

## University of South Dakota Evaluation of the Helmsley Montana First Responder Automated External Defibrillator Project

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Prepared for the Montana Chronic Disease Prevention  
and Health Promotion Bureau

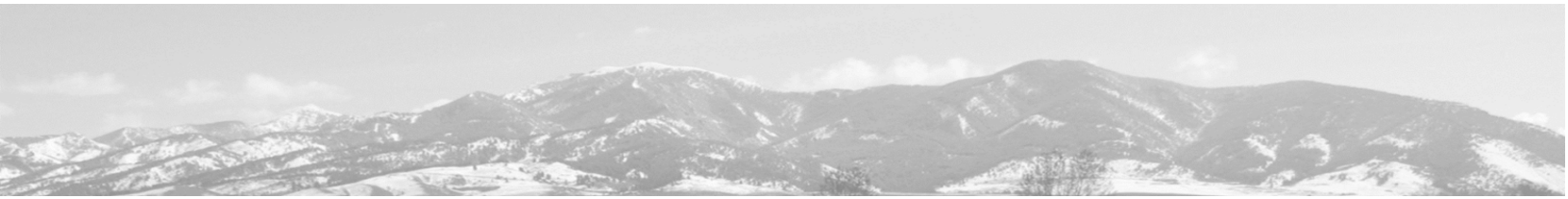
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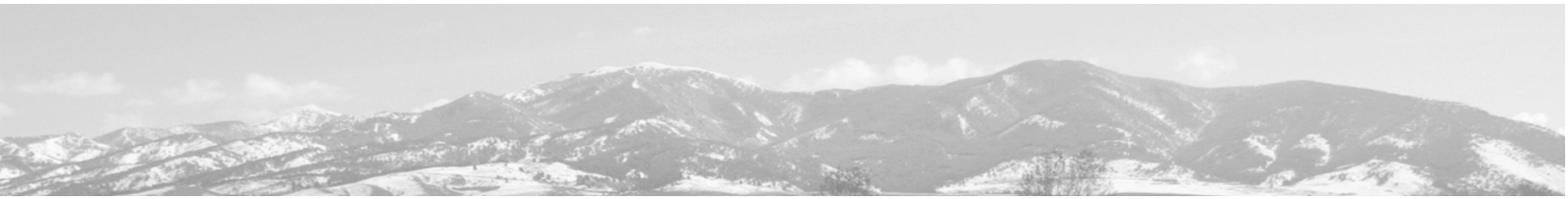
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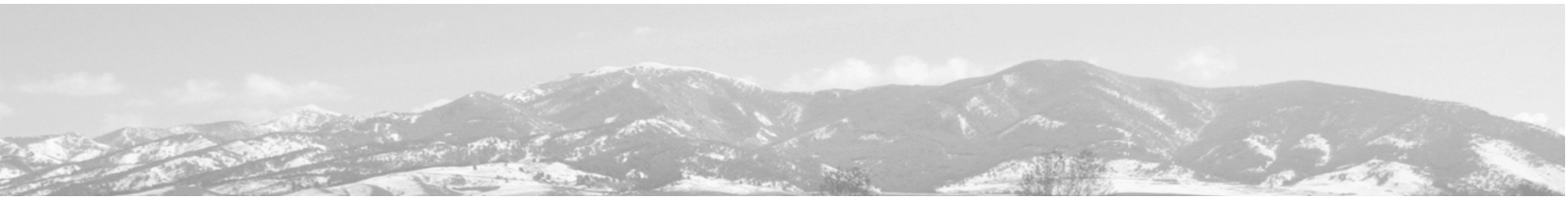
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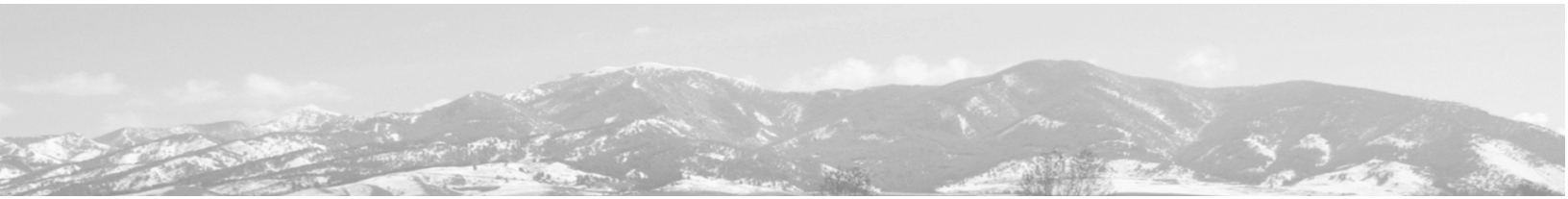
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## **Abbreviations**

AED- Automated External Defibrillator

AI/AN- American Indian/Alaska Native

CARES- Cardiac Arrest Registry to Enhance Survival

Co- County

CPR- Cardiopulmonary Resuscitation

DOH- Department of Health

DNR- Do-Not-Resuscitate

ED- Emergency Department

EMS- Emergency Medical Services

ePCR - Electronic Patient Care Reports

FR- First Responder

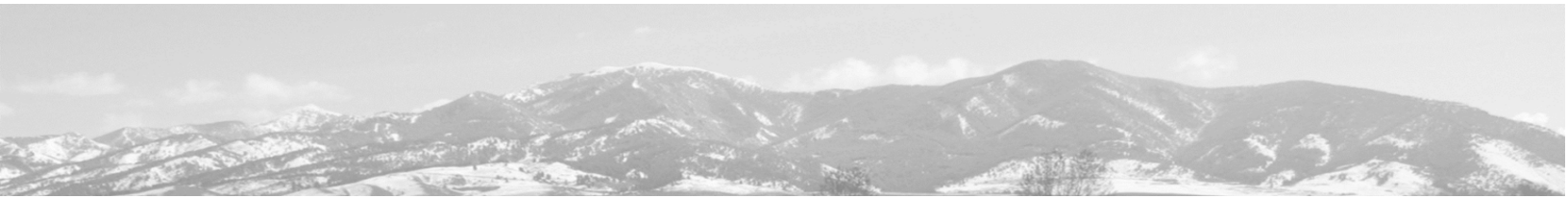
OHCA- Out-of-Hospital Cardiac Arrest

PD- Police Department

RE-AIM- Reach, Effectiveness, Adoption, Intervention, Maintenance

ROSC- Return of Spontaneous Circulation

SO- Sheriff's Office



## Summary of Findings

### Program Reach

A total 159 agencies participated in the program across the state of Montana. Of these, 127 were law enforcement agencies and 32 were fire departments or quick response units. From August 2020-December 2022, there were 385 cases of project AED use reported by Stryker. A project device was used in 38 out of 56 (68%) counties within Montana.

### Program Effectiveness

There was a statistically significant difference between the pre and post period in AED use prior to EMS arrival overall (14.4% vs. 21.0%,  $p < 0.001$ ). This difference remained for both more rural ( $p < 0.001$ ) and more urban ( $p < 0.001$ ) communities. Based on the ePCR data, there was an increase in the proportion of patients who expired in the field in the post-period (52.9%) compared to pre-period (43.3%) ( $p = 0.02$ ). Limiting analysis to those OHCA that were witnessed and had a shockable rhythm, there was no difference in outcomes between the pre and post periods ( $p = 0.16$ ).

Using the CARES data, there was a statistically significant increase in AED use prior to EMS arrival comparing the pre vs. post periods (33.6% vs. 37.7%,  $p = 0.04$ ). When looking at the outcome for this group, while there was a slightly higher survival to hospital discharge in the post group, there was a not statistically significant difference (pre=12.3% vs. post=15.3%,  $p = 0.24$ ).

Compared to all ePCR OHCA cases from 2021-2022, there was higher percentage of project AED cases in smaller communities (61.6% vs. 48.1%). The outcomes for project AEDs were similar to the post period for the ePCR and CARES data. Overall, 16 patients able to be linked with both ePCR and CARES data were discharged from the hospital alive after a project AED use.

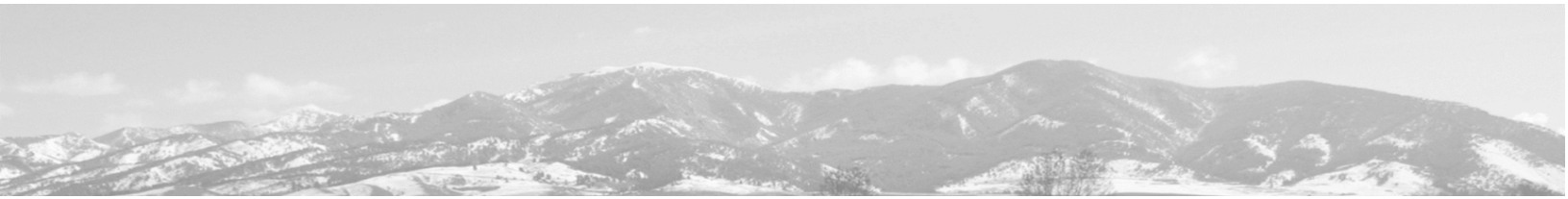
### Program Adoption

A total of 2381 AEDs were distributed which was higher than the initial planned 2342. These were distributed to 159 agencies. Six agencies refused or didn't respond to the program.

A pre-implementation training survey indicated that most respondents felt that AEDs would be a good addition to their department. Noted expected positive program outcomes included the added ability to save lives and provide reassurance. Some concerns were about liability, maintenance of equipment, and burden of training. However, most respondents had no concerns.

### Program Implementation

The first device was connected and in ready status on August 6<sup>th</sup>, 2020. Data from Stryker on AED and site readiness were assessed. About 40-50% of devices were in ready status at any one time point

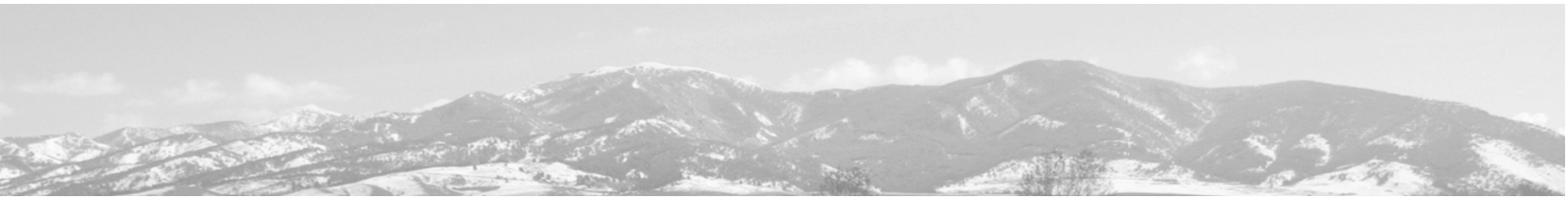


throughout the project period while 25-40% of sites were in the ready level with all AEDS in ready status.

In post-use surveys, respondents indicated that they had the training needed and were comfortable using the AED. When asked to provide additional information, respondents mentioned that the AEDs were easy to use and good tools to have. However, there was some concern about maintenance of the devices especially in regard to pad replacement.

### **Program Maintenance**

AEDs have been supplied to all participating agencies along with an eight-year agreement for support from Stryker and free emergent pad and battery replacement. This includes replacement pads each time the device is placed on an individual in a cardiac arrest. However, long term investment is needed to continue providing the devices after the eight-year agreement time frame expires.



