ILCOR Consensus Statement

Recommended Guidelines for Monitoring, Reporting, and Conducting Research on Medical Emergency Team, Outreach, and Rapid Response Systems: An Utstein-Style Scientific Statement

A Scientific Statement From the International Liaison Committee on Resuscitation (American Heart Association, Australian Resuscitation Council, European Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa, and the New Zealand Resuscitation Council); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiopulmonary, Perioperative, and Critical Care; and the Interdisciplinary Working Group on Quality of Care and Outcomes Research

Mary Ann Peberdy, MD, Co-Chair; Michelle Cretikos, MBBS, MPH, PhD, Co-Chair; Benjamin S. Abella, MD, MPhil; Michael DeVita, MD; David Goldhill, MBBS, FRCA, MD; Walter Kloeck, MB, BCh, FCEM; Steven L. Kronick, MD, MS; Laurie J. Morrison, MD, MSc; Vinay M. Nadkarni, MD, FAHA; Graham Nichol, MD, MPH, FRCPC, FAHA; Jerry P. Nolan, FRCA, FCEM; Michael Parr, MB, BS, FRCP, FRCA, FANZCA, FJFICM; James Tibballs, MBBS, BMedSc, MEd, MBA, MD, FJFICM, FANZCA; Elise W. van der Jagt, MD, MPH; Lis Young, MD, FFPHM

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The majority of patients hospitalized with a cardiac arrest or requiring emergency transfer to the intensive care unit have abnormal physiological values recorded in the hours preceding the event.[1–11] Many studies document that physiological measurements often are not made or recorded during this critical time of clinical deterioration.[12–16] Such physiological abnormalities can be associated with adverse outcome.[17–20] Measurements of abnormal physiology, including temperature, pulse rate, blood pressure, respiratory rate, hemoglobin, oxygen saturation by pulse oximetry, and deterioration of mental status, are therefore important to any system designed for early detection of physiological instability. At a minimum, these measurements must be obtained accurately and recorded with appropriate frequency. A system that both recognizes significantly abnormal values and triggers an immediate and appropriate treatment response is required.

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There is growing evidence that early detection and response to physiological deterioration can improve outcomes for infants, children, and adults.[21–29] A variety of response systems have been described, including teams that respond to patients in hospital wards who are critically ill or who are at risk of becoming critically ill. These systems all adhere to the principles of early detection and response to predefined indicators of clinical deterioration. The terms used for these response teams include medical emergency team (MET), rapid response team (RRT), and critical care outreach team (CCOT).[25,26,28,30–34] These teams may replace or coexist with traditional cardiac arrest teams, which typically respond to patients already in cardiac arrest. Such teams should possess the required skills and equipment to provide immediate on-site stabilization and management of the patient and to initiate discussions about appropriate limits to medical interventions if indicated. Although the response team is the most obvious component of these systems, these teams are only one part of a much more comprehensive system-wide response. Team-based response systems also require educational, quality improvement, monitoring, and feedback components.[35–37]

The core data elements identified in the present report should help direct hospitals to collect the most meaningful data to optimize system interventions and improve clinical outcomes. Identification of supplemental data elements should allow enhanced data collection to further scientific knowledge in these system responses. Standardized data elements and definitions will permit aggregate data analysis, as well as create a consistent nomenclature for publications related to these prevention, early intervention, and response systems. Utstein-style data definitions and reporting templates have helped improve the consistency and comparability of data on cardiac arrest, trauma, and drowning and for this reason are proposed for the MET, RRT, and CCOT. The purpose of the present statement is to create consensus-derived key data elements and definitions and to develop a standardized Utstein-style template for the reporting of data related to systems with response teams such as METs, RRTs, and CCOTs.

The Consensus Process

The need for standardized reporting of MET, RRT, and CCOT data was identified during the 2005 International Consensus Conference on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations.[38] Representatives from the International Liaison Committee on Resuscitation, including scientists and clinicians experienced in rapid response–type systems, were invited to develop a reporting template with consensus-derived data elements and standardized definitions for monitoring and reporting of data related to these systems.

The task force held a series of teleconferences from June 2005 to August 2006. The initial calls reviewed evidence and identified consensus on the type of data elements necessary for optimal program management (core elements), as well as data elements that would be beneficial for research related to MET systems (supplemental elements). A draft set of data elements was developed and divided into 6 categories. Task force members were each assigned a group of data elements, and a virtual modified Delphi method was used to complete the consensus process.[39] All documents used during conference calls were available on the Internet, and all authors had continuous access to documents to provide individual input. A face-to-face conference was not necessary to complete the document. To the best of our knowledge, this is the first time an Utstein-style consensus statement has been generated in this fashion.

Utstein Reporting Templates

In June 1990, representatives from the American Heart Association, European Resuscitation Council, Heart and Stroke Foundation of Canada, and the Australian Resuscitation Council met at Utstein Abbey on the island of Mosteroy in Norway. The purpose of the meeting was to discuss problems with resuscitation nomenclature and the lack of standardized definitions in reports of adult prehospital cardiac arrest. At a follow-up meeting, the decision was made to adopt the term "Utstein style" for the uniform reporting of data from prehospital cardiac arrests.[40] Many other Utstein-style international consensus statements have been published over the past 15 years, including the uniform reporting of pediatric advanced life support,[41] laboratory cardiopulmonary resuscitation research,[42] in-hospital resuscitation,[43] neonatal life support,[44] drowning,[40] cardiopulmonary resuscitation registries,[40] and trauma data.[45] These comprehensive documents are aimed at both the clinical and academic communities. The standardized definitions found in the Utstein scientific statements enable comparative analysis between resuscitation studies and healthcare systems.

The challenges associated with collecting MET, RRT, and CCOT data are similar to those associated with the collection of cardiopulmonary resuscitation data. The task force considered a balance between the inclusion of data elements that are important in determining clinical and process outcomes but may be difficult to collect with variables that may be easy to collect but add little to the overall usefulness of the data set. For consistency with previous Utstein-style reports, the task force agreed that data should be classified as core or supplemental. Core data elements are defined as the absolute minimum required for continuous quality improvement and are necessary to accurately track process and outcomes variables. These include facility, patient, event, and outcomes information. The collection of these data elements is sufficient to enable the comparison of process and outcome between different institutions, both nationally and internationally.[40] Supplemental data elements are defined as elements required for research or to advance the understanding of process-related issues to drive best clinical practice. Standardized definitions for all data elements will enable comparisons between MET-type programs and will permit the aggregation of data to rapidly advance the science of various rapid response systems. Institutional demographics will enable comparisons and establishment of best practices.

Because there is no single comprehensive, evidence-based set of physiological triggers to initiate an MET response, hospitals may develop their own criteria for initiating an MET call. The criteria for activation are core data elements.

