

2002 ANNUAL REPORT

PROVINCIAL OUT-OF-HOSPITAL CARDIAC ARRESTS

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Executive Summary

In 2002, Ischemic Heart Disease (IHD) remained the most frequent cause of death in Nova Scotia. Such deaths are often the result of a cardiac arrest occurring outside a hospital setting. Optimal survival from a cardiac arrest depends primarily on early activation of the *chain of survival*. This consists of early recognition of a medical emergency, activation of 911, initiation of bystander CPR, early defibrillation and early advanced life support. Provincially, advanced cardiac life support includes advanced airway management and intravenous drug therapy. Though each link in the chain is essential, early defibrillation is the most critical determinant of survival.

In our system, a patient care record (PCR) is completed on all patient contacts including DOAs. Once completed, records are entered into a computer software program. From the data entered into this program reports are generated to analyze the information. This report provides statistics on provincial out-of-hospital cardiac arrests from January 01, 2002– December 31, 2002

- In keeping with the Utstein criteria for reporting cardiac arrest data, there were 1,203 sudden out of hospital deaths; 589 had resuscitation attempted [the other 614 had evidence of established death (rigor mortis), injuries incompatible with successful resuscitation or had do not resuscitation orders]; 476 were felt to be of cardiac cause – this number is the denominator for our survival rates. Patients less than 16 years old are included in the 112 non-cardiac causes and will be reported in a separate report.
- The majority of cardiac arrests occurred in males (63%).
- Patients who suffered a cardiac arrest ranged in age from their 20's to over 100 years old.
- 54.6% of out-of-hospital cardiac arrests were witnessed.
- 32% of out-of-hospital cardiac arrest patients received bystander CPR. CPR maintains blood flow to the vital organs until defibrillation can be provided. Nichol¹ has shown that with a nine minute response time (as is the case for the majority of cardiac arrests in NS), with each 5% increase in bystander CPR (35% to 40%) the survival rate could increase 1% (for 589 resuscitations this would translate into 6 more survivors in Nova Scotia annually). Seattle, at 44%, has the highest bystander CPR rate in North America. Twenty (20%) of their population is CPR trained versus 6% of Nova Scotia. This is a link in the chain EHS must work with the Heart & Stroke Foundation of Nova Scotia to improve.

¹ Nichol G, Stiell I, Laupacis A, De Maio V & Wells G. A cumulative meta-analysis of the effectiveness of defibrillator-capable emergency medical services for victims of out-of-hospital cardiac arrest. *Annals of Emergency Medicine* 1999; 34:517-525.

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- Only 28.4% of cardiac arrest patients were in VF/VT on arrival of the ambulance. This reflects the high percentage of unwitnessed cardiac arrests (14% of unwitnessed vs. 35% of witnessed cardiac arrest patients were found in VF/VT) and the rural setting of many cases (greater than 10 minutes from collapse to ambulance arrival). Most patients suffer a cardiac arrest from VF/VT. As time passes this degenerates into Asystole or PEA. It is therefore important to look for alternatives for supplying defibrillation in the shortest interval possible. This would include more First Responders carrying automatic defibrillators and Public Access Defibrillation. Actions have been taken to address both.
 - 6.3% of patients survived and were discharged from hospital. This appears to be a low percentage in comparison to some other systems. However, it is important when looking at other systems' statistics to compare "apples to apples". Many systems with higher survival rates use only patients with witnessed cardiac arrests who are found in VF/VT. A survival rate of 6.3% is higher than last year but is within the range of normal statistical variation that will be seen from year to year.
 - The median age of male survivors was 64 years and the median age of female survivors was 72 years.
 - Survivors also include cardiac arrest patients who were resuscitated by Medical First Responders using a defibrillator before arrival of the ambulance.

This report has several limitations.

- We report only on calls EHS was notified for. It is generally accepted that there is 1 out-of-hospital sudden death per 1,000 population. We would therefore expect 944 out-of-hospital sudden deaths, based on a population of 944,772. Given that 1,203 were reported, it would appear we are reporting on all provincial out-of-hospital sudden deaths.
- The report is limited in such that it is unknown whether or not patients who survived a cardiac arrest and were discharged from hospital are truly neurologically intact. Follow up with discharged patients has begun this year.
- It is still unclear if times marked on the PCR for defibrillation and events are from the same "clock" and if this timepiece is synchronized with the CAD. In many cases times of procedures or medications are not documented and therefore are not "picked up" in the reports.

Table of Contents

Acknowledgements	i
Executive Summary.....	ii
Definitions	1
Utstein Report	2
Utstein Report (Provincial Summary)	3
Utstein Style Report	4
Utstein Style Report (Provincial Summary)	5
Provincial Out-of-Hospital Cardiac Arrest Statistics	6
Provincial Statistics of Survivors from Out-of-Hospital Cardiac Arrests	7
Provincial Comparison of Out-of-Hospital Cardiac Arrest Statistics	8
Provincial Out-of-Hospital Cardiac Arrests with Resuscitation Attempted per 100,000	9
Provincial Call Receipt – to – Defibrillation Interval for Presenting Rhythm of VF / VT, Non-EMS Witnessed	10
Age & Gender of all Provincial Out-of-Hospital Cardiac Arrest Patients with Resuscitation Attempted	11
Age & Gender of Provincial Out-of-Hospital Cardiac Arrest Survivors	12
Provincial Locations of Out-of-Hospital Cardiac Arrests	13
Provincial Out-of-Hospital Cardiac Arrest Statistics	14
Provincial Out-of-Hospital Cardiac Arrest Patient Outcome Statistics	15
MCP Cardiac Arrest Statistics	16
Provincial Comparison of 1998 – 2002 Out-of-Hospital Cardiac Arrest Statistics	18

Definitions

Asystole: The cessation of all electrical activity in the heart.

