BCEHS | BC Emergency Health Services
Provincial Health Services Authority

CARDIAC ARREST ANNUAL REPORT 2019/2020

Towards Improving Resuscitation Outcomes

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This publication was produced by British Columbia Emergency Health Services Department of Clinical and Medical Programs.

This publication has been produced to provide an overview of out-of-hospital cardiac arrest statistics and outcomes in the province of British Columbia.

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2955 Virtual Way, Vancouver, BC V5M 4X6

Email: Clinicalandmedicalprograms@bcehs.ca

The persons shown in photographs in this report are models and are not actual patients of BCEHS, nor are they experiencing a life-threatening event.

Authors

Richard Armour *BParamedPrac*, *MSc*, ACP
Nechelle Wall ACP
Jon Deakin ACP
Jennie Helmer *MEd*, ACP
Lee Roberts *PCP*
Sung Lee

Acknowledgements

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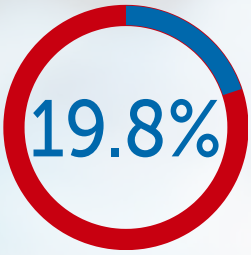
OVERVIEW

SURVIVAL RATES



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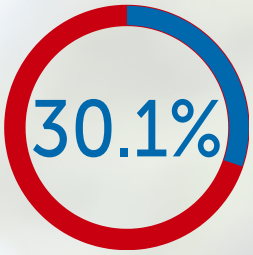
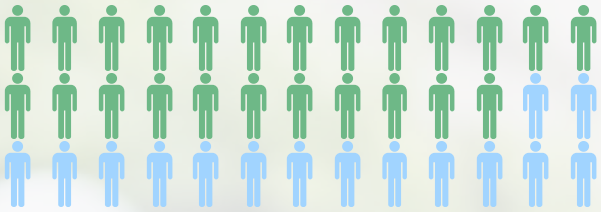
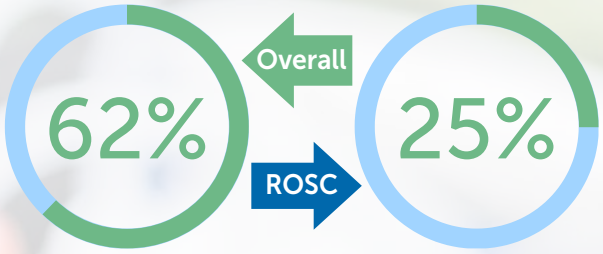


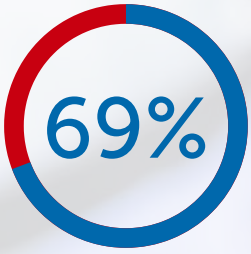
UTSTEIN

PROVINCE WIDE BYSTANDER CPR

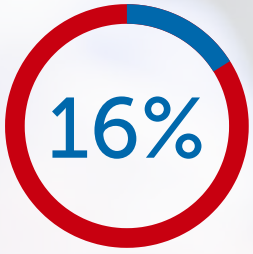




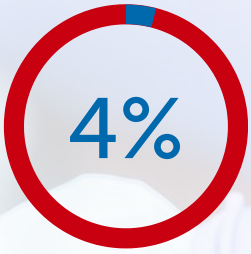
ARREST ETIOLOGY



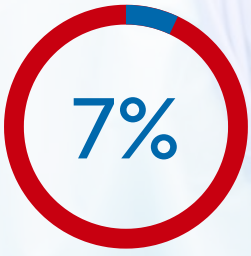
PRESUMED CARDIAC



OVERDOSE RELATED



TRAUMA

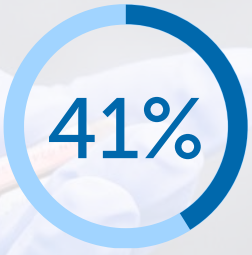


OTHER

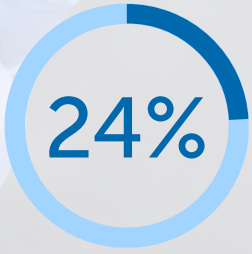
ROSC % BY

WITNESSED BYSTANDER

WITNESSED HEALTHCARE



SHOCKABLE RHYTHM



NO BYSTANDER CPR

OVER 600 LIVES SAVED

80% Survival Rate With Prehospital ROSC

AGE 71

32%

AGE 66

68%

INTRODUCTION

British Columbia Emergency Health Services Cardiac Arrest Registry 2019/2020 Annual Report

The 2019/2020 Cardiac Arrest Annual Report is a publication produced by Clinical and Medical Programs

An out-of-hospital cardiac arrest (OHCA) is the most critical and time-dependent condition to which our service responds. Despite significant developments in the field of resuscitation science, the odds remain stacked against individuals suffering OHCA. Globally, the rate of survival remains a sobering 10%, leaving the lives of the families of the 90% markedly changed forever.

As the provincial ambulance service for British Columbia (BC), it is our mission for the communities in which we live and work to remain active participants in the global effort to improve OHCA survival rates. Congruently, it is imperative we evaluate our data so that we may be able to identify critical areas of improvement and share with the global community our strengths to foster international change.

The primary objective of the annual report is to illustrate the rationale behind measuring OHCA indicators and evaluating BC Emergency Health Services' (BCEHS) clinical performance. This is the second BCEHS annual report on our performance in OHCA to identify gaps and opportunities for improvement, as well as identify the areas in which our paramedics and dispatchers excel. The annual report allows BCEHS to benchmark against other emergency medical systems (EMS) nationally and internationally, who utilize similar systems of care for patients with OHCA.

The data presented in this report is for all OHCA attended to by BCEHS paramedics in the period from April 1st, 2019 to March 31st, 2020. The data for this report was extracted from the BCEHS cardiac arrest registry in April 2021. The data is collated in the registry using a reporting a template based on international definitions outlined in the Utstein style of reporting. Of particular note, BCEHS did not collect data for First Responder (FR) agencies in BC during this time period, and their data is not included in this report. "Resuscitation Attempted" refers only to those events where an attempt at resuscitation is made by BCEHS paramedics. Unless otherwise stated, survival refers to survival to 30-days post cardiac arrest.

In 2019/2020 BCEHS treated 3,193 OHCA with an Utstein survival rate of 30.1 %

We hope this report serves as a reminder for our staff of the importance of the work they do and the gratitude we have for their commitment to excellent patient care.

Dr. Sandra Jenneson,
Interim Chief Medical Officer

"Cardiac arrest is the abrupt loss of heart function in a person who may or may not have been diagnosed with heart disease. It can come on suddenly or in the wake of other symptoms. Cardiac arrest is often fatal if appropriate steps aren't taken immediately."

— American Heart Association

Lillian & Ed's Story

"I really wish I could have thanked the call-taker on the phone with me, she guided me through the worst event of my life, it was like she was standing right there next to me, keeping me focused and guiding me through what I needed to do."

— Lillian, Richmond, B.C.

In the early hours of February 21st 2019, Lillian's husband Ed suffered a sudden cardiac arrest in their Richmond home. Lillian took immediate action, activating 9-1-1 and beginning life-saving chest compressions until paramedics arrived on scene. Shortly thereafter, thanks to the heroic efforts of Lillian, paramedics were able to successfully resuscitate Ed and transport him to Vancouver General Hospital for coronary angiography and stenting.

Lillian today says that she looks back on the events of that day and can't help but think what a miracle it is that her husband is alive and life has returned to normal. Lillian says she can't help but feel blessed and grateful that the stars aligned for Ed.

