

## A Planning Model of Pharmaceutical Needs for Mass Gatherings at Public Special Events

Cecchi Adriana<sup>1</sup> and Carchietti Elio<sup>2\*</sup>

<sup>1</sup>Hospital Pharmacist Executive University Hospital, Udine, Italy

<sup>2</sup>Hospital Department and EMS Director, University Hospital, Udine, Italy

### Abstract

The mass gatherings may be the result of a special public event or a spontaneous unplanned event. A special public event is a planned and organized activity which will place 10,000 or more estimated participants in a defined geographical area, gathered at a specific location for a defined period of time where access by emergency vehicles might be delayed. Historically, planning for an event provides the prevention of risk, injury, suffering, or death that may occur at public events, however, the continuous system improvement includes expenses in order to reduce the costs by avoiding waste of resources. The aim of this work was to verify the usefulness of a formula for estimating the probable number of patients to be treated in field and to assess their needs in a special event for 50<sup>th</sup> anniversary of the Italian aerobatic team "Frecce Tricolori" air show September 11-12, 2010 Rivotto – Italy. We have developed, from these data, the following formula to calculate the number of people needed to treat and their pharmaceutical needs.

**Results:** The number of attendees was lower than expected number of approximately 20% for a total of about 320,000 people. 174 patients (about 0.45% of the people) required medical treatment: 30 people less than expected (14.7% overestimation). Of these, 58 (above 33%) required emergency treatment in field (8% less than expected). The mathematical model adopted was appropriate and helpful in preventing possible shortages or waste of drugs.

**Keywords:** Mass gatherings; Air show; Pre-hospital care

### Aim of the Study

On 11 and September 12, 2010 in military base of Rivotto - Udine - Italy was held the air show for the 50th anniversary of the Italian aerobatic team "Frecce Tricolori". The aim of this work was to verify the usefulness of epidemiological-mathematical formula in emergency planning of a number of people to be treated in the field and pharmaceutical needs in special event management.

### Introduction

Mass gatherings may be the result of a special public event or a spontaneous unplanned event. A special public event is a planned and organized activity which will place 10,000 or more participants in a defined geographical area, gathered at a specific location for a defined period of time where access by emergency vehicles might be delayed [1,2].

The special events attract large numbers of spectators or participants, and, under normal conditions, these events go on with few or no problems [3]. However, spectators and participants at mass gatherings may require medical attention in the event of illness or injury. Typically, the incidence of illness at mass gatherings will be similar to that normally found in a population of comparable size. The main concerns in planning medical care are the expected percentages of patients and casualties from heat stroke, dehydration, cuts from broken glass, injuries from bottles and cans, fainting and exhaustion, cardio-respiratory problems, and-related illness [3]. Providing onsite first aid and intermediate or advanced level medical care at mass gatherings reduces the number of patients requiring transport to hospital [4-7].

Historically, planning for an event provides the prevention of risk, injury, suffering, or death that may occur at public events, [6-8] however, the continuous system improvement includes to discuss expenses in order to reduce the costs by avoiding waste of resources.

In a special event with high risk of major incident, and the "the experience has proven that air shows are high-risk events" the provision of resources requires particular planning for major incident in addition

to the generally applicable guidelines to respond to demands of care under normal conditions [2,9].

Planning pharmaceutical needs, including aspects of health risk assessment and economic assessment, can play a key role, and in most cases, there is a tendency to overestimate the need for fear that the resources are insufficient. Of course, all the numerical models require a proper calibration before it can be used with reasonable accuracy. The overall accuracy can usually be obtained to a greater extent, with the precision of the data and experimental investigations. The limitations intrinsic to the mathematical formula, in any case require an appropriate degree of needs overestimation.

### Method

The planning process includes, among the main objectives of emergency plan, the analysis of patients be treated, which is an essential prerequisite to define the requirement and availability of pharmaceutical resources.

Clinical pharmacist attended meetings with the team of Out-Hospital Emergency Medical Service (EMS) in the two months before the event, for health/emergency planning. The presence of about 200,000 spectators for day ranging in age from 1 to 85 years was provided in airport during the show. In the planning of pharmaceutical needs, were considered the treatment of ambulatory and urgent health problems in site of event. Empirically, based on historical data, were instead defined the pharmaceutical needs for a possible emergency

**\*Corresponding author:** Adriana Cecchi Ospedale Universitario di Udine, 33100 Udine, Italy, Tel: +393387470044; E-mail: [cecchi.adriana@aoud.sanita.fvg.it](mailto:cecchi.adriana@aoud.sanita.fvg.it)

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with mass casualties considering the probability of having to treat in field above 100 serious patients.

