#	Agency	Initiative Title	Submitted By	Description	Details	Amount Requested
NI#1	Skagit Fire District 14	Save a Life	David Skrinde	Place AED's in our communities focusing on places of congregation and public access.	• Zoll AED Plus - **$10,115.00** • Freight - **$82.00** • Tax - **$859.79**	**$11,056.78**
NI#2	Skagit Fire District 7	Equip New Aid Vehicle	Tracy Berg	Reimbursement to outfit recently purchased aid unit with a gurney, stair chair and defibrillator	• Stryker Performance-Pro Gurney - **$8,253.98** • Est. Sales Tax 8.2% - **$676.83** • Stryker Stair-Pro Stair Chair – **$3,642.21** • Est. Sales Tax 8.2% - **$298.66** • Zoll AED Pro Semi-Auto Defib. – **$3,000.75** • Est. Sales Tax 8.2% - **$246.06** • Est. Freight 5% - **$150.00**	**$16,268.49**
NI#3	Anacortes Fire Department	Pre-hospital Doppler Equipment	Joel Pratt	To provide our ALS providers with doppler unit to assess adequate perfusion in cardiac arrest settings, improving accuracy and speed while detecting pulses in the CPR setting.	• Training Cost - $0 to be provided by the individual agency using in-house educators • Anacortes Fire Department - 4 units, up to **$900 each ($3,600 total)** • Mt. Vernon Fire Department - 4 units, up to **$900 each ($3,600 total)** • Burlington Fire Department - 4 units, up to **$900 each ($3,600 total)** • Sedro-Woolley Fire Department - 4 units, up to **$900 each ($3,600 total)**	**$14,400**
NI#4	Skagit Co. Sheriff Regional Response Team	Tactical Medical Support	Jeff Brown	Equip, supply and support the medical element of the county tactical response team. This will assist in expanding the team and continuing to better respond to county wide events.	• Personal Equipment - **$11,242.70** • Individual First Aid Kits - **$913.00** • Medical Equipment - **$8,557.73**	**$21,238.43**
					Total	**$62,963.70**

NI#1

New Initiative Funding Grant Request

Company Name: Skagit County Fire District 14
Company Phone: 360-724-3451
Company Address: 18726 Parkview Lane, Burlington 98233

Partner Agencies (if any): _____

Initiative Title: Save a life

Initiative Description: Place AED's in our communities focusing on places of congregation and public access.

Proposed Start Date: July 2022 Proposed End Date: September 2022

X One-Time Cost _____Ongoing Cost If ongoing, for how long? _____

Checklist (Required – Please attach all supporting documents)

1. **Description of initiative:**

Identify places in our communities where people congregate, placing AED's in key locations accessible to the public and staff at these locations. We are a rural community where ALS/BLS services may be delayed by response times due to the remote location and the availability of services. Location would include restaurants, hotels, motels, churches and mini-marts. Skagit County Fire District 14 staff would assess the locations to mount the equipment and make recommendations based on the accessibility to the public and employees. We have selected 5 location in our region in need of AED's. The fire district would also provide any needed training to business employees at these locations. Studies show that witness cardiac arrest followed by automatic defibrillation and CPR increase the survivability, this initiative will improve the survivability of those suffering cardiac arrest by quick access to AED's.

Supporting Documentation Attached _____N/A____

2. **Cost break down:** (Attach detailed budget including all costs. If multi-year, demonstrate ongoing funding). Budget Attached X

3. **Explanation of Benefits to entire EMS system:**

Research by the National Institutes of Health state the survival rate when a bystander used an AED was 67%, waiting for first responder who on average respond within 6 to 10 minutes, drops to 43%. This initiative will benefit our communities by having these devices placed in key location accessible to the public. The benefit extends outside our communities as we have a transient population who travel through our region.
Placing AED's around are communities will provide quicker access to the general public, increasing the chance of survival during a cardiac event. These devices would be tracked in our CAD system, during a 911 call, the dispatcher can direct someone to the closest device while waiting for first responders to arrive.

Supporting Documentation Attached X____N/A_____

4. **Data supporting benefits:**

Supporting Documentation Attached X____N/A_____

5. **Determination of milestones:**

Supporting Documentation Attached _____N/A_____

6. **Determination of potential roadblocks:**

We foresee no potential road blocks.

Supporting Documentation Attached _____N/A_____

7. **Determination of successful initiative:**

The number of times these devices are used, also the number of lives saved.

Supporting Documentation Attached _____N/A_____

8. **Asset and dissolution plan should initiative not receive continued funding:**

We are not requesting continued funding; this initiative is a one-time cost.

Supporting Documentation Attached _____N/A_____

9. **Additional information and technical specifications:**

Supporting Documentation Attached _____N/A_____

Funding proposals will be evaluated on the following categories:

- Total Budget – is it an affordable project?
- Impact Area – serving the entire County scores higher than serving a single entity
- Work Level – a single entity doing the workload will score higher than multiple entities doing the workload
- Safety/Liability Risk – what is the risk to the community if this project is not implemented? Scores will be higher if there is a demonstrated risk to the community without this project.
- Resource Needs - projects that can access resources needed from their own agency will score higher than those that need resources from multiple resources
- Strategic Plan – define whether this fits into the County Strategic Plan, multiple agency or single agency plan. Scores will be higher for aligning with the County plan.
- Agencies access to resources – If your agency is defined as a wilderness hub or rural with limited access, the score will be higher in this category than an urban agency with immediate access

Save a Life Initiative

Description	Unit Price	Quanity	Ext price
Zoll AED Plus	$1,445.00	7	$10,115.00
Decals	$0.00		$0.00
CPR response kit	$0.00		$0.00
Pedi Padz	$0.00		$0.00
Cabinet	$0.00		$0.00
Sub Total			$10,115.00
Freight			$82.00
Tax			$859.78
Total			$11,056.78

March 6, 2018

Bystanders save lives using defibrillator for cardiac arrest

At a Glance

- A new study found that people are more likely to survive a cardiac arrest if a bystander uses a defibrillator while waiting for emergency medical services to arrive.
- The analysis suggests that 1,700 additional lives were saved each year in the U.S. from bystander use of defibrillators.

