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Management of Massive Fatalities in Health Sector: A Systematic Review

Georgios Alevetsovitis[1], Panagiotis Prezerakos[2], Stavroula Alevizou[3] and Styliani Tziaferi[4]

Abstract

Preparedness of health systems is an important part of the national strategies on the design and implementation of programs pertaining to disaster management. Emergency events usually have an increased number of human casualties and demand continuous and interdisciplinary co-operation and activities. A systematic review of literature findings on health management of catastrophes helps its improvement. From 1980-2014, articles in Medline, Pubmed and Google Scholar were researched, focusing on the topic of health management in catastrophes. 123 articles were found and finally only 52 were used as they referred to phases of health management in disasters, except rehabilitation. Although international, educative organizations are numerous, few steps of improvement have been taken in the health services' sector. In case of emergency, revised plans and actions as well as a high level of response are necessary, mainly due to limited resources on the part of health services.

Keywords: emergency-hospital preparedness, disaster response, risk management, bioterrorism

1 Introduction

The preparation of a country's health services system on a national level, as well as that of International Aid Organizations, in cases of managing disasters with casualties requires a level of emergency preparedness which will ensure the smooth functioning and satisfactory response of systems and procedures and the availability of adequate resources

[1]Military Physician, MSc (c), Department of Nursing, University of Peloponnese
[2]Associate Professor, Department of Nursing, University of Peloponnese
[3]General Physician, MSc (c), Department of Nursing, University of Peloponnese
[4]Assistant Professor, Department of Nursing, University of Peloponnese

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so that immediate and effective assistance can be provided to disaster victims. Such courses of action are intended to facilitate the adoption of restorative measures on all levels of economic, social or other situation beyond control.

Preparedness in emergencies with an increased number of Casualties is a continuous interdisciplinary-interdepartmental activity which should form an integral part of the national strategic planning and implementation of disaster management programs. In essence, it should include four significant phases: prevention, coupled with impact minimization; intervention, along with preparedness; handling, in the sense of response made, and recovery, with post-disaster investigation and analysis. At the same time, three more activities should be in progress, those of risk analysis, of command-control-communication and finally of informing-training [1].

Such phases are set off against their counterparts of disaster-crisis, which are: the prodromal crisis stage, the acute crisis stage, the chronic crisis stage and the crisis resolution stage [2].

Every major event (including both natural and man-made disasters as well as terrorist acts), especially if resulting in casualties, constitutes an emergency which requires that all bodies involved should implement special predefined actions and which is certain to involve a large number of people [3]. The events that unfolded on 11th September 2001 in New York, 12th October 2002 in Bali and 7th July 2005 in London were conducive to Western nations focusing on the possibility of having to face a major terrorist act and on their current preparedness to manage such a crisis. Any such event emerges suddenly and is often followed by widespread panic, a failure of public transportation and communications and generally by the disruption of the balance of socioeconomic structures. Public Health services are bound to play the leading role as they will come under unrelenting pressure right from the start. The ability and potential to respond are vital and require planning, real-time training and effective preparedness.

Public health services will need to have taken certain necessary measures in advance, the completion of which prior to an event is of vital importance for the success of each action. These measures concern the cooperation-communication among the competent bodies through structured plans and guidelines; the participation in risk-hazard assessment processes; the assessment and procurement of the necessary resources; the development of oversight systems; the training and retraining of healthcare staff; the participation in the planning and execution of drills that concern the assessment of preparedness and response capacity and, finally, the reassessment and adoption of remedial action [4].

Aim of the study

The aim of this review is to employ a thorough and the fullest possible referencing to and recording of the bibliographical scientific data-research so that the following can be acknowledged:

(a) expert opinions and suggestions concerning the ideal organization, assessment and implementation of healthcare disaster management systems, and

(b) the assessment of and estimative approach to potential constraints-obstacles on the one hand and to factors that facilitate and promote a successful crisis mass-casualty management on the other.

Much of the literature comes from studies conducted in the United Kingdom and the USA for the most part. However, studies from other countries, like Turkey and Greece, have also been included as they provide additional data and knowledge. The study attempts to

clarify which of these methods could be applicable to the Greek reality, considering the budgetary restrictions on the public health domain.

2 Method

In order to locate literature pertaining to the subject of public health preparation for mass casualty management, extensive online research was performed, mainly using the Endnote software tool and key-words such as "disaster medicine", "risk assessment" and "emergency preparedness", on various websites, namely MEDLINE, PubMed, Google Scholar, National Documentation Center and the National Library of Medicine, which are databases holding subject-specific articles. Other such websites that were also researched include BMJ (British Medical Journal), the Lancet, Disaster Medicine and Public Health Preparedness, Quality in Healthcare and, finally, Medical Education.

The research spanned the period between 1980 and the present day. This time constraint was imposed because prior to 1980 any kind of preparation and emergency management was only relevant to potential civil protection in the event of nuclear threat. Therefore, there was no research-related activity on the subject of natural disasters.

