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**Enhancing Newer NICU Nurse Confidence with Resuscitation Through
High-fidelity, In-situ Crisis Resource Management**

Karen Rose

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Abstract

Neonatal resuscitation is a low-volume, high-risk occurrence. Given the infrequency of resuscitation, newer neonatal intensive care unit (NICU) nurses may have little to no exposure to neonatal resuscitation events. This can lead to a lack of confidence in resuscitation skills, contributing to burnout, poor patient outcomes, and the potential for nursing turnover. This evidence-based practice project, guided by the Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care, focused on enhancing the perceived confidence in neonatal resuscitation skills among newer NICU nurses. To achieve this, multidisciplinary, high-fidelity, in-situ neonatal resuscitation crisis resource management (CRM) events were implemented. Confidence in resuscitation skills before and after the CRM event was self-reported by each nurse participant using the 5-item Confidence Scale (C-Scale). Nine nurses with less than three years of NICU experience in a level III NICU participated in a single CRM event between April 2023 and November 2023. There was a statistically significant difference in the mean confidence scale score pre-CRM ($M = 12$) and post-CRM ($M = 17$) as per the Wilcoxon signed-rank test ($Z = -2.558, p = 0.011$). Implementing high-fidelity, in-situ neonatal resuscitation CRM events significantly enhances newer NICU nurses' confidence in resuscitation skills. This improvement in confidence is expected to lead to better patient outcomes, reduced nurse burnout, and higher nurse retention rates. Repeated assessments of perceived confidence 3- and 6-months post-CRM should be explored to determine the sustained effect of the CRM.

Keywords: Evidence-based practice, Iowa Model Revised, neonatal intensive care unit, neonatal resuscitation, crisis resource management, high-fidelity, in situ, confidence, newly licensed registered nurse, burnout, retention

Enhancing Newer NICU Nurse Confidence with Resuscitation Through High-fidelity, In-situ Crisis Resource Management

Background and Significance

At the time of delivery, less than one percent of newborns require cardiopulmonary resuscitation measures such as chest compressions and/or epinephrine administration (Fernandes, 2023). After the immediate postnatal period, the incidence of cardiopulmonary resuscitation during a newborn's hospital course in the neonatal intensive care unit (NICU) is even less (Handley et al., 2021). Neonatal resuscitation in the NICU setting is a low-volume, high-risk event requiring timely, precise interventions by the multidisciplinary team. Confidence in one's resuscitation skills is a key component of quality resuscitation, impacting the ability to recognize and respond appropriately to the need for resuscitation and the outcomes for the patient (Bowers et al., 2020). Given the infrequent nature of resuscitation in the NICU, the opportunity to build confidence in resuscitation skills is not robust, especially for newer NICU nurses.

The COVID-19 pandemic, decreased job satisfaction, increased burnout, and retirements have led to unprecedented nurse turnover in the past few years (NSI Nursing Solutions, 2023). Left to fill the vacancies created are some of the estimated 200,000 new graduate registered nurses entering the workforce each year (American Association of Colleges of Nursing, 2023). The first few years of a new graduate nurse's career is a crucial time during which skills are developed, and confidence grows. It is also a time of enormous stress, and the new graduate nurse is at high risk for burnout and attrition, especially in an intensive care setting (Stewart, 2021). The turnover rate in the first year of a nurse's career is estimated to be as high as 25 percent (Africa & Trepanier, 2021). Interventions aimed at building confidence and improving satisfaction during this critical time can assist in retaining this workforce population. Simulation

of low-volume, high-risk events such as neonatal resuscitation is one intervention that can bolster the skills and confidence of the newer nurse.

Literature Review

A literature review regarding newer nurses' confidence with resuscitation revealed that simulation-based training with a high-fidelity manikin done in situ was effective for increasing confidence. The literature also demonstrated that confidence can be measured with a valid, reliable tool.