Cardiac arrest is when a person's heart suddenly stops beating. Unless treated within minutes, the person usually dies because blood is no longer being pumped to the brain and other parts of the body.

Quickly shocking the heart with an automated external defibrillator (AED) can save a person's life after cardiac arrest. An AED is a portable, battery-operated device that a bystander can use. It checks the heart rhythm and can send an electric shock to the heart to try to restore a normal rhythm. AEDs are in public places like office buildings, schools, and shopping malls. Experts estimate that each year more than 18,000 Americans have a shockable cardiac arrest outside of a hospital that occurs in public with witnesses.

An automated external defibrillator, or AED, can save the life of someone who has suddenly collapsed and lost consciousness. *nazdravie/iStock /Thinkstock*

After a 911 call about cardiac arrest is made, an estimated 4 to 10 minutes may pass before emergency medical services arrive. A research team led by Dr. Myron Weisfeldt of Johns Hopkins University explored whether a significant proportion of lives could be saved if bystanders used AEDs before emergency medical services arrived. The study was funded in part by NIH's National Heart, Lung, and Blood Institute (NHLBI) and National Institute of Neurological Disorders and Stroke (NINDS). Results appeared online on February 26, 2018, in *Circulation*.

The team analyzed data collected between 2011 and 2015 from a network of six U.S. and three Canadian regions. During this time, emergency medical services treated nearly 50,000 cardiac arrests outside of a hospital. Of those who had an initially shockable heart rhythm observed in public, 469 (19%) were shocked first by a bystander using an AED and 2,031 were shocked first by emergency medical services.

The analysis showed a greater likelihood of survival when a bystander used AED (67%) rather than wait for emergency medical services to shock the heart (43%). In addition, people were more likely to survive with minimal disability after cardiac arrest (57% for AED from a

bystander versus 33% for AED initiated by emergency medical services). The more time that elapsed before emergency medical services arrived, the larger the benefit of bystanders using an AED.

"We estimate that about 1,700 lives are saved in the United States per year by bystanders using an AED," Weisfeldt says. "Unfortunately, not enough Americans know to look for AEDs in public locations, nor are they are trained on how to use them."

A previous analysis of 2005 to 2009 data by the team found that about 500 additional lives could be saved each year in the U.S. and Canada if bystanders used AEDs. Because of increased availability of AEDs and increased use by bystanders, they now estimate that 3,459 people having a cardiac arrest could be saved each year by bystander AED use.

"Bystanders have the potential to save a life," Weisfeldt says. "This should be a great incentive for public health officials and bystanders to strive to have AEDs used on all victims of cardiac arrest."

—by Geri Piazza

Related Links

- Implanted Defibrillators Boost "Real World" Survival (https://www.nih.gov/news-events/nih-research-matters/implanted-defibrillators-boost-real-world-survival)
- Healthy Body, Happy Heart (https://newsinhealth.nih.gov/2017/11/healthy-body-happy-heart)
- Automated External Defibrillator (https://www.nhlbi.nih.gov/health-topics/automated-external-defibrillator)
- Sudden Cardiac Arrest (https://www.nhlbi.nih.gov/health-topics/sudden-cardiac-arrest)

References: Impact of Bystander Automated External Defibrillator Use on Survival and Functional Outcomes in Shockable Observed Public Cardiac Arrests. Pollack RA, Brown SP, Rea T, Aufderheide T, Barbic D, Buick JE, Christenson J, Idris AH, Jasti J, Kampp M, Kudenchuk P, May S, Muhr M, Nichol G, Ornato JP, Sopko G, Vaillancourt C, Morrison L, Weisfeldt M; ROC Investigators. *Circulation*. 2018 Feb 26. pii: CIRCULATIONAHA.117.030700. doi: 10.1161/CIRCULATIONAHA.117.030700. [Epub ahead of print]. PMID: 29483086.

Funding: NIH's National Heart, Lung, and Blood Institute (NHLBI) and National Institute of Neurological Disorders and Stroke (NINDS); U.S. Army Medical Research and Material Command; Canadian Institutes of Health Research (CIHR) Institute of Circulatory and Respiratory Health; Defense Research and Development Canada; Heart and Stroke Foundation of Canada; and American Heart Association.

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News

An international group of researchers has discovered that those suffering from cardiac arrest in a public setting are twice as likely to survive if an automated external defibrillator (AED) was utilized before emergency help arrived.

The study, published in the American Heart Association's journal *Circulation*, analyzed 49,555 out-of-hospital cardiac events in major U.S. and Canada cities.

"We estimate that about 1,700 lives are saved in the United States per year by bystanders using an AED," said Myron Weisfeldt, M.D, senior study author, in a statement. "Unfortunately, not enough Americans know to look for AEDs in public locations, nor are they are trained on how to use them despite great and effective efforts of the American Heart Association."

During a cardiac arrest, the electrical activity in the heart is disrupted. Without immediate CPR, the heart, brain and other vital organs aren't receiving enough oxygenated blood. For every minute without CPR, the chance of death increases by 10 percent, according to the AHA.

Fewer than half (45.7 percent) of cardiac arrest victims get the immediate help they need before emergency responders arrive, in part because emergency medical services take, on average, between four and 10 minutes to reach someone in cardiac arrest, according to the AHA.