## Background

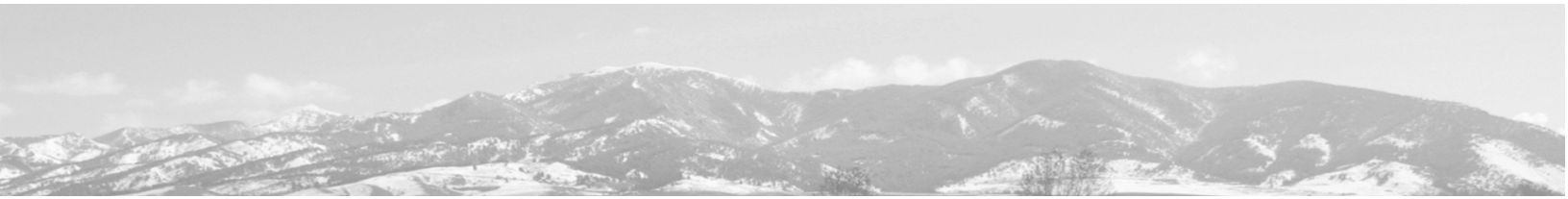
The purpose of the Montana Helmsley First Responder (FR) Automated External Defibrillator (AED) Program was to distribute 2342 AEDs to law enforcement agencies, fire departments, and quick response teams across the state of Montana. The overall goal was to ensure availability and access to ready to use AEDs by trained first responders prior to Emergency Medical Services (EMS) arrival on the scene and therefore, improve out-of-hospital cardiac arrest (OHCA) outcomes, especially in rural and frontier areas. Availability of devices and trained first responders prior to EMS arrival on the scene is presumed to shorten OHCA to defibrillation time and therefore, increase the chance of survival of OHCA patients.

This report provides an evaluation summary of the Helmsley AED project, comparing OHCA data extracted from the Electronic Patient Care Reports (ePCR) and Cardiac Arrest Registry to Enhance Survival (CARES) in the pre-implementation to the post-implementation period. The pre-implementation period included data collected from January 1, 2018, to December 31, 2019. The post data includes data from January 1, 2021, to December 31, 2022.

The evaluation uses the Reach-Effectiveness-Adoption-Implementation-Maintenance (RE-AIM) evaluation framework. This report includes all aspects of the evaluation. For the effectiveness analysis, the report provides findings on the impact of the AED program on short-term outcomes in OHCA by comparing post implementation to pre-implementation outcomes of survival to emergency department (ED) and return of spontaneous circulation (ROSC) in OHCA patients as well as data from the CARES program to assess hospital outcomes of those admitted. Data sources for this evaluation included surveys conducted by the Montana Chronic Disease Prevention and Health Promotion Bureau, the EMS ePCR entries, the CARES registry, and Stryker LIFEPAK CR2 AED CPR reports.

*It is acknowledged that COVID-19 public health emergency may have disrupted first responder agency workflows in ways that are difficult to identify or measure at this time.*





## Reach

The “Reach” component of the RE-AIM framework evaluates inputs related to program participants (i.e., OHCA patients affected by AEDs distributed and used through the program).

This portion of the report contains the outcome assessment of the Montana AED project based on project provided AED CPR reports and program data.

## Participation

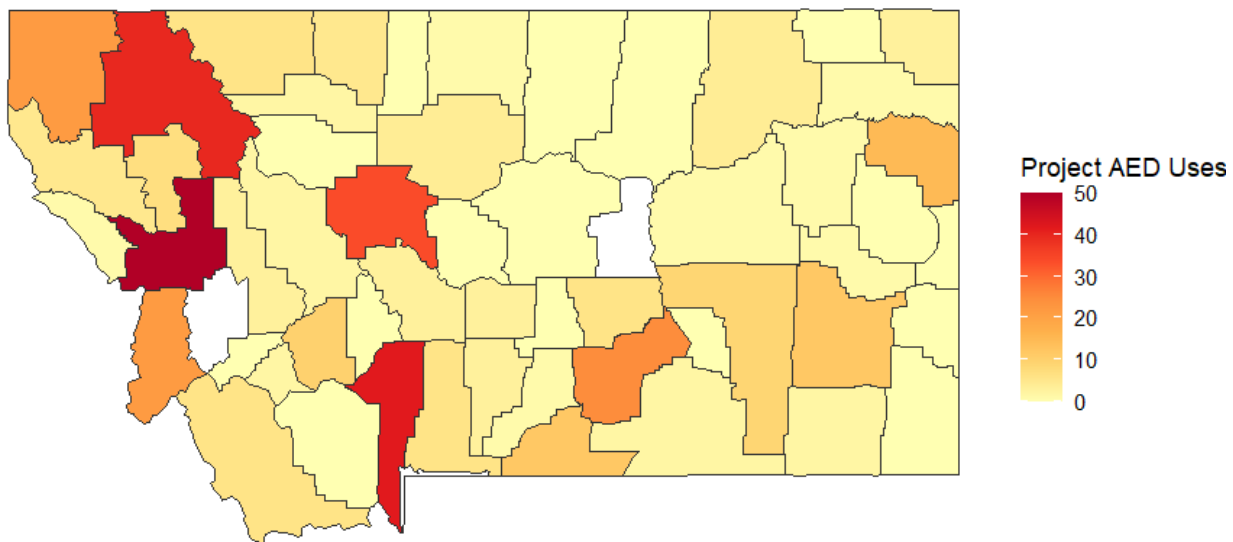
Overall 159 agencies participated in the program across the state of Montana with agencies in 54 out of 56 counties. Of these, 127 were law enforcement agencies and 32 were fire departments or quick response units. Agencies were located across the state in both rural and urban areas.

## Stryker LIFEPAK AED Use Cases

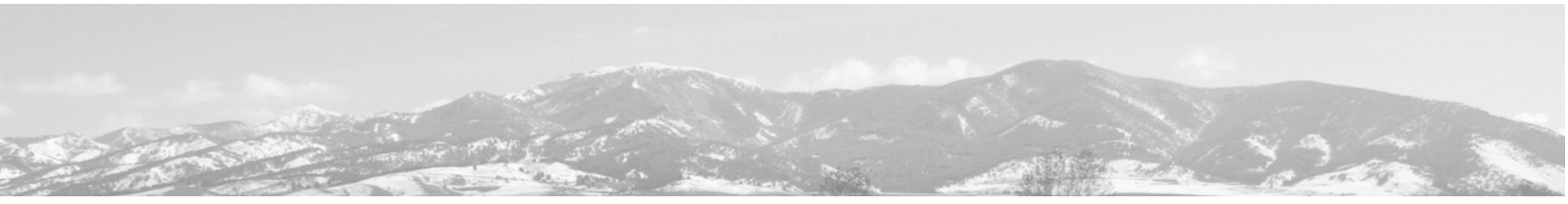
August 6<sup>th</sup>, 2020, through December 31<sup>st</sup>, 2022, there were 385 cases that were reported by Stryker that had a CPR report associated with them. Project AED use increased over time with 46 in 2020, 167 in 2021, and 172 in 2022.

To assess geographic reach, a map was created detailing the number of uses across counties. Overall 68% of counties in Montana reported use of a project AED (38 out of 56). While most of the use was concentrated in the western part of the state, uses occurred throughout a wide geographical area that spanned the entire state.

*Figure 1. AED Use by County 2020-2022*

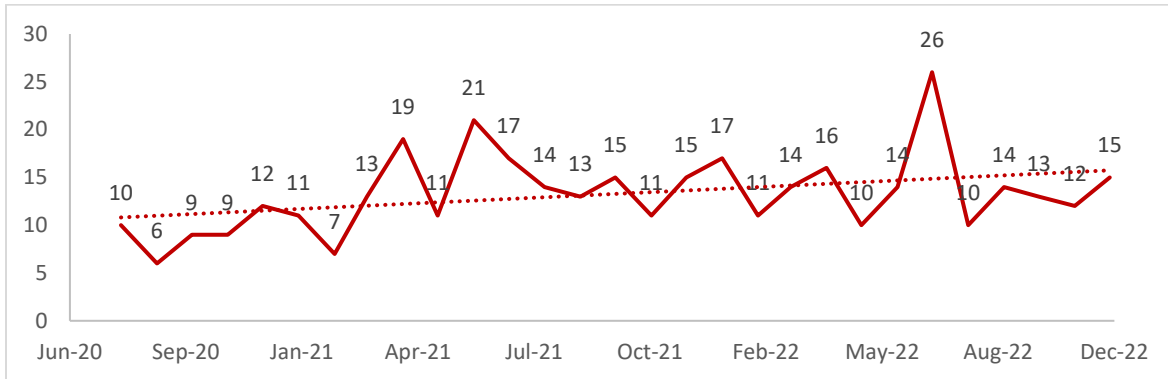


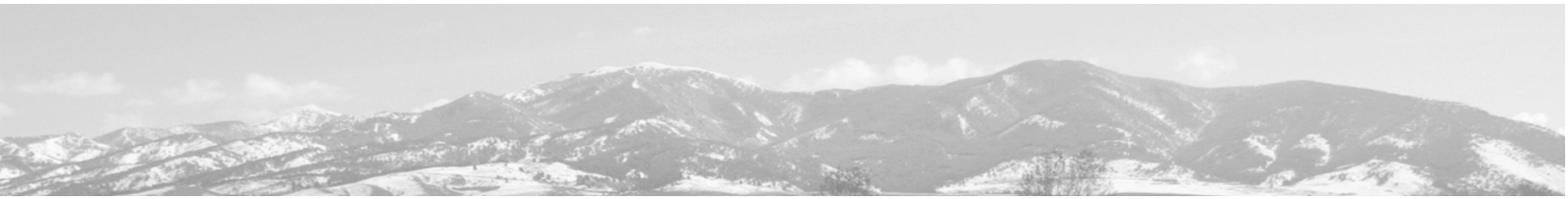
*Note:* Counties in white represent non-participating counties.



Another way to look at the reach of the program is to look at the number of project uses over time. The figure below shows that, while variable by month, there was an overall increase in use over time. The yearly trend can also be seen in the following figure. There are peaks of use that occurring in the late spring in each year of the project followed by lower use in the late summer/early fall.

*Figure 2. Project AED Uses per Month: August 2020 to December 2020*





## Effectiveness

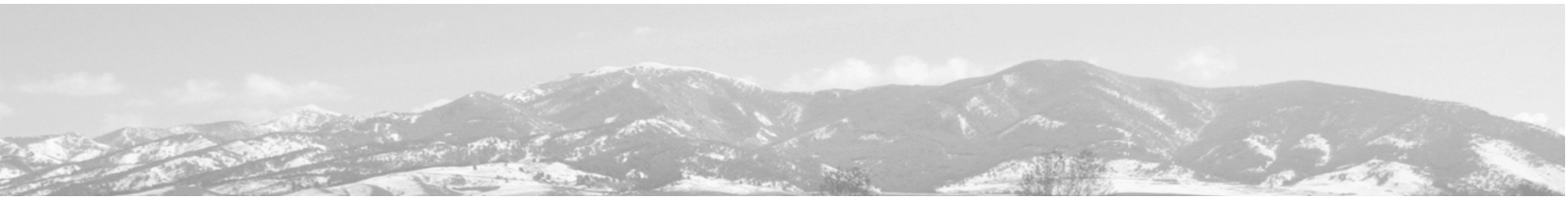
Effectiveness evaluation provides information on the impact of the AED program on OHCA outcomes. Evaluation of program impact on outcomes was evaluated using three data sources ePCR data, CARES data, and Stryker LIFEPAK CPR reports as well as a combined matched version of all three sources. The effectiveness of the AED program is measured by reviewing the incidence and survival of OHCA patients overall and for those with presumed cardiac etiology. Even though the relationship is not a direct one, we expect the project to lead to an uptake by AED use as a whole and therefore, lead to improvement in return of spontaneous circulation (ROSC) and survival to the emergency department (ED) as well as survival to hospital discharge in the short term in OHCA patients.