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With the use of a standardized data set that includes outcomes, it may be possible to determine which calling criteria might be the most useful. To prevent sampling bias, all patient events that occur at or immediately after activation of response teams, as defined by activation criteria, should be included in data reporting. Key patient-level and hospital-level outcomes must be included. Interested individuals or institutions can use these data elements to identify critical factors to consider when these systems are implemented, to monitor system performance, or to compare the rates of team activation and adverse patient outcomes between different institutions.

Figures 1 and 2 are template data collection forms for collection of facility and event data. These forms can be used to assist individual hospitals in creating an efficient, comprehensive data collection tool.

Data Elements and Definitions

Tables 1 through 5 present data elements and their definitions for the response team data collection: hospital data form (Figure 1), and Tables 6 through 10 present data elements and their definitions for the response team data collection: case form (Figure 2).

Discussion

For many patients, clinical condition deteriorates during the hospital stay. This deterioration is frequently unrecognized or inappropriately or incompletely treated. Some patients require emergency transfer to an intensive care unit, or their condition deteriorates to cardiac arrest.[1,5,6,9,11,46–48] System interventions, including the use of METs, RRTs, and CCOTs, have the potential to decrease cardiac arrest and in-hospital mortality rates.[21,23–25,28,49] The precise impact of these interventions remains unclear, because the largest study of METs, a cluster randomized, controlled trial, failed to show an effect of the MET system on rates of cardiac arrest, unexpected death, or unplanned admission to the intensive care unit.[12] The failure to demonstrate effect may have been due to a real failure of the intervention but also may have been multifactorial and possibly design related. Plausible reasons for failure include contamination of the control hospitals, a very short baseline period, insufficient time for team implementation and maturation in the intervention hospitals, an insufficient duration of the study period to demonstrate a difference, and lack of power. Given that these possibilities are likely to have influenced the results, these systems require further study.

One recent publication has outlined guidelines for the uniform reporting of data for METs.[50] This document was developed by a single health service in Sydney, Australia. The present document was compiled by a task force of international representatives and considered all of the existing types of team-based response systems, rather than focusing solely on the MET system. The present document therefore provides a set of core and supplemental data elements for reporting on these systems that was reached by international consensus and that should be capable of being readily adopted in many institutions around the world. This will encourage more complete data collection and consistency in reporting of findings and will enable comparison of cross-institutional and international outcomes.

The context in which MET systems are implemented is important and may affect outcomes. Many of the core data elements in this statement relate to individual institutional facility and demographic data and were recommended to facilitate greater understanding of the environment in which the system was implemented.

Response Teams

Different hospitals have different capacities for intensive monitoring of patients. A response system that works well in one institution may not work well in another. Data collected from many different types of institutions may enable formulation of guidelines for best practice according to the capability of each hospital. The data elements for team demographics and composition are also considered core elements, because the different skills and experience of response team members may influence patient outcome. It is not known whether an immediate response to a patient's deteriorating condition by a team of trained and experienced doctors improves outcome compared with a first response with 1 trained nurse who has the ability to mobilize a more comprehensive team response when required. The nature of the intervention may need to be tailored to local resources. The impact of variable team training, composition, and experience on patient and process outcomes is unknown. Given these uncertainties, collection of and reporting on the core data elements for the team demographics and response are strongly recommended.

Patient Demographics

Some patient demographic data, such as name, medical record number, and date of birth, may not be reported in certain locales because of patient confidentiality restraints. These data elements were included as core elements so that individual hospitals can track individual cases for the purposes of quality improvement and feedback.

Ethnicity was not included as a data element because there is no internationally meaningful and easily constructed definition of ethnicity. Some hospitals may wish to track ethnicity independently to obtain information that is meaningful locally.

Pre-Event Data

An understanding of the patient's pre-event history may be vital to the development of a system that is capable of responding to patients at risk wherever they are in the hospital, because the optimal time for activating a full system response is not known. Identification of high-risk patients for more intensive monitoring and care may assist this process. Therefore, the data elements that provide information about the patient in the 24 hours before activation and at the time of activation constitute important information.

Event Data

A variety of activation criteria have been described for adults. Some systems are quite restrictive, whereas others encompass

Text continues on page 16

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Response Team Data Collection: Hospital Data Form (to be prepared annually)

1.1 HOSPITAL IDENTIFICATION

Hospital Name: _____ **City:** _____ **Country:** _____

1.2 OVERALL BED ALLOCATION – Number of available beds

	Total acute care in-patient beds:	☐ 0-200	☐ 201-400	☐ 401-600	☐ 601-800	☐ 801-1000	☐ 1000+
Pediatrics	**Total acute care in-patient beds:**	☐ 0-100	☐ 101-200	☐ 201-300	☐ 301-400	☐ 401-500	☐ 501+
	Critical care beds:	☐ 0-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ 51+
	Step-down beds:	☐ 0-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ 51+
	Cardiac monitoring beds:	☐ 0-20	☐ 21-40	☐ 41-60	☐ 61-80	☐ 81-100	☐ 101+
	Neonatal acute care beds:	☐ 0-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ 51+
Adults	**Total acute care in-patient beds:**	☐ 0-100	☐ 101-200	☐ 201-300	☐ 301-400	☐ 401-500	☐ 501+
	Critical care beds:	☐ 0-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ 51+
	Step-down beds:	☐ 0-10	☐ 11-20	☐ 21-30	☐ 31-40	☐ 41-50	☐ 51+
	Cardiac monitoring beds:	☐ 0-20	☐ 21-40	☐ 41-60	☐ 61-80	☐ 81-100	☐ 101+

2.1 COMPOSITION AND STRUCTURE OF STANDARD RESPONSE TEAM

	Number of individuals						**Critical care Training**	
Physicians:	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ Yes	☐ No
Physician Trainees:	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ Yes	☐ No
Nurses:	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ Yes	☐ No
Other: _____	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ Yes	☐ No

Hours of Operation:

☐ Always available

☐ Limited hours

If Limited hours:

Day of the week	**Hours (hh:mm)**
☐ Monday	_____:_____ until _____:_____
☐ Tuesday	_____:_____ until _____:_____
☐ Wednesday	_____:_____ until _____:_____
☐ Thursday	_____:_____ until _____:_____
☐ Friday	_____:_____ until _____:_____
☐ Saturday	_____:_____ until _____:_____
☐ Sunday	_____:_____ until _____:_____

Response team same as cardiac arrest team:

☐ Yes

☐ No

☐ Sometimes

If sometimes, explain:

_____

_____

_____

Figure 1. Response team data collection: hospital data form.

