bias)</td>
<td>No High Risk</td>
<td>High Risk of incomplete outcome bias. Large number 68 subjects (13.5% of the originally randomized sample) were excluded after randomization who had chorioamnionitis. Intention to treat analysis performed.</td>
</tr>
<tr>
<td>10. Involvement of multi-site</td>
<td>Yes</td>
<td>Only one site.</td>
</tr>
</tbody>
</table>

**Overall Assessment of the Study**

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>1-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty of overall effect due to study intervention</td>
<td>Intervention increase risk of endometritis with statistically insignificant findings. RCT with high risk of bias.</td>
</tr>
<tr>
<td>Applicability of result to the targeted patient group</td>
<td>No, the result may not be applicable to the target group.</td>
</tr>
</tbody>
</table>
References


Philadelphia, PA: Lippincott Williams & Wilkins.


Thomas, J. & Paranjothy, S. (2001). Royal College of Obstetricians and
Gynaecologists Clinical Effectiveness Support Unit. National Sentinel

Yildirim, G., Gungorduk, K., Asicioglu, O., Basaran, T., Temizkan, O., Davas, I. &
Gulkilik, A. (2012). Does vaginal preparation with povidone-iodine prior to
caesarean delivery reduce the risk of endometritis? A randomized controlled
trial. The Journal of Maternal- Fetal and Neonatal Medicine, 2012;
25(11):2316-2321.

