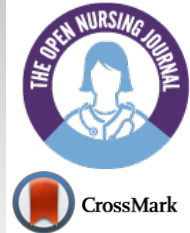




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## RESEARCH ARTICLE

# Management of COVID-19: A Clinical Nursing Practice Guideline for Pregnant Women Undergoing a Cesarean Section

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### Abstract:

#### Background:

Coronavirus disease (COVID-19) has been declared a pandemic respiratory disease. Pregnant women infected with COVID-19 may deliver by caesarean section when there are medical reasons that guarantee the safety of the mother and baby. This leads to the development of a strong guidelines for pregnant women infected with the COVID-19 virus undergoing caesarean section.

#### Objective:

This article is intended to develop a clinical nursing practice guideline for the prevention and control of COVID-19 infection between healthcare providers and COVID-19 infected pregnant women undergoing caesarean section and assess the feasibility of CNPG implementation.

#### Methods:

An action research was employed between October to March 2021. This study was constructed with the NHMRC model involving the following steps: 1) determining the needs and scope of the guide; 2) a multidisciplinary committee meeting to oversee the development of the guideline; 3) set the objectives and target groups of the guideline; 4) the CNPG formula; 5) implement the guideline; and 6) documented as a guideline. We evaluated the feasibility of CNPG implementation.

#### Results:

Four themes in the needs for and scope of the guideline were used to create the guideline. Guidelines for the prevention and control of COVID-19 infection related to medical care from pregnant women with COVID -19 who have undergone caesarean section, there are 3 phases: peri-operative period, intra-operative period, and postoperative period. After using CNPG in three pregnant women with coronavirus infection undergoing caesarean section. It was a pilot study to test the feasibility of CNPG implementation. Overall feasibility was high ( $M= 2.69$ ,  $SD = 0.35$ ,  $p < 0.05$ ).

#### Implications for Nursing:

The results of this study can lead to improve the quality of care for prevention and control of healthcare-associated COVID-19 infection from COVID-19 pregnant women undergoing a caesarean section during the COVID-19 spreading era.

#### Conclusion:

The CNPG has been presented to be beneficial. However, it is necessary to determine the rate of healthcare-associated COVID-19 infection in COVID-19 pregnant women undergoing a caesarean section with an acceptable sample size.

**Keywords:** The clinical nursing practice guideline, COVID-19 pregnant women, Action research, Prevention and control of healthcare-associated COVID-19 infection, CNPG implementation, Caesarean section.

### Article History

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## 1. INTRODUCTION

Coronavirus disease (COVID-19) has been declared a pandemic respiratory disease [1]. This virus results in "several

respiratory conditions as respiratory tract infection and respiratory distress syndrome. All age groups, including newborn to elderly people have been affected. Pregnant women are considered an unusual group that needs further care to be safe for maternal and infants [2]. Three studies reported the impact of pregnant women in trimester (from 31 to 40 weeks gestation) and their babies [3 - 5]. These women were admitted

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before 37 weeks gestation and delivered prematurely as they experienced preeclampsia, premature rupture membrane, and irregular contraction [6]. This contributes not only an increased risk for preterm delivery in pregnant women with COVID-19 but also potential risk on the fetus. Therefore, more attention should be paid to pregnant women with COVID-19. The guideline for COVID-19 with early detection may minimize potential obstetrical complications and may be beneficial for improving pregnancy outcomes [7 - 9].

In Thailand, the first COVID-19 case was found in Bangkok in January 2020, and then it spread to other communities [9]. Thai government controls COVID-19 outbreak by wearing mask, practice social distancing, and lockdown areas. Although maternal and neonatal infections in Thailand were reported very rare, pregnancy expressed concerns regarding being infected with COVID-19 during pregnancy and following birth [10, 11]. In addition, World Health Organization (WHO) has advised that a cesarean section should only be performed for COVID-19 pregnant women when medically justified [12]. The enhancing awareness infection control measures and health management in COVID-19 pregnant women should be constructed.

