Literature Review on Medical Incident Command

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Conflicts of interest: none

Keywords: Emergency Medical Services; leadership; mass-casualty incident; rescue work; review

Abbreviations:
EMS: Emergency Medical System
HRO: high-reliability organization
ICS: incident command system

Received: July 9, 2014
Revised: November 12, 2014
Accepted: November 21, 2014

doi:10.1017/S1049023X15000035

Online publication: February 9, 2015

Abstract

Introduction: It is not known what constitutes the optimal emergency management system, nor is there a consensus on how effectiveness and efficiency in emergency response should be measured or evaluated. Literature on the role and tasks of commanders in the prehospital emergency services in the setting of mass-casualty incidents has not been summarized and published.

Problem: This comprehensive literature review addresses some of the needs for future research in emergency management through three research questions: (1) What are the basic assumptions underlying incident command systems (ICSs)? (2) What are the tasks of ambulance and medical commanders in the field? And (3) How can field commanders' performances be measured and assessed?

Methods: A systematic literature search in MEDLINE, PubMed, PsycINFO, Embase, Cochrane Central Register of Controlled Trials, Cochrane Library, ISI Web of Science, Scopus, International Security & Counter Terrorism Reference Center, Current Controlled Trials, and PROSPERO covering January 1, 1990 through March 1, 2014 was conducted. Reference lists of included literature were hand searched. Included papers were analyzed using Framework synthesis.

Results: The literature search identified 6,049 unique records, of which, 76 articles and books where included in qualitative synthesis. Most ICSs are described commonly as hierarchical, bureaucratic, and based on military principles. These assumptions are contested strongly, as is the applicability of such systems. Linking of the chains of command in cooperating agencies is a basic difficulty. Incident command systems are flexible in the sense that the organization may be expanded as needed. Commanders may command by direction, by planning, or by influence. Commanders' tasks may be summarized as: conducting scene assessment, developing an action plan, distributing resources, monitoring operations, and making decisions. There is considerable variation between authors in nomenclature and what tasks are included or highlighted. There are no widely acknowledged measurement tools of commanders' performances, though several performance indicators have been suggested.

Conclusion: The competence and experience of the commanders, upon which an efficient ICS has to rely, cannot be compensated significantly by plans and procedures, or even by guidance from superior organizational elements such as coordination centers. This study finds that neither a certain system or structure, or a specific set of plans, are better than others, nor can it conclude what system prerequisites are necessary or sufficient for efficient incident management. Commanders need to be sure about their authority, responsibility, and the functional demands posed upon them.

Rimstad R, Braut GS. Literature review on medical incident command. *Prehosp Disaster Med.* 2015;30(2):205-215.

Introduction

Based on interviews with United Kingdom stakeholders, Lee et al have highlighted four themes in emergency management in need of future research: knowledge base for emergency management, social and behavioral issues, organizational issues in emergencies, and an emergency management system.[1] This comprehensive literature review addresses some of these needs through three research questions: (1) What are the basic assumptions underlying incident command systems (ICSs)? (2) What are the tasks of ambulance and medical commanders in the field? And (3) How can field commanders' performances be measured and assessed?

The review focuses on in-the-field commanders in prehospital emergency services in the setting of mass-casualty incidents. Themes pertaining incident command in a control

room setting, on a regional level, or on a national level are omitted. Research Question 1 does, however, also include elements from the broader discussion on ICSs, in which the medical and ambulance commanders play their part.

The terms "command" and "commander," and nomenclature from the American ICS and the European Major Incident Medical Management and Support course, will generally be used in this review, except where conflicting terms from the cited literature are used to highlight differences.[2-3] This does not mean that the authors favor these systems over others, and this does not imply that command, control, leadership, or coordination are basically different processes.

A strain of debate concerns the appropriateness of centralization of decision making and leadership in emergencies. Incident command systems typically centralize command temporarily, but critiques argue for decentralization and decision making on the level of experts in the field.[4] Comfort criticizes the national ICS for being too rigid and rule-bound, and for not being capable of meeting requirements of flexibility and the ability to change.[5] Dynes goes as far as stating: "To create an artificial emergency-specific authority structure is neither possible nor effective."[6] Neal and Phillips challenge the command and control advocates to build "a larger database that supports the command and control assumptions," using more rigorous research methodology.[7]

Quarantelli comments that successful disaster management results from organizational activity and not from planning.[8] There is also controversy on the value of planning versus plans. Lee et al identified a further set of seemingly conflicting organizational issues: "flexible versus standardized procedures, top-down versus bottom-up engagement, generic versus specific planning, and reactive versus proactive approaches to emergencies."[1] Dynes claims that emergency planning in the US has been based on a view of "emergencies as extensions of 'enemy attack' scenarios," assuming social chaos as a dependent consequence and a military-style command and control intervention as the only remedy.[6] In contrast, Helsloot and Ruitenberg observed that "citizens often prove to be the most effective kind of emergency personnel."[9] Drabek advocates "coordination and supervision" as more appropriate than "command and control."[10] Neal draws a picture of the command and control model and the emergent human resources model as "opposite ends of a continuum on managing disasters," and comments that disasters are new experiences to individuals and societies, and therefore, foster emergent norms.[7]

Smith has presented a comprehensive, phenomenological study of the US National Incident Management System based on interviews with commanders with experience from working inside this system.[11] In that study, seven themes were identified as crucial for the understanding of command and control of multi-agency disaster response operations: experience, trust, preparedness, organization, leadership, vision, and communication.

