Medico Research Chronicles

ISSN No. 2394-3971

Original Research Article

THE WHITE PLAN AND HOSPITAL RESILIENCE - TWO FACES OF THE CAPABILITY OF THE HOSPITAL TO RESPOND TO MASS CASUALTY TRAUMATIC INCIDENTS

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Submitted on: January 2016
Accepted on: January 2016
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Abstract

Background: Resilience defines the reserve capacity of the system in the disasters or mass casualty incidents, which requires far superior or different resources to those current, on extended periods, in order to resolve the crisis. Cost efficiency designate the term of tangible benefits produced by money spent to build and maintain the system in action.

Purpose of the paper is to highlight the benefits and usefulness of hospitals in general and specially ED resilience as critical facilities for large-scale events intervention, to identify the main practical issues that limit their ability of specific intervention in emergency situations and to identify their vulnerability and risk elements of in these situations which, if you are promptly fined, can improve overall system performance.

The method of study - several mass casualty s events analysis involving the hospitals over the past 13 years and parallel analysis of hospitals resources from 3 different Romanian's regions.

Conclusion

Resiliency and cost efficiency in emergency systems preplanning must reside in a dynamic balance system.

Hospital medical network is top of the medical pyramid system, but in terms of reaction to crises, has specific needs of planning, command and control that can becomes vulnerabilities throughout the chain of emergency response in case of disaster.

The system flexibility consist of both in the ability to prompt expand capacity and intervention specialization, to ensure sustainability of the primary benefits of the intervention and the ability to develop functional relationships with similar foreign systems.

Keywords: resilience, red plan, white plan, mass casualty accidents, incident command system, cost effectiveness

Introduction

Disasters and mass casualty accidents are unavoidable and more and more realities in contemporary world. Consequently, Emergency Intervention Systems is expected to be prepared to face and manage these occurrences, respecting the ultimate goal – saving victims life.

Integrated approach of these events brings on the floor complex aspects of rescue interventions, Emergency Medicine, people safety, national security matters, and also aspects of legal medicine, criminal law, homicide, and criminal law procedures.

Article 86, paragraph 2 from title IV in Law 95 / 2006 regarding National Health System Reform define collective accident as the occurrence that involves a large number of victims requiring a special intervention plan using additive task forces besides those that are currently on duty[1]The number of victims which is mandatory for starting a special intervention plan is different from one case to another, depending on local system different capacity response, type of emergency, and also depending on local and regional components implementation of National Intervention System in Emergency Situations [2,3]. It is also depend on medical structures integration with County Emergency Situations Inspectorates[4], and last but not the least, on local authorities cooperation with other agencies involved in reducing and clearing off the consequences of these events[5].

Hospital represents the most specialized and highest competence level for diagnostic and treatment capacity in healthcare system. Specialization is the path that continuing develops strictly for unique profile departments. On the other hand, integration represents the strategy that endorses interdisciplinary hospitals development. Both are the two fundamental evolving directions, which permanently increase quality standards in providing hospital medical assistance. In order to prevent and aiming to control the misguidance of emergency patients to the hospitals, in Romania, sanitary beds units are organized varying with their emergency medical assistance capacity and competence[6,7] on different levels. The main idea is to direct the patient according to the concept ``the nearest appropriate hospital``.

Exceptional emergency events activates instantly the entire medical hospital network, in order to solve in minimum of time and with maximum of patients safety, all the medical and accessory needs occurring during the event.

Material and study method

We analyzed 34 hospital and pre-hospital extended events involving in different ways hospitals, that took place between 2000 and 2012 in Romania.

There are three categories of events that can, directly or indirectly, incur a risk to a hospital and force him to change its daily routine activity: inside hospital events, pandemic events and mass casualty accidents. For each one of these situations, hospitals should develop special packages of measures, which will help them to negotiate, in the new specific conditions, the report between resources that could be use and the particular needs, generated by the emergency situation.