Several studies explored increasing confidence among novice nurses through the simulation of low-volume, high-risk events. Franklin and Lee (2014) performed a meta-analysis of 43 studies and determined that perceived self-efficacy in novice nurses increased post-simulation compared to pre-simulation. Similarly, a systematic review by Edwards et al. (2015) showed that simulation as part of training for newly licensed registered nurses contributed to increased confidence. Further, the authors concluded that simulation is more effective for improving nurse knowledge and skills than didactic and self-learning. A non-randomized controlled study by Chan et al. (2012) found that the confidence of novice learners during the simulation of the low-volume, high-risk event of extracorporeal membrane oxygenation increased by a statistically significant amount following the event compared to before the simulation. Specific to resuscitation, a non-randomized controlled study by Morton et al. (2019) showed that self-confidence during a mock code increased by a statistically significant amount after the simulation. Finally, a quality improvement project by Karageorge et al. (2020) revealed that nurse confidence among newer pediatric intensive care nurses increased after a resuscitation simulation compared to before the simulation.

The fidelity of the manikin used during simulation can impact the user's confidence, knowledge, and skills attained. A systematic review by Cant and Cooper (2010) examined 12 studies comparing medium to high-fidelity simulation to other strategies in nursing education. The authors found that using medium to high-fidelity manikins was effective and could increase knowledge and confidence among participants. Cheng et al. (2015) performed a systematic review and meta-analysis of 14 studies evaluating low versus high-fidelity manikins during life support training. A moderate benefit for skills and performance was found when using the high-fidelity manikin. Bultas et al. (2014) performed a pre-test post-test control group design study by comparing high-fidelity manikins to static manikins for pediatric nurse education. They found that using the high-fidelity manikin was effective in increasing nurse recognition and intervention for deteriorating patient status compared to the static manikin. Further support for high-fidelity manikins was garnered from non-randomized controlled studies that explored the use of high-fidelity manikins and their impact on learning and confidence. Hossino et al. (2018) linked high-fidelity manikins to improved provider confidence during neonatal resuscitation. Boling et al. (2016) evaluated the effect of high-fidelity simulation training on the knowledge and confidence of nursing interns in an intensive care unit and found a statistically significant increase in both.

Simulation learning events can occur in a variety of settings, including in a controlled simulation lab setting or in the real-life environment that nurses work in every day. When examining the evidence for the ideal simulation location, support was demonstrated for in-situ simulation. A systematic review of 17 studies by Armenia et al. (2018) concluded that high-fidelity simulation was feasible and effective across various acute-care settings. A randomized control trial by Rubio-Gurung et al. (2014) sought to determine if in-situ simulation improved

neonatal resuscitation. The overall team performance and technical skills scores improved by a statistically significant amount in the group exposed to an in-situ simulation event. Finally, a non-randomized controlled study by Silcock and Waring (2022) exposed 113 participants to an in-situ simulation scenario. Compared to before the simulation, there was an increase in confidence in communicating with the team and confidence in patient assessment skills following the simulation.

Measuring confidence was accomplished in several studies using the Confidence Scale (C-Scale) developed by Grundy (1993). The C-Scale was used by Bailey and Emory (2022) in a non-randomized controlled study measuring the confidence level of 30 nursing students before and after a high-fidelity obstetrical simulation. Chuang et al. (2018) used the C-Scale in a randomized controlled trial study measuring the effect of simulation on 87 nursing students' confidence after receiving education on a skill. Finally, Choi et al. (2020) used the C-Scale in a non-randomized controlled study design to measure the confidence of 23 nurses exposed to a multi-modal education program to recognize delirium in patients.

Evidence-Based Intervention

The implementation of this project was prompted by an analysis highlighting a pressing need for an evidence-based intervention. This analysis primarily focused on the exposure of newer NICU nurses to neonatal resuscitation events, uncovering a noticeable gap in their experience. For instance, in 2022, the NICU recorded fewer than ten neonatal resuscitation cases that required interventions beyond basic airway management, such as chest compressions or the use of resuscitation medications. Notably, these critical incidents were managed exclusively by nurses with over three years of experience in the NICU. Considering that 20% of the NICU nurses possessed less than three years of experience and the fact that the existing resuscitation

simulation program was neither mandatory nor tailored to newer nurses, there was a clear need to develop targeted training and support for this group.

After carefully reviewing the literature, the evidence-based intervention of implementing high-fidelity, in-situ crisis resource management (CRM) events was undertaken. This evidence-based project further supports a top organizational goal for 2023 to improve clinical quality of care.

PICO Question

In NICU nurses with less than three years of NICU experience, how does the implementation of high-fidelity, in-situ neonatal crisis resource management simulation, compared to no simulation training, affect nurses' perception of confidence related to neonatal resuscitation?

