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WORKSHOP #1:

HOW IS RESEARCH DONE IN DISASTERS?

A 12-Step Program

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INTRODUCTION:

This workshop is designed to provide the course participant the fundamental knowledge and basic concepts needed to perform research in disasters. The program draws on the collective experience of the Disaster Reanimatology Study Group (DRSG) of the Safar Center for Resuscitation Research, University of Pittsburgh. The DRSG is an interdisciplinary group of researchers based at the University of Pittsburgh who share an interest in disaster research and who have collaborated, together with ad-hoc foreign researchers, on several disaster research projects since 1989. This core group is composed of the following individuals: Peter Safar, M.D. (Distinguished Service Professor of Resuscitation Medicine), Edmund Ricci, Ph.D. (Chairman, Department of Health Services Administration), Miroslav Klain M.D., Ph.D. (Anesthesiology/CCM), Derek Angus, MB, M.P.H. (Anesthesiology/CCM), Joel Abrams, Ph.D. (Past Chairman, Department of Civil Engineering), Louise Comfort Ph.D. (Associate Professor, Graduate School of Public and International Affairs), Bulent Kirimli, M.D. (Anesthesiology/CCM), Paul Paris, M.D. (Chairman, Department of Emergency Medicine), and Nancy Bowen, Ph.D. (Postdoctoral Fellow, Health Services Administration). For the purpose of this workshop the course director has summarized the methodology used by this group in the following 12 steps:

1. What is the Question?
2. Choose a research strategy.
3. Choose research methods to fit the strategy.
4. Create a data collection plan.
5. Develop a research management system.
6. Conduct a scout survey of the disaster site.
7. Conduct the principal survey at the disaster site.

8. Perform follow-up surveys as needed.
9. Perform data analysis.
10. Prepare research report.
11. Disseminate research findings.
12. Assess the impact of research on users.

GLOSSARY:

- Randomization: a method by which a number of observations are selected at random
- Probability sampling: sampling in which each unit in the population list has an equal probability of being selected.
- Validation: the process by which data is verified or cross-checked for accuracy.
- Triangulation: is the process of obtaining the same information from several sources and types of sources
- Case-control study (retrospective) : a study which allows a comparison between a group of persons who have a disease or risk factor and a group that does not.
- Odds ratio:a statistical method used in retrospective or cross-sectional survey studies to determine the association of a factor and a disease.
- Relative risk: statistical method used in prospective studies to determine the association of a factor and a disease.
- Prospective (Cohort study): a sample of the population selected and followed for a period of ltime to observe who develops the disease or factor.
- Cross sectional survey: a study to determine the prevalence of a disease or factor in a given population.
- Bias: data or information that may distort the findings from retrospective studies.

RESEARCH OBJECTIVES:

The objectives of research into the medical and public health aspects of disaster response and relief activities include the following:

1. Establishment of better methods for the accurate and timely determination of health and medical needs generated by a disaster and the type and quantity of material and human resources required to appropriately match those needs;
2. Development of improved evaluation methods to assess the quality and cost-effectiveness of health and medical disaster management efforts as well as

specific health interventions aimed at reducing morbidity and mortality among disaster affected individuals and communities;

3. Development of improved methods to assess the pre-disaster preparedness and vulnerability status of communities at risk for disaster to serve as input for planning of community-specific vulnerability reduction programs and actions;
4. Development of methods to assess the effectiveness of existing preparedness and vulnerability reduction programs as they have been impacted by disaster so as to learn from each event and to implement better rehabilitation and reconstruction programs in the affected communities thereby strengthening the capacity of the same to withstand future similar events;
5. Identification of relief functions and assignment of appropriate priorities;
6. Reduction in the morbidity and mortality caused by disasters resulting from all of the above.

Step 1: What is the Question?

