

# The evaluation of aspects of the chain of survival at gymnasiums in the Pretoria area

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## Abstract

### Background

Sudden cardiac death related to exercise is an uncommon problem, but is perhaps the single biggest challenge to sports medicine practitioners. Although the overall risk of death due to cardiac causes is substantially reduced in those who exercise regularly, the risk is temporarily increased during exercise. The causes of sudden cardiac death related to exercise vary according to age and are divided into two groups. Firstly, those under 35 years, where structural abnormalities of the heart pose a risk. The most common congenital abnormality is hypertrophic cardiomyopathy (HOCM), which occurs in up to two per 1 000 births. Secondly, those above 35 years, where coronary artery disease is the leading cause of sudden cardiac deaths.

The most frequent initial rhythm documented in witnessed cardiac arrest is ventricular fibrillation (VF). The most effective treatment for VF is defibrillation. The probability of successful defibrillation decreases by approximately seven to 10 percent for every minute that defibrillation is delayed. VF tends to convert to asystole within a few minutes if left untreated. No matter what the setting – home, community or hospital – the majority of successful adult resuscitations depend on early defibrillation.<sup>5</sup>

Public education and training are crucial aspects of any effort to reduce cardiac death. Because the majority of sudden cardiac deaths occur outside the hospital, it is clear that the community must be recognised as the 'ultimate coronary care unit'. Communities with a high number of lay persons trained in life-saving techniques such as cardiopulmonary resuscitation (CPR) and the use of automated external defibrillators (AEDs) may achieve resuscitation rates as high as 49% for patients with a documented out-of-hospital VF.

CPR is a critical component of BLS (basic life support). Prompt bystander CPR is crucial to all resuscitation efforts. In the absence of prompt bystander CPR, successful resuscitation of out-of-hospital cardiac arrest victims is unlikely, despite the availability of trained paramedics with a rapid response time. CPR performed while waiting for defibrillation appears to prolong VF and contribute to the preservation of heart and brain function.

The purpose of the study was to evaluate aspects of the chain of survival in gymnasiums in the Pretoria area. This chain of survival was evaluated against the Basic Life Support (BLS) system known in cardiac resuscitation.

### Methods

Twelve gymnasiums in the Pretoria area were included in the study. A structured questionnaire was given to a staff member of each gymnasium after explanation of the purpose of the study.

### Results

Of the gymnasiums visited, 83% had emergency telephone numbers at hand, while 100% of the staff had CPR training (75% in the last year). Half of the gymnasiums visited had automated external defibrillators (AEDs) available and the staff members at the respective gymnasiums had been trained in the use thereof.

### Conclusion

The partaking gymnasiums in the Pretoria area are well prepared for cardiac emergencies. It is recommended that fitness instructors, medical practitioners and the general public working out in gymnasiums be familiar with the chain of survival, especially how to operate an AED.

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## Introduction

Sudden cardiac death related to exercise is an uncommon problem, but is perhaps the single biggest challenge to sports medicine practitioners. Although the overall risk of death due to cardiac causes is substantially reduced in those who exercise regularly, the risk is temporarily increased during exercise.<sup>1</sup>

The causes of sudden cardiac death related to exercise vary according to age and are divided into two groups. Firstly, those under 35 years, where structural abnormalities of the heart pose a risk. The most common congenital abnormality is hypertrophic cardiomyopathy (HOCM), which occurs in up to two per 1 000 births. Secondly, those above 35 years, where coronary artery disease is the leading cause of sudden cardiac deaths.<sup>1</sup>

The most frequent initial rhythm documented in witnessed cardiac arrest is ventricular fibrillation (VF). The most effective treatment for VF is defibrillation. The probability of successful defibrillation decreases by approximately seven to 10 percent for every minute that defibrillation is delayed. VF tends to convert to asystole within a few minutes if left untreated.<sup>2,3,4</sup> No matter what the setting – home, community or hospital – the majority of successful adult resuscitations depend on early defibrillation.<sup>5</sup>

Public education and training are crucial aspects of any effort to reduce cardiac death. Because the majority of sudden cardiac deaths occur outside the hospital, it is clear that the community must be recognised as the 'ultimate coronary care unit'.<sup>6</sup>

Communities with a high number of lay persons trained in life-saving techniques such as cardiopulmonary resuscitation (CPR) and the use of automated external defibrillators (AEDs) may achieve resuscitation rates as high as 49% for patients

with a documented out-of-hospital VF.<sup>7,8</sup>

CPR is a critical component of BLS (basic life support). Prompt bystander CPR is crucial to all resuscitation efforts.<sup>9,10</sup> In the absence of prompt bystander CPR, successful resuscitation of out-of-hospital cardiac arrest victims is unlikely, despite the availability of trained paramedics with a rapid response time.<sup>9,10</sup> CPR performed while waiting for defibrillation appears to prolong VF and contribute to the preservation of heart and brain function.

## Purpose of the study

Cardiovascular disease is a leading cause of death in the western world.<sup>1,2</sup> There has been a great effort to educate people concerning the cardiac risk factors. As a result, more people enrol in fitness programmes. Gymnasiums are a favourite environment, as they offer a safe milieu and a variety of sports under one roof.