Evidence-Based Practice Model

The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care (The Iowa Model) (Figure 1) is well-suited to guide the evidence-based practice project of implementing high-fidelity, in-situ CRM simulations to improve confidence with neonatal resuscitation in NICU nurses with less than three years of experience (Iowa Model Collaborative, 2017).

The Iowa Model is a well-established model that has guided evidence-based practice interventions for novice and expert nurses across care settings (Iowa Model Collaborative, 2017). The model is well-suited for multidisciplinary projects at any level of an organization, especially those triggered by a clinical issue or new evidence (Dang et al., 2022). Neonatal CRM simulations are a multidisciplinary undertaking inspired by clinical concerns. Thus, the Iowa Model is appropriate to use.

A strength of The Iowa Model is the feedback loops at several steps. Feedback loops exist at the model's problem identification, literature review, and pilot stages. These feedback loops help the evidence-based practice team determine if the intervention should continue based on priority, sufficiency of evidence, and pilot testing results (Iowa Model Collaborative, 2017). If the team identifies a weakness at any feedback loop step, the project is reverted to a previous step for reevaluation before continuing (Iowa Model Collaborative, 2017). This approach to evidence-based practice is beneficial to the neonatal intensive care environment, where vulnerable patients require thoughtful implementation of practice changes. The final step in the model is the dissemination of results. Sharing findings is critical to expanding the evidence on a topic and triggering the evidence-based practice process to start again (Dang et al., 2019).

Methods

A realistic neonatal resuscitation scenario was constructed by this author in collaboration with a neonatologist and the simulation lab nurse coordinator. The scenario was further reviewed with the simulation technician who programmed the high-fidelity newborn manikin. A pilot CRM event with an experienced nurse, respiratory care practitioner, and neonatologist was conducted in situ to confirm the simulation's realism and feasibility and identify improvement opportunities. Following this pilot, nurses with less than three years of NICU experience were recruited to participate in a 75-minute neonatal resuscitation CRM event. Nurses were placed in groups of three and paired with a respiratory care practitioner and neonatologist for the multidisciplinary simulation. Before the start of the simulation, each RN was assigned a computer-generated random participant identification number that they used in place of their name as they completed a pre-simulation questionnaire. The questionnaire included details about their months of NICU experience, the number of live neonatal resuscitation events encountered,

and their perceived confidence with neonatal resuscitation as captured via the C-Scale (Figure 2). After completing pre-simulation data collection, the participants were involved in a pre-brief, which included an orientation to the physical space, high-fidelity manikin, crash cart, and confidentiality expectations. The participants then participated in the CRM event, debriefed using the PEARLS Healthcare Debriefing Tool (Bajaj et al., 2018), participated in the same CRM again, and then debriefed a final time. After the CRM, participants again completed the C-Scale using the same random participant identification number. The pre-and-post-CRM questionnaires were placed in individual envelopes, sealed by each participant, and collected by this author.

Instrument

The C-Scale (Grundy, 1993) was developed to measure confidence in nursing students, and it can be adapted to any psychomotor skill. In this case, neonatal resuscitation. It is a five-statement tool, each item being measured on a Likert scale from 1 to 5, with 5 corresponding with a higher confidence level. The scores for the five items are totaled, with the lowest score possible being 5 (low confidence) and the highest score being 25 (high confidence). The C-Scale was noted to have internal consistency at the time of development, with Cronbach's alpha ranging from 0.84 to 0.93 among nursing students (Grundy, 1993). Permission to use the C-Scale was obtained from the author, Susan Grundy, EdD, RN, prior to data collection.

Ethical Considerations

This evidence-based practice project was approved by Cottage Health, and the use of the data was approved by the Cottage Health Data Use Committee (IRB 23-17nq). Further, this project was approved by the University of San Diego Institutional Review Board (IRB-2023-378).

