Factors That May Influence the Preparation of Standards of Procedures for Dealing with Mass-Casualty Incidents

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Abbreviations:
MCI = mass-casualty incident
SOP = standards of procedure

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Abstract

Introduction: General hospitals in Israel are required to develop standards of procedures (SOPs) to facilitate the management of mass-casualty incidents (MCIs). These SOPs represent the initial step in a continuous process, providing guidelines for hospitals to manage MCIs in an organized and efficient manner. Evaluation of the preparedness levels of hospitals in dealing with MCIs is required in order to promote an effective response, and to identify factors that might impact the quality of SOPs. The aim of this study was to identify the characteristics of hospitals that have an impact on the preparation of SOPs.

Methods: An evaluation tool was developed to assess the SOPs from 22 hospitals during the management of a MCI. The results of the evaluations were analyzed, in relation to the size, trauma capabilities, ownership, geographic location, urban versus rural status of the hospitals, the proximity to other hospitals, participation in drills during the year prior to the evaluation, and number of actual MCIs the hospital managed in the past three years.

Results: The evaluation scores of the SOPs of 11 of the 22 hospitals (50%) were very high, so their SOPs did not require modifications. The SOPs of four hospitals (18%) were rated highly, requiring only minor modifications. The SOPs of four hospitals (18%) received poor ratings, requiring major modifications, and three hospitals (14%) were found to have incomplete SOPs and received very poor ratings. No significant differences were found between the ratings of SOPs in relation to the different characteristics of the hospitals analyzed. A low correlation between the level of SOPs and the number of MCIs that the hospital managed was found ($r = 0.266$, NS).

Conclusions: The tool developed to evaluate the quality of the SOPs of hospitals to manage MCIs was logistically feasible and capable of differentiating between hospital SOPs. The comprehensiveness and completeness of the SOPs appears to be unrelated to the characteristics of the hospitals included in this study. Of particular note was the lack of a significant correlation between the SOP rating and the number of actual MCIs managed by a hospital.

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Introduction

General hospitals in Israel are required to develop and maintain standards of procedures (SOPs) to facilitate the management of a mass-casualty incident (MCI).[1] These SOPs provide guidelines for the hospital to plan its response to MCIs, prepare the infrastructure required, and train medical teams to deal with MCIs.[2] The guidelines and checklists that comprise the SOP are necessary components of the process required for maintaining a high level of preparedness; however, they are only the beginning of this process.[3,4]

For an SOP to be effective in guiding hospital personnel in the management of MCIs, a number of basic steps must be adopted by the hospital: (1) the SOP must be distributed widely among the departments that are likely to be involved in the management of a MCI; (2) drills must be conducted to pro-

vide the opportunity to practice teamwork, analyze shortcomings, and identify areas that require improvement;[5,6] and (3) hospital personnel, on a regular basis, should evaluate the applicability of the SOP, preferably from the lessons learned from conducting MCI drills.[7] Mass-casualty incident drills, such as actual simulations and tabletop exercises, are important in the process of maintaining readiness to manage MCIs, as they provide some indication of the ability of the hospital to manage MCIs. A number of studies have shown that drills can positively impact the performance of hospitals in dealing with MCIs.[8]

The fact that a hospital has prepared a SOP does not automatically result in the effective management of MCIs.[9] Evaluation of preparedness levels for a MCI are required in order to promote an effective response.[10]

The impact of various characteristics of hospitals on the completeness and comprehensiveness of SOPs for managing MCIs, such as the size of the hospital, trauma capabilities, geographic location, urban versus rural facilities, proximity to other hospitals, participation in drills, and experience in coping with MCIs, has not been well-documented. The aim of this study was to investigate the impact of selected hospital characteristics on the completeness and comprehensiveness of hospital SOPs for the management of MCIs.

Organization of the Israeli Healthcare System for the Management of MCIs

The National Health Insurance Act in Israel mandates that the healthcare system must provide comprehensive medical services to all citizens.[11] Twenty-four general hospitals operate emergency rooms capable of managing MCIs. The Ministry of Health provides directives to all general hospitals requiring them to prepare SOPs based on a national doctrine for the management of MCIs. These plans define the operational response model deemed appropriate for each type of MCI.

Methods

Evaluation of SOPs for MCIs

In order to assess the quality of hospital SOPs, parameters deemed as being required for the effective management of a MCI were identified. The parameters were identified by means of a comprehensive literature review and the recommendations of health professionals who were identified as experts in the management of MCIs, from the Ministry of Health, Home Front Command, and general hospitals. There were a total of 95 parameters identified that were classified into 11 categories according to their operational function (Table 1).