An emergency management system must be based on available resources and competence. Prehospital emergency health services differ between countries and regions, and so do emergency management systems. Baker et al contrast the US system based on paramedics to a European tradition of bringing physicians to the street and a subsequent focus on on-site stabilization as opposed to scoop-and-run.[12] It is not known what constitutes the optimal emergency management system, nor is there a consensus on how effectiveness and efficiency in emergency response should be measured or evaluated.[1] From a study of unsuccessful cases of emergency management, using a cultural dimension framework, Tsai and Chi found that directly implanting foreign practices would not always work.[13] A review of strategies to optimize resource management in mass-casualty events found that evidence was insufficient to conclude in most cases, and that field triage systems do not "perform consistently during actual mass-casualty events."[14] Presuming that the overall goal of emergency management is to save lives, Askhenazi et al stress that only a minor portion of casualties suffer from actual life-threatening injuries, and that these individuals must be identified and receive necessary care in time.[15] Bayram and Zuabi point out a controversy in the literature on the assumption that shorter prehospital time will give better outcomes, but confirms that this commonly is a basic premise in emergency medical systems.[16]

Crisis research reaches far and wide and cannot be considered a specific subject with a separate scientific basis. A myriad of arts and sciences are relevant to cast light on these issues, and researchers from different disciplines draw on their professional backgrounds. Comfort discusses intergovernmental crisis management as a "complex, adaptive system."[5] Berlin and Carlstöm found that actual work collaboration between agencies was "practiced to a relatively small degree" in an otherwise coordinated rescue effort, and that "repeated and well-known behavior" was preferred.[17] Amram et al presented the development of a decision support model, adding to a bulk of information and communication technology research.[18] Bearman and Bremner have probed the field of strategies to mitigate pressures and errors on the part of incident commanders.[19] Houghton et al suggest social network analysis as a valuable tool in the study of command.[20]

The nature of emergencies casts methodological challenges on the scientific development of emergency management and disaster medicine, which has been labeled a descriptive discipline.[21] Sudden and unpredictable onset, involving a multitude of actors, makes it difficult to plan and conduct research according to predefined protocols. Randomized controlled trials seem extremely difficult to set up. Case studies and non-scientific reports constitute a considerable portion of published material. Buchanan and Denyer state that the research field is fragmented and characterized by "epistemological pluralism," and claim that crisis research is "a domain in which realist-positivist and constructivist-interpretive ontologies must cohabit."[4] Most emergency service personnel represent professions with little academic tradition. Practitioners tend to value expertise based on practical experience and treats expertise as evidence.[1] Scholars prefer published and peer-reviewed material. Journal editors' resistance against case reports may represent a publication bias, and the peer-reviewed format might discourage contributors from the emergency and rescue professions. The following review, therefore, includes both peer-reviewed and non-peer-reviewed material.

Methods

A systematic literature search was conducted in the databases MEDLINE (Medline Industries, Inc; Mundelein, Illinois USA), PubMed (National Center for Biotechnology Information; Bethesda, Maryland USA), PsycINFO (American Psychological Association; Washington DC, USA), Embase (Elsevier; Amsterdam, Netherlands), Cochrane Central Register of Controlled Trials (The Cochrane Collaboration; Oxford, United Kingdom),

Cochrane Library (The Cochrane Collaboration; Oxford, United Kingdom), ISI Web of Science (Thomson Reuters; New York, New York USA), Scopus (Elsevier; Amsterdam, Netherlands), International Security & Counter Terrorism Reference Center (EBSCO Information Services; Ipswich, Massachusetts USA), Current Controlled Trials (BioMed Central; London, United Kingdom), and PROSPERO (University of York; York, United Kingdom) covering the period up to March 1, 2014. The search was pre-planned with an aim of seeking all available studies.

The MEDLINE search is described in Table 1, and the total database search is presented in Supplementary Material 1 (available online only).

Screening and eligibility assessment included literature containing descriptions or discussions of on-scene incident command, incident commanders, systems of incident management, and/or descriptions of major incident emergency response operations. Linguistic equivalents of command, commander, and management were also included (eg, coordination and leader).

There were no limitations in research method or format of publication. Inclusion was not restricted to literature pertaining to the health services. Records published before January 1, 1990, or not in English, Norwegian, Swedish, or Danish languages, were excluded. Literature restricted to an in-hospital, control room, regional, national, or community-wide setting was excluded, as was literature restricted to psychological consequences or interventions. One reviewer screened titles of all records from the database search, and then the abstracts of all records not excluded by title. Records were tracked using EndNote Version X6 (Thomson Reuters; Philadelphia, Pennsylvania USA). Records with no available abstract were included for full-text eligibility appraisal. The same reviewer hand searched reference lists of literature included for synthesis using the same inclusion and exclusion criteria, except that literature published before 1990 was also included. The cycle of screening, eligibility, and quality assessment was repeated until no new eligible articles were found.