1.1 Potential sources of questions
- 1.1.1 personal observations
- 1.1.2 anectodal reports
- 1.1.3 prior research

1.2 Sample research questions

Identify *Problem* to be studied; **Formulate** *Question/Hypotheses*;

Validate question (Background research). What are the key questions? The application of proper scientific research techniques in large measure depends on the questions being asked, such as the following: When and how did victims become identified for care, what

were their demographic features or characteristics (who were the victims), what medical care was provided to each victim and what was the outcome or the result of the care provided? What risk factors led to death and disability. How did death occur? How did disability occur? Was the care provided appropriate for the various injury conditions? In other words, we need to know who got hurt, what was done to them, and what was the result of the intervention or treatment. Those are certainly the most fundamental questions we would want answered.

Step 2: **Choose a research strategy.** [*Select a research approach according to the highest level of scientific truth possible or desired*]:

- 2.1 'Levels of Truth'
  - 2.1.1 preponderance of the evidence
  - 2.1.2 beyond a reasonable doubt (<20% probability of making an error)
  - 2.1.3 with certainty?
- 2.2 Scientific approach
  - 2.2.1 Qualitative (validation. triangulation)
  - 2.2.2 Quantitative (statistical methods)

The research strategy may be evaluative, epidemiological, or interventional. These elements can be combined in a single project. The first type utilizes qualitative methodologies and the latter two traditionally utilizes quantitative design. This latter methodology generally uses inferential statistical analyses to assess the relationship between cause and effect. However, interventional research design also can utilize qualitative techniques, as much of the information collected will not lend itself to inferential statistical analysis. Much of disaster research lies in the *Domain of Human Science*. "It is within this matrix of inter-subjective social meanings that the human science researcher operates."(Kvale S: *Issues of Validity in Qualitative Research.* Lund,

Sweden: Studentlitteratur, 1995). Validation of the information collected using qualitative techniques is accomplished through triangulation. *Triangulation* is the process of obtaining the same information from several sources and types of sources (e.g., victims, rescue workers, media, etc.) using more than one scientific method.

Step 3: **Choose research method(s) or design to match the strategy.**

The 4 dimensions of a research study:

3.1 *Time frame of study:*
- 3.1.1 retrospective (case history)
- 3.1.2 cross-sectional (prevalence)
- 3.1.3 prospective or longitudinal (cohort)

3.2 Scope:
- 3.2.1 field (prehospital)
- 3.2.2 hospital
- 3.2.3 public health
- 3.2.4 laboratory

3.3 *Subject:*
- 3.3.1 humans (outcome)
- 3.3.2 animals
- 3.3.3 structure
- 3.3.4 process
- 3.3.5 adequacy
- 3.3.6 cost ($)

3.4 Perspective:
- 3.4.1 unidisciplinary
- 3.4.2 multidisciplinary
- 3.4.3 interdisciplinary
- 3.4.4 multinational

The ***design*** should foster the identification of substantive links between the results of the research and disaster management and planning. Analysis of the data should include elements to define structure, process, outcome, adequacy, and costs associated with the

response(s). *Structure* refers to the equipment and personnel, and the way in which these resources were organized for use in the medical response. *Process* refers to the manner in which the system performed during the disaster. *Outcome* assessment concerns the impact of the care provided on the patients served. *Adequacy* describes the extent to which the search and rescue, prehospital and hospital, and public health responses were able to meet the needs of the community during the disaster response. Outcome assessment requires a review of patient records using explicit and/or implicit standards and criteria. If *explicit* standards and criteria are employed, the reviewer(s) use a set of pre-established rules of interventions as relate to outcome. If *implicit* standards and criteria are used, a panel of "experts" are asked to review a set of patient records and make judgments about the appropriateness of treatment as related to patient outcomes. In addition, the studies may involve data collected either retrospectively or prospectively. A primary concern associated with retrospective research design is that much of the information collected is *perishable*. Perishable data change with the passage of time. Much of the qualitative data obtained in or following disaster situations is subject to change by many confounding factors such as the influence of media reports, and the sharing of information between victims, between responders, and between others involved in the care delivered to the victims. The value of perishable information decreases with the passage of time. Thus, for certain data, the time selected for gathering of the data is crucial.