One of the strategies to reduce the incidence of pregnant women with COVID-19 is the approach and procedures for dealing with COVID-19 [13]. Clinical (nursing) practice guidelines [CNPG] are a great instrument applied to standardize care for a specific group of patients. On beginning of COVID-19 era, there were some of recommendations made in flowsheet of caring for COVID-19 pregnant women; however, no evidence had been presented on prevention and control the COVID-19 infection during cesarean delivery process. The purpose of this study was to develop CNPG for COVID-19 pregnant women undergoing caesarean section and assessing the feasibility of CNPG adoption [14].

## 2. MATERIALS AND METHODS

### 2.1. Study Design

An action research was used.

### 2.2. Participants and Procedure

The participants in this study were divided as follows: i) the supportive group included a director and subdirector of the nursing department at Vajira hospital, ii) 13 professionals including 11 perioperative nurses and two academic researchers, and iii) three pregnant women with COVID-19 underwent a cesarean section. For safety and COVID-19 spread reduction, it is recommended that nursing participants were recruited *via* using a purposive sampling approach with eligibility criteria included: 1) senior perioperative nurse with at least 5 years of experience and 2) trained to don, doff, and dispose of personal protection equipment (PPE) including masks (level 2 or 3 filtering face pieces [FFP]) [15]. The COVID-19 pregnant women (asymptomatic or mild symptoms) must be confirmed with a positive rRT-PCR test and are in a full-term pregnancy (39-40 weeks) [16]. All confirmed COVID-19 pregnant women must be undergone a cesarean section.

We used action research based on NHMRC framework to develop the CNPG [17]. These frameworks are intended to promote health, prevent harm, encourage best practice and reduce waste. The frameworks are developed by multidisciplinary committees or panels that follow a rigorous evidence-based approach. The frameworks are based on a review of the available evidence, and follow transparent development and decision-making processes. The frameworks are informed by the judgment of evidence by experts, and the views of consumers, community groups and other people affected by the guidelines. In regard to ethical issues, the frameworks reflect the communities' range of attitudes and concerns.

#### 2.2.1. Developing Process of the CNPG

Intervention development of CNPG has two stages. The first stage is the development of guidelines for the NHRCT process (Step 1-6). The second phase was to evaluate the feasibility with the use of the CNPG. The guideline content was validated by an expert panel. The expert panel encompassed three perioperative nurses, two specialist nurses in anesthesia, two physicians, and a specialist nursing lecturer on respiratory disease worked in Vajira hospital, Medicine of Vajira, and Kaukarun Faculty of Nursing, Navamindhadhiraj University.

The six steps CNPG development was: 1) determining the needs and scope of the guide; 2) a multidisciplinary committee meeting to oversee the development of the guideline; 3) set the objectives and target groups of the guideline; 4) the CNPG formula; 5) implement the guideline; and 6) documented as a guideline. This study was the following by:

Step 1: Collaborative researchers between Kuakarun Faculty of Nursing and Vajira hospital, Navamindhadhiraj University, identified the needs and scope of the CNPG by using four semi-structured, opened-ended interviews. The perioperative nurses were interviewed the following questions:

- (1) How to actually prevent and control of healthcare-associated COVID-19 infection from the COVID-19 pregnant women undergoing a cesarean section?
- (2) What problems of caring for the COVID-19 pregnant women undergoing a cesarean section?
- (3) Can you tell me how to solve these problems of prevent and control of healthcare-associated COVID-19 infection for the COVID-19 pregnant women undergoing cesarean section?
- (4) What facilitating factors that you require from the care for COVID-19 pregnant women undergoing cesarean section?

Step 2: There were eight-member committee including three perioperative nurses, two specialist nurses in anesthesia, two physicians, and a specialist nursing lecturer on respiratory disease worked in Vajira hospital, Medicine of Vajira, and Kaukarun Faculty of Nursing, Navamindhadhiraj University.

Step 3: The objective of the study was to develop a CNPG for COVID-19 pregnant women who underwent cesarean section at Vajira hospital, Navamindhadhiraj University, Thailand. The outcome was the feasibility of the CNPG implementation.

