



# Addressing Cardiac Arrest in Canada

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# Facts

## What is cardiac arrest?

- Cardiac arrest is when the heart suddenly stops beating.
- Cardiac arrest can have many cardiac and non-cardiac causes such as sepsis, drug overdose, structural heart disease and genetic or acquired rhythm disorders.
- Cardiac arrest is life threatening and can cause death if not treated and reversed immediately.

## Cardiac arrest and heart attack are different

- Cardiac arrest is not the same as heart attack. A heart attack is caused by a blockage that stops or limits blood flow to the heart.
- Heart attack is one of the many possible causes of cardiac arrest.
- Signs of cardiac arrest include sudden collapse; unresponsive to touch or sound; and not breathing normally (e.g. agonal breathing or gasping).

## What is the problem?

- An estimated 35,000 cardiac arrests occur in Canada annually.<sup>1</sup>
- Most cardiac arrests occur outside of the hospital.<sup>2</sup>
- Of those who suffer an out-of-hospital cardiac arrest (OHCA), more than 90% die. The survival rate in most communities is less than 10%.<sup>2-5</sup>
- Cardiac arrest can happen to anyone, at any age (including in childhood), any place or time. Most often, a cardiac arrest presents without any warning signs.
- Living on higher floors in high-rise buildings is associated with lower survival rates for OHCA in Canada.<sup>6</sup>
- Women are less likely to receive CPR than men following a out-of-hospital cardiac arrest.<sup>7</sup>
- Survival is significantly decreased for every minute without access to CPR or an AED.<sup>8, 9</sup>
- Emergency medical services are typically six to seven minutes away.<sup>10-12</sup> Some communities face longer response times, especially in northern and remote Canada. Bystanders in all communities have an important role to play in taking immediate action following a cardiac arrest.
- Certain Indigenous communities have a higher incidence of Long QT syndrome, an inherited rhythm disorder that if untreated can increase the risk for cardiac arrest.<sup>13-15</sup> Worldwide, one in 2,000 people have Long QT syndrome, however in the Gitksan First Nations community in northern British Columbia, this ratio is one in 125.<sup>10</sup>

- There are some communities in rural, northern and remote parts of Canada that do not have access to emergency medical services, including 9-1-1 phone services, creating significant gaps and challenges in the emergency care system.<sup>16</sup> This could result in delays when seeking or receiving treatment for cardiac arrest.
- 61% of Canadians say they are willing to perform chest-compression-only CPR if they saw someone collapse, yet actual bystander rates are much lower.<sup>17</sup> In most public places, only 36% to 49% of those experiencing a cardiac arrest receive bystander CPR before professional emergency help arrives.<sup>10,11,18</sup>
- Over 400 lives per year are saved by bystander application of an AED to those experiencing an OHCA.
- Bystander use of AEDs in public spaces occurs in 7% to 17% of OHCA cases.<sup>10,11,18</sup> Bystanders deliver a shock without complication in 19% of publicly observed, shockable OHCA cases.<sup>9</sup>
- When a bystander uses an AED, the chance of survival triples (24%) and when the AED delivers a shock the chance of survival increases five fold (38%). By doing this, patients are also more likely to recover pre-cardiac arrest ability levels.<sup>9, 18</sup>

## Why are CPR/AEDs beneficial?

- Early CPR combined with AED use and activation of emergency medical services supports the best chance of saving a life and providing functional recovery after cardiac arrest.<sup>9, 18</sup> More comprehensive efforts are needed to ensure that OHCA patients make it to the hospital alive because there are notable improvements in the survival outcomes of OHCA cases once the person makes it to the hospital.<sup>19</sup>
- Results from the Resuscitation Outcomes Consortium (ROC) show that cardiac arrest survival rates increase greatly when bystanders use an AED.<sup>9</sup> However, these rates are still low and warrant further public awareness and education efforts as well as increased, widespread access to AEDs especially in rural, remote, and Indigenous communities.
- Data from urban and rural regions in southern Ontario suggests that when each link of the Chain of Survival™ is optimized the survival and functional recovery rates both rise. Collective strengthening of each link in the Chain of Survival™ is associated with improved survival and health outcomes.<sup>10</sup>
- In combination with other interventions, widespread CPR and AED access can also be beneficial in saving lives during public health crises. For example CPR can be life saving for those suffering from an opioid overdose that has progressed to a full cardiac arrest.

## Background

Cardiac arrest is the loss of cardiac activity due to either cardiac (i.e., erratic heart rhythm) or non-cardiac (i.e., drug overdose) related causes. Disruptions in heart function prevents blood from flowing to each of the body's vital organs and back into the heart. The time between the onset of cardiac arrest and the initiation of cardiopulmonary resuscitation (CPR) or the use of an automated external defibrillator (AED) are the major determinants of success for any resuscitation attempt. Educating individuals on CPR and AED use is important as most cardiac arrests occur outside of the hospital.<sup>2</sup> It is important that healthcare professionals are trained in CPR and AED use and that bystanders understand the vital role they play in applying CPR and an AED until emergency services arrive.

### At risk populations

Certain populations are more susceptible to cardiac arrest and face poorer outcomes. Women who suffer an OHCA in public are less likely to receive bystander CPR (39% vs 45% for men) and have lower odds for survival following an OHCA.<sup>7,20</sup> These outcomes are partially due to bystander reluctance to perform CPR on women in public, and women experiencing a lower proportion of shockable initial rhythms than men.<sup>7,20</sup> Some Indigenous populations face similar barriers. Long QT Syndrome, an inherited rhythm disorder that can increase the risk for cardiac arrest, has been identified in three Indigenous communities across Canada.<sup>13-15</sup> Worldwide, one in 2,000 people have Long QT Syndrome, however among the Gitksan Indigenous community in British Columbia, this number is one in 125.<sup>13</sup>

Rural and remote communities lack the necessary resources to address OHCA. A 2013 report by the Canadian Radio-television Telecommunications Commission found that 2% of the Canadian population do not have access to 9-1-1 emergency services.<sup>16</sup> The majority of those without service live in rural or remote areas. This includes many Indigenous communities in northern Canada who lack access to other basic and advanced medical services as well.<sup>16,21</sup> Healthcare, through nursing stations and paramedicine, attempts to address emergency care in Indigenous communities. These services, however, are often underequipped and understaffed. Nurses are reluctant to leave their stations to attend to an emergency due to liability concerns.<sup>22</sup> Hospitals with onsite cardiac revascularization facilities can also be as far as 250 kilometres away.<sup>23</sup> For Inuit communities, this distance can be 500 kilometres or more.<sup>23</sup> For people living in these communities, the Chain of Survival™ is broken.

