Winter 12-13-2019

Preparing Healthcare Staff for Cardiac Arrest Codes in the Outpatient Clinical Setting: Code Drill Training Improves Patient Outcomes

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The acuity of care provided in outpatient clinical settings across the United States continues to rise. It is estimated that more than 350,000 cardiac arrests occur outside of a hospital each year (AHA, 2019). For the purpose of this clinical nurse leader (CNL)-lead quality improvement project, the relevant focus is directed towards improving the knowledge, physical skills and perceptions of healthcare staff within an urgent care center (UCC) regarding the application of advanced rescue skills. It is important to note that the estimated 8,000 UCC's nationwide often bridge the gap between the shortage of primary care providers (PCP's) while simultaneously offering afterhours urgent/emergent care services (Stoimenoff & Newman, 2017). Many economic and demographic factors affect the diversity of the patient population seen at a UCC for primary care or non-life-threatening conditions and acute injury related treatments. Sudden cardiac arrest however, knows no boundary and requires UCC staff to be proficient in advanced rescue measures that rapidly stabilize patients which increase survival rates until they can be transported emergently to a hospital. Rogers and Rund further define proficiency skills as cross-training, knowledge of cardiac rhythm strips, pacing/cardioverting and defibrillating, intravenous/intraosseous access, and appropriate medication administration such as vasopressors and antiarrhythmics for all UCC staff based on scope of practice and training (2019).

The use of mock code (in situ) training, or "Code Drill" simulation, evaluates the strengths and weaknesses of the facility staff when dealing with emergent healthcare crisis such as a cardiac arrest or other cardiovascular events. Utilizing the TeamSTEPPS [see appendix A, Figures 1 & 2] approach during Code Drill simulation we will integrate and involve all staff members to advocate for the patient by implementing advanced rescue measures. These measures build greater situational team awareness, enhanced interdisciplinary communication, leadership and mutual support which work to alleviate fears, uncertainties and role confusion during a code. When these issues are addressed, the functionality of the team increases and patient outcomes improve.

: Code Drill Training Improves Patient Outcomes

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Statement of Problem

Each year, over 595,000 people experience sudden cardiac arrest (SCA), with 350,000 of those experiencing out-of-hospital cardiac arrest (OHCA). 88-95% of SCA victims die before professional help arrives or they are transported to a hospital (AHA, 2017). The first five minutes after a cardiac arrest remain the most crucial time for healthcare providers to impact the survival rate, both immediate and long-term. Survival rates drop 10% every minute that passes without defibrillation but can be improved up to 75% if CPR and defibrillation are initiated within the first 3 to 5 minutes of a cardiac arrest with appropriate post-arrest care administered after return of spontaneous circulation (ROSC) (AHA, 2017).

Disproportionate crisis management skills, disparities in rescue skill approaches, unfamiliarity with code cart equipment, lack of communication or leadership and low confidence in handling these situations have been cited by outpatient clinical staff (OCS) as major barriers toward delivering consistent and effective rescue measures (LaVelle & McLaughlin, 2008). At the head of this leadership and quality improvement (QI) initiative, a clinical nurse leader (CNL) is in the position to identify system processes and risks, incorporating these discoveries into medical simulation training for healthcare staff which provides an experiential tool allowing learners to engage in scenarios and activities that would otherwise be too dangerous to practice in real-life code situations. High fidelity interactive manikins operated by facility education instructors provides valuable technology-based learning by promoting hands on peer to peer mentoring, whereas a typical lecture only class has demonstrated a mere 40% active listening and retention of information.

Rationale & Ethical Considerations

The AIM of this project is intended to increase the UCC staff response time and eliminate any negative perceptions and fears regarding individual abilities to advance and perform clinical rescue skills. The literature review provides ample evidence that using mock code simulation training increases confidence of skill, job satisfaction and provides a higher level of care to an increasing acuity of patients in the clinical setting. In situ mock Code Drills give staff a time and place to practice rescue skills in a safe, nonjudgmental environment (Herbers, et al., 2016).

The Institute of Medicine (IOM) states that simulation-based training for all healthcare professionals improves critical thinking, professional and clinical competency which provides a higher level of safe quality patient-centered care (Kohn et al., 2000). The ethical considerations of reducing medication, procedural and communicative errors during a cardiac arrest have a profound implication on crisis management and patient safety.

The process begins with utilizing the planning stage of the PDSA (Plan, Do, Study, Act) cycle [see appendix B, Figure 1]. At this stage, establishing a concrete AIM statement will focus the process improvement and determine further actions based off a SWOT (strengths, weaknesses, opportunities, threats) analysis [see appendix C, Figure 1] of the clinical environment. Objectives will be reached and methods will be developed to achieve these set goals based off of both internal (strengths & weaknesses) factors and external (opportunities & threats) factors. Further data collection and a literature review (the “Do” stage) will enable the active application of best evidence-based practices (EBP) regarding in situ mock code/high fidelity simulation training (Kowalik et al., 2017).