Bystander CPR : Person who performs cardiopulmonary resuscitation on a cardiac arrest patient and is not a member of the organized emergency response system.

Call Response Interval: From time call for help answered at the ambulance dispatch center until paramedics arrived at scene. Also referred to as call received/receipt until at scene interval.

Call Shock Interval: From time call for help answered at the ambulance dispatch center until the time the first defibrillation (shock) is given.

Cardiac Etiology: A cardiac arrest assumed to be related to heart disease.

Computer Aided Dispatch (CAD): All calls for an ambulance are transferred from a 911 call taking centre to a single Ambulance Communications Centre and automatically assigned a master incident number (MIN) and time stamped.

Dead on Arrival (DOA): A patient who was pronounced dead upon the arrival of paramedics.

Medical Control Physician (MCP): Physician responsible for a specific area in Nova Scotia who oversees the care provided to persons using the ambulance service according to provincial emergency medical polices.

Public Access Defibrillation: The provision of defibrillation by non-traditional “first responders” such as security guards, lifeguards, etc.

Pulseless Electrical Activity: An organized cardiac rhythm but no pulse/cardiac output is present.

Resuscitation Not Attempted: Patients for whom paramedics do not attempt resuscitation on. The current EHS policy is that if a patient has evidence of being dead for a period of time where resuscitation attempts would have no hope of success the paramedics do not attempt resuscitation. Also, if the interval from patient collapse until arrival of the paramedics at the scene is confirmed to be greater than fifteen (15) minutes, no CPR has been performed prior to their arrival and, the defibrillator reveals asystole or gives a no shock advisory, resuscitation is not attempted. Additionally, resuscitation is not attempted on patients with a Do Not Resuscitate (DNR) order.

Utstein Criteria: Internationally agreed upon criteria and definitions for reporting out-of-hospital cardiac arrest data.

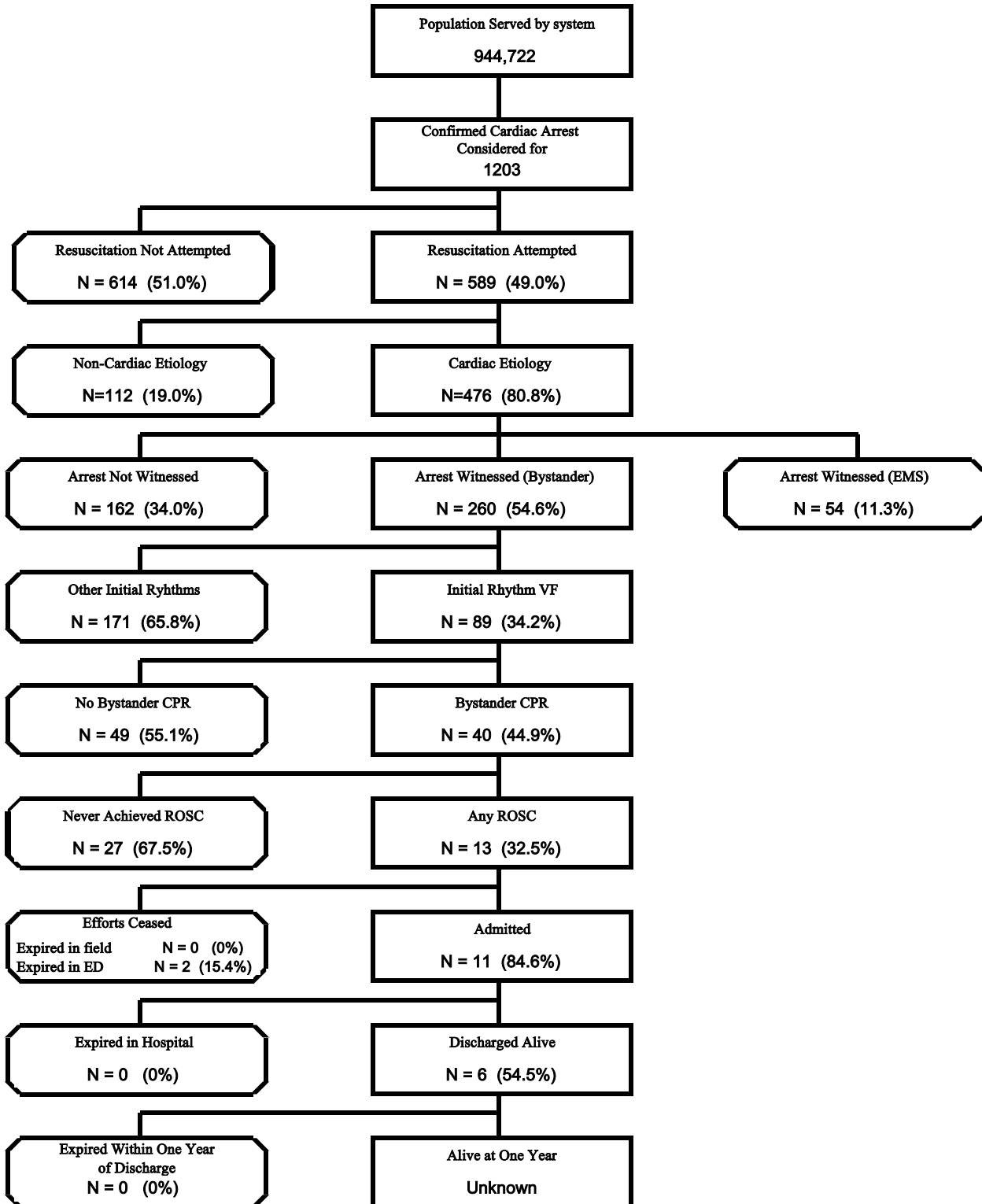
Ventricular Fibrillation / Ventricular Tachycardia (VF/VT): A state of totally disorganized electrical activity in the heart.

