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Clinical paper

To transport or to terminate resuscitation on-site. What factors influence EMS decisions in patients without ROSC? A mixed-methods study



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Abstract

Background: If a patient in out-of-hospital cardiac arrest (OHCA) does not achieve return of spontaneous circulation (ROSC) despite advanced life support, emergency medical services can decide to either transport the patient with ongoing CPR or terminate resuscitation on scene.

Purpose: To determine differences between patients without ROSC to be transported vs. terminated on scene and explore medical and nonmedical factors that contribute to the decision-making of paramedics on scene.

Methods: Mixed-methods approach combining quantitative and qualitative data. Quantitative data on all-cause OHCA patients without ROSC on scene, between January 1, 2012, and December 31, 2016, in the Amsterdam Resuscitation Study database, were analyzed to find factors associated with decision to transport. Qualitative data was collected by performing 16 semi-structured interviews with paramedics from the study region, transcribed and coded to identify themes regarding OHCA decision-making on the scene.

Results: In the quantitative Utstein dataset, of 5870 OHCA patients, 3190 (54%) patients did not achieve ROSC on scene. In a multivariable model, age (OR 0.98), public location (OR 2.70), bystander witnessed (OR 1.65), EMS witnessed (OR 9.03), and first rhythm VF/VT (OR 11.22) or PEA (OR 2.34), were independently associated with transport with ongoing CPR. The proportion of variance explained by the model was only 0.36. With the qualitative method, four main themes were identified: patient-related factors, local circumstances, paramedic-related factors, and the structure of the organization.

Conclusion: In patients without ROSC on scene, besides known resuscitation characteristics, the decision to transport a patient is largely determined by non-protocollized factors.

Keywords: OHCA, ROSC, Decision-making, Transport practices

Introduction

During an out-of-hospital-cardiac-arrest (OHCA), emergency medical services (EMS) deliver advanced life support (ALS) on scene. When a patient does not achieve return of spontaneous circulation (ROSC)

despite ALS, EMS can decide to either transport the patient with ongoing CPR or terminate the resuscitation on scene.¹ In general, 50–90% of OHCA patients do not achieve ROSC on scene.^{2–5} The European Resuscitation Council (ERC) guidelines recommend termination of resuscitation (TOR) in case of asystole for more than 20 min during ALS and recommend that transport with ongoing CPR

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should be considered in case of EMS witnessed arrest, ROSC at any moment, a shockable initial rhythm or a presumed reversible cause.^{1,6} There is evidence that delaying a decision to transportation until termination rules can be applied will impair the chance of survival of those who should be transported without ROSC.⁷ Previous research has shown that the decision to start transport with ongoing CPR could be influenced by factors such as compromised scene safety, the expectation of the public, and environmental circumstances.^{8–11}

In the Netherlands, paramedics are legally allowed to make TOR decisions in the pre-hospital setting without consulting a physician. It is rarely documented which factors contribute to the decision to transport or terminate resuscitation of a patient when resuscitation appears to be unsuccessful. This study aims to explore medical and nonmedical factors that determine the decision to transport or terminate resuscitation on scene and to determine the differences between patients without ROSC that are transported or resuscitation terminated on scene.

Methods

Design

We designed a sequential mixed-methods approach to quantitatively assess the data of OHCA patients without ROSC on scene and to qualitatively assess the perception of paramedics on factors contributing to the decision to transport these patients. The purpose of pairing qualitative and quantitative components within this study was to provide a better understanding of these paramedics decisions.¹²

Quantitative method

Study setting and patient population

For the quantitative part of this study we used the data from the Amsterdam Resuscitation Study (ARREST). The ARREST study is an ongoing prospective registry of all-cause OHCA in the Northwest part of the Netherlands. We included all-cause OHCA patients without ROSC on scene with attempted resuscitation between January 1, 2012 and December 31, 2016. Exclusion criteria were (transient) ROSC before transport and unknown ROSC status before transport. The medical ethics review board of the Amsterdam UMC, Academic Medical Center (AMC), approved the study including the use of data of deceased patients. Deferred consent was obtained from all surviving patients. In the Netherlands there is no donation procedure in case of out-of-hospital cardiac arrest, therefore patients are not transported with ongoing CPR for the purpose of organ donation. The specifics on the EMS system in the region and the ARREST data collection are described elsewhere.^{7,13,14}