The process concludes with examining ("Study" or "Check" stage) the results of the newly implemented mock code training, determining if the expectations of training such as the rate/response time and team performance have improved. It is important to note that at any stage, the PDSA cycle is not static. Based off the identification of problems, discoveries of the SWOT analysis, the ever-evolving clinical environment, and the priorities of delivering outpatient care, the PDSA cycle can recycle through various stages until the expectations are achieved and clinical goals are met. Once methods have been measured as successful, after the primary year of this quality improvement project, the UCC can adopt these new standards (Kowalik et al., 2017).

Cost comparative studies of high-fidelity simulation training have revealed major gaps of the actual expenses versus the cost-benefit of delivering this type of training to healthcare staff. One significant theme however permeated, that costs associated with high-fidelity SIM training positively affected the clinical reasoning, knowledge and satisfaction of participants which led to an increase of positive patient outcomes (Zendejas et al., 2013). Since the UCC administrative offices already supplies the static manikins (no technology) for CPR training, a cost-benefit analysis [see appendix D, Figure 1] on the effectiveness of the high-fidelity manikins will be measured and evaluated over a one-year period. Consideration of expenses: durable equipment (high-fidelity manikin(s) and associated technology/programs to run them), SIM instructor/trainer costs, additional supplies/teaching materials, physical space of the classroom (and it's operating costs) plus the tuition per participant (each employee will be clocked in and paid their hourly wage/rate of pay during training). Costs will be measured in US dollars and multiple measures of effectiveness such as an overall increase of clinical reasoning skills and knowledge applied during a cardiac arrest (utility) will be considered prior to the successful induction of this program (Haerling,2018).

Literature Review

By framing the quality improvement (QI) inquiry "Will preparing healthcare staff in the outpatient clinical setting improve patient outcomes during cardiac arrest codes?", the subsequent development of a PICO (Problem/Patient/Population, Intervention/Indicator, Comparison, Outcome, Time/Type of Study) question assisted electronic data search using keywords: *Code Drill Simulation, urgent care cardiac arrest, outpatient cardiac arrest incidence rates* and *clinical code training for health care staff,* utilizing CINAHL, AHRQ, PubMed/Medline, Institute of Medicine (IOM), American Heart Association (AHA) and general Google search engines. Search criteria was set to only include applicable data collected from and targeted for outpatient clinics in the United States regarding cardiac arrest incidence and Code Drill training. 23 articles were discovered, 21 articles met the search criteria for partial relevance and two articles had full relevance. Five articles were selected for literature review that reflected either full relevance of mock code training in the outpatient setting or the most relevance of mock code training in any situation. There is not as much data regarding cardiac arrest and Code Drill training as applied to the outpatient clinical setting as there is available towards the hospital setting.

Stoimenoff & Newman (2018) published an urgent care industry White Paper conducted from a mixed method analysis of the role and outcomes of urgent care centers in population health. They have noted to date that approximately 2-4% of UCC patients nationwide are transferred emergently to hospitals for crisis situations including cardiac arrest and that integrating UCC collaboration within the medical continuum has an efficient, cost-effective and appropriate impact on patient safety and satisfaction when applied towards the delivery of accessible care.

Rogers & Rund (2019) published a literature review that describes common and atypical presentations and time-sensitive medical conditions in the UCC which warrant immediate triage, rescue interventions and potential transfer to a hospital emergency room department (ER). The article also describes the communication challenges between UCC staff, emergency medical services (EMS) and the receiving ER when calling report. Barriers such as a significant delay in care encountered with patient transfers between the UCC providers, EMS transport and ER providers demonstrate why it is important for early recognition and intervention by trained staff with advanced skills to mitigate risks with potential life-threatening symptoms such as chest pain.

Lavelle & McLaughlin (2008) conducted a mixed method study integrating quantitative and qualitative data from 21 primary/specialty outpatient clinics and 5 UCC's to determine if simulation-based training improves patient safety in the ambulatory care setting and contributes to best practices. Multiple perspectives of healthcare staff collected through observation, interviews, surveys, debriefings and general perceptions of crisis management coupled with SWOT (strength, weaknesses, opportunities & threats) and Gap (side by side) analysis contributed to the conclusion that advanced cardiac arrest training which includes the use of high-fidelity simulation increased staff preparedness and confidence, thus improving patient survival rates.

Herbers & Heaser (2016), though conducted at the Mayo Clinic Hospital, is a quality improvement (QI) study aimed at collecting data over a two-year period to determine if in situ mock code drills significantly increased the confidence and performance of nursing care staff when initiating first responder interventions. 124 RNs and 18 patient care technicians/certified nursing assistants (PCTs/CNAs) participated. Data collected pre- and post- mock code training utilized surveys and assessments of the participants' skills and actions during a mock code scenario. The mock codes were not scheduled or announced to the participants, offering a realistic experience and revealing strengths and weaknesses of the staff. Participants cited an increase in critical thinking, organizational skills and increased improvement/time to response of rescue interventions.

