PROJECT EVALUATION REPORT

Effect of Simulations on Nurse Self-Efficacy and Knowledge of Hypertensive Crisis Treatment in Pregnancy

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Abstract

Severe hypertension in pregnancy is leading to increased rates of maternal morbidity and mortality. A lack of knowledge and awareness regarding protocols for the treatment of hypertensive crises in pregnancy is leading to adverse patient outcomes in the obstetrical units within the hospital. A pretest/posttest design was used to evaluate the effect of simulations on nurse self-efficacy and knowledge of hypertension treatment protocols and algorithms over an 8-week period. The project took place in a labor and delivery unit with a Level III Maternal Designation using convenience sampling of staff nurses. Data was collected using the Self-Efficacy for Obstetric Critical Episodes Evaluation tool. Descriptive statistics and a one-way repeated measures ANOVA test were used to analyze data. Results showed a significant difference in nurse self-efficacy scores between pre, immediately post, and 8-weeks post-intervention ($p < .001$). The findings of the project support the use of simulation-based training to increase nurse self-efficacy for this population. Further research is needed to evaluate efficacy in other settings.

Keywords: Pregnancy, hypertension, severe hypertension, hypertensive crisis, simulation, self-efficacy, nursing education

Effect of Simulations on Nurse Self-Efficacy and Knowledge of Hypertensive Crisis Treatment in Pregnancy

A diagnosis of severe hypertension in pregnancy has become a leading cause of maternal mortality in the United States (Schneider et al., 2021). Schneider et al. (2021) estimated that approximately 17% of all maternal mortalities are related to complications from severe hypertension. The organization joined a statewide initiative with Texas Alliance for Innovation on Maternal Health (AIM) to decrease preventable maternal mortality rates. The collaboration included the implementation of a severe hypertension bundle with treatment algorithms for the treatment of hypertensive crises.

Literature Review

Improving recognition and treatment time of hypertensive crises in pregnancy is a vital component in decreasing maternal morbidity and mortality rates (Aronow, 2017). Several studies have been conducted on methods and approaches to improve recognition and treatment of hypertensive crises; however, collaborative efforts, standardized guidelines, protocols, and algorithms, and the use of simulations have provided consistent results for improvement. There continues to be ongoing research on improving clinical practice for the treatment of hypertensive conditions of pregnancy.

Collaboration and Use of Quality Improvement Initiatives

According to the American College of Obstetrics and Gynecology (ACOG) (2015), collaboration between academic universities, hospital organizations, and state and national quality improvement initiatives has been effective in improving response time to adequately treat severe range blood pressures. Adverse maternal outcomes have been associated with delays in treatment of severe range blood pressures that exceed thirty to sixty minutes (Martin et al.,

2021). Standardized treatment algorithms and protocols have improved recognition and response time leading to timely administration of antihypertensive medications (Froehlich et al., 2018; Martin et al., 2021; Schneider et al., 2021). ACOG developed prescriptive guidelines and treatment algorithms that outline a step-by-step process with parameters to identify hypertensive crises, nursing interventions, physician notification practices, and standards for use of intravenous and oral antihypertensive medications (ACOG, 2015). Froelich et al. (2018) discussed that the use of this widely utilized algorithm was not successful in achieving blood pressure control within one hour of initial treatment; however, the use of the algorithm did show improvements in clinical practice and response times. The implementation of the quality improvement initiative was multidisciplinary and included adequate staff education, but the protocol was not nurse-driven which could potentially cause delays in treatment secondary to the inability to communicate with physicians in a timely manner (Froelich et al., 2018). Martin et al. (2021) reported statistically significant findings for the administration of antihypertensives within fifteen minutes of recognition with the use of a semiautonomous treatment algorithm. These findings support the use of standardized treatment algorithms to improve treatment time for hypertensive crises. Schneider et al. (2021) conducted a study that focused on a collaborative effort with a state quality improvement initiative utilizing a hypertension toolkit. This study focused on early recognition and treatment with appropriate utilization of the hypertension toolkit (Schneider et al., 2021). Results of the study were statistically significant for the administration of antihypertensives within sixty minutes of identification and increased use of antihypertensives in conjunction with magnesium sulfate to prevent maternal seizures and secondary to progression to eclampsia (Schneider et al., 2021). The use of magnesium sulfate in conjunction with antihypertensives had not been widely studied to determine its effects on

maternal outcomes. The studies included in this review focused on the treatment of initial severe range blood pressure only, so further research is needed to assess the efficacy for treatment of subsequent severe range blood pressures. In addition, standardization of methods for education was identified as an opportunity for improvement to increase knowledge retention.

Simulation-Based Training

Simulation-based training to improve recognition, response, and treatment times for hypertensive crises has been widely utilized and studied with consistent results for its efficacy. Studies were conducted with nurses of several levels of experience, from student nurses to experienced nurses. Simulation-based training was beneficial in settings with low-risk patients or settings with a lack of exposure to obstetric emergencies (Kim et al., 2012). The National League for Nursing (NLN) Jeffries Simulation Theory was consistently utilized as the framework for simulation-based training development (Akalin & Sahin, 2020; Erenel et al., 2021; Riley et al., 2021). The use of high-fidelity simulation showed statistically significant results for knowledge retention and clinical decision-making in the experimental group when compared to the control group (Akalin & Sahin, 2020). This study also showed improved participant satisfaction due to the learning environment and ability to learn without causing harm to a patient (Akalin & Sahin, 2020). Ehmke et al. (2021) expanded simulation-based training to a rural setting with a low rate of exposure to high-risk obstetrical emergencies. The use of high-fidelity simulation in this setting showed statistically significant results from pre-intervention to two months post-intervention in treatment of various obstetric emergencies, including hypertensive crises in pregnancy (Ehmke et al., 2021). The staff involved in the simulation-based training in the rural setting expressed positive experiences with a stress and judgment free learning environment, which was consistent with the findings from other studies (Ehmke et al., 2021). Dincer &

Ataman (2020) discovered that an increase in self-confidence because of simulation-based training was associated with increased knowledge retention in the nursing student population. Communication and clinical competence have been shown to be directly related to improvement in clinical outcomes (Kim et al., 2012). Kim et al. (2012) reported that pre/posttest questionnaires yielded results that supported the study hypotheses of improving clinical competence and communication to improve clinical and patient outcomes. In another study with simulation-based training, findings showed a need for student autonomy in learning as opposed to instructor-led education only (Riley et al., 2021). Said et al. (2021) reported statistically significant findings for improvement in knowledge and self-efficacy in the treatment of eclampsia. Erenel et al. (2021) had an unexpected finding that did not show improvement in clinical satisfaction following simulation-based training, but study recommendations included continued use of simulation-based training. The use of simulation-based training and standardized treatment guidelines, protocols, and algorithms were effective in the treatment of hypertensive crises and quality of care by improving communication skills, clinical competence, and self-efficacy of the medical care team. Utilizing a multidisciplinary approach in the implementation of quality improvement initiatives and simulation-based training increased awareness in practitioners of all levels surrounding the importance of adequate and timely recognition, response to, and treatment of maternal hypertensive crises.

Upon reviewing the literature, it was evident that simulation-based training in laboratory and hospital settings was effective in improving clinical practice. Simulation-based training can be generalized to multiple populations and areas of nursing to increase knowledge retention, confidence, and self-efficacy. Methods of developing simulation-based training and scenarios differed between studies along with the level and type of education provided. The pretest/posttest

design was consistent through several studies and yielded similar results with various assessment tools; however, there is not a standardized assessment tool utilized to assess simulation-based training by observation (Kim et al., 2012). There was consistency with improvement in clinical competence, self-confidence, communication amongst peers, and overall satisfaction when using simulation-based training for the treatment of obstetric emergencies. The use of simulation-based training was conducive to learning and should be considered for use on other topics of nursing practice with additional levels of nursing experience. Promoting the use of simulation-based training while fostering a judgment-free environment can assist with successful implementation.

Project Question

Does the use of educational simulations improve nurse self-efficacy and knowledge of hypertensive treatment algorithms for obstetric patients experiencing a hypertensive crisis and decrease transfers to the Intensive Care Unit (ICU) over an 8-week period?

Objectives

- Identify if educational simulations improve nurse self-efficacy and knowledge of hypertensive treatment algorithms for hypertensive crisis and decrease ICU admissions.

Framework

The IOWA Model for Evidence-Based Practice was used to guide this project (Appendix A). The IOWA Model of Evidence-Based Practice closely aligns with the organization's method for promoting and implementing practice change for identified gaps in patient care. The IOWA Model focuses on identifying an issue, developing a plan for practice change, implementing a practice change, and monitoring progress to track the outcome and efficacy of the practice change (Buckwalter et al., 2017). As it aligned with this project, a knowledge gap was identified regarding hypertension treatment protocols and an interdisciplinary team comprised of unit

leadership, educators, key physicians, and the project coordinator was created to work closely in developing a strategy for practice change with a goal of improving nursing knowledge and nurse self-efficacy.