Time intervals and definitions

Time-stamped data on the emergency call at the dispatch center, EMS arrival on scene, EMS departure from scene, and arrival at the emergency department (ED) were collected to create time intervals. EMS arrival on scene was defined as the moment the EMS manual defibrillator was connected to the patient. The ‘time to decision’ of EMS was the interval between EMS arrival on scene and departure of the ambulance from the scene. In cases of EMS witnessed arrests, ‘time to decision’ was the interval between the collapse and departure of the ambulance from the scene. If the resuscitation was terminated on

scene, ‘time to decision’ was the interval between EMS arrival and disconnection of the EMS manual defibrillator at the moment of termination. Information regarding (transient) ROSC was obtained from the EMS report.

Outcome

The outcome of this study in the quantitative analysis was transport with ongoing CPR to the hospital or TOR.

Statistical analysis

Categorical variables were presented as percentages and continuous variables as mean and standard deviation (SD) or as median and interquartile range (IQR) depending on the data distribution. To investigate independent associations between resuscitation variables and transport we used a multivariable logistic regression model. In the model, all variables significantly associated with univariate analysis were included. We used the Hosmer–Lemeshow test for the goodness of fit and the Nagelkerke test to assess the explained variance of the model. We reported the odds ratio with 95% confidence intervals (CI) and associated p values. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using IBM SPSS statistics 26 (IBM Corporation, Armonk, NY).

Qualitative method

Semi-structured interviews were used to explore unknown (non) medical factors that may contribute to the decision to start transport or terminate the resuscitation on scene.

Sample

Paramedics from the four regions in the study area were invited to participate in the study. Selection criteria were: at least 1 year of work experience as an EMS paramedic and participating in at least 10 OHCA. Interested paramedics were informed about the purpose of the study and when they agreed to participate, informed consent was obtained.

Interviews

For the semi-structured in-depth interviews a topic-list was developed based on the results of the quantitative part of this study and previous research (Supplemental data 1a, eTable 1).^{8–11} Topics were about the decision-making on scene and factors contributing to the decision to transport or terminate the resuscitation on scene. We used a narrative approach to encourage the paramedics to share their experiences on scene during resuscitation. Each interview lasted 30–45 min. An in-depth interview is a conversation with a specific research purpose, and the focus lies on the informant's perception of self, life, and experience, expressed in his or her own words. This allows the researcher to understand the personal interpretations of social reality that individuals hold.¹⁵ All interviews were conducted by CG at the location of the participant's choice (either at home or the EMS station). To ensure validity and reduce possible bias every participant received a summary of the interview to check for accuracy of interpretation.

Analyses

All tape-recorded interviews were transcribed verbatim using a thematic content analysis based on comparisons within and across respondents.¹⁶ Data analysis of the first four interviews were done by

two researchers (AdK and CG) so that they could agree upon a method of coding. The remaining analyses were performed by CG. Details of the analysis of the interviews are described in Supplemental data 1b.

Results

Quantitative results

In 5870 of 12,348 patients with suspected OHCA resuscitation was started by EMS. Of these, 3190 (54%) patients did not achieve ROSC on scene. Of these, resuscitation was terminated on scene in 2269 patients and 921 patients were transported with ongoing CPR (Fig. 1).

Baseline patient and process characteristics

Patient and process characteristics of patients without ROSC on scene are shown in Table 1. In a multivariable model, age, public location, bystander witnessed arrest, EMS witnessed arrest, and first rhythm VF/VT or PEA, were independently associated with transport with ongoing CPR (Table 2). The variance explained by the model was 0.36.

Qualitative results

Sixteen paramedics from four different EMS regions each, were interviewed (Table 3). Fig. 2 displays the identified four main themes

and corresponding subthemes. For each main theme representative quotes illustrating different subthemes are shown in Table 4. Additional illustrating quotes for each subtheme are shown in Supplemental data 1c, eTable 2.