Delac et al. (2013), conducted a quantitative study involving 250 staff nurses who had participated in the randomized controlled trial (RCT) "Five Alive", a QI initiative utilizing code drill training. The nurses' skills and actions were assessed during an in situ mock code prior to the training, then reassessed in a secondary in situ mock code after completion of the training program. Not only did the participants report an increased level of confidence initiating first responder interventions, but also expressed they were able to recognize declining patient status more rapidly and 65% improvement in time to CPR, 67% improvement in time to defibrillation and overall increased comfort handling rescue medications.

Methods

The UCC clinical microsystem is composed of regular multidisciplinary healthcare staff which include 47 revolving physicians (medical doctors (MDs) and doctors of osteopathy (DOs), physician extenders (nurse practioners (NPs) and physician assistants (PAs), registered nurses (RNs), medical assistants (MAs), laboratory technicians, radiology technicians and front office staff. Twelve exam rooms, a comprehensive in-house laboratory and radiology suite encompass the clinic. The UCC operating hours are from 8am to 10pm (14 hours per day), 7 days per week, 365 days per year. Currently, all staff are required to have yearly or biennial BLS/ACLS training and certification. Staff members must also complete monthly cardiac checklists which serve to refresh knowledge on the whereabouts of certain items on the crash cart or within the facility. Learning objectives for this teaching plan are aimed toward providing realistic simulation-based education in a safe environment for the entire UCC staff, which mimic the true clinical work setting. The goal is to foster physician, nursing and staff leadership skills as well as active participation within the full scope of practice for each staff member. Every employee is an integral link during a cardiac code whether it is hands on patient care or a supporting role. Individual cognitive, psychomotor or affective learning abilities will be considered to appropriately delegate safe, effective and rapid intervention. It is imperative the learning environment remain neutral, to enhance and reflect the diverse skill set from all staff participants who will be encouraged to interact, cross-monitor, mentor and communicate with each other. A root cause analysis (RCA) utilizing the “5 Whys” [see appendix E, Figures 1 & 2] will be used to troubleshoot the critical care and rescue skill inconsistencies encountered from staff member to staff member. The multidisciplinary team will be brought together and assembled to work in groups to refresh basic life support (BLS), advanced cardiac life support (ACLS) and pediatric advanced life support (PALS) skills using the American Heart Association (AHA) best practices guidelines for individual and two-person cardio-pulmonary resuscitation (CPR) [see appendix F, Figures 1 & 2] prior to Code Drill, advanced equipment and rescue pharmacology training [see appendix F, Figure 3]. Close observation of active skills and applied knowledge will be used to define the problem(s), uncovering critical areas of weakness which are then brought forward by asking the participants “why?”, identifying reasons that allow for counter measures and eventually change.

AHA teaching materials, power-point and video learning will precede each hands-on learning module using interactive simulation manikins and the actual equipment that will be available on the UCC facility code cart during a code crisis. This allows all staff members to become familiar with the location and handling of equipment that may be foreign to them, address and allay fears of “not knowing what to do at what time or how to operate equipment”, which will enable the application of knowledge, skills and critical thinking without the stress of endangering patients. This creates a strong culture of learning and accountability to self and each participants’ profession, thus building confidence which boosts mental preparation during a code (LaVelle & McLaughlin, 2008).

Implementation & Measures

A mandatory yearly in-service at a corporate classroom will be held over a consecutive two-day period lasting 8 hours each day [see appendix G, Figure 1]. Day one will consist of a theoretical part with a CPR refresher, day two will focus on high fidelity Code Drill training. A rotation of 8-10 staff members at a time will be scheduled to attend the two-day training modules, consisting of a diverse mix of nurses, physicians/providers, medical assistants, laboratory/radiology technicians and office/administration staff employees. Staff members will be clocked in and paid for their time, provided a meal and snacks as well as all training materials and certifications at no additional cost. Training will begin with a power-point review and hands on demonstrations of AHA BLS and ACLS skills on low fidelity manikins, with staff members working in groups of two before advancing to rapid response high fidelity interactive Code Drill simulations, rescue pharmacology review and team dynamics exercises. Each skill module will have precise step by step algorithms and paradigms of protocol related to scenarios leading up to cardiac arrest. Medication review and rescue pharmacology templates serve as an additional resource and mandatory return demo exams must demonstrate sufficient skill in order to move on to more advanced modules. At this point in time, monitoring counter-measures used to minimize or eliminate the “why” responses obtained from the participants is an effective problem-solving tool.

Text and workbooks will be provided by the AHA, and utilized as both study material and a final exam to pass the course. The object of the training is focused on the early recognition of signs and symptoms of patient demise leading to cardiac arrest, the application of preventative interventions, confidence when handling equipment such as EKG monitors (correct application and placement of leads, ability to print out rhythm strips), AED machine, intra-osseous (IO) device, and knowledge of skills necessary to respond calmly during one person, two person and team provider rescue scenarios.

