

The Design and Assessment of Mock Mass Disasters for Dental Personnel

REFERENCE: Pretty IA, Webb DA, Sweet D. The design and assessment of mock mass disasters for dental personnel. *J Forensic Sci* 2001;46(1):74–79.

ABSTRACT: Mass disasters represent a significant challenge for dental personnel who are frequently called upon to provide identifications. Recently-published materials have highlighted the need to prepare such groups for the disaster challenge and to report inadequacies in existing preparation methods with an emphasis on team integration, organization, and the psychological and emotional effects of such work. Many studies have retrospectively reported errors that have been made in disaster situations, but few have addressed the issues proactively. In an effort to provide a prepared team of dental members, a mock disaster exercise (Operation: DENT-ID) is conducted annually in Vancouver, Canada. The present study analyzes the effectiveness of this exercise in relation to team organization, assessment of preparedness, and the emotional and psychological issues. An index of preparedness is developed and described. This index, in the form of a questionnaire, can be given to participants in mock disasters to assess the effectiveness of such exercises. While the focus of this paper is on the assessment of dental personnel, the indices and methods used can be applied to any group working within the disaster team. Results indicate that the increase in preparedness as a result of the exercise was highly significant.

KEYWORDS: forensic science, mass disasters, forensic dentistry, team work, preparedness

Mass disasters represent one of the most challenging aspects of forensic dentistry. Many experts have called for mass disaster dental response teams to be prepared for the disaster challenge (1,2). Authors report inadequacies in existing preparation methods, with an emphasis on team integration, organization, and the psychological and emotional effects of such work (3). Many studies have retrospectively reported errors that have been made in disaster situations, but few have addressed the issues proactively (3–8). This study addresses this hiatus in the literature. In order to provide a prepared team of dental members, a mock disaster exercise (Operation: DENT-ID) is conducted annually in Vancouver, Canada. The present study analyzes the effectiveness of this exercise in relation to team organization, assessment of preparedness, and the emotional and psychological issues.

Operation: DENT-ID

The training exercise was conducted over a one-and-one-half-day period, in association with the British Columbia Coroners Ser-

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Received 8 Nov. 1999; and in revised form 28 Jan. 2000; accepted 7 March 2000.

vice and the BC Forensic Odontology Response Team (BC-FORT). The first afternoon was devoted to a lecture delivered by a guest speaker who had previously been involved in a mass disaster dental identification team. The following morning a mock mass disaster exercise was carried out. This was followed in the afternoon by extensive discussion and feedback. Twenty-nine dental personnel, each with varying degrees of disaster and identification experience, participated in the most recent exercise (April 1999). The group was split into three teams: antemortem, postmortem, and comparison. Each team was organized by a team leader and a secondary leader. The team leaders, organizers, and participants of the event are members of a provincial dental mass disaster response team.

The exercise simulated an airplane crash that required the identification of ten individuals. Preserved human remains and antemortem dental records were available. Each of the teams processed its material as per a real disaster. Success was determined by the number of individuals identified at the end of the exercise. Each team was allocated a separate workspace and this was protected to ensure that “crossing the floor” (members of one group “crossing” into the work space of another) was minimized. The role of each team was clearly defined.

The antemortem team was responsible for transcribing dental records received from dental practitioners onto standardized forms. The inherent problems of incomplete records, different tooth numbering systems, and difficult-to-decipher notes were simulated. The postmortem team was responsible for the dental examination and charting of the found remains. Postmortem radiographs of the remains had been produced prior to the exercise. Members of this group used standardized forms. The production of postmortem radiographs was not included as part of the exercise as a portable X-ray unit was not available. Fragmented remains were included to replicate the condition of bodies likely to be encountered in a real disaster. The comparison team received the antemortem and postmortem standardized forms from the respective groups. Using laptop computers and the computer application WinID (Version 2; James McGivney, www.winid.com) possible matches were established and then the team compared the actual records to produce final conclusions. The use of computers to identify a relatively small number of remains was incorporated into the exercise to ensure that comparison team members were familiar with the operation of the system should its use be indicated in a larger disaster. Interaction between the groups was kept to a minimum and aspects of security and prevention of record “contamination” were all considered.

