

Stress and distress: the art and science of dispatcher's assisted cardiopulmonary resuscitation.

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Abstract:

Chances of survival following a cardiac arrest are very low and inversely proportional to the duration of cardiovascular arrest. It is of critical importance to perform cardiopulmonary resuscitation (CPR) as soon as possible, even before the arrival of emergency medical team (EMT) on the scene. Therefore, early bystander CPR is a key factor in improving survival from out-of-hospital cardiac arrest (OOH-CA). In Belgium, the ALERT algorithm (Algorithme Liégeois d'Encadrement à la Réanimation par Téléphone^a) offers the opportunity to help bystanders perform CPR. Dispatchers' assisted telephone CPR has introduced a new link in the chain of survival, that contributes to a reduced OOH-CA mortality rate but at the cost of increased responsibilities and stress. ALERT also gives a new role to bystanders; they are no longer just spectators but become actors when they witness a cardiac arrest. Our team was interested in the psychological burden of ALERT. Therefore, we evaluated the effects of CPR performed by untrained persons. We studied the potential influence of different coping strategies on this impact, as well as the possible correlation with the degree of attachment to the victim and the risk of developing PTSD (Post Traumatic Stress Disorder). We noticed that some psychological negative impact on the bystanders could be recognized. We also identified beneficial and detrimental coping strategies. In the future, we wonder if Video-CPR (V-CPR) might improve the quality of resuscitation.

Algorithm for CPR guidance over the phone originating from Liege, Belgium

1. Introduction:

Every year, 135 million deaths caused by cardiovascular diseases are reported worldwide¹. OOH-CA appears as a sudden and unexpected collapse due to the cessation of myocardial mechanical activity. Such distressful situations have been estimated to be responsible for the deaths of 300 000 people annually in the United States of America². Sudden cardiac arrest is associated with very low survival rates and the mortality rate is estimated at more than 90%³. Additionally, after surviving an OOH-CA, many patients encounter extensive impairments in their level of functioning and quality of life⁴; the few survivors, unfortunately, almost always suffer from long-term disabilities, as the result of brain insult due to the abrupt impairment in cerebral blood flow followed by circulation return, leading to complex re-oxygenation and reperfusion injuries⁵.

Without any care, the chance of survival following sudden cardiac arrest dramatically decreases from 7% to 10% per every minute⁶. According to international recommendations, the first basic resuscitation procedures should be established within the shortest time period, ideally less than 4 minutes⁷. According to the American Heart Association guidelines, the survival chain for the early management of OOH-CA includes four key links. First, the immediate witnesses should call the EMCC112; second, establish early cardiopulmonary resuscitation, third, operate early defibrillation and finally specialized care should be delivered as soon as the EMT arrive⁸.

In order to improve the outcome in OOH-CA resuscitations, it appears thus of critical importance to expedite the initiation of resuscitation procedures by the bystanders and finding the optimal way to achieve this goal has been our priority for the past decade.

Indeed, despite large-scale community training programs, citizen-CPR rates in case of witnessed arrests have been persistently low and only one-third of the victims actually receive CPR before the arrival of emergency medical services⁹. Excessive bystanders stress or apathy, lack of confidence, but also reluctance to give rescue breaths and fear of communicable diseases have been invoked as reasons to explain such a disappointing situation⁹. Concretely, in most western countries, the delays between bystanders' calls and the arrival of the EMS teams at the scene have constantly been excessive, not only in rural areas, but also in suburbs and urban zones. In Belgium, for example, there is a mean free medical interval of 13 minutes before EMS arrival at the scene^{9,10}. Without any cardiopulmonary resuscitation (CPR) by the witnesses, such delays invariably result in poor survival rates in case of OOH-CA^{11,12}.

In 2010, Fabrice Dami introduced the concept of dispatcher's time window⁵. Indeed, for many years the primary mission of emergency dispatch centers consisted in answering all incoming calls, identifying and locating the victim and then dispatching the adequate rescue vehicles and EMS personnel to the site as soon as possible. However, additional life-saving procedures have been further developed which include dispatchers offering emergency guidance to basic life

support to bystanders calling in. Such telephone guidance, called phone-CPR or T-CPR assistance, has not only increased the skills and responsibilities of the dispatchers but has undeniably introduced a new link in the chain of survival and contributed to reduce OOH-CA mortality. As soon as this window was opened and the opportunity of assistance acquired, it was questioned whether this space could help transmit adequate guidance within the time frame available. In that regard, the Advanced Medical Priority Dispatch System (AMPDS), initially developed in Salt Lake City by J. Clawson¹³ has often been considered as the most effective emergency (dispatch) system. It is based on a systematized caller interrogation which help dispatchers determine the severity level of the calls and provide pre-arrival instructions. Its use optimizes resource allocation. These elements explain why in an increasing number of countries in which English is the primary language, this structured, state-of-the-art, dispatch systems have been implemented with success. However, countries whose primary language was not English have been facing the difficult challenge of developing their own system of emergency medical dispatch. The lack of any validated phone CPR protocols translation has long been an important hurdle hindering the active promotion of phone CPR throughout Europe.