The aim of the study is to obtain a real image of hospitals reaction capability to manage an multiple victims accident, is to highlight the benefits and usefulness of hospitals in general and specially ED resilience as critical facilities for large-scale events intervention, to identify the main practical issues that limit the ability of

specific intervention of ED, departments of Anesthesiology and ICU in emergency situations and to identify their vulnerability and risk elements of in these situations which, if you are promptly fined, can improve overall system performance, and to appreciate the real optimal relationship between cost effectiveness of system usual capability s and resilience needs in special situations.

We analyzed some characteristic elements of medical facilities from the Romanian South – Western Development Region. We also studied a 13 year period of significant mass casualty events and various degree of regional hospitals implication. Finally we studied cooperation protocols applied inside or between hospitals, in order to concluder objectives for future exercises and practical simulations. We framed general and particular aspects that could be items in a standard procedure protocol useable in real situations . These items could correct present dysfunctions noticed today in hospitals crisis situations management.

So far, we followed the pattern of the event, its intensity reported to the hospital level, commanding chain, involved resources , the reacting time to onset the intervention chain, efficiency and efficacy of reaction, occurring malfunctions.

We surveyed, during the same period, the frequency, the setup and ongoing simulating exercise for mass events which happened in South Western Developing Region "Oltenia" hospitals. We also evaluate the assessment result process to optimizing diverse pre-planned operative tasks and ordering and managing aspects.

We managed to identify a serial of elements which we consider to be relevant in hospital reaction to a crisis situation such as : hospital type and rank, quality and extension of emergency departments, current ED involvement in pre hospital activities, current activity volume, training and emergency plans existence, volume of material stocks management, communication, inside/inter – organizational informational flux.

In the same time we asked hospitals managing structures in the region including emergency departments medical directors) to answer to a unique questionnaire. This test was based on the knowledge of multiple victims events management, pre-planning directions, emergency plans activation, incidents command system malfunctions), vulnerable elements of own hospital facility, inside risk management concept, intervention and security procedures.

According to these characteristics we tried to elaborate, for each hospital category, groups of recommendations vs. mandatory procedures absolutely necessary`` for intervention or in pre-event planning domain. We also highlighted the complementary elements that can be accomplished by cooperation with other medical institutions based on the complementary - additive principle.

On the other hand we succeed to expose conceptual errors and actions that could lead to additive risks of the event, and we underline the elements that could mislead reaching the expected level of hospital performance, in crisis situations.

Results and Discussions

Studied characteristics of the hospitals involved in extended events management.

According to these criterion, the South – Western Development Region hospitals and also from the rest of the country - generally involved in studied events management find themselves today in this following situations :

- *Emergency Hospital Facilities* with only Emergency Department (UPU) or with Prehospital &Extrication Mobile Emergency Service -SMURD) are expected to have a proper capacity to ``absorb`` the impact of a major event and, in the same time, to continue its clinical activity, to a satisfactory level, comparable to current one, but with specific functional adaptation to higher speed work and increased work- volume. Shifting procedures to Crisis Situation Action Plan are not yet down written, but more often they are subliminal, being extrapolate from daily ongoing medical activity. This aspect is present in four county hospitals from S-W Region.

- *Mono-profile Hospital Facilities or Chronic Illnesses Patients Hospitals* do not have any closest ability, information, training or concern in direction of a presuming reaction to a major event. Right now, practically, on this training domain, these hospitals cannot be use in crisis situations, not even for isolated patients with minor injuries closely related to hospital profile, and even on short period of time), because of local limitations and inertia

- *City Hospital* that deal with emergency cases thru small Emergencies Compartments CPU), structures without the support of a well adapted hospital platform able to receive potential patients, who are usually outside from the attention of hospital hired specialists. Although, even the emergency structure would act professionally according to its responsibilities, the efficient result would be minimized because of the hospital incapacity to adapt to a new reaction type. For this kind of hospitals is mandatory to develop inner - hospital emergency plans. The gaining result of elaborating these documents will consist in organizing the immediate reaction using already existing capabilities, which are impossible to use in absence of a rigorous mobilization plan.

