

## Occasional Survey

# Management of cardiac arrest in the community: a survey of resuscitation services

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### Abstract

**A survey of the English health regions identified nine ambulance based resuscitation schemes. Their structure and function are heterogeneous and their impact on patient survival is often speculative. There is considerable medical, paramedical, and lay enthusiasm for resuscitation schemes but this cannot be harnessed until medicolegal uncertainties are removed and guidelines for development are set out. Better documentation of the benefits of existing schemes should be undertaken so that advanced training of ambulance personnel can proceed rationally.**

### Introduction

Every year in England and Wales over 100 000 people die from ischaemic heart disease.<sup>1</sup> Many of these deaths are sudden or unheralded, and over half of the victims die before they reach hospital. Figures from the United States are similar, with 650 000 deaths each year, and, "since 60-70% of sudden deaths caused by cardiac arrest occur before hospitalisation it is clear that the community deserves to be regarded as the ultimate coronary care unit."<sup>2</sup> The community, and the primary health care team in particular, has clear educational, preventive, and therapeutic responsibilities in relation to ischaemic heart disease but when these measures fail, how are we to respond?

In 1976 a Department of Health circular<sup>3</sup> stated that "no firm evidence has emerged that the use of specially equipped ambulances manned by ambulancemen who have received training in advanced techniques significantly affects the overall mortality rate of patients suffering from acute myocardial infarction" and recommended that "authorities are advised to defer the introduction of new and the extension of existing advanced training schemes for ambulancemen." No further directives have been issued since then; none the less several schemes are in operation.

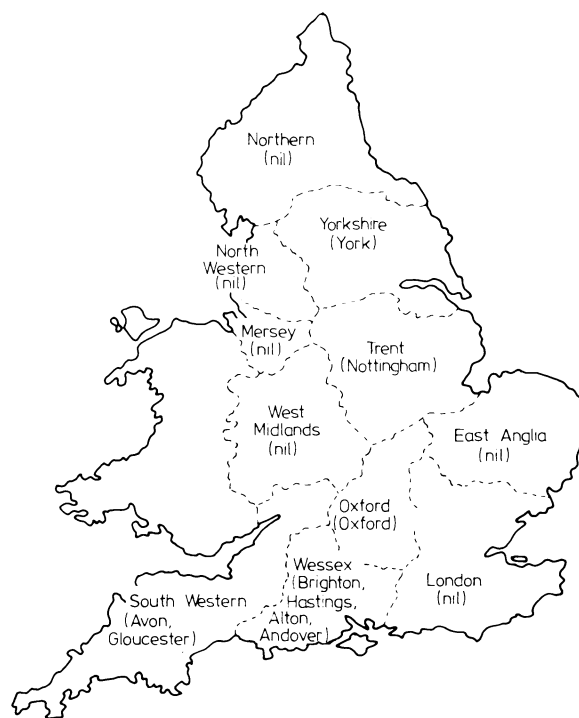
While attempting to set up a local resuscitation scheme, we found that basic information about the extent of resuscitation schemes in England was not available, and there is certainly no consensus view about the most effective way in which schemes should be organised. A survey was undertaken to try to answer these questions. (R H Jones, Upjohn Travelling Fellowship Report, 1982.\*)

\*Copies may be obtained from the librarian, Royal College of General Practitioners, 14 Princes Gate, Hyde Park, London SW7 1PU.

### Methods

Because it seemed likely that most resuscitation schemes would be based on the ambulance service, initial approaches were made by letter to the regional ambulance officers of the 11 English regional ambulance services (the four Thames regions in Greater London are served by one ambulance service). Contact was also made with headquarters and branch representatives of the Association of Emergency Medical Technicians (AEMT) and the British Association of Immediate Care Scheme (BASICS).

When the replies from the regional ambulance officers were available ambulance based schemes in their regions were visited and documented, using a structured interview. During this inquiry I discovered several other schemes in the early stages of development but, with the exception of the new Nottingham coronary ambulance scheme, these are not included in the analysis. Throughout the survey all my inquiries were answered and I received the fullest cooperation from everyone concerned.



Areas with resuscitation ambulance schemes in England.

### Results

The response to the initial letter to the regional ambulance officers showed that resuscitation schemes were operating in five of the 11 English regions (figure). Before discussing these schemes in more

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detail, however, it is instructive to comment briefly on the regions in which there are no resuscitation ambulance schemes.