Step 4: Create a Data Collection Plan

4.1 geographic
4.2 demographic

4.3 sample size (probability vs convenience vs. representative)
4.4 randomization scheme
4.5 sources of data
- 4.5.1 interviews (survivors, health care, search and rescue, coordinators):
- 4.5.1.1 Questionnaire design and construction.(types of questions: Appendix A)
  - 4.5.2.1.1 opend-ended
  - 4.5.2.1.2 closed-ended
  - 4.5.2.1.3 multiple choice user-specified.
- 4.5.2 situation reports (disaster intelligence)
- 4.5.3 official records
- 4.5.4 public health records
- 4.5.5 medical records
- 4.5.6 autopsy records
- 4.5.7 concurrent data

4.6 Select data analysis method
4.7 Triangulation and validation technique
4.8 Bias
- 4.8.1 in the design of questions
- 4.8.2 In recall of events

Identify/construct data (information) collection *instruments*. Data collection methodology may be quantitative or qualitative or a combination of both. All data collected should be cross-checked for validity and reliability (triangulation). Data must be gathered in the closest time to the event as possible or much substance may be lost (perishable). Whenever possible, concurrent data collection should be done. This will increase the validity of data collected retrospectively when the latter is interpreted in light of those data collected concurrently. Concurrent data collection requires its own set of research instruments and criteria. It should be carried out by a member of the medical response team.There should be two components to the data collection process in Disaster research. One is a concurrent component, where data are collected at the time the response effort is unfolding, as things are being done initially to victims. The second is a retrospective look that should occur within a month. With respect to concurrent data

collection, when the victim is first identified, a system or set of procedures should be devised to collect critical pieces of information, and these would be recorded by health care professionals. The data should be entered on a standardized form or card. Perhaps, a plastic covered card or an ID band. This form would stay with the victim through the triage and treatment process. Data on the standardized form or card would include:

- the date of injury,
- time the victim was identified,
- the location of the victim when injured,
- victim name,
- date of birth,
- gender,
- mode of transportation to the treatment facility,
- the diagnosis,
- the treatment provided at the scene of injury, during transport, and
- the status of that patient on arrival to the treatment facility.

Construct sampling *plan*. There should be a scientific sample - this means random or *probability sampling* - and there should be validation of the research methods. There are techniques for validating information that is obtained through interviews as described above.

In disaster it is difficult to collect concurrent data. If we could get concurrent and retrospective data of the kind that we are referring to, these data then can be used for several purposes. The concurrent data could be used to improve assessment in the management of daily operations as well as perform quality assurance. It would certainly be valuable for making decisions about the management of the relief operation. The most important use, though, of the concurrent and retrospective data, is to evaluate what was the quality of the medical and the public health response. And finally, some of this

information could be used for more fundamental research, and lead to better ways of treating victims.

Step 5: Develop a Research Management System (how to conduct the research and manage the data).

- 5.1 select a research team:
  - 5.1.1 team composition
  - 5.1.2 team leader
  - 5.1.3 methodologist/statistician
  - 5.1.4 logistician
  - 5.1.5 data entry
  - 5.1.6 team member (acute care specialists, public health specialist, structural engineer, social scientist, psychologist/psychiatrist)
- 5.2 select a data analysis and management system
  - 5.2.1 epi-info
  - 5.2.2 SPSS
  - 5.2.3 BMDP
  - 5.2.4 SAS
- 5.3 research team schedule.
- 5.4 briefing and debriefing sessions.
- 5.5 select research aids.
  - 5.5.1 notebooks.
  - 5.5.2 tape recorders.
  - 5.5.3 camera

The selection and training of the members of the data collection team(s) is crucial. This process perhaps is the most important aspect of data collection. No matter how structured the data collection instruments may be, the reliability and validity of the data collected is a function of the abilities of the data collectors to use the instruments. Time devoted to the training of these persons is repaid in the quality of the data obtained.

It is important to recognize that often the data required is culturally sensitive. Cultural factors are important confounders in data collection. This is important particularly in international and cross-cultural responses and evaluations. It is essential

that all data collectors are familiarized with the culture of the areas in which they will work and that persons from within the culture be incorporated into the research design, the preparation of the data collection instruments, and in the data collection processes. This is facilitated by using multinational teams in the design of research instruments and in the implementation of the research study.

