

CORRESPONDENCE



Mobile Automated External Defibrillator Response System during Road Races

TO THE EDITOR: The number of marathon races and other road races has rapidly increased in Japan,¹ as have the number of sudden cardiac arrests during these races.² We developed a rapid mobile automated external defibrillator (AED) system to provide early cardiopulmonary resuscitation (CPR) and AED intervention for runners who have cardiac arrest during road races.^{3,4}

The system consists of mobile teams (pairs of paramedics who ride bicycles and carry AEDs and emergency medical kits) and on-foot teams (pairs of paramedic trainees who carry AEDs and can provide basic life support). The system also includes medical communications dispatchers, staff at a first-aid station, and physician volunteers who run the race and are available by a global positioning system–enabled telephone to assist if needed. Details of the system and the method of data collection are provided in the Supplementary Appendix, available with the full text of this letter at NEJM.org.

Between January 1, 2005, and March 7, 2017, we used the system to support 1,965,265 runners in 251 road races of a distance of 10.0 to 42.2 km, and during that period we responded to 30 runners with cardiac arrest (Table 1). There was 1 cardiac arrest per 65,509 runners (1.53 cardiac arrests per

100,000 runners). Regardless of the length of the race, a total of 21 of the cardiac arrests (70%) occurred in the last quarter of the distance run or near the finish line of the race. Gasping was noted in 26 of the runners with cardiac arrest (87%).

Two runners had unwitnessed cardiac arrest. The initial rhythm was pulseless electrical activity in one runner and asystole in the other, and neither of the two runners was successfully resuscitated.

In the 28 runners with witnessed cardiac arrest, the median interval between collapse and the initiation of basic CPR was 0.8 minutes (interquartile range, 0.5 to 1.0) and the median interval between collapse and delivery of the first AED shock was 2.2 minutes (interquartile range, 1.6 to 4.4). Shocks were delivered to 23 runners who had ventricular fibrillation, and another 5 runners (4 with pulseless electrical activity and 1 with ventricular fibrillation) recovered with basic CPR only. The median interval between collapse and the return of spontaneous circulation was 5.5 minutes (interquartile range, 3.2 to 7.0); all these runners had return of spontaneous circulation in the field, and all had a favorable neurologic outcome (Cerebral Performance Category of 1 or 2, on a scale from 1 [good cerebral performance] to 5 [death or brain death]) at 1 month and 1 year. The median length of hospitalization was 5 days (interquartile range, 3 to 8 days).

Tomoya Kinoshi, M.S.Sc.
Shota Tanaka, B.S.
Ryo Sagisaka, Ph.D.
Takahiro Hara, Ph.D.
Toru Shirakawa, M.E.M.
Etsuko Sone, M.E.M.
Hiroyuki Takahashi, Ph.D.
Masaru Sakurai, M.D., Ph.D.
Akira Maki, M.D., Ph.D.

THIS WEEK'S LETTERS

- 488 Mobile Automated External Defibrillator Response System during Road Races
- 490 Catheter Ablation for Atrial Fibrillation with Heart Failure
- 493 Genetics of Diffuse Large B-Cell Lymphoma
- 494 Diagnostic Use of Base Excess in Acid–Base Disorders

Table 1. Characteristics of Races, Runners, and Sudden Cardiac Arrests.*

Variable	All Runners with Cardiac Arrest (N=30)	Runners with Witnessed Cardiac Arrest (N=28)	Runners with Unwitnessed Cardiac Arrest (N=2)
Distance of race — no. (%)			
>21.1 to full marathon, 42.2 km	19 (63)	19 (68)	0
Half-marathon, 21.1 km	7 (23)	6 (21)	1 (50)
10.0 to <21.1 km	4 (13)	3 (11)	1 (50)
Demographic characteristics of runners			
Median age (IQR) — yr	51 (35–59)	52 (36–59)	28 (27–29)
Male sex — no. (%)	27 (90)	25 (89)	2 (100)
Cardiac arrests			
Median time from start of race to cardiac arrest (IQR) — min	159 (121–192)	161 (134–195)	Unknown
Gasping — no. (%)	26 (87)	25 (89)	1 (50)
Median time from collapse to contact with rapid mobile AED system team (IQR) — min	0.8 (0.5–1.1)	0.8 (0.5–1.0)	Unknown
Median time from witnessed cardiac arrest to initiation of CPR (IQR) — min	Unknown	0.8 (0.5–1.0)	Unknown
Person who initially performed CPR — no. (%)			
Rapid mobile AED system team member	23 (77)	21 (75)	2 (100)
Another runner	7 (23)	7 (25)	0
AED analysis			
Defibrillation performed — shocks delivered/patients with ventricular fibrillation (%)	23/24 (96)	23/24 (96)	0
Median time from collapse to delivery of AED shock (IQR) — sec	131 (99–263)	131 (99–263)	Unknown
Documented ECG waveform according to initial AED data — no. (%)			
Ventricular fibrillation	24 (80)	24 (86)	0
Pulseless electrical activity	5 (17)	4 (14)	1 (50)
Asystole	1 (3)	0	1 (50)
Outcome			
Return of spontaneous circulation in field — no. (%)	28 (93)	28 (100)	0
CPC 1 or 2 — no. (%) †			
At 1 mo	28 (93)	28 (100)	0
At 1 yr	28 (93)	28 (100)	0
Median hospital stay (IQR) — day	5 (3–8)	5 (3–8)	Unknown

* AED denotes automated external defibrillator, ECG electrocardiographic, and IQR interquartile range.

† The Cerebral Performance Category (CPC) is graded on a scale from 1 (good cerebral performance) to 5 (death or brain death).

Hiroshi Takyu, Ph.D.
Hideharu Tanaka, M.D., Ph.D.

Kokushikan University
Tokyo, Japan
maezumi@kokushikan.ac.jp

Disclosure forms provided by the authors are available with the full text of this letter at NEJM.org.

1. Sasakawa Sports Foundation. Sports life data. (<https://www.ssf.or.jp/research/sldata/tabid/381/Default.aspx>). (In Japanese.)

2. Shirakawa T, Tanaka H, Kinoshi T, Tanaka S, Takyu H. Analysis of sudden cardiac arrest cases during marathon races in Japan. *Int J Clin Med* 2017;8:472-80.

3. Maezumi T, Tanaka H, Hosokawa T, et al. Importance of bicycle mobile team (Mobile AED team) in citizen marathon. *Journal of Clinical Sports Medicine* 2009;26:329-34. (In Japanese.)

4. Tanaka H, Tokunaga T, Maezumi T, Hosokawa T. A development of an effective emergency medical support in the citizens' marathon events. *The Annual Reports of Health, Physical Education and Sport Science* 2008;27:115-22. (In Japanese.)

DOI: 10.1056/NEJMc1803218