1999 HOUSE HUMAN SERVICES

HB 1242

1999 HOUSE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. HB 1242

House Human Services Committee

❑ Conference Committee

Hearing Date January 18, 1999

Tape Number	Side A	Side B	Meter #
1	X		0.0-36.0
2		X	44.3-End
3	X		0.0-End
Committee Clerk Signature	Susann Lindteigen		

Minutes:HB1242 for an act to provide automated external defibrillator site requirements and civil liability immunity for the use of an automated external defibrillator.

Chairman Rep. CLARA SUE PRICE called the committee to order at 10:00 AM. Present were Representatives Robin Weisz, William Devlin, Pat Galvin, Dale Henegar, Roxanne Jensen, Chet Pollert, Todd Porter, Bruce Eckre, Ralph Metcalf, Carol Niemeier, and Wanda Rose. Absent were Amy Kliniske, Blair Thoreson, and Sally Sandvig due to inclement weather and bad road conditions.

TESTIMONY IN FAVOR

Rep. TODD PORTER, District 34, testified. (Testimony attached.)

Rep. ROBIN WEISZ asked who regulates and trains the operators? Rep. TODD PORTER stated the medical devices are regulated by FDA through the State Health Department,

Emergency Services. The only persons who have them are the trained first repsonders or emergency medical technicians.

Rep. RALPH METCALF asked about line 5, page 1; limiting to a person not a group of persons or organizations? Rep. PORTER said this would allow public defibrillation. They could be placed in a business next to the fire extinguisher.

Rep. METCALF asked do we need or not need the definition of "every business?" Rep. PORTER stated the statutes of good Samaritan would still apply.

Rep. CHET POLLERT asked on Page 2, line 4-6; is there a gray area on how a judge will represent gross negligence as compared on Page 1, line 23-24? Rep. PORTER stated Legislative Council drafted the language so that it would be the same as the current statutes that limit liability for gross negligence.

Rep. PAT GALVIN asked what will stop untrained persons from using the dangerous device placed in a public business? Rep. PORTER stated no, the devices are almost foolproof.

TIMOTHY WIEDRICH, Director, Division of Emergency Health Services, ND Health Dept., testified. (Testimony attached.) Seven minute response time when services should be performed.

Rep. ROXANNE JENSEN asked why is it necessary to have liability provisions if the device is user friendly? Mr. WIEDRICH stated the need to mitigate the fear of being sued. It is possible to harm someone with this device because of possible shock transmittal.

Rep. BRUCE ECKRE asked what are the dangers to the person that are delivering the procedure. Mr. WIEDRICH stated the dangers can be minor to extreme depending on the amount of shock

that the rescuer or bystander receives. The most dangerous situation would be if the defibrillation person would come in contact with the charge, it could result in their death.

DR. BOB OATFIELD, MD, American Heart Assn., testified. (Scientific Statement attached). In 1982-83 the Washburn Ambulance Service decided they wanted to supply a higher level of service to their constituency. They did on their own. Setup their own training program and used manual defibrillators, 120 hours long. Very little state representation but much federal government interest in public access to defibrillation. There is now international interest.

The risk is greater in a wet environment. The reliability is high. Liability issue - medical directors don't ask about it, or the ambulance services sign off so they are able to get equipment they need. It could conceivably cause problems doing that way.

They could potentially prescribe this device and send it home with high-risk patients. It is paid by Medicare.

About 30% of the ambulances services don't have these devices. The devices require training, retraining, certification, etc. and involvement of a medical director. Most of the training is to learn when to use the device and what to do once it's used. Look at Page 2 of handout statement. The key is that you have about 4 minutes of downtime after cardiac arrest and before treatment. Beyond 4 minutes, there is risk of brain damage. The device gives a window of opportunity at a small risk of cost, liability, and other issues. The City of New York has less than 1% survival rate after calling 911.

EMS went to 1000 cardiac arrests. The numbers are higher because EMS is not always called. About 50% of these people have sudden cardiac death and will have some treatable form of

mechanical heart problem, i.e. coronary artery disease, and a good portion of the remainder will be treatable by plantable defribrillators.

Very important for committee to consider putting in a reporting aspect so we can track how these devices are used, when and what the length of time is, or what the survival rate is. It is written in through the use of the defibrillator through Health and Human Services. There is funding.

Rep. CAROL NIEMEIER asked what is the automatic capability provided over the manual?

DR. OATFIELD stated the manual requires that trained people sit and look at the rhythm on a monitor screen. The automatic is within the black box and when hooked up to the patient, it analyzes the rhythm and then gives directions for further procedure, i.e., the average length time for the paramedic to make the decision to defibrillate someone is about 90 seconds. The machine does it in about 11 seconds.

DERICK HANSON, ND EMS Association, AMHA, testified several years ago the AMHA came forth with a major goal which was to get defibrillators out in as many areas as possible, i.e., law enforcement vehicles, fire trucks, volunteer companies, shopping malls, etc. In regard to the ambulance services, the Advanced Life Support Services (ALS) are required to carry a defibrillator on board the paramedic services. Of the Basic Life Support Services (BLS), it is optional. We have not made that mandatory because many are rural and funding is an issue.

Rep. NIEMEIER stated concern for devices placed in public places and asked if it would be placed in a secured area? MR. HANSON stated that he thought that it would most likely be secured. Rep. NIEMEIER stated she wasn't thinking of theft but more that it could possibly be used as a weapon. MR. HANSON said that people would still put it behind a desk or in a locked box.

Rep. PRICE asked what is the cost of the machines? MR. HANSON said $2,800.00 to $7,000.00. Rep. PRICE asked if this went into effect, would the Health Department do some type of follow-up that machines are tested and do continuing education on the people using it? MR. HANSON stated that it is already in the program and can't speak for them as to there being a formal follow-up in writing.

NEUTRAL TESTIMONY

ARNOLD THOMAS, President, ND Health Care Assn., questioned Section 1., No. 1., the requirement that every person who acquires an automatic external defibrillator shall report possession of... Would that be the bill's intent to require a hospital that would possess a defibrillator as part of it's normal equipment inventory to report such a possession?

Rep. PORTER said it would not have that requirement. The intent of this legislation is to only require those who will fall under this particular piece of legislation that report. Rep. PRICE stated we will verify that with Legislative Council.

VINCE FIEST testified that he had a heart attach and stroke about two years ago. The ambulance had a defibrillator and it helped. He is thankful.

SANDI TALKINGTON, American Red Cross, testified. (Testimony and brochures attached.)

DICK PECK, ND Peace Officers Assn., testified they wanted to support this bill because if passed, this equipment will save more lives.

Rep. PRICE asked if it passed, would a number of law enforcement agencies look at purchasing the equipment. MR. PECK said yes, we have officers who are trained in EMT.

DAVID PESKE, ND Medical Assn., testified the AMA committee encouraged strong support for the bill.

Rep. ECKRE asked if he had any problem with the Red Cross being trained on the equipment.

MR. PESKE stated he did not. DR. OATFIELD stated he did not.

TESTIMONY IN OPPOSITION

None.

Hearing Closed at 10:40 AM

Tape 2, Side B, Meter 44.3 - End and Tape 3, Side A, Meter 0.0 - End.

COMMITTEE WORK Rep. Blair Thoreson is present.

Rep. PORTER moved to Adopt Amendment No. 90390.0101.

Rep. METCALF second the motion.

Committee discussion.

ROLL CALL VOICE VOTE # 5: 13 yeas, 0 nays, 2 absent. Amendment is adopted.

Further Committee discussion.

Rep. METCALF moved DO PASS AS AMENDED.

Rep. JENSEN second the motion.

ROLL CALL VOTE # 6: 13 yeas, o nays, 2 absent. Motion Passed.

90390.0101
Title.0200

Prepared by the Legislative Council staff for
Representative Porter
January 18, 1999

VR
1/19/99

PCUSE AMENDMENTS TO HOUSE BILL NO. 1242 **HUMAN SERVICES 1-19-99**

Page 1, line 5, replace "Every" with "Except for a medical services facility or prehospital emergency medical services provider, every"

Page 1, line 9, after "association" insert "or American red cross"

Renumber accordingly

Date: 1-18-99
Roll Call Vote #: 2

1999 HOUSE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 1242

House Human Services Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number _____

Action Taken Adopt Amendment

Motion Made By Porter Seconded By Metcalf

Representatives	Yes	No	Representatives	Yes	No
Clara Sue Price - Chairwoman	X		Bruce A. Eckre	X	
Robin Weisz - Vice Chairman	X		Ralph Metcalf	X	
William R. Devlin	X		Carol A. Niemeier	X	
Pat Galvin	X		Wanda Rose	X	
Dale L. Henegar	X		Sally M. Sandvig		
Roxanne Jensen	X				
Amy N. Kliniske					
Chet Pollert	X				
Todd Porter	X				
Blair Thoreson	X				

Total Yes 13 No 0
Absent 2

Floor Assignment _____

If the vote is on an amendment, briefly indicate intent:

HB 1242

Date: 1-18-99
Roll Call Vote #: 6

1999 HOUSE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. 1242

House Human Services Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number DO PASS AS AMENDED

Action Taken _____

Motion Made By Metcalf Seconded By Jensen

Representatives	Yes	No	Representatives	Yes	No
Clara Sue Price - Chairwoman	X		Bruce A. Eckre	X	
Robin Weisz - Vice Chairwoman	X		Ralph Metcalf	X	
William R. Devlin	X		Carol A. Niemeier	X	
Pat Galvin	X		Wanda Rose	X	
Dale L. Henegar	X		Sally M. Sandvig		
Roxanne Jensen	X				
Amy N. Kliniske					
Chet Pollert	X				
Todd Porter	X				
Blair Thoreson	X				

Total (Yes) 13 No 0

Absent 2

Floor Assignment Porter

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

HB 1242: Human Services Committee (Rep. Price, Chairman) recommends **AMENDMENTS AS FOLLOWS** and when so amended, recommends **DO PASS** (13 YEAS, 0 NAYS, 2 ABSENT AND NOT VOTING). HB 1242 was placed on the Sixth order on the calendar.

Page 1, line 5, replace "Every" with "Except for a medical services facility or prehospital emergency medical services provider, every"

Page 1, line 9, after "association" insert "or American red cross"

Renumber accordingly

1999 SENATE HUMAN SERVICES

HB 1242

1999 SENATE STANDING COMMITTEE MINUTES

BILL/RESOLUTION NO. HB1242

Senate Human Services Committee

❑ Conference Committee

Hearing Date MARCH 17, 1999

Tape Number	Side A	Side B	Meter #
1	X		
Committee Clerk Signature	Carol Kolodziechuk		

Minutes:

The committee was called to order by SENATOR THANE.

REPRESENTATIVE TODD PORTER, sponsor or the bill introduced it in written testimony.

SENATOR KILZER asked how much it cost? REP PORTER: About $2500 is least expensive unit. It is now sold only to certified entities; I think it will come down in price as use increases.

TIM WIEDRICH, ND Health Dept., supports bill. The time of response for ambulance is about 7 minutes. When a person is in cardiac arrest, brain damage can start to occur earlier than that. While the EMS system is effective and responds as quickly as possible it would be much to the benefit of the patient if the public would have access to these devices to facilitate the people that need these services. SENATOR LEE: Who would use them - fire departments? MR. WIEDRICH: It goes well beyond that because the departments of fire, EMS providers, police, are all part of the system now that use them. Public access would be folks like Kirkwood Mall

security officers, power plants, businesses. SENATOR DEMERS: Explain the last line of the bill, please. MR. WIEDRICH: If other good Samaritan statutes would be applicable to the situation this would not usurp this. Passage of this would not be nullified by this.