It has been two years since Ed suffered a life-threatening heart attack and cardiac arrest and today, she is elated to report to everyone involved that Ed walked out of the cardiac intensive care unit only five days post cardiac arrest. Furthermore, although he now has to take several different medications, they are still enjoying the things they used to before the cardiac arrest, and continue to enjoy their daily walks.

Darrel & Kurt's Story

"I think anyone who witnesses a cardiac arrest should step up and help, we all have the ability to a save I life. I am grateful I was there when Kurt needed me, he is my co-worker, but honestly, I would do the same thing for anyone."

— Darrel, Duncan, B.C.

In September of 2019 after returning to their morning bus routes, Darrel and his co-worker Kurt returned to their office for a break. Shortly thereafter, Kurt abruptly stopped speaking and Darrel noted that he was making a strange sound – it quickly becoming apparent that his co-worker Kurt was in medical distress. Darrel promptly placed Kurt on the floor, checked for a pulse and when he could not find one activated 9-1-1 and began chest compressions without hesitation. Darrel continued to provide Kurt with lifesaving chest compressions until paramedics arrived on scene.

Thanks to the incredible actions of his co-worker, Kurt was successfully resuscitated by paramedics. Following treatment by paramedics, Kurt was transported to hospital where at 41 he received a diagnosis of the same congenital heart arrhythmia which his father had suffered with. Kurt spent several weeks at the Royal Jubilee Hospital before being release home where he continued his recovery journey.

VITAL LINK AWARDS

BCEHS Vital Link Awards honour the brave and skillful actions of bystanders at cardiac arrest events. Through their quick actions, immediate lifesaving chest compressions and use of public access defibrillators (PADs), these outstanding members of society give someone a chance at survival. In 2019/20, BCEHS awarded 21 members of the public with Vital Link Awards.

British Columbia Emergency Health Services

OUR COMMUNITIES

BRITISH COLUMBIA Population 5,147,712*

Higher population growth municipalities in BC

Municipality	2019	2020	% Growth
Langford	42,024	44,069	4.9%
Sooke	14,573	15,803	3.5%
New Westminster	80,292	82,590	2.9%
Colwood	18,908	19,373	2.5%
Courteney	28,184	28,862	2.4%
View Royal	11,574	11,829	2.2%
Lake Country	15,320	15,654	2.2%
Kelowna	143,067	146,127	2.1%
Surrey	586,367	598,530	2.1%
Parksville	13,407	13,685	2.1%

* As of July 2020, the population of BC was estimated at 5,147,712, a 1.1% growth from the same time in 2019.

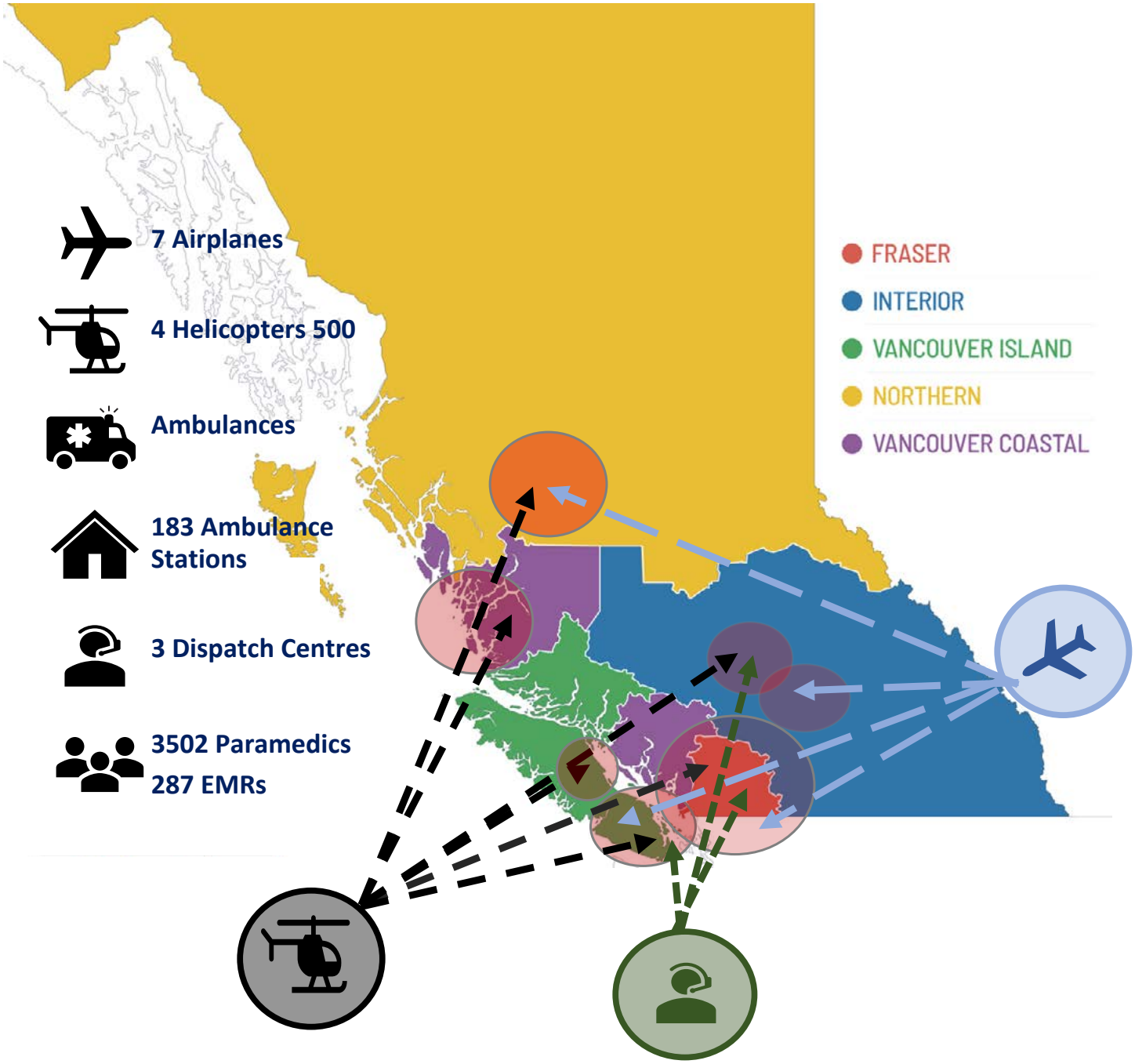
British Columbia Emergency Health Services

WHO WE ARE

Over 4000 dedicated emergency service personnel throughout the province

License Level	Care Provided	Employees
First Responder	Provide emergency scene and patient assessment, as well as basic life-saving interventions, such as CPR, defibrillation and administration of naloxone for drug overdoses	None
Emergency Medical Responder	Provide care at the first responder level, as well as additional basic emergency care procedures such as IV line maintenance, pulse oximetry and blood pressure monitoring	287
Primary Care Paramedic	Provide care at the EMR level, as well as additional emergency care procedures such as the use of airway devices and initiation of IV lines	2,874
Advanced Care Paramedic	Provide care at the PCP level, as well as advanced medical care for a variety of life-threatening conditions including cardiac arrest, provide ACLS drugs, and advanced airways	267
Critical Care Paramedic	Provide the highest level of specialized care, with a focus on inter-hospital transport, air medical response, and infant, child and perinatal care	74
Emergency Medical Call-Takers (EMCT) and Emergency Medical Dispatchers (EMD)	Receive calls for service and ensure that the appropriate resource is dispatched to the call.	287