Results

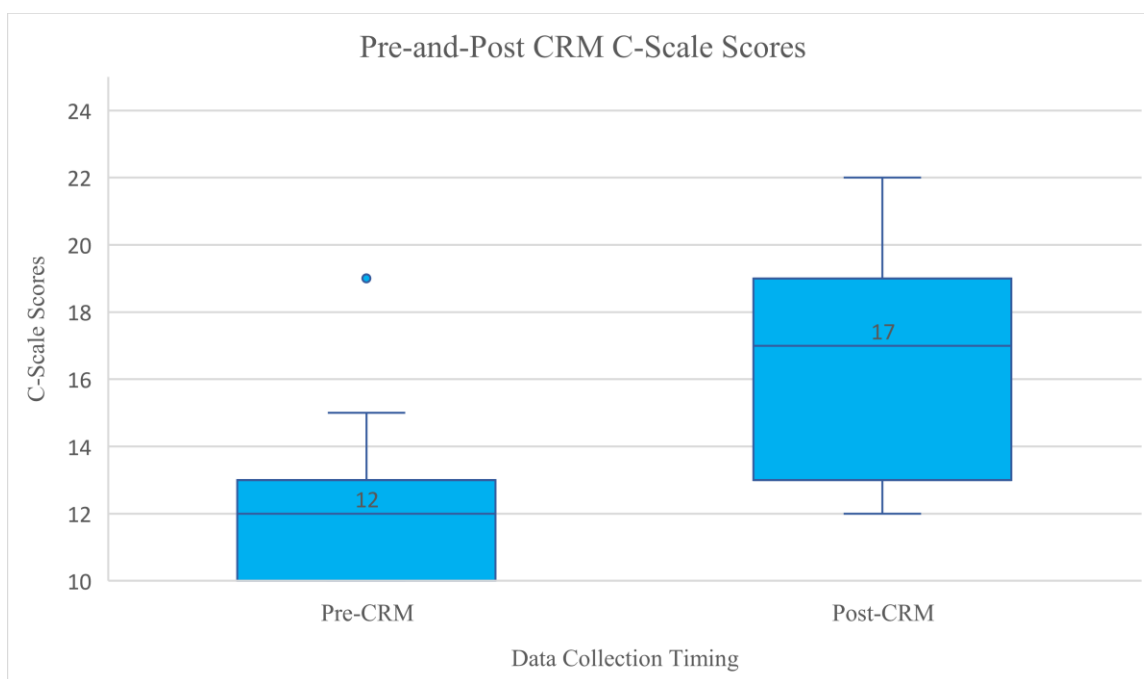
Between April 25, 2023, and November 25, 2023, nine NICU nurses participated in neonatal resuscitation CRM simulation events. NICU experience ranged from 3.5 to 19 months ($M = 7.06$ months, $SD = 4.95$). Three nurses had witnessed one live neonatal resuscitation, and six nurses had never witnessed a live neonatal resuscitation.

Participants' ($n=9$) confidence scores were measured pre- and post-intervention. The Wilcoxon signed-rank test was chosen as the statistical method due to the non-normally distributed nature of the data and the paired design of the project. Data was analyzed using IBM SPSS Statistics for Windows, Version 28.0 (2021). The Wilcoxon signed-rank test revealed a statistically significant difference in nurses' confidence levels before and after the intervention ($Z = -2.558$, $p = 0.011$). The median confidence score increased from 12 (pre) to 17 (post), indicating a significant improvement in confidence (Table 1 and Figure 3).

Table 1

Pre-and-Post CRM C-Scale Scores: Mean, Median, Standard Deviation

	Pre-CRM	Post-CRM
n	9	9
Mean	12.44	16.56
Median	12.00	17.00
Standard Deviation	3.046	3.644

Figure 3*Pre-and-Post CRM C-Scale Scores*

Discussion

The results confirm the efficacy of this evidence-based project in raising newer NICU nurses' confidence in resuscitation following the implementation of high-fidelity, in situ CRM events.

An analysis of the strengths and weaknesses assisted in evaluating the project. Evaluation is an important step in The IOWA Model to see if permanent adoption of the project is appropriate (Iowa Model Collaborative, 2017).

The project had numerous strengths. First, there was the support of the hospital-based simulation lab staff who participated in the CRM events to manage the technical aspects of the manikin. Second, the hospital already owned a high-fidelity newborn simulator. The project also benefitted from the multidisciplinary collaboration and support from the participating

neonatologist and respiratory care practitioner partners. Also, the number of newer NICU nurse staff was plentiful to make the project worthwhile. Finally, the C-Scale was effective in measuring confidence among participants.