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2.2 RESPONSE TEAM COVERAGE AND ACTIVATION

Response team coverage:

☐ **Available in all areas of hospital** ☐ **Available only in some areas**

If partially available, team coverage includes (select all that apply):

☐ **All adult clinical areas**	☐ **All pediatric clinical areas**
OR	**OR**
☐ Adult acute care beds	☐ Pediatric acute care beds
☐ Adult critical care beds	☐ Pediatric critical care beds
☐ Adult step-down beds	☐ Pediatric step-down beds
☐ Adult cardiac monitoring beds	☐ Pediatric cardiac monitoring beds
☐ Adult outpatient / ambulatory areas	☐ Pediatric outpatient / ambulatory areas
☐ Adult emergency department	☐ Pediatric emergency department

Tiered team response? ☐ Yes ☐ No

Systematic criteria for team activation (select all that apply):

☐ Respiratory arrest ☐ Cardiac arrest ☐ Other criteria (please describe): _____

Vital sign criteria:	☐ Yes	☐ No
If Yes, select all that apply:	☐ Heart Rate:	Less than_____ or Greater than _____
	☐ Respiratory Rate:	Less than_____ or Greater than _____
	☐ Blood Pressure:	Less than_____/_____ or Greater than _____/_____
	☐ Temperature:	Less than_____ or Greater than _____
	☐ O_2 saturation:	Less than_____
	☐ ACDU score:	☐ A ☐ C ☐ D ☐ U
	☐ AVPU score:	☐ A ☐ V ☐ P ☐ U

Glasgow Coma Scale:

GCS: ☐ E: ☐ M: ☐ V: ☐

3. HOSPITAL OUTCOME STATISTICS - During the reporting year:

Number of discharges: _____

Number of response team activations: _____

Number of in-hospital cardiac arrests: _____ Excluding critical care area, OR or ED _____

Number of in-hospital deaths _____

Number of DNAR / NFR deaths _____ Excluding critical care area, OR or ED _____

Form Prepared by:_____ _____ **Date:** _____/_____/_____

PRINT **SIGNATURE**

Figure 1. (continued).

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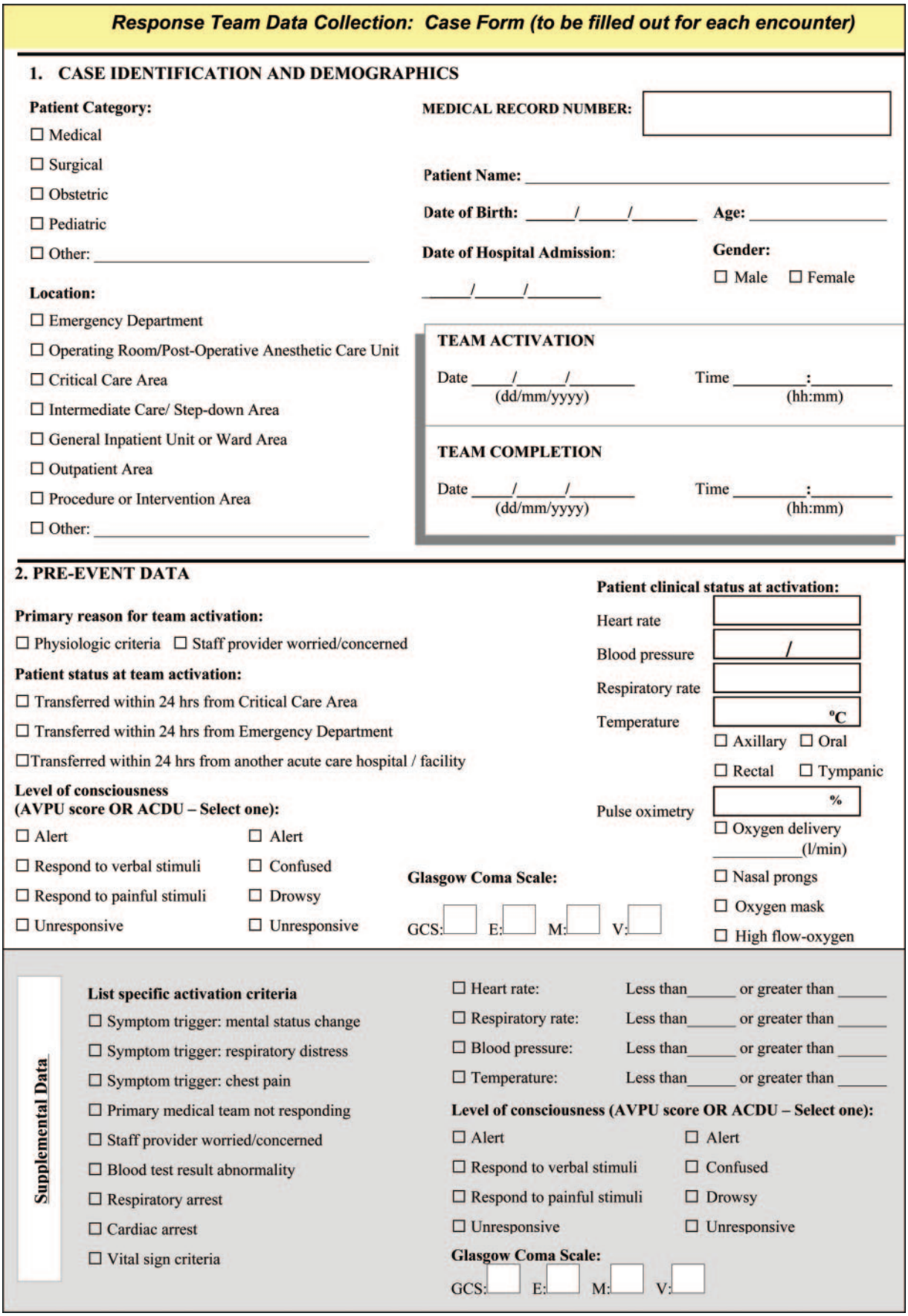

Response Team Data Collection: Case Form (to be filled out for each encounter)

1. CASE IDENTIFICATION AND DEMOGRAPHICS

Patient Category:
- ☐ Medical
- ☐ Surgical
- ☐ Obstetric
- ☐ Pediatric
- ☐ Other: _____

Location:
- ☐ Emergency Department
- ☐ Operating Room/Post-Operative Anesthetic Care Unit
- ☐ Critical Care Area
- ☐ Intermediate Care/ Step-down Area
- ☐ General Inpatient Unit or Ward Area
- ☐ Outpatient Area
- ☐ Procedure or Intervention Area
- ☐ Other: _____

MEDICAL RECORD NUMBER:

Patient Name: _____

Date of Birth: _____/_____/_____ **Age:** _____

Date of Hospital Admission:
_____/_____/_____

Gender:
☐ Male ☐ Female

TEAM ACTIVATION
Date _____/_____/_____ (dd/mm/yyyy) Time _____:_____ (hh:mm)

TEAM COMPLETION
Date _____/_____/_____ (dd/mm/yyyy) Time _____:_____ (hh:mm)

2. PRE-EVENT DATA

Primary reason for team activation:
☐ Physiologic criteria ☐ Staff provider worried/concerned

Patient status at team activation:
- ☐ Transferred within 24 hrs from Critical Care Area
- ☐ Transferred within 24 hrs from Emergency Department
- ☐ Transferred within 24 hrs from another acute care hospital / facility

Level of consciousness (AVPU score OR ACDU – Select one):

☐ Alert	☐ Alert
☐ Respond to verbal stimuli	☐ Confused
☐ Respond to painful stimuli	☐ Drowsy
☐ Unresponsive	☐ Unresponsive