A disheartening feature was that little literature in Greek was found. However, a more in-depth study of the relevant articles revealed the presence of several Greek contributors in foreign articles and their work even set a standard for other authors [6-9]. Accordingly, the search was narrowed down to English only and returned 120 articles, only 67 of which were accessible (due to economic considerations and time constraints) and only 50 of these had a clear and direct relevance to the subject, i.e. healthcare disaster management, and contained well-documented argumentation derived from clinical studies and expert opinion. These were categorised under four main groups (Figure 1. Flow Chart). Every article was carefully read and the key findings isolated. Following that, the findings were organized in order of pertinence to the subject-matter, using the traditional approach of a narrative summary. Key points were compiled from every article and grouped under the four categories. These categories were then subjected to processing and modifications so that they could be restructured under a stricter topic list with a plainer content.

Other papers that were retrieved and included in the study were those quoting well-documented argumentation derived from clinical studies as well as other theoretical approaches, for example, expert panel discussions. The last stage of healthcare disaster management though, that is to say the recovery stage, was the least represented in the scientific papers. This fact is probably due to that stage being on the one hand the longest in duration and on the other the most particular-challenging in terms of compiled data completeness and development monitoring because of the multidimensional involvement of institutional and non-institutional agents.

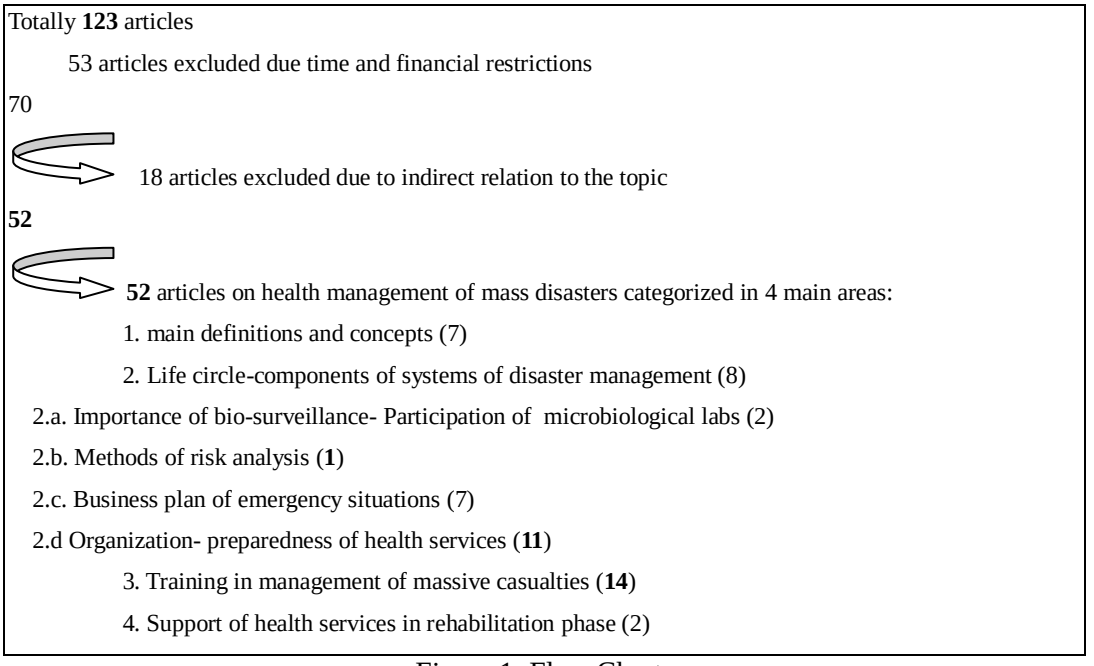

Figure 1: Flow Chart

3 Main Results

3.1 Basic Concepts and Definitions

It would be useful at this point to provide some basic definitions and explanations so that the approach of this review can be more easily understood. A disaster is any natural or man-made event causing an imbalance between the demand for and supply of existing resources [10]. Although disasters exhibit common features, each one of them is unique [11]. This review will not confine itself to a specific type of disaster but will include healthcare preparation, response and management in all types of disaster [12]. Emergency Response is defined as the series of prioritized actions which are taken at the onset of an emergency and include every action intending to protect human life and property and to provide urgent relief to victims of natural or man-made disasters. [13].

Risk Assessment is defined as the overall process of estimating risk levels and determining whether such risk levels are tolerable [14]. A Public Health Emergency [PHE] is any incident impacting or being likely to impact the state of health within a community or nation [15]. In order to avert or scale down the detrimental impact of a PHE on public health, an early detection and timely management of such are essential. Therefore, hospital preparedness is of critical importance when it comes to detecting and managing such events, as hospitals are eminently responsible for biosurveillance and therapeutic interventions in PHE's [16]. Lastly, biosurveillance is the systematic process of gathering and analyzing data with a view to detecting suspicious and rapidly increasing numbers of health issues, such as infections or terrorist acts (as with Sarin gas), and identifying those conditions that are responsible for their predisposition [17].