Witnessed Arrest: Patient collapse was seen or heard by a bystander

Utstein Report

Collection and analysis of data from prehospital Patient Care Reports (PCRs) is the current method used for evaluating out-of-hospital cardiac arrests in our system. Specific information from the PCR is manually entered and recorded in a computer software program. From the information collected a number of reports are generated. The Utstein Report provides a uniform method of collecting and reporting cardiac arrest statistics.

Utstein Report
Provincial Summary Year to Date 12/31/02



Utstein Style Report

The Utstein Style Report is a template constructed similar to the Utstein Report with additional information provided on bystander CPR, ECG rhythms and survive to discharge statistics.

Of the 260 patients who fell into the category bystander-witnessed arrest, 14 (5.4%) survived and were discharged from hospital; of the 162 patients who had a non-witnessed arrest 2 (1.2%) survived and were discharged home from the hospital. It is not surprising that there was a higher survival rate for out-of-hospital cardiac arrests that were witnessed by a bystander compared to those cardiac arrests that were not witnessed. The former are more likely to have the chain of survival activated earlier.

The likelihood of survival for patients who have a witnessed cardiac arrest, are found in VF/VT and receive bystander CPR is 17%. In the same group that do not receive bystander CPR the likelihood of survival is 10%.

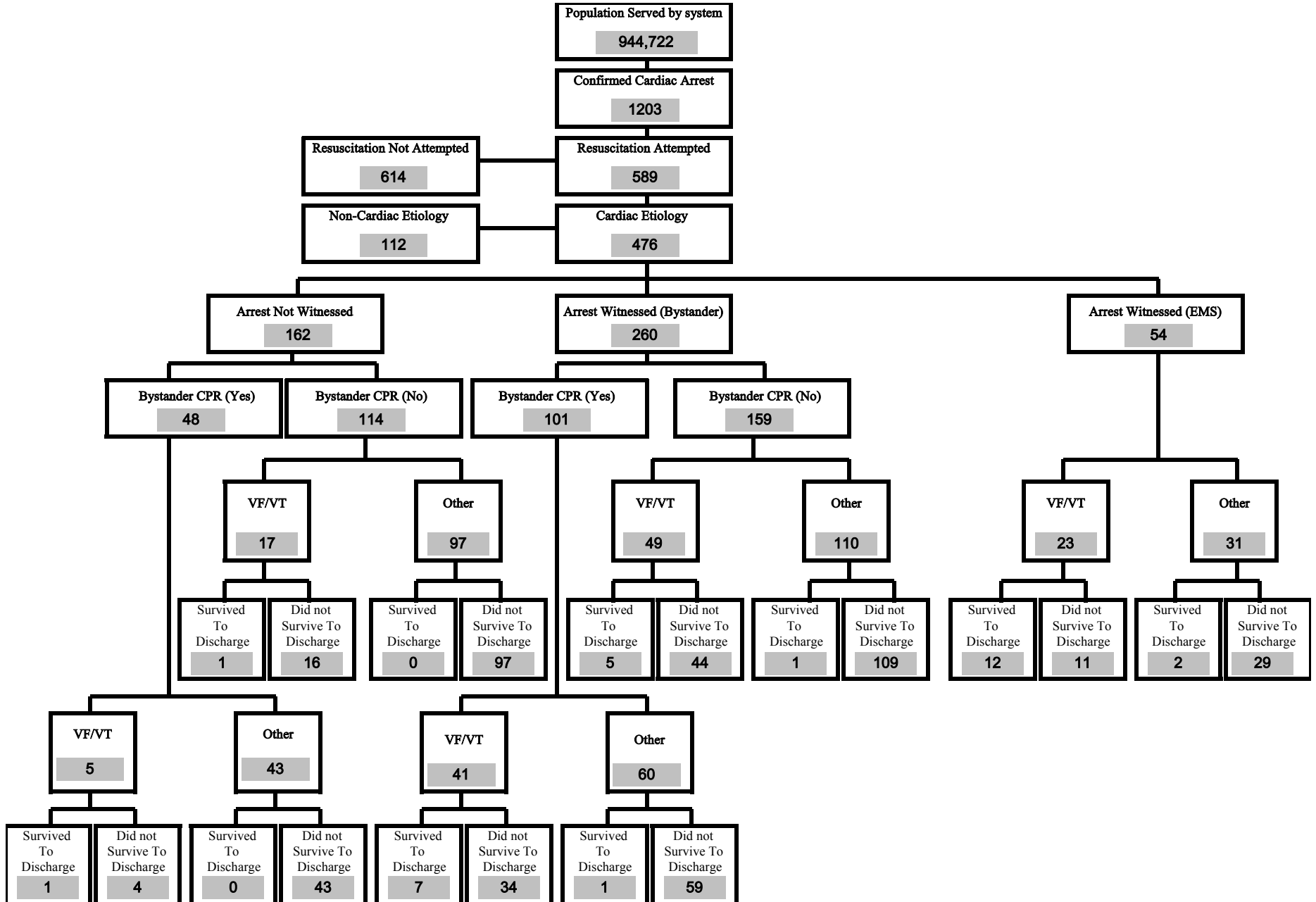
EMS witnessed arrests are looked at separately from bystander-witnessed and non-witnessed cardiac arrests. Because the paramedic witnessed the arrest, bystander CPR and early activation of the EMS are not applicable. Of the 54 EMS-witnessed arrests, 14 (26%) survived and were discharged from hospital. For the most part this higher survival rate reflects the short interval from arrest to defibrillation.