First valuable element, a real turning wheel of this assembly is represented by the Hospital - Pre hospital interface. This interface should provide receiving, patients assessment and triage according to gravity criteria[8], medical exam prioritization, investigations and medical treatment for all patients presenting emergency pathology. Emergency Departments from type I and type II hospitals may develop Mobile Reanimation and Extrication Units, including neonatal transportation, by using their own medical teams and paramedics from County Emergency Situations Department[7,9,10,11] . Inside this department, Resuscitation and Extrication Mobile Emergency Service SMURD) acts as an pre-hospital extension of Hospital facility[12], which allows correctly orientation to optimal medical center[13] for critical patients. In other authorized hospitals for receiving and dealing emergency cases, specialized Emergency Rooms organized – one profile hospitals[9].

Events typology study

In 34 studied events, inner accidents were represented by Giulesti Nursery hospital fire, and pandemic AH1N1 flu, which affected several hospitals. All the rest of events were represented by pre – hospital mass casualty accidents, putting pressure in the moment of victims access from pre-hospital.

- underground mining collective accident in Petrila
- 21 road car accidents 30 of September 2010 Tulcea, 17 of July 2011 Pielesti, 26 of April 2012 Mioveni, 29 of November 2005 Slobozia, Iasi, Constanta,

Sibiu etc. - in many of these, public transport vehicles were involved)

- 2 tramway accidents 19 of May 2012 Bucharest, 29 of March 2012 Iasi
- 5 highway accidents
- 2 railway accidents - September the 21th 2009 Craiova Carcea and August the 14th 2009 Scanteia Iasi
- 1 major pipeline gas explosion, large number of victims Sighetul Marmatiei 2012

By the type, lots of events generating crises involving hospitals could be grouped in 3 categories. Our aim was to identify determining elements, which support quality intervention of the hospitals to solving the situation.

1. In hospital events

The inside hospitals accidents should be an absolute priority which require a pre-incident intervention plan. The importance of this plan result from the various nature of the event, the accident gravity and visibility, the enormous number of possible casualty s, the major psychological implications of the event, accessory risks, and last but not least the amount of medical forces and personnel dislocated.

2. Pandemic Events

Analyzing all started actions during 2009 pandemic flu, we notice that despite correctly initiating of regular reaction measures some incoherence existed :

- overreacting mass-media implications in relating events, insufficient media notification regarding authorities measures and recommendations made for population, causing a serial of overrated reality facts, inconsequence, speculations about large number and gravity of illnesses, and questioning medical management quality. All these were important elements of panic triggering - population did not have fast in off and sufficient easily access to confident communication facilities, such as a green line phone call, hospitals web pages. The consequence was people reaction to unverified and uncontrolled news released thru alternative media channels
- Involvement of epidemiological structures with attributes in detecting, prevention and population health surveillance in crisis was not uniform. Some of easy cases remained undetected, so far generating contacts, other cases were lately reported based on retrospective serological diagnose. Hospitals were suffocated by an avalanche of asymptomatic patients, trying to confirm their good health status, each one being eager to get anti-flu vaccine.
- involvement of medical emergency assistance, intensive care units and contagious illness hospitals were over solicited considering the real situation, the gravity and the number of medical cases. Self initiative presenting of healthy people, or with mild form of illness to hospitals regional in some cases) generated important population afflux to emergency structures and contagious illness hospitals, increasing virus diffusion risk and consequently contagious transmitting illnesses.
- Only in mono profile hospitals quarantine quality was respected. Knowing the fact that some flu affected patients with respiratory insufficiency were treated in intensive care units of regional hospitals, none of the epidemiologic circuit was totally respected patients influx circuit, imagistic investigation circuit, inter-disciplinary medical exams). Established circuits for patients transfer to a higher level hospital or to another inside hospital department was relative and

interfered with usual circuits for other patients.

- the compliance of intervention personnel was unexpected low in wearing N95 mask, especially in pre hospital area. This aspect requires a special attention because only proper use of the protection equipment can control and limit aerial transmitting of viruses.

- supplying with protection equipment was insufficient and late for some hospitals, supplying circuits and distribution modality of light protection equipment recommended by epidemiologist was not clearly specified from the beginning

- over estimated vaccination protection led to agglomerated medical structures and mass population immunization which did not meet the eligibility criteria. These criteria were not well defined, from the beginning contraindications, risks, benefits, limits, serologic diagnose, proper time administration). None the less, evasive attitude of medical personnel regarding vaccination utility, between denial and over recommended, was an important aspect to be noticed.

