



## Emerging Evidence

# Mandating Training Is Not Enough: The State of Cardiopulmonary Resuscitation and Automated External Defibrillator Training in Ontario Schools

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### ABSTRACT

Cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) training in schools are mandated in the Ontario high school curriculum. We surveyed schools to understand the scope of this training, including its barriers and facilitators. We recruited 120 (58.5%) elementary, 25 (12.2%) middle, and 60 (29.3%) high schools. Almost 60% (120 of 200) provided staff with CPR training, but only 56% (27 of 48) of high schools trained students. Major barriers included lack of funding, time, and trainers. Despite government-mandated curriculum, only 56% of high schools offer CPR and AED training. More research is needed to understand the barriers to implementing this lifesaving training.

### RÉSUMÉ

La formation en réanimation cardiorespiratoire (RCR) et défibrillateurs externes automatisés (DEA) est obligatoire dans le cadre du programme d’études secondaires des écoles de l’Ontario. Nous avons entrepris une enquête dans les écoles pour comprendre la portée de cette formation, notamment ses obstacles et ses facilitateurs. Nous avons procédé au recrutement dans 120 (58,5 %) écoles élémentaires, 25 (12,2 %) écoles intermédiaires et 60 (29,3 %) écoles secondaires. Presque 60 % (120 sur 200) des écoles secondaires offraient la formation en RCR au personnel, mais seulement 56 % (27 sur 48) formaient les élèves. Les principaux obstacles étaient le manque de financement, de temps et de formateurs. Bien que le gouvernement ait rendu obligatoire la formation en RCR et DEA dans le cadre du programme d’études secondaires, seulement 56 % des écoles offrent la formation. D’autres études sont nécessaires pour comprendre les obstacles à la mise en œuvre de cette formation qui permet de sauver des vies.

In Canada, an estimated 35,000 sudden cardiac arrests (SCAs) occur each year and fewer than 10% of victims survive.<sup>1,2</sup> With prompt bystander cardiopulmonary resuscitation (CPR) and

early defibrillation by automated external defibrillators (AEDs), survival rates can reach as high as 70%.<sup>3</sup> In Ontario, only 40% of bystanders who witness persons having SCAs provide CPR, and even fewer know what an AED is or where to find one.<sup>1</sup>

Teaching school-age children how to perform CPR and use AEDs is a reliable and sustainable method for increasing rates of bystander CPR and survival from SCA.<sup>4</sup> Worldwide, 6 European countries and 40 US states have legislated CPR and AED training in schools;<sup>5,6</sup> however, no such legislation exists in Canada. In the 1990s, the Province of Ontario mandated the inclusion of CPR and AED training in the Grade 9 Physical Health and Education Curriculum, following successful pilot studies.<sup>7</sup> Although adherence to the curriculum is mandatory, how schools implement training programs is up to

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**Ethics Statement:** Before participation in this project, respondents read a 1-page study description and provided consent. The Research Ethics Board at Unity Health Toronto-St. Michael’s Hospital approved this study.

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See page 825 for disclosure information.

the discretion of each school board. In 2009, a survey of all Toronto high schools found that only 51% of schools trained students in CPR, and only 6% offered AED training.<sup>8</sup> The most commonly cited barriers to providing training were cost, perceived need, and the school population size.

Given the lack of contemporary data on how many Ontario schools offer this training, we aimed to evaluate the availability of AEDs, the current rates of CPR and AED training in publicly funded Ontario schools, and the implementation barriers to providing CPR and AED training to Ontario staff and students.

## Methods

### Study design

A semiquantitative, web-based survey was conducted between January 30, and February 28, 2020.

### Study setting and population

The study population included all publicly funded schools in Ontario. As of 2018 to 2019, there were 3948 elementary and 880 secondary schools in Ontario (total: 4828), administered by 72 school boards, of which there are 31 English Public, 29 English Catholic, 4 French Public, and 8 French Catholic.<sup>9</sup>

### Survey design

We created the survey (Supplemental Appendix S1), using the SurveyMonkey Tool (SurveyMonkey Inc., San Mateo, CA), consisting of 23 questions, closed and open ended, for school principals and vice principals. The questions were grouped into 4 sections: school demographics, AED installation and upkeep, staff CPR and AED training, and student CPR and AED training. Schools without AEDs, or that did not offer CPR and AED training to staff or students, were asked to describe the barriers to installation or offering training. Two investigators (K.S.A., T.T.J.) piloted the survey to assess for clarity and ease of access.

