# The Rhode Island Life Saving Score (RILSS) – A Proposed Life-Saving Definition for EMS and Emergency Medicine

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## PREFACE

*"Unresponsive, pulse 120, respiratory rate 3, pulse oximetry 73%. BVM with 100% oxygen, naloxone given." He opens his eyes.*
*We save another life.*
*"What are you doing?" he asks. "I was taking a nap!"*
— Anonymous Rhode Island EMT


## ABSTRACT

Emergency Medical Services (EMS) and Emergency Medicine staff are often described as life-saving providers, but there is no generally accepted objective definition of a life saved by these providers. Therefore, a proposed definition is described. Development of this definition began with conceptual rules, followed by a survey of physician EMS medical directors, and then by the development of a tool to implement the definition, and measure its validity and reliability through a review of 100 critical care transport EMS patient charts.


**KEYWORDS:** emergency medical services, mortality

## BACKGROUND

Lives are saved in ambulances and emergency departments every day. However, there is no standard definition of a life saved during emergency care. Emergency departments and ambulance services tend to describe their efforts in terms of volume statistics, percent of patients admitted to hospital, and demographics of patients. Other than for cardiac arrest, where the Utstein criteria[1] provide a standardized template, there is no template or definition that can be used objectively by emergency care providers to quantify lives saved during emergency care. This paper proposes such a definition.

## METHODS

The Rhode Island Hospital IRB approved this study. Conceptual rules were derived using a modified Delphi method. Medical director surveys were performed using Illume web-based survey software (Illume, DatStat, Seattle, WA) and an email distribution list provided by the National Association of EMS Officials (www.NASEMSO.org Medical Director Council). Data were converted to Excel (Microsoft Corp., Redmond, WA) for analysis. Simple arithmetic analysis (averages, sums) was performed in Excel. Interobserver reliability calculations were performed by a statistical consultant, Jason Machan, PhD, using SAS version 9.3 (The SAS Institute, Cary, NC).

### Conceptual Rules

We began by drafting proposed conceptual rules. These are detailed in **Figure 1**. They included the need to be able to apply the definition during the period of patient care. While other specialties have continued contact with patients and can perform prolonged follow-up inquiries, such as determining 5-year survival rates after cancer treatment, EMS and emergency medicine are often precluded from obtaining such follow up. In addition, emergency patients often have discrete life-threatening events that are independent of future health problems. They may also have several life-threatening events (e.g., recurring hypoglycemia, arrhythmias, or opiate overdose) over a period of several years, and intervention at each constitutes a discrete life-saving event. Other criteria included simple application by the emergency personnel who wish to apply the definition (i.e., a form or list that can be completed during observation of care or chart review, not a complex algorithm requiring data

**Figure 1.**

| Conceptual Life-Saving Score Rules |
| --- |
| 1. The definition must be based on objective actions, such as procedures performed or treatments given, and causally linked objective outcomes, such as survival or improved vital signs / accepted clinical measures. It must not be based on theoretical evaluations of thought, differential diagnosis, or subjective efforts. |
| 2. The definition must measure the effects of emergency care independent of subsequent intervening events. In other words, the goal is measurement of lives saved during a discrete emergency care encounter, regardless of the effects of later illness or injury, or the efforts of subsequent providers. |
| 3. The definition must be practical to apply and useful. It must not over or underestimate the number of lives saved, and therefore must, at face value, be consistent with saving a life. Practical application demands that the definition be easy to use by emergency providers and their managers. |

from future care), the need for the definition to be objective and therefore reliable when measured by different observers, and the need for the definition to be valid in the sense that it must not over or underestimate the number of lives saved as judged by a panel of EMS experts.

## Initial Proposed Definition

From these conceptual rules we proposed a definition, shown in **Figure 2**. This general definition was based on the division of emergency patients into several categories, paralleling common triage categories. We defined our categories based on a combination of acuity and severity, with critical patients most in need of life-saving care having both conditions that would result in death if untreated, and conditions where such treatment must be delivered in seconds to minutes in order to save a life. One example is defibrillation to treat cardiac arrest caused by ventricular fibrillation. The next category again included conditions that would be life threatening, but that emergent threat to life would take hours or days to develop and could be mitigated by an intervention during the contact period. An example is treatment of sepsis with antibiotics and fluids in compliance with goal-directed therapy, preventing septic shock and subsequent death. The third category of patients has urgent conditions or behaviors that are potentially life threatening, but that threat to life occurs more than days in the future (weeks or longer). An example would be counseling an athlete to wear a protective helmet during future sporting events.