Both reviewers assessed full-text articles and books independently. Consensus was reached, which made the planned use of a third party in case of disagreement unnecessary. Eligible full-text items were appraised for quality with weight on relevance to the research questions. No predefined appraisal tools were used. Papers were excluded if they did not discuss the research questions, as such, not implying lack of scientific quality in a broader sense. With the aim of a configurative synthesis, epistemic criteria like research design and methods used were given little weight on appraisal. Non-peer-reviewed articles and books were not excluded.

The full text of included papers and the relevant chapters of included books were then analyzed using Framework synthesis as described by Gough et al.[22] The initial conceptual framework was the three research questions themselves. Data related to each research question were extracted as citations and organized in a word processor document using Microsoft Word Version 2013 (Microsoft; Redmond, Washington USA). Key themes were identified and used to code the extracted citations. The US Department of Homeland Security's (Washington DC, USA) listing of management characteristics of the ICS (Supplementary Material 2; available online only) was used as a pragmatic starting point to code and sort the section on basic assumptions.[2] Coding was altered as new key themes emerged in the analysis process.

Reporting has been conducted using the ENTREQ checklist for enhancing transparency in reporting the synthesis of qualitative research.[23]

1	((incident* adj2 command*) or incident management or incident medical management or nims or mimms).ti,ab.
2	(prehospital* or pre-hospital* or out-of-hospital* or site* or onsite* or scen* or (field adj (command* or leader* or physician* or officer* or supervis* or co-ordinat* or coordinat* or operat* or experienc* or trauma* or triage))).ti,ab.
3	manpower.fs. or Emergency Responders/ or Emergency Medical Technicians/ or *Firefighters/ or *Police/ or *Health Personnel/ or *Allied Health Personnel/ or *Medical Staff/ or *Nurses/ or *Nursing Staff/ or Physician Executives/ or Physicians/ or *Military Personnel/ or Professional Role/ or Physician's Role/ or *Civil Defense/ or *Patient Care Team/ or Physician's Practice Patterns/ or (physician* or paramedic* or (emergency adj technician*) or (team adj leader*) or (medical adj (command* or staff or team*)) or commander* or (command* adj1 staff) or (area adj command*) or (unified adj command*) or (first adj responder*)).ti,ab.
4	leadership/ or Organization & Administration.fs. or Standards.fs. or (command* or preparedness or readiness or co-ordinat* or coordinat* or operat* or lead* or delegat* or role* or duty or duties or task*).hw,ti,ab. or patient navigation/ or decision.hw. or (organiz* or organis* or function or instruct* or administrat* or manage* or communicat* or allocat*).ti.
5	1 or (2 and 3 and 4)
6	Disasters/ or Disaster Planning/ or Disaster Medicine/ or Terrorism/ or Bioterrorism/ or Chemical Terrorism/ or Emergency Medical Service Communication Systems/ or Emergency Medical Services/ or Emergencies/ or Emergency Medicine/ or Emergency Treatment/ or Evidence-Based Emergency Medicine/ or Traumatology/ or Advanced Trauma Life Support Care/ or *First Aid/ or *Rescue Work/ or (disaster* or ((mass* or major or multiple) adj1 (casualt* or accident* or incident* or fatalit* or emergen* or trauma* or injur* or catastrop*))).ti,ab.
7	5 and 6
8	*Disaster Planning/og, st [Organization & Administration, Standards]
9	*Emergency Medical Services/og, st [Organization & Administration, Standards]
10	*Professional Role/ or *Physician's Role/ or *Physicians/ or command*.ti,ab.
11	(8 or 9) and 10
12	7 or 11
13	limit 12 to yr = "1990 -Current"
14	limit 13 to (danish or english or norwegian or swedish)

Table 1. MEDLINE Search

Results

The literature search identified 6,049 unique records, of which, 6,037 were in English (Figure 1). A total of 185 full-text articles or books were assessed for eligibility. Of these, 97 were off topic, as defined by the research questions. Quality appraisal excluded 12 papers (Supplementary Material 3; available online only).[24-35]

https://doi.org/10.1017/S1049023X15000035 Published online by Cambridge University Press