It was clear that the participation of all members in the afternoon feedback session was a crucial component of the exercise. Team leaders reported satisfaction with team performances and the success of the exercise.

TABLE 1—*The four stages of team development as identified by Tuckman.*

Stage	Description
Forming	Typically exhibited by new teams who often exhibit caution and reserve. They are uncertain about team interactions and their shared purpose. The group will focus on setting group norms and begin to establish working procedures. Little is achieved.
Storming	The group begins to see the emergence of conflict. Different perspectives collide, leading to impatience, jockeying for position, and the development of tension. There is an attempt at productivity but operates suboptimally. The group moves toward consensus.
Norming	The group matures and develops its shared focus. Consensus is built and patterns for teamwork are developed. Team identity is cemented. Greater acceptance of individual differences.
Performing	Shared processing and getting the task completed. Trust between the team members. Effective interaction to realize results.

Method

In order to determine accurately the success of the exercise, several methods were employed. Data were collected during the mock scenario and immediately following the conclusion of the exercise. Collection methods included structured questionnaires and semi-structured interviews with key team members and participants. Observation of participants was carried out during the exercise to examine the team dynamics. This study assessed two main points: (1) teamwork within each of the three teams, and (2) preparedness of the whole group and individuals as assessed by a preparedness index.

Data were collected from the results of the questionnaires and analyzed with information obtained from group observations and the semi-structured interviews. The interviews were conducted with the following individuals: (a) each of the three team leaders, (b) representatives from the Coroners Service involved in the Provincial disaster plan, and (c) the guest speaker who had participated in a disaster involving a plane crash at sea.

Assessment of Team Work

The three teams were assessed using the Tuckman model for team performance (9). Within this model there are four terms used

TEAMWORK

In the event of a mass casualty incident effective teamwork will be vital. Based on your experience of the mock disaster scenario how often would you say your team displayed the behaviours contained within the following statements?

1= Not at all
 2= Just a little
 3= Moderate amount
 4= Quite a lot
 5= A great deal

Please circle the appropriate number using the above scale

1.	During the mock scenario all team members had the opportunity to have their say	1 2 3 4 5
2.	As a team we were able to get on with the task at hand quickly and efficiently	1 2 3 4 5
3.	Within our team there was a clear collective spirit and sense of shared responsibility	1 2 3 4 5
4.	We developed a framework for agreeing to objectives and deciding the best course of action	1 2 3 4 5
5.	Team members were reluctant to ask for help and advice	1 2 3 4 5
6.	Ideas were rejected because they were not fully understood by the whole team	1 2 3 4 5
7.	The team leader made sure we followed procedures and kept focused	1 2 3 4 5
8.	An important aspect of the mock scenario session was to define goals and establish what needed to be accomplished	1 2 3 4 5
9.	Personal agendas were evident during the mock scenario sessions	1 2 3 4 5
10.	We were able to identify and accept each other's strengths and weaknesses	1 2 3 4 5
11.	We assigned specific roles to team members	1 2 3 4 5
12.	Team members sought to avoid conflict	1 2 3 4 5
13.	The tasks presented to the team were different from what was expected and proved difficult to achieve	1 2 3 4 5
14.	Any group problems/disagreement were dealt with quickly and democratically	1 2 3 4 5
15.	There was a high degree of disagreement amongst team members	1 2 3 4 5
16.	The team discussed issues beyond the scope of the set scenarios	1 2 3 4 5
17.	Constructive criticism was evident during the mock scenarios	1 2 3 4 5
18.	A positive team spirit was evident	1 2 3 4 5
19.	The team accomplished a great deal	1 2 3 4 5
20.	The team worked within set procedures/protocols	1 2 3 4 5

Are there any additional issues within the mock scenario sessions that you would like to comment upon?

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FIG. 1—Questionnaire used to assess teamwork function using Tuckman's model.

1 = Strongly Disagree 2 = Disagree 3 = Agree 4 = Strongly Agree

To what extent do you agree with the following statements? Circle the appropriate response using the key above.