## Methodology

The current ePCR dataset does not provide information on the direct use of AED by law enforcement prior to EMS arrival at the scene that is independent of AED use by other first responders such as fire and EMS who are not part of the dispatched response. In this analysis, the ePCR field labeled as “First Responder” in the ePCR dataset was used as an indicator to evaluate AED use by law enforcement from the pre-to-the post -period. The assumption is that AED use by fire and EMS who are not part of the dispatched response remained unchanged or unaffected by the AED distribution program. Therefore, any increase in AED use by this group was assumed to be the result of increased use of AED by law enforcement. However, this field is not required and there was a difference in reporting over time. For cases that indicated an AED use prior to EMS arrival, missing data on who used the AED increased from 21% in 2018-2019 to 68% in 2021-2022. Thus, this report will not look at who used the AED, but only if an AED was used prior to EMS arrival. This dilutes the data a little more since this includes all uses, but is the best way to analyze the data in the face of increased missingness over time.

Outcome assessment is based on the ePCR data and CARES data as well as the project use data from the CPR reports linked to both the ePCR and CARES data. The goal is to determine the overall outcomes for this project based on pre-post analysis. Outcomes include use of AED prior to EMS arrival, outcomes of the OHCA case at the end of the EMS event, and hospital outcomes from the CARES data.

This report includes descriptive data; means and standard deviations for continuous variables and frequency and percentages for categorical variables. Demographic data included the age, gender, and race of everyone involved in an OHCA as well as the size of the community in which the OHCA occurred (<10,000 population, ≥10,000 population). This was determined based on the incident county and incident city. The pre-post analysis included 2018-2019 as the pre-implementation years and 2021-2022 as the post implementation years. We excluded 2020 as program implementation was in process during this time. Pre-post comparisons for categorical were made using chi-square analysis with Fisher’s exact test used for comparisons with small cell sizes. For continuous variables, pre-post comparisons were made using a t-test. We also modeled use of an AED using logistic regression to assess pre-post differences while controlling for demographic variables. Similar models were created for overall mortality and ROSC in the field.



There were some inconsistencies in the data which were cleaned. For records listing a patient’s age as over 110, we set the age to missing (n =11). For use of an AED prior to EMS arrival, there was some conflicting data. Even if AED use prior to EMS arrival was listed as no, if there was someone listed as using an AED prior to EMS arrival and the resuscitation indication mentioned defibrillation, it was assumed that an AED was used prior to EMS arrival. When looking at AED use prior to EMS arrival, we assumed that any missing data was a non-use case. Those who listed AED use as not applicable were excluded.

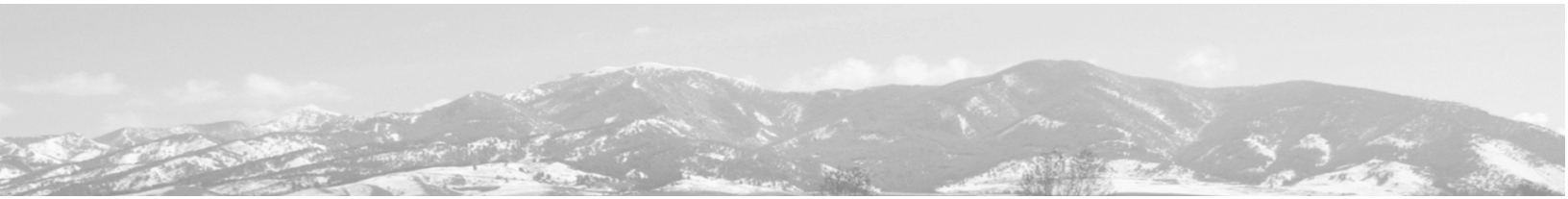
## Demographics

Overall, there were 2659 OHCA cases in 2018-2019 and 3314 cases in 2021-2022. There was a statistically significant difference in average age of those with OHCA in the pre vs. post period ( $p=0.002$ ). The reflected a decrease in age seen in 2021 and 2022. Individuals in the post period were younger. There was not a statistically significant difference observed in race, gender, or etiology. However, there was a difference in OHCA in cities larger than 10,000 population ( $p = 0.04$ ). In the post group there were more cases from more populated areas.

*Table 1. Demographics*

Variable	Level	2018 - Pre (n =1155) N (%)	2019 - Pre (n=1504) N (%)	2021 - Post (n=1727) N (%)	2022 - Post (n=1587) N (%)	Pre vs. Post p-value*
Age	Continuous	Mean = 61.25 Std = 20.03 N = 1093	Mean = 62.45 Std =20.32 N = 1447	Mean = 60.32 Std =20.66 N = 1684	Mean = 60.13 Std =20.72 N = 1541	0.002
Gender	Male	745 (66.3)	953 (65.2)	1136 (66.2)	1022 (64.6)	0.83
	Female	379 (33.7)	508 (34.8)	581 (33.8)	560 (35.4)	
	Missing	31	43	10	5	
Race	AI/AN	120 (14.6)	124 (11.5)	153 (11.0)	146 (11.1)	0.15
	White	658 (80.2)	886 (82.3)	1147 (82.6)	1085 (82.5)	
	Other	43 (6.2)	67 (6.2)	88 (6.3)	84 (6.4)	
	Missing	334	427	339	272	
Community Size	<10,000	586 (51.1)	758 (50.6)	842 (49.1)	741 (47.0)	0.04
	≥10,000	561 (48.9)	741 (49.4)	872 (50.9)	837 (53.0)	
	Missing	8	5	13	9	
Etiology	Cardiac	793 (69.7)	1043 (69.8)	1134 (67.1)	1080 (69.1)	0.15
	Other	344 (30.3)	451 (30.2)	556 (32.9)	484 (30.9)	
	Missing	18	10	37	23	

\*T-test for continuous variables and Chi-squared test for categorical variables.



### AED Use Prior to EMS Arrival

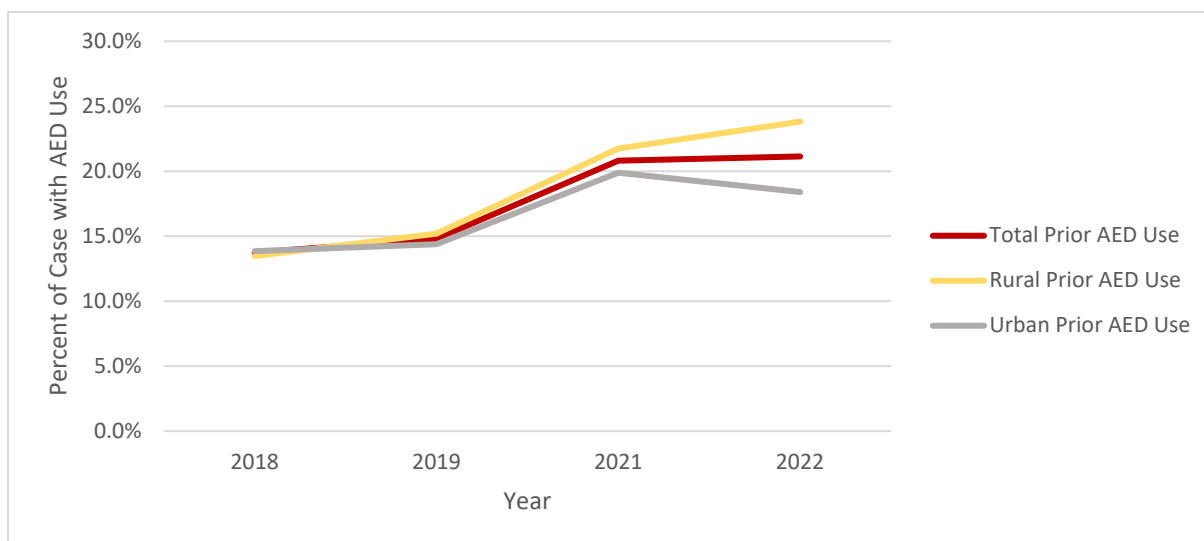
There was a statistically significant difference between the pre and post period in AED use prior to EMS arrival overall (14.4% vs. 21.0%,  $p < 0.001$ ). This significant difference remained for both more rural ( $p < 0.001$ ) and more urban ( $p < 0.001$ ) communities. Figure 1 displays this graphically.

*Table 2. AED Use Prior to EMS Arrival in OHCA by Year*

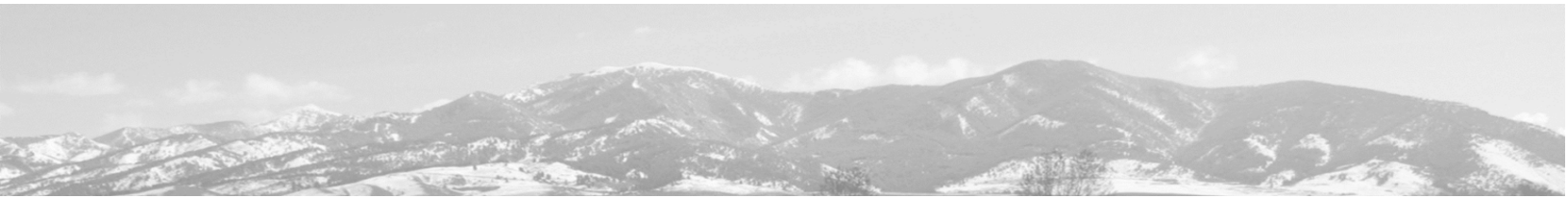
	2018 - Pre (n =1155) N (%)	2019 - Pre (n=1504) N (%)	2021 - Post (n=1727) N (%)	2022 - Post (n=1587) N (%)
Total OHCA with AED use prior to EMS arrival*	157 (13.7)	221 (14.8)	358 (20.8)	335 (21.1)
Total OHCA with AED use prior to EMS arrival – Community size <10,000	78 (13.5)	114 (15.2)	182 (21.7)	176 (23.8)
Total OHCA with AED use prior to EMS arrival – Community size $\geq 10,000$	77 (13.8)	106 (14.4)	173 (19.9)	154 (18.4)
Not applicable	12	12	7	2

\*Not applicable listed for AED use for 24 pre and 9 post

*Figure 3: AED use Prior to EMS Arrival in OHCA: Rural (<10,000) vs. Urban (>10,000)*



When an AED was used prior to EMS arrival, about 28% of the time defibrillation was used, as seen in table 3. Most of the uses did not involve defibrillation.



**Table 3. AED Use Prior to EMS Arrival in OHCA by Defibrillation Status and Year**

	2018 - Pre (n =157) N (%)	2019 - Pre (n=221) N (%)	2021 - Post (n=358) N (%)	2022 - Post (n=335) N (%)
With defibrillation	46 (29.3)	63 (28.5)	91 (25.4)	97 (29.0)
Without defibrillation	108 (68.8)	151 (68.3)	264 (73.7)	237 (70.7)
Unknown defibrillation	3 (1.9)	7 (3.2)	3 (0.8)	1 (0.3)

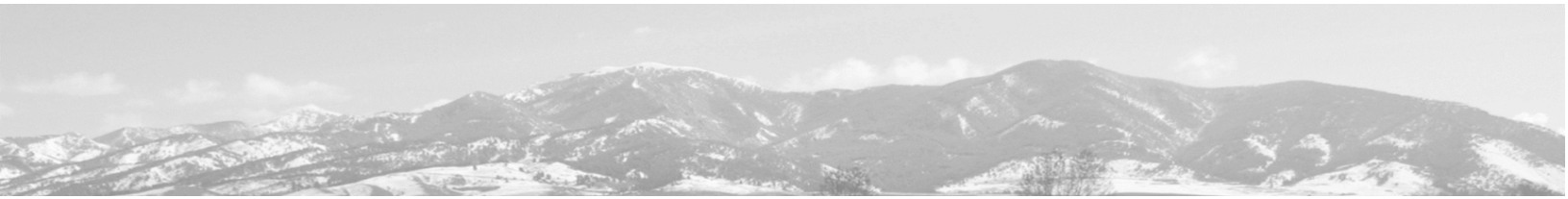
When limited to those of cardiac etiology, there was still a statistically significant difference between the pre and post period in AED use prior to EMS arrival overall (14.6% vs. 21.6%,  $p < 0.001$ ). This significant difference remained for both more rural ( $p < 0.001$ ) and more urban ( $p = 0.003$ ) communities.