In those projects for which qualitative methodologies are used, it is appropriate and essential that frequent debriefings be conducted. Such debriefings serve to validate data and techniques. Whereas, in quantitative studies in which inferential statistics will be used to validate a hypothesis in terms of cause and effect, changing any aspect of the data collection process is inappropriate, it is appropriate in qualitative methodology to adjust the data collection instruments during the data collection process. In this way, the data collected increasingly reflect the appropriateness of the information obtained. This enhances the validity of the observations. For example, the sampling strategies might be adjusted to include areas of low and high mortality rates respectively. Often, open-ended questions provide the stimulus for such adjustments. Data collection instruments must be field tested prior to their use.

Step 6: **Conduct a Scout Survey (1 or 2 research members).**

6.1 Goals and objectives:

- 6.1.1. Perform informal open-ended interviews of key officials.
- 6.1.2. Make local official contacts and get travel clearances.
- 6.1.3. Visit site of disaster.
- 6.1.4. Select survey site(s).
- 6.1.5. Determine relevance of event to research questions.
- 6.1.6. Assess appropriateness and timing of principal survey.
- 6.1.7. Select local research team.
- 6.1.8. Collect preliminary data.

6.1.9. State the purpose and mutual benefits of the research.
6.1.0. Determione roles and responsibilities of team members.

We suggest that in addition to the concurrent data collection, that there be a retrospective evaluation study. It could be initiated by having a small team of one or two people go to the site within two weeks of the disaster to prepare for a larger team which would initiate work within 4-6 weeks. Such scout or primary surveys are useful in the development and revision of the data collection instruments and for securing collaboration of local officials who will facilitate the research study. In a disaster, it is essential that the initial data collection be completed as soon after the event begins as is possible, as there occurs rapid loss of recall and modification of perceptions as the event proceeds.

Step 7: Conduct Principal Survey

7.1. Timing (ideally <6 weeks)
7.2. Duration (14-21 days)
7.3. Flexibility
7.4. Pilot-test research instruments
7.5. Revise questionnaires as needed
7.6. Conduct research.
7.7. Write field report.

This principal survey team would have pre-established research instruments (questionnaires and data collection forms) that they would use to access many of those sources of information mentioned above. And the team must be trained in a particular way, and it should consist of scientists and health care workers who live and work in the zone of the disaster, and some who work outside of the disaster. More importantly, it

should consist of medical professionals and social or behavioral scientists, who are familiar with the kind of research that is being performed.

Step 8: Conduct Follow-up Surveys

8.1. Fill in the gaps.
8.2. Increase sample size.
8.3. Follow trends.

Step 9: Perform Data Analysis (Appendix B)

Data analysis will be dictated by the research design and character of data collected irrespective of whether the study is evaluative or epidemiological.

Step 10: Prepare and Publish Research Report

Should be based on team members' field reports, data collected, data analysis, results, conclusions and recommendations.

Step 11: Disseminate Research Results

11.1. Target audience
11.2. Published reports (research community)
11.3. Technical reports (operational community)
11.4. Executive ummaries (policy makers)
11.5. Conferences, symposia (academic community and others)
11.6. Media (the public).

Step 12: Assess Impact of Research

Did the research findings reach target audience?
Have recommendations been incorporated in the operational field? If not, why not?

APPENDIX A

Sample Questionnaire (Earthquakes)

The following are a list of sample questions for illustrative purposes only. The responses to these questions would be user-specified, in other words, a choice of responses would be provided for each question.

- **Sample questons for the collection of data from the survivors of disasters:**

Name?
Where were you at the time of the earthquake?
What did you do first?
Include an open ended section to describe what he/she did (venting of experiences) and summarize based on brief narrative.
Were you injured?
If so, how?
What type of injury?
Were you trapped?
Were you pinned?
Who rescued you?
Who treated you?
If uninjured did you try to help others?
Have you had any first aid training?
If so, what type of training?
Where did you get this training?
How long ago?
What first aid skills did you use?
Did the victim respond favorably to your first aid intervention?

- **Sample questions concerning victims of disaster:**

- **Demographic/Geographic data**

Name
Age
Sex
Location of victim?
Was victim inside or outside a structure?
If so, what type of structure? (un-reinforced masonry, reinforced concrete, etc.)
How many floors?