1. I am able to function well in a recently assembled or unfamiliar team	1	2	3	4
2. I am prepared to be called away at short notice to work for an undetermined amount of time	1	2	3	4
3. I am aware of the range of emotional and psychological stressors often encountered in a disaster situation	1	2	3	4
4. I am familiar with the recommended coping strategies associated with the emotional and psychological stressors	1	2	3	4
5. I am familiar with the concept of Post-Traumatic Stress Disorder	1	2	3	4
6. I can recognize emotional and psychological stress in others	1	2	3	4
7. I feel confident that I would be able to impart appropriate advice to colleagues displaying signs of emotional or psychological distress	1	2	3	4
8. If I were to experience emotional or psychological distress I would be willing to seek assistance	1	2	3	4
9. I am familiar with the concept of critical incident stress debriefing	1	2	3	4
10. I would be reluctant to share my experiences of a mass casualty incident with my immediate family	1	2	3	4
11. I am aware of the duties required within my identification team	1	2	3	4
12. I am aware of the duties required within the other identification teams	1	2	3	4
13. I am confident in my ability to carry out the duties required of my identification group	1	2	3	4
14. I am confident that I could work effectively in a group other than my own	1	2	3	4
15. I am familiar with the primary forensic literature reporting mass disaster situations and the problems highlighted therein	1	2	3	4
16. I am aware of the range of agencies involved in a mass disaster situation	1	2	3	4
17. I feel I am prepared sufficiently to contribute effectively to a dental mass disaster GO-TEAM	1	2	3	4

FIG. 2—Questionnaire used to assess the participant's preparedness.

to describe a team's development: forming, storming, norming, and performing.

Table 1 describes each of these identifiable stages. Figure 1 shows the questionnaire used to assess the team using this model.

Assessment of Preparedness

Preparedness was assessed using a preparedness index designed specifically for this study. This is shown in Fig. 2.

Results

The results of the study are shown in Tables 2–4. Table 2 (27 responses returned) contains the results of the teamwork assessment. It is important to note the closeness of the scores for the forming, norming, and performing categories. Table 3 (26 responses returned) shows the preparedness score of each participant before and after the exercise. Table 4 illustrates the mean differences in mean score for each assessed aspect of preparedness.

The interviews with the team leaders established the leaders' views on team performance and the overall success of the exercise. Interviews with other individuals related to the integration of the dental team into the larger mass disaster response and the realism of the simulated exercise. In total 26 correctly completed questionnaires were received from a total of 29 participants (90%).

Discussion

Team Development

The vast majority of the respondents in the three teams indicated that their teams had "performed" consistent with the expectations of the team leaders (Tuckman's fourth stage, see Table 2). Equally, all respondents indicated that their teams were least like the volatile "storming" classification. Despite these apparently encouraging findings, caution must be exercised in relation to the closeness of the forming, norming, and performing scores. The suggestion that this indicates no clear team perception is best explained by the ephemeral nature of the team itself (i.e., formed and disbanded during one day). The clearest team perception lay within the post-mortem group, followed by the comparison group, and then the antemortem group. Interestingly, seven out of ten respondents within the postmortem group had not attended the previous year's Operation: DENT-ID exercise and three of the eight members of the comparison group had not. Only one out of eight had not participated in the antemortem group. This result can be explained by the theory of "groupthink" where more cohesive groups (suggested by previous attendance and hence familiarity) are more concerned with achieving consensus than group decision making. Another factor is the unfamiliarity of participants with the antemortem process. De-

TABLE 2—Results of teamwork assessment. Forming, storming, norming, and performing are levels of team development described by Tuckman. Each score relates to the number of responses in the questionnaire, indicating that level of team development.

Participant	Forming	Storming	Norming	Performing
Antemortem Team				
1	20	9	18	22
2	18	10	17	20
3	19	8	20	23
4	20	11	21	22
5	21	12	24	25
6	20	10	20	17
7	19	13	20	24
8	20	9	19	21
9	20	8	18	21
Postmortem Team				
1	17	8	18	20
2	21	10	22	23
3	19	9	17	24
4	17	9	18	25
5	15	8	14	22
6	17	10	18	23
7	17	10	18	22
8	21	9	25	25
9	21	15	21	24
10	16	10	18	18
Comparison Team				
1	18	13	18	22
2	17	12	17	20
3	19	13	17	22
4	18	9	17	24
5	18	10	22	24
6	20	9	20	22
7	21	9	19	24
8	18	9	17	22

TABLE 3—Preparedness of individual participants before and after the exercise. Note that the top score possible (i.e., most prepared) is 68 and the lowest score possible (i.e., least prepared) is 17.