Still, some measures in managing this pandemic worked properly , efficient having a decisive contribution in limiting mortality and illness spreading . Many of these measures were implemented by WHO recommendation, based on previous plans, such as :

- Inter- institutional cooperation coordinated by emergency situations operational centers
- Medical structures flexibility
- Financial and logistic resource flexibility
- Fast mobilization of personnel and material stocks, keeping permanent operational contact between all responsible employees on every level
- Cooperation with public health structures, communication and international research organizations

An essential remark is that an extended retrospective post crisis assessment could provide extreme benefits for an optimal reaction to a potential event . Benefits are real because health employees and firemen are in daily contact with biological agents having various aggressive degrees, discovered days and weeks after contact[14].

3. Outside hospital events

Emergency events occurred outside hospitals may disturb their activity thru several mechanisms: directly by risks nature) or secondary by large influx of victims, contamination or pollution, uncontrolled evacuation from accident scene and spontaneous victims showing up at hospital without passing thru decontamination area, ceasing electricity supply for intervention `s security reasons.

All outside hospital multiple victims events can, unfortunately,`` transfer the disaster to the hospital`` if the pre-hospital system is insufficient, inefficient[15], incapable to provide triage, first aid and to control and ordinate patients flux from accident scene to appropriate identified hospitals.

Hospitals implication typology in multiple victims outside events is much bigger than accepting a large number of victims. This typology is very well connected with reliable pre-hospital intervention support involving human and material resources, command expertise, logistic support and other hospitals expertise by telemedicine system, or even personnel and material resources dislocation required by the collective accident or disaster occurred in affected area. The regional support is provided by the

regional emergency hospital with SMURD unit, as interventions regional commander.

Obviously, in order to cope with this situations hospitals must have a specific resources mobilization and coordinating plan, it statues required calamities resources, actions command, communications, responsibilities, logistic support, public acknowledgement, relationships between pre-hospital – administration and medical superior teams involvements, operative emergency centre actions. According to this plan, worldwide known as White Plan, hospitals should be prepared as soon as possible to receive large influx of victims when, but not only, pre-hospital intervention red plan has been activate, to identify the victims, provide specific advance medical care, to admit, transfer and discharge properly the victims and to prompt and effective negotiate with relatives and media[14,15,16] .

Study of cooperation actions, exercise preparedness and major events simulations

Cooperation actions aim to practice scenarios of different types of accidents happened inside hospitals. They are very rare noticed in pre-hospitals intervention plans and almost inexistent on hospital preparedness plan to a potential disaster. Only 3 hospitals in Romania performed, in 13 years, at least three times cooperation exercises for inside unit events: Emergency Hospital Floreasca, Emergency County Hospital Craiova, Emergency County Hospital Tirgu Mures.

The accuracy of exercises scenarios conceived for these situations could prove valuable in a real situation.

For March 2009 application of Emergency County Hospital Craiova, depicted scenario include 3 death casualties, 8 wounded 3 smoke intoxicated, 2 burned victims, 3 multiple injury), evacuation of 64 victims 23 immobilized with vital function support). 6 of the victims required vertical height rescue techniques with outside building evacuation. Unfortunately, similar real situation with tactical scenario presumed in Craiova`s Hospital exercise, occur 4 months later in Giulesti Nursery fire.

In most cases system responsible is facing a fake safety feeling regarding its own capacity to manage emergency events, using inside resources.

Possibility or probability denial of a major event occurrence that could heavily impact the hospital represent a great weakness in generating a rapid, efficient and coordinated reaction. Very often superficial analyze or administrative cliché are caused by the absence or inadequate back-up solutions, so far unpleasant surprises being extremely hard to be prompt and correctly solved. It is possible that highly specialized hospital facilities and capabilities could be affected in a direct manner, out of duty, or temporary un useable.

In many hospitals, organizing, commanding, control and communication principles are not familiar to medical employees because they are generally trained on clinical medicine in order to cure specific profiles of trauma patients, but none intricate lesions to multiple casualty s.