In Table 1 there is information mentioned in the 49 articles included in this review. 8 articles refer to the second group categorized in this study as: Life circle & components of

systems of disaster management. 2 articles refer to sub-group 2a, 5 articles to the second sub-group (2b), 7 articles refer to the third sub-group (2c), 13 articles to the fourth sub-group (2d), 11 articles to the third group labelled: Training in Management of Massive Casualties and 2 articles report on the fourth group: Support of Health Services in the Rehabilitation Phase.

3.2 Life Cycle-elements of Disaster Management Operations

In 1998, Tufekci και Wallace [16] suggested the separation of emergency response in two stages: pre- and post- disastrous event. The former stage includes the ability to predict and analyze potential risks and the development of the necessary action plan that will prevent and mitigate such risks. The latter stage is launched while the disaster is still unfolding. The challenge in this stage is to detect, allocate, coordinate and manage the resources available. The aforementioned regarded the inclusion of every management attempt in these two stages as extremely important.

In 2002, Green [17] reports that emergency management is better understood if described in four stages: prevention by limiting risk-posing conditions, preparedness, response and recovery. This four-phase approach provides a more focused aspect of emergency management action. The first stage takes on particular significance when considering that its adequate organisation and implementation plays a substantial role for the intensity and extent of a disaster.

3.3 The Importance of Biosurveillance-Participation of Microbiology Labs

A significant part of this stage is biosurveillance, which came out of the advances made in bioinformatics with the development of epidemiological methods in the course of constantly monitoring public health mainly for fear of two potential threats: that of a terrorist biological warfare attack and that of a pandemic brought on by natural causes.

The systems and organisations engaging in biosurveillance are mainly national or international. Of these, the most conspicuous are: The Center for Disease Control and Prevention (CDC) in the USA, the World Health Organization (WHO), the Real time Outbreak Disease Surveillance (RODS) system of the University of Pittsburg, the Automated Epidemiologic Geotemporal Integrated Surveillance System (AEGIS) of the Children's Hospital in Boston, the European Centre for Disease Prevention and Control, the Early Warning Response System (EWRS) of the European Union and, in Greece, the Hellenic Center for Disease Control & Prevention (HCDCP). These systems employ Scan Methods or Scan Statistics [19] mostly, which are applied when the observations are either temporal case events or spatiotemporal case ones and are essentially in the form of automated syndromic surveillance systems [20], enabling the detection of disease clusters in certain geographical locations.

In a 2003 article concerning the significant role Microbiology Labs play in the early identification and detection of suspicious samples, Snyder argued the potential existence of a public-private-military lab network in a country which would be organized on a four-level basis and classified depending on their monitoring and authentication capabilities and which would interoperate and communicate through a single database. The said activity would not hinder the performance of the labs' main tasks but a clinical suspicion based on their technicians' excellent training, the guidelines and the integrated data and

communications network would enable the prompt activation of the response mechanism [19].

3.4 Risk Analysis Methods

In the first stage of the life cycle of Disaster Management, what is very important is the ability to use special methodologies-risk analysis indexes for the approximation of the potential consequences of a disaster. In 2007 Carreno, Cardona and Barbat presented and analysed the RMI (Risk Management Index), which combines a group of indicators that can assess risk management performance and effectiveness. These indicators reflect the various actions (organisational, developmental and institutional) taken to reduce the vulnerability and losses of a given area, to prepare for critical events management and to efficiently recover after a potential disaster. This index provides a quantitative measure of management, based on predefined benchmarks which should be achieved by the response plan. It consists of four levels of public policies. Each level is described by six indicators, which in turn are evaluated by five performance levels (low, incipient, significant, outstanding and optimal). These latter levels concern Risk Identification, Risk Reduction, Disaster Management, governance and Financial Protection. The RMI is the average of these four indexes, that is RMI= (RMI_{RI} + RMI_{RR} + RMI_{DM} +RMI_{FP}) / 4. This index's significance lies in its adaptability to the special features of each country and society and in the robustness of its measurements, despite a potential subjectivity in its valuation [20].

3.5 Operational Emergency Planning

The significance of the second stage in crisis management lies in the integration of all those plans-procedures that will form the basis for the logistical sufficiency of infrastructure and resources. In a 2003 article [24] concerning emergency response preparedness, Perry and Lindell criticised the investment of resources in the development of action plans on the part of the State so that terrorist attacks and other hazardous situations could be dealt with, in the sense that the main emphasis is placed on the preparation of plans rather than on their feasibility or their objective which is none other than social preparedness. They therefore suggested ten guidelines for the development of planning procedures which can be implemented for any kind of threat or social background. These guidelines were based on previous similar writings [21-23]. The use of guidelines in planning procedures establishes the scientific and practical structure that enables preparedness. Besides, disasters – whether natural, technological or terrorist-inflicted – do not wait for the organisation and implementation of procedures. Plans on paper but lacking the necessary knowledge of planning principles cannot guarantee adequate preparedness and can in fact be misleading by offering the illusion of adequacy.
An equally significant part of this stage is the development of communication systems. The significance of information communication, especially in the Public Health domain, is the foundation on which rest both the development of human life rescue chains and the activation sequence of the appropriate mechanisms for crisis management by non-healthcare agents. In research carried out on the communication systems in New Jersey, USA, during 2004, when there was a shortage of anti-flu vaccines, and 2005, with the bioterrorism drill, Uscher-Pines et al (2007) came to useful conclusions mainly concerning information management problems through hierarchical status and the difficulties presented during the shift change of switchboard operators. Lastly, they

mentioned the efficiency of communication systems and its significance and responsibility to health services, as, besides administering face-to-face healthcare, there is also the substantial part of hotline information and advice provision to people who are either in no position to physically appear in hospitals or are overcome by fear and panic over the potential consequences of a catastrophic event [25].