Glasgow Coma Scale:
GCS: E: M: V:

Patient clinical status at activation:
- Heart rate
- Blood pressure /
- Respiratory rate
- Temperature °C
  - ☐ Axillary ☐ Oral
  - ☐ Rectal ☐ Tympanic
- Pulse oximetry %
  - ☐ Oxygen delivery _____(l/min)
  - ☐ Nasal prongs
  - ☐ Oxygen mask
  - ☐ High flow-oxygen

Supplemental Data

List specific activation criteria
- ☐ Symptom trigger: mental status change
- ☐ Symptom trigger: respiratory distress
- ☐ Symptom trigger: chest pain
- ☐ Primary medical team not responding
- ☐ Staff provider worried/concerned
- ☐ Blood test result abnormality
- ☐ Respiratory arrest
- ☐ Cardiac arrest
- ☐ Vital sign criteria

- ☐ Heart rate: Less than_____ or greater than _____
- ☐ Respiratory rate: Less than_____ or greater than _____
- ☐ Blood pressure: Less than_____ or greater than _____
- ☐ Temperature: Less than_____ or greater than _____

Level of consciousness (AVPU score OR ACDU – Select one):

☐ Alert	☐ Alert
☐ Respond to verbal stimuli	☐ Confused
☐ Respond to painful stimuli	☐ Drowsy
☐ Unresponsive	☐ Unresponsive

Glasgow Coma Scale:
GCS: E: M: V:

Figure 2. Response team data collection: case form.

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Supplemental Data

Patient Clinical Status 6 hrs before activation (or closest time with assessment, ____ hrs before activation):

Heart rate ____
Blood pressure ____ / ____
Respiratory rate ____
Temperature ____ °C
☐ Axillary ☐ Oral
☐ Rectal ☐ Tympanic

Pulse oximetry ____ %
☐ Oxygen delivery
_____(l/min)
☐ Nasal prongs
☐ Oxygen mask
☐ High flow-oxygen

Level of consciousness (AVPU Score OR ACDU– Select one):
☐ Alert ☐ Alert
☐ Respond to verbal stimuli ☐ Confused
☐ Respond to painful stimuli ☐ Drowsy
☐ Unresponsive ☐ Unresponsive

Glasgow Coma Scale:
GCS:____ E:____ M:____ V:____

3. TEAM INTERVENTION DURING EVENT

During Event (check all that apply):
☐ Non-medication therapy initiated
☐ Medication therapy initiated
☐ Treatment limitation initiated
☐ Advice or consultation only

Medication therapy:
☐ Yes
☐ No

Treatment limitation initiated:
☐ Institution of a DNAR/NFR order
☐ Treatment limitation order documented

Non-Medication Therapy:
☐ Supplemental oxygen administration or Increase in oxygen administration
☐ Bag-valve-mask ventilation
☐ CPAP/ NIPPV administration
☐ Intubation/ Airway adjunct
☐ External chest compression
☐ Defibrillation
☐ Cardioversion
☐ Bolus fluid administration

Supplemental Data

Patient Clinical Status at time of call completion:

Heart rate ____
Blood pressure ____ / ____
Respiratory rate ____
Temperature ____ °C
☐ Axillary ☐ Oral
☐ Rectal ☐ Tympanic

Pulse oximetry ____ %
☐ Oxygen delivery
_____(l/min)
☐ Nasal prongs
☐ Oxygen mask
☐ High flow-oxygen

Level of consciousness (AVPU Score OR ACDU– Select one):
☐ Alert ☐ Alert
☐ Respond to verbal stimuli ☐ Confused
☐ Respond to painful stimuli ☐ Drowsy
☐ Unresponsive ☐ Unresponsive

Glasgow Coma Scale:
GCS:____ E:____ M:____ V:____

Other team interventions (narrative/comments):

4. OUTCOME MEASURES

Patient status at end of call:
☐ Alive
☐ Dead

If Alive:
☐ Remained in same location
☐ Transferred to critical care area
☐ Transferred to intermediate/ Step-down area
☐ Transferred to cardiac monitoring area
☐ Transferred to another area for procedure/operation/ intervention
☐ Transferred to another acute care hospital

Date of acute hospital discharge or of death:
_____/_____/_____
(dd/mm/yyyy)

Patient status at acute hospital discharge:
☐ Alive
☐ Dead

Form Prepared by:_____ _____ **Date:** _____/_____/_____
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Figure 2. (continued).

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Table 1. Hospital Identification: Report Once Per Year

Data Element	Data Element Definition	Standards for Completion
Hospital name	The official name of the hospital at which the event occurred. If the hospital is part of a larger medical institution or medical center complex, the name of the larger entity may also be indicated.	Core
City	The city where the hospital is located	Core
Country	The country where the hospital is located	Core

Table 2. Hospital Bed Allocation: Report Once Per Year

Data Element	Data Element Definition	Standards for Completion
Total acute care inpatient beds	A bed that is immediately available for acute care and treatment of patients admitted to the hospital. This includes the total number of inpatient acute care beds for adult, pediatric, and neonatal patients but does not include rehabilitation beds or beds assigned to patients awaiting admission to a residential care facility.	Core
Pediatric total acute care inpatient beds 0–100 101–200 201–300 301–400 401–500 ≥501	The total number of patients <18 y of age,* excluding newborns and neonatal ICU patients, who are formally admitted to any inpatient unit for acute care, including a critical care area. Both elective and nonelective admissions are included, but rehabilitation beds or beds assigned to patients awaiting admission to a residential care facility are not included.	Core
Pediatric critical care beds 0–10 11–20 21–30 31–40 41–50 ≥51	The number of beds in the hospital or institution that are dedicated to patients <18 y of age* who require pediatric medical or pediatric surgical critical care management and that are staffed continuously by healthcare providers with expertise in pediatric critical care. Beds for children who require only cardiac monitoring and/or oximetry monitoring as a screening tool for early detection of deterioration but who do not require on-site pediatric critical care expertise are excluded. Beds for neonatal ICU patients are excluded.	Core
Pediatric step-down beds 0–10 11–20 21–30 31–40 41–50 ≥51	The number of beds in the hospital or institution that are dedicated to patients <18 y of age* who do not require the level of care provided by a critical care area but require more extensive and frequent monitoring and/or pediatric medical or surgical expertise and staffing than can be provided in a general patient care unit. Beds for patients who require only cardiac monitoring are excluded. Beds for acute psychiatric care only are excluded.	Core
Pediatric cardiac monitoring beds 0–20 21–40 41–60 61–80 81–100 ≥101	The number of beds outside of critical care areas, intermediate care areas, and neonatal ICUs dedicated to real-time monitoring of cardiac rhythm in patients <18 y of age* who are at risk for developing acute cardiac arrhythmias. Real-time monitoring refers to the ability of staff caring for the patient to observe the patient's cardiac rhythm at all times and does not refer to recording of cardiac rhythm for analysis and review at a later date.	Core
Neonatal acute care beds 0–10 11–20 21–30 31–40 41–50 ≥51	The number of beds in the hospital or institution dedicated to the care of neonatal patients who require neonatal medical or neonatal surgical critical care management. The area is staffed continuously by healthcare providers with expertise in neonatal critical care.	Core
Adult total acute care inpatient beds 0–100 101–200 201–300 301–400 401–500 ≥501	The total number of patients ≥18 y of age* who are formally admitted to any inpatient unit, including a critical care area. Both elective and nonelective admissions are included, but rehabilitation beds or beds assigned to patients awaiting admission to a residential care facility are not included.	Core