"Bystanders have the potential to save a life," Weisfeldt said. "This should be a great incentive for public health officials and bystanders to strive to have AEDs used on all victims of cardiac arrest."

Sixty-six percent of victims who received a shock from AED from a bystander survived to hospital discharge. The research stressed the critical difference in those who received cardiac care before responders arrived on the scene.

Researchers also discovered the following:

- Cardiac arrest victims who received a shock from a publicly-available AED that was administered by a bystander had 2.62 times higher odds of survival to hospital discharge and 2.73 times more favorable outcomes for functioning compared to victims who first received an AED shock after emergency responders arrived.
- Victims who received an AED shock from a bystander (57.1 percent) using a publicly-available device instead of having to wait for emergency responders (32.7 percent) had near normal function and better outcomes.
- Without a bystander using AED shock therapy, 70 percent of cardiac arrest patients either died or survived with impaired brain function.

- AHA officials used the study's findings as a call for companies to provide additional training when it comes to cardiac events.

"First Aid, CPR and AED training need to become part of a larger culture of safety within workplaces," said Michael Kurz, MD, chair of the American Heart Association's Systems of Care Subcommittee, in a statement. "We are certainly seeing higher public interest in this training, and our campaign calls upon decision makers in workplaces and popular public spaces such as arenas, fitness centers, hotels, and churches to place AEDs in the same locations as a fire extinguisher."

NI#2

New Initiative Funding Grant Request

Company Name: Skagit County Fire District 7
Company Phone: 360-422-7577
Company Address: 35058 S. Shore Dr.
Mt Vernon, WA 98274

Partner Agencies (if any): _____

Initiative Title: Equip new Aid Vehicle

Initiative Description: Reimbursement to outfit recently purchased aid unit with a gurney, stair chair and defibrillator.

Proposed Start Date: 7/1/2022 Proposed End Date: 9/1/2022

X One-Time Cost _____ Ongoing Cost If ongoing, for how long? _____

Checklist (Required – Please attach all supporting documents)

1. **Description of initiative:**
To purchase equipment needed for Skagit County Fire District #7 to put a second aid unit in service. The vehicle will be housed in the districts new North Shore Drive station.

Supporting Documentation Attached ____ N/A ✓

2. **Cost break down:** (Attach detailed budget including all costs. If multi-year, demonstrate ongoing funding). Budget Attached ✓

3. **Explanation of Benefits to entire EMS system:**
Skagit County Fire District #7, which consists of the recreational and residential properties that surround Lake Cavanaugh, had a major impact to its ability to respond timely to emergencies from its South Shore Drive station. Skagit County Public Works and the County Commissioners, in August 2021, decided to close off a section

Supporting Documentation Attached ____ N/A ✓

of North Shore Drive rather than repairing the road. The impact has doubled our response time to some residence on the west side of the closure on North Shore Drive. This

4. **Data supporting benefits:**
not applicable

Supporting Documentation Attached ____ N/A ✓

5. **Determination of milestones:**
not applicable

Supporting Documentation Attached ____ N/A ✓

6. **Determination of potential roadblocks:**
not applicable

Supporting Documentation Attached ____ N/A ✓

7. **Determination of successful initiative:**
not applicable

Supporting Documentation Attached ____ N/A ✓

8. **Asset and dissolution plan should initiative not receive continued funding:**
not applicable

Supporting Documentation Attached ____ N/A____

9. **Additional information and technical specifications:**
not applicable

Supporting Documentation Attached ____ N/A ✓

Funding proposals will be evaluated on the following categories:

- Total Budget – is it an affordable project?
- Impact Area – serving the entire County scores higher than serving a single entity
- Work Level – a single entity doing the workload will score higher than multiple entities doing the workload
- Safety/Liability Risk – what is the risk to the community if this project is not implemented? Scores will be higher if there is a demonstrated risk to the community without this project.
- Resource Needs - projects that can access resources needed from their own agency will score higher than those that need resources from multiple resources
- Strategic Plan – define whether this fits into the County Strategic Plan, multiple agency or single agency plan. Scores will be higher for aligning with the County plan.
- Agencies access to resources – If your agency is defined as a wilderness hub or rural with limited access, the score will be higher in this category than an urban agency with immediate access

Skagit County Fire District #7, Lake Cavanaugh Vol. Fire Department

2022 Initiative Grant Check List

Stryker Performance-Pro Gurney		$8,253.98
Est. Sales Tax 8.2%		$676.83
Stryker Stair-Pro Sair Chair		$3,642.21
Est. Sales Tax 8.2%		$298.66
Zoll AED Pro Semi-Auto Defib.		$3,000.75
Est. Sales Tax 8.2%		$246.06
Est. Freight 5%		$150.00
	Total	$16,268.49

NI#3

New Initiative Funding Grant Request

Company Name: Anacortes Fire Department
Company Phone: 360-293-1925
Company Address: 1016 13th Street
Anacortes, WA 98221

Partner Agencies (if any): MVFD, BFD, SWFD

Initiative Title: Pre-hospital Doppler Equipment Initiative

Initiative Description: To provide our ALS providers with doppler units to assess adequate perfusion in cardiac arrest settings. Improving accuracy and speed while detecting pulses in the setting of CPR.

