ORIGINAL ARTICLE

A new method for managing emergency calls

G. Landoni, L. Cabrini, O. Fochi, A. Zangrillo

Department of Anesthesia and Intensive Care, Università Vita-Salute San Raffaele, Milan, Italy

HSR Proceedings in Intensive Care and Cardiovascular Anesthesia 2010; 2: 35-39

ABSTRACT

Available methods for managing territorial medical emergencies are nowadays very effective. Nevertheless, resources are limited, and such methods are far from being perfect. It could be difficult, sometimes, to ensure adequate and prompt medical care to the community when emergency is taking place in such short times as those recommended for cardiocirculatory arrest or a trauma.

The major intent of this project is to implement some drawbacks of the current management of medical rescue on the territory improving overall response times to emergencies and providing the delivery of qualified pre-hospital patient care.

This may include (but not be limited to) the institution of a database, on a voluntary basis, for trained personnel. Such database should include resuscitation specialists, physicians, but also anyone who has undergone recognized training. Upon receiving a medical emergency call, an off-duty operator can be selected from the database (in a cooperative, non-competitive manner with the dedicated emergency services), based on current position of his/her cellular phone and his/her training profile. Finally, the operator who is both closest to and best prepared for the emergency is contacted via cellular phone. If the operator is available he/she can precede or join the mobile unit on site, managing the emergency according to his/her profile, possibly in cooperation with the ambulance personnel and even up to hospital admission.

Keywords: *emergency, out of hospital, mobile phones, cardiac arrest, trauma.*

The "chain of survival" consists of a series of consecutive steps to take care of a person whose life is in danger. It works appropriately in relation to the available resources. We suggest a simple improvement to the survival chain: a method for managing emergency calls received from a user/citizen, which can be used in a cellular telecommunication system. The idea of "proxy on-call assistance" was briefly reported before (1).

Corresponding author:
Landoni Giovanni, MD
Department of Cardiothoracic Anesthesia and Intensive Care
Istituto Scientifico San Raffaele
Via Olgettina, 60 - 20132 Milano, Italy
e.mail: landoni.giovanni@hsr.it

Out-of-hospital emergencies are a burden for society with sudden, out-of-hospital cardiac arrests claiming approximately 1000 lives each day in the United States alone (2). Road accidents are the fourth cause of death in the United States and the main cause of death in people between 1 and 44 years of age.

In contrast to what happens inside hospital, emergencies occurring on the territory usually involve a much younger population, and subsequent deaths or disabilities heavily impact a country's labor force, yielding very high social costs. Resources have been dedicated to implement cardiac resuscitation and a dedicated emergency call number is widespread in all Western nations. In

medical emergencies, the most important factor that determines one's probability to survive without sequelae, is often time. It is known, for example, that one third of those suffering a heart attack die before reaching a hospital, and most of them die within one hour after the symptoms occur.

In such cases, the rapid intervention of a person with even basic training is vital, since she/he could be able to offer first aid on the spot, increasing the probability of survival.

Basic life support training to millions of people and the availability of automated external defibrillators could improve the survival after out-of-hospital ventricular fibrillation from 17 to 33% when cardiopulmonary resuscitation is started within 4 min after collapse and up to 74% for patients who received their first defibrillation within 3 min after collapse (3).

Similarly, the first hour following a road accident or any traumatic accident is now considered the "golden hour": most of what can be done to save the patient's life must be initiated within an hour from the traumatic event. This concept was first introduced in 1977 by Dr. James K. Styner, after a plane crash in which his wife died, and has since then become the object of many trauma care training programs.

Whatever the cause of the medical emergency, many countries have implemented a "chain of survival" which includes a first call for help, a rapid activation of first aid, transportation of the patient to an advanced facility (emergency room) or mobilization of an advanced rescue unit, and continuation of care in a hospital (e.g. operating room, intensive care unit) (4).

In the specific setting of cardiorespiratory arrest, the ''chain of survival'' presupposes rapid access to an emergency medical system, early cardiopulmonary resuscitation, additional treatment such as public access defibrillation and advanced resuscitative care with appropriate management during transport to the hospital.