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Table 2. Continued

Data Element	Data Element Definition	Standards for Completion
Adult critical care beds 0–10 11–20 21–30 31–40 41–50 ≥51	The total number of beds in the hospital or institution dedicated to patients ≥18 y of age* who require adult critical care management; the area is staffed continuously by healthcare providers with expertise in adult critical care. Beds for patients who require only cardiac monitoring and/or oximetry monitoring as a screening tool for early detection of deterioration but who do not require on-site critical care expertise are excluded. Beds for acute psychiatric care only are excluded.	Core
Adult step-down beds 0–10 11–20 21–30 31–40 41–50 ≥51	The number of beds in the hospital or institution dedicated to patients ≥18 y of age* who do not require the level of care provided by a critical care area but still require more extensive and frequent monitoring and/or adult medical or surgical expertise and staffing than can be provided in a general patient care unit. Beds for patients who only require cardiac monitoring are excluded. Beds for acute psychiatric care only are excluded.	Core
Adult cardiac monitoring beds 0–20 21–40 41–60 61–80 81–100 ≥101	The number of beds outside of critical care and intermediate care areas dedicated to real-time monitoring of cardiac rhythm in patients ≥18 y of age.* Real-time monitoring refers to the ability of staff caring for the patient to observe the patient's cardiac rhythm at all times and does not refer to recording of cardiac rhythm for analysis and review at a later date.	Core

ICU indicates intensive care unit.

*If pediatric age is not defined as <18 years, the definition of pediatric age used should be noted.

Table 3. Composition and Structure of Standard Response Team

Data Format	Data Definition (What the Data Mean)	Standards for Completion
Physicians, physician trainees, nurses, other	Identify the type and number of responders on the MET/RRT/CCOT or similar team normally expected to respond rapidly to patients with deteriorating physiological parameters. (This team is distinct from the team that is primarily responsible for the patient's care while in the hospital.)	Core
Critical care training? □ Yes □ No	Indicate which members of the team have critical care training or experience.	Core
Hours of operation: □ Always available □ Limited hours	• Always available: The team is available to provide a response 24 h/d, 7 d/wk. • Limited hours: The team is available <24 h/d, 7 d/wk. Identify the days of the week when the team is available and indicate in 24-h clock format (hh:mm) the daily hours of operation.	Core
If limited hours: Day of the week □ Monday □ Tuesday □ Wednesday □ Thursday □ Friday □ Saturday □ Sunday	• If limited hours, the team is available <24 h/d, 7 d/wk. • Identify the days of the week that the team is available.	Core
Hours (hh:mm)	If limited hours, the team is available <24 h/d, 7 d/wk. Identify in 24-h clock format (hh:mm) the daily hours of operation.	Core
Response team same as cardiac arrest team? □ Yes □ No □ Sometimes	A cardiac arrest team responds principally to patients with cardiac or respiratory arrest or in imminent danger of an arrest. A cardiac arrest team does not respond to a set of activation criteria or any criteria other than a patient in or in danger of cardiac or respiratory arrest. An MET/RRT/CCOT or similar team is the team designated to respond rapidly to patients with abnormal physiological parameters.	Core
If sometimes, explain:		Core

An MET, RRT, or CCOT is defined as a patient response team that responds to calls triggered by abnormalities in patient physiology or a subjective concern on the part of staff. The response team is distinct from the team that is primarily responsible for the day-to-day care of the patient while in the hospital.

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Table 4. Response Team Coverage and Activation

Data Element	Data Element Definition	Standards for Completion
Response team coverage:		Core
□ Available in all areas of hospital	• All hospital inpatient areas: The team will respond to all inpatient acute care areas of the hospital when needed.	
□ Available in only some areas	• Less than all inpatient acute care areas of the hospital: The team will not respond to some areas of the hospital. Identify specific areas of the hospital where the team will respond.	
If partially available, team coverage includes (check all that apply):	• Identify the team as being solely pediatric, solely adult, or responding to both pediatric and adult patients.	
□ All adult clinical areas	• List areas (previously defined) covered by MET/RRT/CCOT.	Core
□ Adult acute care beds		
□ Adult critical care beds		
□ Adult step-down beds		
□ Adult cardiac monitoring beds		
□ Adult outpatient/ambulatory areas		
□ Adult emergency department		
and/or		
□ All pediatric clinical areas		
□ Pediatric acute care beds		
□ Pediatric critical care beds		
□ Pediatric step-down beds		
□ Pediatric cardiac monitoring beds		
□ Pediatric outpatient/ambulatory areas		
□ Pediatric emergency department		
Tiered team response?		Core
□ Yes □ No	Indicate if a tiered team response exists. A tiered response is defined as an initial call to ≥1 team member but not all response team members. This initial response may be followed by a further team call by which additional team members are called to attend as required. If a tiered response exists, describe the type of team response on the team call record.	
Criteria for team activation (check all that apply):		
□ Respiratory arrest	List the specific values of listed criteria used for activation of the response team.	Core
□ Cardiac arrest		
□ Heart rate		
□ Respiratory rate		
□ Blood pressure		
□ Temperature		
□ Oxygen saturation		
□ ACDU score		
□ AVPU score		
□ GCS score		
□ Subjective concern		
□ Other criteria (describe)		

ACDU indicates alert, confused, drowsy, unresponsive; AVPU, alert, responds to voice, responds to pain, unresponsive; and GCS, Glasgow Coma Scale.