Expected Results

Upon formal initiation of this project, UCC staff will demonstrate a 65% increase of rate to response/interventions employed in a [potential or actual] code situation after the initial year of Code Drill training, and an 80% increase by year two. Post code-drill debriefings and anonymous Likert scale surveys [see appendix H, Figure 1] will be utilized to investigate “what went well?’’, “what could be done differently?”, “what if any safety, equipment or team dynamics concerns exist?” and “what did we all learn?”.

Nursing Relevance

Nurses of all levels from many backgrounds have the greatest clinical and bedside contact and interaction with patients in most healthcare settings. It is imperative nurses maintain current clinical skills and continue to seek in-depth training to the fullest extent of their clinical scope of practice. Knowledge-seeking, peer mentoring, collaboration and horizontal leadership catalyze personal accountability to the profession of nursing which impact the driving forces for life-long learning. With each patient encounter, the increased probability of responding to an actual cardiac code is a very real and critical element that deserves to be addressed within the UCC, or any care setting, and advanced knowledge of interventional skills, hands-on practice and clinical preparedness is the key to rapid recognition of patient demise. Patients, their families and members of the healthcare team rely on nurses to be astutely aware, competent and deliver safe, high-quality patient-centered care. After all, nursing remains the most trusted profession.

In summary, the literature review of this quality improvement project supports the health promotion, risk reduction and potential disease prevention initiatives of the UCC/outpatient clinical setting by focusing on early recognition, intervention and implementation of rapid rescue measures which prevent further medical complications and/or death of a patient.

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Appendix A

Figure A1 TeamSTEPPS. TeamSTEPPS is an evidence-based framework to optimize team performance across the health care delivery system.

Figure A2 TeamSTEPPS.

Multi-Team System for Patient Care:

Safe and efficient care involves the coordinated activities of a multi-team system.