Step 4: The guideline content was then developed based on a review of relevant literature published in the English language between 2018 and 2020 from four databases (PubMed, CINAHL, Science Direct, and Ovid), an internet search engine included articles in Thai journals. The search keywords were SAR, CoV-2, COVID-19 guideline, and pregnant women. The results showed that a few research studies had examined the clinical nursing practice guideline for the prevention and control of healthcare-associated COVID-19 infection in COVID-19 pregnant women undergoing a cesarean section.

We found that there were three previous studies conducted at China, (Wuhan), Portugal, and the United States. The content of these studies had been adapted to develop a comprehensive and documented perioperative personnel strategy to prevent transmission. However, that guideline in nursing field had not been evaluated for its feasibility. Therefore, the contents of the guideline in the current study were based only on secondary survey section of the prevention and control of healthcare-associated COVID-19 infection in COVID-19 pregnant women undergoing a cesarean section.

A working team consisting of member of expert panel analyzed the levels of evidence studies. It was found that the evidence used for recommendations for the prevention and control of healthcare-associated COVID-19 infection in perioperative, intra-operative, postoperative phases were level 2. Guidelines were also assessed using the Appraisal of Guideline Research and Evaluation (AGREE) tool, a set of evaluation criteria developed by the AGREE Collaborative Committee to assess the quality of guidelines. The AGREE tool consists of six domains with a total of 23 entries. These domains are scope and purpose of guidelines, stakeholder involvement, rigor of development, clarify and presentation, applicability, and editorial independence. A guideline quality score of more than 60% on the AGREE criteria is considered acceptable [18].

The CNPG draft (the first edition) was reviewed by the same group of eight experts. After revision, the guideline was tested for content validity. The universal agreement content validity index among the same eight experts was 0.89. The first edition of this guideline was also checked for inter-rater reliability by three pair of registered nurses and was found to be 0.86. The CNPG was ready for its feasibility evaluation.

Step 5: The feasibility with the use of the CNPG was measured as a pilot study from October to December 2020. 13 perioperative nurses were interviewed for a version-II CNPG development in the second phase. The perioperative nurses were interviewed the following questions: (1) Could you please tell me what do you feel when you were in the CNPG? and (2) what problems you have after you use this CNPG?

Step 6: The CNPG was documented and published for use in Vajira hospital in March 2021.

### 2.3. Sample

The CNPG was implemented by at a negative pressure operating room, Vajira hospital, Navamindhadhiraj University, Thailand, from October to December 2020. Purposive

sampling participants were selected who willingly participated in this study with the inclusion criteria. The total of participants was 13 perioperative nurses and three COVID-19 pregnant women who underwent cesarean section at Vajira Hospital.

## 2.4. Outcomes Measures

### 2.4.1. Feasibility with CNPG use

The likelihood of using CNPG was defined as the mean and standard deviation of the opinions of nurses using the guideline. The questionnaire items were to ask the nurse regarding 1) ease and convenience; 2) clarify of the CNPG; 3) appropriateness of the CNPG; 4) cost reduction; 5) effectiveness; and 6) feasibility of the CNPG. The format of questionnaire was in the item of a "poor/ fair/ high" answer. There were six questions of the questionnaire, so the possible score was from 1 to 3. When converted to the mean, the possibility of using CNPG as a mean has been identified.

A score of 1-3 was used to determine the nurses' opinions regarding the feasibility of the CNPG implementation. Higher scores indicated a higher level of feasibility, and the levels of feasibility were classified as poor (score 1.00), fair (score 2), or high (score 3).

The Likert scale was used to determine feasibility of the CNPG use. Poor feasible was the mean score of feasibility between 1.00 to 1.65. Fair feasible was the mean score of feasibility between 1.66 to 2.31. High feasible was the mean score of feasibility between 2.32 to 3.00.

## 2.5. Data Collection

Data for the CNPG development in the first step were gathered by using in-depth interviews, voice records, observation, and field note records from Vajira perioperative nurses' team to search the need for and scope of guidelines.

This stage was under the epidemic era of coronavirus spreading. Therefore, in the process of interviewing, research team conducted this research based on the guideline of COVID-19 prevention. The interviewees were interviewed using four semi-structured, open-ended questions regarding caring for COVID-19 pregnant women who underwent cesarean section at Vajira Hospital. During interviewing, the researcher must listen carefully and ask questions without interrupting and concealing assumptions including confirming opinions in a timely manner.