Methods

This was an Evidence-Based Practice (EBP) project. During the project planning phase, a risk assessment was conducted to identify potential challenges or barriers that could negatively affect the project. The effect of identified risks along with mitigation and contingency plans were discussed with the project team (Appendix B). The strengths, weaknesses, opportunities, and threats (SWOT) associated with the successful implementation of the project were assessed prior to project implementation. Several strengths were identified involving leadership support, communication, skill mixture of staff, and physician engagement. Weaknesses surrounding previous leadership and staff turnover secondary to COVID have been identified. Opportunities related to communication, a unit culture change, and staff buy-in were also identified. Additionally, identified threats that could potentially have a negative effect on the project are increased staff turnover due to poor job satisfaction and physician orders that do not align with the protocols and algorithms. Appendix C details the findings from the SWOT analysis. The project team utilized the findings from the risk assessment and SWOT analysis during the planning phase to minimize barriers or challenges encountered during the implementation phase.

Population

The population includes registered nurses caring for obstetric patients experiencing a hypertensive crisis secondary to a diagnosis of a hypertensive condition of pregnancy. Participants were selected using convenience sampling from the nurses employed in the department. Participation was voluntary and nurses attended during scheduled shifts. Department

leadership ensured that adequate staffing was available on the day(s) of simulations to provide coverage for participants. Inclusion criteria were licensed registered nurses that provide direct care to patients diagnosed with a hypertensive condition of pregnancy in the inpatient setting. Exclusion criteria were registered nurses that are contract labor or agency. Contract labor and agency nurses did provide direct care to this patient population; however, the terms of their contracts or short lengths of time working with the hospital could potentially cause challenges and barriers to project completion.

Twenty-seven registered nurses meeting the study inclusion criteria volunteered to participate in the study. Regarding age, 29.6% (n = 8) of nurses were 22-28 years of age, whereas the remaining 66.7% (n = 18) were 29 or older (Table 1). Out of the study participants, 66.7% (n = 18) held baccalaureate degrees, 29.6% (n = 8) had associate degrees, and 3.7% (n = 1) preferred not to answer. The largest group of nurses (37.0%, n = 10) had six months to three years of nursing experience, whereas the sample of nurses with 4-8 years (11.1%, n = 3), 9-13 years (11.1%, n = 3), and 14-18 years (11.1%, n = 3) was equally distributed (Table 2). Similarly, the largest group of nurses (44.4%, n = 12) had six months to three years of obstetric nursing experience, whereas the sample of nurses with 9-13 years (11.1%, n = 3), and 14-18 years (11.1%, n = 3) was equally distributed (Table 3).

Setting

The project setting was a Level III designated maternal care unit comprised of sixteen labor and delivery beds, seven antepartum beds, three operating rooms, and five obstetric emergency department beds. The unit provides care to both low and high-risk obstetric patients with an average of 3,300 deliveries per year. The hospital serves an area with patients from various socio-economic statuses but has a higher volume of patients with a low socioeconomic

status along with a prominent homeless population in the area. This can result in an increased number of patients with limited or no prenatal care and undiagnosed hypertensive conditions or other conditions affecting pregnancy and maternal and neonatal outcomes.

Measurement and Analysis

Demographic information was collected from participating nurses (Appendix D). Information collected from participants included age, level of education (Associates, Bachelors, Masters), total years of nursing experience, and years of experience in obstetrics. The open access Self-Efficacy for Obstetric Critical Episodes Evaluation (SEOCEE) tool was used to measure participants' perception and self-efficacy before and after simulation (Appendix E). Christian & Krumwiede (2013) adapted the SEOCEE tool from an original tool for self-efficacy created by Ravert (2004) with permission to specifically evaluate obstetrics. The reliability of the SEOCEE was determined by a Cronbach's alpha of 0.93 (Christian & Krumwiede, 2013). Reliability for the original self-efficacy tool created by Ravert (2004) was determined by a Cronbach's alpha of 0.88. The SEOCEE tool consisted of twenty-one questions and uses a 5-point Likert scale (5=Extremely Confident, 4=Very Confident, 3=Moderately Confident, 2=Slightly Confident, 1=Not At All Confident) (Christian & Krumwiede, 2013). The SEOCEE tool assessed obstetric conditions that included hypertension, hemorrhage, shoulder dystocia, and physical assessment skills; however, this assessment tool closely aligned with the focus on hypertensive crises for this project (Christian & Krumwiede, 2013). A study conducted by Christian & Krumwiede (2013) utilized the SEOCEE tool and yielded statistically significant findings for self-efficacy ratings in obstetrical emergencies.

Procedure

The educational simulations took place in the labor and delivery unit and were conducted in partnership with the department educators with support from the Nurse Manager, ACNO, and physicians. The simulation process was explained to participants and verbal consent was obtained. Staff that did not wish to participate were given the opportunity to exit the simulation room prior to the continuation of the simulation. Confidentiality was maintained by utilizing a code number instead of a name, initials, or employee identification number. Utilizing ranges for age and years of experience assisted in ensuring confidentiality was maintained for all participants. All forms collected were kept in a locked drawer in an office that remained locked when unoccupied. All data were entered into a data collection dashboard for tracking and monitoring purposes (Appendix F).

The simulations took place in a judgment-free environment to ensure that optimal learning was achieved by participants. During the simulations, participants entered the simulation room and received a Demographic Information Sheet and the first SEOCEE prior to the simulation. Upon completion of these forms but prior to the beginning of the simulation, the participants received copies of the Hypertensive Emergency and Eclampsia Checklists along with the antihypertensive treatment algorithms from ACOG (2021) that are utilized by the Texas AIM initiative (Appendix G). Participants were given the opportunity to review the algorithms and all questions regarding the algorithms were answered prior to the simulation. Standardized scenarios were created in collaboration with the department educators, nursing leaders, and physicians for each simulation to ensure all participants received the same level of education and skill practice (Appendix H). The simulations were conducted in groups of four to six. Upon entering the simulation room, participants were given a role for the simulation at random. The

roles included primary nurse, charge nurse, secondary nurse, and recorder. The simulation leader provided a bedside report with an overview of the patient's medical/surgical history, obstetrical history with complications of past and current pregnancies, the reason for admission, and other details pertinent to the scenario. The participants were expected to assess and provide care based on the patient history and status per the algorithms and protocols. The simulation leader updated vital signs and patient status at specified timeframes per the scenarios agreed upon by the project team. The goal was to induce critical thinking and appropriate nursing actions based on the ACOG treatment algorithms for labetalol, hydralazine, and nifedipine in conjunction with the Hypertensive Emergency and Eclampsia Checklists that reflect real-life situations. The algorithms provided a step-by-step guide for vital sign frequency, guidelines for physician notification, nursing interventions, and antihypertensive dosing and re-evaluation guidelines (ACOG, 2021). The scenarios included caring for a patient requiring treatment for a hypertensive crisis with one scenario progressing to eclampsia. The simulation leader ended the simulation upon completion of all steps in the scenario. The simulations had a debrief session to discuss the care of the patient, opportunities for improvement, and to obtain feedback from participants.

Immediately following the debrief, participants were given a second SEOCEE tool to complete prior to leaving. This assessed the level of self-efficacy immediately post-simulation. The participants received a third and final SEOCEE tool approximately eight weeks after the simulation. The third SEOCEE tool showed the project team if the level of self-efficacy increased, decreased, or remained the same eight weeks post-simulation when compared with the previous evaluation forms. Upon completion of all forms, data was analyzed to evaluate the use of educational simulations to improve nursing self-efficacy and knowledge of hypertensive treatment algorithms. The project coordinator attended all simulations and was the primary

responsible party for data and form collection for the entirety of the project. Upon completion of all simulations, the project coordinator ensured the accuracy of data entry into the dashboard prior to data analysis. Weekly data was collected for the total number of hypertensive crisis cases and the total number of ICU transfers related to hypertensive crises to further validate the efficacy of simulations during this timeframe.

Statistical Analysis

Statistical analysis of the data was completed using the Statistical Package for Social Sciences (SPSS) software version 23. Descriptive statistics were completed on demographic variables that include age, level of education, years of total nursing experience, and years of obstetric nursing experience. Mean, median, and a one-way repeated measures ANOVA test was used to evaluate the use of educational simulations in improving levels of nurse self-efficacy. A statistician was consulted for assistance with statistical analysis.

Ethical Considerations

The project was reviewed by the Graduate Nurse Review Committee (GNRC) for ethical violations and approval to proceed with project implementation was granted. The GNRC is authorized by the University Internal Review Board (IRB). There were no conflicts of interest associated with the project.

Results

Project Outcomes

Descriptive statistics for the pre-simulation self-efficacy scores, immediately post-simulation, and 8-weeks post simulation are presented in Table 4. Mauchly's Test of Sphericity indicated that the assumption had not been violated, $p = .084$. There was a significant difference in self-efficacy scores, $F(2, 50) = 21.58$, $p < .001$, partial $\eta^2 = .46$, observed power = 1.00. The

ANOVA Summary Table is presented in Table 5. The project coordinator noted a mean increase in self-efficacy scores from pre-simulation to immediately post-simulation (*Mean Difference* = 4.97) and from immediately post-simulation to 8 weeks post-simulation (*Mean Difference* = 3.04). However, the largest difference was between scores from pre-simulation to 8 weeks post-simulation (*Mean Difference* = 8.11) (Figure 1).