In order to evaluate the SOPs for MCIs, an evaluation tool was developed based on the 95 parameters that were identified as having an impact on emergency preparedness. The parameters were classified into categories by a team of emergency preparedness experts according to their importance for managing MCIs in an efficient and competent manner. The relative importance of each category was defined. The parameters in each category were classified into one of three levels of importance: Level A consisted of the parameters that were rated as being very important (and contributed 60% of the total grade); Level B consisted of parameters that were rated as having a moderate impact (30% of total grade); and Level C consisted of parameters having the lowest impact (10% of total grade). The relative importance of the categories and the extent of parameters in each category, are presented in Table 1. The scaling and classifications were made utilizing a modified Delphi process with the content experts.[12]

Utilizing an Evaluation Tool to Measure Quality of SOP for MCIs

The evaluation tool was tested in a pilot study conducted in two hospitals, and subsequently, modifications were made to the evaluation tool as required. The final evaluation tool was distributed to all the general hospitals in Israel to enable them to familiarize themselves with the elements to be included in the SOP evaluation process. Three months after the distribution of the evaluation tool, the SOPs of 22 general hospitals were evaluated by the Ministry of Health and the Home Front Command. The two hospitals that participated in the pilot study were not included in the study.

In each of the 22 hospitals, the evaluation was conducted by two evaluators who were required to make their ratings of the SOP independently. When the rating process was complete, the two evaluators compared their ratings—differences were identified and discussed until they mutually agreed upon a rating. A single rating representing the consensus between the two evaluators for each of the 95 parameters were entered into a computer program written specifically for calculating the level of preparedness of the hospital.

Based on the final score, the SOPs were classified into four groups: (1) Very High (91–100%) indicating that the SOP required no modifications; (2) High (81–90%), SOP required only minor modifications; (3) Poor (65–80%), SOP required major modifications; and (4) Very Poor (<65%), SOP inadequate and a new SOP must be prepared.

Relationship between the Quality of SOPs and Selected Hospital Characteristics

The quality of SOPs for dealing with MCIs was evaluated utilizing a pre-formulated evaluation tool. The derived evaluation scores were analyzed to determine if there was a relationship between the quality (comprehensiveness and completeness) of the SOP and the following hospitals characteristics:

1. *Size of hospitals*—Six small hospitals with <400 beds, nine medium size hospitals with 400–700 beds, and seven large hospitals with >700 beds.
2. *Trauma capabilities*—Six Level-1 trauma centers, 12 hospitals with Level-2 trauma rooms, and four hospitals with limited trauma capabilities.
3. *Ownership of hospitals*—Eight government-owned hospitals (operated by the Ministry of Health), two municipal hospitals (operated by the municipalities of Tel Aviv and Haifa), five semi-private hospitals (operated by non-profit foundations), and seven hospitals owned by the Health Maintenance Organization (HMO).
4. *Geographic location*—Seven northern region hospitals, eight central region hospitals, four Jerusalem area hospitals, and three southern region hospitals.
5. *Urban versus peripheral hospitals*—16 hospitals were located in urban areas, and six in the peripheral areas.

Number	Category	Relative Importance (%)	Levels of parameters			
			A[1]	B[2]	C[3]	Total
1	General	6	1	1	7	**9**
2	Policies of mass-casualty incident operation	11	1	8	--	**9**
3	Nursing director in emergency room	19	6	1	--	**7**
4	Command and control (operation center)	10	1	5	3	**9**
5	Admitting sites	10	2	--	11	**13**
6	Operating rooms	14	4	2	--	**6**
7	Support systems (imaging, blood bank, etc.)	6	1	1	7	**9**
8	Security and patient transport	6	1	1	7	**9**
9	Logistics (equipment, infrastructure, etc.)	6	1	2	6	**9**
10	Information center	9	1	6	2	**9**
11	Spokesperson	3	--	3	3	**6**
	Total	**100**	**19**	**30**	**46**	**95**

Table 1—Importance and impact of categories and parameters of emergency preparedness
[1]Parameters with high impact on emergency preparedness (signify 60% of quality of category)
[2]Parameters with moderate impact on emergency preparedness (signify 30% of quality of category)
[3]Parameters with low impact on emergency preparedness (signify 10% of quality of category)

Number of hospitals	Number of MCIs
5	0
1	2
2	3
1	4
2	5
4	6
3	7
3	8
1	12

Table 2—Actual mass-casualty incidents (MCIs) managed in the last three years

6. *Proximity to other hospitals*—15 hospitals were situated in the vicinity of other hospitals (<15 minute drive to next closest hospital), and seven hospitals were located in towns in which they were the sole hospital (≥30 minutes drive to the closest hospital).
7. *Participation in a drill*—Seven hospitals had participated in a conventional MCI drill in the last year and 15 hospitals did not participate in such a drill in the last year.
8. *Actual MCIs managed in the last three years*—A MCI was defined as an event in which there were >20 casualties (Table 2).