In some countries different emergency services, such as police, fire department, paramedics, are managed by means of a single number. In others police, medical emergency center, fire departments are contacted via different numbers. When fielding a 911 call, the emergency medical services dispatcher may ask the caller some questions about the nature of the emergency (patient status and scene information), its level of urgency, the location of the call and so on, so as to be able to send out as soon as possible a mobile emergency unit. The operator, depending on the severity and priority of the emergency call received, identifies resources to be used and organizes the mobilization of a first-aid vehicle, an advanced life support vehicle, or a helicopter. Commonly, the most closely situated vehicle is alerted.

The method described hitherto, which is currently the most used worldwide, works satisfactorily in relation to the resources available. These supplies are limited and cannot provide suitable coverage for the whole territory, in particular with the rapidity that an emergency often requires.

The greater cost to face in order to achieve larger territory coverage arises mainly from the need to improve number and level of certification of the personnel.

What the project adds to the information already available

Following an emergency situation, early access to emergency care must be provided by calling 9-1-1 in the US or 118 in Italy. The call location may or may not coincide with the location of the emergency. The emergency center is able to record the identification data of the emergency call (location and type of emergency) and to transmit these data to the closest ambulance or to the mobile unit center, for example, a first-

aid center, which in turns mobilizes one or more mobile rescue units.
At this step of the rescue "chain", our invention introduces a database of voluntary operators. The database is managed directly by the emergency center or by an additional management center. The list includes for example physicians with specific training, medical doctors, nurses, qualified personnel who has undergone recognized training, such as BLS (Basic Life Support) and advanced cardiac or (pre-hospital) trauma life support, and is able to act in emergency situations. The operators voluntarily participate to this database in their off-duty time.
After receiving the emergency call, the emergency center selects one or more operators from the database, depending on her/his present position with respect to the location of the emergency. For example, a predetermined relation may require that the selected operator be within the same cell (few hundred meters) of the location of the emergency. The identification data of the call (location and type of emergency) are then transmitted to the selected operator, preferably via a text (SMS) message. If the call includes information as to the type of emergency (e.g.: trauma, cardiac arrest) the selection of the operator can take into account a predefined compatibility with the specific emergency. Consequently, the operator who is both closest to and best prepared for the emergency is contacted via cellular phone. The operator (who is off-duty and may be at home, driving, on a bus…) has the possibility to confirm or deny her/his availability, again on a voluntary basis.
In case the operator does confirm her/his availability to intervene, the emergency center transmits this information to the mobile unit mobilized beforehand. The mobile unit is made aware of the fact that a medical operator able to provide professional assistance to the rescue operations will be present on the scene. Depending on the location of the selected operator, she/he will reach the location of the emergency before, at the same time as, or after the mobile unit. The information contained in the message sent to the operator could also include the expected time of arrival of the mobile unit, in order to allow the operator to decide whether to intervene or to wait, based on her/his personal expertise.
A simple software system will be needed in order to identify the nearest volunteers in the existing database.

Milestones alongside the project

Once identified the most suitable city/town/area to initiate a pilot trial of the present project, requirements for operators to be included in the database will be outlined. Emergency-specialized physicians, such as resuscitation, critical care, anesthesiology, surgery, cardiology, emergency medicine specialists, will be the most suitable for inclusion. Medical doctors whose field of specialization does not deal with emergencies would also be considered, as far as they have undergone recognized specific training. As for nurses, they should be included, provided that their daily work involves critical areas or they have undergone emergency training.
The most difficult decision is perhaps the inclusion/exclusion of non-health-care workers with Basic Life Support training. It is now accepted that in many cases of cardiocirculatory arrest the therapeutic actions which are most effective in increasing survival are external chest compressions, artificial ventilation (such as mouth-to-mouth) and early defibrillation. These maneuvers, however, must be put into action within five minutes from a cardiovascular arrest, and lose effectiveness with time. They are very useful to gain time until more advanced rescue will be available. An enormous number of people can be instructed to resuscitate a

patient through modern Basic Life Support (BLS) and can learn how to use effectively a semiautomatic defibrillator. With improving public awareness of emergency medical service issues and the value of personnel trained in First Aid, BLS and public access to semiautomatic defibrillators, it will be less and less likely to be caught by a heart attack in a room where there is neither a defibrillator nor somebody who is able to operate it. Therefore non-health-care workers should be included, and specifically associated with the emergency "cardiocirculatory arrest". Their ability to offer help in other situations may be more questionable.