ICU transfers related to hypertensive crises were tracked over a 16-week period. During this timeframe, hypertensive crisis cases ranged from 1 to 5 ($M = 2.81$, $SD = 1.38$) per week with a median of 2.00 cases per week. However, there were no ICU transfers due to hypertensive crises during this timeframe.

Discussion

The results of this project provide supporting evidence that simulation-based training can increase nurse self-efficacy and knowledge of the treatment of obstetric patients experiencing a hypertensive crisis. These results are consistent with findings from studies conducted by Akalin & Sahin (2020) and Dincer & Ataman (2020). Increasing nurse self-efficacy and knowledge of treatment for hypertensive crises will positively affect quality of care and patient outcomes within the unit. The unit educators will continue to utilize simulation-based training for hypertensive crises and other obstetrical emergencies to increase preparedness and self-efficacy.

Summary

Key Findings

Strengths of the project include consistent support from leadership, a multidisciplinary collaborative approach to implementation, and active physician involvement and staff engagement during simulations. The unit will continue quarterly simulation-based training for hypertensive crises. The project identified additional needs for education on management of

other obstetrical emergencies, such as shoulder dystocia, management of gestational diabetes, and management of obstetric hemorrhage; however, additional research is needed to assess the efficacy of simulation-based training for these emergencies.

Limitations

Although the results support the use of simulation-based training, several limitations were identified. Limitations of the project include the short timeframe for implementation, a limited number of participants, a high volume of agency nurses that were excluded from participating, and staffing constraints due to an increase in COVID patients and staff illness due to COVID. Biases of self-reporting and difficulty in determining if an improvement in self-efficacy was related solely to the intervention or other extenuating circumstances were also identified as limitations.

Conclusion

Hypertensive conditions of pregnancy remain a leading cause of increased maternal morbidity and mortality and can lead to poor maternal and neonatal outcomes if inadequately treated (Texas Health and Human Services, 2021). There is consistent evidence to support the use of simulation-based training and standardized treatment protocols and algorithms to increase knowledge retention and self-efficacy. In the simulation setting, participants can learn in a judgment free environment and increase preparedness for the application of knowledge and skills in clinical practice.

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Table 1

Age

Age	*n*	%	Cumulative %
22-28	8	29.6	29.6
29-35	3	11.1	40.7
36-45	8	29.6	70.4
46-55	4	14.8	85.2
>55	3	11.1	96.3
Prefer not to answer	1	3.7	100.0
Total	27	100.0	

Table 2

Nursing Experience

Nursing Experience	*n*	%	Cumulative %
6 months to 3 years	10	37.0	37.0
4-8 years	3	11.1	48.1
9-13 years	3	11.1	59.3
14-18 years	3	11.1	70.4
19-23 years	2	7.4	77.8
> 24 years	5	18.5	96.3
Prefer not to answer	1	3.7	100.0
Total	27	100.0	

Table 3

OB Nursing Experience

OB Nursing Experience	*n*	*%*	Cumulative *%*
6 months to 3 years	12	44.4	44.4
4-8 years	1	3.7	48.1
9-13 years	3	11.1	59.3
14-18 years	3	11.1	70.4
19-23 years	2	7.4	77.8
> 24 years	5	18.5	96.3
Prefer not to answer	1	3.7	100.0
Total	27	100.0	

Table 4

Descriptive Statistics for the Pre-simulation Self-efficacy Scores, Immediately Post-simulation, and 8-weeks Post-simulation

	Pre-Simulation Self-Efficacy Score	Immediately Post-Simulation	8-weeks Post-Simulation
Mean	83.89	88.96	92.00
N	27	27	26
Std. Deviation	13.27	13.07	11.63
Minimum	58	61	61
Maximum	105	105	105
Median	86.00	90.00	93.00