Another key-element in the art and science of providing CPR instructions through the phone during cardiac arrest is the ventilation and mouth-to-mouth concern. Indeed, providing complete phone-CPR instructions through the traditional 'A-B-C' CPR sequence is a rather long and complex process. The skills required to

check for responsiveness and identify cardiac arrest appear to be difficult to transmit remotely, while instructions on how to perform ventilation are particularly difficult to carry out, thus increasing the delay before the first chest compression. Moreover, airway opening is often poor and, as a consequence, effective rescue breaths are frequently inadequate. However, experimental animal studies and analysis of human data from out-of-hospital cardiac arrest registries have revealed that the absence of ventilation for several minutes immediately following a cardiac arrest may not adversely affect the outcome, provided that chest compressions were correctly performed. Accordingly, the most recent guidelines recommend compression-only CPR protocols for dispatcher-assisted instructions for untrained bystanders. The omission of this persistently repulsive aspect of the basic life support approach for naive bystanders and the subsequent simplification of the protocols for assistance by the dispatchers have considerably contributed to promote active implementation of T-CPR.

As a consequence, we developed in Belgium a French-language algorithm named A.L.E.R.T. (Algorithme Liégeois d'Encadrement à la Réanimation par Téléphone^{a)}) providing medical dispatchers with the operational procedures to guide bystanders in performing basic life support (BLS). In a preliminary manikin study, we demonstrated that this protocol had the potential to help both previously trained and untrained bystanders initiate CPR¹⁴. Based on these results, the Belgian Federal Public Health Service (BFPHS) decided to

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implement ALERT throughout the country. This protocol has been approved by the Belgian Resuscitation Council (BRC) and then added to the standard federal 112 operator training. It is also available online at the following address: www.phonecpr.be. The next step was to develop an educational project for the implementation of the protocol and evaluate the training^{15,16,17}. The need for a continuous training and education has become essential to ensure skills¹⁵. Therefore, a continuous education "E - learning " was developed and we demonstrated the similar pertinence of both methods in terms of efficiency, with a pre- and post- training gain of 51% for the conventional method against 46.7% for the " e-learning " method¹⁶.

As expected, the implementation of this protocol in Belgium rapidly resulted in a significant increase in the quality of assistance, motivation and performance of dispatchers¹⁵. As a consequence, during the 2008-2011 period, the proportion of people receiving CPR significantly increased (from 9.87% in 2008-2009 to 22.55 % in 2010-2011; $p < 0,0002$). In addition, the no flow-time (the period of time between the start of the call and the first chest compressions) which is known to be a major determinant of the survival rate after OOH-CA, has been considerably reduced, leading to a 13% increase of that survival rate¹⁵.

Despite these exciting results, we rapidly wondered what psychological cost we should be expecting from that window opening on private matters and sufferings. Indeed, as soon as that window was half-opened, the dispatchers were directly involved in family distresses and despair,

sometimes having to deal with grief and death issues. These delicate situations raised concerns about dispatchers' personal emotional involvement. Also, on the other side, we wondered if the stress induced when bystanders provide basic life supports efforts was tolerable, and more specifically, if it could or not induce any post-traumatic stress disorders. This new dimension in the role devoted to a bystander, from spectator to actor, might expose bystanders to further emotional stress.

Whereas recent reports suggest that witnesses' presence during CPR are not associated with a higher occurrence of post-traumatic stress disorders-related symptoms (PTSD)¹⁷, little is known about the psychological burden of dispatcher-assisted CPR for the bystanders.

Therefore, we designed a study to evaluate the psychological impact of CPR practice by untrained persons and the potential influence of different coping strategies on this psychological impact.

More specifically, we hypothesized that the guidance or the application of the CPR protocol by untrained persons, regardless the degree of attachment to the victim, partner, child, friend relationship or unknown person, might lead to some psychological impact, such as distress, worry or anxiety during the CPR, 6 to 10 days after, and 2 to 3 months after the event. We also hypothesized that distress, worry, anxiety or PTSD post-event were related to coping strategies such as self-efficacy or perceived social support.