PATIENT

ADMINISTRATION

COORDINATING TEAM

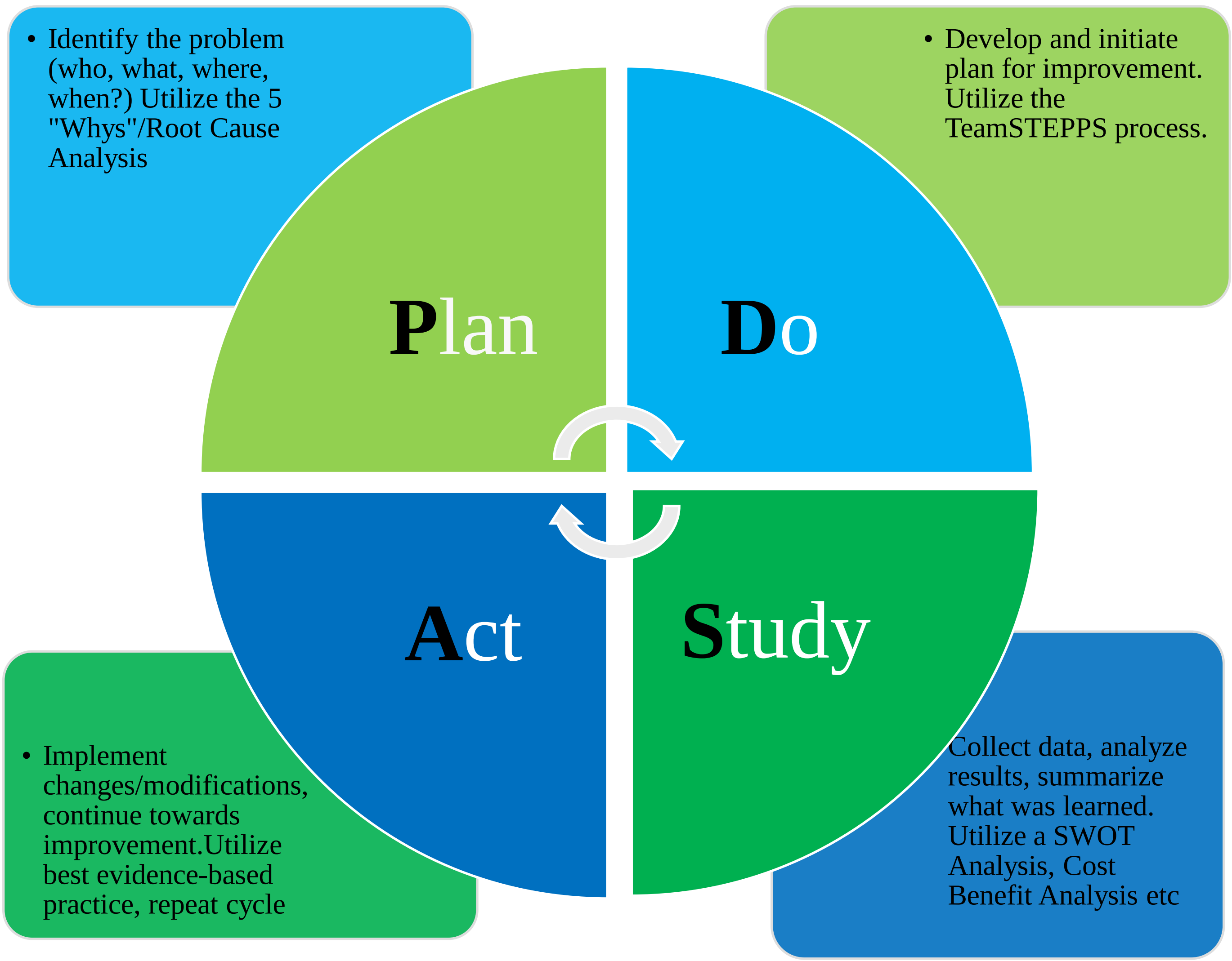
ANCILLARY & SUPPORT SERVICES

CORE TEAM

CONTINGENCY TEAM

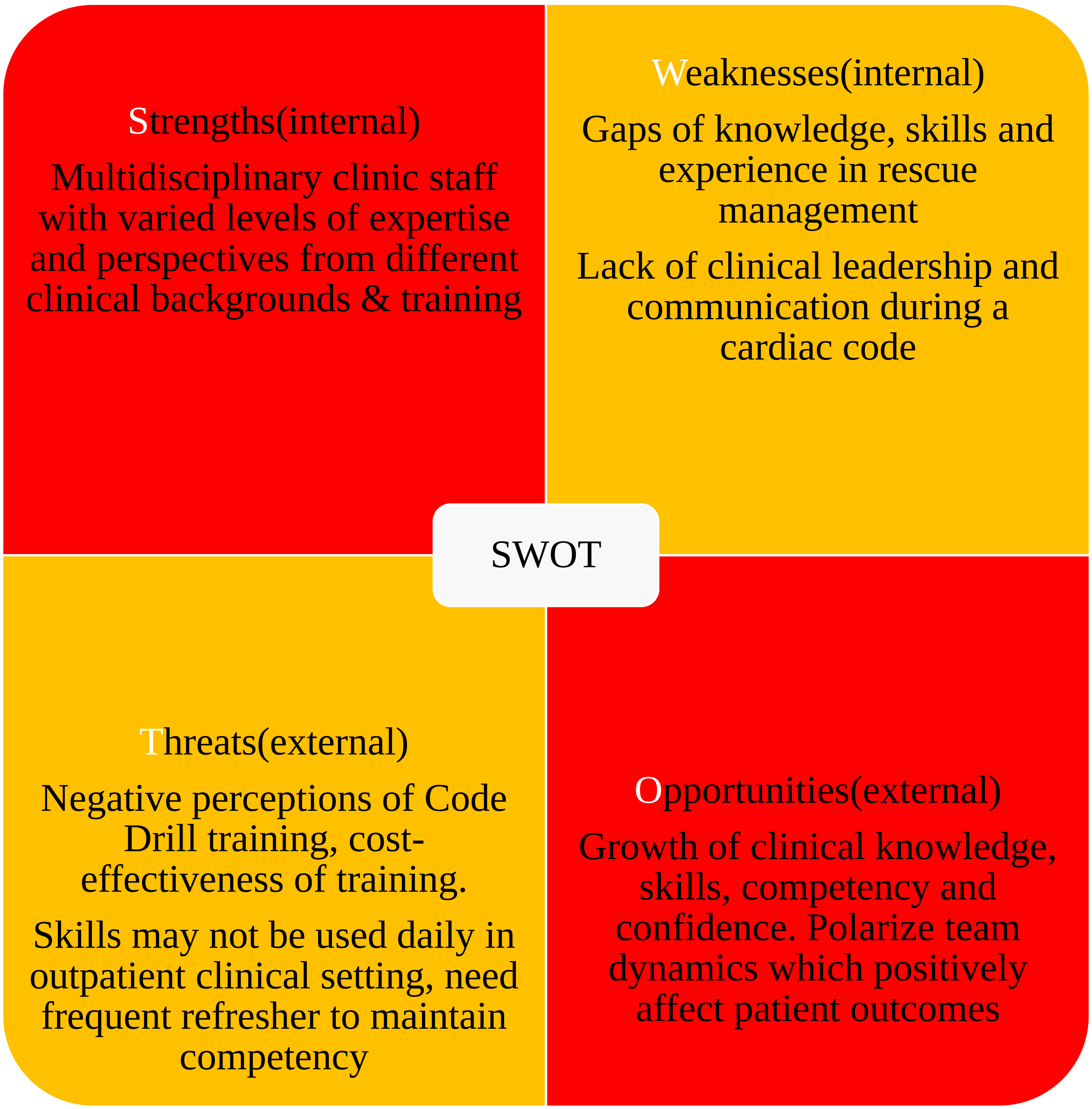
Appendix B

Figure B1 Plan-Do-Study-Act (PDSA) Cycle



Appendix C

Figure C1 Strengths-Weaknesses-Opportunities-Threats (SWOT) Analysis



Appendix D

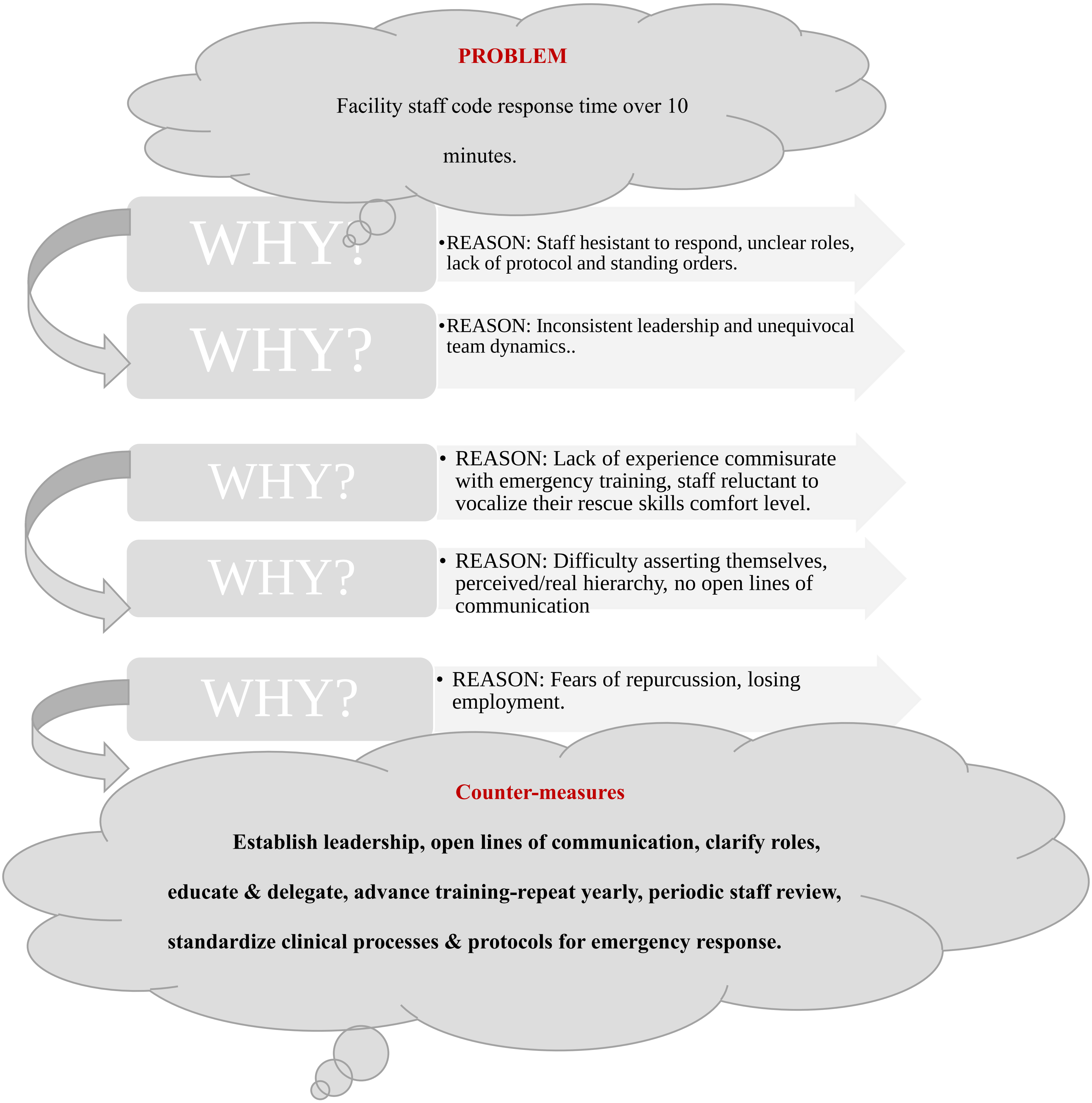
Figure D1 Cost Benefit Analysis (CBA): Associated start-up costs of high-fidelity training.

Appendix E

Figure E1 Root Cause Analysis (RCA): The 5 "Whys".

Identify the root cause of a failure/problem by determining the relationship between different causes.

Figure E2 Root Cause Analysis (RCA): The 5 “Whys”.



Appendix F

Figure F1 American Heart Association (AHA) Guidelines for CPR (Adult)

FAST AND HARD

Compression Rate: 100-120/minute, 5 cycles, 2 minutes

Compression to Ventilation: Adult 30/2, Pediatric 15/2

Compression Depth: based on age, full recoil (2 to 2.4 inches (5 to 6 cm) average adult)

Change person performing compressions every 2 minutes

Figure F2 American Heart Association Guidelines.