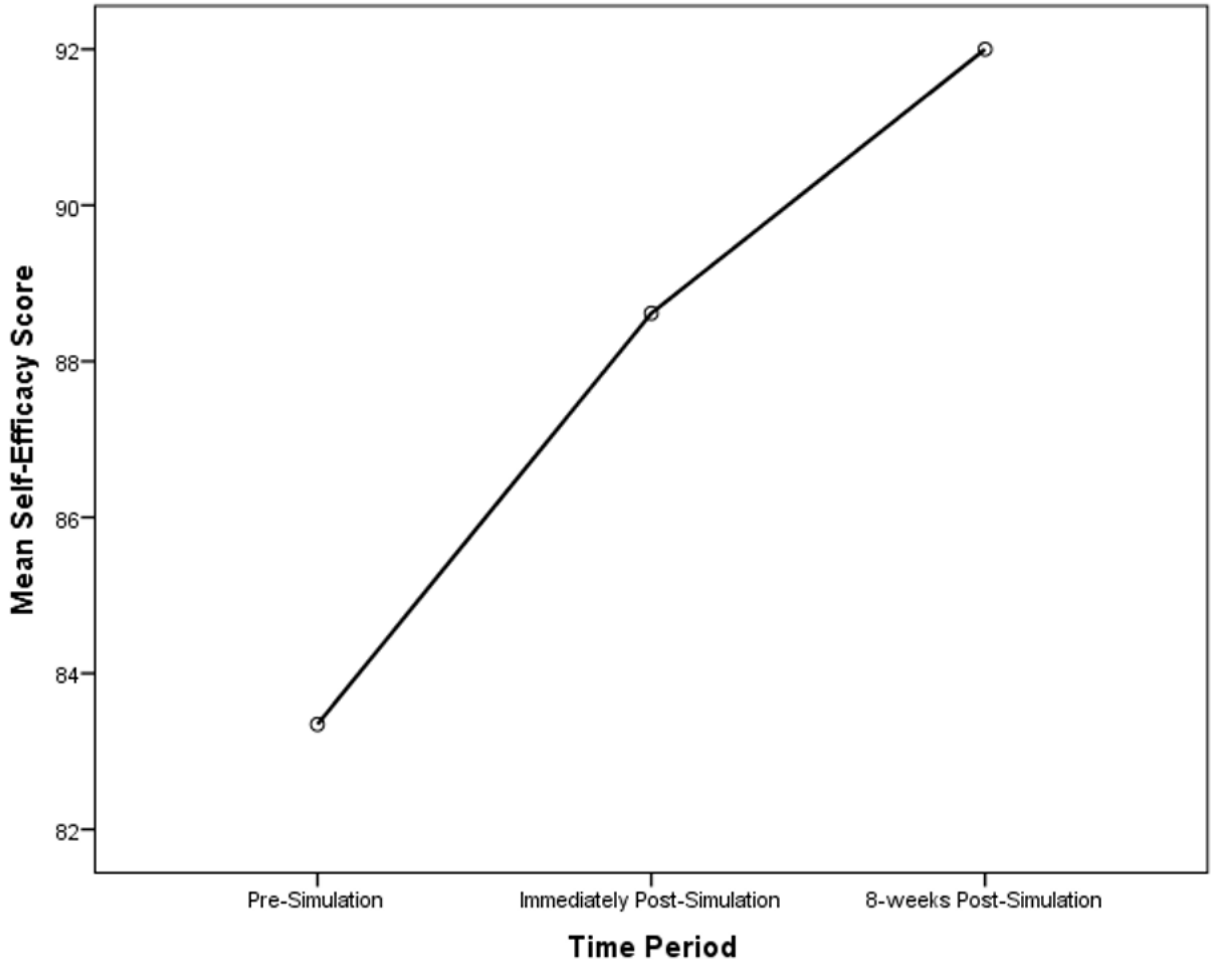
Table 5

Repeated Measures ANOVA Summary Table

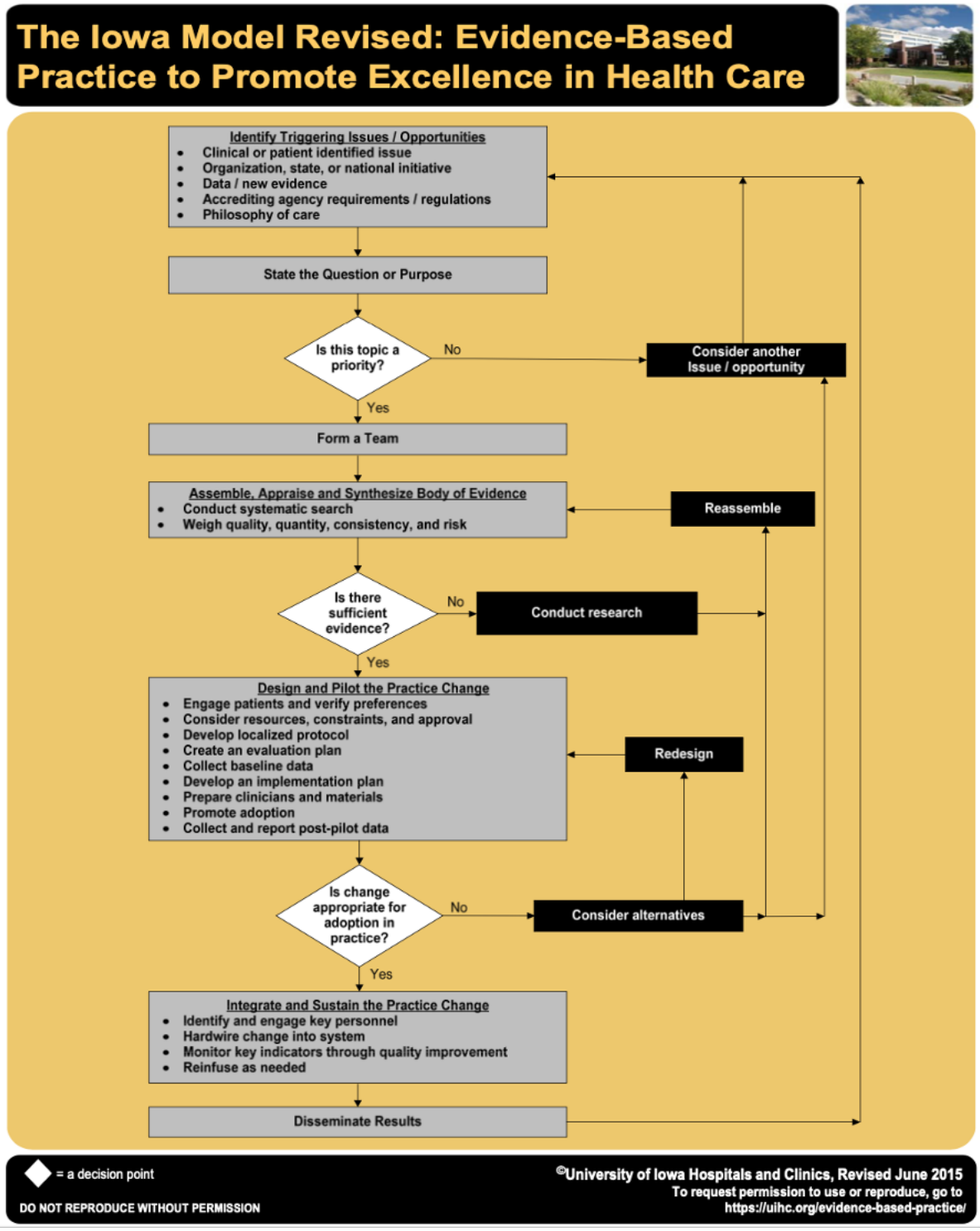
Source		*df*	Mean Square	*F*	*p*	η^2	Observed Power[a]
Self-Efficacy	Sphericity Assumed	2	494.47	21.58	.000	.46	1.00
	Greenhouse-Geisser	1.69	586.65	21.58	.000	.46	1.00
	Huynh-Feldt	1.79	551.20	21.58	.000	.46	1.00
	Lower-bound	1.00	988.95	21.58	.000	.46	.99
Error(Self-Efficacy)	Sphericity Assumed	50	22.91				
	Greenhouse-Geisser	42.14	27.19				
	Huynh-Feldt	44.85	25.54				
	Lower-bound	25.00	45.83				

Figure 1

Line Graph of Mean Self-Efficacy Score by Time Period



Appendix A



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Appendix B

Risk Assessment and Management Plan

Risk	Probability	Impact	Mitigation of Risk	Contingency Plan
Identification of participants	Seldom	Minor	Utilize ranges for demographic data collection	Use code numbers for participants instead of initials Keep documents in a locked drawer and office
Use of paper data collection tools increases risk of data misplacement	Occasional	Critical	Scan paper data collection tools into a secure computer file upon completion	Work with IT to create a secure computer file storage location for documents
Staff turnover during project can result in inaccurate findings	Seldom	Critical	Exclude contract labor and agency staff from participation	Work with unit leadership to determine risk of turnover prior to participation in project Discuss incentive or retention plan with leadership

Appendix C

SWOT Analysis

Strengths	**Weaknesses**
• Consistent support from senior leadership • Accessibility to educational resources • Physician involvement, participation, and engagement • Minimal financial impact for intervention • Wide skill mixture of staff • Staff are actively involved in ways to ensure Level III maternal designation is maintained • Consistent communication from current unit leadership • Presence of current unit educators	• Frequent staff turnover • Previous lack of consistent educators on the unit • Lack of support from previous unit leadership leading to gaps in communication
Opportunities	**Threats**
• Staff buy-in and engagement • Improved culture and communication between nursing staff and physicians • Provide evidence and reasoning for the intervention when introduced to staff	• Current rate of staff burnout and satisfaction • Physician orders that do not follow protocols and algorithms

Appendix D

Demographic Information Sheet

1) Age (Circle One):

   22-28 29-35 36-45 46-55 >55

2) Level of Education (Circle One):

   Associates Bachelors Masters

3) Total Years of Nursing Experience (Circle One):

   6 months-3 years 4-8 years 9-13 years 14-18 years 19-23 years >24

4) Total Years of Obstetric Nursing Experience (Circle One):

   6 months-3 years 4-8 years 9-13 years 14-18 years 19-23 years >24

Appendix E

Self-Efficacy for Obstetric Critical Episodes Evaluation

DIRECTIONS: Individuals do many different things to help themselves perform well in different situations. I am interested in how confident you are in performing each of the following skills. For example for the skill: I can run a marathon, I would rank my confidence as very confident as I have trained for 6 months but this is my first marathon. Record your **first reaction**: do not spend a lot of time thinking about how well you do the skill- just how confident you are that you can do it.

Please check the appropriate column indicating your level of confidence to perform the skill.	5 = Extremely Confident	4 = Very Confident	3 = Moderately Confident	2 = Slightly Confident	1 = Not At All Confident
1. Assessing vital signs (T, P, R, BP)					
2. Assessing reflexes (patellar, brachial, and clonus)					
3. Completing full obstetrical admission physical assessment					
4. Completing postpartum assessment					
5. Inserting IV					
6. Administering IV push medication					
7. Administering intravenous piggyback					
8. Calculating magnesium sulfate loading doses					
9. Monitoring fluid levels					
10. Administering blood products					
11. Understanding pre-eclampsia lab values					
12. Monitoring for CNS involvement with pre-eclampsia					
13. Managing antepartum patient with disease/condition of pre-eclampsia					
14. Managing active labor patient with disease/condition of pre-eclampsia					
15. Managing patient with disease/condition of HELLP Syndrome					
16. Managing patient with eclamptic seizure					
17. Managing patient with disease/condition of postpartum hemorrhage (PPH)					
18. Managing antepartum patient with disease/condition of gestational diabetes (GDM)					
19. Managing postpartum patient with disease/condition of gestational diabetes (GDM)					
20. Managing patient with disease/condition of DIC					
21. Managing patient with shoulder dystocia					

Comments:

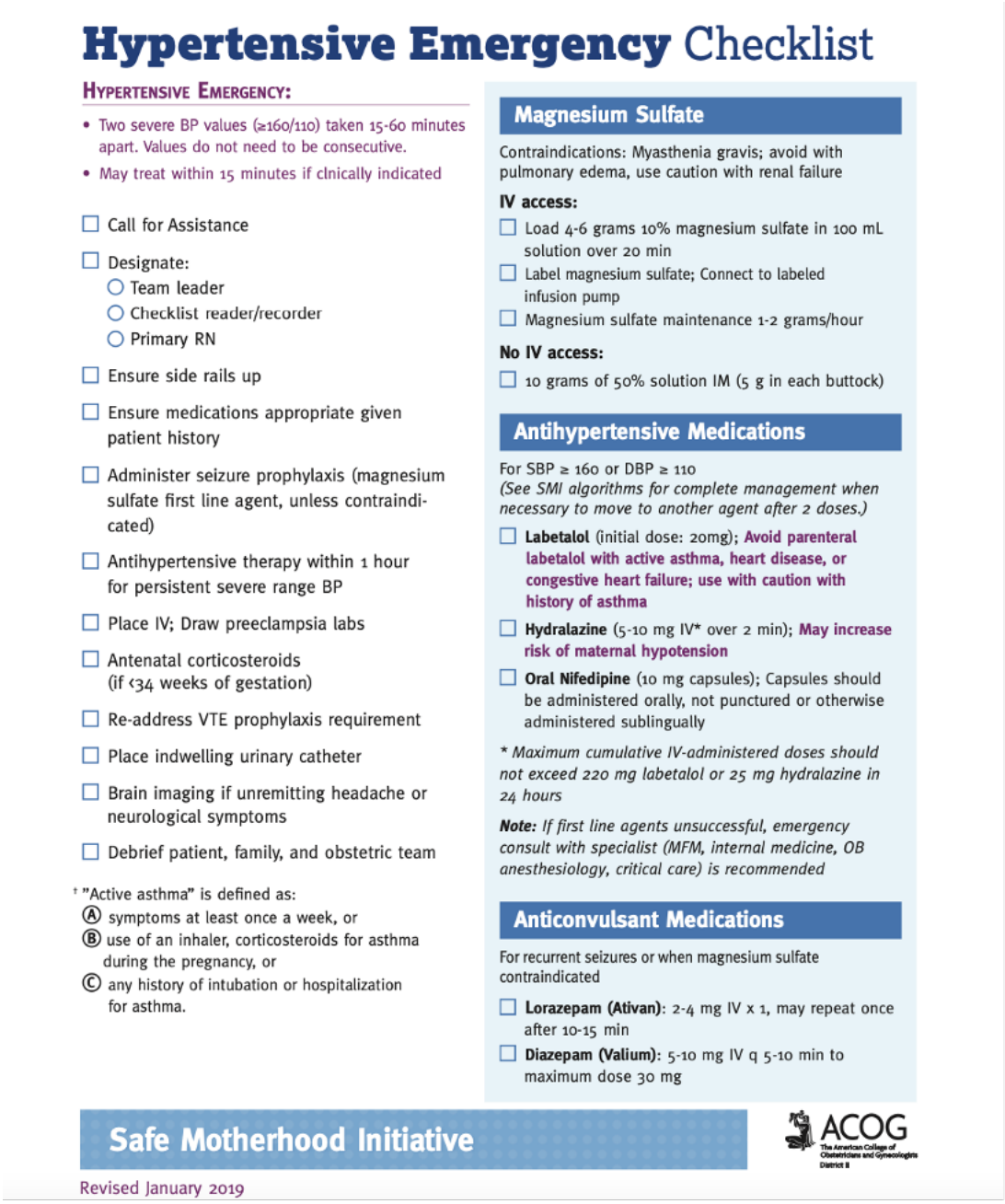
*Evaluation tool adapted with permission from P. Ravert (2004) dissertation project: Use of a human patient simulator with undergraduate nursing students: A prototype evaluation of critical thinking and self-efficacy.

