**Volume 1Chapter 65
Termination of resuscitation in the out-of-hospital setting**

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**Introduction**

The irreversible cessation of life may be difficult to determine with complete confidence, particularly in the austere environment of out-of-hospital emergency care. As a result, clear protocols should be implemented in each EMS agency outlining when to attempt resuscitation and when to terminate resuscitation efforts.

When distinctive protocols do not exist, decision making is left to the discretion of the paramedic and the direct medical oversight physician at the point of care. The literature suggests that this leads to bias and inconsistency in care across similar patients [1].

There is limited evidence to guide when to start resuscitation. Yet a large body of work, including external validation across different geographical regions, exists to guide the development of local protocols to provide a consistent approach to termination of resuscitation in adult out-of-hospital non-traumatic cardiac arrest.

**Adult out-of-hospital cardiac arrest**

**When to start resuscitation**

There are three criteria that must be met to start resuscitation in the prehospital setting.

1. Provider safety is assured.
2. The patient is not obviously dead.
3. The patient does not have a “Do Not Attempt Resuscitation” directive (DNAR) that meets local policy.

The issues related to provider safety and policy and directives governing provider safety are dealt with in other chapters. The Uniform Determination of Death Act, which has been adopted by many states, and endorsed by both the American Bar Association and the American Medical Association, states that “an individual who has sustained either: 1) irreversible cessation of circulatory and respiratory functions; or 2) irreversible cessation of all functions of the entire brain, including brain stem, is dead. A determination of death must be made in accordance with accepted medical standards” [2]. Although this statement attempts to define death, it still leaves the determination of the condition to the vague criterion of “accepted medical standards” as well as the provider’s definition of “irreversibility.”

**When to withhold resuscitation**

In most jurisdictions, obvious death with no need to attempt resuscitation is defined by legislation or by medical directives. An unpublished survey of the Resuscitation Outcomes Consortium (ROC) services was completed prior to establishing the ROC Epistry data set [3]. Definitions of obvious death were similar across the >280 services ([Box 65.1](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fea-0001)).

**Box 65.1 Example of obvious death medical directive**

Resuscitation is not warranted where there is evidence of obvious death as defined as:

* Rigor mortis
* Lividity
* Transection
* Decapitation
* Decomposition

As demographics continue to shift toward an aging population, end-of life decisions may be made in advance more commonly in patients calling EMS. A study in 2008 of cancer patients suggested that 37% had had these discussions in advance, which resulted in decreased ventilation, rates of resuscitation, and ICU admission, and increased hospice enrollment for end-of-life care [4]. Most importantly, these conversations resulted in better quality of life for patients and their caregivers. The various platforms facilitating patient decision making need to be considered when establishing medical directives concerning attempting resuscitation. These include living wills, health care advance directives, or (when combined) comprehensive health care advance directives [5,6] (see [Chapter 64](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c64.xhtml)).

Seattle medical directives have been altered to include verbal DNAR as well as written DNAR. Employing a before-and-after design, Feder demonstrated 50% reduction in resuscitation rates when the directive enabled paramedics to not attempt cardiac arrest resuscitation in patients with a history of terminal illness, under the care of a physician at the time, and with a written DNAR or family requesting a DNAR [7,8]. This would have a positive effect on the survival rates from out-of-hospital cardiac arrest as these patients would be removed from the denominator.

In a system with explicit medical directives pertaining to obvious death and prescribed end-of-life autonomy in decision making, all other victims of out-of-hospital cardiac arrest (OHCA) should receive full resuscitation.

**When to terminate resuscitation in adult non-traumatic OHCA**

To understand the evidence for termination of resuscitation (TOR) rules, one must understand the definition of medical futility. Objective criteria for establishing medical futility were defined in 1990 as interventions that impart a <1% chance of survival [9].

In adult non-traumatic OHCA, there is a validated decision rule to guide TOR for BLS [10] ([Box 65.2](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fea-0002)). This rule has been externally validated in the United States, Canada, Europe, and Japan [11–16].

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**Box 65.2 Termination of resuscitation of non-traumatic adult OHCA at scene is recommended when:**

The patient has received the full (BLS or ALS) resuscitation protocol and the patient has not been transported from the scene and:

1. Did not receive a shock at any time during the resuscitation, **AND**
2. Did not achieve a prehospital return of spontaneous circulation, **AND**
3. Did not suffer an EMS-witnessed OHCA.

