

The medical emergency team in Italy: an overview of in-hospital emergencies response

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Abstract. *Background and aim:* Medical Emergency Team (MET), implemented in many hospitals worldwide, aims to improve the safety of in-hospital patients whose condition is deteriorating. This study describes MET presence and organization in the Italian National Healthcare System Hospitals. *Methods:* A national survey with an online questionnaire was performed. The questionnaire, created ad hoc, was sent by e-mail to the nursing coordinators and MET referents of the Hospitals affiliated to the Italian National Healthcare System with an Anesthesia and Intensive Care service. *Results:* One hundred-ninety-seven hospitals were interviewed (36.2% of the whole national network). A dedicated MET, composed at least by an intensivist and a nurse, was present only in 118 cases (59.9%). The team was composed by a non-dedicated staff (67.8% of doctors, 69.5% of nurses) and a minimum shared standard of education for the nurse component was absent. One third of the estimated hospitals did not use a warning score for emergency call activation. *Discussion and conclusion:* This survey showed a heterogeneous and often lacking organization of in-hospital emergency management in Italy. MET system needs to be implemented in terms of presence in the Italian hospitals, and standardized for personnel structure and training, and equipment availability. A broader study is necessary to compare our data with those of other European Countries to better identify the specific areas which need to be improved more promptly. (www.actabiomedica.it)

Key words: In-hospital emergency, Rapid Response System, Medical Emergency Team, Nurse, Survey

Introduction

The absence of an organized system able to face in-hospital emergencies outside the intensive care unit (ICU) or emergency room (ER) may result in a high risk of potentially preventable life-threatening injuries to patients, with an increased rate of death or unfavorable outcomes (1, 2).

One of the nurse's main working tasks is the vital signs monitoring, which is essential for the timely detection of patients' clinical deterioration (3-6). It has been reported that patients start to deteriorate several hours, i.e. 6.5 hours in median, before the occurrence

of an unexpected life-threatening acute event or a cardiac arrest (7).

A rapid response system (RRS) is defined as "a whole system for providing a safety net for patients who suddenly become critically ill and have a mismatch of needs and resources" (8). There are four components of a RRS: an afferent limb, which identifies the deteriorating patient and escalates care, an efferent limb or the responding team, a process improvement arm, and a governance/administrative structure (8).

In 2006, an International Consensus Conference (9) proposed standardized definitions and suggested RRS as a model of rational approach for in-hospital

emergencies. RRS refers to the whole system of rapid response, which may consist either of a medical-nursing team or medical emergency team (MET), with high skills in resuscitation and care of critical patients, or of a first intervention team composed of a critical care nurse and defined as rapid response team (RRT), with subsequent medical intervention if needed (8, 10). The composition of these teams is tailored to the Institution's goals and resources, the team's aims, and the severity of illness in the patients it would assess. Thus, a great heterogeneity is present among hospitals (11).

A RRS able to early recognize vital signs alteration and to perform appropriate interventions is therefore crucial for patients' clinical outcomes (12). For these reasons, it is considered an important part of the chain of prevention for in-hospital emergencies (13). In the majority of the studies, the introduction of a RRS resulted in an overall reduced rate of unexpected cardiac arrest outside ICU, unscheduled critical care admissions and hospital mortality, although these findings remain controversial (12, 14-20).

METs are rapidly gaining acceptance in the United States, Australia and Europe and several international guidelines and recommendations have been developed (21, 22). In Italy, guidelines on the implementation of MET have been issued jointly by SIAARTI (Italian Society of Anesthesia Analgesia Reanimation and Intensive Care) and IRC (Italian Resuscitation Council) in 2007. The purpose of SIAARTI-IRC recommendations was to delineate a shared program for a gradual improvement of multi-disciplinary and multi-professional response systems for intra-hospital emergencies (23). Despite all these efforts, no data are currently available from the literature about the actual organization and implementation of METs in Italian hospitals.

Aim

Aim of this study was to describe MET implementation in the Italian National Healthcare System Hospitals, focusing on activity, organization, composition and education of the team members.

Methods

Study design

A survey was conducted using an online questionnaire Google Docs (Copyright 2018. Google LCC, Mountain View, California) from 27th of July 2018 to 10th of January 2019. The coordinating center was the General ICU of Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico of Milan – University of Milan.

Instrument

The survey consisted of a questionnaire created ad hoc and composed of 7 questions if MET was not present in the hospital or of 24 questions if MET was present exploring: the participating hospitals characteristics (9 questions), MET organization (6 questions), activation (5 questions) and equipment (4 questions). The complete questionnaire can be found in Table 1.