Statistical Analysis

Data were processed using SPSS 13.1 (SPSS Inc., Chicago, Illinois), using the following tests: Pearson correlation, *t*-test, and one-way analysis of variance (Post-Hoc Test, Duncan).

Results

The SOPs from 22 out of 24 general hospitals (92%) were evaluated. The following conclusions were made: (1) the SOPs of 11 hospitals received very high ratings and required no modifications; (2) the SOPs of four of the hospitals received high ratings and required minor modifications in order to bring them up to an acceptable standard; (3) the SOPs from four hospitals received poor ratings and required major modifications to bring them up to an acceptable standard; and (4) the remaining three hospitals were very poor signifying an unacceptable level of SOPs. The ratings of the SOPs are presented in Figure 1.

Impact of the Size of the Hospital

The SOP scores of the smaller hospitals were found to be slightly higher (average = 94%) than those of the larger hospitals (average = 92%). The SOP scores of the medium-sized hospitals were lower (average = 82.2%) (Figure 2). A one-way analysis of variance test showed that the differences between the hospitals were not statistically significant ($p > 0.05$).

Trauma Capabilities

The quality of SOPs was higher in Level-1 trauma centers (average of 92%) and in hospitals with limited trauma capabilities (average = 93.2%). A lower level was identified in hospitals with Level-2 trauma rooms (average = 83.9%) (Figure 3). A one-way analysis of variance test indicated that there was no significant difference between hospitals ($p > 0.05$).

Ownership of Hospitals

The evaluation scores of publicly-owned hospitals and municipal hospitals were the highest (93%), followed by