- **Search and Rescue (Relevant to earthquakes and building collapses)**

Was the victim pinned?
Was the victim trapped?
Did you extricate the victim?
If so, with what tools? (bare hands, improvised tools, hand held tools, power tools, etc.)
Approximately how long was the victim trapped or pinned?
Approximately how long did it take to extricate the victim?
Did the victims condition worse after extrication?
Who helped?
How did you call for help?
How long before help arrived?

- **Sample questions concerning care provided to victims:**

- **Medical Care (for lay survivors and search and rescue personnel)**

Were you personally involved in the care of this victim? If yes, continue. If no, stop.
Where did you first encounter the victim?
Upon first encounter, was the victim breathing? Awake? Responding to verbal commands? Responding to painful stimuli? Talking? Moving? Moaning? Unconscious? Dead?
Was the victim alive then died?
If the victim was initially alive and then died, approximately how long before he/she died?
Do you think this victim could have been saved with earlier treatment?
If so, what type of treatment?
Was the victim breathing?
Did the victim have any breathing difficulty?
If so, what did you do? (elaborate)
Did the victim have a pulse?
If not, what did you do?
Was the victim bleeding?
If so, what did you do? (elaborate)
Was psychological support available to you during or after the event?
For health care personnel:
Were you involved in the care of this victim?
Was the victim alive when you first encountered him/her? If not, stop.
What was your diagnosis?
What medical interventions were performed on this victim?
Was the victim treated at the scene/place of injury/illness?
If so, by whom?
How was the victim evacuated/transported to the treatment facility?
Was the victim admitted to a treatment facility?
What is your level of training? (nurse, EMT, Doctor, specialist, resident, medical student, other)
Have you had training to for deal with the medical problems you encountered?

If not, why not?
Did you have enough supplies to perform your duties?
Did you have the kind of supplies you needed?
If not, what type of supplies did you need?
Did you work in shifts?
Was psychological support available to you during or after the event?

- **Sample questions concerning prior training in first aid:**

- **Medical training (intended for non-health personnel)**

Have you had any first aid training?
If so, what type of training?
Where did you get this training?
How long ago?
What first aid skills did you use?
Did the victim respond favorably to your first aid intervention? Other?

Appendix B

- **Sample of data analysis for data collected from interviews, medical records, and other sources:**

Table 1: Relation of entrapment to occupant position and initial response.

	Trapped (n=14)		Not trapped (n=101)	
Position in Room				
Exterior wall	3	(21%)	32	(32%)
Middle of room	4	(29%)	33	(33%)
Interior wall	6	(43%)	35	(35%)
Did not know	1	(7%)	1	(1%)
p		NS		
Initial Response				
Moved to doorway	0		7	(7%)
Moved to window	0		3	(3%)
Hid under furniture	0		4	(4%)
Froze	8*	(57%)	43	(43%)
Fled building	N/A		37	(37%)
Other	6**	(43%)	7	(7%)
p'		0.036		

Including all those surveyed who were in a room in the earthquake region at the time of the event.

* excluding those pinned

** including 5 who were pinned

' excluding those who fled building

Table 2: Distribution of building damage in the city.

	Residential	Commercial	City Center (Residential & Commercial)
Heavy	3,176 (20.8%)	844 (54.2%)	2169 (23%)
Medium	4,727 (31.0%)	430 (27.6%)	3240 (34%)
Light	7,324 (48.1%)	282 (18.1%)	4061 (4.3%)

$p < 0.001$ for residential versus commercial building collapse.

Table 3: Characteristics influencing whether persons tried to help.

		Medical training Lay		Medical Training Lay & SAR*	
		yes	no	yes	no
Tried to	yes	16	31	32	49
help others	no	5	53	6	54
p		< 0.001		<0.0001	

*excluding healthcare workers

(ref: Angus D, Pretto E, Abrams J, et al. Epidemiologic assessment of mortality, building collapse pattern, and medcial response after the earthquake in Turkey. Prehospital and Disaster Medicine, 12 (3), 1997).

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