A series of articles in a national United States newspaper looked at survival rates for many large urban US centers. This report focused on survival for patients found in VF/VT. If we look at this group, provincial survival rate is 12.5%. (This does not include EMS witnessed cardiac arrest patients. It is unclear if the US statistics include this group). If we included the EMS witnessed VF/VT patients the survival rate would be 19%.

The series of articles referred to above only looks at survival for urban centers. If we look at our two largest urban centers – HRM and Industrial Cape Breton (both include districts not thought of as urban) then the survival rate for VF/VT patients is 25%. This is not as high as Seattle's reported 44% (tops in North America) but in the range considered as high level in the US.

Utstein Style Report

Provincial Summary Year to Date 12/31/02



Provincial Out-of-Hospital Cardiac Arrest Statistics

Year to Date 12/31/02

Total Patients Recorded	1203
Resuscitations Attempted	589
Cardiac Etiology	476
Median Call to Arrive Scene (min)	7

	Totals	% Patients Cardiac Etiology
Arrest Witnessed	260	54.6%
Bystander CPR	152	31.9%
Initial Rhythm -Asystole	244	51.3%
-PEA	96	20.2%
-VF/VT	135	28.4%
Intubation	428	89.9%
IV	352	73.9%
Survived to Discharge	30	6.3%

Cardiac Arrest Statistical Summary

Provincially, 1203 patients were recorded in our database as having sudden death out of hospital. This number includes all unresponsive, breathless and pulseless patients for whom EHS was activated.

Of the 1203 patients, resuscitations were attempted on 589. 476 were determined to be the result of a cardiac event. 6.3% was the survival rate for arrests determined to be of cardiac origin.

The percentage of cardiac arrest patients who were intubated in 2002 was 96.1% (from QA database). The lower number in this table is the result of times of intubation not being documented and therefore not being "picked up" in this report. This also applies to IV insertion.

Provincial Statistics of Survivors from Out-of-Hospital Cardiac Arrests

Year to Date 12/31/02

Total Patients Recorded	1203	
Total Resuscitations Attempted	589	
Total Cardiac Etiology	476	
Median Call to Arrive Scene (min)	5.5	
Total Survived to Discharge	30	(6.3%)

Survivor Statistical Summary

The survival rate for those cardiac arrests presumed to be of cardiac origin was 6.3%. From this group, 1 (3.3%) of the survivors were found in asystole and 3 (10.0%) were resuscitated from PEA. Survivors had a high percentage of bystander CPR (56.3%) and the vast majority presented in VF/VT (86.7%). The low intubation rate is likely the result of some patients recovering with defibrillation alone.

For those patients presenting with an initial rhythm of VF/VT, 26 (19.3%) survived and were discharged from hospital. It is well documented that patients with an initial rhythm of VF/VT are more likely to survive than those patients with other presenting rhythms.

	Totals	% Patients Survived to Discharge
Arrest Witnessed	14	46.7%
Bystander CPR *	9	56.3%
Initial Rhythm -Asystole	1	3.3%
-PEA	3	10.0%
-VF/VT	26	86.7%
Intubation	20	66.7%
IV	13	43.3%