Participant	Preparedness Score Before Operation: DENT-ID	Preparedness Score After Operation: DENT-ID
1	55	62
2	51	52
3	51	61
4	47	54
5	53	54
6	47	56
7	46	49
8	45	55
9	53	54
10	62	64
11	55	56
12	46	49
13	52	52
14	40	51
15	54	57
16	50	61
17	44	48
18	60	65
19	43	56
20	45	49
21	58	64
22	50	58
23	59	60
24	50	60
25	49	59
26	51	56

spite these concerns, all three teams demonstrated good group dynamics.

Preparedness

In terms of the efficacy of the exercise, (i.e., did the mock disaster increase the preparedness of the members?) a highly significant result was found. As part of the preparedness indices, 17 questions exploring both logistical and psychological preparedness were posed. As the index was issued before and after the exercise, it is possible to ascertain if participant preparedness changed as a result of attendance. With the exception of one participant, whose preparedness index remained unchanged, all participants indicated that their preparedness was greater after Operation: DENT-ID (see Table 3). To test if this difference was statistically significant a paired samples *t*-test was employed (10). The highly significant result of $t = -7.267, df = 25, p < 0.001$ was obtained. From this result we can conclude that there has been a highly significant increase in preparedness over the one-and-one-half-day exercise.

In order to highlight the benefit of this study further, it is important to assess the *formative perspective* (i.e., provide information on how the mock disaster exercise can be improved). This can be done without complicated statistical analysis, which is a strength of this user-friendly index. In order to identify areas of strength and weakness in the exercise each aspect of preparedness was isolated and compared. These results are shown in Table 4. In order to establish which aspects of preparedness could be improved, individual scores before and after the exercise were compared to see how much the mean scores changed. By doing this, the discrepancy of scores is restricted to a rating scale (i.e., between 1 and 4). By reviewing the data it is possible to elicit those aspects of preparedness that did not change significantly as a result of attending Operation: DENT-ID. The highest level of preparedness is a score of 4. It can be argued that any score of 3 or less should be examined, as this would tend to suggest a weakly-prepared aspect of the exercise.

Using these criteria the following areas of weakness were identified:

- Participants seem unprepared to leave offices and practices at short notice and for undetermined amounts of time.
- Participants felt unaware of the psychological issues surrounding critical incident stress or post-traumatic stress disorder. They were not aware of the value of debriefing in order to address these issues. Participants also indicated that they would be unwilling to discuss the features of the disaster with their close family.
- The exercise did not seem to provide sufficient information regarding primary literature pertaining to mass disasters.

It is important to note that the preparedness index has not been validated. The index was developed by the authors based upon intuitive measures of preparedness for a mass disaster and the experience of one of the authors (DAW) with respect to psychological methods. Methods of validation for an index such as this are complex. The authors believe that the index represents a realistic measure. Further use of this index will confirm its validity in mass disaster assessment.

In summary, the exercise should be regarded as a success. Teamwork was measured as effective and there was a highly significant increase in the preparedness of the participants as measured by the preparedness index. All interviews indicated a great deal of satisfaction with the exercise and with the abilities of those participating

TABLE 4—Mean score differences for each item in the preparedness index.

