Role Delineation of the Code Blue Team: A Quasi-Experimental Study During COVID-19

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Contribution to Emergency Nursing Practice

- Poor communication between nurses can occur during code situations within the emergency department. Clearly delineated roles during codes are encouraged according to Advanced Cardiovascular Life Support guidelines but may not consistently be used in practice.
- Extensive research has been done regarding communication and teamwork in nursing during codes. This study offers evidence regarding nurse perception of teamwork in relation to the use of role delineation badges during codes.
- The use of code blue role delineation badges may be a simple and inexpensive way for emergency departments to improve their communication and teamwork within a code blue.

Abstract

Introduction: The purpose of this study was to assess if implementing a code role delineation intervention in an emergency department would improve the times to defibrillation and medication administration and improve the nurse perception of teamwork.

Methods: A quantitative quasi-experimental study used a retrospective chart review to gather data. A pre- and post-test measured nurse perception of teamwork in a code using the Mayo High Performance Teamwork Scale (MHPTS) after a code role delineation intervention using a paired samples *t*-test. Pearson *r* correlations were used to determine relationships between nurse participant ($N = 30$) demographics and results of the MHPTS scores.

Results: A significant increase in teamwork was noted in 5 of the 16 items on the MHPTS regarding improved communication and identified roles in a code: the team leader assures maintenance of an appropriate balance between command authority and team member participation ($t = -5.607$, $P < .001$), team members demonstrated a clear understanding of roles ($t = -5.415$, $P < .001$), team members repeat back instructions and clarifications to indicate that they heard them correctly ($t = -2.400$, $P = .029$), all members of the team are appropriately involved and participate in the activity ($t = -2.236$, $P = .041$), and conflicts among team members are addressed without a loss of situation awareness ($t = -2.704$, $P = .016$). There was significance between total pre- and post-test scores ($t = -3.938$, $P = .001$).

Discussion: Implementation of code role delineation identifiers is an effective method of improving teamwork in a code in an emergency department setting.

Key words: Code blue; Nurse role delineation; Nurse teamwork; Emergency department

Introduction

Cardiac arrest is a frequent occurrence in the emergency department, with approximately 200,000 cardiac arrest cases occurring every year in the hospital setting in the United States.[1] Although the American Heart Association has clear recommended guidelines for Advanced Cardiovascular Life Support (ACLS), these guidelines are sometimes difficult to follow due to a myriad of extenuating circumstances. The highly stressful nature of an arrest situation warrants specific well-defined guidelines and protocols related to role

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responsibilities, to promote organization and positive outcomes of the code.[2] Optimizing nurse competencies and confidence levels plays a significant role during a code.[3] In a code situation, having clearly defined role delineations may be essential to optimal patient care outcomes by decreasing the time in which patients are able to receive life-saving measures, such as medication administration and defibrillation.[4] This research was aimed at establishing a standard of care for a code blue team related to role delineation.

LITERATURE REVIEW

Studies have shown that having clearly distinguished roles within a code blue can improve patient outcomes by improving communication among the code blue team members and decreasing the time to defibrillation and medication administration.[4] It is shown that clearly delineated responsibilities improved nurse confidence in initiating actions, which improved overall efficiency and speed of their own actions.[3] It was shown that a consistent layout and role definition among code participants showed improvement when ACLS guidelines were followed and roles and responsibilities of the team were clearly defined.[5] The code team also maintained a professional environment, and overall improved effectiveness of the code team was reported. The use of physical role delineation lanyards to clearly state individual roles has shown "improved confidence in their role specific skills, clarity in their role positions, and team leadership, as well as a decrease in the time-to-defibrillation."[4] In addition, the use of clearly delineated team identifiers has shown trends toward improved patient outcomes and speed to defibrillate shockable rhythms.[6]

Roles must work together to form a team in a code situation. Study participants rated their teamwork abilities higher after having a role assigned to them by the facilitator prior to a simulation code blue.[7] Without clear role definitions, "role ambiguity and confusion for code team members often exists, possibly creating poor communication and ineffective teamwork that lead to poor patient outcomes."[8] By clearly delineating roles and having a team leader excuse those without a role from the code, the number of providers in the room decreased and code members had a more positive outlook on the nurse leader.[1]

Methods

This quasi-experimental study took place within a 36-bed emergency department at a 320-bed hospital in Southern California, as complete randomization of data would not be practical in a small sample size. Data collection included a retrospective chart review and a pre- and post-test utilizing a psychometrically tested instrument called the Mayo High Performance Teamwork Scale (MHPTS). The convenience sample was drawn from a target population of emergency department registered nurses (RNs) ($N = 90$) employed at the study location.