Proposed Start Date: July 2022 Proposed End Date: _____

__X__ One-Time Cost _____Ongoing Cost If ongoing, for how long? _____

Checklist (Required – Please attach all supporting documents)

1. **Description of initiative:**
Currently, the only consistent means that our pre-hospital providers have at their disposal for detecting pulses in cardiac arrest is by manual palpation. However, this method has its flaws and studies have shown that trained medical personnel frequently misdiagnose pulselessness (Schonberger, 2014). A simple portable doppler gives EMS providers the benefit of real-time audible feedback that is known to improve the efficacy of CPR by verifying arterial bloodflow is occurring (Wang, 2019). This will also assist in a more rapid, accurate differentiation between PEA and ROSC (Germanoska, 2018). Our EMS providers are well versed in the current standards of High-Quality CPR but would undoubtedly benefit from funding the purchase of three handheld dopplers for utilization on ALS units.

Supporting Documentation Attached __X__ N/A___

2. **Cost break down:** (Attach detailed budget including all costs. If multi-year, demonstrate ongoing funding). Budget Attached __X__

3. **Explanation of Benefits to entire EMS system:**
Funding this initiative would directly impact patients that are attended to by AFD, BFD, MVFD, and SWFD response areas. This initiative would he potential to positively impact our cardiac arrest patients with a more reliable tool for assessing our effectiveness during CPR, and shorter pauses in CPR, and improved detection of ROSC. Dopplers have the added benefit of allowing our ALS crews to perform a more accuate assessment of distal arterial flow in limb injuries or suspected limb ischemia.

Supporting Documentation Attached ____ N/A__X___

4. **Data supporting benefits:**

See attached citations and article.

Supporting Documentation Attached _x_ N/A_____

5. **Determination of milestones:**

Objective: CPR metrics to be tracked, measured, and evaluated pre and post doppler deployment. The primary outcome will be a decrease in CPR Pause duration.

Subjective: Personnel will be periodically surveyed to assess perceived benefit.

Supporting Documentation Attached ____ N/A_x_

6. **Determination of potential roadblocks:**

Initial training- For many of our providers, this will be a new piece of equipment that they are unfamiliar with. Personnel must be trained in the device's use, its use must be integrated into our existing procedures, and the use of the device must habituated into our practice. Periodic refresher training should be anticipated and planned for.

Supporting Documentation Attached ____ N/A_x_

7. **Determination of successful initiative:**

The success of the initiative will be measured by our objective and subjective milestones listed above.

Supporting Documentation Attached ____ N/A__x___

8. **Asset and dissolution plan should initiative not receive continued funding:**

This project would be a on-time purchase.

Supporting Documentation Attached ____ N/A__x___

9. **Additional information and technical specifications:**

The proposal would be for the purchase of a hand-held doppler unit of the agencies choosing, not to exceed $900 per unit.

The specific unit purchased would be at the discretion of the ALS agency with the requirements that it must be a medical grade (non-consumer) hand-held doppler, and it must include a vascular probe (4mhz or 5 mhz).

Supporting Documentation Attached ____ N/A__x___

Funding proposals will be evaluated on the following categories:

- Total Budget – is it an affordable project?
- Impact Area – serving the entire County scores higher than serving a single entity
- Work Level – a single entity doing the workload will score higher than multiple entities doing the workload
- Safety/Liability Risk – what is the risk to the community if this project is not implemented? Scores will be higher if there is a demonstrated risk to the community without this project.
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- Strategic Plan – define whether this fits into the County Strategic Plan, multiple agency or single agency plan. Scores will be higher for aligning with the County plan.
- Agencies access to resources – If your agency is defined as a wilderness hub or rural with limited access, the score will be higher in this category than an urban agency with immediate access

1. Supporting Documentation

The goal of cardiopulmonary resuscitation is to circulate blood, which carries oxygen, throughout the body and delays tissue death until the heart can be restarted.

Currently EMS professionals have very limited tools to measure the quality of CPR they provide. The Zoll offers many features that aim to improve the rate and depth of compressions through the use of an exterior accelerometer. This is a rudimentary option that gives purely mechanical feedback with no detection of the impact on a patient's cardiovascular system. In recent years, ETCO2 has become the gold-standard indicator of effective CPR because it can detect when actual respiration is occurring at the cellular level. Unfortunately, this tool has many confounding factors in measuring an accurate ETCO2 that make it occasionally very specific but generally non-sensitive as an indicator for high-quality CPR (Paiva, 2018).

The most effective method for EMS providers to measure adequate CPR is a manual palpation of a patient's pulse. But even a provider's hand, directly detecting the pulsatile flow of a patient's femoral artery, has its limitations. According to Schonberger, et al, "trained medical personnel demonstrate a specificity for the manual diagnoses of pulselessness of only 55% (2014)." However, studies from as far back as 1978 (Grunau) have pointed out that there is a better tool that EMS agencies can deploy to improve the efficacy and outcomes in CPR, a doppler. A simple portable doppler gives providers real-time feedback of the impact they are having on the patients' arterial blood flow (Wang, 2019) and an opportunity for rapid detection of ROSC (Germanoska, 2018)

Citations

Germanoska B, Coady M, Ng S, Fermanis G, Miller M. The reliability of carotid ultrasound in determining the return of pulsatile flow: A pilot study. Ultrasound. 2018 May;26(2):118-126. doi: 10.1177/1742271X17753467. Epub 2018 Jan 29. PMID: 30013612; PMCID: PMC6042301.

Grunau CF. Doppler ultrasound monitoring of systemic blood flow during CPR. JACEP. 1978 May;7(5):180-5. doi: 10.1016/s0361-1124(78)80095-1. PMID: 651071.

Paiva EF, Paxton JH, O'Neil BJ. The use of end-tidal carbon dioxide (ETCO2) measurement to guide management of cardiac arrest: A systematic review. Resuscitation. 2018 Feb;123:1-7. doi: 10.1016/j.resuscitation.2017.12.003. Epub 2017 Dec 5. PMID: 29217394.