Some weaknesses were identified following this EBP project. One weakness was that not all NICU nurses with less than three years of experience could attend a CRM event due to the limited number of events that could be planned on account of the availability of the simulation lab staff. The impact of this was an overrepresentation of NICU nurses with less than one year of experience. Measuring confidence among more nurses between one and three years of experience could have added to the understanding of the project's outcomes. Another weakness was that confidence was only measured immediately following the CRM and not at a future time interval to determine the sustainability of the increase in confidence.

Cost-Benefit Analysis

A cost-benefit analysis of this evidence-based project yields a gain for the organization. The costs associated with the project were comprised of time paid to nurse participants and the nurse facilitator, neonatologist, respiratory care practitioner staff, and simulation lab staff, and the paper and ink to print the participant questionnaires. This amount was approximately \$5,500.

The benefits of the project are financial, non-financial, and intangible. The financial benefits come from cost-avoidance in replacing and training one NICU nurse due to attrition from dissatisfaction in the first year or years of their career and/or burnout related to poor neonatal resuscitation outcomes. Furthermore, there are costs associated with contract labor nursing staff that must be utilized while a replacement nurse is found, onboarded, and trained. The total estimated cost of replacement is approximately \$147,000. The cost-benefit analysis shows that for every dollar spent, there will be a \$27 cost avoidance.

Non-financial and intangible benefits are improved nurse satisfaction with training, improved confidence with skills, and reduced burnout. All of these contribute to nurse retention. For the organization, there is decreased liability related to better resuscitation outcomes and less energy directed to recruitment efforts when staff are retained.

Sustainability

The sustainability of neonatal resuscitation CRM events for newer NICU nurses is bolstered by ongoing support for the intervention by hospital stakeholders. The CRM simulations are now built into the first year of a NICU nurse's career, and attendance is mandatory. For nurses beyond their first year, the goal is to mandate attendance at a CRM event at least annually. The NICU annual budget accounts for costs associated with the CRM events. Additionally, the participating neonatologist and respiratory care practitioner partners continue to support future events. The confidence of participants before and after the simulation will continue to be measured to support the findings of this project.

Implications for Future Research

Future opportunities for research include measuring participants' confidence at 3 and 6 months post CRM to determine if the effects of the intervention are sustained. This information could be used to guide decision-making around how often events should be repeated with participants. An additional area of future research is investigating the attrition of newer NICU nurses post-intervention compared to pre-intervention to determine the impact of neonatal resuscitation CRM events on this outcome.

Conclusion

Newer NICU nurses can experience a lack of confidence in skills for low-volume, high-risk events, such as neonatal resuscitation. Literature supports a focus on developing skills and

confidence in this population through simulation. Guided by the Iowa Model, this evidence-based project brought high-fidelity, in situ CRM events to a NICU with a large number of nurses with less than three years of experience and little to no exposure to live neonatal resuscitation events. Nurse confidence in neonatal resuscitation skills increased statistically significantly following the simulation. Further, in situ simulation was shown to be feasible, and confidence could be easily measured. The project's success was aided by strong organizational stakeholder support to improve the quality of patient care and the potential for cost-avoidance of replacing dissatisfied and burnout staff new to the specialty. Sustaining this intervention is important for long-term retention of confidence and building a culture of engagement and learning that benefits nurses, patients, and the organization.

Implications for Clinical Practice

High-fidelity, in situ crisis resource management events for newer NICU nurses are feasible and effective in building neonatal resuscitation skill confidence. Incorporating CRM events into the continuing education requirements of newer NICU nurses contributes to the adoption of this confidence-building, evidence-based intervention. Increased confidence leads to improved job satisfaction and reduced burnout, aiding in the retention of nurses in the highly specialized NICU environment.