Before the CNPG was implemented, a second co-author, who was the head nurse in the study room, was instructed, the second co-author performed all nurses who were to participate in the study on the implementation of the CNPG until all nurses were recalled phases of the guideline. The nurse in this study experienced using the CNPG with three COVID-19 pregnant women. Finally, the nurses were asked to complete questionnaires and to return them within two days. A full rate (100%) was returned. To gain a better understanding of some of the issues arising from the implementation of CNPG, all participants were interviewed.

## 2.6. Data Analysis

During the interviewing for measuring the need and scope of the guideline, the data collection and analysis were processed simultaneously. Content analysis techniques were used for analyzing data. Trustworthiness and credibility were attained by transcribing all audio recordings and repeatedly reading the transcripts. The first interview ascertained the needs and scope of the guideline, check the previous knowledge, and enhance the credibility and integrity of the interviewers' accounts.

Feasibility of the CNPG implementation was presented using descriptive statistics. The statistical analysis was performed using Statistical Package for the Social Sciences (SPSS version 27.0) [19]. The level of Alpha's Cronbach was 0.07 ( $\alpha=0.07$ ).

## 3. RESULTS

### 3.1. Participants' Characteristics

The study included thirteen participants, between the age of 38 and 56 years, with an average age of  $43.99\pm 4.32$  years. Most perioperative nurses were women (100%). Most of participants were Bachelor's degree (69.2%) and Master's degree (30.8%). The years of working experience were between 18 and 35 years, with an average of  $29\pm 4.56$  years.

The COVID-19 Pregnant women with cesarean section ( $n=3$ ). Age of all participants were 32 and 37 years, an average age of  $35\pm 1.45$  years old.

### 3.2. Key Themes of need for and Scope of the Guideline before Developing CNPG

Data were analyzed using content analysis based on the four themes including: (1) management; (2) the guideline; (3) need to develop the guideline; and (4) equipment and medical supplies.

#### 3.2.1. Management

Most interviewees expressed that the appropriate management for the pregnant women for COVID-19 before and at admission to operative room was the priority of need for the guideline. According to this study, we described expressions including: P1 "I do not have any idea about it. I meant about COVID-19 screening and test to be done for COVID-19 pregnant women. I afraid of working on these pregnant women because we have never worked on it, such as how to diagnose them (COVID-19), how to care for them during labor"; P4 "I think we should take a look on how to transfer a pregnant woman who had COVID-19 infection when they come to the operative room"; P7 "I was not sure regarding the disinfectant that can kill the virus (COVID-19) when we finish the case in operative room"; P13 "What about the partners like staff (birthing partners) we need to incorporate in labor team.

#### 3.2.2. The Guideline

All interviewees mentioned that the guideline could be described despite the rare published guideline for prevention

and control of healthcare-associated COVID-19 infection in operative room. The following stories provided insight about the participants' experiences in this study as they each explained what problems of caring for the COVID-19 pregnant women undergoing a cesarean section was. The participants explained in this way: P5 "When I was searching for evidence of caring for the COVID-19 pregnant women undergoing a cesarean section, I could not find any information for the guideline, such as how to prevent the COVID-19 transmission between intrapartum care, and healthcare team"; P10 "It is difficult to find about it. I think the COVID-19 was the new disease. No evidence had yet been published regarding the test for diagnosing COVID-19".

#### 3.2.3. Need to Develop the Guideline

There were several opinions about need to develop the guideline on health of family members including: P2 "In case reports on severe COVID-19 pregnant women, their child was confirmed and diagnosed with COVID-19. We need to develop the guideline for them"; P4 "I was not sure whether the COVID-19 pregnant women were going to be delivered by a cesarean section, I think we need to prepare and demonstrate the guidelines"; P9 "Labor presents a unique scenario in the COVID-19 pandemic, as all hospital admissions are anticipated and the timing of many admissions to hospital should be planned".

#### 3.2.4. Equipment and Medical Supplies

The three perioperative nurses were found from this study: P8 "Due to the pandemic, the medical supplies were not enough for working in all healthcare settings including PPE, mask, and so on. So, we need to list what equipment and medical supplies we need to use in our labor for COVID-19 pregnant women".