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Table 5. Patient Demographics

Data Element	Data Element Definition	Standards for Completion
Medical record number	A unique local hospital patient identifier assigned to the patient on admission	Core
Patient name	The patient's name as indicated in medical records or on the patient's hospital identification label	Core
Gender	The patient's gender as indicated in medical records or on the patient's hospital identification label	Core
Date of birth	The patient's date of birth as indicated in medical records or on the patient's hospital identification label (dd/mm/yyyy)	Core
Age	If date of birth cannot be provided for reasons of patient confidentiality or because it is unknown, then provide the age in years at last birthday or best estimate. When the date of birth of a child <1 y of age cannot be provided, provide the child's age in months. When the date of birth of a child <1 month of age cannot be provided, provide the child's age in days.	Core

Table 6. Event Data

Data Element	Data Element Definition	Standards for Completion
Date of hospital admission	The date recorded on the admission sheet when the patient was formally admitted to hospital	Core
Date of team activation	The date the call was placed to the appropriate team member or paging operator to mobilize or activate the team	Core
Time of team activation	The time the call was placed to the appropriate team member or paging operator to mobilize or activate the team	Core
Date of team call completion	The date team activation was formally declared as completed by the team leader and responsibility for the patient returned to the original team; alternatively defined as the date that all team members departed and responsibility for patient care was returned to the original team	Core
Time of team call completion	The time that team activation was formally declared as completed by the team leader and responsibility for the patient returned to the original team; alternatively defined as the time that all team members departed and responsibility for patient care was returned to the original team	Core
Patient category	Identify patient category at the time of team call by the primary specialty of the principal physician or primary care team:	Core
□ Medical	Medical: All medical specialties and subspecialties, including mental health	
□ Surgical	Surgical: All surgical specialties and subspecialties, including trauma and gynecological (nonobstetric) surgery patients	
□ Obstetric	Obstetric: Any patient admitted principally for conditions related to pregnancy or childbirth during that hospital admission	
□ Other	Specify other	
Location	Location of patient when team was activated	Core
□ Emergency department	Emergency department includes all areas within the emergency department	
□ Operating room/postoperative anesthetic care unit	Operating room includes all operating rooms, recovery areas, and postoperative anesthetic care areas	
□ Critical care area	Critical care and intermediate or step-down areas are defined above	
□ Intermediate care/step-down area		
□ General inpatient unit or ward area	General inpatient or ward areas include all areas that are not critical care areas, in the emergency department or operating rooms, or procedure or intervention areas	
□ Procedure or intervention area	Procedure or intervention areas include all areas where medical procedures and interventions are performed; for example, endoscopy areas, cardiac catheterization areas, exercise stress testing areas, cardiac defibrillation areas, and electroconvulsive therapy areas. Procedure or intervention areas do not include medical imaging/radiology areas if no procedure or intervention was performed and the patient was undergoing radiological investigation only.	
□ Outpatient area		
□ Other: specify:_____	Other areas include all other areas not specified above. Please specify other areas.	

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Table 7. Pre-Event Data

Data Element	Data Element Definition	Standards for Completion
Primary reason for team activation: □ Physiological criteria □ Staff provider worried/concerned	Select the primary reason for team activation	Core
Patient's status at team activation:		
□ Transferred within 24 h from critical care area	Select if patient was transferred from a critical care area within the institution within 24 h of team activation	Core
□ Transferred within 24 h from emergency department	Select if patient was transferred from the emergency department within 24 h of team activation	
□ Transferred within 24 h from another acute care hospital/facility	Select if patient was transferred from another acute care hospital/facility within 24 h before team activation	
Patient's clinical status at team activation:	Patient's vital signs at time of team activation. Indicate as not applicable if no recordings are available for any or all of these parameters	Core
Heart rate	Heart rate (bpm) at time of team activation	
Systolic blood pressure	Systolic blood pressure (mm Hg) at time of team activation	
Respiratory rate	Respiratory rate (breaths/min) at time of team activation	
Temperature: □ Oral □ Rectal □ Axillary □ Tympanic □ Other	Temperature (centigrade or Fahrenheit and method of measurement)	
Pulse oximetry (%): □ Oxygen delivery (L/min) □ Nasal prongs □ Oxygen mask □ High-flow oxygen	Percentage saturation of hemoglobin as measured by pulse oximetry reading at time of team activation. Indicate percentage of oxygen administration at time of team activation as either: Room air ≤50% oxygen >50% oxygen	
Level of consciousness (AVPU score or ACDU score—check one): AVPU □ Alert □ Responds to verbal stimuli □ Responds to painful stimuli □ Unresponsive ACDU □ Alert □ Confused □ Drowsy □ Unresponsive	Select level of consciousness at time of team activation as measured by AVPU or ACDU score	Core
GCS GCS (score 3 to 15) Eyes (score 1 to 4) Motor (score 1 to 6) Verbal (score 1 to 5)	Score patient's neurological status at time of team activation according to the GCS eyes, motor, and verbal scores. Identify patient as pediatric or adult.	Core
List specific activation criteria if not listed above (for example): □ Symptom trigger: mental status change □ Symptom trigger: respiratory distress □ Symptom trigger: chest pain □ Primary medical team not responding □ Staff provider worried/concerned □ Abnormality in blood test result □ Respiratory arrest □ Cardiac arrest □ Vital signs criteria	Identify specific physiological criteria used to initiate team activation	Supplemental

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Table 7. Continued

Data Element	Data Element Definition	Standards for Completion
Patient's clinical status 6 h before team activation: Heart rate Blood pressure Respiratory rate Temperature: □ Oral □ Rectal □ Axillary □ Tympanic □ Other Pulse oximetry (%): □ Oxygen delivery (L/min) □ Nasal prongs □ Oxygen mask □ High-flow oxygen	Provide all available recordings (up to a maximum of 6 recordings) of heart rate, blood pressure, respiratory rate, temperature, pulse oximetry, level of consciousness (AVPU/ACDU and GCS) in the 6 h before team activation in the same way as for patient status at time of team activation. Indicate time at which each recording was taken (hh:mm). If no recordings are available for any or all parameters, indicate as not applicable.	Supplemental
Level of consciousness (AVPU score or ACDU score—check one): AVPU □ Alert □ Responds to verbal stimuli □ Responds to painful stimuli □ Unresponsive ACDU □ Alert □ Confused □ Drowsy □ Unresponsive	Select level of consciousness as measured by AVPU or ACDU score	Supplemental
GCS GCS (score 3 to 15) Eyes (score 1 to 4) Motor (score 1 to 6) Verbal (score 1 to 5)	Score patient's neurological status at time of team activation according to the GCS eyes, motor, and verbal scores. Indicate if adult or pediatric scale was used.	Supplemental

AVPU indicates alert, responds to voice, responds to pain, unresponsive; ACDU, alert, confused, drowsy, unresponsive; and GCS, Glasgow Coma Scale.