Participating centers

Inclusion criteria were affiliation to Italian National Healthcare System and presence of an Anesthesia and Intensive Care service. In Italy, an official list of these hospitals is not available, so a thorough research on the Internet and on GiViTI (Italian Group for assessment of intervention in ICU) (24) and Intensiva 2.0 (25) websites was performed. GiViTI is an ICU group born with an epidemiologic mission while Intensiva 2.0 promotes the humanization of the care in ICU. ICU nurse coordinators and MET referents were invited to participate to the survey, both via direct email invitation and through the Italian Critical Care Nurses Association (ANIARTI) digital media (website, Facebook, Twitter) and on Nurse24.it®, nursing focused website.

Data analysis

Data analysis was performed on aggregated form with a descriptive statistic approach, using Microsoft Excel (Copyright 2018 Microsoft Corporation, Redmond, Washington). Stata 13.1 (StataCorp, College

Table 1. The questionnaire

- 1) Select your Region:
 - Name of your Region
 - 2) Select your hospital:
 - Name of your hospital
 - 3) Type of hospital:
 - Not university hospital
 - University hospital
 - 4) Number of hospital beds:
 - Number of beds
 - 5) In your hospital is there a doctor for the management of the in-hospital emergency?
 - Yes
 - No
 - 6) Do you have an emergency team whose minimum composition is an intensivist doctor and a nurse?
 - Yes
 - No
 - 7) If present, do you consider this emergency team useful?
 - Yes
 - No
 - 8) If not present, do you believe that this emergency team should be necessary?
 - Yes
 - No
 - 9) How long has the emergency team been present?
 - Number of years
 - 10) When is the emergency team on?
 - Monday – Friday H12 diurnal
 - Monday – Friday H12 nocturnal
 - Monday – Friday H24
 - Monday – Sunday H12 diurnal
 - Monday – Sunday H12 nocturnal
 - Monday – Sunday H24
 - Saturday – Sunday H12 diurnal
 - Saturday – Sunday H12 nocturnal
 - Saturday – Sunday H24
 - 11) When the emergency team is off, who carries on its functions?
 - The emergency team is always on
 - An intensivist doctor
 - A doctor
 - 12) Which are the nurses' emergency team shifts?
 - Shift morning/afternoon/night
 - Shift H12 diurnal/nocturnal
 - 13) What are the educational courses needed to be an emergency team nurse?
 - Years of working experience in critical care area
 - Course BLS/D/PBLS/D
 - Course ALS/ACLS
 - Course ATLS/ATCN
 - Course managed by the local hospital
 - None particular criteria
 - 14) In which situations is the emergency team nurse involved?
 - Emergency situations
 - Execution of planned invasive maneuvers
 - For consulting
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- 15) What wards do the emergency team nurses come from?
 - Intensive care unit
 - Emergency room
 - Other critical areas (high intensity of care wards of medicine or surgery)
 - From any wards, no particular criteria
 - 16) Is the emergency team staff dedicated to this service or do they carry out other activities at the same time during the shift?
 - Intensivist doctor dedicated
 - Intensivist doctor not dedicated
 - Nurse dedicated
 - Nurse not dedicated
 - 17) Where is the emergency team waiting for activation?
 - Intensive care unit
 - Emergency room
 - A dedicated room in the hospital
 - 18) What warning score are used in the wards?
 - None
 - Single parameters systems – MET (Medical Emergency Team)
 - Multiple parameter systems – PART (Patient At Risk Team)
 - Aggregated scores systems – MEWS (Modified Early Warning Score)
 - Other systems
 - 19) How is the emergency team alerted?
 - Any telephone
 - A dedicated telephone
 - Radio
 - Intercom
 - Beeper
 - 20) Is every hospital ward equipped with a cart for emergencies?
 - Yes
 - No
 - 21) What kind of devices has the emergency team available?
 - Monitor defibrillator
 - Bag with drugs
 - Infusion pumps
 - Oxygen tank
 - Suction unit
 - Ultrasound
 - Automated CPR device
 - 22) Who check the emergency team devices?
 - Intensivist doctor
 - Nurse
 - Healthcare assistant
 - 23) When are the emergency team devices checked?
 - At the beginning of every shift
 - Weekly
 - Monthly
 - 24) How are nursing activities shared between the ward and the emergency team nurse?
 - The emergency team nurse replaces the ward nurse
 - The emergency team nurse and the ward nurse cooperate sharing their roles independently
 - The emergency team nurse and the ward nurse cooperate sharing their roles according to hospital procedures
 - 25) Does the emergency team nurse record the nursing activities he/she carried out?
 - No
 - Yes, in the ward medical record which asked for the emergency team intervention
 - Yes, in a specific emergency team medical record
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Station, TX, USA) was used for chi square test to evaluate relationships between categorical variables.