#### REGIONS WITH NO RESUSCITATION SCHEMES

*Northern region*—The question of resuscitation schemes never seems to have arisen here.

*North western region*—Except for a coronary ambulance service based on Wythenshawe Hospital, Manchester, which closed down because of lack of funds, there have been no schemes in this region. There is certainly an awareness of the potential medicolegal problems arising because of lack of national direction.

*Mersey region*—Although advanced training for ambulancemen has been started in Liverpool, there have been no resuscitation ambulance schemes.

*West Midlands region*—There was a "limited training exercise" in resuscitation in the Hereford and Worcester area, which has now ended, and an advanced training scheme operates in Warwickshire.

*East Anglia region*—The possibility of developing advanced training schemes in Cambridge was mooted some years ago but the idea foundered on the question of medicolegal responsibility.

*London region*—Some years ago the London Ambulance service was moving towards the training of ambulance personnel in the use of monitoring and defibrillation equipment, but these proposals were abandoned because of the DHSS circular mentioned above.<sup>3</sup> Advanced training in intubation and intravenous infusion techniques has, however, continued. A rather unusual coronary ambulance service, based on the cardiology department at St Bartholomew's Hospital, serves the City of London between 9 am and 5 pm from Mondays to Fridays. The coronary ambulance is staffed by a registrar from the cardiology or accident department, a nurse from the accident department, a technician from the medical electronics department, and sometimes a medical student. Each year the ambulance is called out between 300 and 400 times and about 20 casualties are defibrillated.

*Leeds*—This scheme was started just before the 1976 DHSS circular<sup>3</sup> was issued; it was an experimental scheme based on electrocardiogram radiotelemetry and speech links between specially staffed and equipped vehicles and the coronary care unit at Leeds General Infirmary. The trial was limited and failed to show any benefit for patients. It was possible to provide cover only between 9 am and 5 pm, and during the 15 month trial period six patients were defibrillated, none of whom survived. The DHSS circular discouraged extension of this experiment.

#### REGIONS WITH RESUSCITATION SCHEMES

Eight centres were examined in detail to document the activities of ambulance based resuscitation schemes: Alton, Andover, Avon, Brighton, Gloucester, Nottingham, Oxford, and York.

##### *Alton*

This new scheme is in Alton, a country town of 15 000 inhabitants that is 15 miles from the nearest general hospital. The scheme was set up by a general practitioner and training is open to all ambulance personnel. In 18 months three patients have been successfully resuscitated with nine further unsuccessful attempts. The medicolegal position of ambulance personnel remains ambiguous, however, but the scheme is at present proceeding as a pilot project.

##### *Andover*

The Andover scheme developed because of the successful activities in nearby Alton. It is based on a country town of 35 000 inhabitants which is also about 15 miles from the nearest district hospital. The scheme, once again, was developed by a general practitioner and is supported by charitable funds. The administrative and medicolegal problems here, however, are even more complex, and at present, although monitoring and defibrillation equipment is carried in the ambulances, ambulance personnel may use only the monitors; defibrillators are used only by general practitioners.

##### *Avon*

Avon has a longstanding, advanced training scheme developed by a consultant anaesthetist at Frenchay Hospital. Almost a quarter of the region's ambulance personnel have been trained, and electrocardiogram monitoring and defibrillation equipment is now available at 10 of the county's 11 ambulance stations. In addition, three mobile resuscitation units with fixed electrocardiographic and defibrillation equipment carry a range of fluids and intravenous drugs. In 1981 cardiac arrest was treated 49 times, and 37 patients were defibrillated.

##### *Brighton*

The well known Brighton coronary ambulance programme<sup>4,5</sup> originally set out to provide a specially equipped ambulance and a doctor to travel rapidly to suspected coronary victims. It was quickly appreciated that it was more appropriate to train the ambulance personnel, and there are now over 30 well trained ambulancemen who are expert in interpreting electrocardiograms, skilled at intubation, defibrillation, and intravenous therapy, and able to administer a variety of intravenous drugs. In 1981 31 out of 128 defibrillations were successful. In addition to this advanced training programme, a successful exercise in community education in cardiopulmonary resuscitation is under way—the Brighton Save a Life Campaign—which has already instructed about 18 000 members of the public.