People with cardiac risk factors are at a slightly greater risk of arrest while exercising.<sup>1</sup> One can thus assume that the gymnasium is an out-of-hospital area where the likelihood of being confronted by cardiac arrest is higher than in other areas. The survival of these patients depends on an emergency cardiac care (ECC) system that is effective.

ECC should be an integral part of the community-wide EMS (emergency medical services) system. The American Heart Association (AHA) has adopted and supported the ECC concept for many years.<sup>11,12</sup>

The metaphor 'chain of survival' is used for the elements involved. The four links of the adult 'chain of survival' are<sup>5</sup>

- Early access to EMS – This includes early recognition, rapid EMS notification and rapid dispatch.
- Early CPR – This is most effective when done immediately after

the victim's collapse. Bystander CPR is the best treatment until the arrival of a defibrillator and ACLS (advanced cardiac life support).<sup>13,14</sup>

- Early defibrillation – This link is the most likely to improve survival rates. The placement of AEDs in the hands of trained rescuers may be the key intervention for increasing survival from out-of-hospital cardiac arrest.<sup>15,16</sup>
- Early advanced cardiac life support – This link is provided by trained EMS personnel. They give basic life support and defibrillation, as well as more advanced care such as cardiac drugs. These advanced actions help the heart in VF to respond to defibrillation or to maintain a normal rhythm after successful defibrillation.

The purpose of this study was therefore to evaluate the competency level of the gymnasium personnel and to discover which of the mentioned elements are accessible at gymnasiums in the Pretoria area.

## Methods and procedures

### Subjects

After written consent was obtained from the managers of the participating gymnasiums, a staff member was selected at random to complete the questionnaire. Ethical clearance (Research Ethics Committee, Faculty of Health Sciences, University of Pretoria, Clearance number: S 87-2002) was obtained for the study and all participants gave written informed consent.

### The measuring instrument

A questionnaire based on the AHA principles of the chain of survival was used. The questions used are summarised in **Table I**. These questions are all based on BLS skills.

**Table I:** Questions included in the questionnaire and responses required from gymnasium staff members to evaluate the chain of survival at gymnasiums in Pretoria.

1. Are you aware of an emergency system at your gymnasium, if a medical emergency like cardiac arrest would develop?		
No, no system available		
Yes, have a system		
2. What emergency number would you dial should a medical emergency develop?		
Telephone number		012
Whose number is it?		
3. Have you had any formal (official) CPR training?		
Have had no formal training		
Have had formal CPR training		< 1 year ago
		1 – 2 years ago
		> 2 years ago
4. Would you start CPR immediately on any cardiac arrest patient (irrespective of the availability of a barrier device)?		
Yes – irrespective		
Yes – only if a barrier device is available		
No		

**Data collection**

The data were collected by the primary investigator, and any misunderstandings were explained by him. Twelve independent gymnasiums in the Pretoria area took part in the study.

**Results**

All partaking gymnasiums indicated that they had an emergency system in place. A total of 83.3% of the participating gymnasiums have at hand an emergency number of a mobile rescue service with no time wasted to search for it.

All the staff members questioned had training in CPR. Seventy-five percent of the members received their training in the year before the investigation. The majority of members interviewed undergo compulsory yearly retraining. Own safety has high priority, as 91,7% of the members had rubber gloves, and 83,3% had one-way facemasks available to do CPR. Gloves were also available in all gymnasiums where CPR training had been done less than two years before the investigation. Facemasks were

present in all gymnasiums where members had training less than one year previously.

Fifty per cent of the gymnasiums that took part in the study had an AED available on the premises, and all staff in these gymnasiums had training in the use of it. Of the staff trained in the preceding year, 77,8% knew what an AED was and how to use it.

Twenty-five per cent of the staff members questioned had experienced a cardiac emergency in the gymnasium. All these individuals had protective devices available, performed CPR immediately and, in 66,7% of cases an AED was available.

**Discussion**

The first two links in the chain of survival are well established in the majority of gymnasiums visited in the Pretoria area. Emergency numbers were well visible and close at hand. Most gymnasiums had the number stuck on the telephone. The majority made use of a private well-known medical emergency rescue unit.

The second link (early CPR) is also an integral part of the gymnasiums visited. All members questioned have had CPR training. CPR is considered the most basic and successful public health initiative of modern times. Some of the gymnasiums make it compulsory for staff to retrain each year. An integral part of CPR is the use of protective devices for own safety. Eleven of the 12 gymnasiums had gloves available, and 10 had a facemask on hand. This availability lessens the possibility of acquiring transmitted diseases when confronted with CPR.

More surprising was how well the costly, but life-saving, third link (AED) has been established. Not only was this device available to provide early defibrillation in half of the gymnasiums visited, but all the staff were trained to use it. These members also retrained each year. It is only in recent years that defibrillation has become part of BLS. This may explain why members who did their training more than one year ago, did not know about the AED.

The availability of the AED is in keeping with first world standards for BLS. This is an objective the community should strive for. The example seems to have been set by the physically active community, where sudden cardiac death is uncommon. We hope that this will soon be the trend in the wider community, where the less physically active dwell.

If you happen to be a medical practitioner working out in a gymnasium, make sure you know the chain of survival, especially how to operate an AED.

### Conflict of interest

Using the following broad definition of conflict of interest, I declare that I have no financial or personal relationship(s) which may have inappropriately influenced me in writing this paper.

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