Ethical considerations

The study protocol was approved by the Internal Review Board of the Foundation IRCCS Ca' Granda Ospedale Maggiore Policlinico of Milan – University of Milan (12/5/2018). The survey was conducted on a voluntary basis and on anonymous form. The only available reference was the name of the Hospital, in order to perform a regional analysis and to exclude duplicate answers.

Results

Five-hundred and forty-four hospitals met the inclusion criteria and were invited to participate. During the study period, 246 questionnaires were completed. After duplicate answer exclusion, a total of 197 questionnaires from 544 hospitals (36.2%) were included in the analysis. The characteristics of the participating hospitals are reported in Table 2.

Of the 197 participating hospitals, 121 (61.4%) were from Northern regions, 37 (18.8%) from Central regions and 39 (19.8%) from Southern ones. The regional distribution of participating hospitals is showed in Table 3.

Table 2. Characteristics of the 197 participating hospitals

Italian Regions:	
north	121 (61.4%)
center	37 (18.8%)
south	39 (19.8%)
Type of hospital:	
not university hospital	156 (79.2%)
university hospital	41 (20.8%)
Number of beds:	
≤ 500	143 (72.6%)
501 – 999	32 (16.2%)
≥ 1000	22 (11.2%)
Presence of MET:	
yes	118 (59.9%)
no	79 (40.1%)

The majority of questionnaires (143; 72.6%) came from small hospitals (≤ 500 beds), while medium and high-volume hospitals were less represented in the survey: 32 (16.2%) had between 500 and 999 beds, and 22 (11.2%) more than 1000 beds.

In all (100%) participating hospitals an emergency service was present, but a MET composed of at least a nurse and an anesthesiologist was present only in 118 cases (59.9%), with a higher percentage in Northern regions (66.1%) compared to Central and Southern regions (48.7% and 51.3% respectively). A MET service was present in 143 (72.6%) hospitals with less than 500 beds. MET was also more present in non-university hospitals (61.5%) compared to university hospitals (53.7%) ($p=0.3596$).

In the majority of cases (61; 51.7%) MET was only recently implemented (≤ 10 years), while some hospitals had a longer experience: 40 (33.9%) between 10 and 20 years, and 17 (14.4%) more than 20 years.

Table 3. Regional distribution of participating hospitals

Italian Regions	Number of interviewed hospitals	Number (%) of replying hospitals
Abruzzo	11	2 (18.2)
Basilicata	8	2 (25.0)
Calabria	16	2 (12.5)
Campania	47	4 (8.5)
Emilia Romagna	43	10 (23.3)
Friuli Venezia Giulia	11	5 (45.5)
Lazio	29	12 (41.4)
Liguria	17	5 (29.4)
Lombardia	88	57 (64.8)
Marche	13	2 (15.4)
Molise	6	1 (16.7)
Piemonte	40	17 (42.5)
Puglia	42	11 (26.2)
Sardegna	23	3 (13.0)
Sicilia	43	4 (9.3)
Toscana	39	12 (30.8)
Trentino Alto Adige	14	4 (28.6)
Umbria	10	4 (40.0)
Valle d'Aosta	1	1 (100.0)
Veneto	43	12 (27.9)
Total	544	197 (36.2)

Almost all (91.1%) respondents working in hospitals without MET reported that the implementation of this service in their structure would be necessary and who had MET considered it useful (99.2%).

MET service was active on a 24/7 basis in 84.8% of hospitals. In the other cases (15.2%), an anesthesiologist managed emergency calls during the hours when MET was not active (mostly night hours and weekends). MET organization is reported in Table 4.