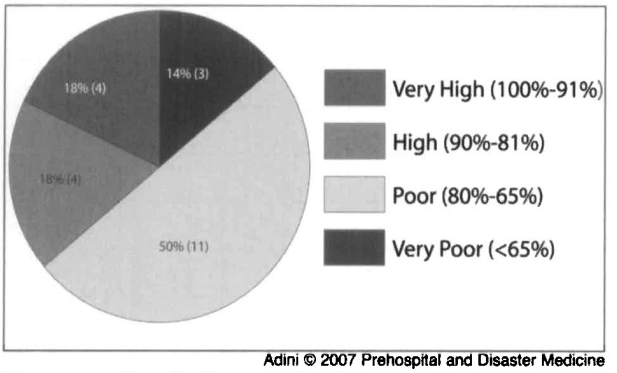

Figure 1—Level of standards of procedure

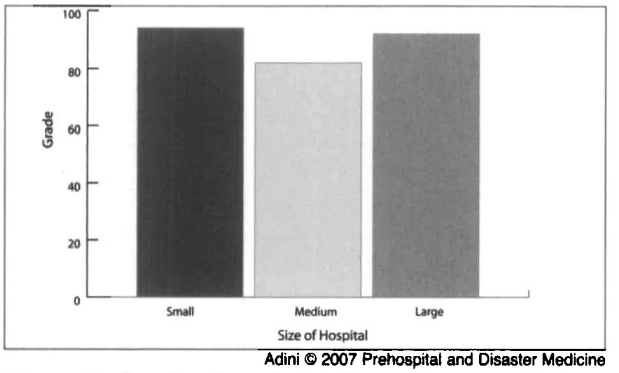

Figure 2—Levels of standards of procedure according to hospital size

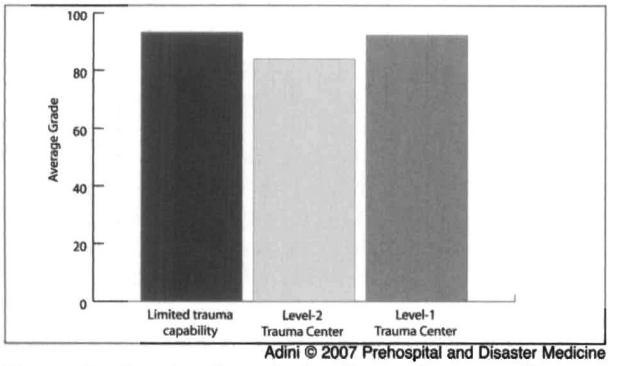

Figure 3—Levels of standards of procedure according to trauma capabilities

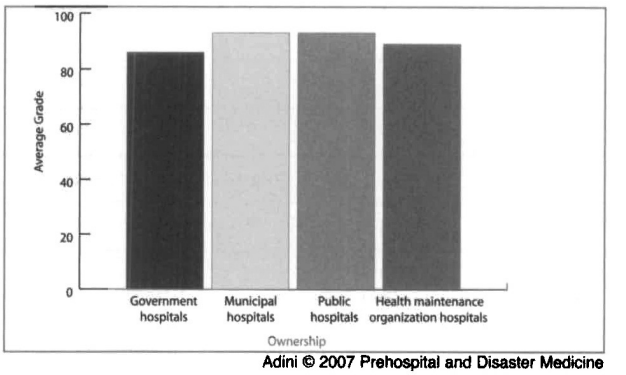

Figure 4—Levels of standards of procedure according to hospital ownership

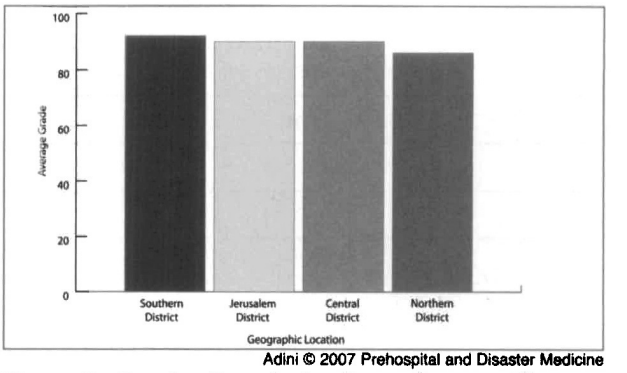

Figure 5—Levels of standards of procedure according to geographic location

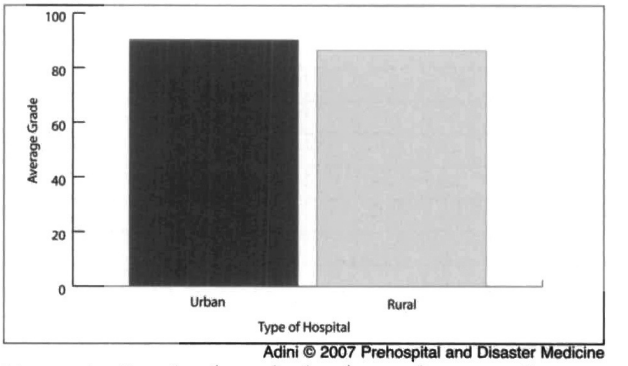

Figure 6—Levels of standards of procedure according to type of hospital

those owned by a major Health Maintenance Organization (89.2%) (Figure 4). Government-owned hospitals received the lowest evaluation score (85.8%). A one-way analysis of variance indicated that the differences between the hospitals were not statistically significant ($p > 0.05$).

Geographic Districts

The SOPs of hospitals located in the southern part of the country had higher evaluation scores (average = 92.3%), followed by the hospitals in the Jerusalem area and in the central area (average = 90%). The SOPs of hospitals located in the northern part of the country were the lowest (average = 86%; Figure 5). A one-way analysis of variance showed that the differences were not statistically significant ($p > 0.05$).

Urban versus Peripheral Medical Centers

The evaluation scores of SOPs in hospitals situated in urban areas were higher compared to those located in peripheral areas (average = 89.9% and 85.6%, respectively; Figure 6). The differences between the hospitals were not statistically significant ($p > 0.05$).

Proximity to Other Hospitals

No statistically significant ($p > 0.05$) differences were identified in the evaluation scores of SOPs of hospitals in relation to their proximity to other hospitals (Figure 7).

Participation in Drills

A comparison of the evaluation scores of SOPs for hospitals that had or had not participated in a conventional MCI

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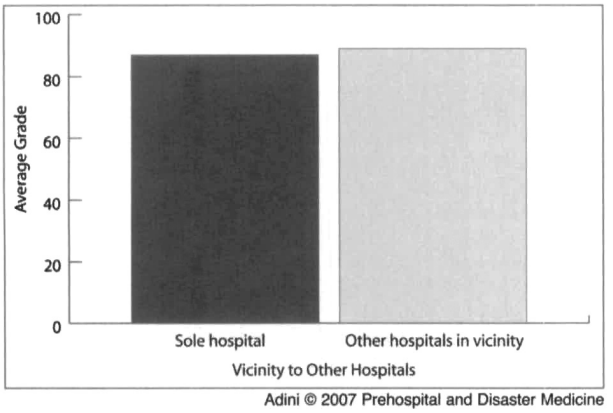

Figure 7—Levels of standards of procedure according to vicinity of other hospitals

