Abstract

Major elements of an effective Emergency Medical Services (EMS) system include a single telephone access number, accurate assessment of the urgency of the health problem and timely dispatch of appropriate personnel and equipment. In Italy, EMS calls are managed by Emergency Operations Centers (EOC). Registered Nurses who have received specialized education in this function. The nurses determine the criticality of the situations and assign an EMS response priority level identified by a color code, ranging from red (very critical) to green (not critical). At times, the severity of a situation may be underestimated, resulting in assignment of a lower EMS response priority, and the potential for patient death (code black).

Purpose: The purpose of this study was to identify the RN undertriage of EMS calls subsequently found to be associated with fatality, termed “green-black code” cases.

Methods: We carried out a retrospective qualitative analysis of the telephone conversations utilizing Fele’s conversation analysis method. We studied a sample of calls occurring in 2011 and we compared those calls with the green-black cases occurred. Call characteristics were compared with the population of all EMS calls during the study period.

Results: Study patients were older, with a mean age of 81.6 years. The callers were individuals calling on behalf of the patients, rather than the patients themselves. Callers reported symptoms that were not life-threatening. Nurse operators did not always inquire about the vital signs as required by the Medical Priority Dispatch System Protocol (MPDS). The phone conversations were considerably shorter than normal (54.26 vs. 65 seconds).

Discussion: Although the importance of dispatch system protocols is well-known, it is also important that nurse triage operators have proper training in order to assure that major parameters such as vital signs and symptomatology are obtained, and to reduce caller stress level.
Introduction

Efforts to improve health care outcomes while fostering cost containment through appropriate use of resources have resulted in a proliferation in the provision of telephone assessment and consultation services by Registered Nurses in a variety of settings. Handling a telephone call which may involve a request for emergency care require substantial expertise. The operator is expected to quickly recognize the severity of the medical condition, identify the possible etiology, and determine the resources required while reducing the caller anxiety or aggressiveness in order to obtain their collaboration. The operator should use time efficiently, collecting only the necessary information without prolonging the phone call. Operators require proficiency in effective communication skills in order to collect all the relevant data. The subsequent decision-making process should lead to the best response (the right emergency care mobile resource, the right staff, at the right time). In Italy Registered Nurses are responsible for both the triage of patients arriving at the emergency department and the telephone EMS dispatch system.

Italian law specifies at least six months seniority in emergency nursing in order to perform medical triage. In addition, Emergency Operating Centre (EOC), RN operators are emergency nurses with at least two years seniority in emergency department and expertise in pre-hospital care.

At the time of the study, Italy did not have a codified system of data collection and analysis specifically designed for pre-hospital emergencies, although efforts have been made to standardize the collection of pre-hospital data in selected conditions, such as severe trauma and cardiac arrest. A recent survey by the Italian Ministry of Health shows that EOC operators use a dual mode (color and alphanumeric) code system to classify both the criticality and the severity of an emergency call (see Table. 1). The code assigned to the prevailing pathology is the second most important information for emergency dispatchers. When a patient has co-morbidities, the operator assigns a code that refers to the most relevant symptoms (Tab. 2). Finally, the location code indicates where the event took place (Tab. 2).

Determining the Appropriate Response Resources

Emergency dispatching is a dynamic decision making process, as well as the most important activity performed by EOCs. It consists of four phases: taking incoming calls, instructing callers, dispatching the appropriate EMS resources and instructing the ambulance crew. Appropriate conversation techniques enable
the operator to obtain collaboration from the caller. In addition, the use of a standardized interview protocol allows for the collection of all relevant details while avoiding conflicts with the caller.\(^6,7\)