Schonberger RB, Lampert RJ, Mandel EI, Feinleib J, Gong Z, Honiden S. Handheld Doppler to improve pulse checks during resuscitation of putative pulseless electrical activity arrest. Anesthesiology. 2014 Apr;120(4):1042-5. doi: 10.1097/ALN.0000000000000106. PMID: 24335750; PMCID: PMC3975650.

Wang H, Zhang S, Gao B. [Feasible study of carotid artery Doppler ultrasound blood flow measurement during chest compression cardiopulmonary resuscitation]. Zhonghua Wei Zhong Bing Ji Jiu Yi Xue. 2019 Mar;31(3):309-312. Chinese. doi: 10.3760/cma.j.issn.2095- 4352.2019.03.010. PMID: 30914091.

2. Cost Breakdown

Training Cost- $0 to be provided by the individual agency using in-house educators.

Anacortes Fire Department- 4 units, up to $900 each ($3,600 total)

Mt. Vernon Fire Department- 4 units, up to $900 each ($3,600 total)

Burlington Fire Department- 4 units, up to $900 each ($3,600 total)

Sedro-Woolley Fire Department- 4 units, up to $900 each ($3,600 total)

Total project cost up to $14,400.

Published in final edited form as:
Anesthesiology. 2014 April ; 120(4): 1042–1045. doi:10.1097/ALN.0000000000000106.

Handheld Doppler To Improve Pulse Checks during Resuscitation of Putative Pulseless Electrical Activity Arrest

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Zhaodi Gong, MD, PhD, and
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Section of Pulmonary/Critical Care; Department of Internal Medicine; Yale School of Medicine; New Haven, CT

INTRODUCTION

The difficulty of determining pulselessness via manual palpation in simulated cardiopulmonary resuscitation (CPR) has been well-documented in the literature. Prior studies have suggested that trained medical personnel demonstrate a specificity for the manual diagnoses of pulselessness of only 55%.[1] Other research has confirmed the poor diagnostic accuracy of manual pulse checks in a wide spectrum of test subjects - from non-medical personnel to critical care physicians.[1–4] These data, along with accumulating evidence for the importance of early, high quality chest compression to improve outcomes from out-of-hospital cardiac arrest, have led the American Heart Association to eliminate pulse checks from their algorithm for bystander CPR. [a]

In this context, the Advanced Cardiac Life Support (ACLS) algorithm for the treatment of Pulseless Electrical Activity (PEA) arrest presents an interesting dilemma, as the very diagnosis of the PEA condition is predicated, by definition, on the finding of pulselessness. Although unnecessary chest compressions during bystander CPR are considered a relatively benign intervention, the failure to promptly diagnose the return of spontaneous circulation during in-hospital PEA Arrest may delay the institution of more targeted and appropriate care modalities. Ambiguity about the presence of spontaneous circulation during

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Meeting Presentation: A portion of this work was presented at the American Society of Anesthesiologists 2013 Journal Symposium; October 15, 2013; San Francisco, CA.

Conflicts of Interest: The authors declare no competing interests.

[a]Highlights of the 2010 American Heart Association Guidelines for CPR and ECC. American HeartAssociation, 2010. (Accessed August 16, 2013, at http://www.heart.org/idc/groups/heart-public/@wcm/@ecc/documents/downloadable/ucm_317350.pdf.)

resuscitation is among many factors that contributes to the challenging task of “running a code.”

Therefore, in order to assess possibilities for improving the detection of the return of spontaneous circulation during in-hospital resuscitation, we conducted a prospective case series (N=8) during which handheld Doppler pulse checks were performed in parallel with standard ACLS procedures during resuscitation of adults with putative PEA arrest or on whom electrocardiogram pads had not yet been placed in an academic tertiary care hospital. The outcomes of interest were: 1) To measure the incidence of Doppler-positive-palpation-negative pulse in patients undergoing resuscitation for putative PEA arrest, and 2) To measure blood pressure in discordant cases of Doppler-positive-palpation-negative putative PEA arrest.

This prospective study was approved by the Yale Human Investigation Committee, including a waiver of informed consent. Investigators applied a portable Doppler (Dopplex Pocket Doppler D900 Vascular Ultrasound with 8MHz probe, Huntleigh, United Kingdom) to an available femoral artery during inhospital resuscitation attempts for putative PEA arrest or in situations of unknown cardiac rhythm prior to electrocardiogram lead placement. The Dopplex D900 with associated probes has been deemed by the Food and Drug Administration to be substantially equivalent to other portable ultrasound devices routinely used for blood flow monitoring. While this technology has been in existence for several decades, the sensitivity and specificity of such devices for detecting pulsatile flow during CPR remain unknown.

For inclusion in the study, a putative PEA rhythm was defined as an organized rhythm in the absence of a manual pulse, excluding ventricular tachycardia and ventricular fibrillation.[b] To be included in the case series, subjects also had to meet the following criteria: 1) age > 18 years, 2) ongoing CPR, and 3) availability of a peripheral site for application of a Doppler probe. For included subjects, audible Doppler pulse checks occurred in addition to standard ACLS procedures simultaneously with manual pulse checks. The site of manual pulse checks was not dictated by the research protocol. Doppler pulse checks occurred at an available femoral location that was not being used for the manual pulse check. In the event of a discordant finding of Doppler-positive-palpation-negative pulse, a repeat pulse check and blood pressure measurement were requested, with all management decisions left to the discretion of the code-runner. The cases represent a convenience sample of codes that occurred during times that a study investigator was available to respond. Codes occurred at a tertiary care hospital at which approximately 24 codes are called per month overhead, of which approximately 15% are true cardiac arrests.