* % of cardiac arrest survivors not witnessed by EMS that received bystander CPR

Cardiac Arrest Report by DHA

Year to Date 12/31/02

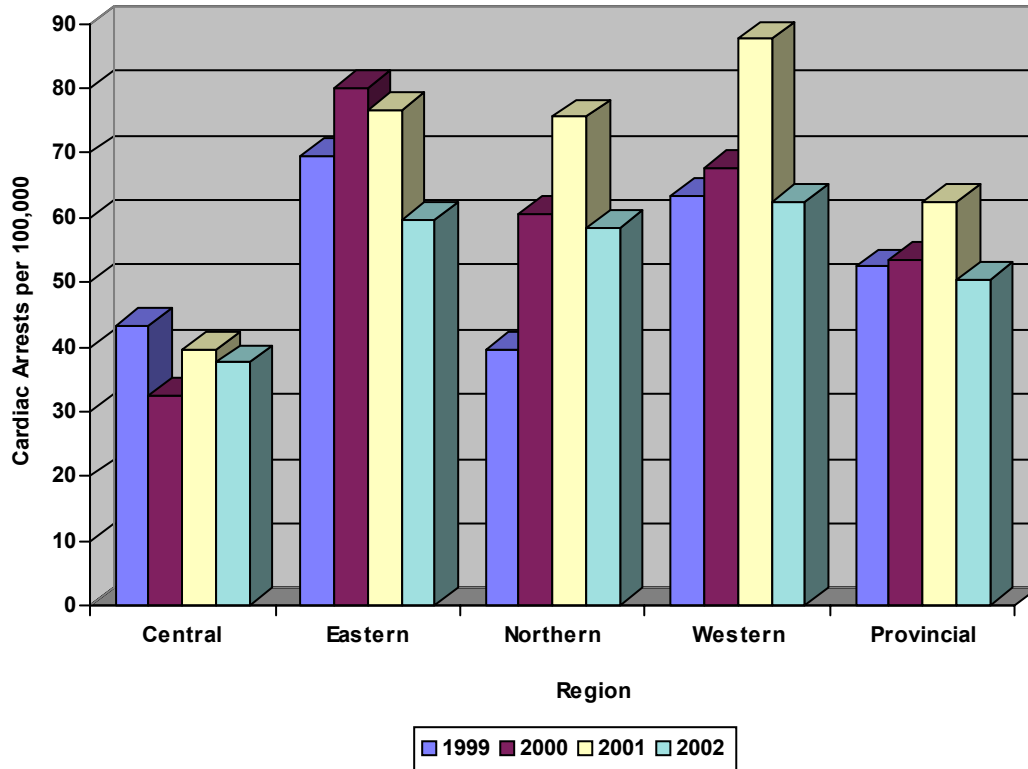
DHA	Total Out of Hospital Cardiac Arrest	Resuscitation Attempted	Cardiac Etiology	Arrest Witnessed	Bystander CPR	Shockable Rhythm VFVT	Asystole	PEA	Survival to Discharge
1	97	51	43	25 (58.1%)	14 (32.6%)	15 (34.9%)	21 (48.8%)	7 (16.3%)	1 (2.3%)
2	116	58	44	28 (63.6%)	17 (38.6%)	7 (15.9%)	28 (63.6%)	9 (20.5%)	0 (0.0%)
3	105	47	39	21 (53.8%)	18 (46.2%)	12 (30.8%)	21 (53.8%)	6 (15.4%)	1 (2.6%)
4	103	59	50	22 (44.0%)	9 (18.0%)	12 (24.0%)	28 (56.0%)	10 (20.0%)	5 (10.0%)
5	44	23	15	9 (60.0%)	5 (33.3%)	5 (33.3%)	9 (60.0%)	0 (0.0%)	0 (0.0%)
6	57	27	22	12 (54.5%)	7 (31.8%)	6 (27.3%)	10 (45.5%)	6 (27.3%)	2 (9.1%)
7	74	37	27	17 (63.0%)	10 (37.0%)	8 (29.6%)	13 (48.1%)	6 (22.2%)	3 (11.1%)
8	220	106	79	43 (54.4%)	27 (34.2%)	24 (30.4%)	41 (51.9%)	14 (17.7%)	4 (5.1%)
9	387	181	157	83 (52.9%)	45 (28.7%)	46 (29.3%)	73 (46.5%)	38 (24.2%)	14 (8.9%)
NS	1203	589	476	260 (54.6%)	152 (31.9%)	135 (28.4%)	244 (51.3%)	96 (20.2%)	30 (6.3%)

A comparison, by DHA, of cardiac arrest statistics reveals the following:

Provincially and by DHA, the percentage of out-of-hospital cardiac arrests that were witnessed, received bystander CPR and whose initial rhythm was VF/VT were similar.

The differences in lower survival rates between regions is not statistically significant (p = 0.35).

Provincial Out-of-Hospital Cardiac Arrests with Resuscitation Attempted per 100,000

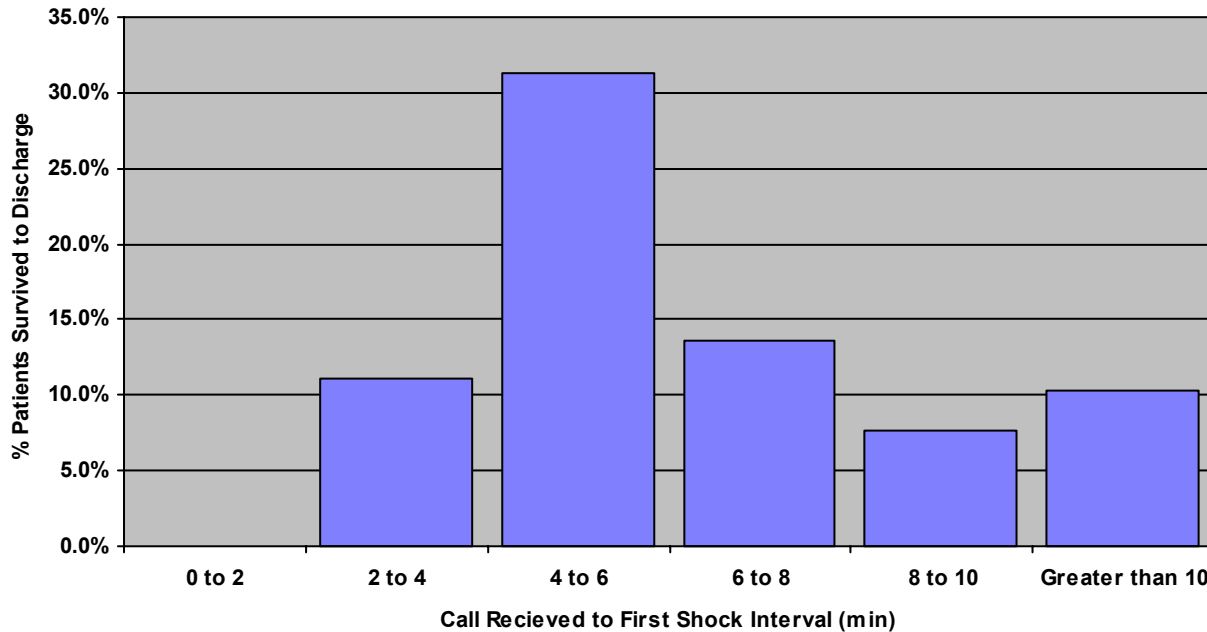


	Central (417,676)	Eastern (182,367)	Northern (133,658)	Western (211,071)	Provincial (944,722)
Year	Arrests (per 100,000)	Arrests (per 100,000)	Arrests (per 100,000)	Arrests (per 100,000)	Arrests (per 100,000)
1999	181 (43)	127 (70)	53 (40)	134 (63)	495 (52)
2000	136 (33)	146 (80)	81 (61)	143 (68)	506 (54)
2001	165 (40)	140 (77)	101 (76)	185 (88)	591 (63)
2002	157 (38)	109 (60)	78 (58)	132 (63)	476 (50)

Next Year be hope to report these numbers by District Health Authority (DHA).