Collaboration depends on three caller variables: emotional status, lack of knowledge, of the situation and general behavior when reporting an emergency. Theoretically, the emotional status of the caller does not really impact on collaboration, since a well-trained operator can guide a scared or angry caller using specific interrogation techniques, as well as a calm voice. Another Italian study confirms that only four per cent of callers are annoyed or irritated.\(^8\) The caller may be the patient themselves (first-party caller), a person in the patient’s direct vicinity (second-party caller), or a person who is not with the patient but is reporting from some distance (third-party caller). About 55% of phone calls in Italy are made by first or second-party callers who, if correctly interviewed, may provide all the relevant information. That is why the use of a standardized interview protocol, together with an appropriate training on how to lead a succinct telephone conversation is so important. When an emergency occurs, the caller has a distorted time perception. For this reason, it is important that an emergency medical call is answered by at least the third ring, although such a response time – about 12 seconds – would still prove rather lengthy for an emergency call.\(^9\)

In case of life-threatening situations such as sudden cardiac arrest, electrocution, drowning, and suffocation, the telephone conversation should last less than one minute. The mobilization time (from call end to EMS vehicle dispatch) generally varies from 75 to 90 seconds. This time interval is considered as part of the standard ambulance response time in Italy, which is eight minutes for urban areas or life-threatening emergencies, and twenty minutes for extra-urban areas such as isolated places. (Health Ministry Decree 15 May 1992).

**Characteristics of an Effective Telephone Encounter**

What are the main features of satisfactory communication when taking an emergency medical call? Although research has increased in recent years, literature concerning the qualitative aspects of telephone dispatching is still rather poor. Several studies appear to lack methodological rigor, with the 5-level priority system used in France, Canada, the USA, the UK and Australia being more consensus based than evidence based.\(^10\) Several studies focus on the efficacy of a single telephone number for all the emergency services, such as 9-11 in the United States or the 1-1-2, introduced in the European Community in 2001.
With the exception of the Province of Varese (Northern Italy) where a single emergency telephone number has been available since 2010, Italy has a different emergency number for each of the various emergency services (fire, medical, and police emergency).

Data from this experience show that EOC operators are able to screen about half of all calls, which ensures that emergency services (police, fire department, EMTS) are activated only when needed. One Italian study shows that EOC operators tend to overestimate the criticality and severity codes as compared to the assessment performed by the emergency medical team on the scene. Several scene responder identified green codes appeared to be overestimated as yellow, while red codes were not always properly identified.

In regard to telephone conversation content analysis, qualitative research is oriented toward defining the local organizational structure, while sociolinguistic research is more oriented toward analyzing telephone conversation between people serving a formal organization/institution. A study analyzing “special conversations” shows that intervention in emergency situations consists of five steps: dispatchers take the incoming call and identify themselves, the caller asks for help, a brief conversation takes place, the caller’s request is responded to, and the process is completed.

A systematic review of the literature concerning telephone triage performed by emergency medical system operators identified 326 studies. The overall quality of these studies is modest, with only a few studies seeming to consistently support the use of specific criteria to identify medical priorities in order to improve the patient’s outcomes. Sometimes calls are not appropriate, e.g., patients that do not meet the specific criteria for an immediate ambulance response. It seems that the accuracy of emergency response procedures improves when operators assign a priority code using a Medical Priority Dispatch System (MPDS) protocol.

Statistically, an assessment utilizing the MPDS protocol is more concordant with the criticality code assigned by the on-scene emergency medical team. The use of a MPDS protocol also seems to reduce emergency medical technicians’ response time in the most critical cases. Despite the use of standard protocols, EMS dispatch assessment errors (under triage) still occur, especially in complex situations involving patients with multiple or chronic diseases. Underestimating an emergency situation may be significant, such as when an emergency medical team, arriving on the scene of what they were told to be a green code (not particularly critical), finds that the patient had died in the meantime. Such occurrences, dubbed “green-black code” cases...
by Italian emergency health workers, are considered sentinel events. This study aims to detect, through a retrospective qualitative analysis of the telephone conversations, the factors associated with undertriage.