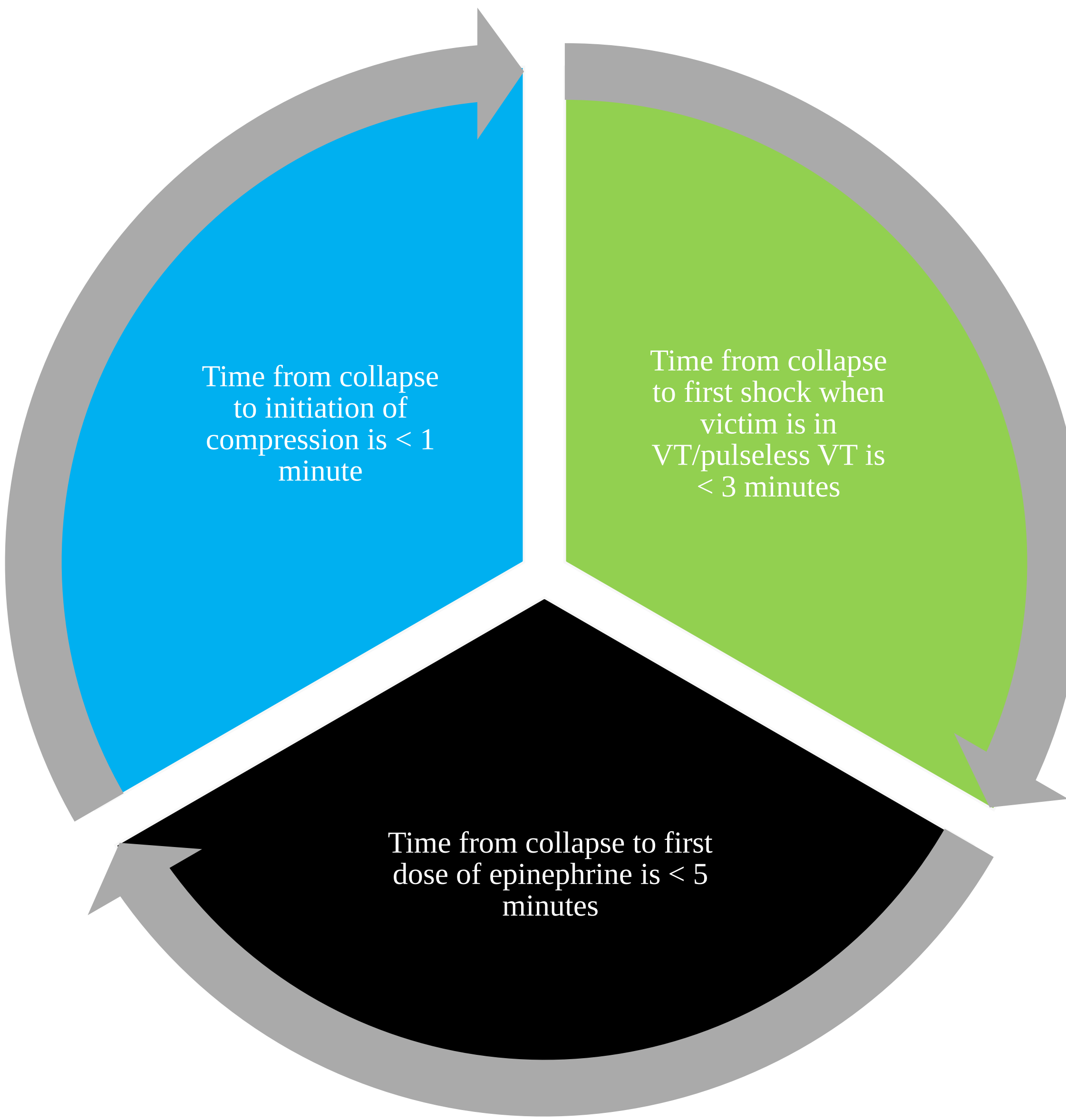


Figure F3 American Heart Association Guidelines.

Epinephrine

1 mg IV/IO every 3-5 min for pulseless arrest (VF/pulseless VT, asystole/PEA)

Amiodarone

300mg IV/IO once, may give additional 150mg once 3-5 min after 1st dose (VF/pulseless VT)

Atropine

0.5mg IV/IO (symptomatic bradycardia) or 1mg IV/IO (PEA/asystole)

max: 3mg

Lidocaine

1 to 1.5mg/kg IV/IO for 1st dose (VF/pulseless VT)

then 0.5 t0 0.75mg/kg

max 3 doses or 3mg/kg total

Vasopressin

1 dose only at 40 U, IV/IO to replace 1st or 2nd dose of epinephrine in pulseless arrest