Appendix F

Data Collection Dashboard										
Project	Use of educational simulations to improve nurse self-efficacy and knowledge of hypertensive treatment algorithms to decrease ICU admissions									
Project Lead: Heather Garcia					Department: Labor & Delivery					
Date: 1/24/2022 - 4/22/2022										
Demographics					Self-Efficacy Survey			ICU Transfers Related to HTN Crises		
Subject	Age	Level of Education	Nursing Experience (Years)	OB Nursing Experience (Years)	Pre-Simulation	Immediately Post-Simulation	8-weeks Post-Simulation	Week	Total Number of Hypertensive Crisis Cases	Total Number of ICU Transfers
1	36-45	Bachelors	9-13	9-13	98	99	102	1	1	0
2	36-45	Bachelors	9-13	9-13	75	76	93	2	5	0
3	36-45	Bachelors	14-18	14-18	98	98	N/A	3	4	0
4	36-45	Bachelors	19-23	19-23	94	103	105	4	5	0
5	22-28	Associates	6m-3y	6m-3y	93	101	102	5	2	0
6	46-55	Bachelors	19-23	19-23	92	98	100	6	2	0
7	46-55	Bachelors	14-18	14-18	87	91	99	7	3	0
8	22-28	Bachelors	6m-3y	6m-3y	86	95	100	8	3	0
9	36-45	Bachelors	14-18	14-18	68	71	92	9	2	0
10	22-28	Associates	6m-3y	6m-3y	90	90	93	10	2	0
11	29-35	Bachelors	6m-3y	6m-3y	63	82	84	11	1	0
12	22-28	Bachelors	6m-3y	6m-3y	58	64	71	12	4	0
13	22-28	Bachelors	6m-3y	6m-3y	61	61	61	13	2	0
14	>55	Bachelors	>24	>24	100	100	100	14	5	0
15	46-55	Associates	>24	>24	89	105	103	15	2	0
16	PNTA	PNTA	PNTA	PNTA	79	82	82	16	2	0
17	46-55	Bachelors	>24	>24	96	96	99			
18	22-28	Bachelors	6m-3y	6m-3y	83	84	85		Dates for Data Collection	
19	36-45	Associates	4-8	6m-3y	105	105	105		of ICU tranfsers:	
20	36-45	Associates	9-13	9-13	89	89	87		1/24/2022 - 5/12/2022	
21	29-35	Bachelors	4-8	4-8	85	88	91			
22	>55	Associates	>24	>24	84	84	84			
23	>55	Associates	>24	>24	70	70	73		PNTA =	
24	22-28	Bachelors	6m-3y	6m-3y	79	105	103		Prefer Not to Answer	
25	36-45	Associates	6m-3y	6m-3y	73	84	89			
26	29-35	Bachelors	6m-3y	6m-3y	67	76	84			
27	22-28	Bachelors	4-8	6m-3y	103	105	105			

Appendix G

Educational Documents



Hypertensive Emergency Checklist

HYPERTENSIVE EMERGENCY:

- Two severe BP values (≥160/110) taken 15-60 minutes apart. Values do not need to be consecutive.
- May treat within 15 minutes if clnically indicated

- ☐ Call for Assistance
- ☐ Designate:
  - ○ Team leader
  - ○ Checklist reader/recorder
  - ○ Primary RN
- ☐ Ensure side rails up
- ☐ Ensure medications appropriate given patient history
- ☐ Administer seizure prophylaxis (magnesium sulfate first line agent, unless contraindicated)
- ☐ Antihypertensive therapy within 1 hour for persistent severe range BP
- ☐ Place IV; Draw preeclampsia labs
- ☐ Antenatal corticosteroids (if <34 weeks of gestation)
- ☐ Re-address VTE prophylaxis requirement
- ☐ Place indwelling urinary catheter
- ☐ Brain imaging if unremitting headache or neurological symptoms
- ☐ Debrief patient, family, and obstetric team

† "Active asthma" is defined as:
Ⓐ symptoms at least once a week, or
Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
Ⓒ any history of intubation or hospitalization for asthma.

Magnesium Sulfate

Contraindications: Myasthenia gravis; avoid with pulmonary edema, use caution with renal failure

IV access:

- ☐ Load 4-6 grams 10% magnesium sulfate in 100 mL solution over 20 min
- ☐ Label magnesium sulfate; Connect to labeled infusion pump
- ☐ Magnesium sulfate maintenance 1-2 grams/hour

No IV access:

- ☐ 10 grams of 50% solution IM (5 g in each buttock)

Antihypertensive Medications

For SBP ≥ 160 or DBP ≥ 110
(See SMI algorithms for complete management when necessary to move to another agent after 2 doses.)

- ☐ **Labetalol** (initial dose: 20mg); **Avoid parenteral labetalol with active asthma, heart disease, or congestive heart failure; use with caution with history of asthma**
- ☐ **Hydralazine** (5-10 mg IV* over 2 min); **May increase risk of maternal hypotension**
- ☐ **Oral Nifedipine** (10 mg capsules); Capsules should be administered orally, not punctured or otherwise administered sublingually

** Maximum cumulative IV-administered doses should not exceed 220 mg labetalol or 25 mg hydralazine in 24 hours*

***Note:** If first line agents unsuccessful, emergency consult with specialist (MFM, internal medicine, OB anesthesiology, critical care) is recommended*

Anticonvulsant Medications

For recurrent seizures or when magnesium sulfate contraindicated

- ☐ **Lorazepam (Ativan)**: 2-4 mg IV x 1, may repeat once after 10-15 min
- ☐ **Diazepam (Valium)**: 5-10 mg IV q 5-10 min to maximum dose 30 mg

Safe Motherhood Initiative

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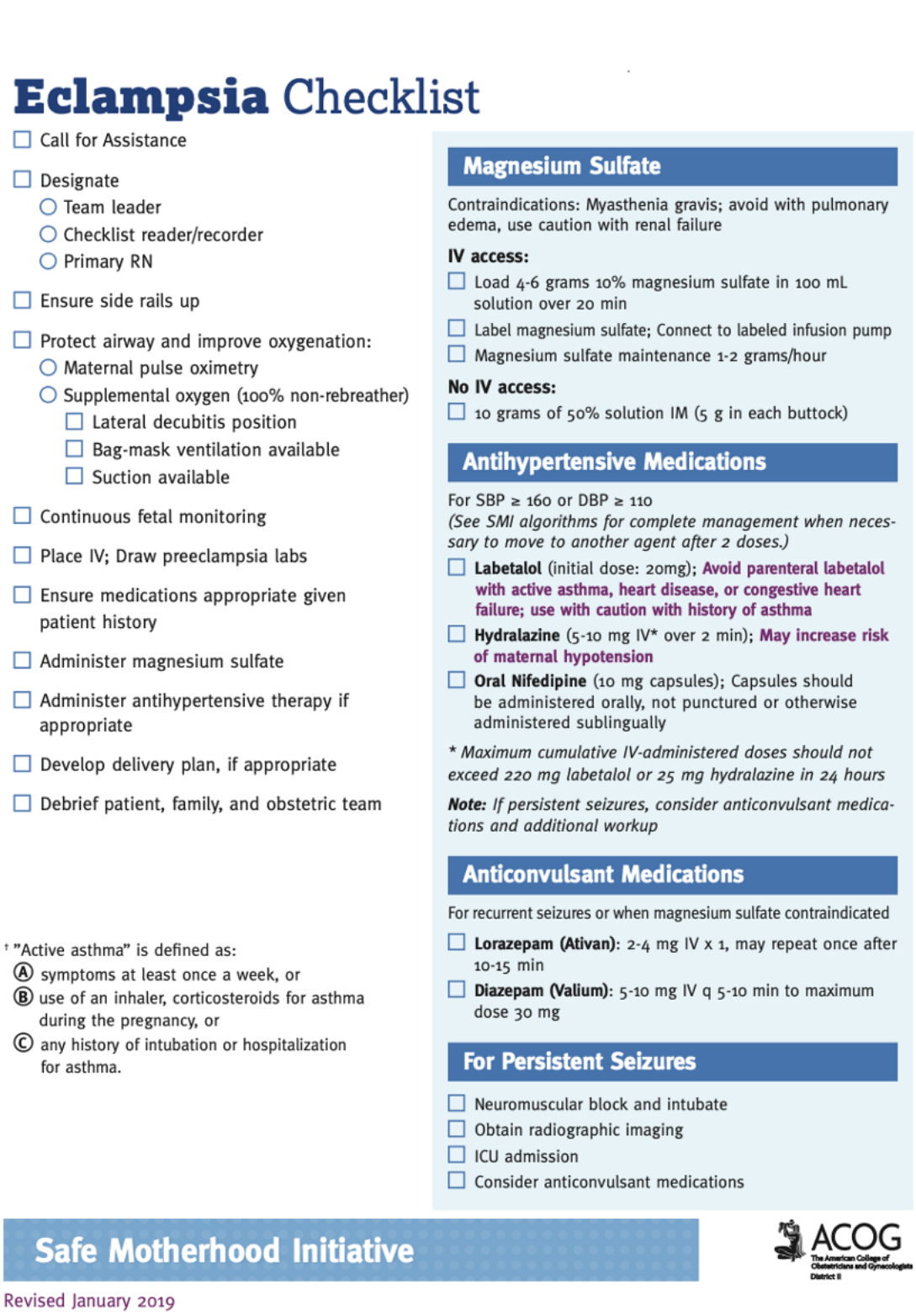
Revised January 2019