DEREK HANSON, ND EMS Association President, demonstrated the machine. Many heart deaths could be prevented if we could get treatment to the patient promptly. If the patient is not treated in 4-8 minutes, the patient will die. 90 out of 101 cases were successfully resuscitated with the shock unit alone. The unit will talk to you and tell you what to do. It will continue until a rhythm is picked up in the heart and the need has diminished. CPR is also going to be very important. It is still a big part of the program. SENATOR KILZER: When you referred to the 2000, how was that verified? That was based on EMS assessment based on ambulance run reports.

SANDY TALKINGTON, Red Cross, supports bill in written testimony.

DAVE PESKE, ND Medical Association, supports bill.

DICK PECK, ND Sheriff Deputy and Police Chief, supports bill. There is a need for this to help save lives. SENATOR KILZER asked where the training was. MR. PECK answered at the academy or in-house, departments, conferences. SENATOR THANE: Is retraining necessary and what is the time for retraining? MR. WEIDRICH answered training is only two hours minimal. It is not ongoing because the device basically walks you through. There is an education piece mandated beyond two years. CPR training is recertified every year. SENATOR DEMERS: The greatest point is using it on someone not needing it. MR. WEIDRICH: The unit responds only to people in need. If heart doesn't need it the machine will be deliver. It is recognized as being safe.

JUNE HERMAN, American Heart Association, supports bill in written testimony. SENATOR DEMERS: Flight attendants would profit, but what provisions for crossing the state line have been made? MR. WEIDRICH: United and American Airlines have defibrillators on planes and Northwest is also looking at it.

No opposition

The hearing was closed on HB1242.

SENATOR DEMERS moved a DO PASS. SENATOR LEE seconded it. Roll call vote carries 6-0-0. SENATOR KILZER will carry the bill.

Date: 3/17/99
Roll Call Vote #: 1

1999 SENATE STANDING COMMITTEE ROLL CALL VOTES
BILL/RESOLUTION NO. HB 1242

Senate HUMAN SERVICES COMMITTEE Committee

☐ Subcommittee on _____
or
☐ Conference Committee

Legislative Council Amendment Number _____

Action Taken Do Pass

Motion Made By Sen DeMers Seconded By Sen Lee

Senators	Yes	No	Senators	Yes	No
Senator Thane	✓				
Senator Kilzer	✓				
Senator Fischer	✓				
Senator Lee	✓				
Senator DeMers	✓				
Senator Mutzenberger	✓				

Total 6 (yes) 0 (no)

Absent 0

Floor Assignment Sen Kilzer

If the vote is on an amendment, briefly indicate intent:

REPORT OF STANDING COMMITTEE

HB 1242, as engrossed: Human Services Committee (Sen. Thane, Chairman) recommends **DO PASS** (6 YEAS, 0 NAYS, 0 ABSENT AND NOT VOTING). Engrossed HB 1242 was placed on the Fourteenth order on the calendar.

1999 TESTIMONY

HB 1242

HOUSE OF REPRESENTATIVES HUMAN SERVICES COMMITTEE
REPRESENTATIVE CLARA SUE PRICE, CHAIRMAN
JANUARY 18, 1999

TESTIMONY BY
REPRESENTATIVE TODD PORTER

IN SUPPORT OF HB1242

Chairman Price and members of the Human Services Committee my name is Todd Porter, Representative from District 34 in Mandan. I stand before you in favor of HB1242.

HB 1242 if enacted would allow the general public to utilize automatic defibrillators. These devices currently are available only to certified emergency responders. This bill through the proper education, would allow a trained individual to place and use the device on patients suffering from cardiac arrest. There are individuals here today that will give the Committee statistical information regarding the general public benefit by enacting this legislation.

The individuals wanting to use these devices would be required to complete training as outlined in a national curriculum prepared by the American Heart Association and establish protocols that test the devices and ensure that the proper notification of the local Emergency Medical Services occur if they use the device.

This bill also affords Good Samaritan coverage to the operator of the device along with the individuals responsible for training, including any volunteer physician input.

I would be more than happy to answer any questions at this time the committee my have.

Testimony for House Bill 1242
before the
Human Services Committee
by
Timothy Wiedrich, Director
Division of Emergency Health Services
North Dakota Department of Health

January 18, 1999

Cardiac arrest is a significant problem in North Dakota. The ambulance run report system indicates that North Dakota ambulance services have responded to 1,972 cardiac arrest calls between 01/01/94 and 11/09/98. The two predominant locations for these calls were private residences (1196 actual, 61% of the total) and public areas (101 actual, 5% of the total). The median time lapse for these cardiac arrest calls from the time the ambulance was summoned until arrival at the patient's side was seven minutes. A full 30% of North Dakota ambulance services do not provide defibrillation services. Typically these services are not provided because the ambulance service lacks sufficient resources to implement a defibrillation program.

This data indicates that public access defibrillation can potentially save lives in North Dakota. Response time and appropriate treatment are critical in treating cardiac arrest. For persons experiencing a type of cardiac arrest called ventricular fibrillation, providing defibrillation is the only treatment which has the potential to be life saving.

Automatic defibrillation devices have been shown to be safe, effective and relatively simple to use. Appropriate placement of these devices can reduce the amount of time between the onset of cardiac arrest and the time defibrillation is delivered. This bill establishes liability protection to those engaging in providing defibrillation services and the owner of the property where defibrillation has been performed. These liability protections are necessary to encourage appropriate placement of the devices and reduce the fear of persons using the devices. Additionally, the bill defines minimal training standards for persons likely to engage in the provision of defibrillation.

We believe that increased availability of automatic defibrillation has the potential to save lives and we support the passage of this bill.

American Red Cross

Madam Chair and Committee Members,

My name is Sandi Talkington, Executive Director of the Burleigh-Morton Chapter of the American Red Cross. I am here today to support House Bill 1242 as a representative of all North Dakota Red Cross Chapters.

The American Red Cross supports training in Automated External Defibrillation (AED) for individuals who have a legal responsibility to provide emergency care, including fire fighters, police, emergency medical personnel and lifeguards. In addition the American Red Cross supports the expansion of AED training to the general public for people who may have a need- such as individuals who have family members with cardiac problems, or other potential responders such as worksite safety or security personnel.

The American Red Cross would also support legislation to ensure access to emergency medical services, requiring that AEDs be available at public access sites such as office buildings, auditoriums, and other sites where large numbers of people gather.

More than 350,000 Americans suffer from a sudden cardiac arrest each year. Less than 10 percent will be discharged from a hospital alive. Cardiopulmonary resuscitation(CPR) started promptly can help save lives. However, CPR by itself is most often insufficient to correct the problem. In more than two-thirds of all cardiac arrests, an electric shock, known as defibrillation, is needed. Studies show that prompt CPR followed by early defibrillation - a key component in the chain of survival- can reduce death from sudden cardiac arrest.

By enacting legislation to support the use of AEDs and by increasing the number of individuals that are trained to respond, the survival rate can be increased significantly. Both AED pilot programs and established programs have reported out-of-hospital cardiac arrest survival rates as high as 58 percent.

Training, public access and widespread availability of AEDs has the support of multiple professional medical organizations in addition to the American Red Cross including the American Heart Association, American Academy of Pediatrics, American College of Cardiology, International Association of Fire Chiefs, and the Association of State EMS Directors.

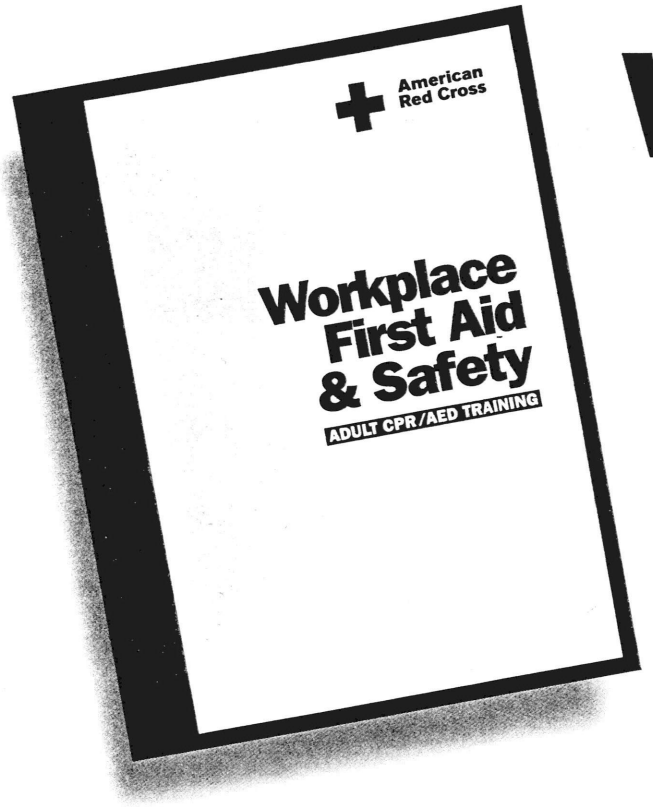
Currently the American Red Cross provides 3 avenues of training in the use of AEDs. This includes a supplemental module to the Emergency Response (first responders) Program, a 4 hour course for professional rescuers- such as police, lifeguards, and fire and rescue personnel, and a 4 hour course that teaches basic adult CPR and AED skills to lay rescuers.

The American Red Cross has been recognized for over 85 years as a leader in providing safety training because of its standards and certification requirements. I ask that House Bill 1242 be amended in Section 1.1.b to include the American Red Cross training along with the American Heart Association as is already in current North Dakota law regarding CPR for child care workers.

Thank you for the opportunity to speak to you today, and I would answer any questions you may have.

New!

This on-the-job training can save a life!



Workplace First Aid & Safety

ADULT CPR/AED TRAINING

Every minute of every day, sudden cardiac arrest claims another victim. Thousands of dollars are lost annually by employers who must cope with the human resource and risk management issues resulting from this debilitating crisis. But with CPR and defibrillation training, literally thousands of employees' lives can be saved.

Now the most trusted name in first aid and safety, the American Red Cross, can provide this critically important training. Designed especially for business and industry, Red Cross' newest program focuses on the lay rescuer in the workplace. It combines OSHA-compliant Adult CPR and Automated External Defibrillation (AED), the two skills needed to save the life of a sudden cardiac arrest victim.

The **American Red Cross Workplace First Aid & Safety: Adult CPR/AED Training Program** includes:

- ✔ key knowledge and skill elements of OSHA-compliant Adult CPR and the use of an AED
- ✔ a unique skills card enabling employees to continue practicing the training after course completion, increasing their retention and maximizing training dollars
- ✔ interactive training which utilizes practice scenarios and video that reflect employees' worksites to keep them engaged
- ✔ training that can be conveniently provided at the worksite
- ✔ training that can be completed within 4.5 hours to maximize employee productivity

Adult CPR/AED Training course materials include:

- ✔ Skills Card *(Stock No. 656551)*
- ✔ Instructor's Manual *(Stock No. 656552)*
- ✔ Video *(Stock No. 656554)*

AEDs at work save lives!

For more information, call your local American Red Cross chapter.

American Red Cross

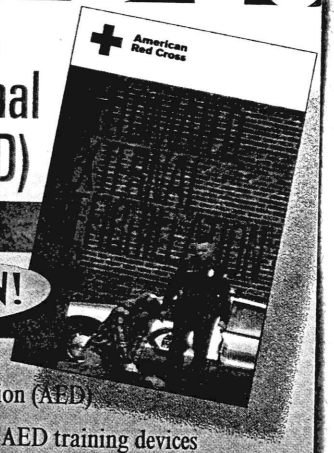
ARC Stock No. 656556

American Red Cross

[redacted]p into the and learn AED from someone you TRUST.