### Survey implementation

We distributed the survey via Twitter, Facebook, and Instagram using the Canadian Sudden Cardiac Arrest Network (C-SCAN) and Cardiac Arrest Response and Education (CARE) accounts, as well as our own personal accounts. Other distribution methods included posting on the C-SCAN website (<https://c-scan.org>), snowball sampling

among the C-SCAN and CARE networks, and enlisting the help of professional administrator associations. Participants were offered \$10 coffee gift cards of their choice for their participation.

### Statistical analysis

Open-ended questions were analyzed according to standard thematic analysis and grouped into similar categories by a single investigator (K.S.A.). Closed-ended questions were analyzed using descriptive statistics. Continuous variables were summarized as means and standard deviations or medians with interquartile range, whereas categorical variables were summarized as counts and percentages. Analyses of parametric and non-parametric data were carried out using 1-way analysis of variance (ANOVA) and the Kruskal-Wallis test, respectively. A  $P < 0.05$  was considered significant. All calculations and data analyses were performed with SPSS software (IBM Corp., IBM SPSS Statistics for Windows, Version 27.0. Armonk, New York).

## Results

### Demographics and study population

Of the 250 respondents who initiated the study survey, we excluded 14 duplicates and 31 who were likely nonhuman. The remaining participants were principals or vice principals from 205 unique public schools (Table 1) with 104,387 children, representing 15 different public school boards (Supplemental Table S1) including English, French, rural, and urban. Collectively, these 205 schools and their corresponding public school boards represent 4.24% (205 of 4828) and 20.8% (15 of 72), respectively, of all publicly funded schools and school boards in Ontario.

### AED installation and training

At least 1 AED was present in 70% (144 of 205) of schools (Table 2). The highest proportion of AED installation was in high schools and middle schools. Approximately 60% said AED training was offered to staff as part of CPR training, and the type of trainers and length of training varied considerably across schools. For schools without AEDs installed, the most cited barriers were lack of funding and time for training (23 of 48; 47.9%), lack of interest (6 of 48; 12.5%) and unsure (9 of 48; 18.8%). A small proportion (6 of 48; 12.5%) mentioned that they wanted an

**Table 1. School demographics**

Variable*	Elementary schools	Middle schools	High schools	Total
Number of schools	120 (58.5)	25 (20.8)	60 (29.3)	205
Average number of students per school	380.7 ± 177.7	502.4 ± 223.0	871.1 ± 452.3	532.6 ± 357.2
Number of staff per school				
1-50	92 (76.7)	20 (80.0)	10 (16.7)	122 (59.5)
51-100	25 (20.8)	4 (16.0)	40 (66.7%)	69 (33.7)
101-300	1 (0.8)	1 (4.0)	6 (10.0)	8 (3.9)
301-500	1 (0.8)	0 (0)	0 (0)	1 (0.5)
501-1000	1 (0.8)	0 (0)	1 (1.7)	2 (1.0)
> 1000	0	0	3 (5.0)	3 (1.5)

\* Values are presented as n (%) or mean (standard deviation [SD]).

