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Pediatric Medical Emergency Team Events and Outcomes: A Report of 3647 Events From the American Heart Association's Get With the Guidelines-Resuscitation Registry

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Abstract

OBJECTIVES: To describe the clinical characteristics and outcomes of a large, multicenter cohort of pediatric medical emergency team (MET) events occurring in US hospitals reported to the American Heart Association's Get With the Guidelines-Resuscitation registry.

METHODS: We analyzed consecutive pediatric (<18 years) MET events reported to the registry from January 2006 to February 2012.

RESULTS: We identified 3647 MET events from 151 US hospitals: 3080 (84%) ward and 567 (16%) telemetry/step-down unit events; median age 3.0 years (interquartile range: 0.0–11.0); 54%

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male; median duration 29 minutes (interquartile range: 18–49). Triggers included decreased oxygen saturation (32%), difficulty breathing (26%), and staff concern (24%). Thirty-seven percent (1137/3059) were admitted within 24 hours before MET event. Within 24 hours before the MET event, 16% were transferred from a PICU, 24% from an emergency department, and 7% from a pediatric anesthesia care unit. Fifty-three percent of MET events resulted in transfer to a PICU; 3251 (89%) received nonpharmacologic interventions, 2135 (59%) received pharmacologic interventions, 223 (6.1%) progressed to an acute respiratory compromise event, and 17 events (0.5%) escalated to cardiopulmonary arrest during the event. Survival to hospital discharge was 93.3% ($n = 3299/3536$).

CONCLUSIONS: Few pediatric MET events progress to respiratory or cardiac arrest, but most require nonpharmacologic and pharmacologic intervention. Median duration of MET event was 29 minutes (interquartile range: 18–49), and 53% required transfer to a PICU. Events often occurred within 24 hours after hospital admission or transfer from the PICU, emergency department, or pediatric anesthesia care unit and may represent an opportunity to improve triage and other systems of care.

Observations over the past 2 decades have changed the belief that most cardiopulmonary arrests (CPAs) are sudden and unpredictable. In fact, CPA is often preceded by several hours of warning signs and symptoms before the deterioration event. Although some hospitalized children may suffer sudden and unexpected cardiac arrests from acute arrhythmia, airway obstruction, or other events, the more common pattern is thought to be a gradual progression of hypoxemia and hemodynamic instability.¹ If abnormal physiology is identified and corrected early, many CPAs can be prevented and outcomes may improve.

First developed in the early 1990s,² medical emergency teams (METs)/rapid response teams have been widely implemented throughout the world with the aim of responding to patients on general wards displaying early physiologic signs of deterioration and rapidly intervening to treat the underlying cause before CPA occurs.^{3–8} A meta-analysis of 5 studies demonstrated a 37.7% decrease in rates of CPA outside of the PICU and a 21.4% decrease in hospital mortality associated with the use of a MET.⁹ Implementation of a MET has also been associated with a decrease in respiratory arrests outside of the PICU.^{3,8} The American Heart Association's Get With the Guidelines-Resuscitation (GWTG-R) database is the only national registry of in-hospital resuscitation events, including CPA, acute respiratory compromise (ARC), and MET events. The purpose of this report is to describe the clinical characteristics and outcomes of a large, multicenter cohort of pediatric MET events occurring in US hospitals reported to the GWTG-R registry. Our specific objectives were to characterize the clinical details before and during pediatric MET events, the duration of time spent at MET events, interventions performed during MET events, and the clinical outcomes of patients cared for by the MET.