To overcome these barriers to care, the Assembly of First Nations Health Transformation Agenda calls for investments in local communities to equip first responders with the skills and technology needed to provide emergency services.<sup>22</sup> Additional engagement of community members in CPR practices and AED use awareness is vital for capacity building within rural and remote communities.

## The Out of Hospital Chain of Survival™

The Out of Hospital Chain of Survival™ refers to a five-step process that, if properly executed, gives an individual the best chance of surviving and recovering from a cardiac arrest. The Chain of Survival™ is only as strong as its weakest link.

The Chain of Survival™ consists of:



Source: American Heart Association. 2015. Available at: <https://ahajournals.org/doi/10.1161/CIR.0000000000000258>.

1. Recognition and activation of the emergency response system
2. Immediate high-quality CPR
3. Rapid defibrillation
4. Basic and advanced emergency medical services
5. Advanced life support and post-arrest care

### Recognition and activation of the emergency response system

Recognizing the symptoms of cardiac arrest is the first step in the Chain of Survival™. Signs that a person is experiencing cardiac arrest include sudden loss of consciousness, no response to shouting or shaking and not breathing normally.

Immediate application of bystander CPR and early pre-hospital care for OHCA can improve survival of cardiac arrest patients; hence it is vital that emergency medical services or 9-1-1 be called as soon as possible following a cardiac arrest. 9-1-1 ambulance communications officers that are equipped to coach callers in CPR and AED use could significantly increase bystander CPR rates.<sup>24-29</sup>

### Immediate high-quality CPR

Anyone can experience cardiac arrest at home, in the workplace, on the street, in a café, at a shopping centre or any other public place. It is likely that the person present to witness a cardiac arrest is a friend, family member or co-worker; hence there is a great need for laypersons to learn CPR and for emergency dispatchers to coach bystanders to perform CPR.

Dispatcher assisted CPR can guide untrained bystanders to perform accurate and effective chest compressions on individuals experiencing a cardiac arrest.<sup>24-30</sup> When bystander CPR is performed on OHCA's, the likelihood of surviving to hospital discharge increases from 7% to 9%, this is a 28.6% increase.<sup>18</sup> A recent study from Denmark observed that when

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bystander CPR and defibrillation were performed on people experiencing OHCA, the risk of brain injury or long-term care admission and death were significantly lowered.<sup>31</sup>

A Canadian study looked at the effectiveness of PulsePoint, a mobile app that notifies users when someone requiring CPR is within a 400 metre radius. Results showed that almost 80% of app users attempted CPR when they arrived on scene before EMS.<sup>32</sup> Similarly, a Swedish study also observed a significant increase in bystander-initiated CPR when mobile technologies were used.<sup>33</sup>

Children and young adults can do CPR successfully, and educating school-aged children in CPR should start as early as possible. In 2015, the World Health Organization endorsed the statement “Kids Save Lives”, which recommends resuscitation education in schools for children 12 years or younger, for two hours per year.<sup>34</sup> While children younger than 12 typically cannot perform effective chest compressions, they can retain CPR education, call 9-1-1 and apply an AED.<sup>35</sup> School children also share their CPR skills with family and friends, making them an important link in amplifying CPR efforts.<sup>34</sup> In 2017, the government of Quebec committed to provide CPR training for all students in Level III at secondary schools.

While there are supports in place to educate youth on CPR, the same supports are lacking for seniors. One study found that individuals who are older and have low income are less likely to receive CPR training.<sup>36</sup> Individuals from these groups should be targeted as high priorities for CPR education since older adults are more likely to suffer from cardiac arrest or be in social settings to help a cardiac arrest victim.<sup>37</sup> Where access to formal training is limited, self-directed CPR tools should be promoted. These tools are as effective as instructor-led CPR classes.<sup>38</sup>

Despite training, education and awareness of CPR, research shows that there is a reluctance for Canadians to engage in bystander CPR. Bystander CPR rates in Canada are often only 36% to 49%.<sup>10,11,18</sup> Perceived barriers include: hygiene of the person, fear of harming the person, fear of liability, fear of contracting a disease or fear of doing the wrong thing.<sup>17</sup> Being female is also a known barrier to having CPR initiated by a bystander,<sup>7,20</sup> suggesting bystander reluctance to touching a woman’s chest. To combat this barrier, JOAN, a New York based agency, released an open source design for an attachment (called “WoManikin”) that converts male CPR mannequins into female mannequins.<sup>39, 40</sup> This highlights the educational need for people to perform CPR on mannequins of multiple body types including male, female and pediatric.

The shift in CPR guidelines in 2010 left many Canadians unaware that bystanders no longer need to perform rescue breaths. Instead a stronger emphasis is placed on hard and fast chest compressions.<sup>28</sup> To understand barriers to CPR

initiation and facilitate a discussion, a group of Canadian researchers launched the Bystander Support Network, an online forum for lay responders to share their experiences and ask questions.