Patient-related factors

Religion of the patient and family, age of the patient, comorbidity, and the Do Not Resuscitate (DNR) status could influence the decision-making on scene. The family may pressure paramedics, because according to their religion everything has to be done including transport for further care. The age of the patient, in particular very young patients, influences paramedics to transport a patient, regardless of the result of the resuscitation effort. Conversely, advanced age could be a factor for some paramedics to withhold the decision to transport:

“For me, I think the age of a patient plays a role, I do have some reservations to resuscitate people who are very old, even if they are vital. They do not get any better from it.” (Paramedic C, male, 42 yr, 7 years of work experience)

In patients with severe comorbidities such as end-stage cancer, dementia, and extensive heart-or pulmonary disease paramedics are more reluctant in the decision to transport. In case of disagreement between family members regarding the DNR status of the patient, the resuscitation was continued or even transport to the hospital could be chosen to escape from the situation.

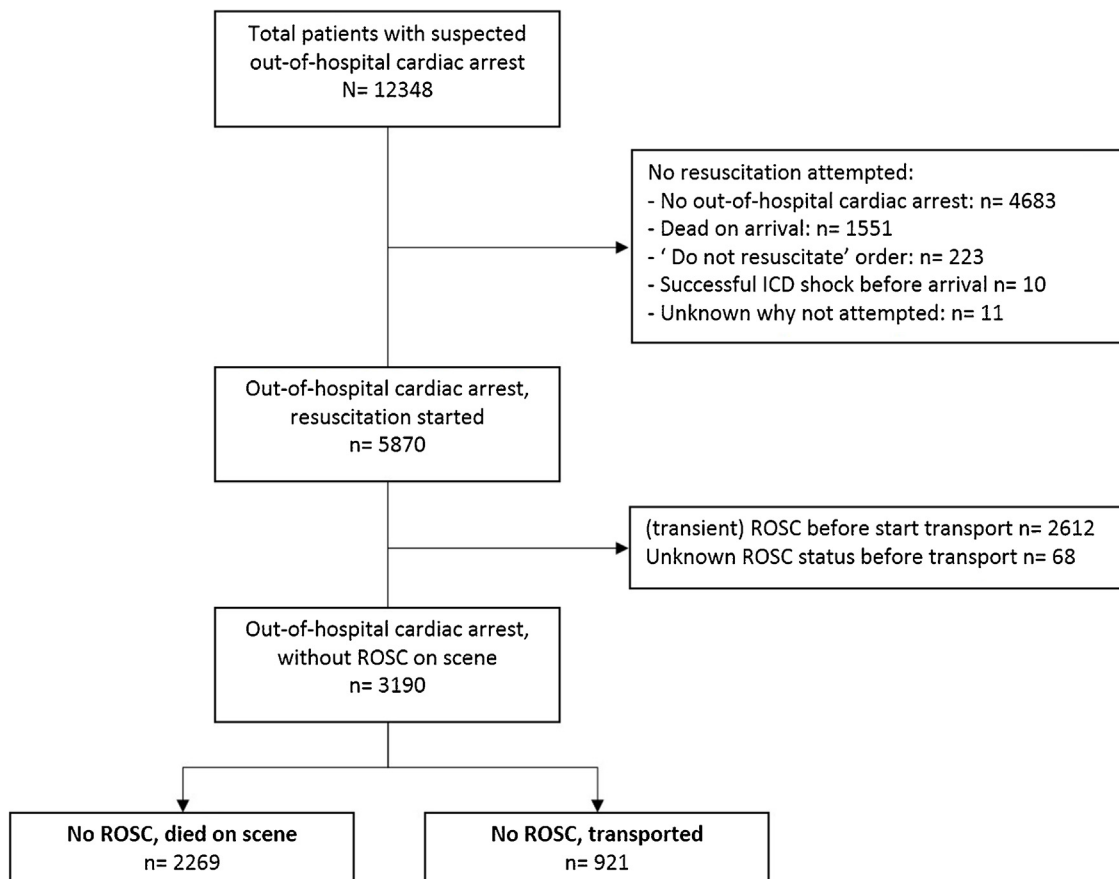


Fig. 1 – Flowchart of patient inclusion.