METHODS

Design

GWTG-R is the American Heart Association's collaborative quality improvement program demonstrated to improve adherence to evidence-based care of patients who experience an in-

hospital resuscitation event or received post–cardiac arrest care after an in-hospital or out-of-hospital event. The program collects data from hospitals across the United States that is used to provide participating hospitals with feedback on their resuscitation practice and patient outcomes as well as to develop new evidence-based guidelines. Its design has been previously described in detail (www.heart.org/resuscitation). Current modules for the GWTG-R registry include cardiopulmonary arrest events, acute respiratory compromise events, medical emergency team events, and post–cardiac arrest care events. The MET module was initiated in January 2006 and includes MET events from January 2006 through February 2012. The 6 domains of data collected in the MET module include (1) pre-event data, (2) event data, (3) MET activation triggers, (4) drug intervention data, (5) nondrug intervention data (diagnostic and therapeutic), (6) MET outcome data, and (7) quality improvement data. Hospitals voluntarily participate in the database for the primary purpose of quality improvement and as such are not required to obtain institutional review board approval or informed consent from patients or families. The current study was deemed exempt from institutional review board oversight at Medical City Children’s Hospital and represents the initial report describing the pediatric MET cohort from GWTG-R.

Study Population

All patients aged <18 years who experienced an inpatient MET event at any of the 151 participating hospitals between January 2006 and February 2012 were eligible for this study. According to the GWTG-R operational definitions, a MET event is any event within the facility for which the MET was activated. The team response may be triggered by abnormalities in patient physiology, a subjective concern on the part of the staff, or family/visitor concerns as defined by a facility’s activation policies or procedures for MET activation. We excluded MET events occurring in ambulatory care, the delivery suite, newborn nursery, rehabilitation/skilled nursing units, diagnostic/intervention areas, the emergency department (ED) and other critical care areas such as the PICU, NICU, and postanesthesia care unit (PACU). We also excluded patients with an illness category of obstetric and visitor or staff events.

Statistical Analysis

We first tabulated patient demographics and characteristics of hospitals contributing to the data set. Next, we evaluated patient outcome measures of interest, including progression to ARC or CPA during the MET event and survival to hospital discharge. According to GWTG-R operational definitions, an ARC event is defined as absent, agonal, or inadequate respirations that require emergency assisted ventilation. A CPA event is defined as either pulselessness or a pulse with inadequate perfusion requiring chest compressions and/or defibrillation of ventricular fibrillation or pulseless ventricular tachycardia. In addition to the patient outcome measures, we also evaluated the reported reasons for MET activation; processes of care variables that surrounded the MET events; the time elapsed since hospital admission or transfer out of a PICU, ED, or PACU; and the interventions initiated during the MET event. Medical interventions were categorized at 3 levels: patient assessment/examination only, ward level, or critical care level as per previous reports of MET activity in the medical literature.¹⁰ Proportions were calculated and percentages reported for categorical variables. Proportions were compared by using the χ^2 statistic. For continuous

variables, medians and interquartile ranges (IQRs) were reported. We performed statistical analysis using SAS v9.3.

RESULTS

Population and Hospital Characteristics

The initial data query resulted in 4514 events, and 3647 events were analyzed after applying the exclusion criteria (867 Excluded Events: 176 Ambulatory/Outpatient, 1 Adult ICU, 8 Delivery Suite, 72 Diagnostic/Intervention Area, 4 Emergency Department, 1 NICU, 2 Newborn Nursery, 2 PICU, 9 Pediatric Anesthesia Care Unit, 144 Rehabilitation/Skilled Nursing Unit, 17 Same Day Surgery Unit, 219 Other/Unknown Location, 51 Obstetric patient, 152 Visitor/Staff, 9 Unknown Illness Category). The demographics for the patient population are displayed in Supplemental Table 6. The median age of patients was 3.0 years (IQR: 0.0–11), and 54% were male. The majority of the cohort (3023 of 3647; 82.9%) had only 1 MET event during their hospital admission, with 6 patients having 6 MET events during the same hospitalization (cohort range 1–6 MET events). There were 23.6% of patients (721 of 3059) admitted to the wards within 12 hours before the first MET event and 37.2% of the patients (1137 of 3059) admitted within 24 hours before the first MET event. Approximately 24% of the patients were admitted from the ED within 24 hours before the MET call, 16% had been discharged from a PICU, and 7% were admitted from a PACU within 24 hours before the MET call. The majority of MET events occurred in urban, nonprofit, major teaching facilities with >20 PICU beds and >500 total hospital beds (see Supplemental Table 7).

