

Session No. 14

Course Title: Social Dimensions of Disaster, 2nd edition

Session 14: Constructing Theoretical Models

1 hr.

Objectives:

- 14.1 Define and illustrate the concept “theoretical model”.
- 14.2 Explain why social scientists construct theoretical models
- 14.3 Discuss the relevance of theoretical model building to emergency management
- 14.4 Discuss the steps in the model building process
- 14.5 Discuss the components that comprise an evacuation compliance model.

Scope:

This session introduces students to the process of building multivariate theoretical models and illustrates the relevance of this process to emergency management.

Readings:

Student Reading:

Perry, Ronald W. 1994. “A Model of Evacuation Compliance Behavior.” Pp. 85-98 in *Disasters, Collective Behavior, and Social Organization* edited by Russell R. Dynes and Kathleen J. Tierney. Newark, Delaware: University of Delaware Press.

Professor Readings:

Merton, Robert K. 1969. “Foreword.” Pp. vii-xxxvii in *Communities in Disaster: A Sociological Analysis of Collective Stress Situations*. Allen H. Barton. Garden City, New York: Doubleday and Company, Inc.

Lindell, Michael and Ronald W. Perry. 2004. *Communicating Environmental Risk in Multiethnic Communities*. Thousand Oaks, California: Sage Publications. (Chapter 3 only, “Disaster Warnings As Risk Communication,” pp. 67-117).

Background References:

Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1981. *Evacuation Planning in Emergency Management*. Lexington, Massachusetts: Lexington Books. (Chapter 6 only; “A Path Analysis of Evacuation Behavior,” pp. 107-119).

Sorensen, John H. 1991. “When Shall We Leave? Factors Affecting the Timing of Evacuation Departures.” *International Journal of Mass Emergencies and Disasters* 9:153-165.

General Requirements:

Overheads (14-1 through 14-9 appended).

See individual requirements for each objective.

Objective 14.1 Define and illustrate the concept “theoretical model”.

Requirements:

Start this session with the student exercise and proceed with lecture material specified below.

Use Overheads 14-1 through 14-3.

Remarks:

I. Introduction.

A. **Exercise.**

1. **Remind** students of exercise procedures.
2. **Divide** class into four groups and assign roles.
 - a. Chair.
 - b. Reporter.
 - c. Timer.
3. Announce time limit: 5 minutes.

B. **Display** Overhead 14-1; “Workshop Tasks”.

1. Group 1 – Specify four propositions that identify factors that best predict college grades.
2. Group 2- Explain why an understanding of the process of constructing theoretical models is relevant to emergency managers.
3. Group 3 – Identify five propositions that Perry (1994) proposed regarding evacuation compliance.
4. Group 4 – Explain the impacts of disaster agent on the components of Perry’s (1994) model of evacuation compliance.

C. **Start** discussion.

D. **Stop** discussion.

E. **Explain** that group reports will be presented at different times through the session.

F. **Display** Overhead 14-2; “Session No. 14 Overview: Constructing Theoretical Models.”

1. **Explain** the summary of this session, i.e., “the big picture must be kept in mind during discussion of detail”.
2. **Review** topics listed:
 - a. What is a theoretical model?
 - b. Why construct theoretical models?
 - c. Relevance to emergency management.
 - d. The steps in the model building process.
 - e. **Example:** Evacuation compliance model.

II. Theoretical models.

A. **Definition:** a theoretical model is a network of interrelated propositions that collectively explain or account for a specified pattern or range of human behaviors.

B. **Proposition:** a statement that specifies the relationship between two or more concepts or variables.

C. Group 1 report: 2 minutes.

D. **Example:** college grades.

1. **Display** Overhead 14-3; “Predicting College Grades: A Simplified Multivariate Model”.

2. **Integrate concepts** with Group 1 report and **illustrate** as required.

a. Dependent variable: college grades.

b. Independent variables:

1) High school grades.

2) SAT scores.

3) Teacher recommendations.

4) Student aspiration.

5) Family socio-economic status.

6) High school quality.

c. **Example proposition:** “the higher the high school grades, the higher the college grades.”

E. **Explain:** **multiple** factors constrain human behavior.

1. Theoretical models are **simplified** explanatory devices.

2. Theoretical models are **multivariate**.

3. **Variables differ** in their explanatory power, i.e., some are more important than others.