Table 4. MET organization

When the emergency team is on:	
always (7d/week)	100 (84.8%)
only diurnal (7d/week)	5 (4.3%)
only nocturnal (7d/week)	2 (1.7%)
always on working day (5d/week)	3 (2.5%)
diurnal only on working days (5d/week)	3 (2.5%)
nocturnal only on working days (5d/week)	2 (1.7%)
only on holydays	3 (2.5%)
MET nurses' shifts:	
morning-afternoon-night	100 (84.7%)
h12 diurnal-nocturnal	18 (15.3%)
MET nurse's educational courses:	
years of working experience in critical care area	83 (70.3%)
BLS/D/PBLS/D course	74 (62.7%)
ALS/ACLS course	41 (34.7%)
ATLS/ATCN course	9 (7.6%)
course managed by the local hospital	25 (21.2%)
none particular criteria	12 (10.2%)
Situations in which the MET nurse is involved:	
emergency situations	118 (100.0%)
execution of planned invasive maneuvers	30 (25.4%)
for consulting	26 (22.0%)
Wards the MET nurses come from:	
intensive care unit	98 (83.1%)
emergency room	25 (21.2%)
high intensity of care wards of medicine or surgery	15 (12.7%)
from any ward	4 (3.4%)
MET staff dedicated to this service or not:	
intensivist doctor dedicated	38 (32.2%)
intensivist doctor not dedicated	80 (67.8%)
nurse dedicated	36 (30.5%)
nurse not dedicated	82 (69.5%)

In all participating hospitals, MET was composed by an anesthesiologist and a nurse. In most cases MET nurses worked in ICU (98 hospitals, 83.0%) or ER (25 hospitals, 21.2%). The MET nurses' emergency training and education was extremely variable among the centers. In 83 hospitals (70.3%) the major selection criteria was the years of working experience in ICU/ER. Basic life support - Pediatric Basic Life Support (BLS/D - PBLS/D) and advanced life support (ALS or ACLS) training were mandatory in 62.7% and 34.8% of cases, respectively. An in-hospital MET training course was activated in 21.2% of cases, while in a minority of hospitals (12, 10.2%) there were no specific selection criteria for MET nurses.

MET nurses were involved in all emergency calls and in many hospitals they were also involved in some elective situations, such as execution of scheduled invasive maneuvers (25.4%) or non-urgent consultations (22.0%).

MET was composed by a dedicated anesthesiologist in 32.2% of hospitals and by a dedicated nurse in 30.5% of hospitals. In the other cases, MET staff was employed in other hospital activities during the regular working shift. The MET organization with non-dedicated staff was more evident in non-university hospitals (77.1%) compare to university hospitals (45.5%) ($p = 0.0031$).

In most cases, MET staff remained in ICU (102, 86.4%) or ER (20, 17.0%) waiting for activation. One hundred and three (87%) hospitals had a dedicated number for MET activation.

MET activation was triggered by patient physical status deterioration, detected through validated single or multiple parameter scoring systems (MET, PART, MEWS, NEWS or other) in 77 hospitals (65.2%), while in the remaining 41 hospitals (34.8%) ward staff requested MET intervention on the basis of a subjective evaluation of the patient's conditions. MET activation is described in Table 5.

In most participating hospitals (113, 95.8%) an emergency cart was present in every ward, while in the others (5, 4.2%) MET carried all emergency devices.

In most cases routinely emergency device control was performed by nurses (114, 96.6%), and in some cases by anesthesiologists (10, 8.5%) or healthcare assistants (4, 3.4%).

Table 5. MET activation

Where the MET waits for activation:	
intensive care unit	102 (86.4%)
emergency room	20 (16.9%)
a dedicated room in the hospital	6 (5.1%)
Warning score used in the wards:	
none	41 (34.7%)
MET (Medical Emergency Team)	35 (29.7%)
PART (Patient At Risk Team)	2 (1.7%)
MEWS (Modified Early Warning Score)	27 (22.9%)
other systems	13 (11.0%)
MET modalities of activation:	
any telephone	21 (17.8%)
a dedicated telephone	94 (79.7%)
intercom	1 (0.8%)
beeper	9 (7.6%)
How nursing activities are shared between ward and MET nurse:	
MET nurse replaces ward nurse	28 (23.7%)
MET nurse and ward nurse cooperate sharing their roles independently	39 (33.1%)
MET nurse and ward nurse cooperate sharing their roles according to hospital procedures	51 (43.2%)
MET nurse recorded nursing activities:	
no	27 (22.9%)
yes, in the ward medical record which asked for the intervention	34 (28.8%)
yes, in a specific MET medical record	57 (48.3%)

A check list of available emergency devices and materials was performed daily in 90 hospitals (76.3%), on a weekly basis in 25 hospitals (21.2%) and monthly in 19 hospitals (16.1%). MET equipment is described in Table 6.

The collaboration between MET and ward nursing staff during an emergency call varied among participating hospitals: in 51 hospitals (48.3%) individual roles were formally established by internal procedures, in 39 hospitals (33.1%) individual roles were not formally established, while in 28 hospitals (23.7%) MET nurse usually replaced ward staff. MET nurse activities performed during an emergency call were documented on a dedicated form in 57 hospitals (48.3%), and in activating ward medical records in 34 hospitals (28.8%). Conversely, in 27 hospitals (22.9%) there was no formal documentation of MET nurse activity.