Methods

We carried out a retrospective study on a sample of 839 EMS calls occurred during 2011 at the EOC of Lecce – Italy. Permission to access the database of the EOC of Lecce was obtained from the General Administrative Management of the EOC. The sample was randomly extracted using a table of random numbers from a population of 62,392 EMS calls (α<5%, IC 99%). We compared the characteristics of the sample telephone conversations with the 15 green-black calls occurred in 2011. The phone calls were analyzed with the aim of collecting information on conversational features. The following variables were considered: details of the event, telephone conversation, EMS resource dispatched, and patient data.

Specific data analyzed for each sections include:

Details of the event: time interval from call receipt until the appropriate mobile care resource was physically en route to the emergency, the dispatcher, the final criticality/priority assessment, and other data.

Telephone conversation: the criticality code assigned while interrogating the caller is the product of a decision-making process that can be based on dispatchers’ experience or on application of the MPDS protocol. This code is communicated to the ambulance crew immediately after the call. Conversations were analyzed using the qualitative and phenomenological techniques implemented by Fele in his conceptual model. Fele is an Italian sociologist who conducted several investigations in the field of the emergency services (police, fire department, EMTS). His “Conversational Analysis Method” is specifically applied to study institution-centered interactions, such as those occurring in EOCs.

EMS Care resources: information regarding the type of resource dispatched, and it’s response time. In Italy the volunteers staffed vehicles provide basic life support and early defibrillation (BLSD), while vehicle with physician and RN provide advanced life support (ALS).

Patient’s data: the data contained in this section permits to analyze the concordance between the emergency code initially assigned by dispatchers and the medical team’s assessment on their arrival on the scene.

Using Fele’s model, we analyzed the 15 telephone conversations focusing on 4 crucial aspects: incoming call
receipt (operators identify the service), problem description (operators collect all relevant data from the caller), problem identification (operators assign a criticality code), and call ending (operators reassure the caller and revise the information collected from them). Statistical analysis: data were exported to a Microsoft Access database version 10.00 and analyzed using SPSS Version 17.0 for Windows. We performed a factorial analysis considering all the variables of a dispatch.

In addition, the qualitative-quantitative variables of the “green-black code” cases were examined.

Results

The EOC is equipped with an Ericsson MD-110 PBX that routes emergency calls to operators (there are generally six dispatchers per shift). During 2011, operators received 62,392 emergency phone calls, from which we randomly extracted a sample of 839 calls. The number of incoming emergency calls per operator while dispatchers were already handling phone calls varied from 2 to 47 (mean: 23.41, SD: 11.12).

Although the proficiency level of operators when creating a dispatch depends on several variables, a regression analysis performed on shows that the variable “operator” is not strictly related to the whole “green-black code” phenomenon. The linear regression analysis ($R^2$ test) shows that the variable “operator” accounts for only 14% of the entire process.

Dispatch creation time: The overall time to generate a dispatch has been calculated using a linear model. The mean time is about 65 seconds (CI 99%: 61-69 sec.). The average duration of telephone conversations is more or less the same in both the sample (range 43.8 – 64.8 sec.) and the “green-black code” subgroup (range 61.5 – 69.4 sec.).

The average time necessary for sending the appropriate care mobile resource and complete the dispatch is 95 seconds (CI 99%: 84-10 sec.). Phone calls generally last less than 120 seconds (82.5%) and, in some cases, less than 60 seconds (43.3%).

Completeness of Data Collection: Operators failed to record all the details required for computer assisted dispatching in 85.7% of the calls. This missing information could enable a better post hoc analysis. Some data seem to be less neglected than others, as in the case of cardiovascular patients additional information was almost always present.
Event location: Most phone calls were about medical emergencies occurring at home (76.9%) or in the street (14.1%) as showed in Table 2.

Prevailing pathology: The vast majority of calls for service were about medical emergencies occurring at home (76.9%). Cardiovascular pathologies represented the most common emergency cases (29.9%), followed by trauma, musculoskeletal problems (21.9%), and respiratory diseases (13.8%). No prevailing pathology was present in 17% of the cases. (Tab. 2).

Criticality score assigned by the operator: in the observed sample the color codes assigned were: red (6.9%), yellow (56%), green (36.8%), and white - not urgent at all (0.3%).