The efficiency of the transportation network is another area of vital importance for the health system response to the needs of those involved in a disaster. Nevertheless, it cannot be taken for granted, especially in the event of natural disasters, when it can be seriously impacted [26]. In 2004, Barbarosoglu and Arda presented a two-stage stochastic programming framework which utilises the urban transportation network for the transit of vital first aid materials to disaster-stricken areas during emergency response. They argued that in the context of generalised uncertainty, the vulnerability of a transportation system leads to random-location storage. The framework can use instant updating and yield results as it relies on the value of information updating in the process of an emergency [12].

Likewise, in 2005, Hale and Moberg used the five-stage process in disaster management [27] along with the procedures suggested by FEMA's Disaster Management Guide as the framework on which to propose a decision-making model for the creation of a secure storage and distribution chain for first aid materials. Their effort was based on the peculiarity of human health which requires the availability of a first-aid-material stock that is easily accessible despite the possibility of supply chain disruptions in times of disasters. Such a disruption of the network could have substantial socioeconomic effects alongside increased Casualties [28].

3.6 Organization-Preparedness of Health Units

The single most important peculiarity of managing Mass Health Casualties is that health services are overloaded with large numbers of cases in a short time period. More specifically, the so-called “Surge Capacity” refers to the ability of a health system to accommodate and handle large numbers of patients that need prompt and effective triage. The American CDC uses a system-model to predict the incoming volume of mass casualties after a critical event. It is estimated that within the first 90 minutes following an incident, 50-80% of the acute casualties are likely to arrive at the closest medical facility, while other hospitals outside the area usually receive few or no casualties. The less-injured casualties often leave the scene under their own power and go to the nearest hospital. This fact contributes to health services being quickly packed with less severe cases, as it is not possible for cases to be triaged at the scene so that they can be dealt with or channeled appropriately. A hospital can approximately estimate the total number of casualties it will receive by doubling the number of cases that arrived within the first hour after the incident.

It is therefore of critical importance to develop plans for the admission and handling of injured-patient surges during the response phase. According to Hick et al in 2004, the concept of accommodating patient surges does not only concern itself with physical space adequacy but also with the organizational structure and a cooperative culture on the part of all social agents, medical and paramedical staff and logistical supply support [28]. An example of such a functional mass case management system is the “Medical and Health incident Management System” [29].

The implementation of the plans for admission and handling of mass casualties starts on receipt of notification-information of a mass casualty event. Especially when it comes to victims caught up in chemical events and explosions, they are expected to arrive at hospital-based Emergency Departments (EDs) within the first six hours [30]. What is called for is an immediate evacuation of EDs through an expedited procedure of patient transfer, especially of ambulant patients. Scheduled admissions and surgical operations will be canceled. Depending on the incident, more space for triage purposes may be required, particularly if the EDs' resources are being depleted by sheer patient volume [31]. The clinically stable inpatients should be discharged as soon as the incident management plan gets under way. Any space available for treatment should be made readily exploitable. Given the limited availability of resources and logistical backup stock, it is extremely difficult to maintain the maximum healthcare standards, especially when they concern isolation and emergency care. This is the kind of situation that calls for resourceful uses of low-tech solutions, as for example when making use of pulse oximeters and simple oxygen supply breathing apparatuses even in areas not intended for treatment such as meeting rooms. [32,33].

However, healthcare is provided not only in organized hospital facilities but also on the scene of a catastrophic event, where the Triage process becomes a matter of particular importance and value. But first, the role of medical and healthcare workers must be clarified. It is arbitrarily assumed that doctors and nursing staff should be present on the scene of a disaster in order to provide immediate medical care to victims. The truth is, medical and healthcare workers are more effective when performing actions familiar to them. Therefore, their positioning within hospitals is more advantageous and efficient. The scene of an incident is not an ED doctor's natural setting, considering that it presents special challenges and requires specialised training. The essence of the practice of triage lies in its basic principle, which is none other than the possibility of survival by making use of the resources available at the time. Proper triage is the most critical course of action on the scene of a disaster. Healthcare staff should realise that, in such cases, the philosophy of nursing is differentiated from its classic form. The instinctive need for overtriage may prove harmful, as the available resources must be distributed based on the principle of more care for the largest possible number of victims [34,35].