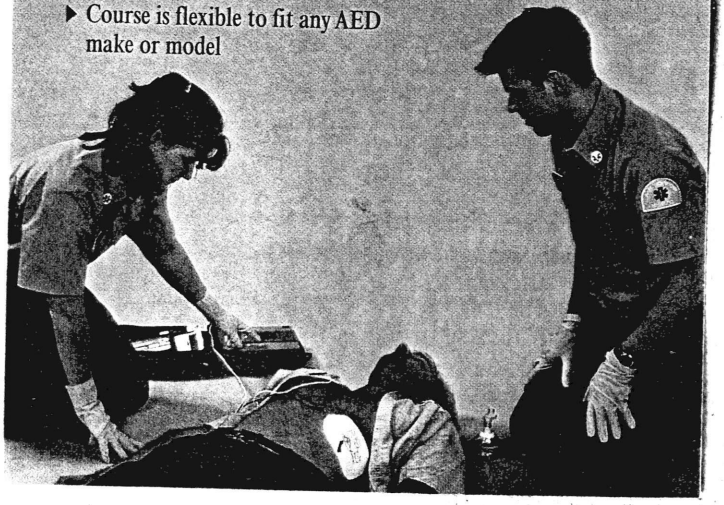
American Red Cross

Automated External Defibrillation (AED) TRAINING



Features: NEW!

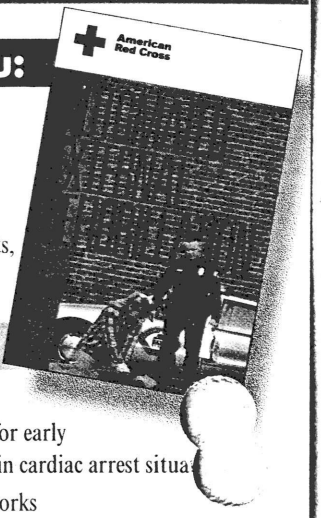
- A 4-hour course focusing solely [redacted]tomated external defibrillation (AED)
- [redacted]ides hands-on practice using AED training devices
- [redacted]s-based video reinforces all the points in the chain of survival
- Participant's manual makes a convenient "take-along" reference
- Course is flexible to fit any AED make or model



Automated External Defibrillation (AED)

TRAINING

Designed for you:



Professional rescuers, including traditional and nontraditional first responders, such as law enforcement personnel, fire fighters, EMS personnel, lifeguards, flight attendants, and industrial response teams

You will learn:

- The basics of automated external defibrillation, including rationale for early defibrillation and the role of CPR in cardiac arrest situa
- What defibrillation is and how it works
- General steps for safely using an automated external defibrillator (AED)
- Precautions to take when using an AED
- What special situations can arise when using an AED
- Elements which should be considered when establishing an early defibrillation program

For more information on taking AED training, or becoming an instructor, contact your local American Red Cross today!

American Red Cross

Stock No. 657714

therapeutic alternative (such as colchicine), there are several points that need to be clarified: in which group of patients and at what dose will colchicine be more efficient? What is the best form of initiating treatment? Is it necessary to administer an "attack dose"? How long should colchicine be administered? It is necessary for treatment to be individualized for each patient. As an example, it is worth commenting on one of the five patients studied since our paper[2] was prepared. This was a 28-year-old patient who had presented with more than 15 crises of recurrent idiopathic pericarditis over the last two years (several crises accompanied by pericardial effusion). Each time the dose of corticoids was reduced below 15 mg/day there was a new attack of pericarditis. Furthermore, the prolonged corticoid treatment was beginning to cause secondary effects (symptomatic osteoporosis). The patient was therefore referred to our cardiac surgery service for pericardiectomy. As a last alternative before surgery, we began treatment with colchicine (1 mg/day) and the dose of prednisone was reduced very slowly. The patient presented with a new crisis of pericarditis when the dose of prednisone was reduced to 7.5 mg/day. Keeping in mind this partial response to colchicine, we increased the dose of prednisone to 15 mg/day and that of colchicine to 2 mg/day, and again slowly decreased the steroid dosage. The colchicine was well tolerated although there were isolated episodes of mild diarrhea. After various attempts we were able to totally discontinue the corticoids, and the patient has been totally asymptomatic for 5 months and without treatment.

In conclusion, we would like to emphasize that our results should be taken as preliminary only. To remove these doubts it is essential to carry out a double-blind study in a large group of patients. Nevertheless, from the results obtained to date in three different centers, it seems evident that colchicine can solve the problem of recurrences in a considerable percentage of patients.

J. Guindo, MD
A. Rodriguez de la Serna, MD
M.A. de Miguel Diaz, MD
A. Bayés de Luna, MD
Departments of Cardiology and Internal Medicine

J.M. Caralps, MD
Cardiac Surgery
Hospital de Sant Pau
Barcelona, Spain

References

1. Millaire A, Goullard L, de Groote P, Ducloux G: Use of colchicine in acute or recurrent pericarditis (abstract). *Eur Heart J* 1990;11:409
2. Guindo J, Rodriguez de la Serna A, Ramió J, de Miguel Diaz MA, Subirana MT, Perez Ayuso MJ, Cosín J, Bayés de Luna A: Recurrent pericarditis: Relief with colchicine. *Circulation* 1990; 82:1117–1120

Dr. Hatfield

AHA Medical/Scientific Statement

State-of-the-Art Review

Improving Survival From Sudden Cardiac Arrest: The "Chain of Survival" Concept

A Statement for Health Professionals From the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee, American Heart Association

Writing Group

Richard O. Cummins, MD, MPH, MSc; Joseph P. Ornato, MD; William H. Thies, PhD; and Paul E. Pepe, MD

Committee Members

John E. Billi, MD; James Seidel, MD, PhD; Allan S. Jaffe, MD; Loring S. Flint, MD; Sidney Goldstein, MD; Norman S. Abramson, MD; Charles Brown, MD; Nisha C. Chandra, MD; Edgar R. Gonzalez, PharmD, RPh; Lawrence Newell, EdD, NREMT-P; Kenneth R. Stults, MS, PAC; and George E. Membrino, PhD

Overview

More people can survive sudden cardiac arrest when a particular sequence of events occurs as rapidly as possible. This sequence is 1) recognition of early warning signs, 2) activation of the emergency medical system, 3) basic cardiopulmonary resuscitation, 4) defibrillation, 5) intubation, and 6) intravenous administration of medications. The descriptive device "chain of survival" communicates this understanding in a useful way (Figure 1). While separate specialized programs are necessary to develop strength in each link, all of the links must be connected. Weakness in any link lessens the chance of survival and condemns the efforts of an emergency medical services (EMS) system to poor results. The chain of survival concept has evolved through several decades of research into sudden cardiac arrest. Effective system interventions have been identified that will allow survivors to remain neurologically intact. While a few urban systems may have approached the current practical limit for survivability from sudden cardiac arrest, most EMS systems, both in the United States and other countries, have defects in their chain. Poor resuscitation rates have been the rule. This statement describes the research supporting each link and recommends specific actions to strengthen the chain of survival.

"Improving Survival From Sudden Cardiac Arrest: The 'Chain of Survival' Concept" was approved by the American Heart Association SAC/Steering Committee on October 17, 1990.

Requests for reprints should be sent to the Office of Scientific Affairs, American Heart Association, 7320 Greenville Avenue, Dallas, TX 75231.

The Links in the Chain of Survival

The Early Access Link

The chain of survival begins with early access, in which the patient is helped as quickly as possible. Early access includes the implied component of early recognition. The resuscitation chain is initiated when a medical emergency is recognized and the emergency medical system accessed and activated.[1] The time required for access begins the moment an emergency is recognized, by either the person with symptoms or a witness to the emergency. With sudden cardiac arrest, access time begins at the moment of collapse and includes recognition of the emergency, the decision to make the call, time spent locating a telephone and emergency number, interrogation of the caller by the emergency dispatcher, and the decision to send an emergency vehicle. The dispatcher may need additional time to route the call to the proper response station or vehicle (call-processing time). Once the responder is notified, ambulance response time begins. Ambulance response time is the interval from receipt of the call by the emergency responder to

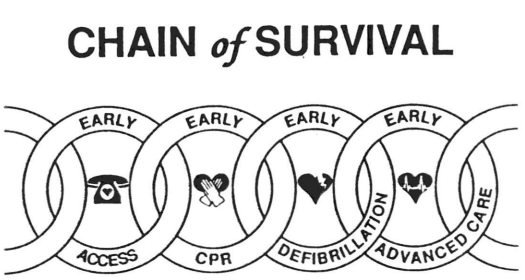


FIGURE 1. *Sequence of events in emergency cardiac care is displayed schematically by "chain of survival" metaphor.*

arrival of emergency personnel at the scene. Additional time may elapse before the responder actually examines the patient. Recognition, call processing, and ambulance response time add seconds, typically minutes, to the critical interval between arrest and initiation of emergency treatment.

The most common approach to shorten the interval between collapse and arrival of emergency personnel has been to acquire more ambulances,[2,3] which is both expensive and inefficient, especially if the EMS system is established. Studies have shown that after a certain point an increase in the number of ambulances fails to lower response time significantly.[4] In one model, response time varied inversely as the square root of the number of vehicles per square mile; an 80% increase in the number of vehicles reduced average response time by only 1 minute.[4] This same 1-minute reduction in average response time could be achieved by greater public awareness and more efficient dispatching systems, and at far less cost.

The early access link can be strengthened through public education, especially persons most likely to witness a cardiac arrest, and by installation of an efficient emergency communication system. Educational and public service programs such as those of the American Heart Association[1] and the American Red Cross[5] are designed to make the public aware of what to do when cardiac arrest occurs. Participants in classes on cardiopulmonary resuscitation (CPR) and AHA-sponsored schoolsite and worksite training learn the warning signs of heart attack, how to recognize a person in cardiac arrest, and to quickly call the EMS system when a person collapses. Persons who are uninformed about chest pain and respiratory distress may not comprehend signs of an impending cardiac arrest. When a person collapses, such a witness may wait a long time before calling the emergency dispatch center. A witness may telephone neighbors, relatives, or even his or her personal physician before calling the emergency number, as observed in both central London[6] and rural Iowa.[7] In Belgium and Holland it is almost the rule to first call the local physician. This poses a problem in terms of early defibrillation because physicians are less likely to carry defibrillators than emergency responders. In Iowa a "phone first" program has been started to achieve immediate notification of the EMS system when a person collapses.[7] Such educational campaigns may become more widespread. Early access ensures that precious minutes are not wasted at the start of cardiac arrest.

Lack of a three-digit 911 emergency dispatch system (or its equivalent) can produce confusion and delays because witnesses may call the wrong number, call multiple numbers, or spend time searching for the number. In one community in North Carolina, 85 different emergency numbers are listed in the local telephone book.[8,9] In contrast, in Seattle, Washington, which has an enhanced 911 system, 90% of 1,271 people interviewed identified 911 as their EMS notification number.[10] Investigators from Minneapolis who performed a before-and-after evaluation of a 911 system[11] noted that the percentage of emergency callers who could activate the EMS system in less than a minute rose from 63% before implementation of the system to 82% afterward. The percentage of callers who made only one telephone call to activate the system went from 40% before the 911 system was started to 74% after the system began.