MET Activation Day and Time

According to GWTG-R definitions, daytime hours were defined as 7:00 AM to 10:59 PM, which represent 66.7% of the total hours in a week (ie, 112 of 168 hours in a week). In our study sample, 70.2% (2513 of 3579) of MET events occurred during daytime hours. This is significantly more than what we would expect if the calls were equally distributed between the daytime and nighttime hours ($P < .001$), although this may not be clinically significant. Weekend hours were defined as Friday 11:00 PM through Monday 7:00 AM, which represent 33% of the total hours in a week (ie, 56 of 168 hours). In our study sample, 31% (1094 of 3647) of MET events occurred during weekend hours. This is significantly fewer than what we would expect if the calls were equally distributed between the weekday and weekend hours ($P < .001$); however, this may also not be clinically significant. The median length of time the MET reported staying during an event (arrival to departure) was 29 minutes (IQR: 18–49). The median time from hospital admission to the first MET event was 47.6 hours (IQR: 15–171).

MET Activation Triggers

The frequency of MET activation triggers is displayed in Table 1. The number of different MET activation triggers per call ranged from 0 to 7, and the majority of patients had either 1 (1360 of 3614, 38%) or 2 (1271/3614, 35%) MET activation triggers. Notably, 27% had >2 MET activation triggers. Respiratory triggers were the most common reason for activation, with 63% of the cohort having at least 1 respiratory trigger, including decreased oxygen

saturations, new onset of difficulty breathing, tachypnea, respiratory depression, or bleeding in the airway. The second most common trigger was for a staff member acutely worried about the patient (859 of 3614, 23.8%). Less frequent MET triggers included cardiovascular and neurologic signs and symptoms. Tachycardia (643 of 3614, 17.8%) and hypotension (286 of 3614, 7.9%) were the most common cardiovascular triggers. Mental status changes (585 of 3614, 16%) and seizures (504 of 3614, 14%) were the most common neurologic triggers for MET events.

Nonpharmacologic and Pharmacologic MET Interventions

Table 2 illustrates the relative proportions of each category of MET interventions (i.e., patient assessment/examination only, ward level, or critical care level), with the largest percentage of the cohort (2625 of 3639; 72.1%) receiving an assessment/examination related intervention. Overall, the most frequent interventions were those related to breathing, particularly ward-based breathing interventions with 60.6% receiving supplemental oxygen during the MET event. Ward level interventions involving circulation (intravenous [IV] fluid bolus and peripherally inserted IV line; 44.2%) and drug therapy (25.8%) were the second and third most frequent interventions performed.

Critical care type interventions were categorized as airway (insertion of either a nasal/oral airway, laryngeal mask, endotracheal tube or a tracheostomy tube airway, tracheostomy care, or bronchoscopy); breathing (use of noninvasive positive pressure respiratory support, bag-and-mask manual ventilation, or invasive mechanical ventilation); circulation (chest compressions, defibrillation or cardioversion, central venous/arterial line/intraosseous line insertion, pacemaker, or administration of blood products); and drugs (intravenous sedation or anesthesia, antiarrhythmic, atropine, calcium, magnesium, mannitol, nitroglycerine, sodium bicarbonate, thrombolytic, or inotrope/vasopressor). Critical care interventions were much less frequent than assessment/examination and ward-level interventions, with the largest percentage (407 of 3637; 11.2%) also related to breathing support through noninvasive or invasive positive pressure ventilation. Critical care interventions related to airway (5.0%), circulation (7.4%), and pharmacologic support (5.7%) were much less frequent.

Table 3 displays the nonpharmacologic interventions performed by the MET. Almost 90% of the MET events (3251 of 3639) required >1 nonpharmacologic intervention to be performed by the team. The number of different nonpharmacologic interventions performed during the MET event ranged from 0 to 16, with a large percentage of events requiring 3 to 5 interventions by the team (1600 of 3646, 43.9%). Table 4 displays the pharmacologic interventions performed by the MET. Pharmacologic interventions were performed in 58.5% (2135 of 3636) of the MET events, with most events (43.2%) requiring only 1 pharmacologic intervention. The most common interventions were the administration of an IV fluid bolus (21.7%), inhaled bronchodilator (16.8%), or anticonvulsant medication (7.1%).