2. Methods:

2.1 Study design and population:

This longitudinal experimental survey investigated the psychological distress and worries on a study sample of Belgian adult OOHCA bystanders.

The study included 3 phases. First, we analyzed emergency calls to the dispatching center concerning an OOHCA (T0). Secondly, we contacted the bystanders of these OOHCA 6 to 10 days

after the call (T1). Finally, we recalled the subjects 2 to 3 months later (T2).

2.2 Data collection and analysis (Figure 1):

The emergency calls were analyzed at T0 with a generic grid stress assessment specifically developed for this study. This tool describes behaviors and reactions of the bystander such as vocal expression, communication, emotions, behavior, task execution and thoughts system.

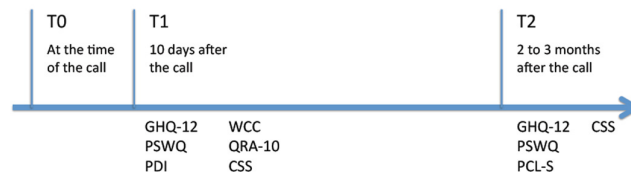


Figure 1. Data collection

Psychological variables were evaluated at T1 and T2 with the following questionnaires:

- the General Health Questionary (GHQ-12¹⁸) which assesses psychology distress (anxiety, depression, social dysfunction and loss of confidence).
- the Penn State Worry Questionnaire (PSWQ¹⁹) which assesses worries.
- the Peritraumatic Distress Inventory (PDI²⁰) which assesses peri-traumatic distress at the time of the call.
- the Post-Traumatic Checklist Scale (PCL-S²¹) which assesses post-traumatic stress symptoms.

Adaptive strategies variables were evaluated at T1 and T2 with:

- the Ways of Coping Check-List (WCC²²) which assesses two

coping strategies (problem-focused strategy or emotion-focused strategy) at the time of the call.

- the Resources Acquired Questionnaires (QRA-10²³) which assesses two general skills: cognitive and emotional self-control (ACE) and expectations efficacy (AEF).
- the Crisis Support Scale (CSS²⁴) which assesses perceived social support.

These score are associated with several clinically relevant cut-off values:

- For GHQ-12, a score ≥ 2 indicates significant distress²⁵.
- For PSWQ, a score ≥ 45 indicates excessive worries²⁶.
- For PDI, a score > 15 indicates significant distress during the call²⁷.
- For PCL-S, a score ≥ 44 indicates post-traumatic stress symptoms²⁸.

2.3 Statistical analysis:

We applied ANOVA, Kruskal-Wallis and Spearman's correlation tests to analyze the data's, and a Wilcoxon signed-rank test to compare T1 and T2 psychological state of the subjects.

3 Results:

3.1 Participants flowchart (Figure 2):

We contacted 44 subjects, among which 14 agreed to participate to our study at T1. Four participants were excluded at T2, by not answering the calls.

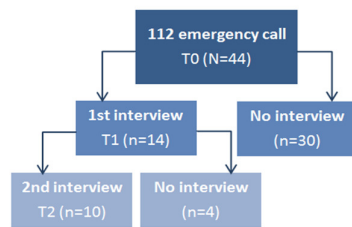


Figure 2. Patients flowchart

Table 1 exposes the demographic data of the 14 study subjects.

	T1		T2	
	M	SD	M	SD
Age	48	12.8	50.1	14.5
	N	%	N	%
Sex				
Man	9	64.3	6	60
Woman	5	35.7	4	40
Link				
Parent	4	28.6	2	20
Partner/spouse	2	14.3	2	20
Friend	8	57.1	6	60

Table 1. Participants characteristics

3.2 Psychological impact:

The Table 2 indicates the scores gained by our study subjects.

We observed that the psychological distress (GHQ-12) scores of 8 subjects are over the cut-off values in T1 and 5 in T2, as well as worries and anxiety (PSWQ) scores, with 4 subjects in T1 and 2 in T2.