Appendix G

Figure G1 Advanced Code Drill Guidelines for Outpatient Clinical Staff

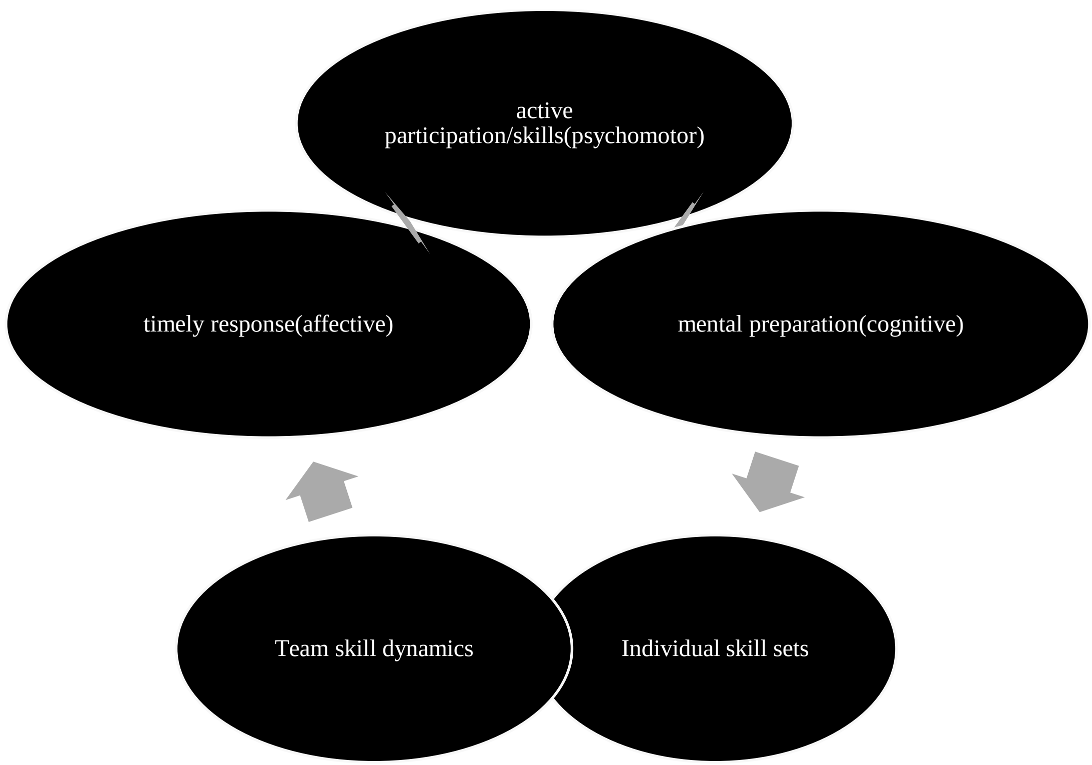
Health Teaching Plan

Best Practices for Increasing Cardiac Survival Rates in Urgent Care Populations

MODULES OF LEARNING

1. Recognizing signs/symptoms of patient deterioration prior to cardiac arrest.
2. Assessment: pulse, respirations, level of consciousness.
3. Institutional/facility support system, initiating call for help.
4. Rapid positioning of patient for CPR.
5. Quality CPR/ventilation is rapidly initiated and sustained until further help arrives.
6. Rapid placement of invasive airways, monitor/defibrillator and intravenous/intra-osseous access. Rhythm analyzation, shocks delivered, monitor, vascular access, meds.
7. Advanced rescue team functions as a unit to deliver early response, collaborating, effectively delegating and communicating. Team leader guides actions, supports team who are comfortable performing their roles.
8. Care is delivered in accordance to AHA algorithms for BLS, ACLS, PALS. Care is age/culture and ethically appropriate utilizing up to date evidence-based scientific knowledge.
9. Safety to all involved during the code is paramount. Only those who have an active role during the code should be in the immediate area as to reduce confusion and clutter.

10. The family should be informed at all times, invited to be present at bedside during code if appropriate with a support person. Decision to terminate code ethically based on information communicated within the team working the code.
11. Decision to terminate code ethically based on information communicated within the team working the code.
12. Post ROSC care, patient survival, transport to hospital by emergency medical technicians.
13. Accurate and completed documentation performed in real time throughout entire resuscitation, One clock, one person used for timing and recording events, legal documentation.
14. Post resuscitation de-briefing.



Appendix H

Figure H1 Likert Scale for Evaluation of Outcomes

Pre/Post Evaluation of Code Drill Training Survey

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	Pre-training				
Participating in a code makes me feel uncomfortable/anxious	9	2	1		1
I feel prepared during high-stress activities and tasks at work	3	2	1	6	
My clinical skills are competent for rescue/code management	2	7		4	
I would like to have more training in advanced rescue management	9	1		1	1
I am comfortable delegating tasks and assuming a leadership role during a clinical emergency		2	2	3	6
	Post-training				
I feel more confident in my ability to perform rescue measures during a code					
I feel more confident communicating with all team members during a clinical emergency					
Code Drill training addressed the clinical skill deficiencies and dynamics of the team					
I have learned to perform new skills					
Code Drill training is a valuable tool for positive clinical safety and patient outcomes					
Total					

Source: Survey distributed amongst 13 Urgent care clinic staff and free-clinic staff, Richmond, VA, October 2019.