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Postprint

This is the accepted version of a paper published in *Disaster medicine and public health preparedness*. This paper has been peer-reviewed but does not include the final publisher proof-corrections or journal pagination.

Citation for the original published paper (version of record):

Rüter, A., Kurland, L., Gryth, D., Murphy, J., Rådestad, M. et al. (2016)
Evaluation of Disaster Preparedness Based on Simulation Exercises: A Comparison of Two Models.
Disaster medicine and public health preparedness, 10(4): 544-548
<http://dx.doi.org/10.1017/dmp.2015.176>

Access to the published version may require subscription.

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:shh:diva-2451>

Evaluation of disaster preparedness based on simulation exercises, the comparison of two different models.

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Abstract

Objective:

The objective of this study was to highlight two models, Hospital Incident Command Systems (HICS) and Disaster Indicator Management Model (DiMI) for evaluating the in-hospital management of a disaster situation through simulation exercises.

Methods:

Two disaster exercises, A and B, with similar scenarios were performed. Both exercises were evaluated with regard to actions, processes and structures. After the exercises, the results were calculated and compared.

Results:

In exercise A the HICS model indicated that 32% of the required positions for the immediate phase were taken under considerations with an average performance of 70%. For exercise B, the corresponding scores were 42% for performance of 68% in average.

According to the DiMI model the result for exercise A was a score of 68% for management processes and 63% for management structure (staff skills). In B the results were 77% and 86%, respectively.

Conclusions:

Both models demonstrated results on an acceptable level in relation to results from previous studies. More research in this area is needed to validate which of these methods that best evaluates disaster preparedness based on simulations exercises or, whether they are complementary to each other and therefore should be used together.

Key words

Hospital disaster preparedness, Simulation exercise, Evaluation,

Hospital Incident Command System, Disaster Indicator Management Model.

Introduction

The issue of assessing the disaster preparedness of a health care organization is a topic that is of great interest both from providers' and researchers' perspective. One basic problem, highlighted in literature, is the lack of a uniform definition of what a disaster is (1). Studying the response to a disaster may lead this process forward. This would necessitate a method with which focus on finding a systematic way of evaluating how organizations' preparedness expressed in general terms are, rather than how the specific preparedness is for each of the many different types of situations that may occur.

Decisions and actions are therefore needed to redistribute the resources, making the management of a major incident one of the critical processes, and thus an important part also of the disaster preparedness. There are, however, limited ways of assessing the management part of disaster preparedness including structures as well as processes.

One way of studying this is by the evaluation performances of management groups, operative in simulation exercises (2). If both structure and process could be evaluated with the same exercise as basis, this could possibly lead to a better estimation of the level of preparedness. The Hospital Incident Command System, HICS, exemplifies one way of assessing hospital's general disaster preparedness. The HICS model, previously proven to be useful and allowing comparison between different hospitals in different settings, contains a standardized way to measure actions for management group functions, which can be used to measure structure and performance level of each function (3,4,5). The HICS addresses both structural and process indicators of a management group performance.

Another method, a more process oriented method that has been put forward, is the Disaster Indicator Model (DiMI). This model, that addresses processes and structures, has been used in several educational contexts and also for evaluation of real incidents (6,7).

DiMI only addresses if a decision, based on a modeling process was performed but does not assess the effect of each decision since this further step requires also a qualitative approach.

An issue to be addressed is if used together, do results from using these models correspond or do the results diverge.

The aim of this study was to highlight two different tools for evaluating the in hospital management of a disaster situation, in simulation exercises.

Methods

Setting

Two table-top exercises were conducted at two major hospitals in the Stockholm area in September 18th and 19th, 2012, respectively.

Scenario

The simulation exercises were conducted with the purpose to evaluate medical response to a mass casualty incident, an explosion in the centre of Stockholm. At both hospitals, the Emergo Train model was used as the simulation tool (8). Emergo Train System (ETS) is an interactive simulation system developed in Sweden. It can be used for education, training and simulations of emergencies and disasters. ETS can be used to test and evaluate incident command systems, hospital preparedness and surge capacity.

Performance indicators

The HICS performance indicators come from worksheets describing definitive positions (2). Each position has a job action sheet consisting of multiple actions to be fulfilled by the responder in charge. Achievement of performance of each position is evaluated on the basis of accuracy of relevant actions taken by the responder, which was scored in percent (4).