In order to increase bystander CPR rates among the Canadian public, the Canadian Association of Emergency Physicians (CAEP) recommends a multipronged approach which includes government-funded CPR education in high schools, tax exemptions for organizations that provide CPR education and coalition building among like-minded individuals to spearhead awareness campaigns on bystander CPR.<sup>41</sup> Successful outreach should also employ community training modules for education and awareness. Campaigns, such as World Restart a Heart Day, provide an engagement opportunity for communities to be involved in CPR and AED education. Community responder programs, such as the Sandpiper Trust Wildcat program in Scotland, train volunteers to respond to cardiac arrest by deploying lifesaving CPR and AED before emergency services arrive.<sup>42</sup>

## Rapid defibrillation

Evidence shows that AED use in OHCA improves survival and recovery outcomes for patients. A U.S. study found that survival from an OHCA was nine percent with bystander CPR, but jumped to 38% when an AED shock was delivered.<sup>18</sup> Another study found that the survival to discharge rate increased by over 50% when patients were shocked by a bystander rather than by EMS.<sup>9</sup> Another study from Sweden compared one month survival rates of OHCA defibrillation in three scenarios: by the EMS, by a first responder and by a public AED. One-month survival was highest (70%) when a public AED was used, followed by a first responder (42%) and EMS (31%).<sup>43</sup> A recent meta-analysis found that median survival rates were 40% in patients shocked with an AED, and the involvement of lay first responders had the highest impact on survival.<sup>44</sup>

Heart & Stroke has led the placement of 15,000 AEDs in communities across Canada. This was accomplished through corporate sponsorships, fundraising and donations, and support from government agencies, including the Public Health Agency of Canada in 2011. This work was further bolstered by a Public Health Agency of Canada commitment with Heart & Stroke to educate over 25,000 Canadians in how to respond to cardiac arrest.

In 2018, a motion (M-124) was passed unanimously in the House of Commons to equip all Royal Canadian Mounted Police (RCMP) vehicles with AEDs. Additionally, some cities across Canada require police forces to equip police cruisers with AEDs. However, despite these efforts, public access to defibrillators remains limited, disconnected and a significant barrier for many in Canada.

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The majority of cardiac arrests that occur in public settings in North America are shockable arrhythmias (ventricular tachyarrhythmias), highlighting the need for the placement of AEDs in accessible public areas.<sup>45</sup> A Toronto-based study analyzed the occurrence of public OHCA and found that the majority of OHCA occur in spaces that would be AED-accessible if AEDs were placed near coffee shops and near ATMs owned by the five largest Canadian banks.<sup>46</sup> While an AED may be available and nearby in the event of a cardiac arrest it may not be accessible. One Canadian study found that one in five OHCA occurred in a location where an AED was inaccessible (due to hours of operation of the business, or placement of the AED behind locked doors in a multi-rise building).<sup>47</sup> This stresses the need for uniform strategies for AED placement and 24-7 accessibility. For example, if AEDs were placed beside bank machines, people would be consistently reminded of this placement while using ATMs, and would know by association to go to the nearest ATM in cases of emergencies.

Most Canadian provinces have AED registries (voluntary or mandatory) to track the number of AEDs in their jurisdictions and to inform individuals of their location. However only a few of these registries are connected to 9-1-1 services or help inform the maintenance of these AEDs.

Currently, Manitoba is the only province that mandates that AEDs be installed in high-traffic public places, such as gyms, arenas, community centres, major shopping malls, schools and airports. Manitoba law also protects Good Samaritans from liabilities from responsibly using a defibrillator. The owners of the premises are responsible for maintenance and inspection of defibrillators.<sup>48</sup> Heart & Stroke is the designated registrar of Manitoba's AED registry which advises EMS and 9-1-1 operators on the nearest AED location. Currently, no other Canadian province or territory has made AEDs mandatory in public places with requirements for AEDs to be in all areas where people dwell (beyond high traffic areas). Gaps also exist in documentation of the number of privately owned AEDs, and on frequency of AED use, due to lack of reporting and data collection mechanisms.

A recent Canadian study observed that individuals living on higher floors in high-rise buildings have worse survival outcomes than those who live on lower floors after a cardiac arrest.<sup>6</sup> Potential reasons for this could be due to building access issues and elevator delays. Furthermore, unlike firefighters, paramedics often do not have access to universal elevator keys which can cause delays in reaching a patient. Drone technologies that carry AEDs may be beneficial in these situations, in addition to CPR education of individuals in these communities. Recent studies from the U.S. and Europe show that drones carrying AEDs have great potential to reduce travel time of an AED to the scene of life-threatening situations.<sup>49, 50</sup>

In Stockholm County, Sweden, the mean amount of time saved in a rural OHCA was 19 minutes.<sup>50</sup> A Canadian study estimates that drones could reduce AED delivery times by 10 minutes in rural areas, and six minutes in urban areas for those in the 90<sup>th</sup> percentile of 9-1-1 response times.<sup>51</sup> Some Canadian jurisdictions, such as Peel Region and Renfrew County in Ontario, are piloting drone technology for AED delivery.

While AEDs are safe and easy to use, there is some public confusion and lack of awareness on the ease of using defibrillators. Some individuals also worry about being held liable, however many provinces and territories have Good Samaritan laws in place, with some having laws for defibrillators in particular. These laws protect Good Samaritans from reasonable use of CPR and AEDs during a medical emergency. Bystanders have the potential to save a person's life so it is crucial for all bystanders to act during a cardiac arrest. Quebec's *Charter of Human Rights and Freedom* legally obliges a person to come to the aid of another whose life is in peril, unless providing aid endangers the bystander. Ontario took special measures to address AED liability when it passed the *Chase McEachern Act* (Civil Defibrillator Liability Act, 2007), an amendment to the province's Good Samaritan law that spells out the safeguards for public use and private ownership of AEDs. Mass public awareness and education efforts should dispel related myths and encourage bystander use of CPR and AEDs.

## Basic and advanced emergency medical services

Each link in the Chain of Survival™ is dependent on decisive action taken in previous links. Early basic and advanced care by emergency medical responders is critical for patient stabilization and handoff for advanced life support; hence it is important to have coordinated systems and protocols in place to ensure that advanced cardiovascular life support is delivered as soon as possible.