4. Many variables are **interrelated**, e.g., SAT scores are correlated to high school grades.

F. **Relevant** statistical tools.

1. **Correlation.**

1. A statistic that assesses the degree to which patterning in one variable is consistent with the patterning in another.

- b. **Example:** height somewhat correlates to weight.
- c. Most social factors do not **co-vary** perfectly, e.g., many high school students have high grades but score low on the SAT.
- d. Correlations range from -1 to +1.
 - 1) **Example:** high school grades typically correlate about $r = .33$ with college grades.
 - 2) **Interpretation:** use the square of the correlation coefficient, i.e., $r = .33$, so $r^2 = .1089$. **Hence**, about 11 percent of the variation in college grades is accounted for by high school grades.
 - 3) **SAT scores:** typically are slightly **less** predictive of college grades than high school grades, i.e., $r = .30$. **Hence**, $r^2 = .0900$; 9 percent of the variation in college grades is accounted for by SAT scores.
 - 4) **Despite** a correlation, both high school grades and SAT scores leave a large amount of **unexplained** variation in college grades, i.e., 89% and 91% respectively.
 - 5) **Negative** correlation: indicates reversed relationship, e.g., the higher the score on one variable, the lower the score on another.
 - 6) **Example:** the greater the number of class absences, the lower the class grade.

2. Multiple correlation analysis.

- a. A series of statistical tools that estimate the **combined impact** of a series of independent variables on a dependent variable.
- b. Takes into account the **intercorrelations among variables**, e.g., SAT scores are correlated with high school grades.
- c. **Example.**
 - 1) R^2 indicates the combined impact of a series of variables.

- 2) High school grades **plus** SAT scores **plus** teacher recommendations = college grades ($R^2 = .360$).
- 3) **Interpretation:** these three social factors account for 36 percent of the variance in college grades.
- 4) **Unexplained variance:** this means that 64 percent of the variance in college grades is **due to other** social factors.
- 5) **Impact of intercorrelation:** because so many social factors are intercorrelated, adding extra variables often does not increase the size of R^2 ; i.e., the amount of variance accounted for by the model.
- 6) **Example:** both high school grades ($r = .33$) and SAT scores ($r = .30$) are correlated with college grades, but the **combined** impact of the two together is slight due to the high degree of intercorrelation, e.g., $R^2 = .340$. Adding teacher recommendations helps, but only slightly; $R^2 = .360$.

Supplemental Considerations:

The **key message** of this section is the **concept** of a theoretical model. Discussion of correlation and multiple correlation would **enhance student** understanding of the session. Some professors may choose to **expand** this section, while others **may minimize** the discussion, especially the statistical portion. The **objective** is to enhance **student understanding** of the Perry chapter and the model building process.

Objective 14.2 Explain why social scientists construct theoretical models.

Requirements:

Use Overhead 14-4.

Remarks:

I. Introduction.

- A. **Ask students:** “Given our discussion of the simplified model to predict college grades, why do social scientists construct theoretical models?” (List answers on chalk board).

B. **Ask students:** “Why did Perry emphasize the criticism of Lieberson regarding the model building process? (**Answer:** Too many models were **overly complex**; Perry accepts Lieberson’s criticism and recommends **simplicity**; Perry 1994, pp. 86-87).

II. The Rationale.

A. **Display** Overhead 14-4; “Why Do Social Scientists Construct Theoretical Models?”

B. **Review** and **illustrate** the seven points listed.

1. Single variable explanations are inadequate.
2. Goal is to generalize across disaster events.
3. Scientific reproducibility is a requirement.
4. Explanation in specified instances.
5. Guidance to literature reviews, i.e., facilitates integration.
6. Analogy to road maps, e.g., geographic model is helpful in city you have not visited.

Supplemental Considerations:

This section is designed to **enhance** student understanding of the **rationale** for model building. Depending on the **context** within which the course is offered, review may be quite **brief**, e.g., sociology majors who have completed course in theory and statistics. For **most students**, however, illustration and explanation of the topics listed on the overhead will **enhance** their understanding of the entire session and their **ability to interpret** other work like Perry’s (1994) chapter. **Note:** professors who are **less familiar** with the process and rationale for constructing theoretical models **are urged** to review Merton (1969) wherein he explains the application to disaster research. Barton (1969) has several **excellent theoretical models** pertaining to disaster behavior although they **remain untested**. These could be a **source of additional examples**, if desired.