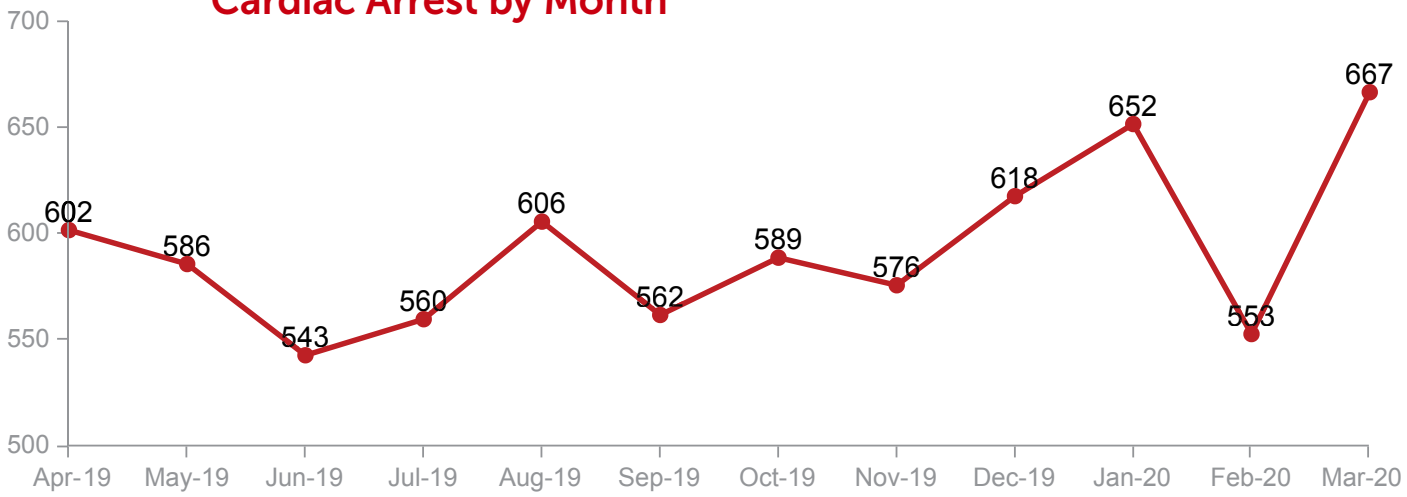
PROVINCIAL MAP OF RESOURCES



DEMOGRAPHICS

2019/2020
BCEHS received the highest number of calls between 08:00 and 17:00

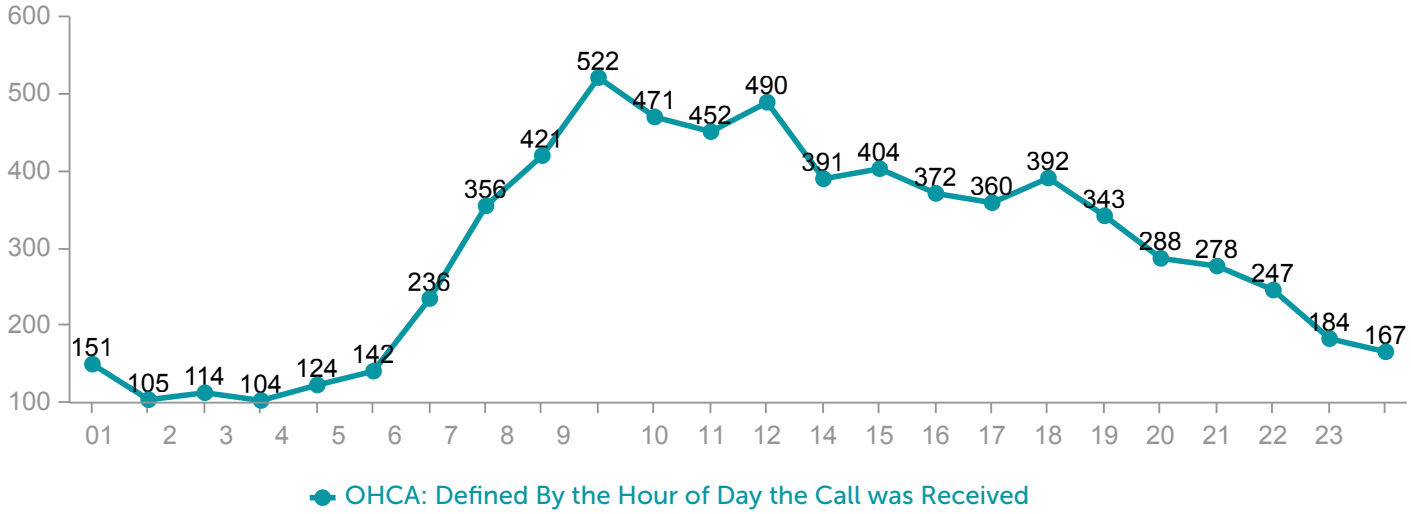
Cardiac Arrest by Month



In the period from April 1st 2019 to March 31st 2020, paramedics in BC attended 7,114 patients suffering OHCA. Of these patients, 7,029 (98.8%) were adult patients (over 19 years of age) and 96 (1.2%) were pediatric patients. This represents the most annual OHCA events ever attended by paramedics in BC to date, and a significant increase over the previously reported 6,166 in 2016/17.

Of the 7,114 OHCA events, 3,193 (45%) received attempts at resuscitation by paramedics. The most common reasons for not attempting resuscitation included do not resuscitate (DNR) orders (1194) and signs of obvious death (1714).

During this reporting period, the crude incidence of OHCA was 138 per 100,000, with the crude rate of attempted resuscitations 62 per 100,000. The incidence of OHCA was steady throughout the year, with the lowest incidence occurring in June 2019 (543 cases) and the highest occurring in March 2020 (667 cases).



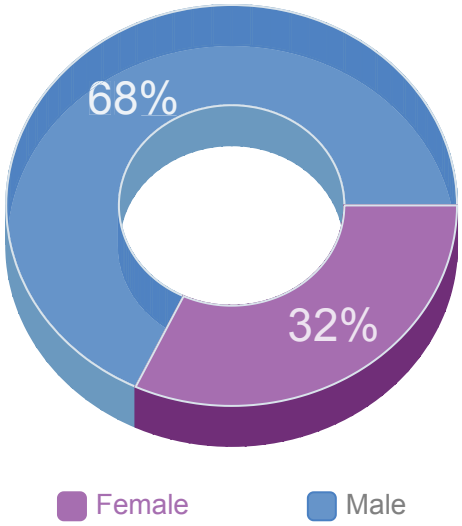
OHCA remains a public health emergency issue in British Columbia and globally, respectively.