Immediate access to emergency medical services can also be challenging for individuals that live in rural, remote and northern parts of Canada. For some of these communities, medical help may be hours away making CPR education and widespread accessibility to AEDs for these communities essential.

## Advanced life support and post arrest care

Strong coordination between in-hospital healthcare teams and the efficient delivery of care is vital to receiving post-arrest care that is effective. Appropriate care in the fifth link of the Chain of Survival™ can also improve neurological outcomes.<sup>52</sup>

Targeted Temperature Management (TTM) is mild hypothermia induced following a cardiac arrest. In-hospital TTM following an OHCA is associated with improvement in

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survival to discharge and good neurological function.<sup>17</sup> The effects of TTM on functional survival may be dependent on the time of initial defibrillation with TTM having a larger impact when time to defibrillation is delayed.<sup>8</sup>

Individuals suffering from OHCA due to coronary artery disease benefit from management of the disease through invasive interventions (coronary angiogram and percutaneous coronary intervention). These interventions are associated with an increased chance of survival to discharge.<sup>53</sup>

Extracorporeal CPR (eCPR) is a method that mechanically oxygenates and circulates the patient's blood to help mitigate cardiorespiratory failure.<sup>54</sup> Treatment recommendations published by ILCOR determined the evidence supporting eCPR as an effective tool for OHCA patients is limited, and that eCPR could be considered when conventional resuscitation fails.<sup>54</sup> St. Paul's Hospital in Vancouver is in the process of measuring feasibility of eCPR in selected OHCA patients. Multiple trials are ongoing to evaluate outcomes and measure cost effectiveness of eCPR in OHCA patients.<sup>55</sup> Although this is an area with some potential, more research is needed.

Care and recovery for cardiac arrest patients must extend beyond hospital walls. Systems of support should be set up for cardiac arrest survivors, the families of survivors, and bystanders involved in the emergency response of OHCA. For example, the Bystander Support Network connects and provides trusted information to witnesses of cardiac arrest across the globe. The Network acknowledges people with lived experience of responding to cardiac arrest can be a valuable asset in providing mentorship and support to others in similar situations. This same model could be very powerful for survivors and family members who are working through the complexities of recovery from cardiac arrest. Health systems planners should work with healthcare providers and other community leaders such as Heart & Stroke to build networks of support following hospital discharge.

## Policy Options

**Heart & Stroke recommends all people in Canada and sectors of Canadian society consider the following policy options to improve health outcomes for adults and children following cardiac arrest.**

## People in Canada

1. Become familiar with the signs of cardiac arrest and steps of CPR and encourage others to do the same.
2. Become familiar with hands-only CPR and with operating an AED. Inquire and stay apprised of the location of the AED nearest to you at your office, in public places, and at home.
  - a. Learn more at the [Heart & Stroke Resuscitation website](#) or by watching [Heart & Stroke's whiteboard AED video](#)
3. Be prepared to act by:
  - a. Performing chest compressions (pediatric CPR still emphasizes the importance of rescue breaths)
  - b. Using an AED in combination with CPR, in the event that someone near you experiences a cardiac arrest.
  - c. Call 9-1-1 and work with dispatcher and other witnesses to support continued CPR.
4. Register any AED devices that you own with emergency medical services (EMS) or device registries as appropriate and available, and perform maintenance and upkeep according to manufacturer guidelines.
5. Share your experience as public rescuers, survivors or witnesses, seek support and learn more about cardiac arrest from resources like the [Bystander Support Network](#).

## Federal government

1. Amend the National Building Code of Canada to include placement of AEDs in buildings as part of comprehensive emergency response plans.
  - a. Consult with stakeholders to develop frameworks for placement of AEDs in various areas (both public and private buildings).
  - b. Ensure that placement of AEDs in federal buildings are integrated into Emergency Medical Systems (i.e. 9-1-1 dispatch/emergency medical services) and are built into emergency response plans.
2. Establish legislation to mandate that all airlines are required to carry AEDs on commercial aircrafts.
3. Establish legislation to mandate all trains and water vessels are required to retain and carry AEDs on commercial routes.
4. Equip all federal emergency response vehicles (such as RCMP vehicles) with AEDs across Canada.
5. Provide financial exemptions/incentives for senior citizens, Indigenous communities and individuals below the low-income cut-offs that enroll in and take a CPR and AED training course.

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6. Respectfully engage with Indigenous organizations and leaders to facilitate discussions on cardiac arrest rates in Indigenous people and improving resuscitation outcomes for Indigenous people.
    - a. Build capacity for First Aid, CPR and AED training in First Nations, Metis, and Inuit communities.
  7. Incorporate access to innovative AED technologies (such as drones) to improve AED response times.
  8. Work together with communities to improve access for 9-1-1 emergency medical services in rural, northern and remote locations
  9. Support a well-funded, sustainable program, such as [World Restart a Heart Day](#), to improve national bystander CPR initiation rates.
  10. Support a well-funded, sustainable mass and social media campaign to raise awareness about the life-saving potential from learning CPR and using AEDs.
  11. Develop a national cardiac arrest registry system and monitoring mechanisms to accurately capture out-of-hospital and in-hospital cardiac arrest incidences and outcomes, and the frequency of bystander CPR and AED usage in private and public settings.
  12. Collaborate with provincial and territorial governments to facilitate the inter-linking of provincial and territorial AED registries.
  13. Ensure through measuring and monitoring that every communication centre is providing at the point of care coaching of bystanders to perform CPR and use the AED in every suspected cardiac arrest
  14. Enable HR/operating policies to ensure that any property that conducts Government business can only be leased, rented or bought as long as an AED is maintained on the premises.
2. Amend the respective provincial or territorial labour code to ensure that organizations with 11 or more employees are required to install AEDs at the workplace.
    - a. Incorporate mandated certified first aid and CPR/AED training for employees.
  3. Implement mandatory CPR and AED education for school-aged students, and ensure that it is funded adequately.
    - a. Establish school-provided CPR and AED education as a mandated pre-requisite for graduation of high school.
    - b. Monitor and evaluate progress of this program to ensure continued success.
  4. Develop and enact legislation requiring that schools be equipped with AEDs on all primary, elementary, secondary and post-secondary premises.
  5. Establish provincial/territorial laws that protect bystanders from liability in cases of responsible use of CPR and AED during a medical emergency in jurisdictions that do not have Good Samaritan laws. Clarify and communicate within Good Samaritan laws the civil liability of using AEDs. Such messages should be communicated in areas where AEDs are placed.
  6. Establish provincial/territorial AED registries that are linked to 9-1-1 operator dispatch.
  7. Equip all provincial/territorial emergency response vehicles with AEDs
  8. Provide tax incentives for corporations that provide CPR and AED training to employees on an annual basis.
  9. Require CPR and First Aid for obtaining and renewing a driver's licence.
  10. Improve access for 9-1-1 emergency phone services in rural, northern and remote communities.
    - a. Support and invest in community paramedicine models in rural and remote communities to close immediate gaps in emergency medical services.