The BLS rule has also been proposed and externally validated as the “Universal Rule” for all levels of providers [12,15,16], for all non-traumatic OHCA ([Box 65.2](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fea-0002)). This reduces confusion in a service with a tiered response and enables simpler implementation strategies. The rules have been validated under the 2005 and 2010 resuscitation guidelines without any change in their performance accuracy [12]. It makes sense that any intervention in the prehospital setting (new drug, new device, or new step-by-step process of care) that potentially increases survival would first and foremost increase the rates of return of spontaneous circulation (ROSC) or enable ventricular fibrillation (VF) more often and increase the potential to receive a shock. Either of these outcomes would make the patient ineligible for TOR, and the rate of transport to hospital would rise. Thus, as scientific advances improve resuscitation outcomes, more patients will meet the criteria for transport instead of termination.

Adult patients with cardiac arrest attributed to an obvious cause such as lightning strike, mechanical suffocation, poisoning, near drowning, etc. should be treated via the prehospital resuscitation protocol and transported to ensure they are given the full benefit of interventions unique to the etiology of their arrests. These arrests were routinely excluded from all the studies pertaining to TOR rules.

**Implementation issues related to termination of resuscitation**

The 2010 Guidelines from the American Heart Association and the 2011 position paper from the National Association of EMS Physicians advocate for the implementation of the TOR rule to reduce the transport of futile resuscitations and provide a more consistent approach to all non-traumatic OHCA patients [17,18]. EMS medical directives relating to TOR need to be tailored in how they are implemented locally, taking system nuances into consideration; however, the medical directive must include the rule as validated with all three components after full prehospital resuscitation by a resuscitation protocol which is guideline compliant [19,20]. For example, if medics did not remain on scene to complete their resuscitation protocol and instead took a scoop-and-run approach, there would be insufficient time to complete the resuscitation protocol. Thus, there is insufficient time to adequately assess if the patient achieves ROSC or received a shock at any time. Termination of resuscitation would be premature and not compliant with the rule. Another example pertains to a medical directive that removed the first and third criteria, instructing the providers to terminate if no ROSC was achieved in the prehospital setting. This was explored in an analysis of the Toronto ROC data and it was found that resuscitation should not be terminated for patients who did not achieve ROSC but did receive shocks or had their arrests witnessed by EMS [21,22]. The survival rate in this group was 3.5%, which exceeds futility. It would be cavalier to reduce the TOR rule to no ROSC as it denies potential survivors the opportunity for transport and continued resuscitation.

Sasson et al. published a number of barriers to TOR protocol implementation, including changing legislation and local EMS remuneration practices to enable EMS services and their medical directors to implement the TOR decision rule [21]. It is essential that both of these barriers are addressed and corrected locally pior to implementation using the body of science and current position statements. Education should include a consistent approach to the use of TOR rules, and include sensitivity and grief counseling for providers who will be providing death notification to the families. Helping medical directors and colleagues understand the current body of knowledge should address the fear of litigation for medical directors and myths relating to the ability of EMS personnel to provide death notification and the effects on family members. Numerous studies have demonstrated that providers are comfortable with terminating resuscitation in the field, comfortable with conveying the news to family, and effective at doing it [7,23,24]. Furthermore, it has been established that family members are receptive to this approach to care and do not suffer any long-term emotional or psychological effects [25–27].

**Pediatric out-of-hospital cardiac arrest**

**When to start resuscitation**

In the case of children (aged 17 years or younger), decisions regarding when to resuscitate, how long to continue, and when to terminate resuscitation are based on fewer available data than we have for adults. Nevertheless, the available data indicate that, with the exception of posttraumatic arrest, EMS providers should attempt to resuscitate any pediatric patient who does not have obvious signs of irreversible death (e.g. lividity, rigor mortis or decomposition) or in the special circumstance of a valid DNAR order [25,28,29].

Due to the low occurrence and increased stress involved in pediatric resuscitation, it may occasionally be difficult for paramedics to reliably discern clinical signs of futility. In fact, in many cases that were later found at the emergency department (ED) to have already developed signs of lividity or rigor mortis, paramedics had found it difficult to truly discern these conditions in the field and therefore attempted resuscitation [29].