Another study showed that imprecise knowledge of how to notify the emergency system can cause confusion and delays.[12] In this telephone survey, people living in 911 system communities knew the correct number to call 85% of the time; in regional systems with several fire departments operating from one dispatching center, people knew the correct number to call only 47% of the time; in systems with a local seven-digit number for a particular fire district, people gave the correct number only 36% of the time. Many people who lived near a 911 area thought 911 was their emergency number; when they mistakenly called 911, delays of 30 seconds to 2 minutes resulted. Establishment of a 911 emergency system is a key step. Given the transient and mobile nature of today's population, a universal access number must be adopted by EMS systems. By 1992 a common emergency telephone number will be introduced in the European community and will cover a population of more than 350 million.

The Early CPR Link

The next link in the chain of survival is early initiation of basic CPR.[1,13] Basic CPR should be started immediately after cardiac arrest is recognized and should coincide with efforts to gain access to and activate the EMS system. EMS systems should rely on trained citizens rather than emergency responders to initiate CPR. With rare exceptions, initiation of CPR by emergency personnel is too late. Only systems with rapid response times, such as that in Milwaukee, Wisconsin,[14,15] can employ EMS providers as the primary initiators of CPR.

For almost 3 decades the chest compressions and positive pressure ventilations of standard CPR have helped return pulseless, nonbreathing patients to spontaneous respiration and cardiac perfusion.[16,17] The value of early CPR is that it can buy time for the primary cardiac arrest patient[1,13,18–22] by producing

enough blood flow to the central nervous system and the myocardium to maintain temporary viability. To do so, however, basic CPR must be started early, and the earlier the better. Initial CPR must be followed by rapid defibrillation, intubation, and administration of cardiovascular medications by EMS personnel.[23] Early bystander CPR is less helpful in resuscitation if EMS personnel equipped with the defibrillator arrive late, or about 8–12 minutes after collapse.[24] Recent data from the Belgium Cardio-Pulmonary-Cerebral Resuscitation Registry[18] and Scotland,[25] however, suggest some prolonged benefit from bystander CPR even with late arrival of advanced life support personnel. The combination of late CPR (more than 4 minutes) and late advanced life support (more than 12 minutes) is particularly lethal.[22,24,26] Several researchers have called these time dimensions the resuscitation "failure zone."[27]

Many reports contain data to compare the survival rates of cardiac arrest victims who receive early CPR (defined as citizen-initiated CPR) with the survival rates of those who receive late CPR (defined as emergency responder–initiated CPR).[22,24,28,29–42] Table 1 presents summary data from these studies, including estimated odds ratios for survival. Early CPR usually differs from late CPR by about 4 minutes. In all but one system, researchers observed a positive benefit of early CPR when they compared survival rates between persons who received early CPR and those who received late CPR. The magnitude of this contribution may be considerable since the odds ratios for improved survival with early CPR can range as high as 11.5 (Table 1). In Milwaukee,[14,36] the only system in which this benefit was not observed, emergency personnel performed late CPR an average interval of only 2 minutes after early bystander-initiated CPR. Thus the data from Milwaukee simply compare early CPR with even earlier CPR. The similar survival rates for people who received bystander CPR compared with those deprived of bystander CPR are not surprising and provide additional support for the concept of a narrow window of CPR effectiveness.[38] The association between early CPR and improved survival appears related to the effect of basic CPR on ventricular fibrillation.[18,38,43,44] Researchers have observed that when rescuers start CPR early, the patient is more likely to be in ventricular fibrillation when a monitoring unit arrives.[44] Investigators in King County, Washington, observed that 80% of cardiac arrest victims were in ventricular fibrillation/ventricular tachycardia if they had received early bystander CPR, compared with 68% if they had received delayed CPR.[38] In Stockholm, 67% of people in cardiac arrest in whom CPR was started by bystanders were in ventricular fibrillation/ventricular tachycardia, whereas only 45% of persons not given bystander CPR were in ventricular fibrillation/ventricular tachycardia.[43] The Belgian Cardio-Pulmonary-Cerebral Resuscitation Registry has reported a 42% prevalence of ventricular fibrillation in cardiac arrest patients who received bystander CPR, compared with 29% in arrest patients who received delayed CPR.[18]

These three studies suggest that CPR prolongs the duration of ventricular fibrillation. In addition, they suggest that the presence of ventricular fibrillation operates as a dependent variable rather than an independent variable in analyses of survival data.[18,22] Victims who receive early CPR are also more likely after electrical shock to convert to a cardiac rhythm associated with restoration of spontaneous circulation.[22,26,38] In King County, Washington, persons in ventricular fibrillation when EMS personnel arrived had a 37% rate of long-term survival if they were given bystander CPR, compared with 29% if they were not.[38] In Houston, 40% of patients with ventricular fibrillation/ventricular tachycardia were discharged from the hospital if they had received bystander CPR, versus 19% for such patients not given bystander CPR.[22]

Several approaches ensure the performance of basic CPR by bystanders before emergency responders arrive. The most widely advocated is citizen CPR training. Community-based CPR training programs, endorsed and conducted by the American Heart Association and the American Red Cross, have trained millions of laypersons in CPR.[1] The American Heart Association has suggested that if 20% of adults were trained in CPR, morbidity and mortality from out-of-hospital cardiac arrest might be significantly reduced.[45] Some communities have actually achieved this level of adult training, despite physician reluctance to "prescribe" CPR training for family members and friends of high-risk patients.[10,46,47] In the Seattle area, for example, Leonard Cobb and coworkers[48] have trained over 2 million people. In Minneapolis a survey of 2,310 adults noted that 23% were trained in CPR.[49]

However, there are problems with the concept that a threshold level of citizen training can be "protective." Most people trained in CPR never see an arrest; most people who see an arrest have not been trained in CPR.[49,50] The Minneapolis survey found that only 10% of the population trained in CPR had witnessed a cardiac arrest[49] and only 30% of witnesses to a cardiac arrest had been trained in CPR. Only 19% of persons trained in Minneapolis continued retraining every year.[49] This figure nearly duplicates that in a report by Gombeski,[50] who noted that only 21% of their trainees returned for 1-year retraining.

Other data, however, suggest a more positive picture.[51–54] Eisenberg et al[51] observed that some knowledge of CPR techniques is so prevalent that many citizens attempt CPR without formal training. In addition, they perform CPR despite a high prevalence of disagreeable physical characteristics (the presence of saliva, blood, or emesis) encountered during performance of bystander CPR.[52] Cobb et al[53,54] observed that outcomes for CPR by untrained citizens is similar to outcomes for trained laypersons. The Belgian Cardio-Pulmonary-Cerebral Resuscita-

TABLE 1. Controlled Studies of Survival (Discharged Alive) From Out-of-Hospital Cardiac Arrest: Bystander Cardiopulmonary Resuscitation Compared With Late Cardiopulmonary Resuscitation

Location/system	Witnessed arrest	Rhythm	Number of patients	Discharged alive (*n*)	Odds ratio*
1. Oslo, Norway[28]	Not reported	Not reported	Bys CPR=75	36% (27)	6.7
EMTs only			Late CPR=556	8% (43)	
2. Birmingham[29]	Implied yes	VF or VT	Bys CPR=7	86% (6)	6.0
Paramedics only			Late CPR=12	50% (6)	
3. Seattle[30]	76% overall witnessed	VF only	Bys CPR=109	43% (47)	2.9
EMTs and paramedics			Late CPR=207	21% (43)	
4. Winnipeg[31]	Not reported	VF or VT	Bys CPR=65	25% (16)	6.2
EMTs only			Late CPR=161		
5. Iceland[32]	Not reported	All rhythms	Bys CPR=38	42% (16)	11.5
EMTs only			Late CPR=84	2% (2)	
6. Vancouver[33]	77% overall witnessed	All rhythms	Bys CPR=43	21% (9)	4.0
EMTs and paramedics			Late CPR=272		
7. Los Angeles[34]	41% overall witnessed	All rhythms	Bys CPR=93	22% (20)	5.6
Paramedics			Late CPR=150	5% (7)	
		VF only	Bys CPR=45	27% (12)	6.0
			Late CPR=70	6% (4)	
8. King County[13]	Not reported	All rhythms	Bys CPR=108	23% (25)	2.2
EMTs and paramedics			Late CPR=379	2% (45)	
9. Pittsburgh[35]	Not reported	VF/VT only	Bys CPR=25	24% (6)	4.3
Paramedics			Late CPR=59	7% (4)	
10. Milwaukee[36]	Witnessed only	All rhythms	Bys CPR=1,248	15% (182)	1.0
EMTs and paramedics			Late CPR=252	15% (38)	
		Coarse VF	Bys CPR=628	24% (148)	1.0
			Late CPR=151	23% (35)	
11. Michigan/Ohio[37] communities (EMTs and paramedics)	Not reported	All rhythms	Bys CPR=472	13% (56)	2.7
			Late CPR=1,367	5% (64)	
12. King County[38]	Both	All rhythms	Bys CPR=726	27% (196)	2.4
EMT-Ds and paramedics			Late CPR=1,317	13% (177)	
	Witnessed only	All rhythms	Bys CPR=579	32% (186)	1.7
			Late CPR=718	22% (158)	
13. York/Adams, Pa.[39]	Witnessed only	VF only	Bys CPR=157	22% (34)	4.5
EMTs and paramedics			Late CPR=225	6% (13)	
14. Tucson, Ariz.[40]	Witnessed only	All rhythms	Bys CPR=65	20% (13)	2.5
EMTs and paramedics			Late CPR=130	9% (12)	
15. West Yorkshire[42]	Not reported	All rhythms	Bys CPR=47	15% (7)	2.0
Ambulance personnel			Late CPR=50	8% (4)	
16. Belgium[41]	Not reported	All rhythms	Bys CPR=985	10% (98)	1.9
Ambulance Personnel			Late CPR=2,036	5% (109)	
17. Houston[22]	Both	Unmonitored VF/VT	Bys CPR=53	30% (16)	2.1
EMTs and medics			Late CPR=133	14% (19)	

EMT, emergency medical technician; EMT-D, emergency medical technician trained to defibrillate; VF, ventricular fibrillation; VT, ventricular tachycardia; Bys, bystander; CPR, cardiopulmonary resuscitation.