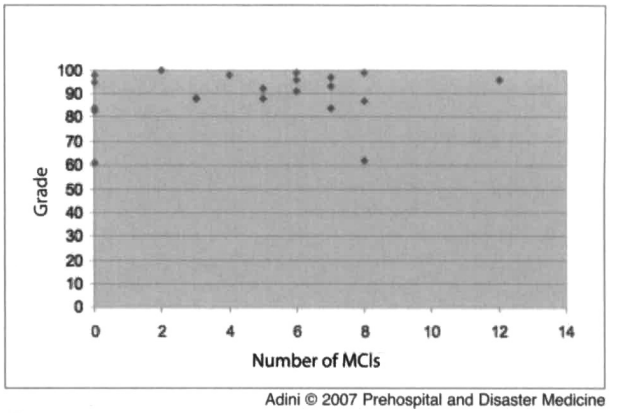

Figure 9—Levels of standards of procedure according to experience in managing mass-casualty incidents

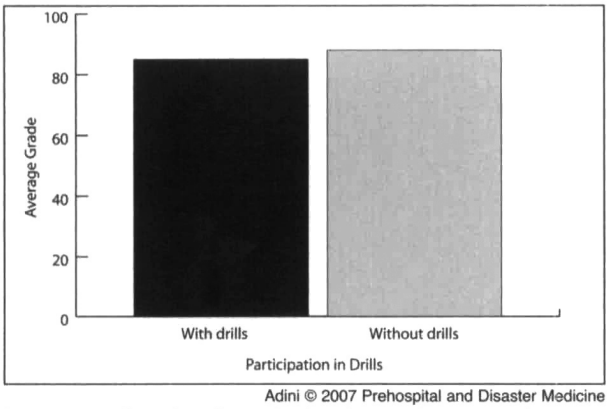

Figure 8—Levels of standards of procedure according to participation in drills

drill during the past year showed an average of 85% and 88%, respectively (Figure 8). The differences were not statistically significant (p >0.05).

Experience in Coping with Actual MCIs

The correlation between the number of actual MCIs that a hospital had managed and the evaluation scores of the SOPs was low (r = 0.266, NS). Hospitals involved in managing MCIs during the past three years scored an average of 88%, while hospitals that had not managed an actual MCI scored an average of 84%. A hospital that had managed three MCIs during the past three years scored a level of 88%, while hospitals that managed six and 12 MCIs, scored averages of 95% and 96% respectively. The data are graphed in Figure 9.

Discussion

Mass-casualty incidents, due to either natural occurrences, accidents, and/or terrorism are events that all societies cope with regularly. For healthcare systems, specifically hospitals, to be able to deal with MCIs in an organized and efficient manner, they must prepare for these events and maintain a high level of readiness. Given that it is impossible to predict which hospitals will be required to manage MCIs, and since the disposition of casualties is determined during the event itself, all general hospitals must be prepared to deal with an MCI.[13] The impact of various characteristics of hospitals, such as size, trauma capabilities, or participation in MCIs, on the quality of SOPs is not well-documented in the literature.

This evaluation of SOPs indicates that the majority of general hospitals in Israel have prepared high standards of SOPs for managing MCIs. There was no correlation between the various characteristics of the hospitals analyzed and the evaluation scores of the SOPs. The size, trauma capability, geographic area, urban versus rural hospital, proximity to other hospitals, or whether or not a hospital participated in conventional MCI drills had no impact on the quality of the SOPs. It might be expected that the experience of a hospital in dealing with actual MCIs would have an impact on the quality of MCIs, and that the hospital would incorporate these lessons learned from the management of the actual MCIs into the SOP. This analysis indicated that this was not the case. A weak correlation was noted between management of actual MCIs and the evaluation score for the SOP.

The quality of a SOP appears to be unrelated to the various characteristics of the hospital or to the experience of managing actual MCIs. This may be explained by the fact that the medical system in Israel has accumulated a great deal of experience coping with MCIs. In addition, the Ministry of Health provides national doctrines and guidelines to all hospitals, instructing them on how to prepare SOPs for the different types of MCIs that the healthcare system is expected to cope with. Each hospital is only required to modify the doctrine according to the organizational infrastructure and resources. The continuous threat of terrorism and the realization that the medical system must be continually prepared to deal with conventional and the threat of non-conventional MCIs, requires that general hospitals prepare and maintain well-developed SOPs.

Conclusions

The quality of SOPs developed by general hospitals in Israel to deal with MCIs is comprehensive and well-documented. The quality of the SOPs appears to be unrelated to the characteristics of the hospitals analyzed. Similarly, the number of actual MCIs managed by hospitals is unrelated to the quality of the SOPs.

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