(ACOG, 2021)



Eclampsia Checklist

- ☐ Call for Assistance
- ☐ Designate
  - ○ Team leader
  - ○ Checklist reader/recorder
  - ○ Primary RN
- ☐ Ensure side rails up
- ☐ Protect airway and improve oxygenation:
  - ○ Maternal pulse oximetry
  - ○ Supplemental oxygen (100% non-rebreather)
    - ☐ Lateral decubitis position
    - ☐ Bag-mask ventilation available
    - ☐ Suction available
- ☐ Continuous fetal monitoring
- ☐ Place IV; Draw preeclampsia labs
- ☐ Ensure medications appropriate given patient history
- ☐ Administer magnesium sulfate
- ☐ Administer antihypertensive therapy if appropriate
- ☐ Develop delivery plan, if appropriate
- ☐ Debrief patient, family, and obstetric team

† "Active asthma" is defined as:
Ⓐ symptoms at least once a week, or
Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
Ⓒ any history of intubation or hospitalization for asthma.

Magnesium Sulfate

Contraindications: Myasthenia gravis; avoid with pulmonary edema, use caution with renal failure

IV access:

- ☐ Load 4-6 grams 10% magnesium sulfate in 100 mL solution over 20 min
- ☐ Label magnesium sulfate; Connect to labeled infusion pump
- ☐ Magnesium sulfate maintenance 1-2 grams/hour

No IV access:

- ☐ 10 grams of 50% solution IM (5 g in each buttock)

Antihypertensive Medications

For SBP ≥ 160 or DBP ≥ 110
(See SMI algorithms for complete management when necessary to move to another agent after 2 doses.)

- ☐ **Labetalol** (initial dose: 20mg); **Avoid parenteral labetalol with active asthma, heart disease, or congestive heart failure; use with caution with history of asthma**
- ☐ **Hydralazine** (5-10 mg IV* over 2 min); **May increase risk of maternal hypotension**
- ☐ **Oral Nifedipine** (10 mg capsules); Capsules should be administered orally, not punctured or otherwise administered sublingually

** Maximum cumulative IV-administered doses should not exceed 220 mg labetalol or 25 mg hydralazine in 24 hours*

Note: *If persistent seizures, consider anticonvulsant medications and additional workup*

Anticonvulsant Medications

For recurrent seizures or when magnesium sulfate contraindicated

- ☐ **Lorazepam (Ativan):** 2-4 mg IV x 1, may repeat once after 10-15 min
- ☐ **Diazepam (Valium):** 5-10 mg IV q 5-10 min to maximum dose 30 mg

For Persistent Seizures

- ☐ Neuromuscular block and intubate
- ☐ Obtain radiographic imaging
- ☐ ICU admission
- ☐ Consider anticonvulsant medications