*Odds ratio is not a simple ratio of survival rates. It is calculated as the odds of surviving with bystander CPR (number discharged alive divided by number who die) divided by the odds of discharge alive for people who received late CPR (number discharged alive divided by number who die).

tion Registry has noted that the quality of bystander CPR is difficult to evaluate.[55] In Belgium the most common bystander CPR errors were omission of mouth-to-mouth ventilations, which occurred 46% of the time, and omission of chest compressions, which occurred 17% of the time.[55] Outcomes were significantly better when rescuers performed both ventilations and chest compressions, compared with ventilations alone or compressions alone.[55]

Another approach to early CPR is the concept of targeted CPR training.[10,53,54,56–59] Such programs are for persons who have an increased likelihood of having to perform CPR, including middle-aged persons, residents and staff of senior centers, survivors of

myocardial infarction, and family members of persons identified as having cardiac arrest risk factors. These programs are slowly becoming more widespread and represent an important change in the focus of CPR training. Much CPR training in the United States focuses on the young, especially school-age children and young adults,[57] who are easy to train and show energetic interest. However, they are not likely to witness a cardiac arrest or to take a CPR course. They do, of course, become the "future" performers of CPR as they enter the age group where risk increases. Cardiac arrest victims are typically aging men, who live at home[6,18,60] and are usually poorly educated and nonprofessional.[61] In King County, Washington, the average age of cardiac arrest patients is 65 years; 77% of cardiac arrests happen at home, and 75% of the victims are men.[60,62] Therefore, persons with the highest likelihood of witnessing a cardiac arrest and being called upon to perform CPR are those living with or closely associated with middle-aged men. Regardless of age, the prognosis for persons resuscitated from cardiac arrest, even the elderly (those over 70 years old), is excellent.[63,64] Unfortunately, few middle-aged women in the United States have received formal CPR training, and those who have received training seldom live with high-risk patients.[10,11] In one survey of people trained to perform CPR, only 7% lived with family members known to have heart disease.[10]

A final method to achieve early CPR is dispatcher-assisted CPR instruction, programs in which emergency telephone dispatchers offer CPR instructions to persons who call to report a cardiac arrest.[51,65–67] Delivery of instructions and performance of a complete CPR cycle of 15 chest compressions and 2 ventilations can be accomplished in 3–4 minutes,[51,65,67] even by persons who have never received CPR training. Telephone instruction also improves the quality of CPR performed by persons with prior CPR training in manikin simulations.[22,67] Panicked bystanders can be calmed and directed by dispatchers and encouraged to perform CPR, despite their alarm at the sudden sight of a loved one who is cyanotic and breathless. With this program, plus other educational efforts, the percent of cardiac arrests in which CPR was initiated by bystanders in King County, Washington, has increased from 30% in 1980 to 60% in 1988 (unpublished data).

The Early Defibrillation Link

The purpose of early defibrillation is to reestablish a normal spontaneous rhythm in the heart. Several new approaches can help achieve early defibrillation:

- Automated defibrillators used by the first responding emergency personnel
- Automated defibrillators used by community responders, that is, persons whose usual occupation or training does not require responding to emergencies
- Home defibrillation programs for high-risk patients
- Transtelephonic defibrillation

The rationale for early defibrillation emerges from data that demonstrate that almost 85% of persons with ambulatory, out-of-hospital, primary cardiac arrest experience ventricular tachyarrhythmias during the early minutes after collapse.[68] In one report 157 ambulatory (not hospitalized) patients experienced fatal arrhythmias during continuous cardiac monitoring.[68] The initial dysrhythmia in 62% of patients was ventricular tachycardia that quickly evolved to ventricular fibrillation, in 8% the dysrhythmia was primary ventricular fibrillation, and in 13% it was torsades de pointes. The duration of the ventricular tachycardia that preceded the ventricular fibrillation ranged from a few seconds to several minutes. This study involved a select population of patients who had some indication for ambulatory cardiac monitoring. Nevertheless, the rhythms they experienced are probably representative of the usual initial rhythms of the sudden cardiac arrest victim.

In prehospital studies, the rhythm of arrest cannot be identified until emergency personnel arrive with a defibrillator/monitor, 4–8 minutes later. In these studies the percent of people in ventricular tachyarrhythmias was lower, at 60% or less.[22,62] Most eventual survivors emerge from the group of people who remain in ventricular fibrillation when emergency personnel arrive. For example, in King County, Washington, over 92% of cardiac arrest survivors were from this group,[62] and over 80% in Houston.[22]

Additional evidence about the importance of early defibrillation comes from cardiac arrest experiences in supervised cardiac rehabilitation programs. On the rare occasion when a person in such a program experiences cardiac arrest, it is witnessed, CPR is started immediately, and defibrillation is performed within minutes. Fletcher and Cantwell[69] reported five cardiac arrests in a medically supervised exercise program; all were resuscitated. Haskell[70] reported that among 13,570 patients in 30 exercise centers, 50 cardiac arrests occurred and 42 (84%) were resuscitated. Hossack and Hartwig[71] observed 2,464 people in a supervised cardiac rehabilitation program over a 13-year period. In this group 25 men suffered a cardiac arrest, and all 25 (100%) were successfully resuscitated. Van Camp and Peterson[72] summarized the experience in 167 cardiac rehabilitation programs; 21 cardiac arrests occurred, and personnel resuscitated 18 (86%) without neurologic sequelae. The type of rhythm at arrest in these series was not reported, but sudden arrest during exercise suggests that the large majority of these patients were in ventricular fibrillation. Overall, of 101 cardiac arrests in these reports, staff members resuscitated 90 (89%) of the victims. This is the highest survival rate reported among defined population groups, and it confirms the value of immediate efforts in early CPR and defibrillation.

In England, general practitioners, the most frequent responders to patients with chest pain and cardiac arrest, have observed that early defibrillation alone produces successful resuscitations.[73] Many pa-

tients in Britain call their general practitioner during the early stages of a myocardial infarction. About 5% of these patients experience a cardiac arrest after the physician arrives.[74,75] The British Heart Foundation donated 78 defibrillators to 25 general practices and reported on the experiences after 1 year.[73] A total of 19 patients suffered cardiac arrest in the presence of a general practitioner who had a defibrillator: 13 (68%) were in ventricular fibrillation, nine were successfully resuscitated outside the hospital, and six were discharged from the hospital.[73]

In the earliest prehospital programs,[33–35,42,76–86] only paramedics provided defibrillation. In most studies of paramedic-only systems, the time between collapse and arrival of paramedics averaged more than 12 minutes. These programs therefore generally provide what is more correctly termed *late defibrillation.* Consequently, the reported survival rates for these systems have been modest, ranging from 7% to 18% for all rhythms.[87] Researchers in the early 1980s demonstrated the ability of personnel less well trained than paramedics, namely, emergency medical technicians (EMTs), to successfully use defibrillators.[88–91] Early defibrillation programs implemented for firefighters and minimally trained EMS first responders spread slowly, more often because of implementation barriers and administrative inertia than from doubt of clinical efficacy.[92,93]

The proposals to allow less well trained emergency personnel to operate defibrillators initially provoked controversy, but most concerns have since disappeared. Conceptually, early defibrillation programs represented the transfer of what was a medical act—diagnosis of the rhythm and operation of a defibrillator—into the hands of nonphysicians. Some authorities accepted the transfer of skills to paramedics. However, many authorities hesitated to permit defibrillation by less well trained emergency personnel. Rational reasons for this hesitancy vanished by the late 1980s with widespread acceptance of the principle of early defibrillation[1,20,23] and the success of automated external defibrillators.[94,95] Regrettably, in Germany, France, Japan, and other countries, medicolegal factors still prevent implementation of early defibrillation programs by nonphysicians.

The principle of early defibrillation holds that the professional rescuer who arrives first at the scene of a cardiac arrest should carry a defibrillator and be trained to operate it.[1,20,23] With few exceptions, the defibrillator should be automated and external.[93,94,96–102] Automated external defibrillators are highly accurate[98,99,101–103] and eliminate the need for training in the complex skills of rhythm recognition. The operator simply attaches the defibrillator's adhesive electrodes to the chest of the person thought to be in cardiac arrest. When activated by a single control, the device analyzes the rhythm, and if ventricular fibrillation or tachycardia is present, the device either charges and delivers a shock (automatic devices) or indicates to the operator that a shock is needed (semiautomatic, or shock-advisory, devices).[104,105] With shock-advisory devices, the operator delivers the shock by pushing a second control.[104,106] This simplicity of operation decreases the time and expense of initial training and continuing education and markedly increases the number of persons who can operate the devices. Clinical studies also show that systems using automated defibrillators can deliver the first shock up to 1 minute faster than conventional defibrillators because of the speed with which these devices can be attached and with which they operate.[98,99]

Each year more communities in the United States allow the use of both automated and conventional defibrillators by EMTs and by less trained personnel called *first responders,* a term that refers specifically to persons who have completed a 40-hour course. The term can refer to a much larger group of public safety employees, including firefighters, ambulance personnel, part-time emergency volunteers, police officers, highway patrol personnel, security guards, merchant marine sailors, and airline, railroad, and other public transportation vehicle crews.

Automated defibrillators are used by first responders around the world,[107,108] with early defibrillation programs in Scotland,[25] Denmark,[109] England,[6] West Berlin,[107,108] Norway,[110] Sweden,[43] Australia,[111] Singapore,[112] Finland, Belgium, and many other countries. By 1988, 37 states in the United States had passed legislation permitting early defibrillation by EMTs and, in some states, basic first responders.[113] An additional 10 states planned to initiate similar programs in 1989.[113] Many communities permit first-responder (usually firefighter) defibrillation, including Houston; Dallas; Memphis; San Francisco; Salt Lake City; Seattle; King County, Washington; and Eugene-Springfield, Oregon.[102,114–116] The International Association of Fire Chiefs has endorsed this concept and has started an initiative called *RapidZap,*[114–116] which has the goal of equipping all fire department emergency response vehicles with automated defibrillators by the year 2000. The fire chiefs adopted this concept not only out of concern to provide effective care for all citizens but also concern for the well-being of their personnel. Surveys of firefighter deaths have noted that the majority of on-duty deaths are due to sudden cardiac arrest.[117,118]

How effective are programs in which defibrillators are given to EMTs and first responders? Variable degrees of success have been observed in clinical studies thus far. The published survival rates for systems whose prehospital response teams consist only of EMTs trained in defibrillation range from 6% to 26% for patients found to be in ventricular fibrillation.[43,88,89,119–121] The most important comparison, however, is between the survival rate in communities before and after institution of an early defibrillation program. In suburban communities in King County, Washington, for example, the survival rate for patients in ventricular fibrillation increased from 7% to 26%.[88] Similarly,

TABLE 2. Effectiveness of Early Defibrillation Programs: Survival From Ventricular Fibrillation

Location	Before early defibrillation	After early defibrillation	Odds ratio for improved survival*
King County[88]	7% (4/56)	26% (10/38)	4.6
Iowa[90]	3% (1/31)	19% (12/64)	6.9
Southeastern Minnesota[119]	4% (1/27)	17% (6/36)	5.2
Northeastern Minnesota[77]	3% (3/118)	10% (8/81)	4.2
Wisconsin[122]	4% (32/893)	11% (33/304)	3.3

*The odds ratio is not a simple ratio of survival rates. It is calculated as the odds of surviving after an early defibrillation program (number who live divided by number who die), divided by the odds of surviving before an early defibrillation program (number who live divided by number who die).

in communities in Iowa it increased from 3% to 19%.[90] In southeastern Minnesota the survival rate was 4% without EMT defibrillation and 17% with such a program,[119] whereas in northeastern Minnesota the survival rate was 2.5% without and 9.9% with EMT defibrillation.[77] When an early defibrillation program was started in certain Wisconsin communities, the survival rate rose from 3.6% to 6.4% for all cardiac arrests and was 11% for patients initially noted to be in ventricular fibrillation (Table 2).[122] It is important to note that these programs should maintain and increase initial improvements in survival rates as experience and competency improve over time.