##### *Gloucester*

Gloucester has an advanced training scheme with many similarities to the Avon scheme, although some details of the training programme differ. About a quarter of the ambulance staff in the county have received advanced training, and there are 15 mobile resuscitation units at 10 of the 12 stations. This scheme interacts with an immediate care scheme based on 20 general practitioners in west Gloucestershire.

##### *Nottingham*

The Nottingham experimental coronary ambulance schemes were started in 1973 when a single ambulance with cardiac monitoring equipment and a defibrillator came into service; over the next few years the efficacy of this scheme was tested experimentally, firstly, with comparisons of the responses of ordinary ambulances and coronary ambulances to emergencies, then with the inclusion of a hospital doctor in the ambulance crew on alternate days, and, finally, with the exclusion of general practitioner initiated calls and assessment of the effect of the service in response to 999 calls only.<sup>6</sup> This study showed no difference in prehospital mortality between patients carried by coronary ambulances and those carried by routine ambulances. At the end of this study the coronary ambulance service was discontinued.

The scheme is now being redeveloped. The lessons learnt from the experiments in the past eight years include the suggestion that detailed training in drug administration and endotracheal intubation are probably less important than early monitoring and defibrillation for victims of myocardial infarction. The new scheme will cover a population of about 500 000 with 10 emergency vehicles. A coronary register is being established in Nottingham so that deaths from ischaemic heart disease can be recorded before the scheme becomes operational and reviewed after the scheme has started. There are further plans to develop a programme of community education in cardiopulmonary resuscitation.

##### *Oxford*

The Oxford scheme, a more recent countywide advanced training scheme, started in 1978. The thorough training programme has produced 48 trained personnel out of an establishment of 142 in Oxfordshire. There are 16 monitor-defibrillator units in use throughout the county and 39 accident and emergency vehicles. In 1981 23 patients were defibrillated. A community cardiopulmonary

resuscitation scheme in Oxfordshire began in 1981, and 52 instructors and almost 1000 members of the public have now been trained. In 1981 36 patients required intubation and 23 were defibrillated.

### York

All 42 ambulance personnel in York have been trained to use their monitor-defibrillators, of which six are available in the city ambulances. The emphasis, as in the proposed Nottingham scheme, is on early defibrillation rather than detailed training in intubation and infusion techniques. Between 1970 and 1981 13 of the 181 defibrillations resulted in ultimate recovery.

The table summarises the features of these coronary ambulance schemes. General practitioner involvement refers to the cooperation of general practitioners in training and in the day to day running of the scheme. The two Hampshire schemes were started by general practitioners and the Gloucester scheme interacts with a group of immediate care doctors, but the remainder have little contact with local primary care doctors, although there are BASICS groups in Oxfordshire, Somerset, and Bristol.

### OTHER SCHEMES

#### *Association of Emergency Medical Technicians (AEMT)*

The Association of Emergency Medical Technicians is an association for paramedical personnel interested or active in emergency care. About 700 ambulancemen are members of AEMT, which has 43 branches throughout the country. The training programme is quite separate from the ambulance service advanced training programme and is organised on guidelines which have been agreed with BASICS. In addition the AEMT provides an insurance indemnity for £500 000 against malpractice claims.

#### *British Association for Immediate Care (BASICS)*

The British Association for Immediate Care is an organisation of medical practitioners who have an interest in immediate care. At present about 1350 belong to the 44 schemes in England. Each scheme is organised in response to local needs, but in general BASICS sets out to deal with accidents rather than medical emergencies. A survey of the 14 largest BASICS groups, accounting for over 60% of the total membership, suggests that ready access to electrocardiogram monitoring and defibrillation equipment is the exception rather than the rule.

### Discussion

Provision of mobile resuscitation facilities for dealing with cardiac arrest occurring outside hospital is patchy, and if not chance then serendipity seems to have guided their development. Clearly non-clinical determinants operate in the development of coronary ambulance and mobile resuscitation programmes; taken together with evidently widely differing perceptions of the role of the ambulance service an unevenness of approach is inevitable.

What is perhaps most unsatisfactory about the development of resuscitation strategies is their uncertain value, both in the

absolute sense of saving life and in the relative sense of the appropriateness of diverting funds and energies which might be better used elsewhere. Few attempts have been made to tackle this difficult and important question. There seem to be three different approaches to managing out of hospital cardiac arrest, exemplified in the various schemes which have been surveyed: firstly, a perception of chest pain and myocardial infarction as a medical emergency requiring urgent medical attention and hospital admission; secondly, an attempt to provide a much wider range of skills to deal with trauma and medical and surgical emergencies as well as cardiac arrest; thirdly, the provision of less advanced but equally mobile expertise with the emphasis on early defibrillation and basic life support.