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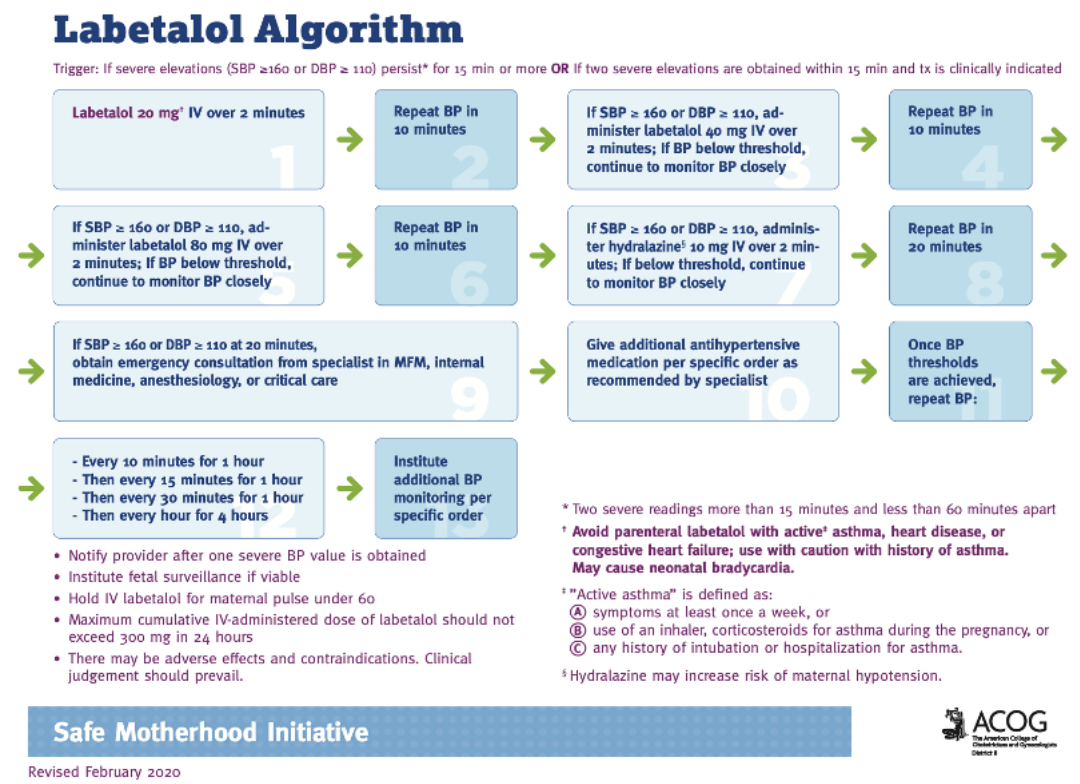
Labetalol Algorithm
Trigger: If severe elevations (SBP ≥160 or DBP ≥ 110) persist* for 15 min or more OR If two severe elevations are obtained within 15 min and tx is clinically indicated
Labetalol 20 mg† IV over 2 minutes
1
Repeat BP in 10 minutes
2
If SBP ≥ 160 or DBP ≥ 110, administer labetalol 40 mg IV over 2 minutes; If BP below threshold, continue to monitor BP closely
3
Repeat BP in 10 minutes
4
If SBP ≥ 160 or DBP ≥ 110, administer labetalol 80 mg IV over 2 minutes; If BP below threshold, continue to monitor BP closely
5
Repeat BP in 10 minutes
6
If SBP ≥ 160 or DBP ≥ 110, administer hydralazine§ 10 mg IV over 2 minutes; If below threshold, continue to monitor BP closely
7
Repeat BP in 20 minutes
8
If SBP ≥ 160 or DBP ≥ 110 at 20 minutes, obtain emergency consultation from specialist in MFM, internal medicine, anesthesiology, or critical care
9
Give additional antihypertensive medication per specific order as recommended by specialist
10
Once BP thresholds are achieved, repeat BP:
11
- Every 10 minutes for 1 hour
- Then every 15 minutes for 1 hour
- Then every 30 minutes for 1 hour
- Then every hour for 4 hours
12
Institute additional BP monitoring per specific order
• Notify provider after one severe BP value is obtained
• Institute fetal surveillance if viable
• Hold IV labetalol for maternal pulse under 60
• Maximum cumulative IV-administered dose of labetalol should not exceed 300 mg in 24 hours
• There may be adverse effects and contraindications. Clinical judgement should prevail.
* Two severe readings more than 15 minutes and less than 60 minutes apart
† Avoid parenteral labetalol with active‡ asthma, heart disease, or congestive heart failure; use with caution with history of asthma. May cause neonatal bradycardia.
‡ "Active asthma" is defined as:
Ⓐ symptoms at least once a week, or
Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
Ⓒ any history of intubation or hospitalization for asthma.
§ Hydralazine may increase risk of maternal hypotension.
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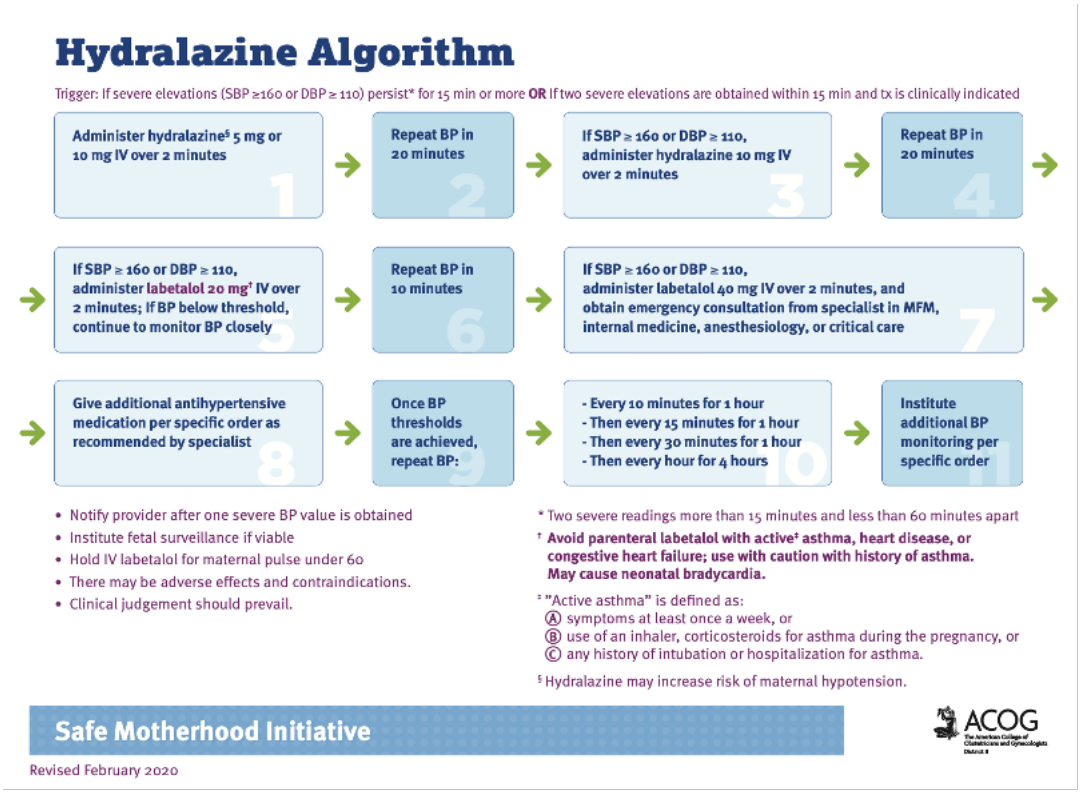
Hydralazine Algorithm
Trigger: If severe elevations (SBP ≥160 or DBP ≥ 110) persist* for 15 min or more OR If two severe elevations are obtained within 15 min and tx is clinically indicated
Administer hydralazine§ 5 mg or 10 mg IV over 2 minutes
1
Repeat BP in 20 minutes
2
If SBP ≥ 160 or DBP ≥ 110, administer hydralazine 10 mg IV over 2 minutes
3
Repeat BP in 20 minutes
4
If SBP ≥ 160 or DBP ≥ 110, administer labetalol 20 mg† IV over 2 minutes; If BP below threshold, continue to monitor BP closely
5
Repeat BP in 10 minutes
6
If SBP ≥ 160 or DBP ≥ 110, administer labetalol 40 mg IV over 2 minutes, and obtain emergency consultation from specialist in MFM, internal medicine, anesthesiology, or critical care
7
Give additional antihypertensive medication per specific order as recommended by specialist
8
Once BP thresholds are achieved, repeat BP:
9
- Every 10 minutes for 1 hour
- Then every 15 minutes for 1 hour
- Then every 30 minutes for 1 hour
- Then every hour for 4 hours
10
Institute additional BP monitoring per specific order
• Notify provider after one severe BP value is obtained
• Institute fetal surveillance if viable
• Hold IV labetalol for maternal pulse under 60
• There may be adverse effects and contraindications.
• Clinical judgement should prevail.
* Two severe readings more than 15 minutes and less than 60 minutes apart
† Avoid parenteral labetalol with active‡ asthma, heart disease, or congestive heart failure; use with caution with history of asthma. May cause neonatal bradycardia.
‡ "Active asthma" is defined as:
Ⓐ symptoms at least once a week, or
Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
Ⓒ any history of intubation or hospitalization for asthma.
§ Hydralazine may increase risk of maternal hypotension.
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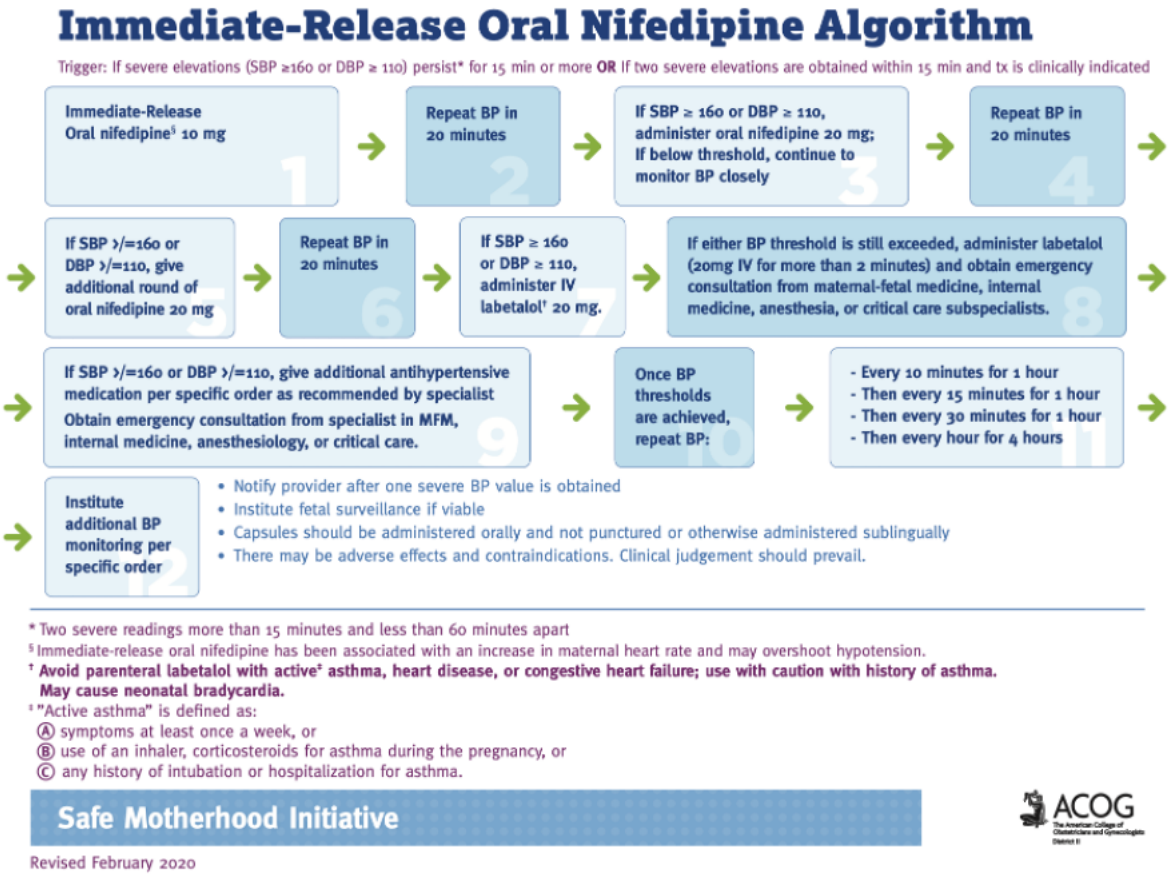
(ACOG, 2021)


Immediate-Release Oral Nifedipine Algorithm
Trigger: If severe elevations (SBP ≥160 or DBP ≥ 110) persist* for 15 min or more OR If two severe elevations are obtained within 15 min and tx is clinically indicated
Immediate-Release Oral nifedipine§ 10 mg
1
Repeat BP in 20 minutes
2
If SBP ≥ 160 or DBP ≥ 110, administer oral nifedipine 20 mg; If below threshold, continue to monitor BP closely
3
Repeat BP in 20 minutes
4
If SBP >/=160 or DBP >/=110, give additional round of oral nifedipine 20 mg
5
Repeat BP in 20 minutes
6
If SBP ≥ 160 or DBP ≥ 110, administer IV labetalol† 20 mg.
7
If either BP threshold is still exceeded, administer labetalol (20mg IV for more than 2 minutes) and obtain emergency consultation from maternal-fetal medicine, internal medicine, anesthesia, or critical care subspecialists.
8
If SBP >/=160 or DBP >/=110, give additional antihypertensive medication per specific order as recommended by specialist
Obtain emergency consultation from specialist in MFM, internal medicine, anesthesiology, or critical care.
9
Once BP thresholds are achieved, repeat BP:
10
- Every 10 minutes for 1 hour
- Then every 15 minutes for 1 hour
- Then every 30 minutes for 1 hour
- Then every hour for 4 hours
11
Institute additional BP monitoring per specific order
12
• Notify provider after one severe BP value is obtained
• Institute fetal surveillance if viable
• Capsules should be administered orally and not punctured or otherwise administered sublingually
• There may be adverse effects and contraindications. Clinical judgement should prevail.
* Two severe readings more than 15 minutes and less than 60 minutes apart
§ Immediate-release oral nifedipine has been associated with an increase in maternal heart rate and may overshoot hypotension.
† Avoid parenteral labetalol with active‡ asthma, heart disease, or congestive heart failure; use with caution with history of asthma. May cause neonatal bradycardia.
‡ "Active asthma" is defined as:
Ⓐ symptoms at least once a week, or
Ⓑ use of an inhaler, corticosteroids for asthma during the pregnancy, or
Ⓒ any history of intubation or hospitalization for asthma.
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Appendix H