Total HICS performance score was calculated as an average of all incorporated positions performance scores, also in percent. The HICS also demonstrates, how many and which of the recommended positions had been filled during the exercise.

The DiMI model consists of two groups of indicators: a) hospital management; and b) staff skills. Each group includes 11 indicators (Table II), which are scored 2, 1 or 0 as correct, partly correct, and incorrect/ omitted, respectively.

Evaluation

The evaluation focused on hospital immediate response within the first few hours after the incident. Both exercises were observed and evaluated by two researchers, with HICS and DiMI model experience, observing actions, processes and structures. All participants of the simulations (staff and managers) were asked to document their decisions and actions. These documents were, together with the documented observations by the researchers, also used in the evaluation process. Final scoring and analysis of the results was done through consensus of both researchers; the results of the models then being calculated and analyzed.

Another evaluation criterion was the percentage of activated positions at the hospital compared to the 22 suggested positions by HICS-2006 for immediate phase after an incident consisting of an explosion. A position is equivalent to a functional area so it is possible for a staff member to man more than one position. (Table I).

Ethical consideration

The evaluation was position specific as apposed to person/ participant specific, which make approval from IRB board unnecessary. The Helsinki declaration was followed.

Results

Exercise A indicated that out of 22 HICS-2006 positions suggested for immediate phase after an explosion, only 7 (32%) were manned by the hospital emergency response system.

In the exercise B, 9 of 22 HICS-2006 positions, suggested for immediate phase after an explosion, were activated (41%). In both exercises, two positions not belonging to the immediate phase, mental health and documentation were also activated. In both exercises the number of persons in the management staffs varied over time (10-15 persons) due to persons working in shift and replacing each other.

In both exercises (A and B), the activated positions were mainly from the command team and the operation section; Security branch positions however, were not activated. (Table I).

On the basis of the HICS indicators (Table I), the average performance of activated positions, concerning hospital response team, was 70% in exercise A and 68% in exercise B.

According to the DiMI model the managerial performance (Table II) of hospital response system was 68% (15 out of 22) in the exercise A and 77% (17/22) in the exercise B. The hospital performance, on the basis of staff skill indicators, was 63% (14 out of 22) in the exercise A and 86% (19/22) in the exercise B.

Discussion

Finding methods for evaluating disaster preparedness is a challenge. One way is assessing the preparedness based on an after-event report based on a template (9).

Another way is by addressing structures by a holistic approach based on indicators on several organisational levels (10). By using results obtained from performance during exercises, this study highlights a more limited way of addressing disaster preparedness.

The results from the present study indicate that there is no single method that solely provides the full picture of the level of preparedness based merely on simulation exercises.

The HICS model addresses the structural parts more completely than the DiMI, as well as demonstrated a higher percentage of activated positions in exercise A than in exercise B.

HICS has previously been used to evaluate hospital standard operating procedure (4). In this previous study it was suggested that HICS be used by hospitals in Sweden, as well as in other countries, due to its (relative) comprehensiveness. However, a good structure is only one key factor; there is also a need for processes and actions to take place. In this respect both systems indicate somewhat contradicting results. DiMI gave better scores for exercise B, and HICS slightly better in exercise A. With respect to that the two models are not addressing the same issues, however, caution is urged regarding this conclusion in as much as this was a pilot study, and no inferential statistics was performed.

It must, however also be understood that there is no accepted standard of best performance to compare with. For this there is a need for evaluating performance also during situations other than simulations. And, drawing conclusions from the somewhat diverging results cannot be done after two exercises only. The difference between HICS and DiMI with regards to processes is that in the DiMI model there is also a standard (a suggested bench-mark) set to each process indicator. The scoring of the result 0,1 or 2 will thereby have a substantial impact on the total score. These standards, expressed as time-limits, have been used in several contexts, but have yet to be validated. However, two models may be complimentary and do, in deed, to a certain degree give the same information. The results of the structure part of DiMI (staff skills) point in an opposite direction than HICS, and this needs to be further studied. One explanation could be that the structure-issues related to the two models have a different focus, and perhaps this should be interpreted as different aspects being evaluated. It is interesting to note that while positions were manned according to HICS, in exercise A 9/24, while in exercise B 11/24 the results differed in percentage, higher in exercise A.