In a separate analysis of those patients admitted from the ED, discharged from the PICU, or admitted from the PACU in the 24 hours before the MET event compared with those who did not meet these criteria, there were no significant differences seen in pharmacologic or

nonpharmacologic interventions performed during the MET, percentage of patients transferred to the PICU at the MET, PICU median length of stay of those transferred to the PICU, progression of the MET event to an ARC or CPA event, or mortality.

MET Outcomes

Table 5 reports the outcomes for patients after MET intervention. There were 223 MET events (6.1%) that progressed to an ARC event and 17 MET events (0.5%) that required chest compressions for CPA during the event. There were 2150 of 3644 patients (59%) who were transferred to a higher level of care after the MET, with the majority of patients (1913 of 3644, 52.5%) being transferred to an ICU. There were 1451 of 3644 patients (39.8%) who remained on their current unit after the MET event. Of patients transferred to a PICU, the median length of hospital stay was 12 days (IQR: 6–31 days). There were 5 deaths (0.14%) during the MET event, and another 232 patients who died during their hospitalization, for a survival to hospital discharge of 93.3% (3299 of 3536, 76 patients with a pending discharge disposition). Of note, MET events that were documented to include a trigger of staff concern had similar outcomes, 51.5% went to the ICU, 5.4% progressed to ARC, and 0.5% progressed to cardiac arrest. There were 41 MET events with a trigger of staff concern only, and of these only 19.5% were transferred to the PICU and no patient progressed to ARC or CPA.

DISCUSSION

This report describes the clinical characteristics and outcomes of the largest multicenter cohort of pediatric MET events reported from a national registry of US hospitals. We found that MET activation was most commonly triggered for objective respiratory conditions followed by the subjective concern of a staff member. Duration of MET team interaction was a median of 29 minutes (IQR: 18–49 min). Pharmacologic and nonpharmacologic interventions performed by the MET responders were more commonly assessment/examination type interventions and ward-level interventions, rather than critical care-type interventional support. Most (53%) of the patients were transferred to the PICU, but few decompensated to require emergency-assisted ventilation (6%) or cardiopulmonary resuscitation (0.5%) during the MET event. Perhaps the most striking finding was the large percentage of MET events (47%) that occurred within 24 hours of transfer to the ward from the ED, PICU, or PACU.

Assessment/examination interventions and ward level interventions by the MET were much more frequent than critical care interventions. The main nonpharmacologic diagnostic maneuvers or interventions performed by the MET were changes in, or commencement of, oxygen therapy and monitoring by pulse oximetry or electrocardiogram, and few received critical care airway support (5%) or breathing support via noninvasive or invasive positive pressure ventilation (11.2%). Pharmacologic interventions were performed less frequently than nonpharmacologic interventions yet were provided to >50% of the cohort. This is similar to a previous report showing that pediatric MET medications were provided to slightly more than half of the cohort.¹¹ Most patients provided with a pharmacologic intervention only received 1 such intervention. The most common therapies by the MET in

our cohort were administration of an intravenous fluid bolus (21.7%) or inhaled bronchodilator (16.8%), both ward-level interventions. Surprisingly, only 6% of patients met criteria for progression of the MET event to an ARC event as defined by GWTG-R. In addition, only 0.5% of patients had progression of the MET event to a CPA event. The in-hospital mortality for children who had a MET call was 6.7%, highlighting that this is a high-risk population with mortality rates even higher than those recently reported for >10 000 children admitted to PICUs (1.3%–5.0%) across 7 institutions.¹²

These children may represent a target for earlier recognition and highlight an opportunity to further improve care in pediatric hospitals. After MET evaluation, 40% of patients remained on inpatient wards, suggesting MET-associated treatments may have stabilized or improved the condition of some children judged to be clinically deteriorating by ward staff.