**Table 2. AED installation and training**

Variable*	Elementary schools	Middle schools	High schools	Total	P value
<b>AED Installed</b>	71 (59.2)	19 (76.0)	54 (90.0)	144 (70.2)	< 0.0001
Number of AEDs per school					
1	66 (93)	19 (100)	35 (64.8)	120 (83.3)	< 0.0001
2	5 (7)	0	18 (33.3)	23 (16)	< 0.0001
4	0	0	1 (1.9)	1 (0.7)	NS
<b>AED location</b>					
Main office/hallway	36 (50.7)	10 (52.6)	27 (50)	73 (50.7)	NS
Front entrance/foyer	21 (29.6)	4 (21.1)	10 (18.5)	35 (24.3)	NS
Gym	11 (15.5)	4 (21.1)	6 (11.1)	21 (14.6)	NS
Cafeteria	0	0	2 (3.7)	2 (1.4)	NS
Other	3 (4.2)	1 (5.3)	3 (5.6)	7 (4.9)	NS
Unspecified location	0	0	6 (11.1)	6 (4.2)	NS
Policy for AED Maintenance	56 (78.9)	16 (84.2)	33 (61.1)	105 (72.9)	NS
Offers AED training to staff	65 (56.5)	14 (56)	30 (61.2)	109 (57.7)	NS
<b>Type of trainers</b>					
Local EMS service	2 (3.1)	0	0	2 (1.8)	NS
Professional association*	12 (18.5)	3 (21.4)	4 (13.3)	19 (17.4)	NS
Staff trainers	1 (1.5)	0	2 (6.7)	3 (2.8)	NS
Private company	9 (13.8)	4 (28.6)	1 (3.3)	14 (12.8)	NS
Unspecified format	27 (41.5)	4 (28.6)	13 (43.3)	44 (40.4)	NS
Unsure	14 (21.5)	3 (21.4)	10 (33.3)	27 (24.8)	NS
<b>Length of training</b>					
1 to 60 minutes	10 (15.4)	2 (14.3)	3 (10)	15 (13.8)	NS
One-half day	7 (10.8)	4 (28.6)	0	11 (10.1)	NS
1 day	4 (6.2)	0	6 (20)	10 (9.2)	NS
2 days	5 (7.7)	2 (14.3)	2 (6.7)	9 (8.3)	NS
Unspecified	39 (60)	6 (42.9)	19 (63.3)	64 (58.7)	NS

Values are presented as n (%) or mean (standard deviation [SD]).

AED, automated external defibrillator; EMS, emergency medical service.

\* Includes Red Cross, Heart and Stroke Foundation, and St. John's Ambulance.

AED installed, and 8.3% (4 of 48) stated that they were in the process of obtaining one for their school.

### CPR training

Elementary schools reported the highest rates of staff CPR training compared with high schools and middle schools (Table 3). Only 18.8% (34 of 181) of schools reported training students how to perform CPR and use AEDs, with high schools reporting significantly higher rates of training compared with middle and elementary (56.3% high school vs 4.0% middle vs 5.6% elementary  $P < 0.0001$ ). Of the high schools that reported providing the training to students, most offered it during a Grade 9 physical education or health class (40.0%, 10 of 25); some organized specific workshops or training sessions outside of school (16.0%, 4 of 25); others (36.0%, 9 of 25) offered it as part of a specialty course (co-op, sports team, specialist high-skills major program), and 8% (2 of 25) did not specify the format. Elementary and middle schools were more likely to provide training as part of an organized workshop or training session outside of school (71.4%, 5 of 7) rather than during a physical education or health class (14.3%, 1 of 7), and 1 school (14.3%, 1 of 7) did not specify the format.

### Barriers to offering training

Barriers to offering CPR training to staff and students differed. The most frequent barriers to providing staff CPR training included lack of funding and time (73.0%; 51 of 69) and lack of interest or availability (26.1%; 18 of 69). Major

barriers to providing students with CPR and AED training were lack of funding and time (33.6%; 41 of 122), student age (21.3%; 26 of 122), had not thought of offering it to students (18%; 22 of 122), did not believe it was mandated in the curriculum (13.1%; 16 of 122), lack of trainers (8.2%; 10 of 122), and other (5.7%; 7 of 122).

### Discussion

This study demonstrates that most surveyed Ontario public schools that responded to the survey offered CPR and AED training to staff and have at least 1 AED installed on the premises. Despite government-mandated CPR and AED training in the high school curriculum, only 56% of secondary schools offer it to their students, mostly through physical education and health classes or organized workshops outside of school hours. Major barriers to providing staff and students with training included lack of funding, time, and availability.

In comparison with a survey of all Toronto secondary schools conducted in 2009, rates of CPR training for staff and students have either decreased or stagnated with time. Of the 250 secondary schools, 80% and 51% reported training their staff and students in CPR,<sup>8</sup> respectively, compared with 60% and 56.3% in 2020. Other countries have also observed low implementation rates of CPR training in schools despite legislation.<sup>10</sup> A 2017 study from Denmark found that even with CPR and AED training being legislated in schools since 2005, only 28.4% of eligible classes had completed CPR training, and even fewer (10.3%) had completed AED