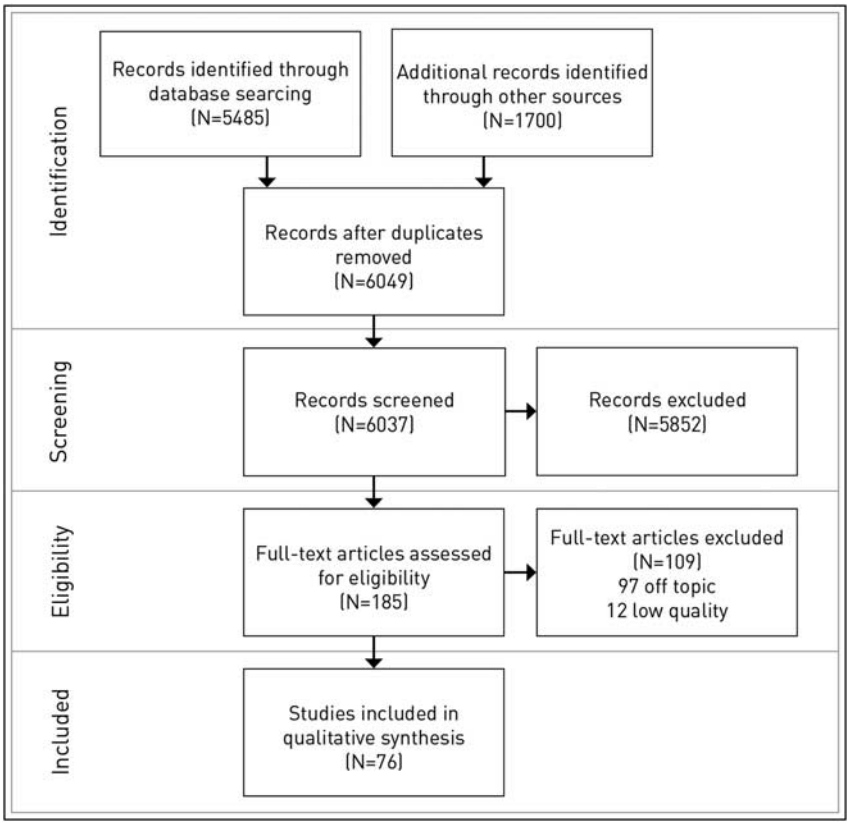

Figure 1. Flow Chart of the Inclusion Process.

Finally, 76 articles or books, henceforth both described as papers, were included in the synthesis (Supplementary Material 4; available online only).[2-3,19,21,36-107] Most of the included papers were written by authors working in North American or Western European institutions (Figure 2). The context of the papers was distributed between Emergency Medical Services (EMS), fire and rescue, military, police, and interdisciplinary (Figure 3). The amount of included material was fairly equal between peer-reviewed and non-peer-reviewed papers (Figure 3). The included papers were published between 1986 and 2014, but only seven papers were published earlier than 1997 (Figure 4).

Discussion

The discussion section is divided into three parts: one for each research question. The first part on ICSs and their basic assumptions sets out to present the American ICS and its derivatives, and similar counterparts in other parts of the world, as does a significant amount of the included papers. The section then goes on to discuss and criticize the ICS, which is a prominent theme in the peer-reviewed literature. This includes several angles of analysis, like social network governance, resilience, high-reliability organizations (HROs), complex adaptive systems, and decision-making theory.

The second part on commanders' tasks is richest in citations, both peer-reviewed and non-peer-reviewed. Many papers set out to clarify the commanders' roles through descriptions of their tasks. A myriad of expressions has been summarized, and no attempt has been made to judge which ones are the better, or to develop the nomenclature as such. This is beyond the scope of a configurative synthesis.

The third part on measuring and assessing field commanders' performances is relatively short, reflecting the scarcity of literature on this topic.

What are the Basic Assumptions Underlying Incident Command Systems?

The American ICS uses five standard, structural components: command, operations, planning, logistics, and finance/administrations,[104] which "groups similar functions into subordinate management units."[76] A key organizational feature of ICS is that it can be applied with one commander executing leadership of all functions, or expanded as required to a multi-layered organization with numerous modules,* giving organizational flexibility and adaptability.[97,99-100]

A larger organization means the commanders work more through branch leaders,[72] the competence of which affects the outcome of the operation.[93] In systems with prehospital physicians, the ambulance commander and the medical commander work as a command team, with different solutions as to who is subordinate to whom.[3,50] The modular expansion of the response organization may, to a large degree, be guided by the principle of "manageable span of control."[48,51-52,76,97,100] The number of individuals manageable by one leader is three to five,[104] ideally five,[58] or three to seven.[101] Each individual emergency response worker will have one superior, which gives a chain-of-command through the

* References: 48,51-53,58,72,76,86-87,93,107.

https://doi.org/10.1017/S1049023X15000035 Published online by Cambridge University Press

Figure 2. Geographical Distribution of Included Papers.
Number of included papers from each continent. All American papers are from countries in North America.

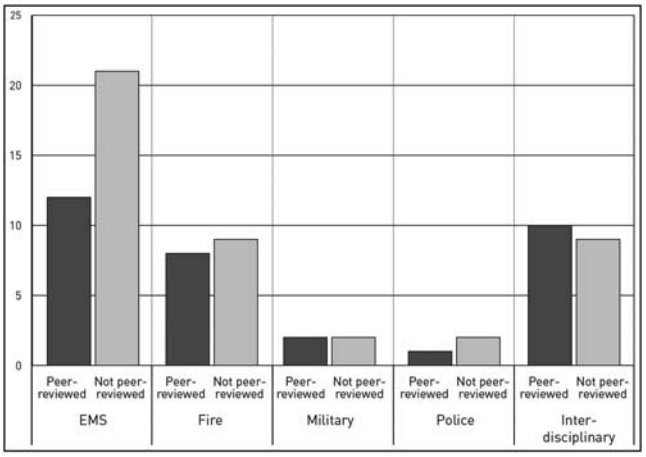

Figure 3. Characteristics of Included Papers.
The professional context of the 76 included papers included: Emergency Medical Services (33), fire and rescue (17), military (4), police (3), and interdisciplinary (19). The distribution between peer-reviewed and non-peer-reviewed papers is illustrated for each category.
Abbreviation: EMS, Emergency Medical Services.