Provincial Call Receipt - to - Defibrillation Interval for Presenting Rhythm of VF/VT, Non-EMS Witnessed

Year to Date 12/31/02



0 to 2 min Survived to Discharge	2 to 4 min Survived to Discharge	4 to 6 min Survived to Discharge	6 to 8 min Survived to Discharge	8 to 10 min Survived to Discharge	>10 min Survived to Discharge
0 of 1 (0.0%)	1 of 9 (11.1%)	5 of 16 (31.3%)	3 of 22 (13.6%)	1 of 13 (7.7%)	3 of 29 (10.3%)

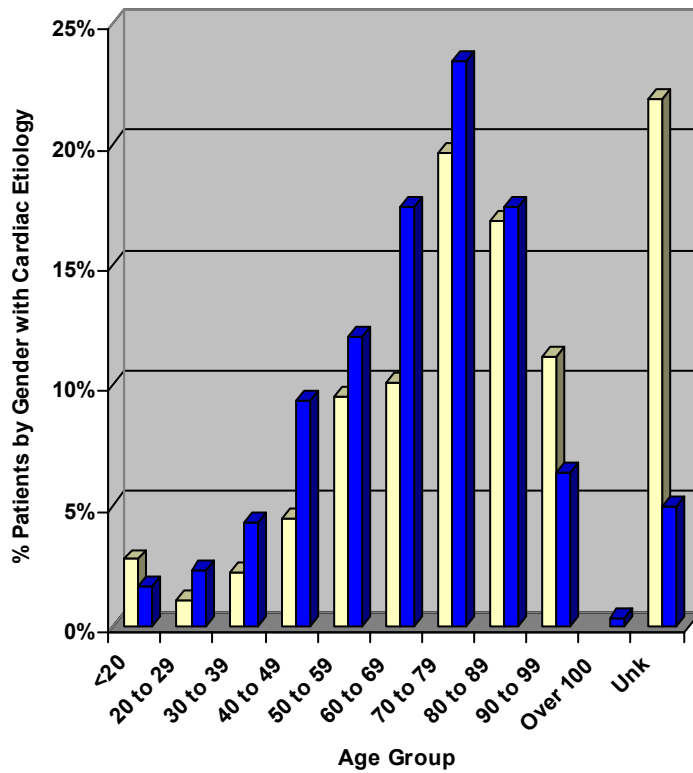
Rapid defibrillation after an out-of-hospital cardiac arrest with a VF/VT ECG rhythm is the single most important determinant of patient outcomes. Successful cardiac resuscitation depends primarily on the time interval between cardiac arrest and first defibrillation. The goal of any emergency medical system is to provide prompt defibrillation.

However, recent literature appears to show a benefit of performing CPR for at least one (1) minute before defibrillating a patient in cases where the Call Response Interval exceeds 5 minutes. This presumes bystander CPR is not being performed.

Some of the times at first defibrillation were not recorded, and therefore only 90 of the 135 VF/VT cases are included in this report due to limitations in the software. These data are included for trend analysis only.

Age & Gender of all Provincial Out-of-Hospital Cardiac Arrest Patients with Resuscitation Attempted

Year to Date 12/31/02



Age & Gender Statistics

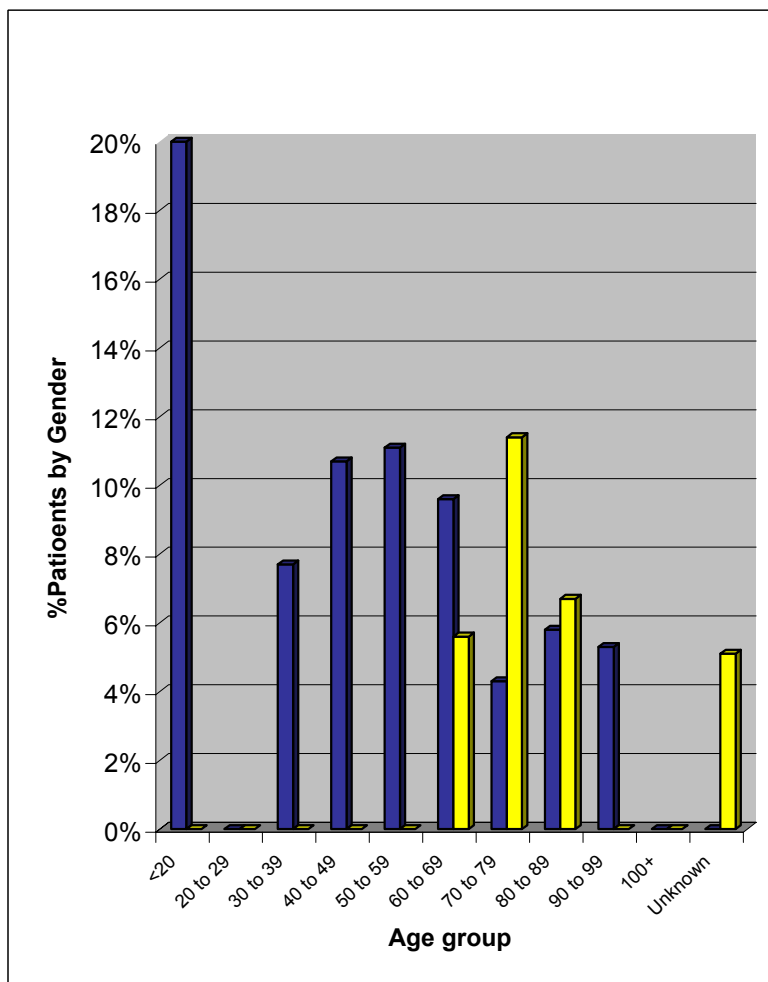
Provincially out-of-hospital cardiac arrest patients ranged in age from their 20's to over 100 years. 298 (62.6%) patients were male and 178 (37.4%) were female.