Table 1 – Baseline characteristics of OHCA patients who died on scene and patients transported with ongoing CPR.

	No ROSC and died on scene N = 2269	No ROSC and transported N = 921	p-Value	Missing N (%)
Pre-OHCA factors				
Age, years, mean (SD)	67 (16)	63 (15)	<0.001	57 (2%)
Sex, n (%)				
Female	735 (33%)	188 (21%)	<0.001	2 (0.1%)
Male	1515 (67%)	695 (79%)		
Resuscitation parameters				
First monitored rhythm, n (%) ^a				
VF/VT	270 (13%)	417 (52%)	<0.001	252 (8%)
PEA	685 (33%)	256 (32%)		
Asystole	1127 (54%)	128 (16%)		
Presumed cause, n (%)				
Medical	2046 (91%)	810 (92%)	0.38	1 (0.1%)
Not medical	206 (9%)	72 (8%)		
Location of arrest, n (%)				
Residential	1856 (83%)	518 (59%)	<0.001	1 (0.1%)
Public	395 (17%)	365 (41%)		
Witnessed arrest, n (%)				
Not witnessed	1041 (47%)	185 (21%)	<0.001	37 (1.2%)
EMS witnessed	76 (3%)	108 (12%)		
Bystander witnessed	1108 (50%)	580 (33%)		
CPR before EMS, n (%) ^b				
No Bystander CPR	383 (18%)	147 (19%)	0.41	30 (1%)
Bystander CPR	1742 (82%)	612 (81%)		
AED connected, n (%) ^b				
No	810 (38%)	316 (41%)	0.07	1 (0.1%)
Yes	1339 (62%)	448 (59%)		
First defibrillation by ^c				
AED	227 (48%)	270 (51%)	0.34	1 (0.1%)
EMS manual defibrillator	249 (52%)	257 (49%)		
Time intervals				
Response time, minutes, median (IQR 25,75)	12.3 (9.8, 15.3)	11.5 (9.4, 14.6)	0.001	509 (16%)
Call to first defibrillation, minutes, median (IQR 25,75) ^c	9.6 (7.5, 11.5)	9.3 (7.1, 12.0)	0.40	1 (0.1%)
Time to decision, minutes, median (IQR 25,75)	22.8 (17.3, 27.9)	24.9 (18.8, 30.7)	<0.001	649 (20%)

Chi-square statistics were used to compare categorical data. For continuous data unpaired *t*-test or Mann–Whitney *U* test was used when appropriate.

CPR — cardiopulmonary resuscitation; VF/VT — ventricular fibrillation/tachycardia; PEA — pulseless electrical activity; EMS — emergency medical services; SD — standard deviation; IQR — inter-quartile range; ED — emergency department.

Percentages shown are column percentages.

^a In case of EMS witnessed, first monitored rhythm is rhythm at collapse.

^b If not EMS witnessed.

^c If shockable first rhythm (including AED shocks).

Local circumstances

Bystanders present, the OHCA location, circumstances before EMS arrival, weather conditions, and safety could influence the decision-making. Paramedics reported that they decided to transport when bystanders, especially family, insisted and exerted pressure to transport or continue CPR. It was often mentioned that the hospital was a safer place or a quieter environment, which would make it easier for the family to accept termination of resuscitation. Also, in a public location (e.g. streets, church) paramedics would favour transport to remove the patient from the situation. Circumstances as witnessed OHCA, AED use, and BLS before EMS arrival influence the opinion on the chances of the patient and therefore also the decision to transport a patient. Weather conditions (e.g. heavy rain or cold) led to the decision to treat the patient in the ambulance and when a patient was already in the ambulance, the decision to transport was made faster. Transport was also accelerated by unsafe local circumstances such

as the location itself (e.g. freeway) or by threats from bystanders or family.