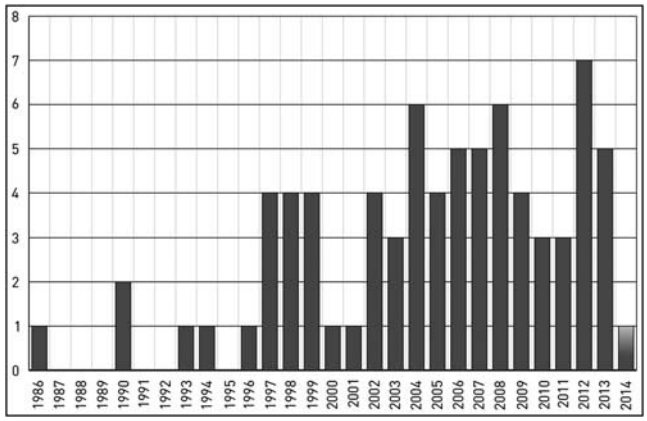

Figure 4. Year of Publication of Included Papers.

entire organization.[48,51-52,76,97,100] Without this, Morris predicts "considerable confusion and chaos, and total inefficiency."[76] Some suggest each sector commander needs an aid "to make sure actions occur according to plan and attention is paid to even the smallest of details,"[62] or to take care of radio transmissions.[83]

An organized, structured, and standardized approach to incident emergency response is considered necessary by many.[2,43,47,61,65,76] The ICS is claimed to be based on universally applicable management principles and is constructed to be applicable to all types and sizes of events and situations.[2,51-52,58,70,79] Moynihan points out there is "little empirical evidence as to whether this assumption is accurate."[77] Wenger et al discuss several problems with the ICS and stress that "there is little positive evidence from our and other research that there can be 'one model' that can be utilized in all disasters by all groups."[106] Buck et al suggest that "part of the reason for the controversy is that localized emergencies are the most common

https://doi.org/10.1017/S1049023X15000035 Published online by Cambridge University Press

responses experienced by official first responder organizations, and in these responses, ICS is useful, while scholarly writers have in mind more complex disaster occasions, a context where ICS usefulness is more questionable."[48]

From focus groups, King et al found 138 attributes that were held to distinguish effective from ineffective responders and leaders in disasters.[67] This "included knowledge, skills, attitudes, behaviors, and personal characteristics."[67] A challenge for commanders is to find the correct balance between "expression of command" and "freedom of action."[84] Stambler and Barbera found that, despite being a common claim, there was "no direct or purposeful linkage to military command models during the development of ICS."[96] The ICS is based on common terminology across agencies,[51-52,100] including, in some cases, "common terms for equipment and supplies."[48] Maniscalco and Christen comment that "some people get extremely agitated over terminology," which tends to be adjusted to locally experienced needs.[73] The tricky part of several agencies working together seems to be the linking of their agency internal chains-of-command and secure information sharing.[75] The ICS tries to solve this by a unified command structure, where commanders are joined in a command team.[51-52,54,97,100,103] Wenger et al, in contrast, find "there is little place in the ICS for inter-organizational coordination."[106] In a large-scale exercise, Helsloot found that "multidisciplinary coordination of the activities of the emergency services was limited," but noteworthy, also found that "this did not impede the effectiveness of each service's mono-disciplinary response."[64] The procedure manual of London Emergency Services Liaison Panel (London, United Kingdom) recognizes that commanders in the early stages of an operation are "fully occupied with their own sphere of activity," which will delay the formation of a coordination group.[71]

Command should be established and communicated by the first arriving units, as the first minutes are considered extremely important for setting the stage of the entire operation,[66,69,72,76,82,100,103] then possibly transferred to more-trained personnel arriving later.[48,100] Rake and Njå found that commanders generally would need a good 15 minutes to "grasp the big picture after they arrived on scene," and "did not understand the situations before the response units were in full action."[85] Commanders are expected to set objectives,[100] to "focus the response,"[47] and "create a cohesive joint tactical response."[71] It seems to be accepted that organizations must have incident response plans that are known and trained, and that an incident action plan is developed to guide the response in each case.[42,54,79,100] Some authors underscore the need to focus planning on rapid evacuation of casualties.[37,70,82]

Training and exercise are highly valued to prepare for major incidents.[44,47-48,66,79,87] Some favor the use of daily routines in incident command and recommend the use of ICS principles on the smallest of incidents to make this the daily routine.[51,55,69-70,74,81,98] A contrasting view is that incident command is a distinct discipline with its own set of specific competencies, and that the speed of transition from routine to crisis operations in an organization "is a major determinant of whether an incident will be managed effectively."[57]

An important component of the system is management and allocation of resources, including mobilization of resources and supplies.[51-52,54,91,100] Briggs foresees a lack of supplies and personnel if teams are to work outside the ICS structure.[46] Abbasi et al found that incident management teams do not focus on resource shortage and "make do with what they have available to them at the time."[36]

The ICS organizational model may be described as hierarchical[55,59] and based on bureaucratic principles.[48] The hierarchical model has been viewed positively by response practitioners who have "focused on the command and control value of ICS," and has been criticized for "lack of focus on coordination between organizations and levels of government responding to disaster."[48] Moynihan emphasizes the "network structural form" of multiple organizations in a large-scale emergency response operation, finding that "any crisis response using the ICS therefore reflects an intriguing mixture of network and hierarchy."[77] This is supported by Dudfield, pointing out that the "two models are not antithetical, although they may appear so."[53]