Home and community responder defibrillation programs. Two other techniques advocated to help achieve early defibrillation are home defibrillation programs for high-risk patients and early defibrillation by community responders. Community responders include public safety workers or laypersons who may have a perceived duty to respond to an emergency.[96,123–125] Although these approaches have been under evaluation for several years, their specific effects on community-wide survival rates from cardiac arrest have not been determined.[123] Moore et al[126] observed that of 95 survivors of ventricular fibrillation, only 63 (66%) were eligible for a home defibrillator, and only 38 of 47 (81%) persons approached agreed to participate. This suggests that approximately half (0.66×0.81) of ventricular fibrillation survivors would receive the device and appropriate training. McDaniel et al[127] also experienced recruitment problems in a similar home-defibrillation study. Only 8% of survivors of acute myocardial infarction participated in their study. The reasons for low participation included patients living alone, patients discharged to nursing homes, patients having no telephone, resuscitation considered medically inappropriate, implantation of automatic internal defibrillators, residence outside the study areas, no perceived chance of repeat cardiac arrest, religious objections, and elimination from the study at the demand of personal physicians.[126,127]

Nevertheless, enough experience has accumulated to establish the feasibility of training family members of high-risk patients and community responders to use automated defibrillators.[126–129] Despite some decline in skill retention and performance, family members and lay responders can remember most training and retain the skill for up to 1 year and can use the device at the moment of cardiac arrest of a family member or coworker.[128]

So far, only limited clinical experience demonstrates the practicality and effectiveness of home and community responder defibrillation programs. Chadda et al[130] reported a case series of 30 patients with witnessed cardiac arrest. Lay persons used automated defibrillators before the arrival of trained emergency personnel. Rescuers resuscitated eight of these patients to an organized rhythm associated with spontaneous circulation. Five were discharged from the hospital. Swenson et al[131] reported a series of 48 high-risk patients where the research team trained family members to operate automated defibrillators. Five cardiac arrests occurred in this series. The trained home responders used the automated defibrillator four times, and three patients had successful restoration of circulation.

Researchers from King County, Washington, however, have experienced less positive results with home[132] and community responder defibrillation.[128] Eisenberg et al[132] placed automated defibrillators in the homes of 59 persons who had survived prehospital cardiac arrest. Ten cardiac arrests occurred; home responders used the device in six patients. Only two patients were in ventricular fibrillation. One of the two patients was resuscitated but survived only a few months with residual neurological deficits. In another King County study, researchers placed 14 automated defibrillators in a variety of community settings and trained 146 lay people working in those settings to operate the device.[128] Only three cardiac arrests occurred. Recognition and operation errors prevented proper attachment and use of the defibrillator for all three patients. However, manufacturers have since developed simpler, lighter, and more sophisticated automated defibrillators with more user-friendly protocols and simpler placement of electrode pads. Researchers may achieve better results if they conduct future studies with the currently available devices.

In contrast, several other studies have achieved better results when automated defibrillators were placed with community responders. Weaver et al[133] trained 160 security personnel at the 1986 World's Exposition in Vancouver, British Columbia, to operate an automated defibrillator in the event of a cardiac arrest. There were five cardiac arrests among 22.1 million visitors. Rescuers used automated external defibrillation on each victim, two of whom were in ventricular fibrillation. Automated external defibrillation was successful in both patients, and sustained circulation returned. Both patients were moving and semiconscious by the time emergency personnel arrived. In England researchers placed automated external defibrillators on long-distance aircraft of an

international air carrier.[134] This preliminary study ceased when another company purchased the air carrier, but senior cabin attendants trained with great enthusiasm. Several other airlines are likely to implement similar programs in the near future. In London researchers trained conductors at several British Rail stations to operate automated defibrillators. There are early anecdotal reports of successful resuscitations.[134] High-risk or isolated industrial settings represent another interesting target group for implementation of early defibrillation programs. Safety personnel have, for example, placed and successfully used automated external defibrillators on oil platforms in the North Sea, at electricity plants, and on passenger cruise ships and merchant marine vessels.[95,100,110,130]

Future research will help establish the exact role of these innovative approaches. However, clinical evidence is insufficient to support widespread home placement of automated external defibrillators with high-risk patients. The evidence is more encouraging for busy public places such as airports, railway stations, convention centers, major hotels, and large public assemblies, and high-risk or remotely located industries with trained safety personnel.

Transtelephonic defibrillation. Transtelephonic defibrillation is a recently introduced method to provide early defibrillation.[135–137] However, it should not be classified with automated external defibrillation. In transtelephonic defibrillation a trained family member or other companion attaches adhesive monitor/defibrillator pads to a person with cardiac complaints or in cardiac arrest. The defibrillator pads are attached through cables to a home unit that then transmits the rhythm by telephone circuitry (either hard-wired or cellular) to a remote base station. Emergency personnel at the base station interpret the rhythm and make the decision to deliver a shock. Base station controls can be used to charge the home defibrillator unit and deliver the shock. A two-way speaker phone provides simultaneous voice communication between the home and the base station.

Researchers have confirmed this concept of remote defibrillation in hospital settings.[136,137] Physicians have attached the device to patients in one hospital location (usually a coronary care unit for elective cardioversions) and operated it from another. This approach offers potential advantages over automated external defibrillators when used in the home setting, including two-way voice communication, automatic dialing of 911, and transfer of decision making to emergency personnel.[138] Although approved for clinical use, clinical experience confirming the effectiveness of prehospital transtelephonic defibrillation is limited to a single patient, widely reported in the lay press.[139] It remains to be seen whether transtelephonic defibrillation will be considered cost-effective and put to major practical use. This doubt is especially valid since clinicians have already confirmed the ability of automated external defibrillators to interpret rhythms and deliver shocks satisfactorily.

The Early Advanced Cardiac Life Support Link

In many instances CPR and defibrillation alone do not achieve or sustain resuscitation. The unique interventions of the early advanced cardiac life support link—endotracheal intubation and intravenous medication—are necessary to further improve the chances of survival. In the United States, paramedics provide advanced cardiac life support for prehospital cardiac arrest patients.[140] Paramedics receive 1,000–3,000 hours of classroom training and field instruction and can provide intubation, defibrillation, and intravenous medications.

EMS systems in other countries provide many models of care. Some are more innovative than those used in the United States. There are no paramedics as such in Europe. Ambulance personnel in the first responding units are sometimes provided with extensive training, which may be from 400 to 500 hours. In Oslo, for example, ambulance personnel (equivalent to US basic EMTs) are taught to perform endotracheal intubation. In Holland a registered nurse who can operate a manual defibrillator arrives on more than 80% of the first-responding ambulances. Other systems, such as that in Göteborg, Sweden, use a second responding unit manned by specially trained nurses on 24-hour duty, similar to a US paramedic unit. Physician-manned mobile coronary care units are also common.

In other locations, especially in France, Israel, and Germany, and to a much lesser extent in England, Australia,[42] and Finland, emergency physicians (called *ambulance doctors*) provide advanced cardiac life support.[107] They respond in specially equipped vehicles, known as *doctor-manned ambulances.* Systems in the United States, however, abandoned programs with physicians or nurses on ambulances years ago because physician-staffed ambulances in the United States were considered an inefficient use of physician resources. In addition, paramedics can perform the same functions with comparable effectiveness.[140]

Physician-staffed ambulances in Europe, however, may well be more cost-effective than they are in the United States, depending on relative operating costs, professional salaries, population density, and combined services such as air rescue. In Norway, for example, nine doctor-ambulance units combined with helicopter services respond effectively to about 4,500 patients a year in a population service area of 4 million people. These units depend on public subscriptions and have been quite popular. In Australia several states and localities use a single-layer ambulance response. The ambulance training, however, includes both early defibrillation and administration of up to 20 drugs (but not intubation). The guiding principle in all systems, no matter how organized, is to provide the necessary treatment to the patient in the most timely and cost-effective manner.

TABLE 3. Range of Rates of Survival to Hospital Discharge for All Cardiac Arrest Rhythms and for Ventricular Fibrillation by System Type*

System type	Survival: all rhythms	Weighted average	Survival: ventricular fibrillation	Weighted averages for survival
EMT/AMB only	2–9%	5%	3–20%	12%
EMT/AMB-D	4–19%	10%	6–26%	16%
Paramedics/doctors only	7–18%	10%	13–30%	17%
EMT/AMB+paramedics/doctors	4–26%	17%	23–33%	26%
EMT/AMB-D+paramedics/doctors	13–18%	17%	27–29%	29%

EMT/AMB, Basic emergency medical technicians or ambulance personnel.[31,33,77,78,88,90,122,142,152,153]
EMT/AMB-D, Emergency medical technicians or ambulance personnel who are trained to defibrillate.[77,88,90,119,122]
Paramedics/doctors only, Ambulance vehicles staffed with paramedics or doctors.[6,33–35,76–86]
EMT/AMB+paramedics/doctors, Ambulance vehicles staffed with basic emergency medical technicians or ambulance personnel plus second response vehicles staffed with paramedics or doctors.[33,38,39,101,154–158]
EMT/AMB-D+paramedics/doctors, Ambulance vehicles staffed with emergency medical technicians or ambulance personnel who are trained to defibrillate, plus second response vehicles staffed with paramedics or doctors.[89,143]
*Data from 31 locations.

Defibrillation and advanced cardiac life support. Observers classically have considered defibrillation a part of advanced cardiac life support care. Now, however, early defibrillation is a separate link in the chain of survival. EMTs and other early responders[113] share this skill with paramedics, physicians, and nurses. Still, in view of the simultaneous therapies employed during a resuscitation attempt, it is difficult to separate the value of defibrillation from the value of intubation and intravenous medications.

What incremental benefit can be derived from these advanced procedures compared with defibrillation alone? Evidence from different locations, with different emergency response systems, sheds some light on this question. Differences in survival rates exist between a system that provides only early defibrillation and a system that provides both early defibrillation and early advanced cardiac care. These differences may indicate the additional benefit of advanced cardiac life support. In Iowa, for example, small communities that have provided early defibrillation without prehospital advanced cardiac life support care have achieved a ventricular fibrillation survival rate of 19%.[90] Meanwhile, suburban King County, Washington, which uses a tiered system (early defibrillation crews followed by advanced cardiac life support crews), has achieved an even greater survival rate. This system reports a 29% survival rate for patients with witnessed ventricular fibrillation arrest.[89] Emergency personnel resuscitated about 30% of persons who survived with defibrillatory shocks alone, either from emergency medical technicians trained to defibrillate (EMT-Ds) or from paramedics. These people did not require subsequent intubation or intravenous medications.[141]

The average survival rate for EMT-D–only systems has been 16%[43,90,119,120,142] (see Table 3). This rate refers to patients in witnessed cardiac arrest and in ventricular fibrillation. This is significantly lower than the average ventricular fibrillation survival rate of 29% in combined EMT-D and paramedic systems.[89,143] Paramedic-only systems have an average survival rate of 17%, almost exactly the same survival rate as EMT-D–only systems.[33–35,76–86] Paramedic-only and EMT-D–only systems average the same survival rate for a specific reason. In paramedic-only systems all advanced cardiac life support interventions (defibrillation, intubation, and administration of medications) are performed, but performed late. Only basic CPR and defibrillation are performed in EMT-D–only systems, but these interventions are performed much earlier.

These observations confirm that a considerable portion of all survivors are alive because of early defibrillation alone. These data also imply the important additional value of intubation and intravenous medications. Researchers think that these interventions not only promote return of spontaneous rhythm and circulation but also stabilize and maintain patients during the immediate postresuscitation period. Ventricular fibrillation survival rates in EMT-D–only systems (Table 3) can be compared with survival rates of tiered EMT-D/paramedics systems. Such a comparison hints at the relative value of these two system types. The table shows that EMT-D systems alone resuscitate about half of all potential ventricular fibrillation survivors.

Systems already staffed with paramedics or, as in Europe, with doctor-manned ambulances should consider the addition of a basic EMT- or ambulance-defibrillation program, which may significantly increase the ventricular fibrillation survival rate. However, no system should delay the start of an early defibrillation program because of the absence of paramedics or doctor-manned ambulances. In fact, some paramedic-only[42] or doctor-manned systems[73,111] have such long response times and such poor outcomes that they may be abandoned in favor of or supplemented by early automated defibrillation.