Paramedic-related factors

The religion of the paramedic, collaboration with colleagues, expectations of the outcome, and work experience, could influence decision-making. Some paramedics reported that the religion of a colleague influenced a decision and those colleagues often continued the resuscitation when others would have stopped:

“I did have one colleague who was very religious, he wanted to resuscitate everyone even if someone was totally asystolic.” (Paramedic G, male, 49 yr, 22 years of work experience)

In the collaboration on scene, when conflicting opinions between team members occurred, the opinion to transport generally prevailed

Table 2 – Multivariable logistic regression of variables associated with transport.

	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age, per year	0.98 (0.98–0.99)	0.98 (0.97–0.99)
Male	1.79 (1.49–2.16)	1.16 (0.91–1.48)
Public location	3.31 (2.79–3.93)	2.70 (2.13–3.41)
Bystander witnessed ^a	2.95 (2.45–3.55)	1.65 (1.29–2.11)
EMS witnessed ^a	8.00 (5.73–11.15)	9.03 (5.89–13.85)
First rhythm ^b		
VF/VT	13.60 (10.71–17.26)	11.22 (8.45–14.89)
PEA	3.29 (2.61–4.15)	2.34 (1.75–3.11)
Response time, per minute	0.99 (0.98–1.01)	–

Hosmer and Lemeshow Test P: 0.114.
Nagelkerke R Square: 0.36.
OR — odds ratio; CI — confidence interval; EMS — emergency medical services; VF/VT — ventricular fibrillation/tachycardia; PEA — pulseless electrical activity.
^a Reference category: not witnessed.
^b Reference category: asystole.

Table 3 – Characteristics of the 16 paramedics interviewed.

	Paramedic interviews ^a N = 16
Age, years, median (IQR 2575)	49 (41, 52)
Sex, n (%)	
Male	10 (63%)
Female	6 (37%)
EMS work experience, years, median (IQR 2575)	18 (13, 22)
Attempted OHCA's, n, median (IQR 2575)	100 (93, 200)

EMS - emergency medical services; OHCA - Out-of-hospital cardiac arrest; SD - standard deviation; IQR - inter-quartile range.
^a The age and gender distribution of the paramedics interviewed are representative of the work force in this region. According to Dutch EMS statistics, 70% of all paramedics is between 35–54 years old, with a gender distribution of 65% male and 35% female paramedics.

over the opinion to terminate on scene. The expectation of the outcome influenced the decision, positive experiences with patients who survived despite a bad situation on scene led to more transport decisions. Paramedics reported that during the early years of their careers, the decision to stop was more difficult to make and they transported more often instead of terminating the resuscitation on scene. Years of experience made the decision to stop on scene easier.

Structure of the organization

Non-medical responders on scene, resuscitation protocol, complaints or lawsuits, availability of mechanical CPR, training, and available hospitals could influence the decision-making on scene. The non-medical responders on scene (police and firefighters) sometimes wondered why CPR was stopped but this did not influence the decision to stop or transport. In general, the resuscitation protocol is clear regarding the termination of resuscitation, illustrated by the fact that in the case of patients in PEA or asystole paramedics report to agree on

termination. The experience of complaints or lawsuits could influence the decision to transport patients:

"Actually, just as with every complaint, incident, or possible suboptimal functioning, people will get more careful, they feel hurt and will transport and present patients more easily. That way they will step by step build a new level of confidence until something happens again." (Paramedic H, male, 54 yr, 16 years of work experience)

Paramedics reported that with the introduction of mechanical CPR it was easier to transport patients to the hospital with ongoing CPR and paramedics from regions without the availability of mechanical CPR reported they would probably transport more patients if they had mechanical CPR. They also indicate that there could be more focus on communication and social skills when deciding to terminate resuscitation in training according to paramedics. In general, the level of the hospital or distance to the hospital did not influence the decision. Sometimes if the distance to a hospital was relatively long, a physician was contacted for consultation before the decision to transport or termination was made.