### Pharmaceutical needs planning for pre-hospital first aid

It was estimated that the majority of spectators were from our Region. Whereas the normal development of the event, it was considered likely that a number of people to be treated in the field would be equivalent to the number of people entering each day to the emergency room of University Hospital. The people who belong to the hospital emergency room in Udine are about 130,000 each year, of these, 55,000 are not acute patients (white code), and only 75,000 are acute or serious patients, equal to about 8.5 people for hour. We have developed, from these data, the following epidemiological-mathematical model to calculate the number of people needed to treat and their pharmaceutical needs.  $PPN = P \times \alpha \times T^3$

- $PPN = \text{Preventable Patients Number}$
- $P = \text{number of acute or serious patients entering the emergency room every hour in regional hospital}$
- $\alpha = \text{correction factor - result of dividing the number of spectators with the number of people who access the emergency room of hospital to which you refer. Example: 2 if the number of people to which you refer is half or 0.5 if it is twice.}$
- $T = \text{hours of the event duration}$

In our case,  $PPN = 8.5 \times 1.5 \times 8 = 102$  people for day (204 in two days)  $P = 8.5$  (75,000 each year  $= 8.5$  for hour)  $\alpha = 1.5$  (the spectators attended was 200,000 people for day, while people, not acute, acute and serious who belong to the hospital emergency room, are about 130,000)  $T = 8$  (duration of event every day).

*Emergency planning-PEPN=Probable Emergency Patients Number*  
The epidemiological incidence of red code (emergency) in people who belong to the hospital of Udine, is about 4%. The incidence of the rapidly evolving emergencies (yellow code) is 37%. Total emergency patients=41%. We applied to the epidemiological-mathematical formula (PPN) the percentage of regional red and yellow emergency codes for predicting the number of patients to be treated in emergency, as follows.  $PEPN = PPN \times \beta$   $PPN = 204$  people in two days  $\beta = \text{percentage of epidemiological emergency severity codes} = 41\%$   $T \times \beta = 83.6$  probable number of acute or serious patients in two days.

### Results

The working environment was festive and noisy. In two days, the number of attendees was lower than expected number of approximately 20% for a total of about 320,000 people. 174 patients (about 0.45% of the people) required medical treatment: 30 people less than expected (14.7% overestimation). Of these, 58 (above 33%) required emergency treatment in field (8 % overestimation). The emergency treatment concerned 11 patients with cardio respiratory failure, 3 Acute Myocardial Infarction, 3 asthma attacks, 41 fainting syncope from heat and dehydrated.

### Discussion

Emergency care management for mass gatherings at special events needs to plan medical resources for major incident and for intermediate or advanced level of care with provision of human and pharmaceutical availability. The purpose of planning is the prevention of injury, suffering, or death that may occur as a major incident but also under normal condition.

In according with American College of Emergency Physicians (ACEP) [9] the aim of emergency plan is to provide an outline of the resources and planning needed to meet the emergency medical care needs of the individual and the possible victims of disaster. The mathematical model adopted in this work was related to the participation, under normal condition, of a number of people was lower than expected. Making necessary corrections to the formula ( $\alpha = 1.2$ ) we would have expected a reduction of patients (162 in two days and not 204) and a consequent reduction in expected emergencies (67 and 83). This correction reduced overestimation of the values that will fall from 14.7% to 7% for total work, and by 8% to 3.5% for emergencies. A reasonable overestimation should always be considered not only possible but necessary for the inherent limitations of the mathematical model that requires a proper calibration depending on the circumstances, and the presence of numerous factors that can interfere with the planning criteria, in particular the definition probabilistic the number and characteristics of people attending the event, environmental and climatic factors, the type of events. Epidemiological-mathematical formula adopted was appropriate for planning pharmaceutical resources and helpful in preventing possible shortages or waste of drugs. Current literature reports the constant involvement of doctors and nurses in the planning and management of special events, but clinical pharmacists involved in planning and therapeutic care within the system of pre-hospital emergency care, are still rare [10-12]. However, even in this area, safety of care is one aspect of quality, where quality includes not only avoiding preventable harm, but also making appropriate care. The predictability of pharmaceutical needs for a special public event requires a specific professional experience and in most cases there is a tendency to overestimate the need for fear that the resources are insufficient. The first line medical treatment should be simplified, as short as possible and economical in terms of both human and material resources. The daily hospital use of pharmacy pertaining to emergency rooms patients may be a inappropriate value for planning the pharmaceutical needs. In fact, some treatments in the emergency room, involve the use of larger quantities of drugs. Must be considered, in fact new issues related to management of low-acuity patients and capacity for surge events.

The clinical pharmacists may be integrated with the role of experts in the therapeutic use of medications and, in addition, this expertise may be used to ensure the rational planning of therapy, the safety and quality assurance and the economic control of expenditures [13,14]. The planning of pharmaceutical needs is a necessary and critical part of planning in today's unforeseen medical events and emergency situations. The particular circumstances surrounding the activities of emergency pre-hospital system require the pharmacist to have a specific expertise in emergency management [15,16].

### Conclusion

The special events attract large numbers of spectators or participants, and, under normal conditions, these events go on with few or no problems. However, mass gatherings may require medical attention in the event of illness or injury. A mathematical formula for planning pharmaceutical resources, based on the local epidemiology, may be valid and helpful in preventing possible shortages or waste of drugs for all public events. The involvement of the clinical pharmacist within pre-hospital emergency system to planning management health/emergency in special events is crucial to ensure the proper definition of pharmaceutical needs and the economic control spending and avoid wastage of pharmaceutical resources.

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