Abbasi et al take the social network analysis perspective, from where "simple static networks frequently perform better when they have a centralized actor as the manager and coordinator of the network; while in the case of complex and dynamic networks, decentralization can frequently yield better results" through adaptive behavior.[36] In a complex adaptive system, initiative that is distributed rather than centralized "is a source of great strength and energy for any organization, especially in times of crisis."[101] Groenendaal et al find from literature "little empirical evidence to support the assumption that frontline responders can be hierarchically controlled during the first phase of large-scale emergencies."[59]

In contrast to the general focus on getting triage right and doing things right the first time, Aylwin et al favor the resilience concept by recognizing that "over triage rates will rise when casualty clearance from a hazardous scene is the priority, and this situation must be compensated for by reducing surge and increasing surge capacity at other stages of disaster response."[41] The emergency response organization can be viewed as a HRO "able to capitalize on efficiency and control benefits of bureaucracy."[44] Owen found from ergonomic HRO research a focus on dynamic environments, complex coordination, and interdependencies.[80]

On-scene commanders must make decisions in stressful environments characterized by: "time pressure, ill-structured problems, action/feedback loops, high stakes and multiple players, and organizational goals and norms;"[102] "serious threats and requiring urgent responses;"[85] "shifting ill-defined or competing goals;"[40] factors like noise, reduced visibility, heat, and stressful responsibility;[81] "imposition of organizational norms from above" and "bottom-up pressure;"[49] and "extremely difficult decisions, characterized by ambiguous and conflicting information, shifting goals, time pressure, dynamic conditions, complex operational team structures, and poor communication and circumstances where every available course of action carry significant risk… now regarded as typical of situations requiring naturalistic decision making."[56] As opposed to analytical decision making, "where the officer must think about a number of possible courses and then select the best option," recognition-primed decision making is swift and, by practitioners, referred to as "intuition or gut feel."[81] Ash and Smallman found incident ground cues like smell, colors, sounds, and radiated heat to be "playing a key role in incident ground [decision making]." Commanders would also typically decide on one set of action, and then "re-evaluate the method of work as events unfolded."[40]

Rake and Njå observed that commanders often choose to monitor the crews' activities and make few decisions.[85] Van den

Heuvel et al's informants held that "prolonging or avoiding the decision would be the biggest mistake novices would make."[102] Flin and Arbuthnot highlight that "although it may appear that a decision has to be taken immediately, this may not be the case. The skilled… commander will be able to identify when this is the case and when it is not."[57] Commanders' decisions "are not made in a vacuum, but rather in close cooperation with the other actors on scene."[85] Helsloot further found that "the decisions of the disaster staff were no more than a confirmation of decisions taken at the scene of the disaster" due to the fact that commanders were fully occupied with tasks at hand and did not give priority to communication with off-scene staff.[64] Distributed decision making "assumes that it is impossible to understand and control all of the different and complex aspects of dynamic organizations through a centralized decision-making process," and proposes that each individual unit should make its own decisions as independently as possible within the main outlines of the overall goal.[59]

What are the Tasks of Ambulance and Medical Commanders in the Field?

A prerequisite for command is some sort of overview of the incident scene. The process of getting this overview is called a scene size-up,[58,72,107] assessment,[3,38,57,88,91] evaluation,[56-57,76,82,105] (problem) identification,[45,50,82,105] or survey.[69] Though the commander often will physically move around the incident scene to get an overview, scene assessment may be performed through the eyes and ears of the first units on scene or medical teams present.[72,82] Items or themes to be assessed may include the "nature and scope" of the incident,[58] hazards and risks,[58,105] need for mobilization and deployment of medical resources,[88] and number of patients, extent of injuries, or medical issues in general.[3,55,58,82,91] A priority concern in the emergency operation should be the safety of rescuers on scene.[†]

Scene assessment can also be seen as the ongoing process of monitoring the development of the situation.[3,107] Detailed instructions on task performance are not to be given by commanders. Commanders monitor and review operations,[50,56-57,66,76,97,101] ensuring that quality of care, and that plans and intentions, are followed.[3,50,76,79,91] Supervision is given, where needed, for execution of assigned tasks,[97,101] revision of plans may be necessary, and staff may have to be exchanged if they are not "functioning properly."[56-57,69,76]

Commanders make decisions on behalf of the whole organization. Decision making is described as immediate,[50] in the heat of the moment,[81] dynamic,[102] high-risk with life-and-death outcomes,[57] and based on incomplete information and ambiguous intelligence.[81] This is a defining task of commanders.[42,76-77,83,101] Competencies to make decisions include "the ability to assess available time and level of risk,"[81] managing personal stress,[57] and "handling multiple, demanding problems concurrently."[57] Christen and Maniscalco warn, "checklists tend to fail," and discourage attempts to reduce incident management to a matter of following checklists.[51]

Leadership of an emergency operation needs some sort of underlying idea of how the operation should be executed. This may be expressed as an incident action plan or just "plan,"[‡] strategy,[§] tactic,[73,79,95,97] level of medical ambition,[21,60,89-91] guidelines,[21,60,89-90] priorities,[39,91,95,97] tasks and activities,[73,91,95] objectives,[95] or any combinations of these. It is worth noting that one may be expected to develop a strategy, a tactic, and tasks, regardless of the definition of the level of command as tactical, operative, or otherwise. The official termination of a major incident emergency response is a queue to involved organizations and personnel to return to normal operations. This is considered a commander task.[**] The declaration of a major incident may also be the task of a commander.[3,69]