Prior to the intervention, the standard flow of the department was to have one nurse designated to specific rooms. If a patient in cardiac arrest or who arrested later was placed in a room assigned to a nurse, that nurse would automatically be assigned as the primary nurse. Beyond the primary nurse, however, there was little guidance on who would assist and in what role. If it was a less busy day in the department, there could be more than the necessary number of nurses present although a busy day may yield too few nurses.

For example, the primary nurse would randomly assume any one of the 3 roles depending on the needs of the patient. The other 2 roles were typically assumed by another staff nurse, the charge nurse, or the rapid response nurse. There was no defined standard regarding who would assume each role. Without definitive roles, crowd control could be difficult to manage.

Within this department, a standard of care related to role delineation in a code utilizing role delineation badges was created to provide optimal care for all patients who arrest. Role delineation badges were placed on each crash cart to be used in every code during the research period. Nurses who participated in code situations during the span of the 6-month intervention period were eligible for inclusion and were invited to participate in the study. Study volunteers were asked to complete a teamwork assessment instrument before and after implementation of the role delineation standard of care.

A Cronbach α was calculated to determine reliability of the study survey items, with a result of 0.88. This is comparable to what was found in the literature, in which the authors of the scale found a Cronbach Alpha of 0.81 to 0.85. This signifies appropriate reliability of the survey instrument. Significance was found in 5 questions; the team leader assures maintenance of an appropriate balance between command authority and team member participation, each team member demonstrates a clear understanding of his or her role, team members repeat back or paraphrase instructions and clarifications to indicate that they heard them correctly, all members of the team are appropriately involved and participate in the activity, and disagreements or conflicts among team members are addressed without a loss of situation awareness.

Select demographics on patients were collected to determine potential influence on code blue data. Items collected included age, outcome, and sex. Nurse demographics collected included age, sex, ethnicity, years of ED employment, certification, shift worked, type of employment, and highest level of education.

STUDY PROCEDURES

After obtaining Institutional Review Board approval (STUDY2020000644 and 2020FA0003), labels were created by printing specific roles on color-coded cards. These labels were placed in plastic card holders and affixed to a badge clip for nurses to wear. The labels included the RN roles of "Defibrillation," "IV/Medications" and "Documentation." These roles were determined by the hospital's code blue protocol and ACLS guidelines.[2]

A participant email was sent to each nurse within the emergency department explaining the study and included a link to the survey pre-test to be completed via Microsoft Forms called the MHPTS. The scale is a 16-question Likert scale, which allows participants to assess different aspects of teamwork, such as leadership, role clarification, and communication, on a scale of 0 to 2. This email list was provided by the education department and included the nurses employed at the time of this intervention launch date. Next, each crash cart was supplied with 3 badges, 1 for each role. After the dispersion of the labels, a notice of the standard of care change was provided in the daily huddle for one week. All RNs were required to sign that they attended huddle at least once each week. Most of the RNs were documented as having heard this update.

To promote intervention fidelity, all rapid response team members were asked to aid in enforcing the use of the labels and in defining the roles during an arrest. In addition, a tracking sheet was created for each crash cart and a patient label was affixed to the sheet after utilizing the badges in the code. After 6 months of utilizing the new standard of care, volunteers who had participated in a code utilizing the intervention were asked to fill out a short instrument using the MHPTS as a post-test to determine if there was a difference in nurses' perception of teamwork in a code blue after the role delineation standard of care implementation. The instrument was dispersed on Microsoft Forms via the same email address list. The initial participants remained anonymous.

A chart review then was conducted utilizing all 47 charts available from patients in the emergency department that were dated in the 6 months before the intervention and after the initiation of COVID-19 isolation precautions (between March and November 2020). The time to defibrillation and time to initial medication administration then was determined. The medication administration time was recorded by the administered time of several different medications including but not limited to EPINEPHrine, Atropine, Amiodarone, Bicarbonate, etc. The same was done utilizing 17 charts after the intervention was initiated, which had documented nurses using the intervention. Although there were more codes during this time frame, only the 17 with documented intervention usage were studied. Each code that is run within this facility is recorded on paper for official documentation. One copy is held with the patient's chart and a carbon copy is submitted to clinical excellence for review. The copies reviewed were requested from the clinical excellence department.

The times to defibrillation and medication administration were determined from when the code button was pressed (or the door time of arrival) to the time of the documented defibrillation. These times were documented in minutes according to the current standard at the facility. Select patient demographics and nurse demographics were collected. After the study implementation was initiated, the investigator waited 5 months to send out an email requesting post-test survey participation.