Recent literature has shown that survival to hospital discharge in pediatric patients greater than 1 year old is higher (9.1% for children aged 1–11 years and 8.9% for those aged 12–19 years) than survival in both infants (<1 year, 3.3%) and adults (4.6%) [30], suggesting that pediatric OHCA survival is improving [30–32].

**When to terminate resuscitation**

With regard to the decisions to terminate efforts in pediatric patients, no reliable clinical predictors have been sufficiently evaluated in the out-of-hospital setting to accurately predict pediatric resuscitation success or failure, and no decision rules derived for adult prehospital TOR have been evaluated in the pediatric population [17]. Furthermore, compared to adults, pediatric patients have been shown to have increased rates of survival from non-shockable rhythms [30,32,33], a cornerstone of many TOR decision rules used in the adult population. Published studies of pediatric OHCA have demonstrated that unwitnessed cardiac arrests, arrests without bystander cardiopulmonary resuscitation (CPR), and arrests with initial non-shockable rhythms are associated with decreased survival [28–31]. However, none of these variables alone or in combination has been shown to accurately predict futility. A lack of prehospital ROSC is also strongly associated with mortality [29,30,34], suggesting that, as with adult cardiac arrests, prehospital providers should focus on the delivery of high-quality CPR during initial resuscitation efforts instead of resorting to a scoop-and-run approach. In a prospective study of about 300 consecutive pediatric OHCAs, on-scene ROSC was never achieved in 267 children despite aggressive attempts at ACLS for more than a half hour, and none of these children survived [29].

The exact duration of CPR prior to recommending TOR is unknown. The absence of spontaneous circulation within 20–30 minutes of ACLS initiation has been associated with poor survival (unless there is hypothermia or persistent VF) [28,29,31,35–37]. However, current data are inconsistent and further research is needed to determine any specific cut-off values. A recent study of 138 pediatric OHCAs showed a median duration of CPR of 18.5 minutes in survivors compared to 41 minutes in non-survivors; however, survivors were reported with up to 64 minutes of resuscitation [34]. Cut-off values and predictive factors must be interpreted cautiously as emerging in-hospital treatments such as postarrest therapeutic hypothermia [38] and the use of extracorporeal membrane oxygenation (ECMO) [39,40] may result in good neurological outcome in patients who were once considered futile.

The concept of on-scene termination of resuscitative efforts for children is further complicated by the psychosocial effect on the family and the psychological discomfort of the EMS providers [24,25,41].

Health care professionals often find it more psychologically challenging to withdraw CPR attempts rather than not starting resuscitation in the first place [42]. A blinded survey of EMS personnel regarding comfort levels with on-scene pronouncement was reported using a rating scale of 1 (not comfortable) to 10 (very comfortable) [24]. The study found that veteran paramedics (n = 201) are very comfortable (average score 10) with the pronouncement of an adult on scene, but not with pronouncement of a child (average score 2). Accordingly, with the greater availability of in-hospital support services for the families of pediatric patients and the EMS providers’ potential concerns with on-scene pronouncement, termination of resuscitative efforts for children may be best performed in the hospital. Nevertheless, it has also been emphasized that once medical futility is determined, EMS personnel should take care during transport not to create additional risks in traffic, and in-hospital personnel might adopt modified procedures that limit further resuscitation and resource use [24,25]. In addition, in some cases of suspected sudden infant death syndrome, unwarranted resuscitative efforts and hospital transport may compromise a potential crime scene investigation.

With limited and inconsistent evidence to terminate resuscitation, current guidelines do not recommend the use of TOR rules or specific criteria for pediatric OHCA [17,43,44]. In the absence of clear criteria, EMS providers should employ explicit definitions of obvious death to dictate when to start resuscitation and to continue resuscitation while transporting to the hospital, seeking consultation with direct medical oversight as required.

**Adult traumatic cardiopulmonary arrest**

Among the greatest challenges in EMS is decision making around the patient who is found to be experiencing a traumatic cardiopulmonary arrest. Whether traumatic arrest is the result of blunt or penetrating trauma, the prognosis for survival (approximately 2%) is dismal, but not futile as defined by an overall survival rate <1% [9,45].