DESCRIPTION OF CASES

Summary

A total of 8 subjects underwent the protocol. Discordant Doppler-positive-palpation-negative pulse checks occurred in 5 of 8 cases for an estimated incidence of 62.5% (95% CI 29–96%). In 3 of the 5 discordant cases, manual pulse checks following the finding of Doppler pulsatility resulted in a positive manual pulse check. In 1 of the 5 discordant cases, a radial artery catheter was successfully placed before repeat manual pulse check occurred, confirming pulsatile flow. In the fifth discordant case, repeat manual pulse check was negative followed by a visually confirmed pulse from a bounding carotid artery. Systolic

[b] 2005 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Part 7.2: Management of Cardiac Arrest. American Heart Association, 2005. (Accessed August 25, 2013, at http://circ.ahajournals.org/content/112/24_suppl/IV-58.full.)

blood pressures in the discordant group ranged from 58–160mmHg with a mean of 106 mmHg. Diastolic blood pressures ranged from 30–100mmHg with a mean of 56 mmHg. 4 of 5 Doppler positive/manual negative cases survived to intensive care unit (ICU) admission and none of the 3 concordant cases lacking pulsatile flow survived to ICU admission.

Case 1

Investigators applied the Doppler to the femoral artery site of a 45-year-old male undergoing chest compressions for lack of pulse and prior to placement of electrocardiogram leads. During CPR, manual and Doppler pulse checks occurred at both radial and femoral locations without discordance (lack of pulse was found in both locations by both modalities). After placement of electrocardiogram leads, asystole was identified. Despite the continuation of CPR, there was no return of spontaneous circulation, and resuscitation efforts were eventually halted.

Case 2

Investigators applied the Doppler to the femoral artery site of an 82-year-old male undergoing chest compressions for a putative PEA rhythm. At the first Doppler pulse check, there was a concordant finding of pulselessness. At the second Doppler pulse check, there was a discordant Doppler-positive-palpation-negative pulse. Compressions resumed at the direction of the code-runner without a repeat manual pulse check. At the next pulse check, a discordant Doppler-positive-palpation-negative pulse again occurred. A repeat manual pulse check was again negative at which time a member of the code team visually recognized the presence of a pulse in the form of a bounding carotid artery. A non-invasive blood pressure was measured at 160mmHg/100mmHg. The patient survived to ICU admission.

Case 3

Investigators applied the Doppler to the femoral artery site of a 72-year-old male undergoing chest compressions for a putative PEA rhythm. During CPR, manual and Doppler pulse checks found no pulse throughout the code. There was no return of spontaneous circulation, and resuscitation efforts were eventually halted.

Case 4

Investigators applied the Doppler to the femoral artery site of a 79-year- old male undergoing chest compressions for a putative PEA rhythm. At the first Doppler pulse check, there was a discordant Doppler-positive-palpation-negative pulse. Compressions resumed at the direction of the code-runner without a repeat manual pulse check. At the next pulse check, a concordant Doppler-positive-palpation-positive pulse occurred. A non-invasive blood pressure was measured at 58mmHg/30mmHg. Resuscitation efforts continued, including intermittent chest compressions based on manual pulse checks, and the patient survived to ICU admission.

Case 5

Investigators applied the Doppler to the femoral artery site of a 72-year-old female undergoing chest compressions for a putative PEA rhythm that developed during a surgical procedure. At the first Doppler pulse check, there was a concordant finding of pulselessness. At the second Doppler pulse check, there was a discordant Doppler-positive-palpation-negative pulse. A radial artery catheter was placed at this time demonstrating a blood pressure of 80mmHg/50mmHg. In the presence of an arterial line, manual and Doppler pulse checks were no longer performed. The patient eventually expired prior to leaving the operating room.

Case 6

Investigators applied the Doppler to the femoral artery site of a 35-year-old male undergoing chest compressions for a putative PEA rhythm. During CPR, manual and Doppler pulse checks confirmed pulselessness at multiple timepoints without discordance. There was no return of spontaneous circulation, and resuscitation efforts were eventually halted.

Case 7

Investigators applied the Doppler to the femoral artery site of a 54-year-old male undergoing chest compressions for a putative PEA rhythm. At the first Doppler pulse check, there was discordance between a Doppler-positive pulse and an “ambiguous” manual pulse. A repeat manual pulse check was performed, and a pulse was identified. A non-invasive blood pressure was concurrently measured at 102mmHg/54mmHg. The patient survived to ICU admission.

Case 8

Investigators applied the Doppler to the femoral artery site of a 59-year-old male undergoing chest compressions who had been shocked from pulseless ventricular tachycardia into a putative PEA rhythm. At the first Doppler pulse check, there was a discordant Doppler-positive-palpation-negative pulse. A repeat manual pulse check was performed, and a pulse was identified. A non-invasive blood pressure was measured at 127mmHg/42mmHg. The patient survived to ICU admission.

DISCUSSION

The present case-series suggests that during attempts at in-hospital resuscitation, standard manual pulse checks frequently lag behind the Doppler recognition of the return of spontaneous circulation. The failure to identify a pulse on manual palpation may occur across a wide range of blood pressures, including in the presence of significant systemic hypertension.

Prior studies have documented the difficulty of determining pulselessnes via manual palpation. In one study for example, investigators used a cardiopulmonary bypass model of pulselessness in a group of 206 emergency medical technician and paramedic trainees and practitioners.[1] They brought subjects into a cardiac operating room and asked them to determine the presence or absence of a pulse by palpation of the carotid artery without knowing the cardiopulmonary bypass status of the patient before them. The median time to diagnosis of pulselessness among study subjects was 30 seconds. When asked to evaluate the group of patients who were not on cardiopulmonary bypass, 45% of study subjects made an incorrect diagnosis of pulselessness despite systolic pressures > 80mmHg. Conversely, when patients were on bypass, 10% of participants diagnosed a positive carotid pulse despite the absence of pulsatile flow. When pulsatile flow was found, it took a median of 15 seconds to make this determination.