In a 1994 paper concerning the effectiveness of triage process training in an effort to use such processes to categorise and channel mass casualties under environmental conditions of varying degrees of difficulty, Gonzalez et al conclude the following: By attending a theory session followed by a hands-on practice session, acceptable levels of effective triage can be obtained, with environmental conditions serving as a variable that eventually affects the effectiveness of the method, thus necessitating further training [35]. In 2011, Casagrande et al suggest a new nuclear disaster triage model, known as MORTT (Model of Resource and Time-Based Triage) [36], which is differentiated from conventional ones such as START (Simple Triage and Rapid Treatment) [37] by defining the effect on survival depending on the severity and type of injury. Through the use of this model it was ascertained that in a limited-resource setting, prioritising medium severity – but still life-threatening – injuries ahead of others of critical severity helps save more lives and reduces the demands for intensive care.

3.7 Training in Mass Casualties Management

Lennquist, in a 2005 article, defined Disaster Medicine training as the science of analysing and developing the required methodology for the management of situations where available resources are insufficient for the healthcare emergency in hand. Therefore, in the context of effective preparedness of the health system, the knowledge and skills of classic healthcare are inadequate and need enhancement in order to meet the perceived needs. Specialized training is required to meet the unique requirements of mass casualties. The aforementioned criticises the many existing training systems for disregarding the actual time parameter for various actions. His golden rule for such training was the avoidance of such simulations if time frames could not be realistic [38].

Despite the existence of many quality international training courses in disaster medicine (WHO International Diploma in Vulnerability Reduction and Emergency preparedness, European Master Program in Disaster Medicine, Major Incident Medical Management and Support, Emergotrain System, Disaster Medicine Online) [39-42], in surveys conducted in order to establish the competence of future doctors' training in disaster medicine, the organisation and pursuit of such programs were found wanting. [43, 44].

This very fact is reflected in the health system as a whole and even more so in hospitals. Studies into the degree of hospital preparedness to manage mass casualties in the United States of America and the United Kingdom found that, despite the fact that operational plans did exist (mostly on paper), in terms of organisation there was no complete picture of an acceptable level of preparedness. The difficulties found mainly concerned communications, logistics and effective cooperation among sociopolitical agents [45-47].

In a recent article by Pesiridis et al (2014) aiming at development, implementation and evaluation of an educational program for nurses regarding the provision of health care during disasters, a randomised controlled trial, using Switching Replications design, was conducted for the evaluation of the programme. 207 hospital-based nurses were randomly assigned into intervention (n = 112) and original control (n = 95) groups. Changes between groups and over time were measured by questionnaire and used as the outcome measure to demonstrate effectiveness of the training intervention. The intervention improved nurses' knowledge and self-confidence levels while no significant changes were detected in behavioral intentions. A significant increase in the mean knowledge score was observed in both groups in times 2 and 3 compared to time 1 [pre-test: 6.43 (2.8); post-test: 16.49 (1.7); follow-up test: 13.5 (2.8)], ($P < 0.002$). Changes in knowledge between intervention and control group were significantly different ($P < 0.001$) with a large effect size (eta-squared = 0.8). The training programme was feasible and effective in improving nurses' knowledge concerning disaster response [48].

3.8 Health Service Assistance in the Recovery Phase

The literature concerning this stage of management was generally limited. References were mainly restricted to the management of mental health problems and the prevention of post-traumatic stress disorders. The importance of integrating psychosocial care into management response and of the effective cooperation between medical doctors and mental health professionals are specially noted. In 2007, Hobfoll et al in particular suggested the use of guidelines based on five principles, promoting: a sense of safety, calming, a sense of self-and community efficacy, connectedness and hope [49].

Table 1: Articles referred to health management of massive casualties in four categories of the present systematic review

Authors – year of publication	Title	Journal/Organization/ website	Country	Criteria for inclusion / exclusion	Thematic category based on current review	Method of study	Research type used in study	Main outcome	Relation to medical intervention
Fink S (1986)	Crisis Management-Planning for the inevitable	Amacom/ i Universe, Inc.	USA		Crisis Management		Primary	Crisis stage analysis and planning	
Alevantis P (1999)	Training Workshops, Major Incident Medicine, Overview Of Methods And Practices In European Union Member States	The National Emergency Planning Research Institute	France		Life cycle-elements of Disaster Management operations		Systematic Review		
National Audit Office-UK (2002)	Facing the challenge: NHS emergency planning in England	National Audit Office http://www.nao.gov.uk	United Kingdom		Health Unit Organization-Preparedness	Questionnaire use	Systematic review of emergency planning, correlation between practices in other countries	Health services' response capacity needs replanning	
CDC (Department of health and human services, Centers for Disease Control and Prevention) 2011	Public Health Emergency Response guide for state, local and tribal public health directors, version 1.0	CDC emergency preparedness and response, http://www.bt.cdc.gov	USA	Only data concerning management in acute crisis phase	Health services' response in acute disaster phase	Guidelines to management of acute disaster phase		Need for use of programs and action plans by local and national social agents	Healthcare staff and other Health services' cooperation in crisis management urgent interventions
N. Altay, W.G. Green III (2006)	OR/MS research in disaster operations management	European Journal of Operational Research	USA	Literature on emergency response to major disasters not to routine emergencies	Disaster management	Database research using key-words	Systematic review	Disaster management field is fast evolving and effectiveness depends on improving preparednesss and speed of response	
Economou, A. (2004)	The compound Poisson immigration process subject to binomial catastrophes	Journal of Applied Probability	Greece	Population survival-development models in minor catastrophic events	Probabilistic models of impact on population in catastrophic events	Application of the compound Poisson process in population movement	Primary	Creation of algorithm to calculate a person's chances of survival in a minor catastrophe	