Discussion

Our study showed that the factors in quantitative data that were associated with transport only explained 36% of the variance in the decision to transport without ROSC. There was a number of cases where the reason for the decision to transport or to terminate resuscitation was not clear from the quantitative data, indicating that additional factors contributed to that decision. Clearly, our quantitative factors did not describe the process of the decision to transportation sufficiently. The additional variance could be explained by findings of our qualitative research: factors related to the patient, to local circumstances, to the paramedic himself, and to the structure of organization were identified as important additional themes contributing to the decision to transport a patient with ongoing CPR.

A recent review identified similar themes and classified as: the arrest event, patient characteristics, the resuscitation scene, resuscitation provider perspective and medico legal concerns.¹⁷ The review indicated that the resuscitation provider perspective is missing from resuscitation decision-making literature. Our study provides insights on the provider perspective and is an extension of pre-existing literature. A qualitative study using vignettes and focus groups, identified six domains of influencing factors in EMS provider decision-making.¹⁸ Factual information, structural, cultural, interpersonal, safety risk and personal were the domains identified, factors within these domains were similar to the themes in our study (e.g. personal safety, experience of paramedic, age of the patient and the view of colleagues).

According to ERC guidelines, transportation with ongoing CPR should be considered in case of an EMS witnessed arrest, ROSC at any moment, a shockable initial rhythm or a presumed reversible cause, and the guidelines recommend to withdraw further resuscitation in case of asystole for more than 20 min during ALS.^{1,6} In our study both quantitative and qualitative data show that an EMS witnessed arrest and a shockable initial rhythm indeed contribute to the decision to transport and asystole as rhythm to the decision to terminate the resuscitation. Factors such as BLS and AED use before EMS arrival

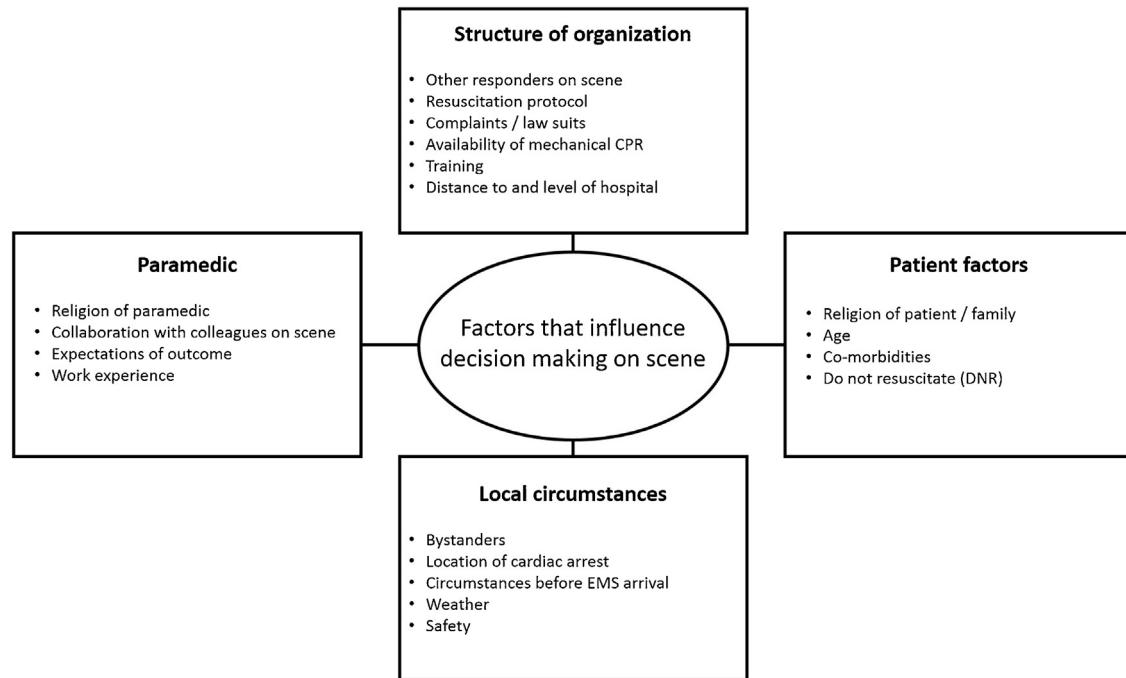


Fig. 2 – Summary figure qualitative data. Main themes and subthemes identified after analysis and coding of the qualitative data.

were mentioned in the qualitative study to contribute to the decision to transport but this was not shown in the quantitative data.