**Table 4. AED Use Prior to EMS Arrival in OHCA of Cardiac Etiology by Year**

	2018 - Pre (n =793) N (%)	2019 - Pre (n=1043) N (%)	2021 - Post (n=1134) N (%)	2022 - Post (n=1080) N (%)
Total OHCA with AED use prior to EMS arrival*	106 (13.4)	160 (15.4)	247 (21.9)	230 (21.3)
Total OHCA with AED use prior to EMS arrival – Community size <10,000	51 (13.3)	83 (15.9)	127 (23.3)	126 (25.3)
Total OHCA with AED use prior to EMS arrival – Community size ≥10,000	53 (13.3)	76 (14.8)	119 (20.4)	102 (17.7)

\*Not applicable listed for AED use for 9 pre and 6 post.

To assess differences in use of AED prior to EMS arrival, a multivariable logistic regression model was used to determine possible differences by gender, race, community size, and age. After adjusting for confounders, there was a statistically significant difference in AED use prior to EMS arrival between the pre and post period. The odds of first responder AED use in the pre-period was 28% lower than in the post-period overall and 34% lower limited to cardiac etiology. Race, age, and community size were also statistically significant predictors of use. Overall, there was lower use in American Indian compared to White individuals, slightly decreased use with increasing age and higher use in rural compared to urban areas (see table 5).



*Table 5. Predictors of AED Use Prior to EMS Arrival in OHCA*

	All OHCA		Cardiac Etiology	
	Odds Ratio	95% CI	Odds Ratio	95% CI
Pre vs. Post	0.72	(0.61-0.85)	0.66	(0.54, 0.80)
Female vs. Male	0.85	(0.72-1.00)	0.88	(0.72, 1.07)
American Indian vs. White	0.43	(0.31-0.58)	0.44	(0.30, 0.65)
Other vs. White	1.09	(0.80-1.49)	1.22	(0.83, 1.79)
Age (continuous)	0.99	(0.99-1.00)	0.99	(0.99, 1.00)
Community size (<10,000 vs. ≥10,000)	1.24	(1.05-1.45)	1.37	(1.14, 1.65)

### Outcomes of AED Use Prior to EMS Arrival

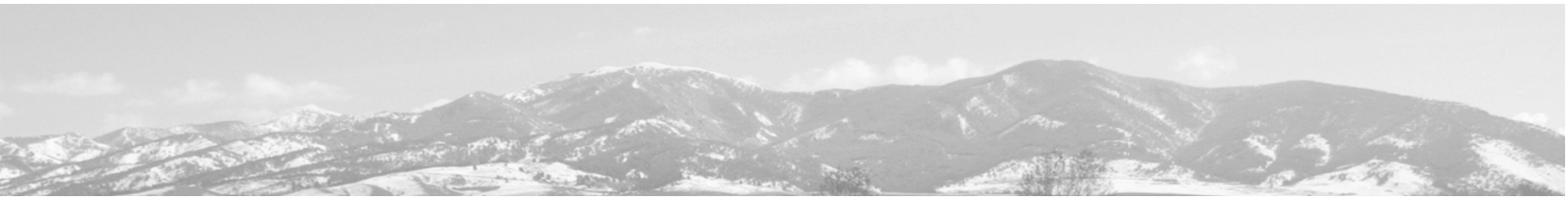
There was a statistically significant difference in initial outcomes between the pre and the post period ( $p=0.02$ ). There was an increase in the proportion of patients who expired in the field in the post-period (52.9%) compared to pre-period (43.3%). When exploring overall mortality with a logistic regression model, controlling for gender, race, age, and community size there was a decreased odds of death in the pre versus post which was statistically significant (OR = 0.71, 95% CI: 0.51-0.98). When exploring ROSC in the field compared with all other outcomes in a logistic regression model, controlling for gender, race, age, and community size there was a increased odds of ROSC in the field in the pre versus post, but this was not statistically significant (OR = 1.28, 95% CI: 0.87-1.90).

*Table 6. Outcomes of OHCA with AED Use Prior to EMS Arrival by Year*

Outcome	2018 - Pre (n =157) N (%)	2019 - Pre (n=221) N (%)	2021 - Post (n=358) N (%)	2022 - Post (n=335) N (%)
Expired in the ED	31 (20.1)	36 (16.5)	64 (18.4)	57 (17.5)
Expired in the Field	64 (41.6)	97 (44.5)	177 (50.9)	179 (55.1)
Ongoing Resuscitation	27 (17.5)	37 (17.0)	38 (10.9)	50 (15.4)
ROSC in the ED	13 (8.4)	10 (4.6)	23 (6.6)	8 (2.5)
ROSC in the Field	19 (12.3)	38 (17.4)	46 (13.2)	31 (9.5)
Missing or No Data	3	3	10	10

### Utstein Guidelines

When using the Utstein guidelines there were a total of 2711 OHCA that were witnessed and 904 OHCA that had a shockable rhythm, with 640 OHCA cases with both criteria met (107 in 2018, 181 in 2019, 173 in 2021, and 179 in 2022). Comparing the pre to post period, there was not a statistically



significant increase in AED use prior to EMS arrival in those with an OHCA that were witnessed and had a shockable rhythm (25.5% vs. 30.6%,  $p = 0.16$ ).

**Table 7. OHCA Cases with AED Use Prior to EMS Arrival with a Witness and Shockable Rhythm**

	2018 - Pre (n =107) N (%)	2019 - Pre (n=181) N (%)	2021 – Post (n=173) N (%)	2022 – Post (n=179) N (%)
AED use	35 (33.0)	38 (21.1)	59 (34.3)	48 (27.0)
No AED use	71 (67.0)	142 (78.9)	113 (65.7)	130 (73.0)
Missing or No Data	1	1	1	1

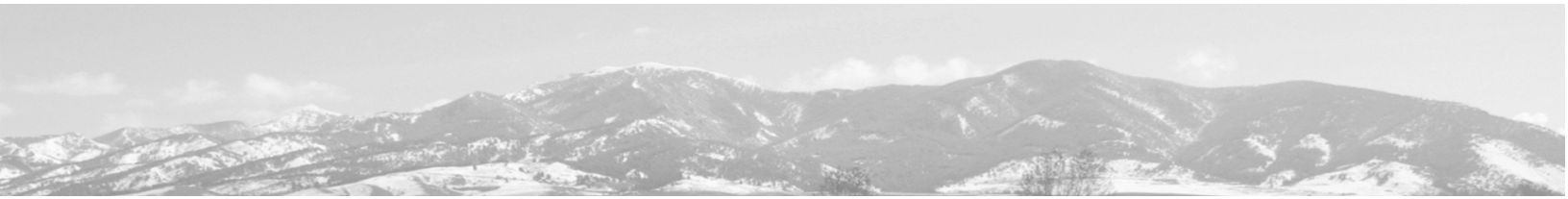
Comparing the pre to post period, there was not a statistically significant difference in outcomes overall ( $p = 0.16$ ). There was higher ROSC in the field for the pre versus the post group (28.7% vs. 20.6%,  $p = 0.02$ ). Comparing overall deaths, there was a lower incidence of death in the pre versus post group (either in the field or in the ED) (38.3% vs. 46.2%,  $p = 0.05$ ).

**Table 8. Outcomes for OHCA with a Witness and Shockable Rhythm**

Outcome	2018 - Pre (n =107) N (%)	2019 - Pre (n=181) N (%)	2021 - Post (n=173) N (%)	2022 - Post (n=179) N (%)
Expired in the ED	33 (31.4)	28 (15.8)	47 (28.1)	39 (22.5)
Expired in the Field	12 (11.4)	35 (19.8)	29 (17.4)	42 (24.3)
Ongoing Resuscitation	28 (26.7)	42 (23.7)	39 (23.4)	45 (26.0)
ROSC in the ED	8 (7.6)	15 (8.5)	15 (9.0)	14 (8.1)
ROSC in the Field	24 (22.9)	57 (32.2)	37 (22.2)	33 (19.1)
Missing or No Data	2	4	6	6

When limited to those with an AED use prior to EMS arrival, outcomes were similar. Comparing the pre to post period, there was not a statistically significant difference in outcomes overall ( $p = 0.23$ ). There was higher ROSC in the field for the pre versus the post group (34.7% vs. 22.4%,  $p = 0.05$ ). Comparing overall deaths, there was a lower, but non-statistically significant incidence of death in the pre versus post group (either in the field or in the ED) (34.7% vs. 47.6%,  $p = 0.09$ ).





**Table 9. Outcomes for OHCA with a Witness, Shockable Rhythm, and AED Use Prior to EMS Arrival**

Outcome	2018 - Pre (n =35) N (%)	2019 - Pre (n=38) N (%)	2021 - Post (n=59) N (%)	2022 - Post (n=48) N (%)
Expired in the ED	10 (28.6)	5 (13.5)	16 (27.6)	7 (15.6)
Expired in the Field	2 (5.7)	8 (21.6)	13 (22.4)	13 (28.9)
Ongoing Resuscitation	10 (28.6)	6 (16.2)	9 (15.5)	13 (28.9)
ROSC in the ED	5 (14.3)	1 (2.7)	6 (10.3)	4 (8.9)
ROSC in the Field	8 (22.9)	17 (45.9)	14 (24.1)	8 (17.8)
Missing or No Data	0	1	1	3

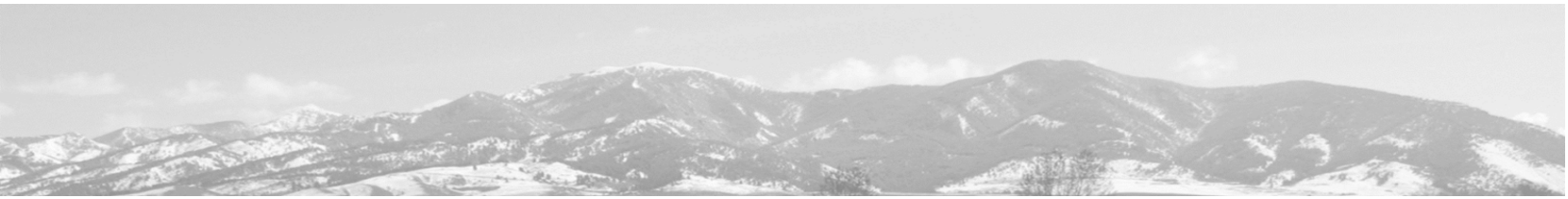
### CARES data

Data from the CARES registry was linked to the ePCR data to provide information on overall outcomes. A total of 2198 cases were entered into the CARES dataset for Montana in 2018, 2019, 2021, and 2022. Matches were made to the ePCR in 1790 cases, representing 81.4% of the cases in the CARES registry. There was an increase in the number of agencies reporting to the CARES registry over time (18 in 2018, 31 in 2019, 44 in 2021, and 44 in 2022). More rural agencies were included in later years. The table below provides the matches by year and the percent of ePCR cases linked to the CARES registry for each year. As expected the percent of ePCR cases represented in the CARES data increases over time from 25.4% in 2018 to 34.2% in 2022. This could bias the pre-post comparison since more rural agencies with longer response times were included in the post intervention data.