Concordance in Criticality Score: The EOC operators and scene responders agreed in only 31.6% of green patients, and in 26.7% of the yellow patients.

The “green – black code” cases: during 2011, 15 dispatches out of 62,392 (1:4000) classified as non-urgent (green) by the EOC operators were associated with a patient death (black code). The analyses performed in the general population were repeated for this particular subgroup, however, the confidence interval (CI) was set at 95%. since the subgroup was smaller (Tab. 3).

In addition, telephone conversations were analyzed to evaluate the quality of communication and the occurrence of wrong assessments during calls. The response time in the “green – black code” subgroup was significantly shorter (54.26 seconds, CI 95%; 44 -65 sec.) when compared to the sample. Most phone calls lasted less than 60 seconds (66%). In those under triaged cases (green code), operators had not filled in all the MPDS major items (consciousness, breathing, circulation) on the dispatch form, and a BLS staffed ambulance (volunteers crew) was sent instead of an ALS staffed ambulance.

When the volunteers with BLS training assessed the criticality of the situation, they called the EOC for medical support, so that a second ambulance with a nurse and a physician was sent. The first ambulance arrived within 8 minutes (standard time for urban areas) in 25% of cases. Because of the non-urgent emergency code, the mean response time of the first ambulance was about 17 minutes (CI 95%; 6 - 29 min.)

The mean response time for rural areas was 18 minutes (CI 95%; 9 -26 min.), which means that the 20-minute standard response time for rural areas was generally accomplished (86%). When compared to the
mean age of all the patients treated (61.8 years), the patients in the subgroup were significantly older (mean age 81.6 years, CI 95%: 77 - 86), as showed in Table 3.

**Qualitative assessment of telephone conversations:** As proposed by the “Fele” method, we divided conversations into four parts: incoming call receipt, problem description, problem identification, and call ending.

**INCOMING CALL RECEIPT:** When taking an incoming call, operators should immediately identify the service as well as themselves by saying "Emergency Operations Center 118, I am a nurse”. Operators generally do identify the service (86.7%).

**PROBLEM DESCRIPTION:** When taking emergency calls, operators ask for details according to a set of standard questions. They may go through the whole list of questions (accurate interrogation), ask only a few questions (inaccurate interrogation) or just listen (simple listening). The interview was accurate in 4 cases (26.7%), inaccurate in 8 cases (53.3%), and with operators simply listening in 3 cases (20%).

**PROBLEM IDENTIFICATION:** In order to quickly obtain vital information about patient status and scene conditions, the operator should act according to the MPDS protocols, asking the caller if the victim is alert and breathing. Operators asked both questions (alert and breathing) in one case (6.7%), only one question (alert or breathing) in 5 cases (33.3%), and did not ask this question in 9 cases (60%).

**CALL ENDING:** At the end of the conversation the operator reassured the caller telling them that an ambulance was on its way in 13 cases (86.7%). In order to evaluate the accuracy of telephone conversations, we assigned a score between zero (0%) and 6 (100%) to the described variables (Tab. 4). The mean score of the 15 telephone conversations was 54.4% (CI 95%: 43.7 – 65.2).

**Discussion**

This study focused on the qualitative aspects of EOC RN operators activity with the aim of detecting the possible causes of underestimation of severity of health emergencies subsequently associated with so-called “green-black code” cases. The 15 calls associated with the “green-black code” cases were routed to the operators by automatic switching equipment. This study has several limitations, primarily related to the lack of a common reference model for measuring the effectiveness of the dispatch process at EOCs. The few existing studies on this topic refer to different organizational settings and are specifically focused on...
indicators such as dispatch accuracy, ambulance response times, and concordance between severity codes assigned by dispatchers and the actual emergency scenario found by medical teams on their arrival. Assuming that the “green-black code” cases are sentinel events, we compared the 15 fatalities with the overall activity of the EOC considered in this study via a retrospective analysis. The aim was to detect possible differences in the activity of operators (dispatch appropriateness and effectiveness), the demographic characteristics of the victims, or the telephone conversations. Our data refer to a local EOC, which means that results cannot be generalized.