Three subjects' scores are also over the cut-off values for post-traumatic symptoms (PCL-S) in T2

Subject	T1			T2		
	PDI	GHQ-12	PSWQ	GHQ-12	PSWQ	PCL-S
1	13	7	39			
2	8	0	20	0	18	17
3	4	9	45	1	26	21
4	9	5	68	11	58	58
5	5	0	27	0	30	21
6	8	4	43			
7	7	0	40	2	35	27
8	7	0	34			
9	13	7	50	2	37	31
10	11	4	41	7	35	44
11	15	9	46	2	47	46
12	2	0	32	0	32	24
13	5	6	29			
14	5	1	36	0	25	23

Table 2. Raw scores of subjects to psychological impact variables

3.3 Correlations between psychological impact and adaptive strategies:

Six to 10 days after the event, the emotional and cognitive control factor of self-efficacy was negatively correlated with psychological distress ($p<0.05$) and

worries ($p<0.06$) (Table 3). After 2 to 3 months, the use of emotion-focused coping strategies at the time of the call was positively correlated with worries ($p<0.05$) and social support negatively correlated with psychological distress ($p<0.06$).

		QRA-10		WCC at the time of call		CSS
		ACE	AEF	Problem-focused coping	Emotion-focused coping	
T1	PDI			-.34	.43	
	GHQ-12	-.50*	.14	-.31	.08	.38
	PSWQ	-.65**	-.14	-.18	.03	-.03
T2	GHQ-12	-.35	-.24	-.31	.52	-.60*
	PSWQ	-.28	-.04	-.26	.66**	-.52
	PCL-S	-.31	-.19	-.38	.52	-.40

Note. *p < .06. **p < .05

Table 3. Pearson's correlations between psychological impact index and adaptive strategies variables

3.4 Correlations between psychological impact and affective link:

We didn't find any significant correlation between psychological impact of the CPR practice on the bystander and an affective link with the victim.

4 Discussion:

Data from this study support the hypothesis that CPR's practice by untrained persons could have a psychological impact. In accordance with previous works^{29,30}, our results confirm that the use of coping strategies focused on emotions at the time of call, cognitive and emotional self-control skills and social support might influence this psychological distress.

Indeed, we identified that the use of emotion-focused coping strategy was detrimental in the way that it increased the psychological distress and decreased the perception of control and self-efficacy, and could then increase stress reactivity and the psychological distress of the event. The subject becomes then less effective in the adjustment to a stressful situation.

On another hand, social support is, for its part, perceived to be an important adjustment factor to stressful event³¹, which should be favored.

Interestingly, we were able to identify 3 subjects with Post-Traumatic Checklist Scale score at 3 months above the cutoff value, meaning the emergence of post-traumatic symptoms cut. Although such finding does not imply the systematic development of a true chronic PTSD, which cannot be diagnosed until 6 months³² after the event exposure, this observation deserves cautious attention.

Indeed, in the absence of comparison of the psychological impact between the active versus passive bystanders, it is impossible to determine the particular impact of the bystander's active or passive role in the resuscitation.

However, this early evaluation should be considered as a warning point, allowing the early recognition of subject demonstrating a degree of fragility who could potentially benefit from support.

Besides the benefits for the patient, ALERT still seems to have little-known psychological issues for the bystanders.

These findings motivated us to develop further research on psychological distress of bystanders CPR's practice, because a better identification of emotional distress on bystanders and adaptive strategies could help emergency medical services develop measures to limit such psychological impact and then increase

their involvement.

The lack of tools available and the limited training of the dispatchers as concerns communication skills or the identification and management of stress during communication³³, should be the trigger to study the inhibiting and facilitating communication factors between the dispatcher and the bystander. Indeed, a better understanding of these tools and techniques could reduce the stress at the time of the call and after, but also increase the implementation of resuscitation.

In that perspective, the evaluation of the dispatcher's psychological point of view would also be beneficial.

As mentioned above, the current "normal" practice in the field dispatcher-assisted CPR (in Liege at first and in Belgium soon after) is phone CPR assistance through ALERT (and its translation in Dutch and German). This first step was essential in meeting what had become a universal standard in terms of quality of emergency services, but further stages have to be crossed. In that perspective, we believe that telemedicine represents our future.

5 Limitations and perspective:

Our results should be interpreted with caution as regard the small sample size.

These preliminary results will be re-examined in view of further data recordings that are currently performed in our Centre. In further research, we will also re-evaluate the Post-traumatic symptoms 6 months after the event.

On the basis of our preliminary works on video-assisted CPR, we sincerely believe that this further step forward will truly help saving more life and reducing most of the suffering resulting from these dramatic incidents³⁴.

This study opens a new era in the understanding of bystanders' psychological distress as a consequence of CPR's practice. Time has come then to consider dispatchers' point of view and to evaluate the use of new technologies in the art and science of bystanders' assisted CPR.

6 Conclusion:

OOH-CA is a tragic event that radically reduces the survival chances of the victim. The ALERT algorithm has the potential to improve the quality and the frequency of CPR initiated by bystanders. However, such improvement comes at the cost of some psychological burden.

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