The majority of males who had a cardiac arrest were between the age of 70-79 (23.5%) and the majority of females who had a cardiac arrest were between the age of 70-79 (19.7%).

Age	<20	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 to 99	100+	Unknown	Total
Male	5 (1.7%)	7 (2.3%)	13 (4.4%)	28 (9.4%)	36 (12.1%)	52 (17.4%)	70 (23.5%)	52 (17.4%)	19 (6.4%)	1 (0.3%)	15 (5.0%)	298 (62.6%)
Female	5 (2.8%)	2 (1.1%)	4 (2.2%)	8 (4.5%)	17 (9.6%)	18 (10.1%)	35 (19.7%)	30 (16.9%)	20 (11.2%)	0 (0%)	39 (21.9%)	178 (37.4%)
Total	10 (2.1%)	9 (1.9%)	17 (3.6%)	36 (7.6%)	53 (11.1%)	70 (14.7%)	105 (22.1%)	82 (17.2%)	39 (8.2%)	1 (0.2%)	54 (11.3%)	476

Age & Gender of Provincial Out-of-Hospital Cardiac Arrest Survivors

Year to Date 12/31/02



Age & Gender Survivor Statistics

This graph shows the count and distribution of cardiac arrest survivors as a % of cardiac arrest patients with resuscitation attempted.

Of the 30 provincial out-of-hospital cardiac arrest survivors, 21 were male and 9 were female.

The median age of male survivors was 64 and the median age of female survivors was 72.

Provincial Locations of Out-of-Hospital Cardiac Arrest

Year to Date 12/31/02

Location	Arrests	%
Home/Cottage	888	73.8%
Not Documented	87	7.2%
Other Public Areas	52	4.3%
Street or Public Walkway	44	3.7%
Extended Care Facility	42	3.5%
Public Building	31	2.6%
Ambulance/Helicopter Landing Zone	18	1.5%
Recreational Facility	10	0.8%
Unknown	9	0.7%
Industrial	8	0.7%
School/Day Care	4	0.3%
Group Home	3	0.2%
Drs Office	2	0.2%
Hospital	2	0.2%
Airport	1	0.1%
Casino	1	0.1%
Penitentiary	1	0.1%
Total	1203	100.0%

Most cardiac arrests occur outside of a hospital. In our system, 73.8% of out-of-hospital cardiac arrests occurred at the patient's home; 3.7% in the street or public walkway; 4.3% in other miscellaneous public areas; 3.5% in an extended care facility and 2.6% in a public building. Cardiac arrests with no location documentation account for 7.2%.

Provincial Out-of-Hospital Cardiac Arrest Statistics

Year to Date 12/31/02

	Public	Private	Total
Total Patients Recorded	321	882	1203
Resuscitations Attempted	167	422	589
Cardiac Etiology	137	339	476
Median Call to Arrive Scene (min)	7	7	7

n (%) Patients Cardiac Etiology

Arrest Witnessed	79 (57.7%)	181 (53.4%)	260 (54.6%)
Bystander CPR	39 (28.5%)	113 (33.3%)	152 (31.9%)
Initial Rhythm -Asystole	69 (50.4%)	175 (51.6%)	244 (51.3%)
-PEA	20 (14.6%)	76 (22.4%)	96 (20.2%)
-VF/VT	48 (35.0%)	87 (25.7%)	135 (28.4%)
Intubation	118 (86.1%)	310 (91.4%)	428 (89.9%)
IV	94 (68.6%)	258 (76.1%)	352 (73.9%)
Survived to Discharge	12 (8.8%)	18 (5.3%)	30 (6.3%)

The larger percentage of witnessed arrests, bystander CPR and patients found in VF/VT did not result in a significant difference ($p = 0.18$) in survivor percentages between patients suffering a cardiac arrest in public versus in a private dwelling.

Provincial Out-of-Hospital Cardiac Arrest Patient Outcome Statistics

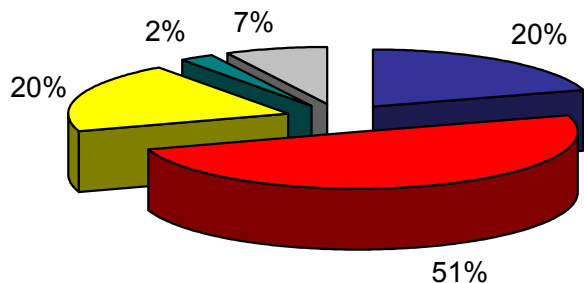
Year to Date 12/31/02

Total Patients: 1203

Resuscitation Attempted: 589

Cardiac Etiology: 476

■ Resus. Terminated: 244	■ No Resus. Attempted: 599
■ Expired in ED: 240	■ Survive to Discharge: 30
■ Unknown: 90	



Outcome of Cardiac Arrest Patients

In our system resuscitation efforts can be terminated in the field, after full advanced life support measures (defibrillation, endotracheal intubation, IV medication) and consultation with an On-Line Medical Control Physician. Resuscitation is not attempted on patients with obvious lividity or rigor mortis and those patients that have a DNR order.