The mean length of telephone conversations was 65 seconds. As regards dispatch initiation, the average length of time was 95 seconds, with the limit of 120 seconds – a standard accepted by experts\(^9\) generally being respected (82.5%). At times, collecting data from the caller was difficult and time-consuming, therefore the delay was not attributable to operators. Although the proficiency level of operators when creating a dispatch depends on several variables, a regression analysis shows that the variable “operator” is not strictly related to the whole “green-black code” phenomenon.

Because of the small sample size, it is not possible to establish a relationship between the duration of a dispatch and the criticality code assigned. As regards the dispatch form, we observed that items referring to symptoms and events (chest pain, trauma, car accident, sudden illness) were often left blank (85.7%). Symptoms/events that are more likely to be reported are “chest pain” (5.6%) and “car accident” (4.7%), perhaps due to the fact that such occurrences require the implementation of specific protocols such as acute myocardial infarction and pre-hospital trauma care protocols. Operators generally tend to overestimate the condition of patients reporting chest pain\(^{20}\). The vast majority of calls for service are about medical emergencies occurring at home (76.9%), and this consistent with national statistics. Given their prevalence\(^{21}\), cardio circulatory problems are predominant (29.9%) and are followed by musculoskeletal problems (21.9%) and a number of “other pathologies” (17.4%). The average duration of telephone conversations was more or less the same in both the sample (range 43.8 – 64.8 sec.) and the “green-black code” subgroup (range 61.5 – 69.4 sec.). All the 15 “green-black codes” emergency calls were made by a relative and in one case the caller was a caregiver. When compared to the sample, the 15 victims in the subgroup were older (mean age was 81.6 vs. 61.8 y.). The presence of chronic conditions and the old age of the patients may have led the callers...
to probably underestimate the severity of the situation. Dispatch was not accurate in 11 cases. Operators
never filled in the dispatch form when interrogating the callers over the phone, with vital signs (awareness,
breathing) being only partially assessed, if not entirely neglected. All the above-listed factors could have
contributed to under-triage. When analyzing telephone conversations utilizing the “Fele method”, it appears
that in all cases callers described a vague and generally not alarming situation (dysuria, constipation, leg pain
since three days). If the emergencies reported, described as non urgent, probably strongly influenced the
operators decision on the type of criticality code to be assigned, our analysis reveals that callers had not
been interrogated accurately enough, either. Such underestimations inevitably resulted in the dispatch of an
ambulance equipped only with a volunteer-based crew to a “green code” scene (therefore neither emergency
lights, nor sirens were activated). Volunteers, after assessing the emergency scenario, called the EOC for
medical support so that precious time was wasted waiting for a second ALS staffed ambulance with a nurse
and a physician.

Conclusions

Even if “green black code” cases are rare (1/4000 interventions), they represent a sentinel event that indicate
a failure in the EMS system. Nurses working at EOCs usually assess patients’ conditions and make important
decisions with very limited time (60 – 120 seconds). The introduction of a specific training based on the
“Fele method” could improve both quality and effectiveness of telephone triage. The training could involve
simulations of EMS calls, as well as the analysis and discussion of real cases of under triage EMS calls.
From a methodological point of view, the results of this research could be useful to create a near miss and
adverse events database.

Further research is needed to better understand the “green-black code” phenomenon and to analyze the role
of communication in the assignation of an underestimated priority code.

Nursing implications

Triage is essential for the early recognition and treatment of the seriously ill patients, which reduces
morbidity and mortality. In Italy, telephone triage of EMS calls is done by experienced nurses with at least
two years seniority in emergency department.
Regular retraining may help the RN operators to avoid undertriage by focusing on the MPDS protocol. It is important that nurses act in accord to the MPDS protocols, asking the caller about patient status and scene condition, particularly when the caller reports not life-threatening situations, in order to assign the appropriate EMS response priority level.
References