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Figure 1

The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

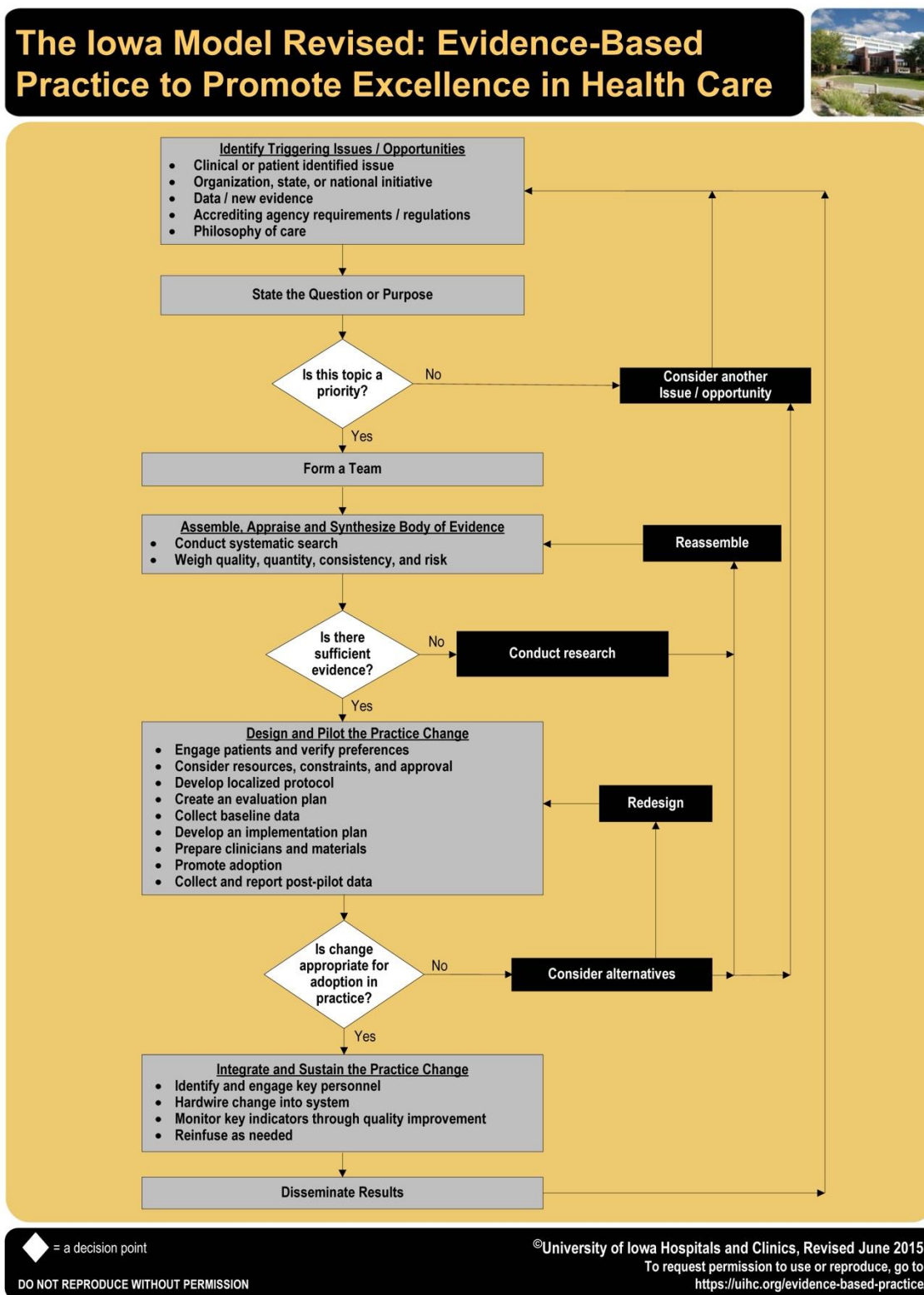


Figure 2

The Confidence Scale

C-Scale Directions: Circle the number which best describes how you perceive your current ability to perform neonatal resuscitation during a crisis resource management event on a neonatal patient.
(NOTE: Make sure that the circle encloses just ONE number.)

Copyright Susan E. Grundy (1993)

1.	I am certain that my performance is correct:				
	1	2	3	4	5
	not at all certain	certain for only a few steps	fairly certain for a good number of steps	certain for almost all steps	absolutely certain for all steps
2.	I feel that I perform the task without hesitation:				
	1	2	3	4	5
	I have much hesitation	a fair amount of hesitation	a good part of it without hesitation	almost completely without hesitation	absolutely no hesitation
3.	My performance would convince an observer that I'm competent at this task:				
	1	2	3	4	5
	not at all	agree, a little	for much of it	for almost all of it	for absolutely all of it
4.	I feel sure of myself as I perform the task:				
	1	2	3	4	5
	not at all	very little	for much of it	for almost all of it	for absolutely all of it
5.	I feel satisfied with my performance:				
	1	2	3	4	5
	not at all	very little	for much of it	for almost all of it	absolutely satisfied with all of it