**Figure 2.**

| Initial Proposed Definition of an EMS Life Saved |
|---|
| A life is saved if EMS or other emergency providers perform a procedure or apply a therapy that: |
| (1) Results in patient improvement from a condition that is critical or emergent, as defined by likely death if untreated within seconds to minutes (critical) or hours to days (emergent), or prevents death at some future time through a change in behavior or health and |
| (2) Maintenance of that improvement is maintained until discharge or transfer of patient care to subsequent providers. |

## Expert Panel Survey

We surveyed physician EMS directors from every state in the country and several territories to determine the validity of our definition with an expert panel, using the Medical Director Council email list provided by the National Association of EMS Officials (www.NASEMSO.org). The survey consisted of a list of proposed actions within the three categories described above: critical, emergent, and urgent. For each action we listed a proposed condition, the therapeutic action, and a proposed improved state. The subjects were asked to score whether they felt each individual action set constituted a life saved if the process proceeded as described. We achieved a good return from these surveys, and good group agreement about the critical and emergent action lists. However, the group felt that the urgent list, due to the vague and unspecified future threat to life, should not be included in the definition of life-saving actions by emergency care providers. This group of experts is well aware of the important progress being made by injury prevention, behavior modification, teachable moment, abuse recognition and prevention, and other similar efforts in emergency care, but was uncomfortable validating the interventions by these groups as immediately life-saving.

## Resultant definition

Therefore, the resultant definition includes only critical (death within seconds to minutes, if untreated) or emergent (death within hours to days if untreated) conditions, and objective therapies that stabilize or improve these conditions during provider contact time. This revised definition is shown in **Figure 3** as the Rhode Island Life Saved Score (RILSS).

**Figure 3.**

| Revised Definition: The Rhode Island Life Saved Score (RILSS) |
|---|
| A life is saved if EMS or other emergency providers perform a procedure or apply a therapy that: |
| (1) Results in patient improvement from a condition that is critical or emergent, as defined by likely death if untreated within seconds to minutes (critical) or hours to days (emergent), and |
| ((2) Maintenance of that improvement is maintained until discharge or transfer of patient care to subsequent providers. |

## Tool Development and Reliability Testing

From the RILSS definition and the survey tool, we developed a preliminary form that could be used by an emergency provider to score whether or not a particular patient received life-saving care. This form, attached as **Figure 4**, lists interventions and instructs the scoring provider to count the patient as having had their life saved if one or more of these interventions were applied for an appropriate indication and resulted in stabilization or improvement in the patient's condition.

Reliability testing was sought by having four emergency medicine attendings independently score the same 100 consecutive adult transport charts provided by the LifePACT critical care transport service at Rhode Island Hospital. Almost all of these patients are transferred between hospitals, and are admitted to intensive care or procedural settings such as cardiac catheterization or interventional radiology laboratories, or the operating room. Therefore, they constitute a group of patients with a likely high concentration of life-saving activities. We sought to determine if our score had good interobserver reliability, and if it appeared valid given the acute and severe conditions present in this patient population.