**Table 10. Linkages between ePCR and CARES Data by Year**

Year	CARES	Linked CARES	% of CARES records linked to ePCR	ePCR	% of ePCR cases linked to CARES
2018	388	293	75.5%	1155	25.4%
2019	509	426	83.7%	1504	28.3%
2021	641	528	82.4%	1727	30.6%
2022	660	543	82.3%	1587	34.2%

Between 30-40% of cases in the CARES data had an AED use prior to EMS arrival. There was a statistically significant increase in AED use prior to EMS arrival when comparing the pre vs. post groups (33.6% vs. 37.7%,  $p = 0.04$ ). Results are broken down by year in table 11.



**Table 11. CARES Data with AED Use Prior to EMS Arrival**

AED use	2018 - Pre (n =388) N (%)	2019 - Pre (n=509) N (%)	2021 - Post (n=641) N (%)	2022 - Post (n=660) N (%)
No	250 (64.4)	346 (68.0)	385 (60.1)	425 (64.4)
Yes, with defibrillation	39 (10.1)	48 (9.4)	78 (12.2)	77 (11.7)
Yes, without defibrillation	99 (25.5)	115 (22.6)	178 (27.8)	158 (23.9)

When looking at the outcome of those who had an AED use prior to EMS arrival, while percent discharged alive was higher in the post period, there was a not statistically significant difference in those discharged alive comparing the pre vs. post groups (12.3% vs. 15.3%,  $p = 0.24$ ).

**Table 12. Final Outcomes from CARES Data with AED Use Prior to EMS Arrival**

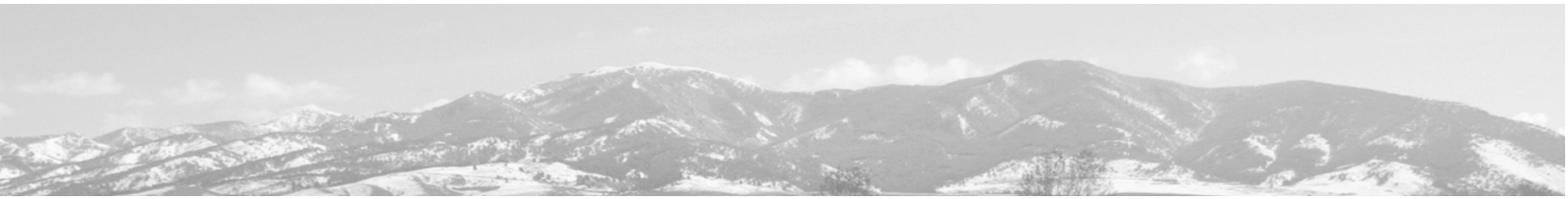
Outcome	2018 - Pre (n =138) N (%)	2019 - Pre (n=163) N (%)	2021 - Post (n=256) N (%)	2022 - Post (n=235) N (%)
Expired in the Field	59 (42.8)	74 (45.4)	108 (42.2)	115 (49.1)
Expired in the ED	36 (26.1)	37 (22.7)	67 (26.2)	57 (24.4)
Expired in the hospital	27 (19.6)	31 (19.0)	38 (14.8)	30 (12.8)
Discharged Alive	16 (11.6)	21 (12.9)	43 (16.8)	32 (13.7)
Missing or No Data	0	0	0	1

### Project AED Uses

This portion of the report contains the outcome assessment of the Montana AED project based on project provided AED CPR reports, matching ePCR cases and matching CARES data when available. Out of the 384 cases 299 (77.9%) could be matched to the ePCR data. Out of the 299 cases matched to the ePCR data, 104 (34.8%) were also able to be matched to the CARES data. Outcomes were compared to the data overall either from the ePCR or CARES system as appropriate.

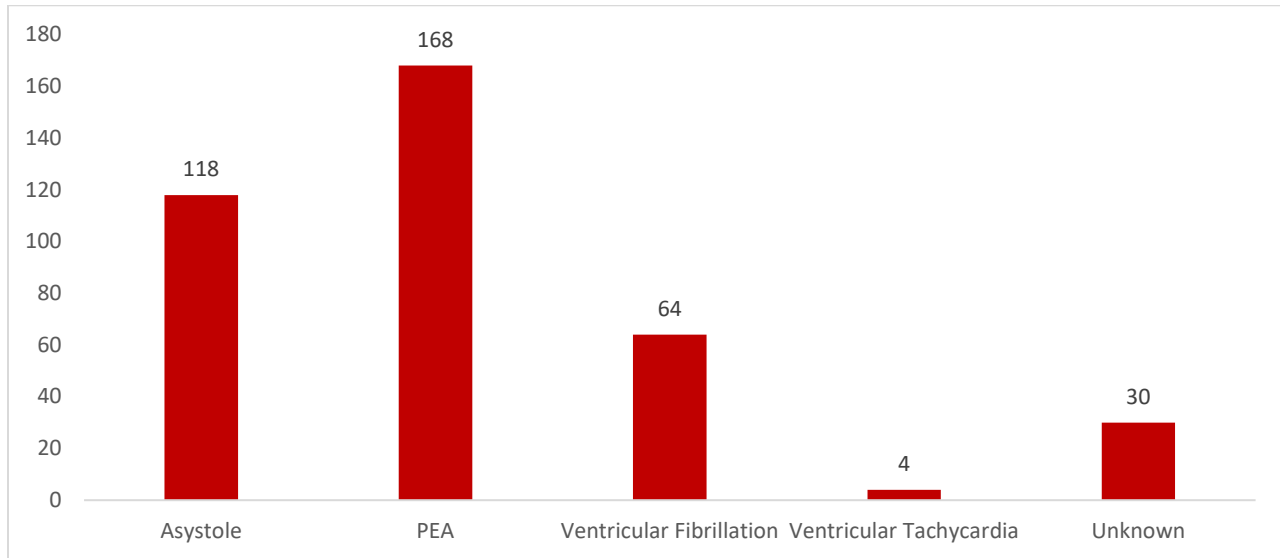
**Table 13. CPR and Compression Measurements Based on Stryker CPR Reports**

Measure	Range	Frequency and % in Range
CPR Ratio	80-100	310 (80.7)
Compression Ratio	80-100	266 (69.3)
Compression Rate	100-120	329 (85.7)
Compressions per Minute	80-120	299 (77.9)

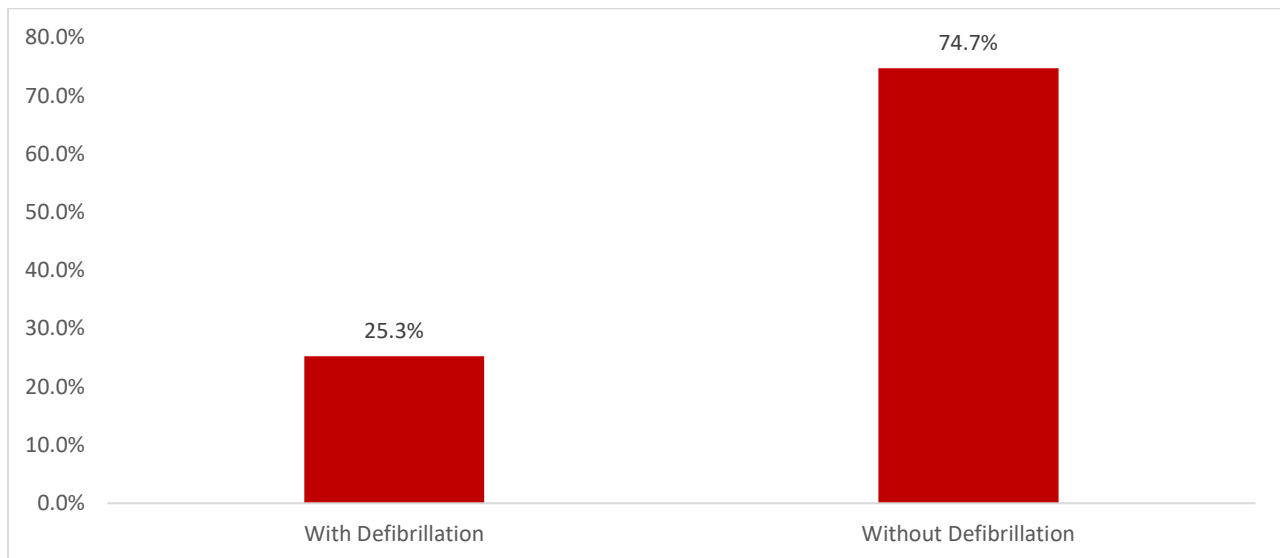


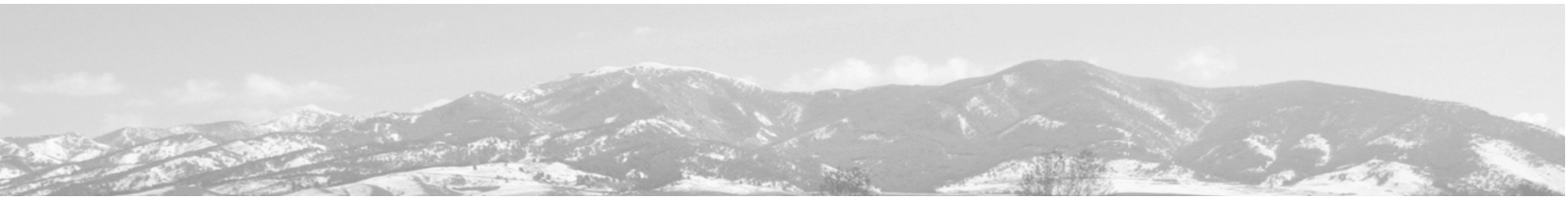
Most of the time the CPR measurements were in the correct range. The compression rate had the highest in range percentage and the compression ratio had the lowest.

*Figure 4. Initial Rhythm of AED Patients Based on Stryker CPR Reports*



*Figure 5. Defibrillation Status of AED Use Based on Stryker CPR Reports*





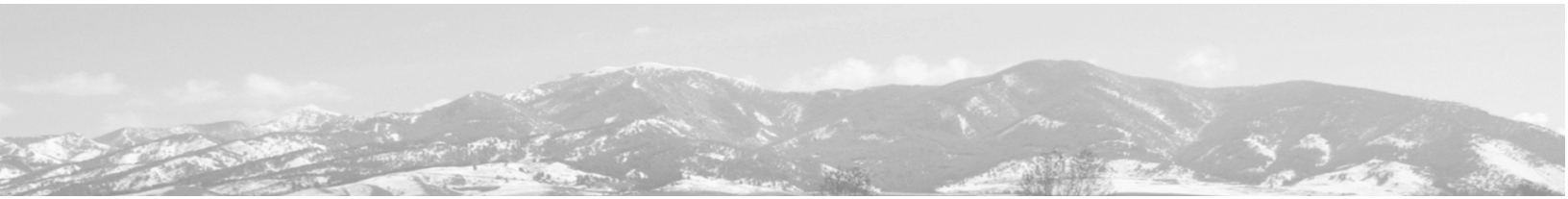
**Table 14. Demographics of Project Distributed AED Patients Linked to ePCR Data**

Variable	Level	N (%) (n = 299)
Age	Continuous	Mean = 57.37 Std = 20.37 N = 292
Gender	Male	206 (69.4)
	Female	91 (30.6)
	Missing	2
Race	AI/AN	15 (6.6)
	White	198 (87.2)
	Other	14 (6.2)
	Missing	72
Community Size	<10,000	179 (61.1)
	≥10,000	114 (38.9)
	Missing	6
Etiology	Cardiac	204 (68.5)
	Other	94 (31.5)
	Missing	1

Project AED users had a higher percentage of use in smaller communities compared to all ePCR data from 2021-2022 (61.6% vs. 48.1%).