Table 6. MET equipment

Presence of a cart to deal emergencies in each hospital ward:	
yes	113 (95.8%)
no	5 (4.2%)
MET equipment available:	
monitor defibrillator	85 (72.0%)
bag with drugs	114 (96.6%)
infusion pumps	34 (28.8%)
oxygen tank	59 (50.0%)
suction unit	56 (47.5%)
ultrasound	15 (12.7%)
automated CPR device	10 (8.5%)
Who checks the MET equipment:	
intensivist doctor	10 (8.5%)
nurse	114 (96.6%)
healthcare assistant	4 (3.4%)
When the MET devices are checked:	
at the beginning of every shift	90 (76.3%)
weekly	25 (21.2%)
monthly	19 (16.1%)

Discussion and Conclusions

This is the first survey on MET implementation in Italian hospitals, including also data on nursing staff. The survey had a response rate of 36% (197 questionnaires from 544 invited hospitals). Most questionnaires came from Northern regions (61.4%), reflecting the higher number of Hospitals present in those regions. Small volume hospitals (< 500 beds) were the most represented in the survey (72.6% of responding hospitals), being also the most common healthcare facilities in Italy. MET was more commonly implemented in small volume hospitals (72.6%) than in medium and high-volume hospitals. We have hypothesized that in large hospitals, with multiple specialist ICUs and Anesthesia services, it was more likely that in-hospital emergencies could be handled by more than one response system and not by a unique official team. This consideration could be particularly true in pavilion hospitals than in block hospitals in which it was easier to reach the patients. Moreover, in university hospitals the emergency team often consisted of an anesthesiologist (consultant) and an Anesthesia

and Intensive Care fellow (resident), who replaced the nurse. In some cases, however, the emergency call was handled only by an anesthesiologist.

It was important to highlight that almost all survey respondents, working in facilities without a dedicated MET believed that its implementation would be essential to improve the management of in-hospital emergencies. This meant that probably healthcare professionals judged alternative systems of management of in-hospital emergencies inadequate.

In most cases MET was active on a 24/7 basis. However, there were hospitals where this service was not always available, particularly during night hours and weekends, when hospital ward staff is usually reduced and patients are more at risk.

According to our survey, in the majority of cases MET had been implemented for less than 10 years. It was also important to note that, while the specialization in Anesthesia and Intensive Care was mandatory for MET medical staff, no minimum shared standards of education and training for the nursing component of the team were required. Indeed, based on the results of our survey, advanced life support training (ALS/ACLS) was mandatory only in a minority of hospitals (34.8%), and basic life support training (BLS/BLSD) was not formally required in over a third (37.3%) of participating hospitals. These data were in contrast with American Heart Association and European Resuscitation Council guidelines that recommend basic life support principles as fundamentals of early emergency management and supported their diffusion through the whole population (26, 27).

Only in about one third of the cases MET was composed of dedicated personnel. In the remaining cases (the majority), it was made up of personnel actually working in the ICU (or ER), who left the ICU to manage in-hospital emergencies. This lack of personnel weighed on the intensive departments, which were already burdened with a high workload and might lead to an increased risk of complications for critically ill patients (28).

An even more worrisome finding was that in some hospitals a dedicated telephone number for MET activation was lacking, leading to a less prompt activation of the emergency team (29,30). This delay could increase hospital mortality and morbidity (31).

Parameter scoring systems were widely recognized as excellent tools for early detection of patients at increased risk of death or complications (32-35). However, they were routinely used only in 65% of Hospitals with a MET service. Subjective patients' assessment by healthcare professionals was associated with a greater number of unnecessary or late MET activations.

Limits

The main limitation of this study is the relatively limited sample size, since approximately 36% of the hospitals meeting the inclusion criteria actually responded to the survey. However, this response rate is in line with the average values reported in the literature for this type of survey. Second, our survey was specifically targeted to the hospitals in which MET has already been implemented but it didn't explore other kind of intra-hospital emergency management systems, which may be equally effective. Finally, we didn't consider pediatric in-hospital emergency systems. However, dedicated pediatric ICUs are present only in few hospitals, and, in most cases, the same MET manages both adult and pediatric emergencies. Third, the study was a purely descriptive investigation. Indeed, new studies are needed to better analyze variables that may affect the MET implementation, and to describe outcome differences in the hospitals where MET is present compared to those in which it is absent.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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