Factors within four main themes could be identified: patient-related factors, local circumstances, paramedic-related factors, and the structure of the organization. Patients transported with ongoing CPR was significantly younger than patients where the resuscitation was terminated. This quantitative finding was complemented in the interviews: paramedics experienced the resuscitation of patients of older age as futile, and even if such a patient survived, the likelihood of a good neurologic outcome was considered questionable. Also, comorbidities such as end-stage cancer, dementia, and extensive heart or pulmonary disease were factors in which paramedics were more reluctant to decide to transport. Obviously such beliefs can create a self-fulfilling prophecy. We know from previous research that resuscitation-related factors and not comorbidity determine outcome after OHCA in elderly patients and that the resuscitation of older patients is not useless because the vast majority of survivors have a favorable neurologic outcome.¹⁹ This indicates that sometimes paramedics now make decisions based on outdated information.

Local circumstances influenced the decision in multiple ways. An OHCA at a public location more often is being witnessed, receives bystander CPR, has an AED attached, and has a shockable initial rhythm. These are all resuscitation characteristics that positively influence the outcome.^{13,20,21} We found that an OHCA in a public location encourages transport independently of these factors, indicating there is more to the decision in public than only resuscitation-based characteristics. If a scene was unsafe because of its location (i.e. highway) or because of pressure or threats from bystanders the decision was made to transport a patient with ongoing CPR to a safer place. This finding is supported by previous literature which also found that scene safety influenced EMS practice.⁸

Several paramedic-related factors were identified with the qualitative part of this mixed-methods study. Experience strengthens confidence and decision-making of paramedics.^{22,23} In our study, clinical experience influenced on-site decision-making, particularly the decision to stop and end the resuscitation on scene was reported as being easier to make through the years of experience. Consequently, this means less experienced paramedics will probably transport more OHCA patients to the hospital because of uncertainty. However, it is not certain if the decision made by the most experienced, indeed is the best decision.

Within the structure of the organization, the availability of mechanical CPR was reported to influence the decision to transport. Manual CPR in a moving ambulance reduces the quality of CPR and potentially harms the paramedic.^{24,25} Mechanical CPR can ensure the quality of CPR and safety of the paramedics during transport.^{24,26} The consequence mentioned in the interviews is that paramedics tend to transport patients with mechanical CPR who would otherwise be left at the scene. This may result in the transport of patients with a very poor prognosis and more pressure on hospital resources.

Another factor within the organizational theme was resuscitation training. Paramedics reported that they experience that in training and post-arrest evaluation the emphasis is on resuscitation skills resulting in a successful resuscitation, while they should welcome more attention to end-of-life decision-making and improving communication skills with bystanders or family. Teaching and discussing Termination of Resuscitation issues as described in our study could be included in training scenarios. Literature suggests that regular training and education help paramedics making the right decisions, while the ability of sharing experiences after an cardiac arrest, for example through a debriefing with feedback, helps to cope with decision-making on scene.^{27,28}

Table 4 – Illustrative quotations for contributing themes in the decision-making process on scene.