**Table 15. Initial Outcomes for Project Distributed AED Patients Linked to ePCR Data**

	All Linked Patients	Patients with a Witness and Shockable Rhythm
Outcome	N (%) (n = 299)	N (%) (n = 38)
Expired in the ED	66 (22.8)	13 (34.2)
Expired in the Field	159 (54.8)	9 (23.7)
Ongoing Resuscitation	21 (7.2)	6 (15.8)
ROSC in the ED	15 (5.2)	2 (5.3)
ROSC in the Field	29 (10.0)	8 (21.1)
Missing or No Data	9	0

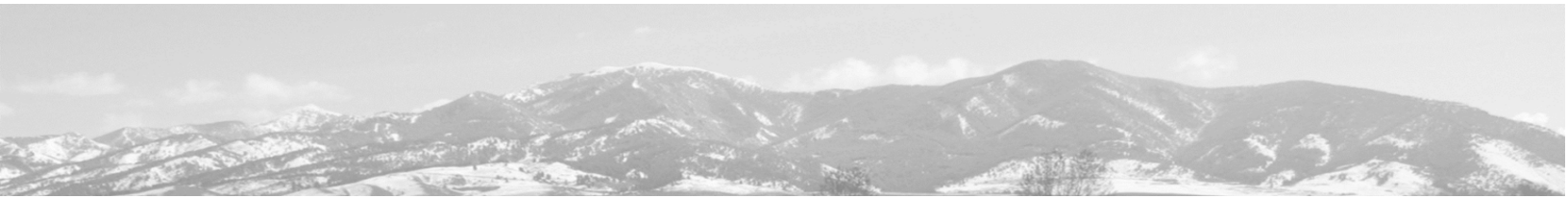


Outcomes for device uses were similar to outcomes overall for AED use prior to EMS arrival across the post period (Table 14). Just over 15% of patients achieved ROSC in the field or in the ED. For events that were witnessed and had a shockable rhythm, outcomes were much better with 26.4% achieving ROSC in the field or in the ED. These results were also similar to the overall ePCR results across the post period.

Overall outcomes from the CARES data were similar to outcomes overall for AED use prior to EMS arrival across the study years (Table 16). A total of 15.4% of patients with CARES data survived to hospital discharge which is similar to the overall survival of patients in the post period of the CARES data overall.

*Table 16. Final Outcomes for Project Distributed AED Patients Linked to CARES Data*

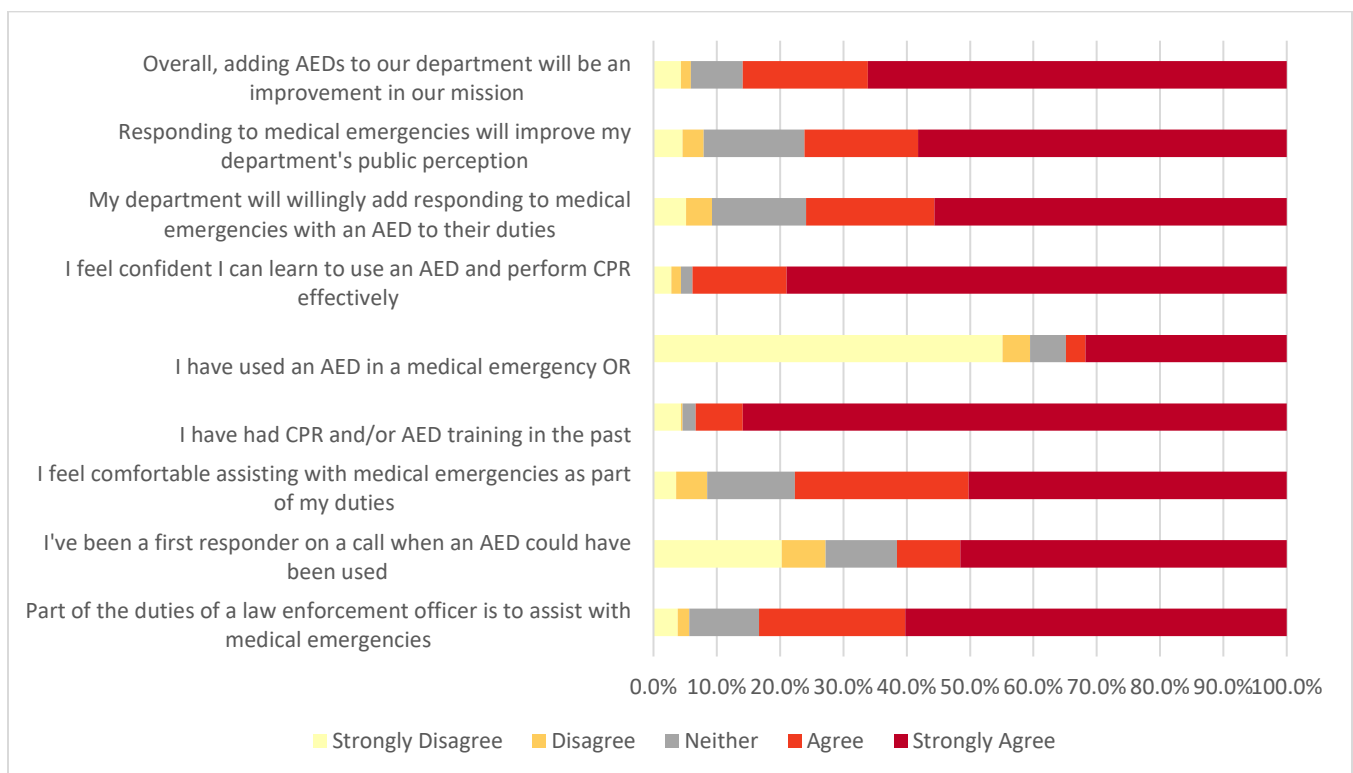
Outcome	N (%) (n = 104)
Expired in the Field	55 (52.9)
Expired in the ED	25 (24.0)
Expired in the hospital	8 (7.7)
Discharged Alive	16 (15.4)



## Adoption

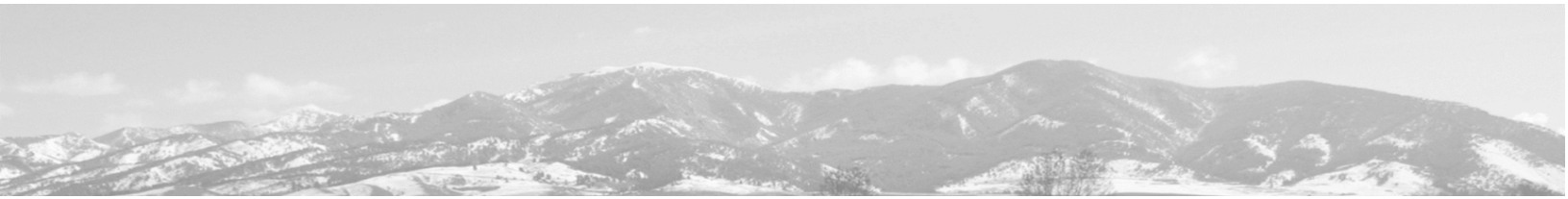
The “Adoption” component of the RE-AIM framework evaluates inputs related to program adoption by law enforcement and other agencies who were trained and received an AED ready for use through the project. Part of the adoption process starts with pre-implementation training to determine possible barriers to adoption of the program. The following graph presents the results from the pre-training survey that was answered by 390 individuals who were potential law enforcement participants in the AED program.

*Figure 6. Pre-Survey Responses*



Overall, there was high agreement with most of the questions, indicating that respondents felt that AEDs would be a good addition to their department and that there was a lot of comfort and acceptance to adding assisting with medical emergencies, including use of AEDs to law enforcement’s other duties.

Qualitative survey questions asked about positives to the programs as well as questions and concerns. Themes for positive outcomes included improved outcomes, reassurance, response times, and other. For improved outcomes, most comments were about the added ability to save lives through use of the AED. In the reassurance theme, comments mentioned public perception, having reliable equipment, comfort in knowing they will be able to provide aid. Under the theme of response times, officers



mentioned that law enforcement is often first on the scene for medical assistance calls. Characteristic quotes for each theme are presented in the table below.

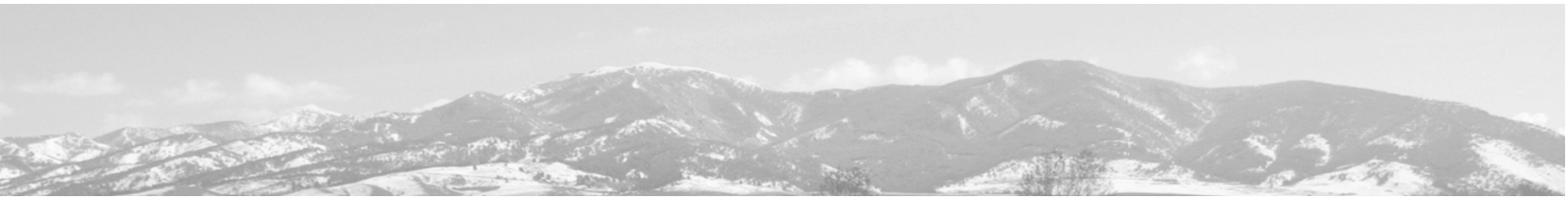
*Table 17. Perceived Positive Outcomes of the Program*

Theme	Quotes
Improved Outcomes	“Having an AED as an additional tool during a cardiac event may give the patient a better chance for survival until advanced medical measures can be administered at a hospital.”
Reassurance	“...if nothing else, it helps to know you did everything possible for the patient” “Comfort and confidence in being able to aid the public if need be.”
Response Times	“Quicker AED and CRP initiated in the field” “I work in a very rural area. Most times I get on scene and am waiting for EMS to arrive.”

When asked about concerns for the program, the following themes emerged; liability, maintenance, training, willingness, and other. Many of those surveyed had no concerns listed. Out of 373 written responses, 179 (48.0%) indicated that they had no concerns. Representative quotes for the themes are presented in the table below.

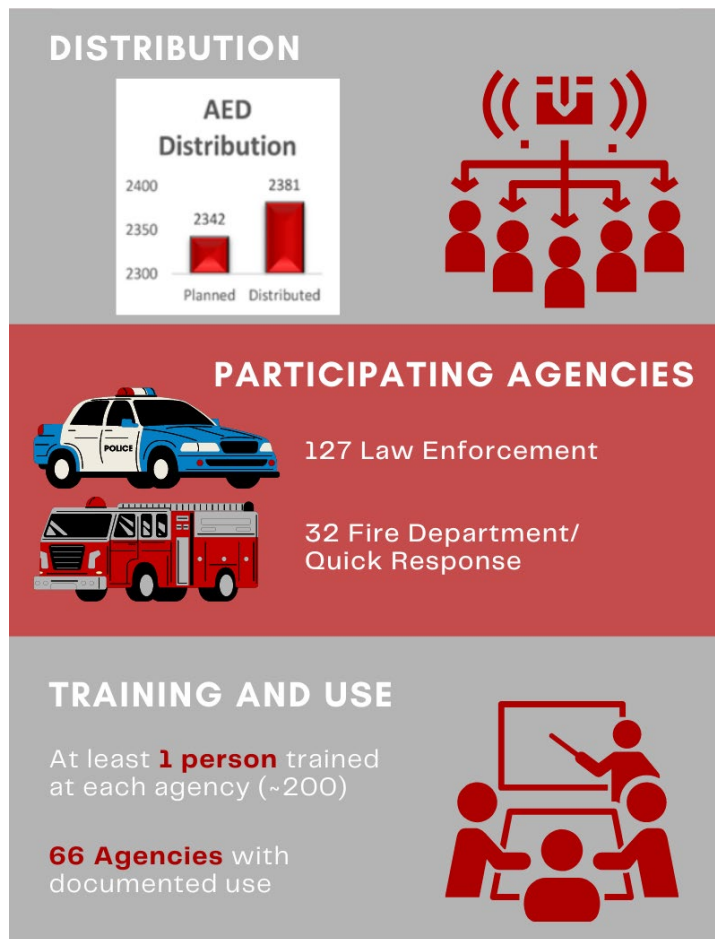
*Table 18. Concerns about the Program*

Theme	Quotes
Liability	“Our department administration does not view us as first respondents and often times Agents are questioned if they take action to aid in a situation. My worry would be that an Agent would be scrutinized if they utilized their AED in an emergency setting.”
Maintenance	“The cost associated with the program vs. the practical applications” “How often maintenance is required” “Pad replacement – expiration dates on all things medical” “Wear and tear requiring maintenance as a result of the conditions it would be placed in.” “Storing the AED in a vehicle when temperatures are extreme”
Training	“Re-certifications, how often do we need to re-certify?” “Additional training to our already overstretched workforce” “Not enough medical training to know when to use”
Willingness	“They will sit in our cars and collect dust. Unfortunately” “We have a lot of other duties and training requirements. While the AED is a nice addition, law enforcement is already tasked with a lot of roles.”