The decision whether to withhold or terminate resuscitation of the traumatic arrest patient is fraught with emotion since patients are typically young and the circumstances surrounding the event often occur unexpectedly in public and unsecure settings, and can be subject to intense immediate and prolonged public and media scrutiny. In addition, there is a need for EMS providers to act quickly and decisively in an environment where it can be difficult to determine whether the patient has a detectable pulse [46].

Contrary to non-traumatic cardiopulmonary arrest, there are no prospectively derived and validated clinical decision rules to guide EMS providers on whether to withhold resuscitation of the traumatic arrest patient, or circumstances where it might be reasonable to terminate resuscitation after failed attempts to achieve ROSC in the field or during transport. Nevertheless, some observational studies have identified factors that are associated with futility such as the absence of organized electrocardiographic activity often described as asystole [45,47–53] and EMS provider CPR for greater than 10-15 min without ROSC [48,51,53–57]. Whereas, other observational studies suggested an increased survival was associated with the presence of normal sinus rhythm, pupillary responses, or visible respiratory effort, especially in penetrating trauma patients [46,52,58]. The challenge in making recommendations is that the literature reports >1% survival rates for victims of blunt and penetrating trauma even in the presence of dire clinical findings such as asystole [51,52,57,59]. It appears as if no single criterion unequivocally distinguishes between survivors and non-survivors of traumatic arrest.

Despite these challenges, NAEMSP and the American College of Surgeons Committee on Trauma (ACSCOT) have published joint position statements and supporting resource documents (initially in 2003[60] and updated in 2012 [45,61,62]) to provide guidance on withholding resuscitation and termination of resuscitation of adult traumatic arrest patients. The 2012 position statements provide separate recommendations for withholding resuscitation and TOR (see [Boxes 65.3](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fea-0003) and [65.4](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fea-0004) below). The components of the position statements are a combination of operational design recommendations that are largely common sense, as well as a number of patient care assessment and intervention recommendations that resulted from a structured literature review focusing on clinical factors that are associated with outcomes of traumatic arrest.

**When to terminate resuscitation (**[**Box 65.4**](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fea-0004)**)**

The clinical aspects of the position statement regarding TOR are meant to identify traumatic arrest patients who meet the criteria for resuscitation but do not achieve ROSC after adequate trials of CPR and other resuscitative procedures as dictated by the EMS providers’ scope of practice and medical protocols. This is because both blunt and penetrating traumatic arrest patients who do not achieve ROSC have close to zero probability of survival despite further attempts at resuscitation in the hospital, including resuscitative thoracotomy. The duration of an “adequate trial” of CPR is not precisely defined. Traditionally 15 minutes has been supported as a cut-off; however, as reported in the 2012 position statement, the collective literature suggests that only 0.75% of traumatic arrest patients with more than 10 minutes of CPR survive to hospital discharge with good neurological status [45]. This low rate of survival suggests 10 minutes is a reasonable trial of CPR. It is somewhat difficult to conclude whether penetrating trauma patients (especially those with thoracic injuries) should have a longer trial of CPR before considering TOR since many studies do not differentiate between penetrating and blunt trauma in their patient populations. Yet, reports of survival in patients with CPR for greater than 10 minutes tend to favor penetrating trauma patients [53,57].

It should be noted that contrary to 2003, the 2012 position statement does not specifically mention whether TOR should be considered in patients with EMS-witnessed traumatic arrest who fail to achieve ROSC after 10–15 minutes of prehospital resuscitation. The reason for this is not mentioned; however, it is important to acknowledge since about 37% of traumatic arrest patients fall within this category [57]. Unfortunately, most literature regarding prehospital traumatic arrest simply describes the presence or absence of arrest in the field but not its timing. Given only one neurologically compromised survivor out of 110 patients with EMS-witnessed TCPA [57], it seems reasonable to apply the TOR recommendations to this group as well.