The emphasis in the Brighton scheme is on the first of these, although the resuscitation ambulances respond to a variety of other life threatening emergencies; the second is the basis for the Oxford, Avon, and Gloucester schemes; and the third underlies planning for the new Nottingham scheme and is the basis for the York city ambulance scheme and also of the general practitioner related schemes in Alton and Andover. The third must also be taken as the rationale for those general practitioner based immediate care groups having access to defibrillators.

The Brighton resuscitation ambulance programme is probably the best known and most widely reported, although the home versus hospital question of the management of myocardial infarction remains unresolved and there are common-sense reasons for regarding flashing blue lights and high technology as arrhythmogenic. There is a sense, too, in which primary care is bypassed when chest pain means a 999 call and hospital admission. The Brighton ambulance personnel are probably the best trained in cardiac care and their expertise and ability to administer drugs may contribute greatly to the management of cardiac arrest, although Hampton and his colleagues have cast some doubt on the impact on survival of these abilities.<sup>7</sup> The resuscitation ambulances also respond to other, non-cardiac emergencies, such as drowning, trauma, drug overdose, and hypoglycaemia.

The second approach to managing cardiac arrest outside hospital forms one element of a much more comprehensive view of the value of paramedical training for ambulance personnel. Although good documentation would massively enhance their credibility, the mobile resuscitation units and the staff with advanced training in Avon, Oxford, and Gloucester are a most impressive development. Correction of hypovolaemic shock before admission to hospital, for example, must be judged a potentially life saving contribution, and the versatility of these ambulance crews, evident when reviewing the reports of patients whom they have helped, is beyond doubt. In distinction to a "pure" coronary care approach these schemes appear to require no justification, although their revenue consequences are not inconsiderable. Unfortunately the 1976 DHSS circular acted as a damper on advanced training of this type.<sup>3</sup>

Thirdly, limited resuscitation by early defibrillation (assumed to be performed in a setting of basic cardiopulmonary resuscitation capabilities) avoids some of the training, organisational, and financial consequences of more elaborate schemes. This seems a second best buy for the ambulance service but is probably ideal when cooperation between the ambulance service and

*Some features of resuscitation ambulance schemes*

	Alton	Andover	Avon	Brighton and Hastings	Gloucester	Nottingham	Oxford	York
No of years running	2	1	10	8	10	—	4	12
No of trained personnel	12	11	50	43	55	35	48	42
Intubation-infusion trained	+	+	+	+	+	+	+	+
Able to administer drugs	0	0	+	+	0	0	+	+
Specially fitted vehicles	0	0	+	+	+	0	0	+
Significant charitable funding	+	+	+	+	+	0	+	+
Community cardiopulmonary resuscitation programme	+	0	0	+	0	0	+	0
General practitioner involvement	+	+	0	0	+	0	0	0



general practice is good. It does seem more sensible, however, for relatively expensive and bulky electrocardiogram monitoring and defibrillation equipment to be carried by the ambulances rather than being handed from general practitioner to general practitioner in an immediate care scheme. On the other hand, a recent report on the management of myocardial infarction by "immediate care doctors"<sup>8</sup> stated that an appreciable number (23 out of 511) of patients died in the presence of their general practitioner. This, it was suggested, argued for the wider use of defibrillators by general practitioners.

This may be one way in which primary care doctors can contribute to "the ultimate coronary care unit" but there are others. At present general practitioner and ambulance based resuscitation schemes make only a small impression on the number of sudden deaths in the community. The reason for the delay in developing more widespread advanced training for ambulance personnel has already been mentioned but there seems little doubt that when political, financial, legal, and attitudinal difficulties have been overcome, greater opportunities for dealing with out of hospital cardiac arrest will arise. This survey showed that in many areas, particularly country districts, there is great potential for fruitful cooperation between general practitioners and the ambulance service. This might be expressed as involvement in immediate care arrangements, contribution to training, and support of proposals for extending the role of ambulance personnel.