### 3.3. The CNPG for COVID-19 Pregnant Women

The guideline developed by Navamindhadhiraj University researcher team with seven relevant articles included perioperative; intra-operative, and postoperative care. In addition, there were limitations of COVID-19 instruments and the hospital policies. The comparison between our findings in this study and other studies was not done. The following areas were included in the CNPG for COVID-19 pregnant women with cesarean section contacted in our hospital (Table 1).

#### 3.3.1. Perioperative Phase

All staff in the operating room were initially trained regarding the infection prevention and control procedures and understanding of how to get the infection from COVID-19 pregnant women [9, 10]. In addition, all employee needed to learn how to don and remove personal protective equipment, as well as learn to implement the guideline, and protect themselves after operative was done. A full-termed pregnant patient with a positive RT-PCT test (asymptomatic or mild symptoms) was transferred to the operating room by a negative pressure stretcher [11]. An operating room with negative-pressure ventilation was used for a COVID-19 pregnant woman [11]. In the operating room, standard equipment was

applied and all operating room staff and pediatric teams used full PPE, including a protective suit, N95 masks, disposable caps, goggles, and rubber gloves [12]. Rely<sup>+</sup>On Virkon<sup>TM</sup> disinfectant (a ratio of 1: 100) was applied to reduce the risk of contamination from Sar-CoV2 in the transferring process and in the operating room [13]. All medical instruments were sealed with a double-layer disposable plastic wrapper [14]. The isolated neonatal intensive care unit [NICU] was undergone for an infant born from a COVID-19 mother [14]. A pediatric physician with a full PPE received and transferred the infant to a radian-warmer and negative-pressured incubator [14].

**3.3.2. Intra-operative Phase**

Senior staff were selected to perform this operation for reducing exposure time. The COVID-19 pregnant women must be specially monitored for clinical manifestations of infection. Both regional and general anesthesia were recommended in COVID-19 pregnant women with a cesarean section [14]. However, spinal anesthesia with a single shot subarachnoid block is suggested for emergency cesarean section [14, 15]. The patient under anesthesia procedure must be additionally performed during the extubating procedure [14, 15].

**Table 1. A clinical nursing practice for COVID-19 pregnant women undergoing a cesarean section.**

Phase	Ward Nurse	Transfer Team	Surgeon	Scrub Nurse	Circulating Nurse	Cooperating Nurse	Cardio-pulmonary Technician	Operating Staff	Pediatric Team
<b>Pre-operative Phase</b>	- Call for transferring to OR before 30 minutes.- Place on PPE level 3. - Transfer pregnant woman with a negative pressure stretcher.- Clean the stretcher with 1% Rely <sup>+</sup> On Virkon <sup>TM</sup> disinfectant before leaving from OR <sup>1</sup> .	- Dressing PPE set B. - After receiving the call from ward, locked elevator for COVID-19 patient with a negative pressure stretcher. - After transferring, the elevator was cleaned.	- The senior surgeon wears PPE set C.	- Preparing the operative instrument. - Turning Ultra-air filter.	- Preparing operative instrument. - Wrapping the essential instruments. - Informing the patient's information. - Documenting the patient's report.	- Assessing the patient's symptoms. - Supporting a special procedure. - Ultra-air filter. - Wearing PPE set B.	- Wrapping a necessary tool with a double-layer disposable plastic bag. - Preparing a special tool. - Moving tools with PPE set B.	- 1% Rely <sup>+</sup> On Virkon <sup>TM</sup> disinfectant is prepared for reducing the Sar-CoV2 contamination. - Wrapping a necessary tool. - Moving tools with PPE set B.	- Pediatric physician wears a PPE set C receive an infant born from a mother with COVID-19 and transfer to the isolated NICU <sup>3</sup> .
<b>Intra-operative phase</b>	-	- Moving patient with a negative pressure stretcher. - Removing their PPE set B to an infection trash. - Placing the negative pressure stretcher in the operative room.	-	-	-Transferring patient to operative bed. - Performing in circulating routine.	- Receiving the patient with a negative pressure stretcher. - cooperating the operating team outside the room. - Documenting a nursing record.	- Supporting and sending operative tools.	-	- Standing by a radiant warmer and infant tool for receiving an infant. - Assessing the infant's symptoms -Transferring the infant to COVID ward or NICU. - Cleaning incubator with Rely <sup>+</sup> On Virkon <sup>TM</sup> disinfectant.
<b>Post-operative phase</b>	After delivery, the COVID-19 patient was monitored in the operating room and subsequently transferred by a negative-pressured stretcher to an isolated care unit for recovery period.	-	-	-	-	-	-	-	- Physician reports a circulating nurse received the infant before cleaning and removing their PPE.