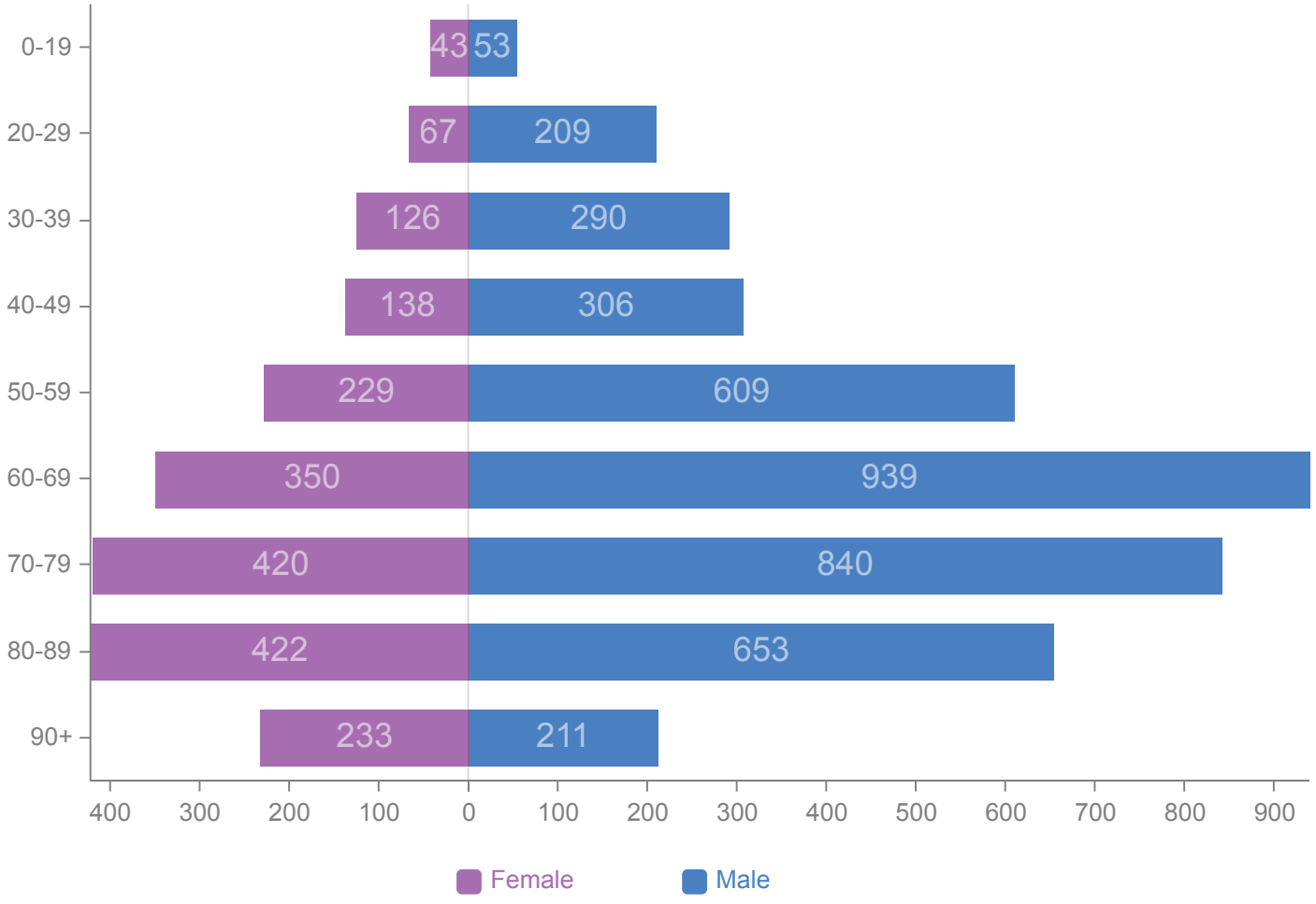
Each year, approximately 35,000 Canadians will suffer a cardiac arrest — only 10% will survive.

In 2019/2020 BCEHS received 7,114 cardiac arrest calls, 3,193 we treated.

GENDER/ AGE BREAKDOWN

In this reporting period, just over two-thirds of OHCA patients attended by paramedics were male [68%]. The median age of OHCA across the province was 66 years of age for males, with a higher median age of OHCA in female patients with a median age of 71 years respectively who accounted for 32% of all OHCA patients.

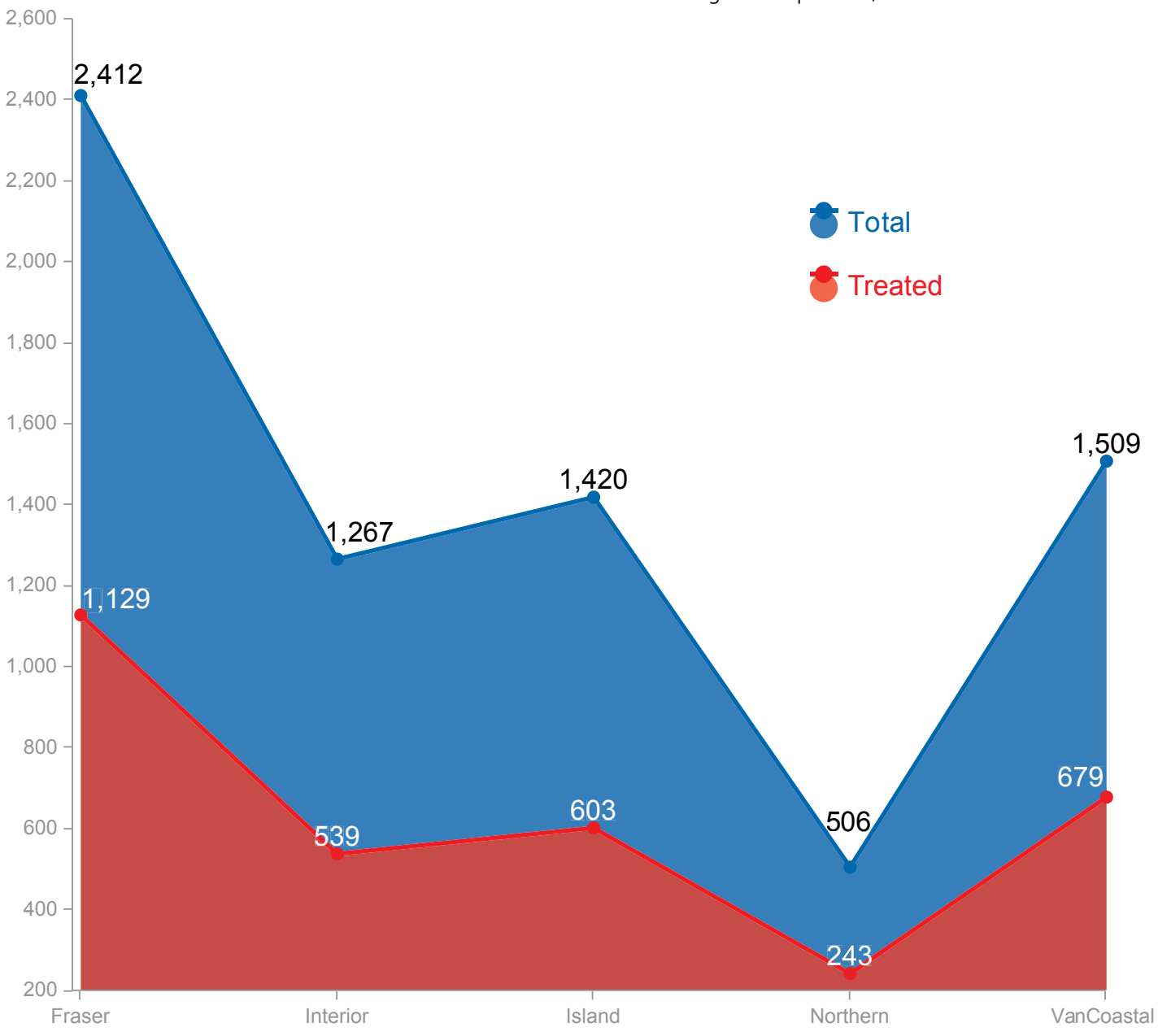




CARDIAC ARREST BY REGION

All regions across BC reported an increase in OHCA cases compared with 2016/17 data, aside from the Vancouver Island region. 81% of OHCA events occurred in a metropolitan or urban region. The highest number of OHCA were reported in the Fraser region (2,412 cases), followed by the Vancouver Coastal region (1,509).