Economou, A., Fakinos, D. (2003)	A continuous-time Markov chain under the influence of a regulating point process and applications in stochastic models with catastrophes	European Journal of Operational Research	Greece		Stochastic models in catastrophic events	Application of continuous-time Markov chain	Primary	Probabilistic disaster model	
Nikolopoulos, C.V., Tzanetis, D.E., (2003)	A model for housing allocation of a homeless population due to a natural disaster. Nonlinear Analysis	Real World Applications	Greece	Details of earthquake in Athens in 1999	Probabilistic models in catastrophic events	Application of a nonlinear system of differential equations	Primary	Creation of a probabilistic model for homeless population transfer after disasters	
Zografos, K.G., Douligeris, C., Tsoumpas, P., (1998)	An integrated framework for managing emergency-response logistics: The case of the electric utility companies	IEEE Transactions on Engineering Management	Greece		Analysis methods of emergency management	Application of system for urgent restoration of damage to electric grid	Primary	Proposed system for support to strategic planning for restoration of electricity failures	
Noji E. (1996)	Disaster epidemiology	Emerg Med Clin North Am	USA		Disaster epidemiology		Systematic review	Usefulness of epidemiological knowledge of disaster morbidity and mortality rates	
Waeckerle J. (1991)	Disaster planning and response	N Eng J Med	USA		Health unit organization & preparedness	Bibliographical overview of disaster planning for health services	Bibliographical review	Healthcare community must have action plans in place in case of mass casualties	Triage Training
Barbarosoglu G., Arda Y. (2004)	A two-stage stochastic programming framework for transportation planning in disaster response	Journal of the Operational Research Society	Turkey		Emergency operational planning	Evaluation of stochastic programming model for first aid material transportation planning	Primary	Creation of stochastic model to serve as decision-making tool on the basis of asymmetrical information	
Filolia et al (2005)	Total management system of crisis and human factor	Economic Library	Greece		Disaster management		Book		
Xingming Li, Jianshi Huang, Hui Zhang (2008)	The regulations on Emergency Public Health Events	BMC Public Health	China	Secondary and tertiary care hospitals answering <50% of the questions	Health unit organization-preparedness	Use of weighted questionnaire in 400 hospitals	Primary with questionnaire use	Hospital preparedness still at beginner's level	
Kavazis (2011)	Application of statistical control of techniques in bio- surveillance	University of Piraeus	Greece	Significance of biosurveillance		Thesis	Statistical control value of epidemic detection process		

Tufekci, S., Wallace, W.A. (1998)	The emerging area of emergency management and engineering	IEEE Transactions on Engineering Management	USA		Emergency operational planning		Primary	Need for existence of emergency response plans using modern computer technology and analytical models	
Green, W.G., III, (2002)	Four phases of emergency management	Electronic Encyclopedia of Civil Defense and Emergency Management.	USA		Emergency management.	Data from risk management plans of US government bodies	Systematic review	4 phase- analysis of crisis	
Chung S, Shannon M. (2005)	Hospital planning for acts of terrorism and other public health emergencies involving children	Arch Dis Child	USA	Bioterrorism consequences on pediatric patients	Health unit organization-preparedness – biosurveillance	Systematic review-use of syndromic surveillance model		Biosurveillance use is also significant in pediatric population to detect bioterrorism	
Snyder J.W. (2003)	Role of the Hospital-Based Microbiology Laboratory in Preparation for and Response to a Bioterrorism Event	Journal Of Clinical Microbiology,	USA	Use of data from microbiological laboratories	Importance of biosurveillance		Systematic review	Importance of biosurveillance means	
Carreno M.L., Cardona O.D., Barbat A. (2007)	A disaster risk management performance index.	Nat Hazards	Spain		Risk analysis methods	Vulnerability and risk indicators	Primary	Development of risk management index	
Quarantelli, E.L. (1982)	Ten Research-derived Principles of Disaster Planning	Disaster management	USA		Elements of disaster management operations	Preparation of 10 guidelines	Primary	Guidelines for preparation of planning processes for all types of casualties	
Rockett, J.D. (1994)	A Constructive Critique of United Kingdom Emergency Planning	*Disaster Prevention and Management*	United Kingdom		Elements of disaster management operations	Preparation of 19 guidelines	Primary	Guidelines for emergency disaster management.	
Alexander, D.E. (2003)	Towards the Development of Standards in Emergency Management Training and Education	*Disaster Prevention and Management*	United Kingdom		Training in management of disaster operation planning	Review of civil protection principles	Systematic review	Presentation of standard for civil protection and training on it	
Perry R., Lindell M. (2003)	Preparedness for Emergency Response: Guidelines for the Emergency Planning Process	*Disasters*	USA		Emergency operational planning	Bibliographical review of disaster management guidelines	Systematic review	Presentation of 10 different types of guidelines, applicable to all types of disasters	
Uscher-Pines L., Bookbinder S., Miro S., Burke T. (2007)	From Bioterrorism Exercise to Real-life Public Health Crisis: Lessons for Emergency Hotline Operations	*J Public Health Management Practice*	USA		Crisis management	Telephone records-data analysis and quality observation-feedback through interviews	Primary	Needs for improvement of emergency communication means in mass casualties	