MCP Cardiac Arrest Statistics

The following table provides data regarding the percentage of cardiac arrests in which resuscitations were attempted and the percentages for witnessed arrests, bystander CPR and initial rhythm of VF/VT by Medical Control Physicians (MCP) areas. Median response times are also included for Call Response Interval and Arrival at Scene to First Shock. The percentage of patients who survived to discharge is also presented. The table is partitioned off according to MCP in order to reflect cardiac arrest statistical information in the area for which they are responsible. Five physicians, Buffett, Jones, Legere, Loveridge, and Rappard had no cardiac arrest patients in their area with an initial rhythm of VF/VT therefore, in the corresponding cell Arrive Scene to Shock there is no data.

MCP Cardiac Arrest Statistics

Year to Date 12/31/02

MCP	Cardiac Etiology	% Arrest Witnessed	% Bystander CPR	% Initial Rhythm VF/VT	Median (Minutes)		Survived to Discharge	% Survived to Discharge
					Call to Arrive Scene	Arrive Scene to Shock *		
Allen	22	54.5%	31.8%	27.3%	8	6	2	9.1%
Bennett	23	69.6%	39.1%	34.8%	11	8	3	13.0%
Buchholz	14	64.3%	35.7%	28.6%	10	3	0	0.0%
Buffett	0	0.0%	0.0%	0.0%	11		0	0.0%
Dow	10	50.0%	20.0%	20.0%	11	3	0	0.0%
Holmes	3	100.0%	0.0%	33.3%	23		0	0.0%
Howlett	50	44.0%	18.0%	24.0%	9	2	5	10.0%
Jones	9	33.3%	44.4%	0.0%	10		0	0.0%
Legere	10	60.0%	40.0%	0.0%	9.5		0	0.0%
Loveridge	1	100.0%	100.0%	0.0%	4		0	0.0%
MacDonald	10	50.0%	40.0%	10.0%	10.5		0	0.0%
MacLennan	15	60.0%	33.3%	33.3%	6	8	0	0.0%
McLeod	39	53.8%	46.2%	30.8%	8	2	1	2.6%
Morash	43	58.1%	32.6%	34.9%	11	4	1	2.3%
O'Sullivan	9	77.8%	55.6%	11.1%	6		0	0.0%
Petrie	138	54.3%	26.8%	32.6%	6	2	14	10.1%
Rappard	4	25.0%	25.0%	0.0%	12		0	0.0%
Wawer	76	52.6%	35.5%	30.3%	5	3	4	5.3%
Summary	476	54.6%	31.9%	28.4%	7	3	30	6.3%

* Filtered on resuscitation attempted / cardiac etiology / initial rhythm- VF/VT / prior to hospital transport. Blank spaces mean no patients were defibrillated. There is concern about the accuracy of this measure as the time of first shock is not always taken from a time piece synchronized with the CAD which marks arrival at scene.

Provincial Comparison of 1998 - 2002 Out-of-Hospital Cardiac Arrest Statistics

Year	Resuscitation Attempted	Cardiac Etiology	Arrest Witnessed	Bystander CPR	VF/VT	Survived to Discharge
1998	492	438 (89.0%)	207 (47.3%)	139 (31.7%)	128 (29.2%)	12 (2.7%)
1999	558	495 (88.7%)	270 (54.5%)	176 (35.6%)	159 (32.1%)	27 (5.5%)
2000	574	506 (88.2%)	274 (54.2%)	177 (35.0%)	165 (32.6%)	35 (6.9%)
2001	697	591 (84.8%)	293 (49.6%)	210 (35.5%)	158 (26.7%)	31 (5.2%)
2002	589	476 (80.8%)	260 (54.6%)	152 (31.9%)	135 (28.4%)	30 (6.3%)

A comparison of cardiac arrest statistics is provided in order for EHS to be able to identify any trends in the data. Any changes can have an impact on EHS policy development.

A comparison between 1998 and 2002 cardiac arrest statistics indicates there was no significant change in the percentage of cardiac arrests that were of cardiac etiology, that were witnessed, received bystander CPR or had an initial rhythm of VF/VT. The survive to discharge percentage is higher this year than last year, but is within the normal statistical variation seen year to year.

In order to affect an appreciable change in survival there needs to be an increase in bystander CPR and improvement of the call shock interval. To achieve the former there needs to be a co-operative effort between the Department of Health, the Nova Scotia Heart and Stroke Foundation and the various CPR training organizations to increase the percentage of Nova Scotians who know what to do when they witness a cardiac arrest.

To statistically improve the call shock interval more emphasis needs to be put on first response defibrillation and perhaps public access defibrillation (PAD). The lack, at large numbers of cardiac arrests at any one venue, makes it difficult to target PAD programs to a specific location. As well, a prospective, multicentre, randomized clinical study (The Public Access Defibrillation Trial) will not be completed until September 2003. This study is testing whether volunteer, nonmedical responders can improve survival from out of hospital cardiac arrest. It will also look at cost effectiveness.