A second group of investigators inserted aortic pressure catheters in patients undergoing CPR. They found that of 94 patients who were diagnosed clinically with electro-mechanical dissociation (since re-named PEA), 41% were found to have measurable aortic pulsations. Two of these patients were found to have systolic pressures greater than 90mmHg.[5]

In the present case-series, the observation that 3 of 5 discordant cases were subsequently found to have a manually palpable pulse suggests that the addition of a portable Doppler to resuscitation efforts may enhance the accuracy of manual pulse checks. The portable Doppler pulse check is a practical and easily performed intervention that may help to

address the difficulty of assessing pulsatility in a reliable and timely fashion. However several limitations of the present case series should be highlighted. Most importantly, the effects on patient-outcomes of increasing the sensitivity of pulse checks during CPR are not known. Given the small convenience sample reported in the present case series, the benefits of Doppler pulse checks remain speculative. Among the potential benefits includes the possibility that the addition of Doppler pulse checks could prevent premature abandonment of the resuscitation effort based on an incorrectly negative manual pulse check. Supporting this notion, recent evidence has described significant differences in resuscitation times between hospitals, with more favorable outcomes associated with institutions that continue resuscitation for longer periods.[6] It is also possible that of the 3 concordant cases, some may have had spontaneous circulation that was missed by both pulse-check modalities which, if true, could imply that Doppler pulse checks are not sufficiently sensitive to prevent premature abandonment of resuscitation efforts. Further study is needed to investigate whether Doppler pulse checks may prove a useful addition to future in-hospital resuscitation algorithms.

Acknowledgments

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NI#4

New Initiative Funding Grant Request

Company Name: Skagit Co. Sheriff Regional Response Team
Company Phone: 360-416-1911
Company Address: 600 S. 3rd St #100. Mount Vernon, WA 98273

Partner Agencies (if any): Burlington PD, Serdro Woolley PD, Anacortes FD

Initiative Title: Tactical Medical Suport

Initiative Description: Equip, supply and support the medical element of the county tactical response team. This will assist in expanding the team and continuing to better respond to county wide events.

Proposed Start Date: May 1, 2022 Proposed End Date: Ongoing

X One-Time Cost _____Ongoing Cost If ongoing, for how long? _____

Checklist (Required – Please attach all supporting documents)

1. **Description of initiative:**
Curretly the County Regional Response Team is supported by 1 volunteer EMS provider on an on-call basis. The team has funded and acquired basic response and extrication equipment. The team is in need of additional providers, equipment and personal protective euipment. This initiative will assist in purchasing PPE as well as tactical medical kits and supplies that are specialized for austere and high threat environments.

Supporting Documentation Attached ____ N/A___

2. **Cost break down:** (Attach detailed budget including all costs. If multi-year, demonstrate ongoing funding). Budget Attached ____

3. **Explanation of Benefits to entire EMS system:**

The Skagit County Regional Response Team is a multi-agency tactical team responding events throughout all of skagit county. The medical element is designed to provide care beyond barricade as well as act as a medical reference and patient advocate. Tactical medical personnel provide care for hostages and victims ahead of traditional EMS as well as innocents, suspects and law enforcement officers including canines.

Supporting Documentation Attached ____ N/A_____

4. **Data supporting benefits:**

Aside from the SRRT, there are no other acencies that provide EMS services in tactical or denied environments in the entire county. The medical element has been active for multiple years but has been under funded and largely self supporting. Currently The Skagit County Sheriff's Office is the host agency but does not have a dedicated budget for Tactical Medical Providers or their unique equipment.

Supporting Documentation Attached ____ N/A_____

5. **Determination of milestones:**

3 Milestones have been identified. 1, increasing the team size to better cover all emergencies and planned operations. The Providers will need to be outfitted with basic ballistic protective equipment kits, and supplies. 2. Basic training will need to be procured as well as ongoing development. 3, Providing for the resupply and equipment replacement of both durrable and perrishable items. A weekly, monthly and annual equipment check will be implemented to ensure all items are within expiration dates and are servicable. Restock and maintenance will be performed at these times as well as immediatly following use, prior to securing.

Supporting Documentation Attached ____ N/A_____

6. **Determination of potential roadblocks:**

Funding for equipment has been a notable roadblock thus far. Additional road blocks may include the inability to obtain appropriate training and maintain skillsets due to current COVID restrictions on class sizes and gatherings. Locating qualified and capable applicants with schedule availability . Outside agency pushback as well as lack of support from other agencies could be a potential roadblock as well.

Supporting Documentation Attached ____ N/A_____

7. **Determination of successful initiative:**

Success will determined by the fielding of properly trained, equipped and supported tactical medical personnel. Further success will be determined by wide support for this unique initiative.

Supporting Documentation Attached ____ N/A_____

8. **Asset and dissolution plan should initiative not receive continued funding:**

The Skagit County Sheriff's Office will maintain custody of any equipment and supplies that are purchased with grant funding.