3.3.3. Post-operative Phase

After birth, the infant were admitted and intensively monitored for infectious clinical manifestations in the isolated NICU for approximately 14 days [11]. After delivery, the COVID-19 patients were monitored in the operating room and subsequently transferred by a negative-pressured stretcher to a designated and isolated care unit for recovery care [14].

3.4. Feasibility of the CNPG Implementation

Once the CNPG had been developed and implemented as a pilot study with 30 COVID-19 pregnant women who underwent the cesarean section, the perioperative nurses were invited to participate in a questionnaire regarding the feasibility of the CNPG implementation. Overall feasibility of the CNPG implementation was high (M= 2.69, S.D. = 0.35). Ease and convenience, appropriateness, clarify, effectiveness, and feasibility of the CNPG were high (M= 2.94, SD = 0.32; M= 2.88, SD = 0.24; M= 2.68, SD = 0.43, M= 2.63, SD = 0.43; M= 2.73, SD = 0.43, respectively). The study also presented that cost reduction were fairly feasible (M= 2.29, S.D. = 0.23) (Table 2).

Table 2. Feasibility of the CNPG implementation.

Items	Mean Scores	Standard Deviation	Level
1. Ease and convenience	2.94	0.32	High feasibility
2. Clarify	2.68	0.43	High feasibility
3. Appropriateness	2.88	0.24	High feasibility
4. Cost reduction	2.29	0.23	Fair feasibility
5. Effectiveness	2.63	0.43	High feasibility
6. Feasibility	2.73	0.43	High feasibility
Total	2.69	0.35	High feasibility

3.5. Key Themes after using the CNPG

After using the CNPG, there were two problem themes as follows: (1) lack of awareness; and (2) lack of equipment and medical supplies.

3.5.1. Lack of Awareness

The theme of lack of awareness could be described as “lack of realization” “lack of worry” Lack of awareness arisen as the theme from the participants as including: P5 “I don’t want to get any trainings because I understood and remembered the entire process of how to perform the care for COVID-19 pregnant women underwent cesarean section”; P11 “When some trained staff took vacation, we always had a in charge nurse to manage the COVID-19 infection, in the pregnant case underwent a surgery. The charge nurse always presented and performs in every shift. They are good at managing the COVID-19 pregnant case and commanded the team as an effective team in order to control the COVID-19 transmission. So, we don’t need to any training, we can handle the situations. The rate of healthcare-associated COVID-19 infection in operative room was zero (N = 3) since October 2020 to now.”.

3.5.2. Lack of Equipment and Medical Supplies

The theme of lack of equipment and medical supplies could be described as “lack of materials” “lack of tools” Lack of equipment and medical supplies emerged as the theme from the participants as following: P2 “Because every hospital needs masks, face fields, PPE sets, and so on to work with the COVID-19 case, all required tools were not enough. Some days on my work, we reused the old N95 mask, and I washed my face field with soap and alcohol for recycling”.