Risks management on a sudden event scene[17] require special rules and measures, stage prioritization, resource capitalization, aspects that are not wide known to involved personnel. Acting in a well planned, familiar, orderly, well illuminated surroundings (regular climate activity in hospitals) is totally different than chaos, smoke, limited access and

visibility, unavoidable conditions during a fire, explosions or collapsed structures.

As the matter of fact, when a major event occur inside of the hospital, instantly transform the orderly, protected, clean and specialized inner hospital environment into a multidisciplinary battle scene, incapable to valorize own performance and high competence attributes.

Studying the characteristics of real events and some hospitals event applications we were able to notice :

> inside hospitals co- exists a multitude of risks which are not known as that by the employees oxygen, blood tests laboratories, radioactive doses, materials warehouse, basements, electric devices, acclimatization system, toxic waste, elevators)

> extended, rigorous standards for hospitals built are in place only for new built hospitals and is not always specified standards to avoid risks for furniture endowment, consumable items, protection equipment and fire proof materials acquisition

.> absence in old hospitals of alarm signal devices that should be connected to 112 Emergency Alert System , absence of smoke sensors, and automatic fire extinguish systems

> Personnel lack of knowledge regarding announcing and emergency intervention procedures, especially in the chronic illness profile hospitals

> Frequently absence of own electric generators and own water supplies for the low level of competency hospitals

> large number of critical patients inside hospital depending on electric life supporting devices, especially in ICU, orthopedics, postoperative period of time, pediatrics injection pumps, artificial lung / cardiac monitoring systems, dialysis systems), patients who requires alternative assistance during evacuation

> during intervention there is a lot of connected action directions such as : rapid relocation preserving low temperature - cold chain of blood supplies and blood derivate products, radioactive device sources evacuation from radiotherapy department, securing of potential contamination sources from hospital labs, securing of medication and volatile or pressurized anesthetic gases, oxygen pressurized bottles. To follow all these objectives, the Operational Security Commander[11] should have a direct communication with every level responsible, who was appointed by the hospital manager according to emergency intervention plan. Medical Security Director MSD[11] should know them in person and should collect from them reliable data that could be use by OSC

> patients relocation inside hospital to unaffected areas should use safety routes with proper specialized medical assistance

> the necessary patients evacuation to other hospitals evacuation triage, prioritization, patients regrouping for evacuation, resources selection, assistance)

> it is important to consider uncritical vulnerable patients who cannot self evacuate which depends on hospital employees children and newborns, plaster devices immobilized patients)

> there are no dedicated cant paths or grades in many hospitals, stairways and elevators being the only patients access possibilities between different floors. In emergency situation these usual pathways are vulnerable and should be avoided. They are useless for patients lying in intensive care beds, for patients in wheel chairs, patients on hand-barrows (exception carrying strikers), so far victims

capacity transfer being very much diminished.

> Panic control inside hospitals is a very difficult task. Panic and polluted atmosphere amplify chaos. Hospital personnel is affected by the primary event, low visibility, usual access routes are blocked by locked doors or collapsed walls.

> although ED in cooperation with County Emergency Situations Inspectorate have both a good and familiar expertise in emergency situation management and an important operational capital, still they don` t have the leading role in hospitals interventions plan

> Frequent, in - hospital communication could be limited to analog cable phone service. That could cause difficulties in emergency major situations in early event reporting to emergency operative center, cooperation process, and cause problems in Incident Command System forming and function[18].

> Very often, hospitals guard and security systems are provided by private entrepreneurs, and their working procedures and staff diagram are not familiar to emergency services. There is no compatibility between communication system of this private safe guard agencies and hospital internal communication system making impossible cooperation between these two structures. Sometimes occur unproductive time consuming negotiations between rescue intervention teams and safeguard agency employees regarding special ways access of hospital compound

> Many times, specialized emergency intervention vehicles access inside hospital `s territory is jammed by unauthorized private parked cars

> In emergency events, media access inside hospitals is a very delicate and sensitive situation. Between the necessity of a real time, constant and accurate public information and the need of a secure work space for rescue teams action, very often tensions appears. This conflicts happens because, unfortunately, intervention plans oversight media relationship rules[19].