Supporting Documentation Attached ____ N/A_____

9. **Additional information and technical specifications:**

Supporting Documentation Attached ____ N/A_____

Funding proposals will be evaluated on the following categories:

- Total Budget – is it an affordable project?
- Impact Area – serving the entire County scores higher than serving a single entity
- Work Level – a single entity doing the workload will score higher than multiple entities doing the workload
- Safety/Liability Risk – what is the risk to the community if this project is not implemented? Scores will be higher if there is a demonstrated risk to the community without this project.
- Resource Needs - projects that can access resources needed from their own agency will score higher than those that need resources from multiple resources
- Strategic Plan – define whether this fits into the County Strategic Plan, multiple agency or single agency plan. Scores will be higher for aligning with the County plan.
- Agencies access to resources – If your agency is defined as a wilderness hub or rural with limited access, the score will be higher in this category than an urban agency with immediate access

Tactical Medical Equipment Proposal

The following lists have been further broken in to 3 priority levels

- Priority 1
  - Essential to the Tac Med mission. Need to be purchased or acquired immediately.
- Priority 2
  - Necessary to the Tac Med mission. Need to be purchased or acquired as soon as possible
- Priority 3
  - Beneficial to the Tac Med mission. These items will make SWAT Operations safer but can be purchased or acquired at a later time either due to being cost prohibitive or having suitable alternatives.

PERSONAL EQUIPMENT

Vender	Qty	Item #	Description	Size	Color	Price ea.	Subtotal	Priority
Velocity Systems	3		Level III-A IBA Vest	All	OD	380.00	1140	1
Velocity Systems	3		Level III-A Plates	N/A	BLK	1200.00	3600	1
5.11 Tactical	3	58631	VTac LBV		OD	109.99	109.99	2
Galvion Caman	3	32-BHO	MICH Ballistic Helmet	Med	OD	1600	4800.00	1
Code3Tactical	3	Sperian	CBRN Gas Mask	Med	Black	251.00	753.00	1
	3	Sperian	CBRN Gas Mask Canister	40mm		56.60	169.80	1
	3	37215	Uvex Safety Glasses		Clear	19.99	59.97	1
US Cav	3	36601	Drop Leg Platform		Multicam	16.99	50.97	1
Desert Tactical	3	8455	Rip Away Med Pouch		Brn	39.99	119.97	1
	3	Blackhawk	Hydration Pouch		OD	34.99	104.97	3
Voodoo Tac.	3	99	Mossad Tactical Duffel		OD	41.99	125.97	3

Total Pri. 1	10,901.77	Total Pri. 2	109.99	Total Pri. 3	230.94	Total	11,242.70

INDIVIDUAL FIRST AID KITs

Vender	Qty	Item #	Description	Size	Color	Price ea.	Subtotal	Priority
Tac Med Sol.	3	DOK	Downed Operator Kit			39.50	118.50	2
			SOF Tactical Tourniquet		Black			2
			OLAES Combat Dressing	4”				2
			Nitrile Gloves	L	OD			2
			Trauma Shears		Black			2
			Medical Tape	2”				2
			Face Shied					2
CRO	3	TA-IFAK	Belt IFAK		OD	265.00	795.00	

Total Pri. 1	0	Total Pri. 2	913.00	Total Pri. 3	0	Total	913.00

MEDICAL EQUIPMENT

Vender	Qty	Item #	Description	Size	Color	Price ea.	Subtotal	Priority
N.A.R.	3	60MP0	Spec Ops Medic Pack		OD	275.00	825.00	1
AED Pro	1	901101	Zoll A.E.D. Pro			2895.00	2895.00	3
Chinook	1	01340	Medication Bag		Multicam	107.95	107.95	2
Chinook	1	01137	SKED Rescue Sled		OD	659.00	659.00	3
Tac Med Sol.	1	F-LITC-T	Foxtrot Litter		Black	189.00	189.00	3
N.A.R.	1	90-0002	Rescue Recovery Strap		OD	81.99	81.99	2
US Cav	1	36732	Surgical Tool Kit		OD	24.99	24.99	1
US Cav	1	29389	Field Corpsman Kit		Black	142.99	142.99	1
US Cav	2	35670	SOF Tactical Tourniquet		Black	34.99	69.98	1
US Cav	2	25986	Emerg Thermal Blanket		OD	14.99	29.98	1
Laredall	1	982600	BaXstrap Backboard		OD	210.00	210.00	3
Chinook	1	01166-OD	Spyder Strap		OD	97.16	97.16	2
N.A.R.	2	50-0010	ACE Cervical Collar		OD	15.99	31.98	1
N.A.R.	1	50-0015	Traction Splint		Blk	170.95	170.95	2
Neves	1	CUT1	Restraint Cutter		Black	13.99	13.99	1
N.A.R.	1	30-0076	Junctional TQ		Red	249.99	249.99	1
Tac Med Sol.	4	HALO	Halo Chest Seal			15.95	63.20	1
Tac Med Sol.	6	CG/R	QuickClot Combat Gauze			46.33	277.98	1
N.A.R.	3	30-0009	BOA Tourniquet			12.99	38.97	1
Chinook	5	961011	K9 Torniquet			4.73	23.65	2
K9	1	K9-2	K-9 Muzzle			9.95	9.95	1
Chinook	1	01332	P.O. Medications			41.72	41.72	2
N.A.R.	6	ZZ-056	Pulse Oximeter			9.58	57.48	1
N.A.R.	1	10-0017	BLS Airway Kit			73.99	73.99	1
Boundtree	6	620-01	Bio-Chem Antidote kit			65.49	392.94	2
Chinook	20	05168	Fluorescein Strips			0.28	5.60	2
Chinook	3	01814	Stethoscope			59.80	179.4	2
Chinook	3	01809	B/P Cuff			18.90	58.90	2

GALLS	3	DD149	ETCO2			514.00	1534.00	2
Total Pri. 1	3,910.47	Total Pri. 2	1,114.66	Total Pri. 3	3953.00	Total	8,557.73	

TOTAL COST

Priority 1 equipment	**$2,746.94**
Priority 2 equipment	**$1,817.15**
Priority 3 equipment	**$6,372.13**
Approximated cost of initial equipment	**$21,238.43**