**Figure 4.** Rhode Island Life Saved Score (RILSS) Tool

| PRE-CONDITION | INTERVENTION | RESULT | PRESENT? |
|---|---|---|---|
| CRITICAL | | | |
| Cardiac arrest | Resuscitation (PALS*, ACLS, ATLS) | Return of spontaneous circulation (ROSC) | [ ] |
| Ventricular fibrillation | Defibrillation | ROSC | [ ] |
| Pulseless ventricular tachycardia | Defibrillation / cardioversion | ROSC | [ ] |
| Unstable tachycardia (Rapid Afib, SVT) | Electrical/Chemical cardioversion OR rate control | ROSC or improved HR/BP | [ ] |
| Unstable bradycardia | Transcutaneous pacing or med for rate control | Pacer capture or improved HR/BP | [ ] |
| Pericardial tamponade | Pericardiocentesis | Improved MAP, resolved tamponade | [ ] |
| Respiratory arrest or failure | Advanced airway management (intubation, LMA, etc.) | Sufficient oxygenation/ventilation | [ ] |
| Respiratory failure or sedation or paralysis causing respiratory insufficiency | Advanced airway or ventilation or CPAP/BiPAP (continuation) | Adequate ventilation and oxygenation | [ ] |
| Airway obstruction / Choking | Removal of foreign body/establish patient airway | Sufficient oxygenation/ventilation | [ ] |
| Anaphylaxis | Epinephrine and/or advanced airway control | Resolution of reaction | [ ] |
| Tension pneumothorax | Needle decompression/tube thoracotomy | Adequate ventilation, oxygenation, and BP | [ ] |
| Opiate overdose with respiratory compromise | Naloxone, Naltrexone | Adequate respiration and ventilation | [ ] |
| EMERGENT | | | |
| Infection or sepsis | IV fluids, Anti-infective agent +/- surgery | Improved perfusion, reduction in SIRS criteria / shock | [ ] |
| Shock (diverse causes including septic, traumatic, hemorrhagic, neurogenic, cardiogenic, anaphylactic) | IV fluids or pressors or removal of causative medication or agent or emergency thoracotomy | Improve MAP and tissue perfusion | [ ] |
| Ruptured AAA | Application of pneumatic anti-shock garment, shock treatment | Improved clinical condition | [ ] |
| Significant anemia +/- Hemorrhage | Blood transfusion | Adequate blood volume | [ ] |
| Anticoagulation With Hemorrhage | Reversal of anticoagulation (FFP, Vit K, etc.) | Hemostasis | [ ] |
| Toxic or hazardous material exposure (+/-shock or other associated critical condition) | Removal of exposure or application of antidote, decontamination | Improved clinical condition | [ ] |
| Life threatening circumstances (entrapment, hazardous material exposure) | Rescue and removal from environment | Improved safety | [ ] |
| Symptomatic hypoglycemia | D50 or other dextrose/glucose/ glucagon | Normal glucose level | [ ] |

*Rhode Island Life Saved Score (RILSS) Tool Abbreviation Key

| | |
|---|---|
| AAA | Abdominal Aortic Aneurysm |
| ACLS | Advanced Cardiac Life Support course, American Heart Association |
| Afib | Atrial fibrillation |
| ATLS | Advanced Trauma Life Support course, American College of Surgeons |
| BiPAP | Bilevel Positive Airway Pressure |
| BP | Blood Pressure |
| CPAP | Continuous Positive Airway Pressure |
| D50 | Dextrose 50% water |
| FFP | Fresh Frozen Plasma |
| HR | Heart Rate |
| IV | Intravenous |
| LMA | Laryngeal Mask Airway |
| MAP | Mean Arterial Pressure |
| PALS | Pediatric Advanced Life Support course, American Heart Association |
| ROSC | Return of Spontaneous Circulation |
| SIRS | Systemic Inflammatory Response Syndrome |
| SVT | Supraventricular tachycardia |
| Vit K | Vitamin K |

## RESULTS

The expert panel survey revealed agreement about the conceptual score construct and the specific critical and emergent life-saving actions. The chart audit revealed excellent agreement between observers regarding which patients received life-saving interventions. The overall Fleiss-Cohen weighted kappa was 0.83 (0.78-0.87), with no differences across pairings (p=0.5980) (SAS version 9.3, The SAS Institute, Cary, NC). Approximately one half (48.75%) of patients had at least one life-saving procedure performed (range 0-4 life-saving procedures per patient), confirming validity of the score as a reasonable measure of life-saving activity in this select population. Therefore, the RILSS Tool and definition are both valid and reliable when used to assess a critical care transport EMS patient population.

## DISCUSSION

The RILSS definition (**Figure 3**) and final scoring tool, presented as **Figure 5**, allow EMS and other emergency care providers to quantify their life-saving activities in addition to measures counted by current methods (return of spontaneous circulation after cardiac arrest). This proposed Rhode Island Life Saved Score (RILSS) can be used in EMS and emergency care quality improvement efforts, objective descriptions of EMS service performance and activities, and for comparison between patient populations served. Weaknesses of our score include inability to predict long-term survival (arguably irrelevant to EMS providers) and lack of large-scale validation in 911 and emergency department settings. Future study should refine the score and tool, and seek validation in other settings.

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### Reference

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### Disclosures

The authors have no financial disclosures to report

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