DATA ANALYSIS

The data were analyzed using IBM SPSS 24. A paired sample *t*-test was performed on the pre- and post-test data from the MHPTS to measure teamwork in emergency nurses before and after a role delineation intervention. This analysis compared the item mean scores and total mean scores from the 16 items from the pre-test to the post-test. The items were paired by using an anonymous participant identifier. Demographic data were analyzed using descriptive statistics. Correlational analysis was run to determine relationships between demographic data and pre-test and post-test Performance Teamwork Scale scores.

NURSE DEMOGRAPHICS

A power analysis showed that 30 nurses should fill out the MHPTS. In a department that employed 90 nurses at the time of investigation, 33.3% of emergency nurses should participate in the scale. As this intervention involved a standard of care change, all nurses in the department would participate in the role delineation intervention. From the sample ($N = 30$), few nurses ($n = 2$, 6.7%) held associate's degrees, most ($n = 20$, 66.7%) held bachelor's degrees, and some ($n = 8$, 26.7%) held a master's degree. Ages ranged

from 24 to 63 years old (37.3 [SD = 9.71]). The majority were female ($n = 25$), with 60% Caucasian, 20% Hispanic or Latino, 16.7% Asian or Pacific Islander, and 3% other. The participants worked in the emergency department for 0.5 years to 24 years. Of the participants, 14 held a Mobile Intensive Care Nurse certification, 8 earned their Certified Emergency Nurse certification, one had a Stroke Certified RN, 1 a Certified Medical-Surgical RN, and 1 was a Public Health Nurse. Nurse demographics can be found on Table 1.

TABLE 1
Descriptive statistics of nurse demographics (Total $N = 30$)

Demographic variable	Mean	SD	*n*	%
Age	37.3	9.71	-	-
Sex				
Male			5	16.7
Female			25	83.3
Ethnicity				
Asian or Pacific Islander			5	16.7
Hispanic or Latino			6	20.0
White or Caucasian			18	60.0
Other			1	3
Years employed in ED	8.2	6.36	-	-
Certifications				
MICN			14	46.6
CEN			8	26.6
SCRN			1	3.3
CMSRN			1	3.3
PHN			1	3.3
Shift worked				
Dayshift			11	36.7
Midshift			10	33.3
Nightshift			9	30.0
Type of employment				
Full-time			27	90
Part-time			3	10
Per diem			0	0
Highest level of education				
Associate degree			2	6.7
Bachelor's degree			20	66.7
Master's degree			8	26.7

CEN, Certified Emergency Nurse; CMSRN, Certified Medical-Surgical Registered Nurse; ED, emergency department; MICN, Mobile Intensive Care Nurse; PHN, Public Health Nurse; SCRN, Stroke Certified Registered Nurse.

Results

Twenty-one post-tests were collected after 5 months of the code intervention implementation. Total mean teamwork performance scores improved from a total score of 24.8 to 28.9, out of a maximum score of 32. Of the 21 posttests, 17 were able to be paired to the pretest utilizing the 4-digit participant identifier.

After analyzing the data of individual items with a paired samples *t*-test, 5 items showed a significant difference from pre-test to post-test at the $P \leq .05$ level. This significance was found in questions 2, 3, 7, 8, and 9 and the total scores. These items read as follows: the team leader assures maintenance of an appropriate balance between command authority and team member participation ($t = -5.607$, $P < .001$), each team member demonstrates a clear understanding of his or her role ($t = -5.415$, $P < .001$), team members repeat back or paraphrase instructions and clarifications to indicate that they heard them correctly ($t = -2.400$, $P = .029$), all members of the team are appropriately involved and participate in the activity ($t = -2.236$, $P = .041$), and disagreements or conflicts among team members are addressed without a loss of situation awareness ($t = -2.704$, $P = .016$). An independent samples *t*-test revealed a significant improvement from pre-test to post-test total scores ($t = -3.938$, $P = .001$). No correlations were found between certification, number of years in the emergency department, or age, and the Perceived Teamwork survey scores. Data on all questions for the MHPTS are shown in Table 2.

Forty-seven code blue charts were collected prior to the intervention, ranging from March 2020 to November 2020. Of these charts, all patients received medications and 5 were defibrillated during the code. An additional 17 patients were documented as nurses utilizing the code role badges during the code blue from November 2020 to May 2021. These physical charts were obtained from the clinical excellence department. One chart was unable to be located by the Principal Investigator or the clinical excellence department, so 16 charts were reviewed for analysis. Of these patients, 15 received medication and 2 were defibrillated.