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Table 8. Team Intervention During Event

Data Element	Data Element Definition	Standards for Completion
During event (check all that apply): □ Nonmedication therapy initiated □ Medication therapy initiated □ Treatment limitation initiated □ Advice or consultation only	See below	Core
Nonmedication therapy:		Core
□ Supplementary oxygen administration or increase in rate of oxygen administration	Indicate whether team provided or requested supplementary oxygen or increase in oxygen concentration	
□ Bag-mask ventilation	Indicate whether team performed or requested bag-mask ventilation	
□ CPAP or NIPPV	Indicate whether team provided or requested CPAP or NIPPV	
□ Intubation or insertion of an advanced airway device	Indicate whether patient was intubated by team or at request of team. Intubation includes insertion of tracheal tube or supraglottic airway device or other advanced airway technique such as needle cricothyroidotomy or emergency tracheostomy.	
□ External chest compressions	Indicate whether external chest compressions were initiated during team activation and whether or not a formal cardiac arrest system was subsequently activated in the hospital	
□ Defibrillation	Indicate whether electrical defibrillation was attempted	
□ Cardioversion	Indicate whether cardioversion was attempted	
□ Bolus fluid administration	Indicate whether a bolus of intravenous fluid was administered during team activation. A bolus of fluid is a volume of fluid (≥250 mL in adults, ≥10–20 mL/kg in children) given over ≤15 min.	
Medication therapy? □ Yes □ No	Indicate whether medications were administered during team call	Core
Treatment limitation initiated: □ Institution of DNAR/NFR order □ Treatment-limitation order documented	Indicate whether a new DNAR/NFR order or a treatment limitation order was instituted while team was in attendance. This should include new treatment-limitation orders from original team or original attending physician in immediate response to communication with response team at time of team attendance (eg, documentation of a DNAR/NFR order; documentation that patient is not to receive intubation or renal replacement therapy).	Core
Patient's clinical status at time of call completion: Heart rate Blood pressure Respiratory rate Temperature: □ Oral □ Rectal □ Axillary □ Tympanic □ Other Pulse oximetry (%): □ Oxygen delivery (L/min) □ Nasal prongs □ Oxygen mask □ High-flow oxygen	Document patient's status at time of completion of team activation in the same way patient status was documented at time of team activation. If no recordings are available for any or all parameters, indicate as not applicable.	Supplemental
Level of consciousness (AVPU or ACDU score—check one): AVPU □ Alert □ Responds to verbal stimuli □ Responds to painful stimuli □ Unresponsive ACDU □ Alert □ Confused □ Drowsy □ Unresponsive	Select level of consciousness as measured by AVPU or ACDU score	Supplemental
GCS GCS (score 3 to 15) Eyes (score 1 to 4) Motor (score 1 to 6) Verbal (score 1 to 5)	Score patient's neurological status at time of team activation according to the GCS eyes, motor, and verbal scores. Indicate if pediatric or adult scale was used.	Supplemental

CPAP indicates continuous positive airway pressure; NIPPV, noninvasive positive pressure ventilation; DNAR, do not attempt to resuscitate; NFR, not for resuscitation; AVPU, alert, responds to voice, responds to pain, unresponsive; ACDU, alert, confused, drowsy, unresponsive; and GCS, Glasgow Coma Scale.

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Table 9. Patient Outcome Measures

Data Element	Data Element Definition	Standards for Completion
Patient's status at end of call: □ Alive □ Dead	Indicate whether patient was alive or dead at time team call was completed	Core
If alive:	If patient was alive at time team call was completed, indicate whether patient:	Core
□ Remained in same location	Remained in same location as before event without a need for transfer to another area of hospital or another hospital	
□ Transferred to critical care area	Was transferred to a dedicated area in hospital or institution for patients who require medical or surgical critical care management. Area is staffed continuously by healthcare providers with expertise in critical care.	
□ Transferred to intermediate/step-down area	Was transferred to area outside critical care area and general ward area (defined above) where patients require more extensive and frequent monitoring and/or medical or surgical expertise and staffing than can be provided in a general patient care unit. Beds for patients who require only cardiac monitoring are excluded. Beds for acute psychiatric care only are excluded.	
□ Transferred to cardiac monitoring area	Was transferred to area outside critical care and intermediate care areas dedicated to real-time monitoring of patient's cardiac rhythm. Real-time monitoring refers to ability of staff caring for patient to observe patient's cardiac rhythm at all times and does not refer to recording cardiac rhythm for analysis and review at a later date.	
□ Transferred to another area for procedure/operation/intervention	Was transferred to another specific area of hospital where diagnostic or therapeutic operations or procedures are performed; for example, the operating room, cardiac catheterization area, endoscopy area, or interventional radiology area	
□ Transferred to another acute care hospital	Was transferred to an independent acute care hospital not physically connected to hospital where the event occurred	
Patient's status at acute care hospital discharge: □ Alive □ Dead	Indicate whether patient was alive or dead at time of hospital discharge	Core
Date of acute care hospital discharge or death	Date of discharge from acute care hospital or date of death (dd/mm/yyyy)	Core

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Table 10. Hospital Outcome Measures

Data Element	Data Element Definition	Standards for Completion
During the reporting year:		
No. of discharges	The number of acute care discharges regardless of patients' status as dead or alive at time of discharge	Core
No. of response team activations	The number of times the team was activated	Core
No. of in-hospital cardiac arrest events	The total number of cardiac arrest events that occurred in the hospital, defined as the need for chest compressions and/or defibrillation. This should include cardiac arrest events that occurred in critical care areas, the emergency department, the operating room, and ambulatory care areas, as well as all other general inpatient areas, but should exclude all prehospital cardiac arrests (cardiac arrests that occurred before presentation to hospital) among patients admitted to the emergency department only and visitors and staff who experienced a cardiac arrest.	Core
No. of in-hospital cardiac arrests not occurring in a critical care area, operating room, or emergency department	The total number of in-hospital cardiac arrests that did not occur in a critical care area, emergency department, or operating room	Core
No. of in-hospital deaths	The total number of deaths recorded after admission to the hospital. This should exclude all patients who were declared dead on arrival at the hospital.	Core
No. of DNAR/NFR deaths	The total number of deaths among patients with prior DNAR/NFR orders in whom no resuscitative efforts were made	Core
No. of DNAR/NFR deaths, excluding critical care areas, operating room, or emergency department	Total number of DNAR/NFR deaths, excluding deaths that occurred in critical care areas, emergency department, or operating room	Core

DNAR indicates do not attempt to resuscitate; NFR, not for resuscitation.

These data should be reported once per year and should be separated into data for adult and pediatric patients. If pediatric age is not defined as <18 years, the definition of pediatric age used should be noted.

many different criteria, including subjective criteria. Only 1 set of calling criteria has been published for infants and children.[28] More information on the patient's physiological status at the time of the call may be helpful in determining the optimal set of activation criteria by linking the patient's physiological status at the time of team activation to the patient's outcome. Alternatively, different sets of activation criteria may be equally useful. These data elements also provide information on how critical the patient's condition was at the time of activation, which provides an opportunity for more consistent comparison of team responses and impact.

The core data set discussed here forms part of the most common and widely used sets of activation criteria. Level of consciousness is included in most sets of activation criteria, but level of deterioration is specified or described in many different and sometimes subjective ways. Although there is no universally accepted scoring system to characterize mental status, there was consensus to use either the ACDU (Alert, Confused, Drowsy, Unresponsive) or the AVPU (Alert, responds to Voice, responds to Pain, Unresponsive) scoring system. Both systems are easily used by general ward staff and have been validated as methods for tracking changes in level of consciousness.[51] The Glasgow Coma Scale (GCS) is sometimes included in activation criteria, but in practice, it is not often used in general ward environments and may be scored incorrectly by people who do not use it often.[52] The ACDU and AVPU systems may therefore be more practical and useful for scoring deterioration in neurological patients.