Helferich O.K., Cook, R.L. (2002)	Securing the Supply Chain: Management Report	CLM Publications, Oak Brook	USA		Emergency operational planning	Analysis of completion and effectiveness degree in supply chain plans	Conventional data analysis		
Hale T., Moberg Ch. (2005)	Improving supply chain disaster Preparedness. A decision process for secure site location	International Journal of Physical Distribution & Logistics Management	USA		Emergency operational planning	Use of 5-stage disaster management process to create secure site locations for supply chain	Systematic review	Secure site locations for supply chain are necessary	
Hick J. et al (2004)	Health Care Facility and Community Strategies for Patient Care Surge Capacity	Ann Emerg Med	USA		Health unit organization-preparedness	Plan analysis for mass casualty reception and management	Systematic review		ED organization and triage-procurement of first aid naterials
Barbera J, Macintyre A. (2003)	Medical and health incident management system: a comprehensive functional system description for mass casualty medical and health incident management	[George Washington University Institute for Crisis, Disaster, and Risk Management Web site]. Available at: http://www.gwu.edu/;icdrm	USA		Emergency operational planning	Development of operational model of response to mass casualties	Primary		
Greenberg MI, Hendrickson RG.(2003)	CIMERC: Drexel University Emergency Department Terrorism Preparedness Consensus Panel: report of the CIMERC/Drexel University Emergency Department Terrorism Preparedness Consensus Panel	Acad Emerg Med	USA	Mass patient arrivals at EDs after catastrophic events	Emergency operational planning, health unit organization-preparedness	Expert suggestions for development of EDs with the least possible response preparedness in mass casualty cases		Issue of unified directive for ED preparation for mass casualty cases.	
Schultz CH, Mothershead JL, Field M. (2002)	Bioterrorism preparedness, I: the emergency department and hospital.	Emerg Med Clin North Am.	USA		Health unit organization preparedness.		Systematic review	Necessity for existence of workable action plan for ED staff in bioterrorism incidents	
Viccellio P.(2003)	ED overcrowding: right diagnosis, wrong etiology, no treatment.	EM News	USA		Health unit organization-preparedness.	Bibliographical review	Bibliographical review	Existence of plan for bed & common rooms modification is necessary for the reception of large numbers of patients	
Waeckerle J.(1991)	Disaster planning and response	*N Eng J Med*	USA		Health unit organization-preparedness.	General principles of disaster management planning	Systematic review	Proper triage on the basis of realistic chances of survival	Triage

Frykberg E. (2002)	Medical Management of Disasters and Mass Casualties From Terrorist Bombings: How Can We Cope?	The Journal of Trauma, Injury, Infection, and Critical Care	USA		Mass casualty management-Health unit organization-preparedness.	Bibliographical review of terrorist act impact	Systematic review	Need for existence of effective action plans for mass casualty management	
Gonzalez A.P. et al.(1994)	The triage in disaster medicine: analysis of a practical exercise	Rev Sanid Hig Publica	Spain		Training in mass casualty management	Preparation of 25 pairs of doctor-nurses in triage processes and assessment– comparative training assessment	Primary	Efficiency in successful triage depends on training, albeit fast-paced	Triage
Casagrande R.(2011)	Using the Model of Resource and Time-Based Triage(MORTT) to Guide Scarce Resource Allocation in the Aftermath of a Nuclear Detonation	Disaster Med Public Health Preparedness (2011)	USA		Training in mass casualty management	Development of triage model on the basis of surviving time frames and materials stock	Primary	MORTT is effective in prioritizing rescue decisions in Mass Casualty cases	
Benson M, Koenig KL, Schultz CH. (1996)	Disaster triage: START, then SAVE, a new method of dynamic triage for victims of a catastrophic earthquake	Prehosp Disaster Med	USA		Training in mass casualty management	Development of a dynamic triage system	Primary	Dynamic triage system is more effective in unfolding disasters	
Lennquist S. (2005)	Education And Training In Disaster Medicine.	Scandinavian Journal of Surgery	Sweden		Training in mass casualty management	Comparative assessment of triage and mass casualty management methods	Systematic review		Triage
Dubouloz M. (2003)	WHO International Diploma Course in vulnerability reduction and emergency preparedness.	J Dis Med	Sweden		Training in mass casualty management	Development of training program in disaster medicine planning	Primary	Successful coverage in disaster management	
Debacker M, Delooz H, Dellacorte F. (2003)	The European Master Program in disaster medicine.	Int J Dis Med	Belgium-Italy		Training in mass casualty management	European Master in Disaster Medicine (EMDM) program analysis	Primary	EMDM program achieves high scores in evaluation	
Hodgetts T. (2003)	Major medical incident management training: A systematic international approach.	Int J Dis Med	United Kingdom		Training in mass casualty management	Major Incident Medical Management and Support (MIMMS) program analysis	Primary	MIMMS program achieves high scores in evaluation	