There was regional variation in the crude incidence of OHCA. Although the majority of OHCA occurred in the Fraser and Vancouver Coastal regions, the rate of OHCA was higher in the Vancouver Island, Interior and Northern regions. In both the Fraser and Vancouver Coastal regions the incidence of OHCA was 126 per 100,000, in the Interior 153 per 100,000, in the Vancouver Island region 165 per 100,000 and in the Northern region 177 per 100,000.



THE CHAIN OF SURVIVAL IN BRITISH COLUMBIA

Time is critical when OHCA occurs. For every minute without chest compressions and defibrillation survival rates plunge by as much as 10%. Quick action from bystanders, emergency medical call takers (EMCTs), dispatchers, first responders (FRs) and paramedics can truly make the difference between life and death.

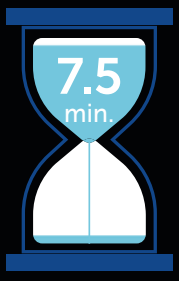
In recognition of the importance of early action and defibrillation, the Chain of Survival is an internationally recognized initiative aimed at maximizing survival following OHCA and depicts system-level approach to OHCA care. The five links in the Chain of Survival are:

1. Recognition of cardiac arrest and activation of 9-1-1
2. Early chest compressions
3. Rapid defibrillation
4. Basic and advanced emergency medical services
5. Early access to advanced post cardiac arrest care

RECOGNITION OF CARDIAC ARREST AND ACTIVATION OF 9-1-1

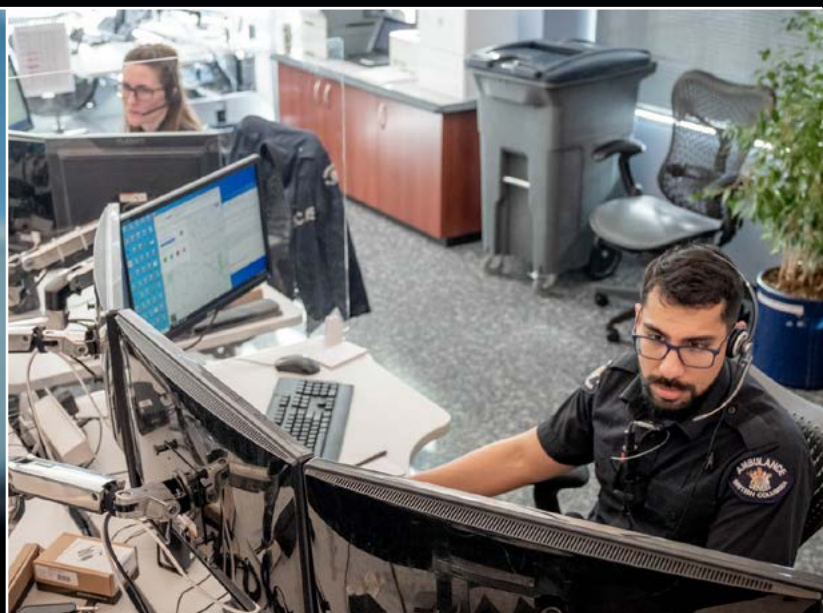
The placement of a 9-1-1 call activates a system designed to recognize OHCA and initiate appropriate care. Emergency call takers and dispatchers are the first point of contact for British Columbians who call 9-1-1. Call takers are trained to immediately recognize OHCA and to rapidly provide instructions for bystanders to deliver chest compressions and deploy a Public Access Defibrillator (PAD), whilst allowing dispatchers to send trained help to the scene.

CA identified by Emergency Medical Call Takers (EMCTs).



BCEHS province wide median response time to an OHCA.

In 2019/20, of the 3,193 OHCA where resuscitation was attempted by paramedics, 75% (2394/3193) were identified correctly by EMCTs. This allowed for paramedics to arrive on scene within a median of 7.5 minutes provincially.



EARLY CHEST COMPRESSIONS AND RAPID DEFIBRILLATION

Starting chest compressions as soon as possible on a person who does not have visible signs of circulation will ensure that vital organs receive oxygen until paramedics arrive. The delivery of chest compressions by bystanders, prior to the arrival of FRs or paramedics, has been shown to increase the likelihood of survival following OHCA. EMCTs recognizing OHCA significantly impacts the delivery of bystander chest compressions by providing telephone-CPR (T-CPR) instructions. In this reporting period, an incredible 62% of patients with OHCA received bystander chest compressions across the province. This figure is a significant improvement on the 41% reported in 2016/17.

PulsePoint

ACTIVATE CITIZEN RESPONSE.

PulsePoint

"Building Informed Communities"

PulsePoint is a free smartphone app available to all British Columbians. The PulsePoint app, which can be downloaded on any smartphone, provides the public with two valuable pieces of data. Firstly, dispatchers send out push notifications to smartphones which have the PulsePoint app downloaded, alerting the public to the location of an OHCA. Secondly, through accessing the PAD database, dispatchers are able to provide the public with the location of the Automated External Defibrillator (AED) nearest to the event.

In 2019/20, PulsePoint recorded 13,474 app users in BC. Download your PulsePoint and helps save lives!

Public Access Defibrillation

Almost all cardiac arrest victims will die without an electric shock to restart the heart. The BC Public Access Defibrillator (PAD) program was established in 2013 with funding from the BC Ministry of Health, and facilitates public access to AEDs. An AED is a portable, safe and easy-to-use device to restart a heart. The AED provides the defibrillation to shock a heart that has stopped beating effectively, and allows the heart to reset into a normal rhythm. BCEHS maintains a PAD registry, and all registered AEDs are linked to the 911 system. in 2019/20, BCEHS had a total of N= 1848 registered PADs across BC which were utilized in 2% cases prior to the arrival of FRs or paramedics.