## Provincial/territorial governments

Provincial and territorial governments play an important role in enabling healthy and supportive environments for all people in Canada. Provincial and territorial governments should adopt comprehensive public access to defibrillation (PAD) legislation. This legislation could include some or all of the components below:

1. Amend provincial building codes and public space legislation to mandate inclusion of AEDs in buildings and public spaces as part of comprehensive emergency response plans.
  - a. New or amended provincial legislation, regulation or guidelines should also include mandated maintenance, inspection and registration of AEDs.
11. Establish provincial/territorial laws to mandate that all public transit systems are required to carry AEDs.
12. Support a well-funded, sustainable mass and social media campaign to raise awareness about the life-saving potential of CPR and AEDs and encourage their use.
13. Support training for 9-1-1 ambulance communications officers to provide CPR instructions to bystanders. Implement an internationally recognized program for dispatch communication and CPR instruction support.
14. Support a well-funded, sustainable cardiac arrest registry to measure and report on provincial/territorial bystander CPR initiation rates and outcomes after cardiac arrest.

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15. Establish a regulatory framework for ongoing maintenance and servicing of AEDs to ensure comprehensive maintenance requirements.
  16. In accordance with Heart & Stroke Guidelines for AED placement, enable HR/operating policies to ensure that any property that conducts government business can only be leased, rented or bought as long as an AED is maintained on the premises.
  17. Ensure that law enforcement vehicles are equipped with regularly maintained AEDs.

## **Municipal governments**

1. Amend municipal building codes and bylaws to require AEDs in buildings as part of comprehensive emergency response plans.
2. Ensure that AEDs are placed in an accessible 24-7 location based on arrest data and mathematical optimization strategies in all public locations.
3. Support a well-funded, sustainable public awareness campaign to educate bystanders of the importance of CPR and AEDs, and encourage AED use.
4. Provide all emergency medical responders with universal elevator access keys to initiate quicker medical care response times in high-rise buildings.
5. Ensure that emergency vehicles are equipped with regularly maintained AEDs.
6. Ensure all municipal employees are trained annually in CPR and the use of AEDs.

## **Health system planners and Emergency medical services (EMS)**

1. Advocate for the strengthening the Chain of Survival™ through timely and adequate access of AEDs for responders in all Canadian communities and jurisdictions.
2. Support early CPR and defibrillation initiatives to be implemented within the pre-hospital Chain of Survival™.
3. Work with provincial and territorial governments, and partners, to develop AED registries and implement regular AED inspection protocols.
  - a. Implement population-response digital technologies (such as apps that reports and updates nearby AED locations so bystanders can find an AED closest to them during a cardiac arrest).

4. Include AED programs as comprehensive emergency response plans that are linked with the EMS system. Implementation of the system should account for transfer of care protocol, coordination or oversight, training, continual readiness, quality assurance and improvement, data collection and evaluation.
5. Stay updated with the International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations with relation to the Chain of Survival™.
  - a. Follow provincial guidelines for AED programs wherever guidelines have been established.
6. Work with healthcare providers and partners to build systems of support for cardiac arrest survivors, the families of cardiac arrest survivors, and bystanders involved in the emergency response.
7. Respectfully and meaningfully engage with Indigenous communities and healthcare system funders to improve access to EMS for Indigenous people so that all Indigenous people have access to the complete Chain of Survival™.

## **Healthcare providers**

1. All healthcare providers and staff who are responsible for caring for patients should be required to maintain annual certification in Basic Life Support.
2. Certain personnel, where relevant, who provide direct care to patients in the Emergency Department, Intensive Care Unit, Coronary Care Unit or Cardiac Care as part of a Code or Rapid Response Team should be required to maintain Advanced Cardiovascular Life Support certification every two years (as appropriate to their scope of practice).
3. Certain personnel, where relevant, who provide direct care to patients in Neonatal Intensive Care Unit, Pediatrics or other relevant areas should be required to maintain certification of Pediatric Advanced Life Support or Pediatric Emergency Assessment Recognition and Stabilization every two years (as appropriate to their scope of practice).

## **Hospitals, healthcare centres, and health system regulators**

1. Accreditation Canada should develop compulsory cardiac arrest program requirement for Accreditation status for any healthcare facility that operates an Emergency Department, Rapid Response or Code Team, ICU, CCU, Cardiac Unit, PICU, NICU or any other relevant advanced cardiac medical treatment service.
  - a. Develop a nationally consistent framework for data collection of in-hospital reporting measures

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2. Advocate for the strengthening of the Chain of Survival™ through timely and adequate access to AEDs, as well as early advanced care and rehabilitation. This, including extend the Good Samaritan law and Chase McEachern Act to include AED use by non-medical health care professionals during in-hospital cardiac arrests.
  3. Stay current with the Guidelines for CPR and Emergency Cardiovascular Care, as they are frequently updated and provide the best evidence for the provision of quality care.
  4. Ensure that all staff that provide patient-care are trained to respond in medical emergency situations and that staff renew BLS skills annually at a minimum.
  5. Hospitals should equip all public areas with AEDs to ensure widespread availability and accessibility of AEDs.