The location where the patient's condition deteriorates may be related to outcome. Knowledge of patient location at the time of system activation is essential.[18,47] This information may also serve to highlight whether there are areas of the hospital where patients' conditions commonly deteriorate. This may help institutions provide tailored solutions through increased monitoring or staffing of these areas, or it may stimulate other improvements in quality of care.

Team Activations and Interventions

When studying the potential benefit of an MET or other rapid response system, the cost of providing a team response, measured in terms of time that team members are absent from their usual duties, may be an important consideration. Therefore, collection and reporting of the time of team activation and the time of completion of activation are core data elements. It is widely reported that time reporting that is not centralized or adjusted to a single clock is unreliable, and thus, hospitals that adjust to a single timepiece should be able to compare time-response effects. The interventions provided by the team are crucial for understanding the range and type of interventions that may be required to treat patients with deteriorating conditions. These interventions may also have an impact on patient outcome. The MET commonly undertakes therapies such as providing supplementary oxygen and fluids. These simple interventions may be as important in determining outcome as more invasive therapies.[33]

After team activation, team members may also consider institution of treatment-limitation orders when escalation of medical support is considered futile or inappropriate. These interventions, or the opening of discussion about treatment limitations, are an important part of response team activities and constitute an indicator of quality of care. In particular, the institution of a do-not-attempt-resuscitation (DNAR)/not-for-resuscitation (NFR) order is an important treatment. Institution of any treatment-limitation order or DNAR/NFR order should be collected and reported in order to understand the contribution of response teams to patient management.

Patient Outcome Measures

Patient outcomes are the most important measures of the effect of a system-wide intervention. Outcomes should be collected accurately to enable quality assurance of existing care and research into the different types of system responses to define future standards of care and to allow comparison between centers. The listed outcomes have been chosen for their simplicity and their importance in understanding system interventions. In particular, the patient's vital status at time of discharge was selected to enable comparison of rates of serious adverse outcome, including cardiac arrest, because these are central indicators of patient outcome.

Hospital Outcome Measures

The hospital-level data elements related to DNAR/NFR deaths have been defined as core data in recognition of the potential for these system interventions to improve quality of care, particularly for patients at the end of life. It is also important to track the number of DNAR/NFR deaths when the cardiac arrest event rate and other indicators of system effectiveness are being monitored. This will help determine whether any decrease in cardiac arrests is the result of an increase in the rate of assignment of DNAR/NFR orders, and if so, whether this is an appropriate response and what proportion of the reduction in cardiac arrests can be attributed to this change. We anticipate that many institutions may have some difficulty in collecting this information, because it is often recorded poorly or not reported at all, but we urge investigators to make every effort to include information about DNAR/NFR deaths and the location of these deaths in their data collection and reporting. The MET has the best chance of altering outcome for patients who die unexpectedly in areas where the level of care is inappropriately low, and this is where the attention of most of these teams is directed. Unexpected deaths that occur in critical care areas, operating rooms, and emergency departments are not likely to be affected by a system such as the MET, because the level of care should already be optimal.

Pediatric Systems

A special effort has been made to ensure that data on the use of response systems for pediatric inpatient care are also collected. Only 1 study has attempted to assess the impact of an inpatient pediatric MET in preventing serious adverse events, including death.[28] More information is necessary to determine whether these systems show a consistent benefit in this population. Although many of the data suggested for collection will be similar for adults and children, specific physiological activation criteria (heart rate, respiratory rate, and blood pressure) will differ depending on the age of the patient. A uniform method of collecting these data should

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make validation and assessment of the usefulness of activation criteria in infants and children achievable. In addition, the types of serious adverse events experienced by pediatric patients may also be different, because respiratory system–mediated events are more common in these patients than primary cardiac events.[53] Data on newborns who receive care in neonatal intensive care settings have been purposely excluded from this effort because intensive care expertise is consistently available to the majority of these neonates.

Summary

The number of core data elements may be challenging, but every effort has been made to minimize demands on clinicians, quality-improvement staff, and researchers. Where data elements require retrospective review of patient records, careful consideration of the cost-benefit of these data elements was made, and in every case, the additional benefit was thought to outweigh the costs of data collection. We urge clinicians to make every effort to include these data elements in their internal quality-improvement programs, and we urge researchers to include them in their research design.

The level of monitoring of patients in hospitals may increase significantly in the future, and it is possible that many more patients will be monitored continuously rather than intermittently. These changes may affect the activation criteria used and resources required to staff response teams adequately. Increased surveillance may increase the number of response team calls. Optimal methods for monitoring hospitalized patients are not well understood, but the information collected as part of the investigation of these response teams may also contribute to more appropriate monitoring strategies.

The purpose of MET, RRT, and CCOT systems is to improve quality of care and prevent adverse outcomes in hospitalized patients. In particular, the prevention of medical error is a high priority.[54,55] Systems such as these are needed to ensure that gaps in quality of care are closed.

Conclusions

A proportion of hospitalized patients are cared for in areas that are inappropriate for the severity of their illness. There are opportunities to improve patient outcomes and optimize the use of limited healthcare resources by identifying patients at risk of deterioration, cardiac arrest, or death and by intervening early to lower these risks. By consensus, a list of core and supplemental data elements has been developed in the Utstein style for monitoring incidence and outcome of such in-hospital events, and a system intervention has been designed to reduce such events. These data may be used to develop evidence-based recommendations for best clinical practice and to improve outcomes in hospitalized patients.

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Disclosures

Writing Group Disclosures

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Michael DeVita	University of Pittsburgh, UPMC Presbyterian Hospital, Dept of Critical Care	None	None	Various institutions, speaking about MET or ethics in critical care	None	None	None
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Michael Parr	Liverpool Hospital, Sydney, Australia	Steering committee of MERIT study	None	None	None	None	None
James Tibballs	Royal Children's Hospital, Melbourne, Australia	None	None	None	None	None	None
Elise W. van der Jagt	University of Rochester School of Medicine/Dentistry, Rochester, NY	None	None	None	None	None	None
Lis Young	Simpson Centre for Health Services Research, Sydney, Australia	None	None	None	None	None	None

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NHLBI indicates National Heart, Lung, and Blood Institute; UPMC, University of Pittsburgh Medical Center; AHRQ, Agency for Healthcare Research and Quality; SSWAHS, Sydney SouthWest Area Health Service; and MERIT, Medical Early Response, Intervention, and Therapy.

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Michael D. Buist	Monash University, Melbourne, Victoria, Australia; Dandenong Hospital, Melbourne, Victoria, Australia	None	None	None	None	None	None	None
Geoff Lighthall	Stanford University	None	None	None	None	None	None	None

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Mary Ann Peberdy, Michelle Cretikos, Benjamin S. Abella, Michael DeVita, David Goldhill, Walter Kloeck, Steven L. Kronick, Laurie J. Morrison, Vinay M. Nadkarni, Graham Nichol, Jerry P. Nolan, Michael Parr, James Tibballs, Elise W. van der Jagt and Lis Young

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