Preparedness Item	Before	After	Diff.
I am able to function well in a recently assembled or unfamiliar team.	3.15	3.56	0.41
I am prepared to be called away at short notice to work for an undetermined amount of time.	2.81	3.00	0.19
I am aware of the range of emotional and psychological stressors often encountered in a mass disaster situation.	3.11	3.52	0.41
I am familiar with the recommended coping strategies associated with emotional and psychological stressors.	2.85	3.22	0.37
I am familiar with the concept of post-traumatic stress disorder.	3.04	3.33	0.29
I can recognize emotional and psychological distress in others.	2.78	3.07	0.29
I feel confident that I would be able to impart appropriate advice to colleagues displaying signs of emotional/psychological distress.	2.56	2.89	0.33
If I were to experience emotional or psychological distress I would be willing to seek assistance.	3.37	3.52	0.15
I am familiar with the concept of critical incident stress debriefing.	2.63	2.96	0.33
I would be reluctant to share my experiences of a mass casualty incident with my immediate family.	2.30	2.33	0.03
I am aware of the duties required within my identification team.	3.12	3.85	0.73
I am aware of the duties required within the other identification teams.	3.04	3.52	0.48
I am confident in my ability to carry out the duties required of my identification group.	3.31	3.67	0.36
I am confident that I could work effectively in a group other than my own.	3.35	3.59	0.24
I am familiar with the primary forensic literature reporting mass disaster situations and the problems highlighted therein.	2.81	3.00	0.19
I am aware of the range of agencies involved in a mass disaster situation.	2.73	3.19	0.46
I feel that I am prepared sufficiently to contribute effectively to a dental mass disaster team.	3.04	3.59	0.55

in it. The logistics of the exercise were smooth; a testament to the large volume of work that is required to stage such an exercise. The potential problems of this workload conflicting with dental practice responsibilities was elucidated during the team leaders' interviews.

The study identified areas of weakness that need to be addressed in order to increase the effectiveness of the exercise. One of the most pivotal areas of weakness was that of willingness to leave the workspace and support the identification effort. It can be argued that there is little point in training individuals who are ultimately not able to participate in an actual disaster. It appears that little can be done to address this point. During the exercise the importance of the identification team and the need to be available was emphasized repeatedly. Results of interviews highlighted that dentists were concerned about the financial implications of participating in a mass disaster. This area was addressed in the exercise but may need more reinforcement in the future. Those contemplating a similar program should be aware of this complication. A more radical solution is to select only those individuals who indicate their willingness to be involved prior to the exercise.

The second area of weakness pertained to the psychological issues. The preparedness data, in conjunction with interviews, showed that the participants felt that this area deserved more attention. The subject was covered in the exercise but the issue took second place to the larger implications of the exact duties of teams. Interviews with team leaders elicited differing opinions. One team leader felt that his responsibility was limited to the physical act of dental identifications and that other professionals should be responsible for the assessment of the mental well-being of his team members. Other opinions stated that the well-being of the group was of paramount importance to effective identifications and therefore was within their responsibilities as team leaders. All team leaders stated that more knowledge of the psychological issues would be useful. The issue of speaking to family members was raised specifically by the guest speaker, who stated that involving those close around you was essential to ensure harmony both at the morgue and in the family environment. Interestingly, despite this, many of the participants did not feel that this is something that they felt prepared to do.

It is clear that more attention needs to be focused on the psychological aspects of mass disaster preparedness. The presence of ac-

tors exhibiting signs of post-traumatic stress disorder within teams and a psychologist trained in this area may help address this. The published literature on this subject is comprehensive and should be made available to the participants (11–19). Reference lists alone do not suffice. Certainly the psychological implications of mass casualty identification must be thoroughly addressed and this may be best achieved in small groups to enable open discussion. Interviews on this subject with participants recognized the value of the guest speaker, whose candid and frank descriptions of the trauma of disaster involvement were highly valued.

Conclusions

A mock disaster can be a helpful tool in the training of dentists likely to be called to provide identification services in the event of mass casualties. Assessment of such exercises is essential to enable areas of strength and weakness to be identified and to assure authorities that the dental team is appropriately trained. Anecdotal evidence is helpful, but the use of properly structured questionnaires and interviews will enable accurate assessment. The authors encourage the use of mock disaster scenarios and of the measures provided in this paper to assess such exercises. The area of post-traumatic stress disorder must be carefully addressed, as well as the issue of commitment to the dental response team by the participant, including the financial impact that this may present.

Acknowledgments

The authors gratefully acknowledge Dr. Dave Hodges, Dr. Tom Routledge, Dr. Ian MacLachlan, and Coroners Chico Newell and Robert Stair for their assistance during this study. The authors extend their gratitude to Dr. Alan Hannam, Faculty of Dentistry, University of British Columbia for providing funding for this study. Dr. Iain A Pretty is supported by an educational grant from the Forensic Science Society, UK.

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