Simulation Scenarios

Scenario 1: Hypertensive Crisis

A.L. is a 26-year-old Gravida 3 Para 2002 at 36.5 weeks gestation with a history 2 previous vaginal deliveries. Patient was admitted for observation from the physician's office following findings of elevated blood pressures with proteinuria and persistent headache unrelieved by acetaminophen for the past 24 hours. No significant medical or surgical history. No known allergies. Patient has received regular prenatal care starting at 8 weeks gestation and reports no complications with previous pregnancies and did not have any issues with current pregnancy until today's routine office visit. On arrival, blood pressure (BP) is 181/102, heart rate (HR) 82, temperature 98.3 degrees, pain 7 out of 10 related to her headache, and has a category I fetal tracing with no uterine activity. Physician notification should be initiated with orders received for labetalol as first line therapy if a second severe range BP is obtained within 15-60 minutes per protocol. Laboratory data: Hemoglobin 11.2, Hematocrit 34.4%, WBC 8,000 K/uL, Platelets 198,000, AST 20 IU/L, ALT 16 IU/L. Twenty minutes after arrival, her BP is 198/108. Nurse should call for assistance. IV is already in place and labetalol 20mg IVP should be given per protocol. Repeat BP ten minutes later is 186/98. Labetalol 40mg IVP should be given per protocol. Repeat BP ten minutes later is 170/90. Labetalol 80mg IVP should be given per protocol. Repeat BP ten minutes later is 162/88. Hydralazine 10mg IVP should be given per protocol. Repeat BP twenty minutes later is 144/90. Scenario ends

Scenario 2: Eclampsia

J.W. is a 17-year-old Gravida 1 Para 0000 at 29.3 weeks gestation. Patient was admitted for observation from the obstetric emergency department due to severe range BP accompanied by blurry vision and unresolved headache for the last 24 hours. Patient medical history includes asthma, no surgical history. No known allergies. Patient had late onset prenatal care starting at 21 weeks gestation but has been to all visits since. At the start of simulation, BP is 162/102, HR 91, temperature 98.6 degrees, pain 8 out of 10 related to her headache, and fetal heart rate tracing appropriate for gestational age with no uterine activity. Physician notification should be initiated with orders received for hydralazine as first line therapy if a second severe range BP is obtained within 15-60 minutes per protocol. Laboratory data: Hemoglobin 10.2, Hematocrit 32.1%, WBC 13,000 K/uL, Platelets 97,000, AST 24 IU/L, ALT 32 IU/L. Nurse will enter room and introduce self to patient. Patient has an IV saline lock in place. At this time, patient will begin to have an eclamptic seizure. Nurse will call for help. Provider and team will enter room. Per protocol, continuous fetal monitoring, repositioning, and airway protection should be initiated. Vital signs during seizure: BP 170/110, HR 110, oxygen saturation 94%. Provider will order magnesium sulfate 4-6 gram loading dose to be administered now along with hydralazine 5mg IVP. Nurses will administer medications as ordered. Patient will stop seizing after approximately 90 seconds. VS following seizure: 156/90, HR 98, oxygen saturation 97% on room air. Decision will be made to proceed with delivery when patient is stable. Scenario ends.

Appendix I

GNRC/IRB Approval

UNIVERSITY OF TEXAS ARLINGTON | COLLEGE OF NURSING AND HEALTH INNOVATION

Doctor of Nursing Practice Program
College of Nursing and Health Innovation
Box 19407
411 S. Nedderman Drive
Arlington, Texas, 76019-0407

January 21, 2022

Dear Heather Garcia,

The UT Arlington Office of Regulatory Services and the UTA IRB have empowered the Graduate Nursing Review Committee to make preliminary determinations as to whether DNP projects submitted to the GNRC may include aspects of Human Subjects Research under 45 CFR 46.102(d). **For all projects that fit the federal definition of "Research with Human Subjects," IRB review and approval is required before any research activities begin per UT Arlington's policy 5-705.**

The following is the decision by the Graduate Nursing Review Committee regarding your project:

1. The results will be disseminated, but they are not generalizable knowledge. The results will include use of the most current research to translate the knowledge into practice, thus it is not new generalizable knowledge.
2. This project is an evidence-based implementation or quality improvement project that will translate existing knowledge into the clinical setting. The intention of the project is to implement local, setting-specific improvements to the quality or processes of patient care, not to discover or test new ways to improve processes and patient care with the intention of sharing scientific findings. Therefore, this project is not considered Human Subjects Research and does not require IRB review.
3. This quality improvement project did not satisfy the *definition of research* under 45 CFR 46.102(d). Therefore, it was not subject to the Health and Human Services regulations for the protection of human subjects in research (45 CFR part 46), UT Arlington's policy 5-705, *Statement of Principles and Policies Regarding Human Subjects in Research*, or require Institutional Review Board approval.

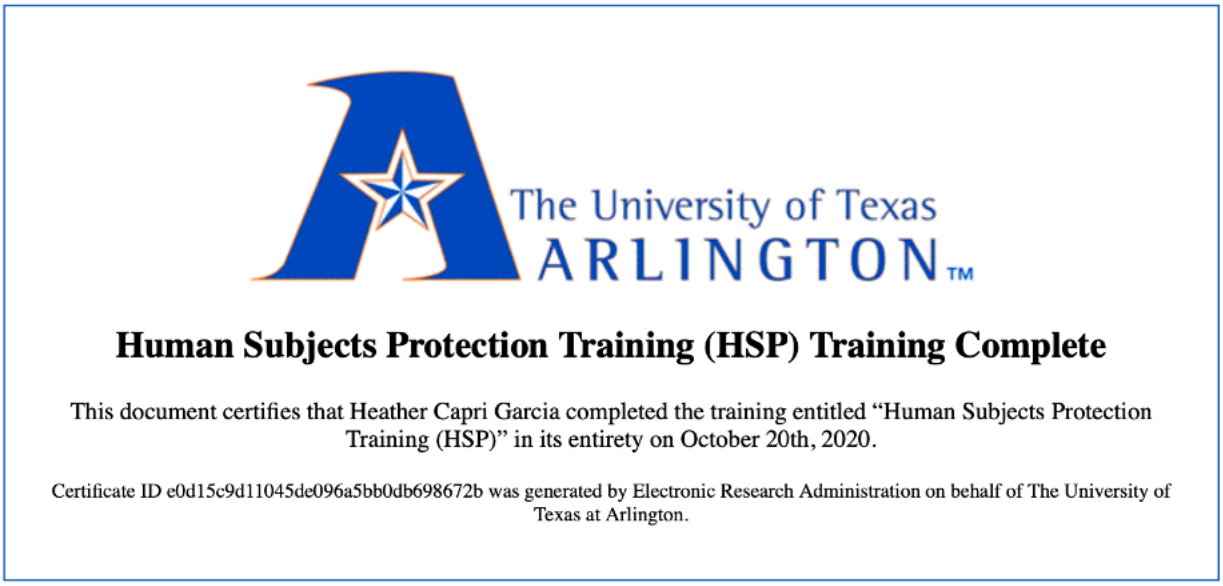
The Graduate Nursing Review Committee recommends approving this project, ***Effect of Simulations on Nurse Self-Efficacy and Knowledge of Hypertensive Crisis Treatment in Pregnancy to Decrease ICU Admissions.***

Graduate Nursing Review Committee,

Donna Hamby, DNP, RN, APRN, ACNP-BC, GNRC Chair
Tamara Eades, DNP, MSN, RN
Deborah Behan, PhD, RN, University IRB Chair
Lynda Jarrell, DNP, RN, FNP-BC
Cynthia Plonien, DNP, RN, CENP, Director of DNP Program
Deborah Lewis, DNP, APRN, FNP-C

Appendix J

Human Subjects Protection Training



The University of Texas ARLINGTON™

Human Subjects Protection Training (HSP) Training Complete

This document certifies that Heather Capri Garcia completed the training entitled "Human Subjects Protection Training (HSP)" in its entirety on October 20th, 2020.

Certificate ID e0d15c9d11045de096a5bb0db698672b was generated by Electronic Research Administration on behalf of The University of Texas at Arlington.