Alternatively, the MET diagnostic evaluation may have provided confidence that the child's status was appropriate for ward care and did not need transfer to an ICU. It is unclear what the optimal proportion of patients staying on the ward after a MET call is in terms of balancing the mission of preventing CPAs and the workload presented to the MET.

A striking finding from the cohort was that 47% of children with MET calls had been admitted to the wards from the ED, PACU, or PICU within 24 hours before the MET call. The first question highlighted by these data is whether these children, or a subset of them, could have been identified, anticipated, and triaged directly to an ICU setting. Our data set does not include the last set of vital signs in the PICU, ED, or PACU just before ward transfer or other data elucidating whether they were sufficiently stable for the general wards. However, these data generate hypotheses for further studies that should target triage assessments for further investigation. Alternatively, it is possible that these patients were stable for the wards but represent an at-risk group for whom close observation for deterioration may be warranted. This may be particularly significant for patients transferred out of the PICU because pediatric patients have significantly worse outcomes if readmitted to the PICU during the same hospital admission.^{13,14} Recently, the Ontario Pediatric Critical Care Response Team Collaborative demonstrated that the standardized implementation of a multicenter pediatric MET that followed up all PICU discharges was associated with a decrease in the rate of PICU mortality after PICU readmission (57%), but it had no effect on mortality after urgent PICU admission.¹⁵

Our data reveal that most children who have a MET call require mostly assessment/examination and ward-level interventions, rather than critical care interventions. This information supports future exploration of the optimal makeup of the MET. It is possible that a small team of critical care nurses (ED or PICU) or advanced practice nurses¹⁶ and respiratory therapists, rather than a physician-led team, may meet most requirements. Importantly, the median length of time the MET was present at the bedside was 29 minutes, and 25% took longer than 49 minutes, raising concerns about the safety of staffing teams with providers who are being potentially pulled from clinical responsibilities in the PICU or ED. Not surprisingly, a growing number of institutions are considering teams with staff whose primary responsibility is to proactively identify deteriorating patients early through proactive surveillance as well as to respond to emergencies.^{17–21}

The limitations of our study are similar to those seen in all studies using large multicenter databases. Selection bias, data integrity, and validation issues at the multiple sites submitting data to the registry may limit data analysis. The rigorous abstractor training and certification process, uniform data collection, consistent definitions, and large sample size, unique to GWTG-R, are intended to minimize these sources of study bias. Participation in GWTG-R is voluntary; nearly 15% of the hospitals in the United States are represented in this database, with ~6% being freestanding children's hospitals. It is possible that outcomes may be different at nonparticipating institutions, and this report does not reflect outcomes in those institutions. This study was not designed to determine the effectiveness of METs because, unfortunately, the GWTG-R registry does not collect specific information on MET composition (eg, physician vs nurse led), when the MET was introduced at each facility, or information on "family" MET activation,^{17,20,22} and it does not designate or evaluate specific MET activation criteria. Each hospital uses its own MET activation criteria, which is not standardized across participating centers. Of note, the registry does not collect data enabling calculation of desirable outcome metrics for METs, including the number of CPA events outside the PICU, critical deterioration of patients after ICU transfer, temporal association between a MET and a critical deterioration, CPA mortality, and overall in-hospital mortality.

CONCLUSIONS

MET teams were triggered on general inpatient wards for both objective clinical indications as well as subjective staff concerns with similar outcomes. The large majority of the MET events involved assessment/examination and/or ward-level interventions, with a smaller subset requiring critical care interventions. After evaluation by the MET, 40% remained on inpatient wards, suggesting MET associated treatments may have stabilized or improved the condition of some children judged to be clinically deteriorating by ward staff or perhaps stabilized primarily through increased staff resources via the MET. The high prevalence of MET events within 24 hours of patient transfer from the ED, PACU, or PICU suggests there may be value in review of triage systems from these locations or proactive surveillance of this patient cohort. Only 6% of patients had progression of the MET event to an ARC event, and 0.5% of patients had escalation of the MET to a CPA. The in-hospital mortality (6.7%) for this high-risk cohort is worrisome and may represent a target for earlier recognition and highlight an opportunity to further improve care in pediatric hospitals.