**Table 3. CPR training**

Variable*	Elementary schools	Middle schools	High schools	Total	P value
<b>Staff training</b>					
Staff required to have CPR training	79 (66.4)	13 (52)	28 (50)	120 (60)	NS
Median number of staff trained per school (interquartile range)	3 (2,6)	2.5 (2,5)	6 (3.3, 10)	3 (2,6)	0.04
<b>Type of trainers</b>					
Local EMS service	2 (2.6)	0	0	2 (1.8)	NS
Professional association*	25 (32.9)	3 (23.1)	7 (31.8)	35 (31.5)	NS
Staff trainers	2 (2.6)	0	3 (13.6)	5 (4.5)	NS
Private company	5 (6.6)	3 (23.1)	0	8 (7.2)	NS
Local school board	13 (17.1)	0	2 (9.1)	15 (13.5)	NS
Unsure	21 (27.6)	7 (53.8)	10 (45.5)	38 (34.2)	NS
<b>Length of training</b>					
1 to 60 minutes	1 (1.3)	0	2 (9.1)	3 (2.7)	NS
One-half to 1 day	8 (10.5)	2 (15.4)	1 (4.5)	11 (9.9)	NS
1 to 2 days	21 (27.6)	5 (38.5)	3 (13.6)	29 (26.1)	NS
2 days	11 (14.5)	2 (15.4)	4 (18.2)	17 (15.3)	NS
Unspecified	35 (46.1)	4 (30.8)	12 (54.4)	51 (45.9)	NS
<b>Student training</b>					
CPR training provided to students	6 (5.6)	1 (4.0)	27 (56.3)	34 (18.8)	< 0.0001

Values are presented as n (%) or mean (standard deviation [SD]) unless otherwise indicated.

CPR, cardiopulmonary resuscitation; EMS, emergency medical service.

\* Includes Red Cross, Heart and Stroke Foundation, and St. John's Ambulance.

training.<sup>10</sup> Similar to our results, lack of funding, time, and access to training materials were the most frequently reported barriers. Clearly, legislation alone is not enough to guarantee successful implementation of CPR and AED training in schools; additional strategies are needed such as raising awareness of the mandated legislation, providing funding, and easy access to relevant teaching materials.<sup>10</sup>

Our surveyed schools used a wide variety of differing formats, lengths, and types of trainers. Training sessions ranged from 1 hour to as long as 2 days, depending on the course content and who delivered the training. The startup costs of a school CPR training program have been estimated at ~ \$1000 USD and yearly maintenance costs of ~ \$500 USD, with funds typically allocated from existing school resources.<sup>11</sup> These costs can be significant barriers for the majority of public schools. A potential solution is to develop and implement alternative training methods, such as self-directed learning or peer-to-peer training.<sup>12-13</sup> Conceivably, these methods would help to reduce the overall cost of delivering training by eliminating the cost of purchasing and maintaining CPR manikins, training teachers to become CPR instructors, or hiring an external company to provide training.

Teaching students how to perform CPR and use AEDs has widespread public health implications beyond the classroom; it is an easy and cost effective method of educating an entire generation of lifesavers who will be more likely as adults to help in emergency situations.<sup>14</sup> Trained students are also effective "CPR multipliers," by teaching their friends and families.<sup>15</sup> In countries where this training has been mandated and implemented in schools for a number of years, there have been marked increases in rates of bystander CPR and survival to hospital discharge.<sup>16</sup> With effective implementation of this training in schools, there is the opportunity to save hundreds of future lives.

### Limitations

During the survey period, ongoing labour disputes and the start of the COVID-19 pandemic limited our ability to engage directly with school boards to recruit a wider range of

participants. Our small sample may not be representative of all provincial school boards, particularly outside of Toronto. The survey was in English only, which may have limited some respondents from participating. Schools with AEDs may have been more likely to respond than those without.

### Conclusions

Most public schools that responded to the survey reported having 1 AED installed and provide CPR training to staff. Despite government-mandated CPR and AED training in the high school curriculum, just half of the responding surveyed high schools offer it to their students. More research is needed to understand the barriers to implementing this lifesaving training in schools.

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### Disclosures

S.L. and P.D. are Network Investigators of the Cardiac Arrhythmia Network of Canada (CANet), as part of the Networks of Centres of Excellence (NCE), and hold a CANet Program grant. K.S.A. is Chair of the CANet Training and Education Committee and receives salary support from a CANet Program grant. She has received an honorarium from Zoll Medical Inc., for a speaking engagement. The other authors have no conflicts of interest to disclose.

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## Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://cjcopen.ca/> and at <https://doi.org/10.1016/j.cjco.2021.02.008>.