Theme	Subtheme	Illustrative quotes
Patient related factors	Religion	"I told the wife of a patient: 'we really do not have anything more we can do, this is the end'. The response was: 'I want you to try it, only then it is god's will' I said: 'Well, if you think that's the only way, we will go on.'" (Paramedic A, male, 59 yr, 20 years of work experience)"
	Co-morbidities	"Advanced cancer without viable treatment options or end stage cancer, dementia, old age with extensive heart failure or extensive COPD. [. . .] you should be more withholding with resuscitation, or at least the survival chances for these patients are very small. I will not immediately transport these patients."(Paramedic E, male, 40 yr, 14 years of work experience)
Local circumstances	Bystanders	"In particular, family from time to time can be very pressing and insisting. Especially, when you are only with two or four, you are quickly outnumbered and the only thing you can say is: 'When the situation asks for it we will transport to the hospital but keep in mind that the hospital will do very little more.' The only advantage at that moment is that the decision will be taken in a more quiet environment" (Paramedic H, male, 54 yr, 16 years of work experience)
	Circumstances before EMS arrival	"Sometimes you cannot know how long someone is down and when the collapse occurred and you have to start anyway. However, if I know for sure that someone is down for a long time or that it is actually futile to resuscitate, than I will stop." (Paramedic I, female, 48 yr, 20 years of work experience)
	Weather	"If you are resuscitating on the streets in a heavy rain shower, well than you say: 'let's go into the car'. [. . .] 'he is now in the car, so just continue and drive to the hospital!'" (Paramedic K, male, 45 yr, 18 years of work experience)
	Safety	"Well, then a firearm was shown and we were told: 'You will go for transport, right?' Of course sir..'" (Paramedic H, male, 54 yr, 16 years of work experience)
Paramedic	Collaboration on scene	"[. . .] it is unspoken rule that if someone objects to stop, than we will transport. Because in the end you want that, that someone has a comfortable feeling or the feeling that he has done everything he could and does not arrive at home with a guilt feelings." (Paramedic E, male, 40 yr, 14 years of work experience)
	Expectations on outcome	"[. . .] we resuscitated continuously for a long time on a very bad patient and who in the end did make it to the hospital. [. . .] the neurological damage was way less than we had expected. That really surprised me. So maybe we need more of those success stories so we think like maybe we should lower the threshold to transport." (Paramedic E, male, 40 yr, 14 years of work experience)
	Work experience	"At the start of my career, it was difficult for me to take a decision about someone's life. I am in service now for 21 years and have seen so much, it is easier to take it." (Paramedic F, female, 49 yr, 21 years of work experience)
Structure of organization	Protocol	"I think, which protocol you have to follow also influences your motivation very much. But I think that if you go in the direction of the asystole/PEA protocol you unknowingly are less motivated to go on, [. . .]."(Paramedic K, male, 45 yr, 18 years of work experience)
	Mechanical CPR	"[. . .], the moment mechanical CPR was introduced the number of people who were transported with asystole increased. [. . .], patients just went underneath the device and got transported because the device was on. However when you stop that device you just see asystole and you have to ask yourself if you want to continue or not." (Paramedic G, male, 49 yr, 22 years of work experience, worked in both EMS regions with and without mechanical CPR)
	Training	"The training on resuscitation skills is very good, however there is less training on what other considerations you can take into account and how you can play a role in what you can do justice to the patient and family. Because you can do justice to the family if you do everything you can, but also when you do nothing." (Paramedic A, male, 59 yr, 20 years of work experience) "

CPR— cardiopulmonary resuscitation; VF/VT — ventricular fibrillation/tachycardia; PEA — pulseless electrical activity; EMS — emergency medical services.

Limitations

One of the limitations that has to be taken into account is that the use of interested paramedics as participants for the semi-structured interviews could create a selection bias. Except possibly having relatively longer work experience, the characteristics of the paramedics that we interviewed (Table 3) does not suggest bias in age and sex of the paramedics. In view of the exploratory nature of the qualitative part of this study we were still able to gain insight in the decision-making on scene. Another limitation is that the qualitative data collected by the interviews do not provide information on how often in daily practice such a factor will contribute to the decision.

Future research

Future studies will be necessary to verify our findings, quantify how much the identified factors contribute to the decision and study whether it is possible to influence these factors in the decision-making process in daily practice.

Conclusion

In patients without ROSC on scene known resuscitation characteristics only explain part of the variance in the decision to transport. Additional factors contribute to the decision-making on scene such as

age and comorbidities of the patient, pressure by family or bystanders, the safety of the OHCA location, work experience of the paramedic, the experience of an incident or lawsuit, and the availability of mechanical CPR.

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Conflict of interest statement

CG was supported and received a speaker's fee from Stryker. RWK was the recipient of the funding for maintaining the ARREST database.

CRedit authorship contribution statement

All authors meet the criteria for authorship stated in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.resuscitation.2021.05.005>.

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