On a wider front, the potential of any resuscitation scheme cannot be realised without widespread training of the public in the principles of cardiopulmonary resuscitation. In Seattle about one third of the population have received such instruction and this probably accounts for the high success rate of the resuscitation there which undoubtedly saves about 100 lives each year.<sup>9</sup> Despite this, only in Brighton and Oxford have resuscitation ambulance programmes acted as a stimulus for public education in cardiopulmonary resuscitation, and this is a further area in which general practitioners may contribute to the out of hospital management of cardiac arrest.

There is obviously a great deal of enthusiasm among doctors and ambulance staff who want to contribute to the prehospital care of the critically ill. Whereas on one hand it will be a waste if this enthusiasm remains untapped and unchannelled for want of national direction, on the other, the DHSS is unlikely to support extension of resuscitation services unless they can be shown to represent money well spent.

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## Are antiprostaglandins of any value in treating the irritable bowel syndrome?

Possibly, but it is too early to be sure. Diarrhoea is the predominant feature in a few patients with the irritable bowel syndrome. These patients often have raised concentrations of prostaglandin E<sub>2</sub> in their jejunal fluid, and in six such patients an uncontrolled trial of indomethacin 25 mg four times daily cut the stool volume and frequency by half.<sup>1</sup> These preliminary results need to be confirmed in a placebo controlled trial since many patients with the irritable bowel syndrome respond well to placebos. Meanwhile, it may be relevant that in patients with this syndrome who develop diarrhoea in response to specific foods the concentration of prostaglandin E<sub>2</sub> in rectal fluid rises when they are challenged with the food in question.<sup>2</sup> Again, these are early findings, and the precise role of prostaglandins in the irritable bowel syndrome with diarrhoea is far from clear.—K HEATON, reader in medicine, Bristol.

<sup>1</sup> Bukhave H, Rask-Madsen J. Prostaglandin E<sub>2</sub> in jejunal fluids and its potential diagnostic value for selecting patients with indomethacin-sensitive diarrhoea. *Eur J Clin Invest* 1981;**11**:191-7.

<sup>2</sup> Jones VA, McLaughlan P, Shorthouse M, Workman E, Hunter JO. Food intolerance: a major factor in the pathogenesis of irritable bowel syndrome. *Lancet* 1982;iii:1115-7.

## What is the risk of a person who has had one coronary thrombosis having another attack?

For the purposes of this reply I will assume that the subject has survived their first myocardial infarction by at least one month. The Framingham study indicates that for men, the average annual mortality will be 5% a year for the next 10 years, between three and

four times that of the general population.<sup>1</sup> Women have a higher mortality in the first year but fare similarly thereafter. Most of the deaths will be cardiac. Thirteen per cent of Framingham men and 40% of women had a further non-fatal myocardial infarction within five years of the first attack. The Framingham data are important because they include all cases of myocardial infarction occurring in a defined community irrespective of whether they were admitted to hospital. Considerably more information is available from studies of subjects discharged from hospital after myocardial infarction. Luria assembled 10 069 subjects who had recovered from acute myocardial infarction from various studies and noted that five year mortality clusters at 30% to 35%.<sup>2</sup> Many of these studies, however, included subjects with previous episodes of myocardial infarction. A recent study from this side of the Atlantic reported on the mortality of men under 60 surviving their first myocardial infarction or episode of unstable angina by at least 28 days.<sup>3</sup> For myocardial infarction, five, 10, and 15 year mortality percentages were 22, 40, and 59, rather more than three times that of the general population. This paper contains a review of 22 other studies of postinfarction mortality. Subjects more likely to die after myocardial infarction are older; those with larger infarcts as evidenced by complications such as heart failure; hypertensive subjects; and those who continue to smoke. Beta-blockade may improve survival in suitable subjects but this effect is modest and probably less than the effect of stopping smoking.—I M GRAHAM, consultant cardiologist, Dublin.

<sup>1</sup> Kannel WB, Sorlie P, McNamara PM. Prognosis after initial myocardial infarction: the Framingham study. *Am J Cardiol* 1979;**44**:53-9.

<sup>2</sup> Luria MH, Knoke JD, Wachs JS, Luria MA. Survival after recovery from acute myocardial infarction. Two and five year prognostic indices. *Am J Med* 1979;**67**:7-14.

<sup>3</sup> Graham I, Mulcahy R, Hickey N, O'Neill W, Daly L. Natural history of coronary heart disease: a study of 586 men surviving an initial acute attack. *Am Heart J* 1983;**105**:249-57.