In addition to the pre-survey, additional indicators for program adoption, including distribution, participation, training and device use. The figure below provides these metrics.

*Figure 7. Adoption Metrics*

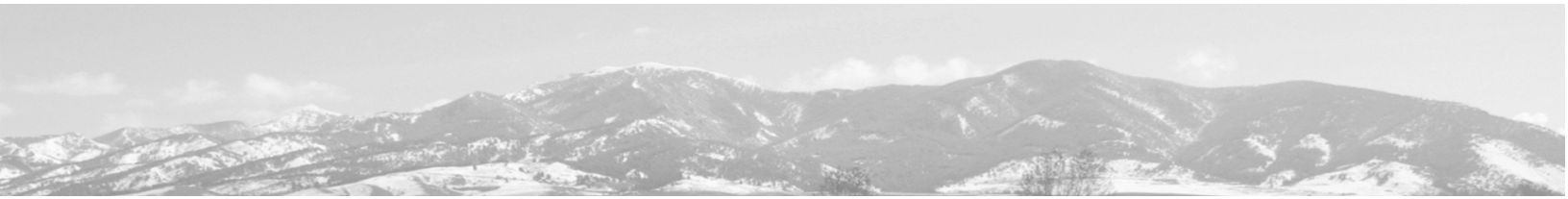


As such, the project has met its adoption targets in terms of number of AED distributed and personnel trained.

### Agency Refusals

Six agencies had documented refusals (3 sheriff offices, 2 police departments, and one tribal agency). Some federal agencies also refused. Reasons for refusal included non-response, too much work, concerns about data transmission and HIPPA, already had an AED program, and perceived feasibility issues (“won’t work”, “ambulance gets there right after us”).





## Implementation

The “Implementation” component of the RE-AIM framework evaluates how the program was delivered and put into place. For this report, we will focus on consistency of implementation through assessment of readiness of project devices for use as well as responses to the post-use surveys.

### AED Device and Site Readiness

#### Device Readiness

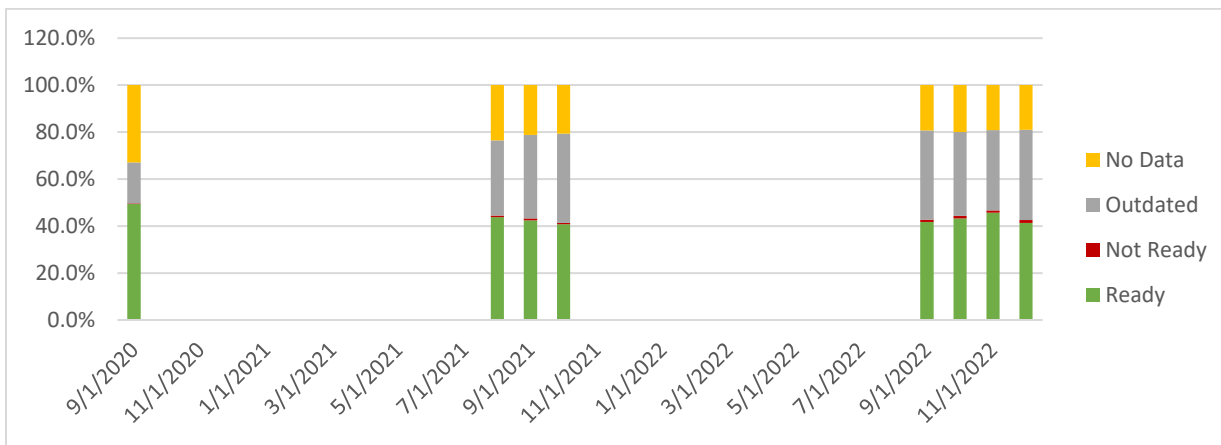
There are two ways that we evaluated readiness for this project. One was by looking at each device. For each device, there are several potential results for readiness. The table below details each result.

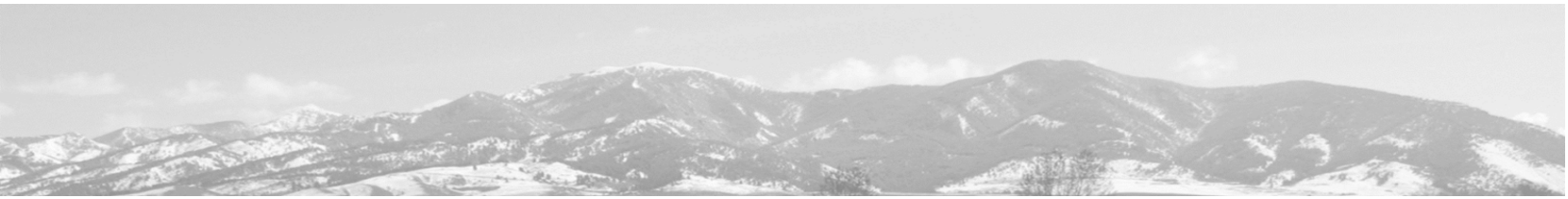
*Table 19. AED Readiness Status Codes*

Status	Meaning
Ready	Connected with no user reported issues
Not Ready	Needs a part replacement (e.g. pads, battery)
Needs Attention	Usable but potential issues (e.g. battery/electrodes expiring soon, no Wi-Fi check in at normal scheduled time)
Outdated	Previously connected, but out of Wi-Fi signal range (once brought within range and force transmitted, the device will return to ready status)
No Data	Never connected or checked-in wirelessly or manually

The first device was connected and in ready status on August 6<sup>th</sup>, 2020. The information is provided monthly via a report available from LIFELINKCentral, but was only saved intermittently, so only some readiness statuses are known over time. However, these did not change substantially over time.

*Figure 8. AED Readiness Status 2020-2022*





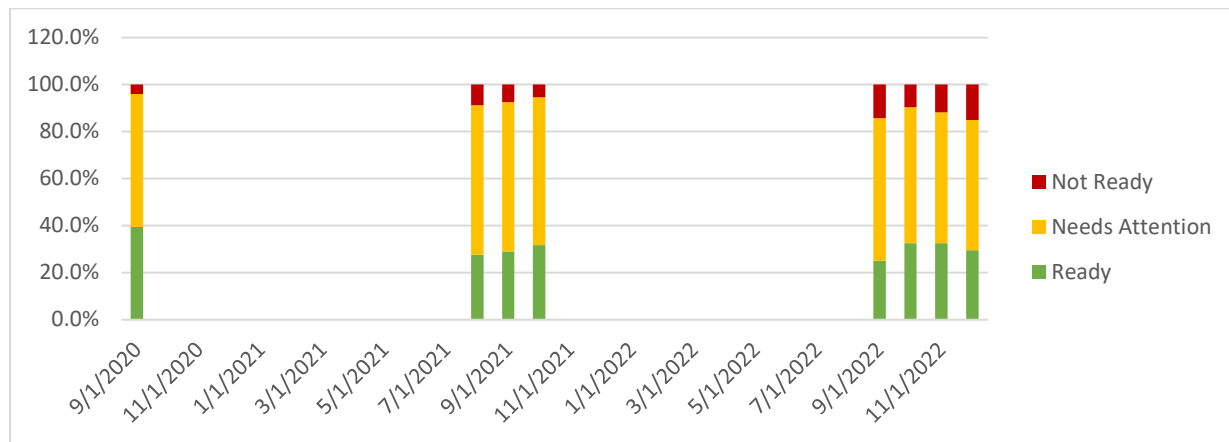
### Areas of Improvement:

Educate agencies to ensure devices are set up and connected at regular intervals. Discuss with sites that have not used their project AEDs to determine if there are barriers to their use.

### Site Readiness

Sites receive an overall readiness rating consisting of three different levels: Ready (all AEDs at the site are in ready status), Needs attention (one or more AED at the site needs attention), Not ready (at least one AED is in the not ready status).

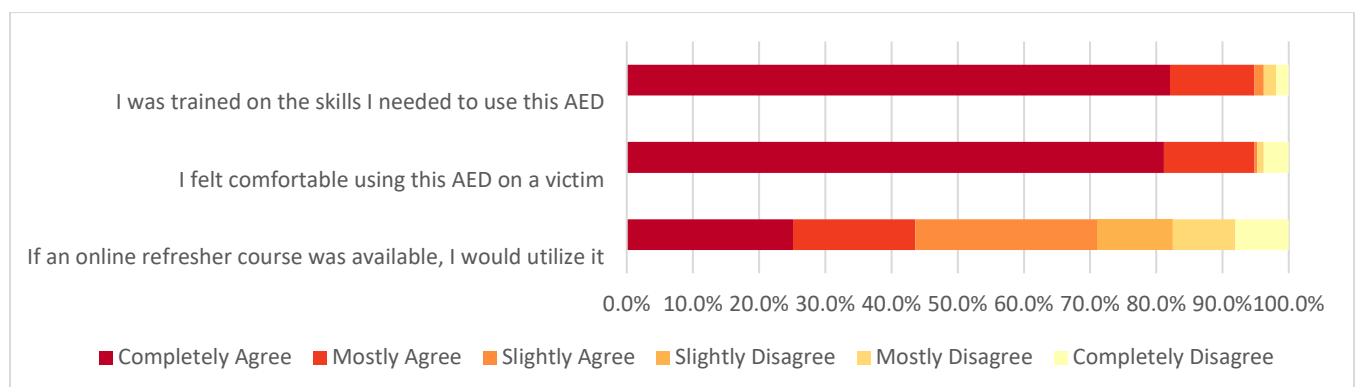
Figure 9. Site Readiness Status 2020-2022

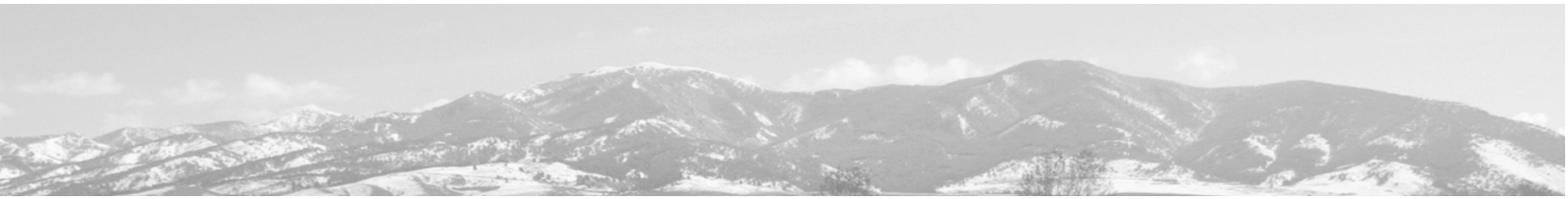


### Post Use Survey Results

Overall, respondents were satisfied with the use of the AED in practice. Some questions asked about previous training and additional training needs. Most felt they had been adequately trained and didn't need additional training (see the following figure).