DOWNLOAD THE PULSEPOINT RESPOND APP

DOWNLOAD FOR IOS | DOWNLOAD FOR ANDROID

DOWNLOAD THE PULSEPOINT AED REGISTRY APP

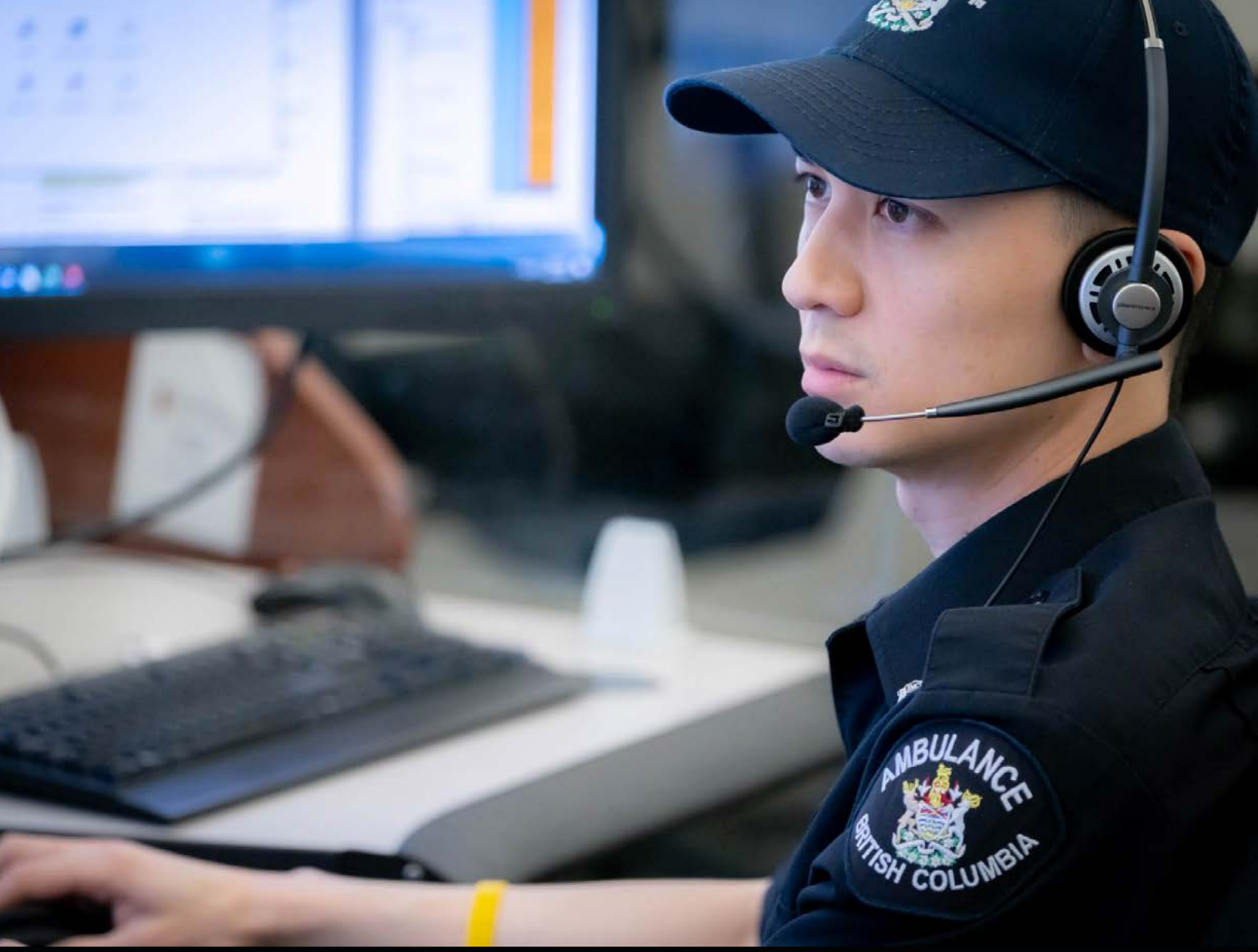
DOWNLOAD FOR IOS | DOWNLOAD FOR ANDROID

BASIC AND ADVANCED EMERGENCY MEDICAL SERVICE CARE

Performance Indicators

In early 2019 BCEHS committed to the development and implementation of a province-wide high-performance CPR (HP-CPR) program to establish excellence in the essential elements of OHCA care. This curriculum was founded in the six key standards identified by the American Heart Association (AHA) as indicative of high quality resuscitation, and is tailored to BCEHS:

1. Chest compression fraction > 80%
2. Rate of chest compressions from 100-120/minute
3. Depth of compressions between 2-2.4 inches
4. Rhythm analyses every 2 minutes
5. Ventilations at a rate of 12 per minute



After downloading data to the central database, paramedics receive CPR feedback after each resuscitation. This process allows for continual paramedic reflection, data collection, analysis and feedback.

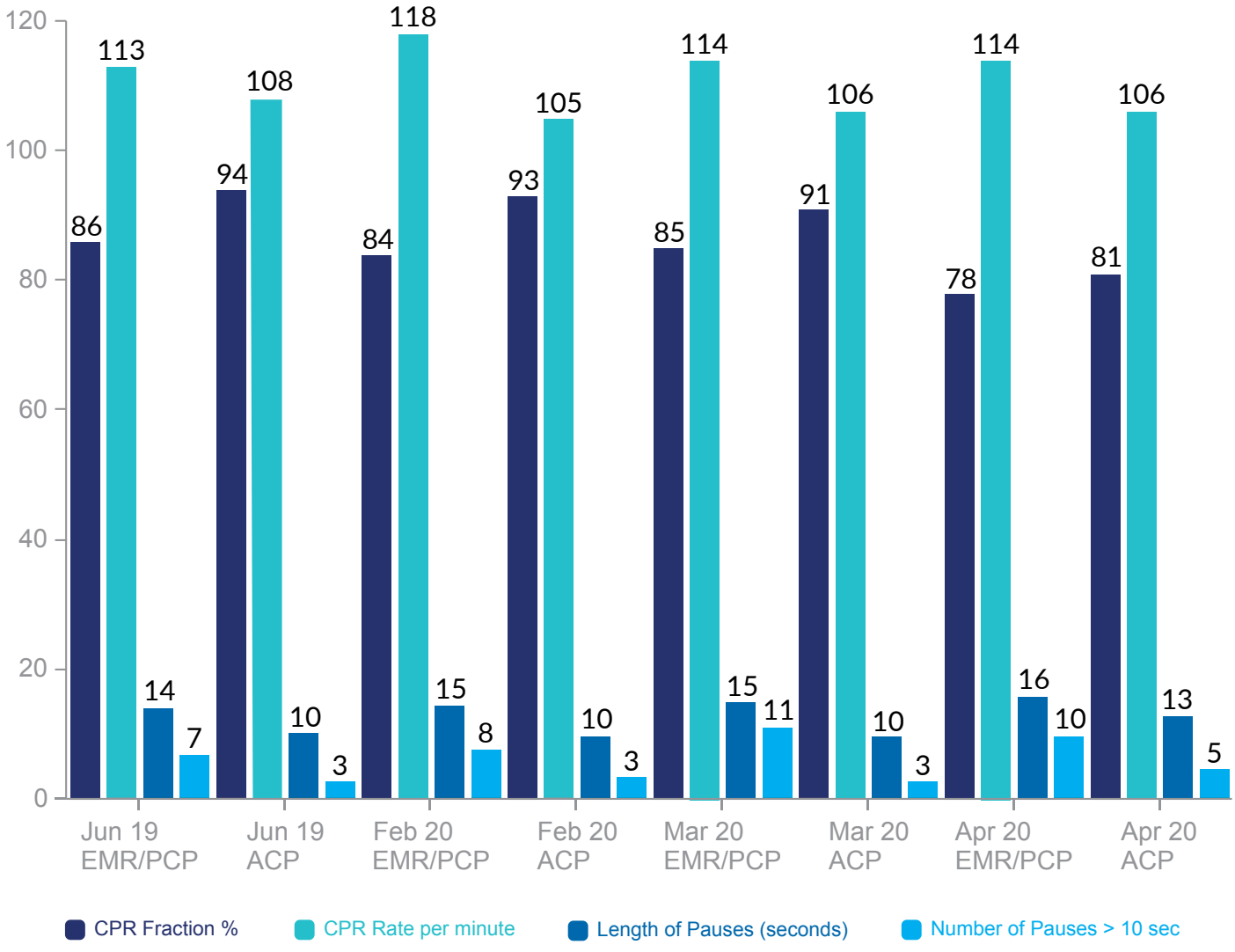
Unfortunately, owing to the COVID-19 pandemic the delivery of HP-CPR has been postponed until pandemic measures allow for safe congregation of students in the classroom setting once again. During the pandemic, BCEHS implemented significant practice changes to keep paramedics, patients and other responders safe. Particularly, the COVID-19 pandemic saw BCEHS shift from the delivery of continuous chest compressions with asynchronous ventilations to the delivery of chest compressions at a rate of 30:2 to maintain provider safety. Ultimately, the system of data collection, analysis and feedback is used to track the effect of these changes on the delivery of high-quality resuscitation.