## Training agencies

1. Promote CPR and AED training and education that aligns with the guidelines for CPR and AED established by Heart & Stroke as recognized best practices.
2. Educate on the “diffusion of responsibility”, a term for the psychological phenomenon where a bystander is less likely to help at the scene of an emergency when a greater number of bystanders are present. Knowledge of this effect can break the barrier that prevents action and the initiation of CPR.
3. Align training standards with the Compression-Airway-Breathing (CAB) method. Consider offering a diverse variety of CPR practice mannequins for training sessions which include male, female and pediatric torsos to enable trainees to learn on and feel comfortable performing CPR on both sexes and on pediatric mannequins.
4. Offer incentives and/or discounts for individuals who are on fixed or limited income to enroll and engage in CPR and AED training and education.
5. Encourage and advocate that public facilities have emergency response protocols and drills which include deploying AEDs.
6. Employ feedback devices that collect data on CPR application when delivering courses to healthcare providers and professional (i.e., not for lay provider or general public training) to accurately assess and improve CPR performance.
7. Offer online training free of charge in order to reach the largest possible audience.
8. Consider using community training models to engage the public in awareness and education of CPR and AED skills.

## AED Manufacturers

1. Invest in research and development that explores advancements in AED technologies which may limit the need for regular maintenance.

- a. Explore AED devices that can be docked in hardwired cabinets so they can remain permanently charged, and discourage theft and vandalism.
  - b. Invest in developing smaller, more mobile technology for easy transportation.
  - c. Create mobile apps and connectivity that allows individuals to connect to local AED devices that can be easily found in case of a medical emergency.
  - d. Develop solutions that simplify and allow for free updates when AED protocol guidelines change.
2. Encourage public facilities to incorporate AEDs into more comprehensive emergency plans.
  3. Develop comprehensive building packages that ensure bulk purchase, installation, and compatibility with central monitoring.

## Organizations and Corporate Canada

1. Ensure that all employees are educated in CPR & AED use and equipped to use an AED in case of an emergency.
  - a. Clarify to employees that the use of an AED is intended for response to anyone experiencing a cardiac arrest, including individuals outside the organization – AEDs are intended to safeguard everyone.
    - i. Ensure that AEDs are accessible to all people in the building at all hours. Avoid using signage that says “for use by authorized personnel only”.
  - b. Ensure that employees are aware of the AED location on site and are comfortable in using them in an emergency.
2. Follow the guidelines for installing AEDs at the workplace, and comply with provincial guidelines where applicable.
  - a. Based on these guidelines, incorporate the appropriate number of AEDs in the workplace and into comprehensive emergency response plans.
3. Both small and large retailers, including banks (in particular at ATMs), should ensure that all franchises and businesses carry AEDs, especially those located in remote and rural parts of Canada.
  - a. If the business does not operate 24 hours a day, ensure that the placement of the AED leaves it accessible at all hours.

## Researchers

1. Explore enhancements in every link in the Chain of Survival™ including from cardiac arrest recognition by 9-1-1 communication officers, to bystander readiness to act, to rehabilitation of survivors
2. Explore efforts regarding digital technologies and how they can be beneficial for public access to defibrillation and CPR.

3. Explore how advances in CPR techniques and technologies can improve survival and neurological outcomes following a cardiac arrest.
4. Meaningfully engage with Indigenous people, organizations and leaders to explore cardiac arrest incidence rates, hospitalization rates and outcomes in Indigenous people.
5. Research cardiac arrest incidence rates, hospitalization rates and outcomes in all including and specifically on racialized people and women.

## Property managers/building owners/ landlords/strata corporations

1. Ensure that every tenant or strata owner has equitable access to an AED. Brief them on the location of the AED that is closest to them.
  - a. Follow the AED placement guidelines when installing AEDs in these properties.
2. Incorporate CPR and AED use into comprehensive emergency response plans to minimize unwanted delays for emergency responders to reach tenants and visitors who need medical help.
3. Advocate for revisions to building code, to ensure AEDs are applicable in all occupied buildings.