The main tools for conducting an emergency response operation are personnel, vehicles, and equipment. An emergency service commander takes the responsibility for all medical resources at the scene.[38,71,88] Where both a medical commander and ambulance commander are present, the medical commander will typically manage nurses and doctors. A considerable task for commanders is to spatially and functionally distribute or allocate available resources across the incident ground to get the job done,[††] but also to request additional or special resources and supplies, if needed.[‡‡] The balance between keeping resources at the scene and using them for patient transport is a crucial decision point.[69] The incident ground can be divided into "working regions" or "sectors," both an organizational and a spatial term.[50,82] Some functions will be tied typically to a designated area: vehicle staging,[3,74,94,103] treatment area or casualty clearing station,[3,69,71,74,93] morgue,[93] access and egress routes,[3] and ambulance loading zone.[69] Commanders must also position themselves, often at a command post or command position.[3,51-52,66,76,79,103]

With a growing number of personnel at the scene, the organization should be expanded with functional (and if needed, spatial segment) units with subordinate commanders or unit leaders.[§§] Such units may include triage,[63,74] treatment,[63,74] transport,[63,69,74] staging,[63,74] and communications.[74] Where separate unit leaders for each of these function are not needed, Christen and Maniscalco suggest delegating responsibilities for all functions to a specific subcommander, along with other functions.[51] Doctors and nurses at the scene may be delegated key roles as medical advisors to unit leaders, or function as leaders themselves.[41,88,93] Arbuthnot declares "Commanders may also need to consider whether there is a need for a… strategic level of command."[39]

Key tasks for the medical part of an emergency response operation are triage, treatment, and transport.[3,38,58,65,69,71,88] Treatment and transport to health care facilities are the mitigation activities of the health services.[45] Triage, staging, traffic control, infrastructure, and equipment are tasks aimed at supporting the mitigating functions. Commanders ought not to be involved directly in these tasks.[55] The task of commanders is to assign practical tasks to appropriate subcommanders, or individual personnel, as appropriate, based on prioritization of tasks and assessment of availability of resources.[***] With assignment of duties should follow "the delegation of authority necessary to accomplish the assignments."[78] Commanders are expected to document the course of the emergency operation, including task accomplishment, communication, and

[†] References: 3,38,50-52,58,72,74,79,91,97.
[‡] References: 42,50-53,56-58,66,78-79,93,101.
[§] References: 50,56-57,73,76,78,86,95.
[**] References: 45,50-51,56-57,68-69,71,76,105.
[††] References: 39,50-52,56-57,66,69,72,78,91,97,101.
[‡‡] References: 3,50,58,69,71-74,76,93,97.
[§§] References: 51-52,56-57,76,78,93,97.
[***] References: 3,39,57,65,72,74,76,78,95,97,105.

decisions.[42,91,93,97] Documentation provides accountability and enables post-incident audit.[52,79]

Casualties with significant trauma, or otherwise in need of hospitalization, must be distributed to the right hospital. In more remote areas, and in countries with few and larger hospitals, all patients may be distributed to just one hospital. When more than one hospital is involved, the distribution may be determined by an emergency service commander,[3,50,58,71,82,91,93] or by the medical commander or ambulance commander specifically.[38,55] Distribution criteria may be necessary hospital specialties or resources to meet the individual patient's needs,[50,55,93] each hospital's current bed availability or receiving capacity,[55,82,93] and "overall impact on the EMS system."[93] Not all hospitals have the capability to receive patients from a mass-casualty incident.[71]

Communication is another core task of commanders,[3,36,38,45,50,56-57,91] including "information management" and "gathering and analyzing information."[101,105] Information that needs to be communicated includes: the incident address or position,[74] type of event,[82] situation reports,[†††] resource requirements,[82,88] plan or strategy,[19,78-79] distribution of patients to hospitals,[88] casualty figures,[55] logistical and clinical information on individual patients,[55,88,91] task assignments and instructions,[68,101] and vulnerability and risks.[79] Liaison with collaborating agencies (police, fire and rescue, and others) through their commanders, is highlighted.[‡‡‡] Likewise, the vertical communication within the health services on- and off-scene is: dispatch/alarm/communication center or strategic level of command,[§§§] subordinate on-scene commanders,[51,78-79,93] receiving hospitals,[3,71-72] and other off-scene medical resources.[71] Emergency services commanders have an obligation to give information to media, whether this is given directly or in coordination with other agencies,[3,21,50-51,60,89-90] or is limited to "authorizing the release of information."[52]

How can Field Commanders' Performances be Measured and Assessed?

Measurement or evaluation of the commanders' efforts is difficult to conduct in a scientific way.[21,60,89] There are no widely acknowledged measurement tools or validated research instruments available.[68]

One way to approach this problem area is to use validated performance indicators.[50] A Swedish expert group has developed a set of such indicators specifically designed to evaluate prehospital command and control in multi-casualty incidents, and demonstrated its feasibility in exercises.[21,60,89-90] The indicators focus on reporting from the incident scene to the dispatch center, information sharing, and time stamps. A wider set of indicators were developed in a related Delphi process, which included more time stamps and several indicators not directly connected to the commanders' performance.[92] Locally used indicators have also been published in other European countries.[49,68] None of these seem to have been internationally recognized or adopted.