> Today, transfers of isolated patients between hospitals in the region in very well established by written procedures. Still, there is no procedures for mass evacuation during a major emergency event to other hospitals in the region, related to the team activation criteria and specific medical profiles between this hospitals[20].

Conclusions

This study offered us the opportunity to identify major problems in all hospitals: flexibility, pro-active planning, training in realistic conditions, lack of crisis situation management information at the health units administrative level, informational chain management, communication, command / inner hospital action command, inter-institutional cooperation, cooperation with superior structures, hospital - pre hospital integration, media communication and last but not the least, extremely high visibility of multiple victims events.

The logical solution for all that hospitals, without delay, should elaborate and implement plans that reorganize the activity during a large number of victims influx including a precise appointed operational command system onset and functioning. Proactive preplanning of "the unforeseeable", should be conducted, specifically on strategic, tactical and technical levels, to flow optimally informational, operational and relational system benefits. Pro-active planning,

constant practice in most realistic conditions, basic formation and sustained training of management teams in the spirit of crisis situation action represent the best antidote against chaos, improvisation, late reaction, turbulence and risk after a sudden extended, heavy controlled occurrence as multiple victims event always is

Finally this plan must be integrated with pre-hospital intervention red plans and with up to date intervention procedures for events occurred inside own hospital facility.

Some of the noticed aspects require protocols generating process, practical recommendation instructions to be elaborate and realistic practical simulations scenario design established. We consider being important to regulate:

Conceiving training modules for crisis situations integrate management may facilitate the elaborating process of these intervention plans by the hospital management teams and also could increase inter institutional cooperation with other intervention acting factors.

ED's, especially if acting outside hospital (SMURD, Romanian model of intervention system), through their current activity specifics are exposed to overcharge patients, lumped with different profiles and needs of different assistance so that personnel and material resources must be permanent proactive planned in this regard. **Resiliency of these systems is mandatory** and expressed including the existence of special intervention modules from disasters and mass casualty accidents the local/regional, with immediate reaction to need, with additional capacity of achievement including a medical advanced point for 50 - 75 patients.

ICU's, given the specificity of high specialization in advanced management, also by definition limited, constructive or technical (limited treatment facilities-ventilation, dialysis, and extracorporeal membrane oxygenation).

In turn, **departments of Anesthesiology** will limit its ability to extended events with limitations related to teams or surgical intervention capabilities and infrastructure capacity concerned and assistance of these patients postoperatively.

For commune events with multiple casualties (traffic accidents), in which the special issue is the sheer volume of resources required in the short time, **resiliency is a best solution**, the necessary additional resources being identical to those used in current work, so preplanning and flexibility of intervention system and control (hospital white plan), could lead to solving the crisis in the optimal mode of trauma centers of highest level.

For situations with multiple casualties resulting from special events (intoxications, mass burns, pandemic), **resiliency is an absolute condition** for limiting the immediate imposition of fatality's, specific advanced initially management, **but should be supplemented with backup solutions**, preplanned counter-measures fast outside resources its own extensive system. Intervention needs in these situations differ tremendously, primarily qualitative as well as quantitative ones, so the eventual pre plan required is extremely difficult, as anticipation of instant resource reserves very specialized.

Even for tertiary trauma centers, **the keystone of the optimum resolution of these situations seem to remain inter centers cooperation to readjust the flow of patients to the capabilities of their own system.**

So, the system flexibility consisting of both in the ability to prompt expands capacity and intervention specialization, to

ensure sustainability of the primary benefits of the intervention and the ability to develop functional relationships with similar foreign systems. In this equation, resiliency and cost efficiency in emergency systems preplanning must reside in a dynamic balance system

Acknowledgements:

All the authors have had equal contribution. All the authors, Luciana Rotaru, Cosmin Ciulu, Cristian Boeriu, Monica Puticiu – declares no any commercial and financial interests. The study was supported by the University of Medicine and Pharmacy Tirgu Mures - Research Grant No.15897 / 10.11.2014

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***Erratum:** Authors have acknowledged that the study was supported by the University of Medicine and Pharmacy Tirgu Mures - Research Grant No.15897 / 10.11.2014