## References

1. Krueger & Associates Inc and Heart & Stroke, unpublished data. 2019.
2. Vaillancourt C, Stiell I. Cardiac arrest care and emergency medical services in Canada. 2004;20(11):10.
3. Nichol G. Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA*. 2008;300(12):1423. doi:10.1001/jama.300.12.1423
4. Girotra S, van Diepen S, Nallamothu BK, et al. Regional variation in out-of-hospital cardiac arrest survival in the United States. *Circulation*. 2016;133(22):2159-2168. doi:10.1161/CIRCULATIONAHA.115.018175
5. Berdowski J, Berg RA, Tijssen JGP, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: Systematic review of 67 prospective studies. *Resuscitation*. 2010;81(11):1479-1487. doi:10.1016/j.resuscitation.2010.08.006
6. Drennan IR, Strum R, Byers A, et al. Out-of-hospital cardiac arrest in high-rise buildings: Delays to patient care and effect on survival. *CMAJ*. 2016;188(6):413-419.
7. Blewer AL, McGovern SK, Schmicker RH, et al. Gender Disparities Among Adult Recipients of Bystander Cardiopulmonary Resuscitation in the Public. *Circ Cardiovasc Qual Outcomes*. 2018;11(8). doi:10.1161/CIRCOUTCOMES.118.004710
8. Drennan IR, Lin S, Thorpe KE, Morrison LJ. The effect of time to defibrillation and targeted temperature management on functional survival after out-of-hospital cardiac arrest. *Resuscitation*. 2014;85(11):1623-1628. doi:10.1016/j.resuscitation.2014.07.010
9. Pollack RA, Brown SP, Rea T, et al. Impact of bystander automated external defibrillator use on survival and functional outcomes in shockable observed public cardiac arrests. *Circulation*. 2018;137(20):2104-2113. doi:10.1161/CIRCULATIONAHA.117.030700
10. Buick JE, Drennan IR, Scales DC, et al. Improving temporal trends in survival and neurological outcomes after out-of-hospital cardiac arrest. *Circulation: Cardiovascular Quality and Outcomes*. 2018;11(1). doi:10.1161/CIRCOUTCOMES.117.003561
11. Grunau B, Kawano T, Dick W, et al. Trends in care processes and survival following prehospital resuscitation improvement initiatives for out-of-hospital cardiac arrest in British Columbia, 2006–2016. *Resuscitation*. 2018;125:118-125. doi:10.1016/j.resuscitation.2018.01.049
12. Ministry of Health and Long-Term Care. Emergency health services land ambulance program. [http://www.health.gov.on.ca/en/pro/programs/emergency\\_health/land/responsetime.aspx](http://www.health.gov.on.ca/en/pro/programs/emergency_health/land/responsetime.aspx). Accessed May 6, 2019.
13. Arbour L, Asuri S, Whittome B, Polanco F, Hegele RA. The genetics of cardiovascular disease in Canadian and international aboriginal populations. *Canadian Journal of Cardiology*. 2015;31(9):1094-1115. doi:10.1016/j.cjca.2015.07.005
14. Goldenberg I, Moss AJ, Bradley J, et al. Long-QT Syndrome after age 40. *Circulation*. 2008;117(17):2192-2201. doi:10.1161/CIRCULATIONAHA.107.729368
15. Goldenberg I, Horr S, Moss AJ, et al. Risk for life-threatening cardiac events in patients with genotype-confirmed Long-QT Syndrome and normal-range corrected QT intervals. *Journal of the American College of Cardiology*. 2011;57(1):51-59. doi:10.1016/j.jacc.2010.07.038
16. Denton T. *Report on Matters Related to Emergency 9-1-1*. Canadian Radio-television and Telecommunications Commission; 2013:80.
17. Cheskes L, Morrison LJ, Beaton D, Parsons J, Dainty KN. Are Canadians more willing to provide chest-compression-only cardiopulmonary resuscitation (CPR)? – a nation-wide public survey. *CJEM*. 2016;18(04):253-263. doi:10.1017/cem.2015.113
18. Weisfeldt ML, Sitlani CM, Ornato JP, et al. Survival after application of automatic external defibrillators before arrival of the emergency medical system. *Journal of the American College of Cardiology*. 2010;55(16):1713-1720. doi:10.1016/j.jacc.2009.11.077
19. Wong MKY, Morrison LJ, Qiu F, et al. Trends in short- and long-term survival among out-of-hospital cardiac arrest patients alive at hospital arrival. *Circulation*. 2014;130:1883-1890. doi:10.1161/CIRCULATIONAHA.114.010633
20. Blom MT, Oving I, Berdowski J, van Valkengoed IGM, Bardai A, Tan HL. Women have lower chances than men to be resuscitated and survive out-of-hospital cardiac arrest. *Eur Heart J*. May 2019. doi:10.1093/eurheartj/ehz297
21. Cram S, December 2 2016 7:00 AM ET | Last Updated: 2016. First Nations communities cope with lack of emergency response resources. CBC. <https://www.cbc.ca/news/indigenous/first-nations-emergency-response-health-1.3826391>. Published December 2, 2016. Accessed May 6, 2019.
22. Assembly of First Nations. *The First Nations Health Transformation Agenda*; 2017:137. [https://www.afn.ca/uploads/files/fnhta\\_final.pdf](https://www.afn.ca/uploads/files/fnhta_final.pdf).
23. Canadian Institute for Health Information. *Hospital Care for Heart Attacks among First Nations, Inuit and Métis*. Ottawa, Ont.: Canadian Institute for Health Information; 2013:96.
24. Bohm K, Vaillancourt C, Charette ML, Dunford J, Castrén M. In patients with out-of-hospital cardiac arrest, does the provision of dispatch cardiopulmonary resuscitation instructions as opposed to no instructions improve outcome: A systematic review of the literature. *Resuscitation*. 2011;82(12):1490-1495. doi:10.1016/j.resuscitation.2011.09.004
25. Vaillancourt C, Verma A, Trickett J, et al. Evaluating the Effectiveness of Dispatch-assisted Cardiopulmonary Resuscitation Instructions. *Academic Emergency Medicine*. 2007;14(10):877-883. doi:10.1197/j.aem.2007.06.021
26. Ro YS, Shin SD, Lee YJ, et al. Effect of dispatcher-assisted cardiopulmonary resuscitation program and location of out-of-hospital cardiac arrest on survival and neurologic outcome. *Annals of Emergency Medicine*. 2017;69(1):52-61.e1. doi:10.1016/j.annemergmed.2016.07.028
27. Tsunoyama T, Nakahara S, Yoshida M, Kitamura M, Sakamoto T. Effectiveness of dispatcher training in increasing bystander chest compression for out-of-hospital cardiac arrest patients in Japan. *Acute Medicine & Surgery*. 2017;4(4):439-445. doi:10.1002/ams2.303
28. American Heart Association. *Highlights of the 2015 American Heart Association Guidelines Updates for CPR and ECC*; 2015:36.