Select demographics were collected on the patients before and after the intervention. The ages of those in the preintervention group ranged from 27 to 96 years of age. In that group, 72.3% were male and 27.7% female. In addition, 39.1% survived Return of Spontaneous Circulation and 60.9% expired. The ages of those in the post-intervention group ranged from 40 to 82 years. Male patients made

TABLE 2
Paired *t*-test of MHPTS in emergency nurses (Total $N = 17$)

MHPTS question	Pre-test mean	Post-test mean	SD	*t*-test	df	Sig. (2-tailed)
1	1.41	1.70	0.59	−2.063	16	.056
2	1.12	1.88	0.56	−5.607	16	< .001*
3	1.12	1.76	0.49	−5.416	16	< .001*
4	1.59	1.94	0.70	−2.073	16	.055
5	1.47	1.82	0.70	−2.073	16	.055
6	1.53	1.76	0.83	−1.167	16	.260
7	1.53	1.88	0.60	−2.400	16	.029†
8	1.50	1.75	0.44	−2.236	15	.041†
9	1.47	1.94	0.72	−2.704	16	.016†
10	1.88	2.00	0.33	−1.461	16	.163
11	1.65	1.82	0.53	−1.376	16	.188
12	1.75	1.68	0.77	0.324	15	.751
13	1.82	1.64	0.53	1.376	16	.188
14	1.76	1.76	0.50	0.000	16	>.99
15	1.69	1.88	0.54	−1.379	15	.188
16	1.69	1.94	0.58	−1.732	15	.104
Total	24.8	28.9	4.24	−3.938	16	.001*

df, degrees of freedom; MHPTS, Mayo High Performance Teamwork Scale.
* Significance at $P \leq .01$ level.
† Significance at $P \leq .05$ level.

up 62.5% while 37.5% were female. In the post-intervention group, 46.7% survived after the code while 53.3% expired. Long term survival was not investigated. Data on patient demographics can be found on Table 3.

Prior to the intervention, mean time from time of code blue called to medication administration was 1.55 minutes. Post-intervention showed a mean time of 2.08 minutes. An independent samples *t*-test was conducted to compare the time of medication administration between the pre-intervention and post-intervention groups. There was no apparent difference in time to medication administration between groups. In addition, a comparison of patient survival pre-intervention and post-intervention did not show a significant difference. A Pearson *r* correlation analysis showed no significance between select patient demographics and medication administration timing. As only 5 patients pre-intervention and 2 patients post-intervention were defibrillated, there was not adequate data to assess pre-data and post-data.

Although having role delineation badges did not change the time to medication administration or defibrillation, there was a significant difference in the perception of teamwork overall by the nurses after the intervention. The areas showing most improvement were those areas related to the level of involvement of the nurses and their ability to communicate effectively.

Discussion

This study complemented what has been viewed in the literature review, that having a physical means of determining nurse roles in a code blue may help to improve the nurse perception of a code blue. As stated in the study findings, nurses found that teamwork aspects such as communication were improved through the use the code role delineation badges.

After the implementation of this project in the emergency department and seeing the positive outcomes, the Code Blue Committee at the study site moved to implement a code blue role intervention over the entire hospital. It is the hope of the principal investigator that the role delineation standard of care will continue to improve nursing teamwork performance during code situations in various hospital settings, as well as the emergency department. Other hospital populations also may benefit from such an intervention.

RECOMMENDATIONS

Future studies are needed to investigate the effectiveness of a hospital wide role delineation intervention in codes. Role confusion during inpatient codes at the study site has been observed. These codes require the arrival of a code team including a rapid response nurse, an emergency nurse, the House Supervisor RN, and a charge nurse from intensive care unit. Exploring a nurse leader role was not investigated in this study. Having a method of clearly delineated roles for nurses who may not know each other well may potentially be beneficial in improving communication and teamwork.

It is recommended that a similar longitudinal study be performed with a larger sample size. There was not enough data regarding time for medication or defibrillation to determine significance as this project ran for a short period, only 6 months. A power analysis indicated that at least 40 code blue charts would be needed to obtain enough data for an adequate effect size. Although over 40 code blue charts were able to be obtained for the pre-review, there were only 16 charts documented as having used the intervention available post-intervention and therefore not enough data to determine all the differences in pre-intervention group and post-intervention group items due to the smaller post-review size. In addition, the total number of code blues in the intervention period was not recorded, but the data may have offered insight into code blue performance as a whole during the study intervention. Similarly, although 30 nurses filled out the initial surveys, only 17 were able to be paired with post-intervention surveys. Both events may have caused a type II error, as there could have been greater significance if the sample of charts collected post-intervention was larger. If this research study is repeated or continued, it should be introduced to multiple hospital units to gain more participants from a wider variety of specialties and to have a higher incidence of a code blue. It also may be beneficial to create an easier method of tracking whether the role delineation badges were used, as most code blues did not document usage and were unable to be included in the data collection.