Some authors highlight the overall impression of the emergency response as a measure of its success. The response operation should be like a "perfectly conducted orchestra,"[63] "orderly and systematic,"[66] "calm a tense situation,"[66] "start, stay, and end under control,"[87] "the first responders felt satisfied about the job performed,"[85] "a good result at the same time as the people feel good,"[91] and with "overall successful resolution."[50] Indirectly, the success of the overall operation would be considered a measure of the commanders' performances. Yeager goes as far as recommending help should be called for in increments, as this "allows a smooth building" of structure.[107]

Emergency response success could further be indicated by lives saved, delivery of the best possible emergency medical care, or property conservation.[52-53,63,71,85,93,105] Rüter et al specify that the patients should not only be alive when reaching hospital, but "leave the hospital alive and without suffering complications."[91] Aylwin et al argue that the emergency response, in most cases, "can only have a minimum effect on the numbers of deaths at scene, but some reduction in immediate mortality could be achieved."[41] This further implies that most patients actually can await definitive treatment without serious complication, a point mostly ignored in the included literature.

Timeliness of transport and definitive treatment is emphasized, and different time stamps and intervals are suggested as a quality measurement: first patient transport to transport of last immediate patient,[74] and incident to last survivable patient in treatment facility.[63] The benchmark time requirement is mostly expressed as "as soon as possible,"[63,71,105] but Gryth et al refer to "the golden hour."[60]

Whereas most of these indicators are possible measures of effectiveness of the emergency response, Dudfield calls for evaluation of efficiency.[53] Rüter et al also suggest evaluating whether the objectives for the operation in question were reached.[91]

A different approach to evaluating the commanders could be to assess their decision-making skills, including their "ability to handle problems outside the standard plans or models."[42] Flin and Arbuthnot find this difficult, but state "outcomes are not a clear guide to the competence of the officer performing the task."[57] Rüter et al claim decisions could be evaluated as to whether they benefit victims and contribute to the aim of the operation.[91]

Limitations

Most comprehensive reviews in the medical literature are of an aggregative nature, and are concerned with questions like what intervention is the most effective in the treatment of an illness. The aim of this qualitative, configurative synthesis was to describe the breath of the field of medical incident command in mass-casualty incidents. Careful considerations were done before deciding to include non-peer-reviewed literature and papers based on data from non-medical settings. This choice was based on the assumptions that practical experience, also from related contexts, would be of importance in building knowledge of how the prehospital medical response operation, as a part of a broader system, can and should be led. The material on which this study was based is therefore considerably less standardized than what is common for classical medical meta-analyses. If this was meant to be such a study, the amount of eligible texts would have been negligible, possibly also giving results that were less valid for practical purposes. On the other hand, there is no reason to believe that the majority of non-peer-reviewed literature is to be found indexed in the databases used. A great amount of such texts appears in non-indexed journals or administrative documents. This fact introduces an unavoidable bias in the included literature. Previously published guidelines for evaluation and

[†††] References: 19,21,60,68-69,76,89-90,97.
[‡‡‡] References: 3,21,39,50-51,57,60,68-69,88-91,97.
[§§§] References: 3,21,52,60,69,71-72,76,78-79,89-90,93.

research on health disaster management do not appear to be used commonly (eg, for standardizing terminology and methods).[108]

A general observation was that the peer-reviewed papers presented a variety of scientific angles, while the non-peer-reviewed papers were more homogenous. A discourse analysis of the literature could be of interest to illuminate whether most practitioners actually share the same experiences, or if there is an informal standard to what one feels obliged to write about the subject. Such an analysis was beyond the scope of this review. It was, however, interesting to note that there were scarcely any quality differences between peer-reviewed and non-peer-reviewed case stories.

Due to linguistic challenges, this study is restricted to texts published in Scandinavian languages or English. This favors material from North and Western Europe and North America. Papers from other parts of the world may show a different picture. However, judged from the included texts based on experiences from other health systems, there are no systematic differences related to location.

Conclusion

Seen from all points of view, an efficient ICS has to rely upon competent and experienced commanders. Based on the included data, analysis gives no reason to believe that the competence and experience of the commanders can be significantly compensated by plans and procedures, or even by guidance from superior organizational elements such as coordination centers.

The study neither finds that a certain system, structure, or specific set of plans are better than others, nor can it conclude what system prerequisites are necessary or sufficient for an efficient incident management.

Nevertheless, it is clear that commanders need to be sure about their authority, responsibility, and the functional demands posed upon them. The description of such elements is a sensible part of a plan that can be expected to work. System and plans thus seem to be important for defining the role of the commanders and the other actors on scene, more than giving them detailed instructions on how to execute their work. These findings draw the attention in the same direction as previously described by Smith.[11] The study cannot conclude whether command and control strategies are more or less efficient than coordination strategies. Perhaps this may be because these two strategies are clearly differentiated in theory, but not so easily distinguished in practice. The great diversity related to terminology and methods calls upon continued efforts to standardize research in this field.

Acknowledgements

The authors gratefully acknowledge the contribution of Marie Isachsen, at the Medical Library of Oslo University Hospital, and Inger Gåsemyr, at the University Library in Stavanger, in constructing and performing the database search, and Lena Gran in developing illustrations.

Supplementary materials

To view supplementary material for this article, please visit http://dx.doi.org/10.1017/S1049023x15000035

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