In mid-2019, an audit of downloaded data reflected a high quality of CPR within BCEHS across all license levels. Chest compression fraction (CCF) consistently exceeded the recommendation of the AHA, with the rate of compressions also falling within the recommended range. EMRs and PCPs averaged longer pauses and more frequent pauses greater than 10 seconds. This was felt to reflect the length of time required by the automated defibrillators (AEDs) used by EMRs and PCPs to interpret cardiac rhythms, as this group are not currently permitted to perform manual rhythm interpretation and defibrillation by provincial legislature.

CPR METRICS JUNE TO FEB-MARCH

The results of this audit continued to be reflected in the data obtained during February and March 2020, although there was a noted improvement in the ACP average length of pauses. Following the onset of the COVID-19 pandemic and the swap to synchronous CPR delivery, the CCF across all license levels was noted to drop significantly, with a notable increase in the length of pauses and frequency of pauses greater than 10 seconds. In addition to the transition to synchronous CPR delivery, it was hypothesized this was related to paramedics becoming accustomed to the communication difficulties associated with increased levels of personal protective equipment (PPE) required to safely respond in a pandemic.

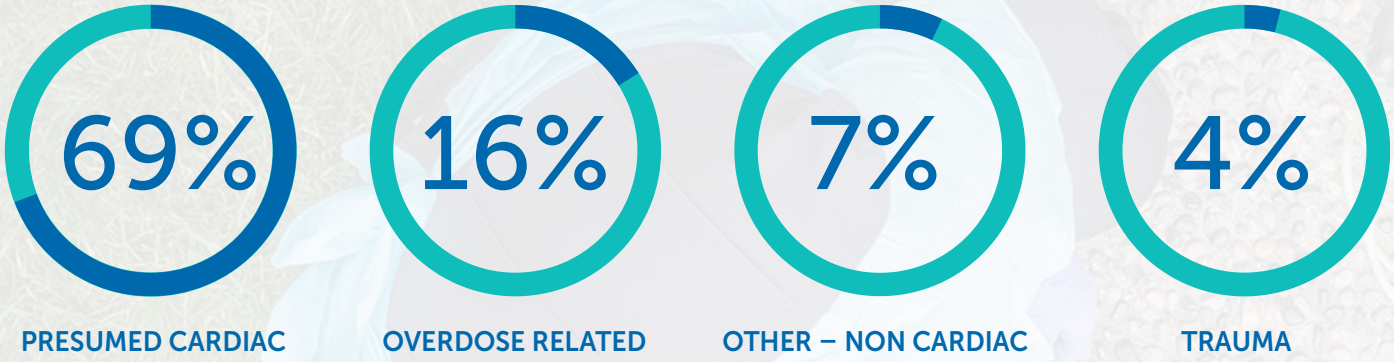
Moving forward into 2020/21 the system developed for monitoring resuscitation quality will be critical in evaluating the impact of COVID-19 pandemic on resuscitation quality within BCEHS.



ACCESS TO ADVANCED POST-ARREST CARE

In BC, ACPs may provide advanced therapies such as advanced airway management, anesthesia, vasoactive agents and 12-Lead electrocardiogram (ECG) interpretation to tailor post-arrest care in the pre-hospital setting. Across BC, there are five hospitals capable of providing percutaneous coronary intervention (PCI) and one hospital with a recognized clinical pathway for initiation of extracorporeal membrane oxygenation (ECMO) for refractory OHCA. In 2019/20, 64% (n = 508/792) of patients who were successfully resuscitated, (sustained ROSC to ED) were taken to a facility capable of PCI, with 7 patients transported in refractory OHCA for initiation of ECMO.

CARDIAC ARREST CAUSES



PRESUMED CARDIAC | OVERDOSE RELATED | OTHER – NON CARDIAC | TRAUMA

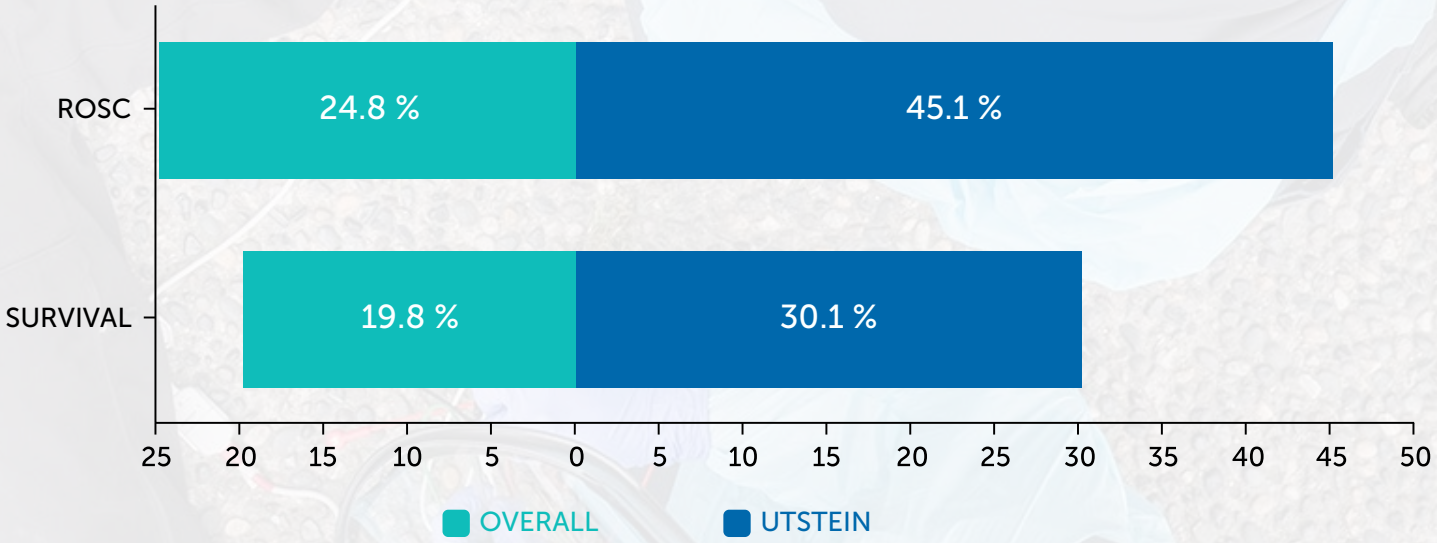
Consistent with global data, the overwhelming majority of OHCA attended by BCEHS paramedics were considered to be the result of a presumed cardiac or unknown cause (69%). The on-going opioid crisis in BC was reflected in the recorded etiologies of OHCA by paramedics, with 16% of OHCA considered to be the result of a drug overdose. Non-cardiac causes (7%) and trauma (4%) were the other suspected causes of OHCA.

UTSTEIN ROSC & SURVIVAL

The return of spontaneous circulation (ROSC) may be used as an initial marker of successful resuscitation. Of the 3,193 patients who received attempts at resuscitation by BCEHS, 24.8% (n = 792) achieved ROSC on scene with BCEHS paramedics.