GET WITH THE GUIDELINES-RESUSCITATION INVESTIGATORS

In addition to the authors Tia Tortoriello Raymond, MD, Vinay M. Nadkarni, and Christopher S Parshuram, members of the Get With the Guidelines-Resuscitation Pediatric Task Force include Melania Bembea, MD, The Johns Hopkins Hospital—Charlotte R. Bloomberg Children's Center; Allan de Caen, MD, Stollery Children's Hospital; Ericka Fink, MD, Children's Hospital of Pittsburgh of UPMC; Michael G. Gaies, MD, MPH, C.S. Mott Children's Hospital; Anne-Marie Guerguerian, MD, The Hospital for Sick Children; Elizabeth A. Hunt, MD, MPH, PhD, Johns Hopkins Medicine Simulation Center; Monica Kleinman, MD, Boston Children's Hospital; Peter C. Laussen, MB BS, Children's Hospital Boston; Stephen M. Schexnayder, MD, Arkansas Children's Hospital; Robert Sutton, MD,

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Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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TABLE 1**MET Activation Triggers From Hospitals Contributing to the GWTG-R**

Trigger	Frequency^a (n)	Frequency (%)
Respiratory		
Decreased oxygen saturation	1151	31.9
New onset of difficulty breathing	938	26.0
Tachypnea	839	23.2
Respiratory depression	437	12.2
Bleeding into airway	18	0.5
Cardiovascular		
Tachycardia	643	17.8
Hypotension	286	7.9
Bradycardia	138	3.8
Symptomatic hypertension with end organ signs/symptoms	13	0.4
Neurologic		
Mental status change	585	16.2
Seizure	504	14.0
Acute loss of consciousness	132	3.7
Suspected acute stroke	8	0.2
Unexplained agitation or delirium	33	0.9
Staff member acutely worried about patient	859	23.8
Uncontrolled bleeding	36	1.0
Chest pain unresponsive to nitroglycerine	20	0.6
> 1 stat page required to summon regular team for acute problem	19	0.5
Acute decrease in urine output	14	0.4
Other	645	17.9
Unknown/not documented	33	0.9

^aData obtained from 3614 events.

TABLE 2

Categories of MET Interventions and Relative Proportions of Overall Use

Assessment/Examination	n	%	Ward-Level Intervention	n	%	Critical Care-Level Intervention	n	%
Apnea/bradycardia monitor, ECG, NIBP, pulse oximeter, ECHO, chest x-ray, EEG, head CT, lactate, ultrasound	2625	72.1	Airway: suctioning Airway: mask/nasal prongs	581	16.0	Airway: oral/nasal airway, laryngeal mask, endotracheal tube, tracheostomy care/replacement, bronchoscopy	184	5.0
			Breathing: oxygen via mask/nasal prongs	2206	60.6	Breathing: noninvasive positive pressure ventilation, bag-and-mask hand ventilation, invasive positive pressure ventilation	407	11.2
			Circulation: peripherally inserted IV cannula, IV fluid bolus	1608	44.2	Circulation: CPR, defibrillation, cardioversion, CVL insertion, arterial line insertion, intrasoosous insertion, pacemaker, administration of blood products	271	7.4
			Drugs: IV diuretic, IV glucose, bronchodilators via nebulizer, IV anticonvulsants, aspirin, low molecular weight heparin, IV insulin/glucose	939	25.8	IV drugs: sedatives, anesthetic agents, antiarrhythmics, inotropes/vasopressors, atropine, calcium, mannitol, nitroglycerin, sodium bicarbonate, thrombolytic	208	5.7

CPR, cardiopulmonary resuscitation; CT, computed tomography; ECG, electrocardiogram; ECHO, echocardiogram; NIBP, noninvasive blood pressure.