Resources may prevent establishment of a tiered response system that includes first-responder defibrillation as well as paramedics. In these circumstances, first-responder defibrillation, rather than paramedics alone, is probably the most efficient method to improve survival from cardiac arrest. For locations without an effective method of rapid deliv-

ery of prehospital defibrillation, the rational approach is to start with first-responder automated defibrillation. Innovative leaders in such locations as Japan,[144] Scotland,[25] Singapore,[112] England,[6] Norway,[110] Australia,[111,145] Sweden,[43] and Hong Kong[146] have all abandoned inappropriate plans to institute or continue paramedic systems. Instead, these programs are going directly to the more efficient and more effective approach of automated defibrillation.

Commentary

What is the maximum practical survival rate? The number of people resuscitated from sudden cardiac death by emergency personnel is not known. Nor is it known how many people can be resuscitated with a reasonable chance of surviving and remaining neurologically intact. Cardiac disease, in general, is the single greatest cause of death in the United States.[22,147] For the adult American population, epidemiologists have estimated the annual incidence of out-of-hospital sudden cardiac arrest at about 1 in 1,000 per year.[147] Other statistics from the American Heart Association are often quoted: 1.5 million "generic" heart attacks per year in the United States, of which 25%, or 350,000–400,000, die out of the hospital.[147] Though no national averages are available on the proportion of people who survive out-of-hospital cardiac arrests, current estimates suggest that no more than 1–3% of victims live to be discharged from the hospital. The true percentage is probably even less.[148]

It could be argued that the highest survival rates currently reported for out-of-hospital cardiac arrests are a reasonable target for all locations. While achievements of such survival rates are not practical in every community, this approach does expose the gap between what a community does achieve and what is possible. The highest published rates come from sophisticated urban/suburban systems like King County, Washington,[62] and Seattle.[143] Both can be described as mature EMS systems. Over the past 10–15 years these locations established strong links in the chain of survival. The annual survival rates for King County, Washington, from 1976 through 1987, fluctuate between 15% and 20% for all cardiac arrests and 25–30% for all patients in ventricular fibrillation (Figure 2). These overall survival rates, however, have remained moderately stable despite a number of system interventions, such as EMT defibrillation with manual defibrillators,[88] EMT defibrillation with automated defibrillators,[98] dispatcher-assisted CPR,[51] and transcutaneous pacing.[149] Therefore, this level of ventricular fibrillation survival may represent the practical limits for prehospital emergency care.

How many people would survive if all emergency medical systems in the United States approached the hypothesized maximum survival rate of 20% that occurs in these mature EMS systems? If an estimated 3% survival rate[148] is applied to the presumed annual 400,000 cardiac arrests, approximately 12,000 people

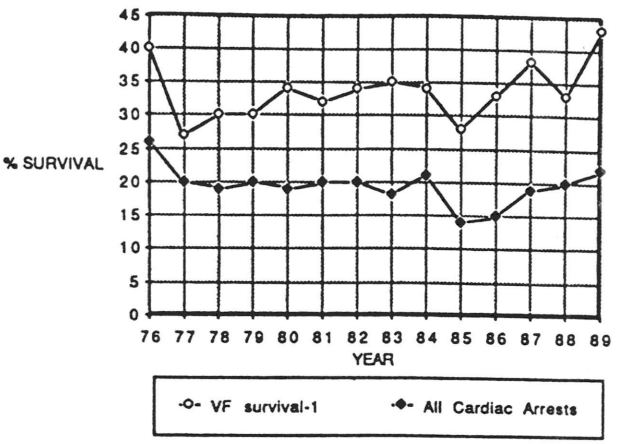


FIGURE 2. *Ventricular fibrillation survival rates over time. Percentage of people in nontraumatic cardiac arrest with initial rhythm ventricular fibrillation who survive to hospital discharge. Data from King County, Washington, Division of Emergency Medical Services, Seattle–King County Department of Public Health, Seattle.*

per year now survive out-of-hospital cardiac arrest.[147] A 20% survival rate for this population of nontraumatic cardiac arrest patients would yield 80,000 survivors, or an additional 68,000 people. The American Heart Association estimates that nationwide implementation of all life-saving emergency cardiac care mechanisms in each community may save between 100,000 and 200,000 lives annually in the United States.[1] Without proper implementation of a full prehospital care system, however, emergency services cannot achieve such rates. People not resuscitated before hospital arrival rarely survive.[150,151]

Design Imitation?

Is it possible for EMS systems to imitate the design of more successful locations and thus achieve the same survival rates? Table 3 summarizes data published on cardiac arrest survival from many cities worldwide.* These data show marked variation in survival rates among the different types of EMS systems, ranging from 5% to 17% survival for patients in all cardiac arrest rhythms and from 12% to 29% for patients specifically in ventricular fibrillation.

Simple structural imitation of successful EMS organizations, however, does not always succeed. Even in locations with similarly structured EMS systems, marked differences in the observed survival rates persist. For example, studies from 15 different paramedic-only or doctor-manned ambulance systems (Table 3, row C) reported survival rates from 7% to 18% for all rhythms and from 13% to 30% for ventricular fibrillation.[6,33–35,76–86] Table 3 summarizes results from nine EMT-paramedic systems (row D). These systems display the same wide variations.[33,38,39,101,154–158]

*References 31, 33–35, 38, 39, 43, 76–90, 101, 119, 120, 142, 143, 152–158.

It is unclear exactly why these differences occur within the same types of systems. Part of the explanation is that definition of terms and reporting of data are not standardized.[159] While some researchers have proposed uniform reporting systems, many others have pointed to the need for an international standardized nomenclature.[18,27,35,39,87,159,160] Regardless, part of these differences may very well be due to variable effectiveness or lack of EMS medical leadership and direction.[161–165]

It can also be argued that similarly constructed systems have different survival rates because they differ in how well they develop and implement each link in the chain of survival.[87,163,166] This appears particularly true for early initiation of CPR and early arrival of personnel trained to operate a defibrillator. Many cities in the United States, for example, established a strong link for early advanced life support by starting paramedic services at great expense and effort.[33–35,76–86] Most of these paramedic-only systems have achieved disappointingly low survival rates. In part this is because citizens in these locations seldom attempted to perform CPR. In addition, long paramedic response times, in the absence of an early defibrillation program, precluded early defibrillation and early advanced care. In paramedic-only systems, paramedics are generally preoccupied with many other minor emergencies and consequently are less available (and less skilled) to deal with cardiac arrest patients.[163]

To strengthen the early CPR link in the chain of survival, several EMS systems have mounted extensive CPR campaigns. They have trained a large percentage of the population in basic CPR skills. Unfortunately, these systems also have observed diminished survival rates because they failed to provide an emergency medical service with rapid defibrillation and rapid advanced life support.[18,39,43,78,153,155] Enhancements of early CPR programs, such as targeted CPR training[10,53–59] and dispatcher-assisted CPR programs,[51,65,67] will also fail if defibrillation does not occur soon after collapse.

Conversely, systems that have established early defibrillation programs by training their less advanced ambulance personnel to use defibrillators[43,90,119,120,142] may experience low success rates if they do not also train citizens to recognize cardiac arrest early or to call the emergency service immediately. The defibrillator will not arrive quickly enough if the EMS system is not called immediately, if local ambulances or first-responder units are not equipped with defibrillators, or if managers do not strategically deploy emergency response vehicles with defibrillators.

Responsible people must apply continuous quality improvement concepts to each link in the chain of survival. In early CPR, for example, it is not only a matter of the number of people who are trained. Systems can achieve better results by targeting the right groups and evaluating training programs, short-term results, and long-term trends. Automated defibrillators must be placed, then complemented with carefully planned training and follow-up programs and close medical control of the system, including individual case reviews and overall data management programs. Without these quality improvement methods, a system will not realize the full benefit of any new organization.

Summary

The chain of survival concept embodies standard principles of system management. The phrase restates[167] the familiar emergency medical services continuum pioneered by Peter Safar, who coined the term *life support chain.*[168] Other authors have referred to the concept with various phrases.[1,3,20,23,140] As a pedagogic construct, it emphasizes that there are no easy, single-step approaches to improving survival from cardiac arrest.[166,167]

Early access to the EMS system ensures early CPR, defibrillation, and advanced care. Early access is easiest to achieve with 911 systems and widespread community education and publicity. Instructors may also teach early access during citizen CPR classes. Early CPR helps patients by slowing the process of dying, but its effectiveness disappears within minutes, and defibrillation must soon follow. Early recognition and early CPR are best achieved when citizens are well informed about cardiac emergencies and well trained in CPR. The earliest possible delivery of defibrillation is critical and almost by itself is sufficient for many victims of sudden cardiac death.

Defibrillation has therefore emerged as the single most effective intervention for patients in nontraumatic cardiac arrest. Automated external defibrillators help to accomplish this goal and permit widespread implementation of a variety of early defibrillation programs. Early advanced care helps those who do not immediately convert to an organized cardiac activity or who do not achieve a spontaneous circulation following early defibrillation. Advanced care allows the highest possible survival rate through respiratory and antiarrhythmic stabilization and monitoring of patients in the post-resuscitation period.

At present, early CPR and rapid defibrillation, combined with early advanced care, can result in long-term survival rates for witnessed ventricular fibrillation as high as 30%. Researchers have observed that neurological and psychological recovery from cardiac arrest depends on the time within which these critical interdependent treatment modalities are delivered.[22,169] Therefore, high resuscitation rates will also lead to a high percentage of patients who recover to the neurological level they had before their arrest.

The future of the chain of survival will be highly dependent on multicenter cooperative studies of cardiac arrest in both in-hospital and out-of-hospital settings.[150,162,170] In addition to scientific research, the training of those responsible for implementing and maintaining the chain of survival must become a priority.[150,162,164] For emergency medical services the challenge is to develop programs that will allow

recognition, access, bystander CPR, defibrillation, and advanced care to occur as quickly as possible. Ideally systems should deliver these interventions within moments after sudden death victims collapse. Achievement of such a goal requires the deployment of multiple, properly directed programs, within an EMS system. Each program should lend strength to the chain of survival, thereby enhancing successful recovery and long-term survival.

Recommendations

The Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee of the American Heart Association recommend that all communities take the following actions to strengthen their Chain of Survival:

1. *Early Access*
   - All communities should implement an enhanced 911 system.
   - All communities should develop education and publicity programs that focus on cardiac emergencies and a proper response by citizens.
2. *Early CPR*
   - Communities should continue to vigorously implement and support community-wide CPR training programs.
   - Community CPR programs should emphasize early recognition, early telephone contact with the EMS system, and early defibrillation.
   - Community CPR programs should develop and use training methods that will increase the likelihood that citizens will actually initiate CPR.
   - Communities should adopt more widespread and effective targeted CPR programs.
   - Communities should implement programs to establish dispatcher-assisted CPR.
3. *Early Defibrillation*
   - All communities should adopt the principle of early defibrillation. This principle applies to all personnel who are expected, as part of their professional duties, to perform basic CPR: they must carry an automated external defibrillator and be trained to operate it.
   - Health professionals who have a duty to respond to a person in cardiac arrest should have a defibrillator available either immediately or within 1–2 minutes.
   - Responsible personnel should authorize and implement more widespread use of automated external defibrillation by community responders and allied health responders.
4. *Early Advanced Life Support*
   - Advanced life support units should be combined with first-responding units that provide early defibrillation.
   - Advanced life support units should develop well-coordinated protocols that combine rapid defibrillation by first-responding units with rapid intubation and intravenous medications by the advanced cardiac life support units.