Figure 10. Post Survey Training Responses

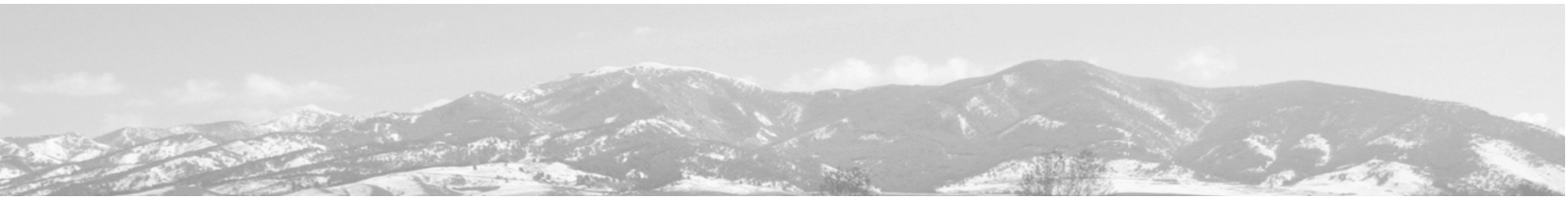




There was also an opportunity for respondents to add additional information at the end of the survey. Based on responses, four themes were identified: ease of use, reassurance, pad issues, and other. Most comments were positive; however, there was concern about replacement of the pads and the propriety nature of them making them not interchangeable with other AED pads. Characteristic quotes for each theme are presented in the table below.

*Table 20. Post Survey Additional Information*

Theme	Quotes
Ease of Use	"It's so simple that even us police can use it properly!"
Reassurance	"It is nice to have an AED automatically on when you need it, one less thing to think about." "In this case, the AED was a great tool. I provided mental clarity and reassurance in highly stressful situation. I also believe it provided emotional comfort to the family present at the time. I was grateful and thankful to have such a resource."
Pad Issues	"Additional pads would be great. An AED is useless as we await the arrival of replacement pads. Other than that, it is a great tool and expedites our chances at saving a life."



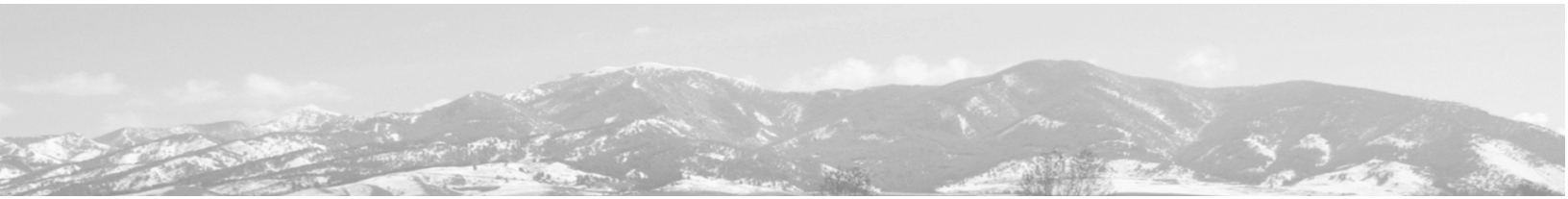
## Maintenance

The maintenance component of the RE-AIM framework evaluates to what extent the project becomes part of organizational practices.

Through this project, AEDs have been supplied to all participating agencies along with an eight-year agreement for support from Stryker and free emergent pad and battery replacement. This includes replacement pads each time the device is placed on an individual in a cardiac arrest. However, long term investment is needed to continue providing the devices after the eight-year agreement time frame expires. This would include pad and battery replacement as well as AED replacement. The longevity of this program will require a community-wide approach to ensuring the most effective care for OHCA patients and to make sure that projects such as this are continued, and AEDs are available to those who need them most as soon as they need them.

### *Areas of improvement:*

Communicate with agencies on the importance of long-term sustainability for the program and budgets to support pad and battery replacement. It would be helpful to survey agencies to understand how the project has been integrated into their current practice and what the needs would be to keep the project devices in a state of readiness.



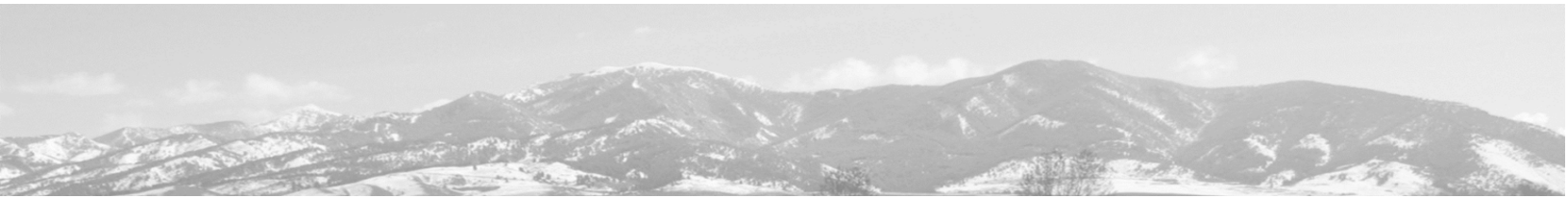
## Appendix A. Stryker LIFEPAK CR2 AED Post Use Survey 2020, 2021, and 2022

**Bold numeral indicates the number of survey responses**

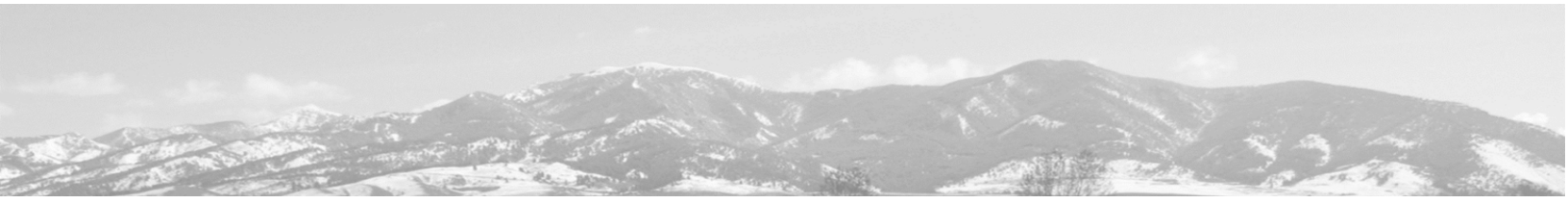
*Italicized text indicates comment on the responses*

1. I work for the following \_\_\_\_\_ agency (*free text entry*)
  - Responses represent the following agencies: Beaverhead CS, Belgrade PD, Bighorn CS, Blackfoot law, Bozeman PD, Broadwater Co, Butte-Silver, Carbon CS, Cascade CS, Colstrip PD, Columbia Falls, Custer CS, Dawson CS, Flathead CS, Fort Benton PD, Gallatin CS, Garfield CS, Great Falls PD, Hamilton PD, Jefferson CS, Kalispell PD, Laurel PD, Libby PD, Lincoln CS, McCone CS, Meagher CS, Miles City PD, Mineral CS, Missoula CS, Missoula PD, Montana HP, Musselshell CS, Park CS, Polson PD, Pondera CS, Powell CS, Prairie CS, Ravalli CS, Richland CS, Roosevelt CS, Rosebud CS, Sheridan CS, Sidney PD, Sweet Grass CS, Thompson Falls, Toole CS, Valley CS, Wheat CS, Yellowstone CS.
  - Response not provided in 38 instances
2. The following age group best describes my age at this time (*allow for only one response*) **n=212**
  - a. 18-24 **14 (6.6%)**
  - b. 25-34 **80 (37.7%)**
  - c. 35-44 **73 (34.4%)**
  - d. 45-54 **34 (16.0%)**
  - e. 55-64 **7 (3.3%)**
  - f. 65+ **4 (1.9%)**

\*Total does not equal 100% due to rounding
3. I used the Stryker LIFEPAK CR2 AED on a victim on \_\_\_\_\_ (*please provide date*) (*free text entry*)
  - Dates provided throughout the years 2020, 2021, and 2022
4. When I initiated use of the Stryker LIFEPAK CR2 AED on the previously provided date, I was the only first responder present **n=212**
  - a. Yes **76 (35.9%)**
  - b. No **136 (64.1%)**
5. I was trained on the skills I needed to use this AED, Stryker LIFEPAK CR2 AED **n=212**
  - a. Completely Agree **174 (82.1%)**
  - b. Mostly Agree **27 (12.7%)**
  - c. Slightly Agree **3 (1.4%)**
  - d. Slightly Disagree **0 (0%)**
  - e. Mostly Disagree **4 (1.9%)**
  - f. Completely Disagree **4 (1.9%)**
6. I felt comfortable using the Stryker LIFEPAK CR2 AED on a victim **n=212**
  - a. Completely Agree **172 (81.1%)**
  - b. Mostly Agree **29 (13.7%)**



- c. Slightly Agree **1 (0.5%)**
  - d. Slightly Disagree **0 (0%)**
  - e. Mostly Disagree **2 (1.0%)**
  - f. Completely Disagree **8 (3.8%)**
7. If an online Stryker LIFEPAK CR2 AED use refresher course was available, I would utilize it **n=211**
- a. Completely Agree **53 (25.1%)**
  - b. Mostly Agree **39 (18.5%)**
  - c. Slightly Agree **58 (27.5%)**
  - d. Slightly Disagree **24 (11.4%)**
  - e. Mostly Disagree **20 (9.5%)**
  - f. Completely Disagree **17 (8.1%)**
8. Prior to training on the use of the Stryker LIFEPAK CR2 AED training, I had received CPR and AED training **n=210**
- a. Yes **207 (98.6%)**
  - b. No **3 (1.4%)**
9. Prior to this experience, I had used an AED (of any brand) on a victim. **n=212**
- a. Yes **131 (61.8%)**
  - b. No **81 (38.2%)**
10. If yes to having used an AED on a cardiac arrest victim, Prior to this AED use experience on the date provided it has been \_\_\_ months since I used an AED on a victim **n=90**
- a. Within the last 6 months **53 (39.3%)**
  - b. 6-12 months ago **25 (18.5%)**
  - c. More than 12 months ago **57 (42.2%)**
11. If yes to prior use of an AED on a victim, compared to other AEDs I have used on a victim the Stryker LIFEPAK CR2 AED's use on a victim was **n=35**
- a. Much easier **34 (25.2%)**
  - b. Easier **35 (25.9%)**
  - c. About the same **65 (48.2%)**
  - d. Harder **1 (0.7%)**
  - e. Much harder **0 (0%)**
12. Have you utilized the no cost, post-AED use call-in counseling service provided by Stryker?  
**n=140**
- a. Yes **2 (1.0%)**
  - b. No, there is a department sponsored program **31 (14.8%)**
  - c. No, but I will consider it **36 (17.2%)**
  - d. No, I am not interested **140 (67%)**



13. If you have accessed any post-event counseling service after AED deployment, did you find the service to be helpful? **n=24**

- a. Yes **11 (14.5%)**
- b. Somewhat **8 (10.5%)**
- c. No **57 (75%)**

14. Do you have any additional information you would like to share?