TABLE 3
MET Nonpharmacologic Interventions From Hospitals Contributing to the GWTG-R Registry

Nonpharmacologic Interventions	Frequency	
	n ^a	%
Respiratory management		
Supplemental oxygen	2206	60.6
Suctioning	581	16.0
Noninvasive ventilation	407	11.2
Bag-valve mask	206	5.7
Elective intubation for airway protection	52	1.4
Mechanical ventilation (includes BIPAP/CPAP)	92	2.5
Mask CPAP/BIPAP	89	2.5
Endotracheal tube	71	2.0
Nasal airway	46	1.3
Tracheostomy care/replacement	42	1.2
Oral airway	10	0.3
Hyperventilation	3	0.1
Monitoring		
Pulse oximetry	2145	58.9
EKG	1533	42.1
Noninvasive blood pressure	1434	39.4
Apnea/bradycardia	238	6.5
12-lead ECG	222	6.1
Venous access		
Peripheral vein	1161	31.9
Central vein	190	5.2
Intraosseous	9	0.3
Consultations		
Critical care	481	13.2
Other	102	2.8
Neurology	47	1.3

Nonpharmacologic Interventions	Frequency	
	<i>n</i>	%
Surgery	36	1.0
Cardiology	30	0.8
Pulmonary	13	0.4
Transfusion		
Packed red blood cells	63	1.7
Albumin	10	0.3
Platelets	10	0.2
Fresh-frozen plasma	5	0.1
Other	3	0.1
Chest radiograph	609	16.7
Head CT (stat)	162	4.5
Nasogastric/orogastric tube	64	1.8
Serum lactate	24	0.7
Foley catheter	24	0.7
Electrocardiogram	9	0.3
Chest tube	9	0.3
Cardiopulmonary resuscitation	8	0.2
Gastric lavage	3	0.1
Cardioversion	4	0.1
Bedside cardiac ultrasound	5	0.1
Pacemaker	2	0.1
Bronchoscopy	1	0.03
None	388	10.7

BIPAP, bilevel positive airway pressure; CPAP, continuous positive airway pressure; CT, computed tomography.

^aData obtained from 3639 events.

TABLE 4
MET Pharmacologic Interventions From Hospitals Contributing to the GWTG-R Registry

Pharmacologic Interventions	Frequency	
	<i>n</i> ^a	<i>n</i> ^a %
Aspirin	3	0.1
Antiarrhythmic agent	28	0.8
Antiepileptic	258	7.1
Atropine	16	0.4
Calcium	14	0.4
Diuretic (IV)	64	1.8
Fluid bolus (IV)	789	21.7
Glucose bolus	26	0.7
Heparin/low molecular weight heparin	7	0.2
Inhaled bronchodilator	612	16.8
Insulin/glucose	12	0.3
Magnesium	17	0.5
Nitroglycerine (IV)	2	0.1
Nitroglycerine (sublingual)	10	0.3
Reversal agent	73	2.0
Sodium bicarbonate	23	0.6
Thrombolytic	1	0.03
Vasoactive agent infusion (not bolus)	27	0.7
Other	812	22.3

^aData obtained from 3636 events.

TABLE 5

MET Outcomes From Hospitals Contributing to the GWTG-R Registry

Outcome	Frequency	
	<i>n</i>	%
Patient required emergency-assisted ventilation for ARC	223	6.1
Patient required chest compressions for CPA Post-MET event destination ^a	17	0.5
Stayed on current unit	1451	39.8
Cardiac catheterization laboratory	3	0.1
Operating room	17	0.5
ICU	1913	52.5
Telemetry/step-down unit	187	5.1
Other hospital	30	0.8
Morgue	1	0.03
Other	42	1.2
Died during MET event ^b	5	0.1
Declared DNAR during MET admission ^c	169	4.8
Survival to discharge ^d	3299	93.3

ARC, acute respiratory compromise; DNAR, do not attempt resuscitation.

^aData obtained from 3644 events.^bData obtained from 3646 events.^cData obtained from 3531 events.^dData obtained from 3536 events.