The management score in exercise B was higher than in A which could suggest that the manning (11 out 24 positions manned) could have a relation to what was achieved. Two exercises are, of course, not enough to draw conclusions on disaster preparedness from and there are many other factors involved that could have interfered.

The results from this pilot study where two different tools for evaluation were used suggest that the two applied models for estimating disaster response as a part of disaster preparedness could complement each other, although more studies are needed to substantiate this. However, the process of finding methods for assessing disaster preparedness must continue to develop.

Any shortcomings of the preparedness must be identified beforehand, and if possible eliminated or at least mitigated even if this means the investment of time and money.

If not, the actual costs as a consequence of an incident may be higher and it is also likely that the management of patients will be affected.

Conclusions:

Results from two similar exercises, evaluated by the HICS and DiMI model, demonstrated performance on an acceptable level in relation to results from previous studies, yet most of positions were missed according to the HICS method. More research on this area is needed to validate which of these methods best evaluates disaster preparedness based on simulations exercises or, if they are complementary to each other and therefore should be used together.

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Table I- Activated positions and performance of hospital response system, on the basis of HICS model, in exercises A and B

		Activated positions	
N	HICS-2006 position in immediate phase after an explosion	Exercise A	Exercise B
1	Incident Command	95%	79%
2	Public Information	50%	30%
3	Safety	38%	50%
4	Liaison	-	-
5	Operations Section	83%	84%
6	Medical Care Branch	60%	77%
7	Inpatient Unit	90%	78%
8	Outpatient Unit	-	-
9	Casualty Care Unit	89%	89%
10	Patient Registration Unit	-	-
11	Security Branch	-	-
12	Access Control Unit	-	-
13	Crowd Control Unit	-	-
14	Traffic Control Unit	-	-
15	Planning Section	-	54%
16	Situation Unit	-	-
17	Patient Tracking	-	-
18	Bed Tracking	-	-
19	Logistics Section Chief	-	83%
20	Support Branch	-	-
21	Labor Pool & Credentialing	-	-
22	Finance/ Administration Section	-	-
	Mental Health Unit Leader (not included in immediate phase)	50%	52%
	Documentation Unit (not included in immediate phase)	75%	75%
	Total performance according to HICS indicators	70%	68%

Table II- Performance indicators, staff skills and management on the basis of DiMI model, in exercises A and B. Correct: 2 pts ; Partly correct: 1 pts; Incorrect: 0 pts

Measurable indicators	Set standard time and/or structure					Score	
						Exercise A	Exercise B
Assigning functions to staff members	Immediately on arrival					2	2
Positioning in room in accordance to above	Directly					1	2
Designated telephone numbers	Directly					2	2
Introduction of arriving staffmember	Max 1 min					0	1
Utilisation of equipment (only if equipment is available)	Whiteboard/ Flipchart	Not	0	1	2		
	Fax						
	Computer						
	Other						
						Average: 1.5	2
Staff briefing	Max 8 min					2	2
Content of staff briefing	Reports from staff members	Not	0	1	2		
	Updated summary						
	New assignments						
	Next briefing					Average: 1.5	2
Telephone discipline	(during staff briefings)					0.5	0
Content of staff schedule	Staff briefings	Not	0	1	2		
	Contacts with media						
	Meals						
	Staff releif					Average: 0.5	2
Summary: oral briefing						1	2
Summary: written						2	2
	TOTAL					14	19

Performance indicator (process)	Set standard time (min)	Score	
		Exercise A	Exercise B
Decide on level of preparedness	3	2	2
Formulate initial guidelines for hospital response	15	1	2
First information to media	15	1	1
Reporting information on resources to strategic level of management	25	2	2
Ensuring that there has been medical offices appointed at Emergency & Surgery	30	2	2
Estimate needs of ICU capacity	45	2	2
First information to hospital staff	60	1	2
Estimate endurance of staff	90	1	1
Estimate and reports estimated shortage of own capacity	120	2	0
Estimate influence on daily hospital activities	120	1	2
Information plan for patients with postponed appointments and operations	180	0	1
		TOTAL	15 17