METHODS

A survey will be conducted in order to identify the most suitable city/town/area to initiate a pilot trial of the present project. A "control" city could also be recognized, with the same territorial emergency service organization and similar overall mortality.
Regional governments and local emergency services will be involved in this process. Study population will be constituted by both new enrolled volunteers and pre-existing personnel, as well as the population of the "pilot" city.
Operators participate to this database in their off-duty time. Adhesion to the database must be completely voluntary, names and personal data treated according to local laws on privacy. Operators should not face any economical cost for his/her participation: mobile phone and calls to the emergency center should be free of charge, policies regarding insurance coverage ensured. Efforts will be needed in order to involve and provide incentives for a sufficient number of operators. Pre-existing personnel in the territorial emergency services (both voluntary and professional) will also be involved.
A software able to manage the list of operators, locate their mobile phones, and contact them will then have to be created.
Using a GSM cellular communication system, the software will make a proximity comparison between the cell which represents the location of the selected operator and the cell which represents the location of the emergency. The selection of the operator may be performed by imposing as a rule that the cell of the emergency should be adjacent to the cell in which the operator is momentarily located, or that the two cells should coincide.
The method here described has a particular advantageous application if the identification data of the call furthermore includes the nature of emergency call and the list or database associates each operator with an area of expertise.
Using this additional data of the emergency call, the step of selecting the operator is performed in such a way that the type of operator has a predefined compatibility with the nature of emergency. Consequently, the operator who is both closest to the zone of the emergency and who, in terms of specialization characteristics, is the best prepared to deal with the particular emergency situation is chosen.
The local emergency service operational centres will have to be optimized in order to cooperate effectively with the new operators.
A widespread advertising of the project will be made among the general population.
The pilot project will then be started and a cost/benefit analysis will be made before the end of the 3-year period.
The results of the pilot study will then be presented at national and international meetings, published on specialized journals and both the general population and the local authorities will be made aware of them.
Reduction in mortality among the general population will be the primary outcome.

General transferibility and potential impact of results

This new method of "proxy on-call assistance" is able to overcome some of the drawbacks of the current "118 system" allowing the emergency center to be put in contact with a specialized operator present next to the emergency zone (in a cooperative, non-competitive manner with the dedicated emergency services).

Trained operators would be widely available for rapid intervention, at a much lower cost and in shorter time than providing every mobile rescue unit with specialized personnel. A simple software system able to identify the nearest volunteer in the existing database is needed, and spreading of Basic Life Support training among the population, along with the distribution of semiautomatic defibrillators in public places, could improve first aid in cardiorespiratory circulatory arrest, trauma or catastrophes.

CONCLUSIONS

According to this project of "proxy on-call assistance" it will be possible to contact in real time the nearest operator available for managing a medical emergency in order to optimize response times and, consequently, increase survival rates of victims of cardiocirculatory arrest, trauma or other catastrophes. This response plan to emergencies is feasible thanks to spreading of mobile phone communication, implementation of appropriately trained personnel, control of medical equipments and early access to a dedicated emergency call system.

A simple software will be needed to identify the nearest medical operator, with the highest level of training, among those included in a local database.

No conflict of interest acknowledged by the authors.
This paper was supported in part by "Un cuore per la vita".

Acknowledgements
The authors wish to thank Cristiano Chiappa, SN, for the support in developing this method.

REFERENCES

1. Landoni G, Biselli C, Maj G, Zangrillo A. "Faster rings in the survival chain: mobile phones could improbe the response to the dedicated emergency call system". Resuscitation 2007; 75: 547.
2. Centers for Disease Control and Prevention (CDC). State-specific mortality from sudden cardiac death. United States, 1999. MMWR Morb Mortal Wkly Rep 2002; 51: 123-126.
3. Valenzuela TD, Roe DJ, Nichol G, et al. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. N Engl J Med 2000; 343: 1206-1209.
4. Weisfeldt ML, Becker LB. Resuscitation after cardiac arrest: a 3-phase time-sensitive model. Jama 2002; 288: 3035-3038.