29. International Liaison Committee on Resuscitation. Dispatcher Instruction in CPR (pediatrics). <https://costr.licor.org/document/dispatcher-instruction-in-cpr-pediatrics>. Published January 2019. Accessed April 16, 2019.
30. Ng Y, Leong S, Ong M. The role of dispatch in resuscitation. *smedj*. 2017;58(7):449-452. doi:10.11622/smedj.2017059
31. Kragholm K, Wissenberg M, Mortensen RN, et al. Bystander efforts and 1-year outcomes in out-of-hospital cardiac arrest. *New England Journal of Medicine*. 2017;376(18):1737-1747. doi:10.1056/NEJMoa1601891
32. Brooks SC, Simmons G, Worthington H, Bobrow BJ, Morrison LJ. The Pulsepoint Respond mobile device application to crowdsourced basic life support for patients with out-of-hospital cardiac arrest: Challenges for optimal implementation. *Resuscitation*. 2016;98:20-26. doi:10.1016/j.resuscitation.2015.09.392
33. Ringh M, Rosenqvist M, Hollenberg J, et al. Mobile-phone dispatch of laypersons for cpr in out-of-hospital cardiac arrest. *New England Journal of Medicine*. 2015;372(24):2316-2325. doi:10.1056/NEJMoa1406038
34. Böttiger BW, Van Aken H. Kids save lives – Training school children in cardiopulmonary resuscitation worldwide is now endorsed by the World Health Organization (WHO). *Resuscitation*. 2015;94:A5-A7. doi:10.1016/j.resuscitation.2015.07.005
35. Plant N, Taylor K. How best to teach CPR to schoolchildren: A systematic review. *Resuscitation*. 2013;84(4):415-421. doi:10.1016/j.resuscitation.2012.12.008
36. Blewer AL, Ibrahim SA, Leary M, et al. Cardiopulmonary resuscitation training disparities in the United States. *Journal of the American Heart Association*. 2017;6(5). doi:10.1161/JAHA.117.006124
37. Vaillancourt C, Kasaboski A, Charette M, et al. Barriers and facilitators to CPR training and performing CPR in an older population most likely to witness cardiac arrest: A national survey. *Resuscitation*. 2013;84(12):1747-1752. doi:10.1016/j.resuscitation.2013.08.001
38. Lynch B, Einspruch EL, Nichol G, Becker LB, Aufderheide TP, Idris A. Effectiveness of a 30-min CPR self-instruction program for lay responders: a controlled randomized study. *Resuscitation*. 2005;67(1):31-43. doi:10.1016/j.resuscitation.2005.04.017
39. Womanikin. Learn on a women. Save a women. <https://womanikin.org/About>. Accessed October 10, 2019.
40. Young S. First female CPR dummy created to help save women suffering from cardiac arrest. The Independent. <https://www.independent.co.uk/life-style/women/womanikin-cardiac-arrest-female-cpr-breasts-dummy-joan-a8943781.html>. Published June 4, 2019. Accessed June 7, 2019.
41. Vaillancourt C, Epstein N, Cheskes S, et al. CAEP position statement on bystander cardiopulmonary resuscitation. *CJEM*. 2011;13(05):339-342. doi:10.2310/8000.2011.110604
42. Fickling K, Clegg G, Jensen K, Donaldson L, Laird C, Bywater D. PP22 Sandpiper wildcat project – saving lives after out-of-hospital cardiac arrest in rural grampian. *Emerg Med J*. 2019;36(1):e9. doi:10.1136/emered-2019-999.22
43. Ringh M, Jonsson M, Nordberg P, et al. Survival after public access defibrillation in stockholm, sweden – a striking success. *Resuscitation*. 2015;91:1-7. doi:10.1016/j.resuscitation.2015.02.032
44. Bækgaard JS, Viereck S, Møller TP, Ersbøll AK, Lippert F, Folke F. The effects of public access defibrillation on survival after out-of-hospital cardiac arrest: a systematic review of observational studies. *Circulation*. 2017;136(10):954-965. doi:10.1161/CIRCULATIONAHA.117.029067
45. Weisfeldt ML, Rea T, Bigham B, et al. Ventricular tachyarrhythmias after cardiac arrest in public versus at home. *The New England Journal of Medicine*. 2011;364(4):313-321.
46. Sun CLF, Brooks SC, Morrison LJ, Chan TCY. Ranking businesses and municipal locations by spatiotemporal cardiac arrest risk to guide public defibrillator placement. *Circulation*. 2017;135(12):1104-1119. doi:10.1161/CIRCULATIONAHA.116.025349
47. Sun CLF, Demirtas D, Brooks SC, Morrison LJ, Chan TCY. Overcoming spatial and temporal barriers to public access defibrillators via optimization. *Journal of the American College of Cardiology*. 2016;68(8):836-845. doi:10.1016/j.jacc.2016.03.609
48. Government of Manitoba. The Defibrillator Public Access Act. <http://web2.gov.mb.ca/laws/statutes/2011/c01011e.php>. Accessed May 6, 2019.
49. Pulver A. Locating automated external defibrillator enabled medical drones to reduce response times to out-of-hospital cardiac arrests. May 2017.
50. Claesson A, Fredman D, Svensson L, et al. Unmanned aerial vehicles (drones) in out-of-hospital-cardiac-arrest. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*. 2016;24(1):124. doi:10.1186/s13049-016-0313-5
51. Boutilier J, Brooks SC, Janmohamed A, et al. Optimizing a drone network to deliver automated external defibrillators. *Circulation*. 2017;135:2454-2465.
52. Tagami T, Hirata K, Takeshige T, et al. Implementation of the fifth link of the chain of survival concept for out-of-hospital cardiac arrest. .9.
53. Redpath C, Sambell C, Stiell I, et al. In-hospital mortality in 13,263 survivors of out-of-hospital cardiac arrest in Canada. *Am Heart J*. 2010;159(4):577-583. e1. doi:10.1016/j.ahj.2009.12.030
54. Holmberg MJ, Geri G, Wiberg S, et al. Extracorporeal cardiopulmonary resuscitation for cardiac arrest: A systematic review. *Resuscitation*. 2018;131:91-100. doi:10.1016/j.resuscitation.2018.07.029
55. Providence Health Care. Cardiac resuscitation trial at St. Paul's Hospital the first of its kind in Canada. <http://www.providencehealthcare.org/news/20160713/cardiac-resuscitation-trial-st-pauls-hospital-first-its-kind-canada>. Published July 13, 2016. Accessed May 6, 2019.

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