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American Red Cross

Mr. Chairman and Committee Members,

My name is Sandi Talkington, Executive Director of the Burleigh-Morton Chapter of the American Red Cross. I am here today to support House Bill 1242 as a representative of all North Dakota Red Cross Chapters.

The American Red Cross supports training in Automated External Defibrillation (AED) for individuals who have a legal responsibility to provide emergency care, including fire fighters, police, emergency medical personnel and lifeguards. In addition the American Red Cross supports the expansion of AED training to the general public for people who may have a need- such as individuals who have family members with cardiac problems, or other potential responders such as worksite safety or security personnel.

The American Red Cross would also support legislation to ensure access to emergency medical services, requiring that AEDs be available at public access sites such as office buildings, auditoriums, and other sites where large numbers of people gather.

More than 350,000 Americans suffer from a sudden cardiac arrest each year. Less than 10 percent will be discharged from a hospital alive. Cardiopulmonary resuscitation(CPR) started promptly can help save lives. However, CPR by itself is most often insufficient to correct the problem. In more than two-thirds of all cardiac arrests, an electric shock, known as defibrillation, is needed. Studies show that prompt CPR followed by early defibrillation - a key component in the chain of survival- can reduce death from sudden cardiac arrest.

By enacting legislation to support the use of AEDs and by increasing the number of individuals that are trained to respond, the survival rate can be increased significantly. Both AED pilot programs and established programs have reported out-of-hospital cardiac arrest survival rates as high as 58 percent.

Training, public access and widespread availability of AEDs has the support of multiple professional medical organizations in addition to the American Red Cross including the American Heart Association, American Academy of Pediatrics, American College of Cardiology, International Association of Fire Chiefs, and the Association of State EMS Directors.

The American Red Cross has been recognized for over 85 years as a leader in providing safety training because of its standards and certification requirements. Currently the American Red Cross provides 3 avenues of training in the use of AEDs. This includes a supplemental module to the Emergency Response (first responders) Program, a 4 hour course for professional rescuers- such as police, lifeguards, and fire and rescue personnel, and a 4 hour course that teaches basic adult CPR and AED skills to lay rescuers.

Thank you for the opportunity to speak to you today, and I would answer any questions you may have.

APPROPRIATENESS OF LIMITED IMMUNITY LAY RESPONDERS

- **Is gross negligence protected by such amendments?**

  The immunity is specified as "limited." The limitation is that *immunity is not given to grossly negligent* acts, but immunity is granted for simply *negligent* acts. For example, if a rescuer becomes flustered during a resuscitation attempt and hits the "power" button instead of the "shock" button, the AED will be turned off. Once the rescuer realizes the mistake, defibrillation will be delayed by the time (perhaps a minute) that it takes to restart the defibrillator, "clear" the victim, re-analyze the victim's rhythm, and activate the "shock" button. This mistake is an acceptable operator error. Although someone could allege that this mistake is negligent, any legal action against this rescuer would be dismissed if limited immunity is provided under the Good Samaritan statute.

- **What steps are taken to reduce risk of gross negligence?**

  Risk of gross negligence is reduced by other program components such as approved training, course supervision, and skill review—a classic risk management approach. Discussions of law suits or legal actions against lay rescuers using an AED are theoretic and speculative—as of the end of 1998 there have been no allegations of device failure, operator negligence, or operator gross negligence.

- **Does Good Samaritan coverage applies to employees who respond to emergencies and provide CPR as part of their job responsibilities, for example, security personnel?**

  In most states, individuals respond with Good Samaritan immunity because they receive no specific compensation for the resuscitation itself. Police officers, security guards and others who may respond to emergencies are not considered compensation for the emergency aid provided. These individuals are paid the same salary whether or not they are called upon to render aid on a given day—they receive no specific compensation for the emergency response.

  Corporations may explicitly maintain Good Samaritan status for AED rescuers by requesting that the employees volunteer for resuscitation "duty" and be trained in CPR and use of an AED. This is consistent with "gratuitous" service, in that the security guards or employees are paid for normal duties, regardless of whether or not they respond to a cardiac arrest.

APPROPRIATENESS OF LIMITED IMMUNITY FOR ENABLERS

- Who are "enablers"?

State PAD legislation should provide for limited immunity for the AED premises owner, the medical director or physician prescriber or acquirer, and the trainer of the AED rescuer.

- Why confer limited immunity to the premises owner?

Lay rescuers are not likely to be the sole target of legal action, primarily because "Good Samaritans" almost never harm victims, and also because they are unlikely to have sufficient financial resources to cover monetary penalties or alleged damages. More common would be attempts made to recover damages from physicians, businesses and even CPR trainers. Note that these comments are completely hypothetical because the AHA ECC Committee is not aware of any reports of legal action regarding lay rescuer defibrillation.

Limited immunity is needed for the premises or business owners to encourage AED placement. Owners of large buildings or businesses could be perceived to have financial resources, which could be targeted for collection of alleged damages. The ECC committee has received correspondence from several businesses that have planned to install AEDs and have been told by their insurance companies that insurance premiums will either rise drastically or won't cover the added liability. Placement of an AED in buildings throughout the community will reduce the time to defibrillation for victims of sudden cardiac death and may save lives; such placement should be encouraged without putting owners at risk or forcing them to assume a significant financial burden.

- Why confer limited immunity to the physician prescriber?

The physician who authorized the AED placement should have limited immunity for any clinical use by a trained rescuer of the AED in a home, business or public place. Unless this limited immunity is provided, physicians will resist authorizing use of AEDs by lay rescuers. Malpractice authorities have indicated that physician malpractice insurance will not cover prescription of an AED that will be used outside of the physician's practice setting (e.g., in a stadium), by and for people who are not the physician's patients.

Limited immunity should also extend to physicians who agree to serve as medical directors of AED programs in buildings, communities and businesses. Medical direction has value for it may help to ensure that the AED is used properly by appropriately trained rescuers, and that outcome data are monitored.

- Why confer limited immunity to the trainer?

Trainers of AED rescuers should be included in legislation to promote public access defibrillation. Legal counsel may attempt to show that damage has resulted from improper training of rescuers. If the trainer conducts the training using American Heart Association guidelines and an American Heart Association or other nationally-recognized (or state EMS lead agency—approved) course, this training is appropriate and reasonable, so limited immunity should be conferred on the trainer.

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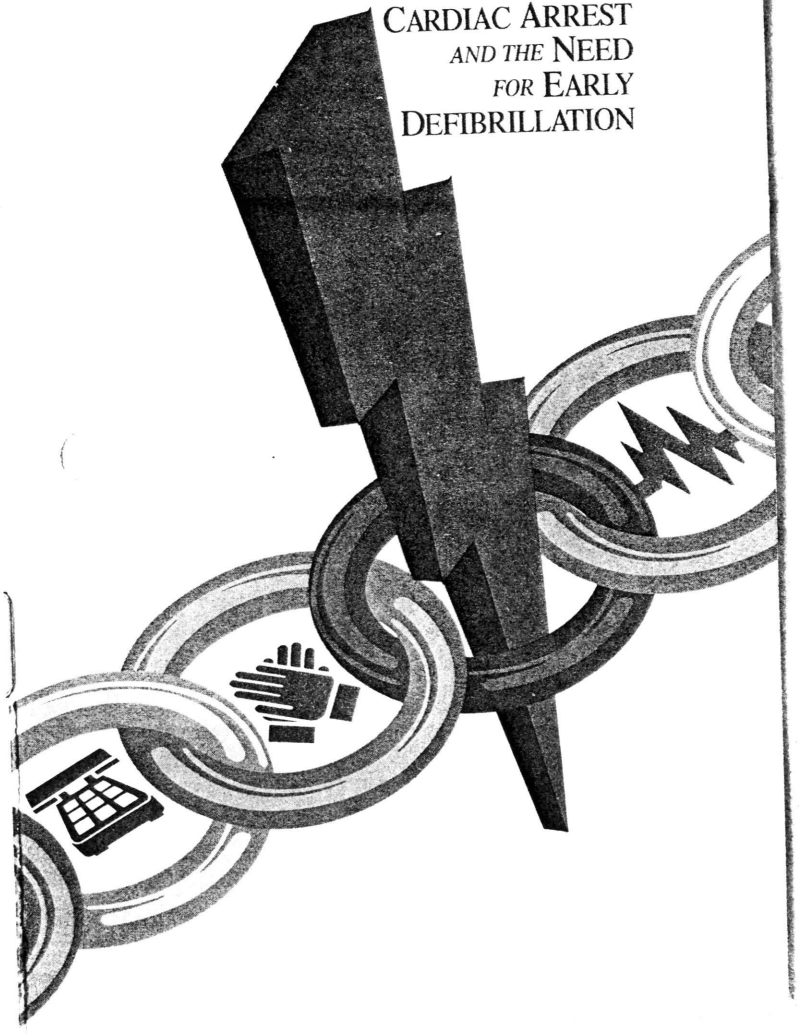

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SENATE HUMAN SERVICES COMMITTEE
SENATOR RUSSELL THANE, CHAIRMAN
MARCH 16, 1999

TESTIMONY BY
REPRESENTATIVE TODD PORTER

IN SUPPORT OF HB1242

Chairman Thane and members of the Human Services Committee my name is Todd Porter, Representative from District 34 in Mandan. I stand before you in favor of HB1242.

HB 1242 if enacted would allow the general public to utilize automatic defibrillators. These devices currently are available only to certified emergency responders. This bill through the proper education, would allow a trained individual to place and use the device on patients suffering from cardiac arrest. There are individuals here today that will give the Committee statistical information regarding the general public benefit by enacting this legislation.

The individuals wanting to use these devices would be required to complete training as outlined in a national curriculum prepared by the American Heart Association and establish protocols that test the devices and ensure that the proper notification of the local Emergency Medical Services occur if they use the device.

This bill also affords Good Samaritan coverage to the operator of the device along with the individuals responsible for training, including any volunteer physician input.

I would be more than happy to answer any questions at this time the committee my have.

Testimony for HB 1242
before the
Senate Human Services
by
Timothy Wiedrich, Director
Division of Emergency Health Services
North Dakota Department of Health

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Cardiac arrest is a significant problem in North Dakota. The ambulance run report system indicates that North Dakota ambulance services have responded to 1,972 cardiac arrest calls between 01/01/94 and 11/09/98. The two predominant locations for these calls were private residences (1196 actual, 61% of the total) and public areas (101 actual, 5% of the total). The median time lapse for these cardiac arrest calls from the time the ambulance was summoned until arrival at the patient's side was seven minutes. A full 30% of North Dakota ambulance services do not provide defibrillation services. Typically these services are not provided because the ambulance service lacks sufficient resources to implement a defibrillation program.

This data indicates that public access defibrillation can potentially save lives in North Dakota. Response time and appropriate treatment are critical in treating cardiac arrest. For persons experiencing a type of cardiac arrest called ventricular fibrillation, providing defibrillation is the only treatment which has the potential to be life saving.

Automatic defibrillation devices have been shown to be safe, effective and relatively simple to use. Appropriate placement of these devices can reduce the amount of time between the onset of cardiac arrest and the time defibrillation is delivered. This bill establishes liability protection to those engaging in providing defibrillation services and the owner of the property where defibrillation has been performed. These liability protections are necessary to encourage appropriate placement of the devices and reduce the fear of persons using the devices. Additionally, the bill defines minimal training standards for persons likely to engage in the provision of defibrillation.

We believe that increased availability of automatic defibrillation has the potential to save lives and we support the passage of this bill.