A. Lund, K. Lam, P. Parks (2002)	Disaster Medicine Online: evaluation of an online, modular, interactive, asynchronous curriculum.	Disaster Medicine Subsection, Division of Emergency Medicine, University of Alberta, Edmonton, Alta	Canada		Training in mass casualty management	Disaster Medicine Online (DMO) program analysis	Primary		
Kaiser H.E. et al. (2009)	Perspectives of future physicans on disaster medicine and public health preparedness: challenges of building a capable and sustainable auxiliary medical workforce.	Disaster Med Public Health Prep	USA		Training in mass casualty management	Internet research	Primary	Insufficient mass casualty training in US Medical schools	
S N Madge, J P Kersey, G Murray, J R Murray (2004)	Are we training junior doctors to respond to major incidents? A survey of doctors in the Wessex region	Emerg Med J	United Kingdom	New doctors' participation	Health unit organization-preparedness.	Questionnaire via telephone among 6 doctor specialties in 11 hospitals	Primary	Lack of knowledge and role assumption in mass disaster cases	
Wetter D.C., Daniell W.E., Treser C. D. (2001)	Hospital Preparedness for Victims of Chemical or Biological Terrorism.	Am J Public Health	USA	Questionnaire in EDs	Health unit organization - preparedness.	Questionnaire in 224 EDs in 4 states	Primary	EDs are not adequately prepared for mass casualty management	
Wong K (2006)	Preparation for the next major incident: are we ready?	Emerg Med J	USA	Questionnaire to specializing doctors	Health unit organization-preparedness.	Questionnaire to specializing doctors	Primary	EDs are not adequately prepared for mass casualty management	
Ruzek JL, Young BH, Cordova MJ, FlynnBW (2004)	Integration of disaster mental health services with emergency medicine.	Prehosp Disaster Med	USA		Health service assistance in the recovery phase	Bibliographical review	Systematic review	Mental health casualties should be an integral part of emergency medicine	
Hobfoll SE et al. (2007)	Five essential elements of immediate and mid-term mass trauma intervention: empirical evidence	Psychiatry	USA		Health service assistance in the recovery phase	Guidelines based on evidence	Primary	5 basic empirical principles for prevention and management of post-traumatic syndromes	
Pesiridis et al (2014)	Development, Implementation and evaluation of a disaster training program for nurses: a Switching Replications randomized controlled trial.	Nurs Edu Pract	Greece	Questionnaire & intervention	Training in management of massive casualties	RCT	Primary		Yes
Pesiridis et al (2011)	Nursing students' perceptions of disaster nursing: implications for curricula development.	Nursing care and research	Greece	Questionnaire & intervention	Training in management of massive casualties	RCT	Primary		Yes
Pesiridis et al (2013)	Investigation of nurses knowledge and the factors affecting it regarding the provision of care during disasters	Nosileftiki	Greece	Questionnaire & intervention	Training in management of massive casualties	RCT	Primary		Yes

Pesiridis T. (2013)	Evaluation of the effectiveness of an educational program for nurses in disaster nursing	PhD Thesis National & Kapodistrian	Greece	Questionnaire & intervention	Training in management of massive casualties	RCT	Primary		Yes

4 Discussion and Conclusion

Summing up this review, we could conclude that when the health system is called upon to manage critical and catastrophic events, there is no differentiation in crisis management from any other organisation. Perhaps the situation is even more difficult for healthcare services, considering the very tight time windows before they are completely overrun by casualties and by the rapid depletion of supplies and services. Especially these days, when there is a growing tendency for finances and available resources to be limited, the temptation to deprioritise disaster organisation and preparation looms large.

The peculiarity of the nature of disasters does not allow for safely programming each and every need and essentially enables preparation but never complete preparedness. The services involved can only use probabilistic rather than deterministic models, which denotes the utmost significance of proper and adequate planning that includes all sociopolitical agencies. The science of organisational Leadership provides some significant principles related to the organisation and implementation of such planning. What must be understood is that the mere existence of plans does not tie in with realistic preparedness. The cornerstone of success in mass casualty management is the assisting participation of all the agencies involved set against a well-organized background of understanding, admin support, communications, cooperation and reevaluation of institutions and procedures.

Health services, by virtue of the nature of their objective, are always called upon to play a leading role in any catastrophic event. Thus they need to integrate and effectively implement disaster management plans. Seeing that the classic model of medicine that is doctor-based and relies on the sufficiency of materials, resources and time is doomed to fail in such circumstances, the need for special training conforming to hypothetical scenarios, but with a realistic use or resources, is easily understood. However, mere training is not enough. What is needed is regular retraining so that competence can be ensured. Perhaps, if healthcare management in mass disaster cases were to be represented in the academic arena, it could be substantially aided in achieving its actual goals.

Crises have damaged and will continue to damage societies and economies. As there is no method that lends itself to the prediction of most of them, prevention and preparation remain the only route if the socioeconomic balance is to be restored.

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