Prehospital TOR of traumatic arrest patients is operationally challenging because CPR (and most other procedures) should typically be performed during transport (scoop and run). Therefore, application of TOR protocols under these circumstances would likely lead to many patients qualifying for TOR during transport. Moreover, many patients in urban settings would likely arrive at trauma facilities prior to “adequate” trials of CPR being completed. Development of TOR protocols during transport predictably will require consultation and support from a wide variety of stakeholders including the EMS agencies, medical oversight physicians, trauma centers, regulatory agencies, law agencies, and the medical examiners. Local protocols would also have to include the specific destination (e.g. morgue, coroner’s office, emergency department) once TOR has been implemented. In urban settings, it may be that the best local solution once transport has been initiated is to continue resuscitation and leave the decision for TOR to the receiving trauma center.

While the 2012 position statement advocates for active physician oversight in developing and locally implementing TOR, there is no specific statement indicating the need for direct (online) medical oversight. While identifying patients who qualify for withholding resuscitation seems reasonably straightforward and ostensibly could be implemented without direct medical oversight, TOR appears more complex, especially since other resuscitative measures beyond CPR are typically performed. To ensure compliance with the recommendations and EMS provider comfort with implementing TOR, it may be that direct medical oversight would provide additional value to making the final decision.

A number of patient groups experiencing extenuating circumstances are noted in the guidelines which are not specifically addressed. This may be largely because the available literature has excluded them from study or the available information is scant and incomplete. Examples of these patient groups include pediatric patients, patients with environmental injuries, pregnant patients, and patients where the mechanism of injury does not correlate with the clinical condition. Many services will implement resuscitation and transport of these patients without regard for TOR recommendations, which is appropriate given the lack of literature.

For patients who are transported to trauma centers in accordance with the position statement, it is important for EMS providers to appreciate that arrival at a trauma center does not dictate that a resuscitative thoracotomy will be performed. Rather, the recommendations identify patients who *may* qualify for resuscitative thoracotomy, and transport to a trauma center gives the option to the trauma team.

It should be noted that the literature on resuscitative thoracotomy is largely based on reports from Level I trauma centers that have experience and expertise in performing this procedure. It is logical to conclude, despite the absence of supporting literature, that the survival of traumatic arrest patients would be <1% in those who must be transported to non-Level I trauma centers. This would suggest that prehospital traumatic arrest TOR protocols may be more appropriately applied in rural EMS settings.

**Conclusion**

The decision of when to start or terminate resuscitation is fraught with inconsistency if left to the discretion of the individual provider or direct medical oversight. There is a body of knowledge that guides medical directors on an approach to TOR in adult OHCA of non-traumatic origin. The TOR rule is sanctioned by NAEMSP and AHA. Implementation includes addressing legislation and remuneration barriers, employing targeted education techniques, local planning with local authorities who share responsibility for death notification in the community (police, ambulance, fire, emergency departments, primary care physicians, and coroner’s office) and engaging the physicians involved in direct medical oversight to assure common understanding, agreement, adoption, and adherence. All other cardiac arrests of a unique and obvious non-traumatic etiology such as near-drowning or overdose who fit the criteria to start resuscitation should be transported with ongoing resuscitation to benefit from etiology-specific interventions.

In the case of pediatric OHCA, there is a paucity of literature informing when to start and when to stop. Without signs of obvious death as defined by a medical directive, EMS personnel should attempt resuscitation in all cases of pediatric cardiac arrest. Factors such as unwitnessed arrests, non-shockable rhythms, and longer resuscitative efforts are all associated with poor outcomes; however, there are currently no accurate determinants of futility in pediatric cardiac arrests. Adult TOR guidelines have not been validated in the pediatric population and current cardiac arrest guidelines do not support the use of specific criteria to terminate resuscitation. Due to a lack of research examining pediatric TOR, each case should be examined on an individual basis in consultation with medical oversight, or transported to the hospital with continued resuscitation.

The science on when to withhold or terminate resuscitation of traumatic patients is less defined than for non-traumatic OHCA. All evidence is observational and has not been subjected to a clinical decision rule analysis. There appears to be no single clinical finding that universally distinguishes between survivors and non-survivors from either blunt or penetrating traumatic arrest. Recently updated guidelines have been published that provide a working tool for EMS medical directors to develop protocols to address these issues. A clinical flow chart outlining the key components of the 2012 NAEMSP-ASCOT position statement on withholding or termination of resuscitation in traumatic cardiopulmonary arrest is illustrated in [Figure 65.1](https://jigsaw.vitalsource.com/books/9781118990827/epub/OPS/c65.xhtml#c65-fig-0001).