4. DISCUSSION

This study had two aims. The first was to develop a clinical nursing practice guideline for COVID-19 pregnant women in order to prevent and control of healthcare-associated COVID-19 infection in COVID-19 pregnant women undergoing a cesarean section (Table 1). This guideline is generated by perioperative nurses’ interviewing regarding the needs for and scope of the guideline. Before CNPG development, the findings of this study reported four themes of need for and scope of the guideline: (1) management; (2) the guideline; (3) need to develop the guideline; and (4) equipment and medical supplies. The most participants in this study verbalized that: management could be described as information how to prevent and control of healthcare-associated COVID-19 infection from the COVID-19 pregnant women undergoing a cesarean section. For example, the guideline should show how to transfer the COVID-19 mother and the infant, what disinfectants should the nurses use, and so on. Additionally, the guidelines revealed as restriction of guidance due to a new disease. The guideline emerged from the participants’ voices and included such statements “could not find any information for the guideline for how to prevent the COVID-19 transmission between intrapartum care and healthcare team”, and “no evidences for COVID-19 pregnant women’s guidance.” Most participants in this study were further outlined and needed to develop as “necessity to development” and “It should prepare simulation of the COVID-19 pandemic.” Participants shared how to solve these problems to prevent and control of healthcare-associated COVID-19 infection for the COVID-19 pregnant women undergoing cesarean section. Lastly, equipment and medical supplies in this text was defined as medical tools and materials to prevent COVID-19 during working in labor. Equipment and medical supplies emerged as theme from the participants as including PPE set, N95 mask, and a negative pressure operative room. Therefore, motivational intervention or CNPG based on participants’ context must be concerned to develop the effective prevention and control infection for COVID-19 transmission in COVID-19 women during getting pregnancy.

In addition, the guideline was developed *via* reviewing of the relevant literatures regarding COVID-19 pregnant women undergoing to a cesarean section. Three phases of the guideline include perioperative; intra-operative, and postoperative care. It has been shown that COVID-19 infection prevention and control for COVID-19 women during undergoing a cesarean section includes training for all staff, COVID-19 testing screening, personal protection, in order to protect the safety of pregnant women, newborns, and operative workers. Several

studies reported that training is essential to help prevent the spread of COVID-19. Health workforce capacity building includes COVID-19 transmission risks and how to protect themselves and others [20 - 26]. In additionally, RT-PCR testing improves detection of cases, which will help to prevent virus transmission to the healthcare providers [20 - 26]. Health workers should adhere to hand washing, personal protective equipment (PPE) protocols ensure staff training is up-to-date, and systematic staff should test themselves using RT-PCR test [20 - 26].

During developing process of CNPG, most relevant literature were opinion experts, reviews, and case reports on COVID-19 pregnant women who underwent cesarean section. In addition, the CNPG was validated by three respiratory experts. Therefore, when the CNPG was implemented as a pilot study, the CNPG appeared to be highly feasible to manage for COVID-19 cases who underwent a cesarean section. However, it is necessary to determine the rate of healthcare-associated COVID-19 infection in COVID-19 pregnant women undergoing a cesarean section with an adequate sample size. Furthermore, we found that this CNPG could be applied in different areas.

After using the CNPG, two aspects that should be concerned were lack of awareness, equipment, and medical supplies. Thus, these suggestions should be used to develop the CNPG in the next generation.

## 5. IMPLICATIONS

The results of this study have implications for nursing practice [27]. The results support and change a new protocol for management in COVID-19 pregnant women who underwent cesarean section. In addition, the results of this study can lead to improve the quality of care for COVID-19 pregnant women requiring cesarean section during the COVID-19 spreading era [28].

## CONCLUSIONS AND RECOMMENDATIONS

The development of the clinical nursing practice guidelines for COVID-19 pregnant women undergoing cesarean section has presented to be beneficial. However, it is necessary to determine the rate of healthcare-associated COVID-19 infection in COVID-19 pregnant women undergoing a cesarean section with an acceptable sample size.

## ETHICS APPROVAL AND CONSENT TO PARTICIPANTS

The study was also conducted by the Code of Ethics approved by two Research Ethics Committees: Kuakurun Faculty of Nursing (KFN 13/2020) and Vajira hospital, Medicine of Vajira Navamindhahiraj University (COA 08/2020). The researchers suggested an explanation of the research objectives, and asked voluntarily to participate in this research. In addition, written informed consent was obtained from all participants before collecting data.

## HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures

performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

## CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

## STANDARDS OF REPORTING

STROBE guidelines were followed.

## AVAILABILITY OF DATA AND MATERIALS

The data that support the results of the study are available as requested.

## FUNDING

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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