Limitations

Initially the nurses were hesitant to participate. There was pushback as nurses did not want to wear role badges or they forgot to wear them. Many of the nurses who wore the badges did not put them back onto the crash cart after using them. In addition, nurses stated they forgot to put patient labels on the tracking forms.

The chart review revealed a need for education for nurses on how to fill out a code documentation form correctly. Occasionally, vital information was lacking from the forms. It is the policy of the facility at the time of the code to have all the information from the code documented on paper alone. No information needs to be converted into the electronic medical record by the RN. It was noted during the chart review that many patients were missing information such as initial cardiac rhythm, pulse checks, and patient outcome.

Limited data and timing of the study contributed to the overall study limitations. This study pre-test was distributed prior to the COVID-19 surge that took place November 2020 to February 2021. During and after the surge, it was noted that many emergency nurses chose to move to a different specialty or quit entirely. As a result, there were fewer nurses who participated in the post-survey than who were working in the department at the time of the pre-survey distribution. In addition, during the post-survey period, the hospital stated a record high number of nurses on leave of absence for various reasons. It is the policy of the hospital to not check emails and respond while on leave of absence. This also impacted the number of nurses who may have filled out the pre-survey but were not available during the post-survey period. Launching the initial intervention during a pandemic created several obstacles. There was some hesitation due to the emergency nurses not having the energy to add to an already draining workload. Crash carts occasionally were not used for codes during the first few months of the intervention, as they occurred so frequently that respiratory trays and a defibrillator were sometimes used in lieu of bringing the crash cart into a room with a COVID-19 positive patient. As the badges were stored on top of the crash cart, any code ran in this method would likely not have been recorded as using the intervention. It would be more conducive to implement the intervention at a time when the emergency department is well staffed with a more consistent patient census and set of resources. This also may serve to eliminate some of the extraneous variables that occurred because of the pandemic such as unusual numbers of codes overall and occurring simultaneously, severe contamination issues, intensified short staffing, and extremely high patient acuity levels.

STRENGTHS

One strength of this research was the willingness of the rapid response nurses to maintain intervention fidelity and ensure the proper labeling of the nurses and the code tracking form. The compliance of the rapid response team is especially

TABLE 3
Descriptive statistics of patient demographics (Total $N = 63$)

Demographic variable	Mean	SD	*n*	%
Pre-intervention				
Age	65.83	14.39	-	-
Outcome				
Survived			18	38.3
Expired			28	59.6
Sex				
Male			34	72.3
Female			13	27.7
Postintervention				
Age	63.38	14.50	-	-
Outcome				
Survived			7	46.7
Expired			8	17.0
Sex				
Male			10	62.5
Female			6	37.5

helpful if this intervention moves to a hospital wide setting, as the rapid response nurse responds to all codes in the hospital. Anecdotally, the PI received positive feedback from the rapid response nurses that they perceived improvement of the organization of the code with the role delineation intervention.

Implications for Emergency Nurses

Overall, this intervention has offered an improved standard of care to help emergency nurses be clearer on their roles in code situations. Role delineation may help to improve the overall performance of nurses in code situations.

Conclusions

Although time to medication administration and defibrillation did not show statistical improvement, nurses stated that their perception of teamwork did improve compared to the original practice of nurses volunteering for a code and helping with several roles within the code blue. This study regarding code role identification for nurses has offered meaningful evidence as to its effectiveness in improving nurse teamwork. The MHPTS showed improvement in the following items after the role delineation intervention: the team leader assures maintenance of an appropriate balance between command authority and team member participation, each team member demonstrates a clear understanding of his or her role, team members repeat back or paraphrase instructions and clarifications to indicate that they heard them correctly, all members of the team are appropriately involved and participate in the activity, and disagreements or conflicts among team members are addressed without a loss of situation awareness. Total mean scores of the MHPTS improved from 24.8 to 28.9 out of 32 points.

It is recommended that this study be repeated involving nurses from a wider variety of specialties. In addition, a longitudinal study could provide more data regarding time to medication administration and defibrillation in a code. This study intervention suggests role delineation is an effective method to improve nursing teamwork in times of patient arrest in the emergency department and may lead to improved overall nursing performance and therefore may improve patient outcomes.

Author Disclosures

Conflicts of interest: none to report.

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