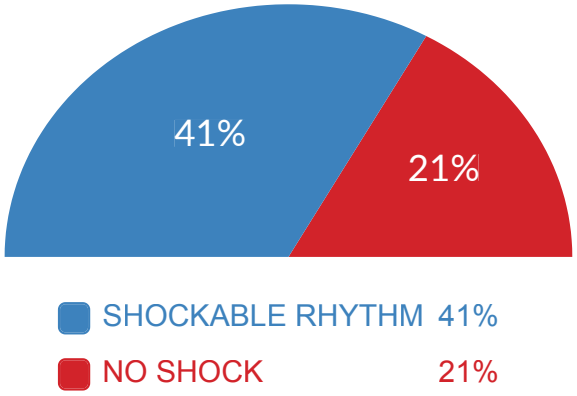
The outcomes for OHCA for international benchmarking compare rates of ROSC sustained to hospital handover and survival for a specifically selected group of patients. This subgroup is referred to as the Utstein cohort and requires that the following criteria be met: all-cause, resuscitation attempted, shockable presenting rhythm and bystander witnessed. In the Utstein subgroup of cardiac arrests, defined as witnessed cardiac arrests of any etiology with an initial shockable rhythm and who represent 481 of the 3,193 patients resuscitated by BCEHS, ROSC was obtained in 45.1% of patients.

ROSC was more likely in cardiac arrests witnessed by healthcare providers (38%) or bystanders (32%) compared with those that were unwitnessed (15%). ROSC was also related to the response time of BCEHS paramedics, with increasing response times unsurprisingly leading to lower likelihoods of survival. In the 19% of patients who presented with an initial shockable rhythm (regardless of witnessed status) 41% obtained ROSC compared with 21% in patients without an initial shockable rhythm. Interestingly, there was little change in the proportion of ROSC in patients who received bystander CPR (25%) compared with those who did not receive bystander CPR (24%).

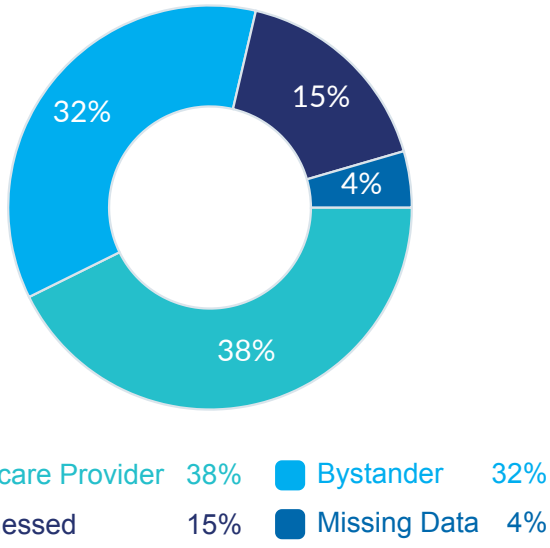


SUSTAINED ROSC

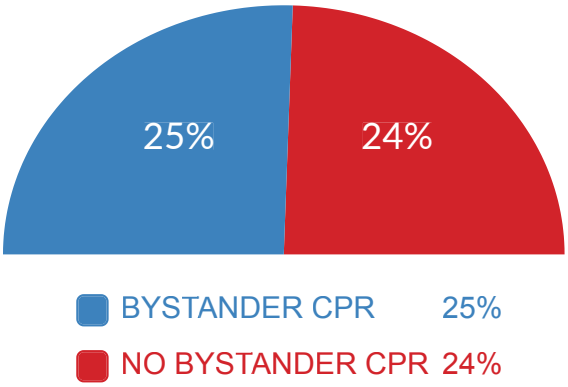
SHOCKABLE RHYTHM



WITNESSED ARREST



BYSTANDER CPR



Although ROSC may be seen as a preliminary success measure, ultimately the goal of resuscitation is to return the patient to their lives prior to the OHCA. Overall, 19.8% of (*N* = 3,193) patients who received attempts at resuscitation by BCEHS paramedics survived until hospital discharge. Utstein patients had a higher rate of survival to hospital discharge at 30.1% (*n*= 481) Utstein patients).

CARDIAC ARREST REGISTRY AND RESEARCH

The BCEHS cardiac arrest registry was formally established in August of 2018. BCEHS captures data on all OHCA attended by paramedics. Using electronic patient care recording (ePCR), paramedics record specific data on each cardiac arrest.

Research plays a vital role in determining best practice standards, and provides sound evidence for the care we provide throughout the province. The knowledge and data generated from the BCEHS cardiac arrest registry is shared with our research partners at CanROC, and is used to generate knowledge that improves patient outcomes.

CONCLUSION

The 2019/20 reporting period for OHCA saw a number of important initiatives to improve both the performance of resuscitation by paramedics, as well as the development of systems for monitoring and evaluating our performance. These systems will serve us well moving forward in monitoring the quality of resuscitation provided by BCEHS, as well as benchmarking our service against national and international standards.

2019/20 saw the highest number of OHCA cases attended by BCEHS paramedics on record, with over 600 of these patients reunited with their friends and families thanks to the efforts of quick bystander action, call-takers and dispatchers, paramedics and allied first responder agencies.

DEFINITIONS

OHCA INCLUSION CRITERIA

Patients of all ages who suffer a documented cardiac arrest (any etiology) within BC

Patients who are pulseless on arrival of paramedics OR

Patients who become pulseless in the presence of paramedics OR

Patients who have a pulse on arrival of paramedics, where a successful attempt at defibrillation was undertaken by a bystander prior to paramedic arrival

Patients who have a pulse on arrival of paramedics, where FR attempted resuscitated, and where resuscitation was warranted (this is the most challenging and we are still working to better understand this).

OHCA EXCLUSION CRITERIA

In-hospital cardiac arrest

Brief episode of suspected pulselessness who do not receive CPR or defibrillation by paramedics, and where paramedics do not have evidence verifying a cardiac arrest occurred

Bystander-suspected cardiac arrest, where the patient is not in cardiac arrest on arrival of paramedics, or no defibrillation prior to arrival or no other evidence verifying a cardiac arrest state is present

BYSTANDER INITIATED CPR

Identifies the initial person to perform CPR.

CPR initiated prior to the arrival of First Responders and Emergency Services personnel.

FIRST ARREST RHYTHM OF PATIENT

First monitored rhythm is the first cardiac rhythm present when a manual monitor/defib or AED is attached.

"Unknown Shockable" or "Unknown Unshockable Rhythm"

First ALS rhythm recorded

SUSTAINED ROSC	ROSC defined as restoration of a palpable pulse or a measurable BP Sustained ROSC is deemed to have occurred when chest compressions are not required for 20 consecutive minutes and signs of circulation exist.
FIRST AED/ MONITOR APPLIED	Determines the incidence of automated external defibrillator (AED) use prior to EMS arrival This captures both public access defibrillation (PAD) and First Responders with an AED
RESUSCITATION ATTEMPTED BY 911 RESPONDER	Attempt to resuscitate patient in CA by a 911 Responder (see below where resus initially attempted by FR and discontinued with higher level of care and scope to discontinue) Defined as attempting to maintain or restore life by establishing and/or maintain airway, breathing, and circulation through CPR, defibrillation, and other related emergency care techniques Patient's with signs of obvious death (dependent lividity, rigor mortis, decomposition) where initial efforts may have been initiated will NOT be considered as attempted resuscitation. This includes cases where FR may start CPR but upon arrival of ALS/BLS, efforts are ceased due to obvious signs of death.
CALL-TAKER IDENTIFIED ARREST	When a MPDS code prompts the call-taker to instruct the bystander to initiate CPR.
ARREST WITNESSED	Witnessed arrest is one that is seen or heard by another person.
ARREST AFTER ARRIVAL OF 911 RESPONDER	Patient arrested after arrival of a 911 responder (EMS or FR).

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