Objective 14.3 Discuss the relevance of theoretical model building to emergency management.

Requirements:

Use Overhead 14-5.

Remarks:

- I. Introduction.
 - A. Group 2 report (2 minutes).
 - B. **Integrate** and **supplement** as required with the points listed below.
- II. Relevance to emergency managers.
 - A. **Ask students:** “Are there any additional reasons that an understanding of the model building process is important to emergency managers?” (List reasons on chalk board).
 - B. **Display** Overhead 14-5; “Relevance to Emergency Management.”
 - C. **Integrate** with Group 2 report, class responses, and elaborate as required.
 1. Debunk common sense explanations, e.g., disaster myths.
 2. Comprehend future research studies.
 3. Training others.
 4. Participate in professional network.
 5. Avoid misapplications.
 6. Organize reading.
 7. Design future research.
 8. Disaster planning.
 9. Policy guidance.

Supplemental Considerations:

It is **essential** that this section enhance student understanding of the **linkages** between the theoretical modeling process and the practice of emergency management. Some professors will sense that a **quick review** of the points listed is all that is required. With **some student populations**, however, this session will require **elaboration**. Additional **discussion time** should be allocated as required.

Objective 14.4 Discuss the steps in the model building process.

Requirements:

Use Overhead 14-6.

Remarks:

- I. Introduction.
 - A. **Ask students:** “What steps did we go through when we constructed the simplified model to predict college grades?”
 - B. **List** responses on chalk board.
- II. The steps in model building.
 - A. **Display** Overhead 14-6; “Constructing Theoretical Models”.
 - B. **Review** and **illustrate** the points listed.
 1. **Observation**, e.g., some people evacuate, some do not.
 2. **Define and delimit**, e.g., Perry (1994) limited his model to evacuation compliance as the **dependent** variable.
 3. **Review literature**, e.g., what other studies have been completed on evacuation compliance?
 4. **Organize concepts**, e.g., what concepts or variables have others proposed that might **constrain** evacuation compliance?
 5. **Define variables**, e.g., possible independent variables of relevance to evacuation compliance would be warning confirmation or risk perception.
 6. **Create hypothesis network.**
 - a. **Definition:** a **hypothesis** is a statement of a **suspected** relationship between two or more variables.
 - b. Similar to a **proposition**, but as yet **untested**, not tested adequately, or not tested in newly defined conditions (e.g., tornado event, but not hazardous materials).

c. **Example:** the **higher** the credibility of the warning source, the greater the degree of evacuation compliance.

7. **Create measurements.**

8. **Field test model.**

9. **Revise model.**

10. **Confirm revised model.**

11. **Investigate** range of external validity, e.g., what types of disaster events are applicable?

12. **Integrate** model with related theory.

Supplemental Considerations:

Most of the **steps** in the model construction process are rather **straightforward**. Use of **examples**, like those specified above will enhance student understanding. Additional examples may be required, but it is recommended that the professor **not** become “**bogged down**” in this section so as to distract from the final section, i.e., 14.5. While discussion of these steps is important, the final example focused on Perry’s (1994) chapter should **assist in helping students** obtain the overall objective of the session, i.e., role of model building in research related to emergency management. There is one **exception**, however. That is the final point about **general theory**. It may be desirable to use the following quotation from Merton (1969) unless the professor has a favorite example for illustration.

“Such theories often enable us to anticipate phenomena that are at odds with commonsense expectations, that is, with expectations based upon an undisciplined and unexamined set of self-evident assumptions drawn from everyday experience. It is only a matter of common sense, for example, to believe that the greater the loss experienced by families in a disaster, the more they will feel deprived. This belief is based on the unexamined assumption that the magnitude of objective loss is directly and linearly related to the subjective appraisal of the loss; that the appraisal is a purely personal one. But the theory of relative deprivation leads to quite other expectations. In this theory, self-appraisals are seen as depending upon people’s comparisons of their own situation with that of other people perceived as being of the same kind. The theory therefore leads us to anticipate that, under certain conditions, families suffering serious losses will feel *less* deprived than those suffering smaller losses; if, for example, they are in situations leading them to compare their own lot with that of people suffering even more severe losses. And it is people in the area of greatest impact of a disaster who, though themselves substantially deprived, are most apt to see about them others who are even more severely deprived.” (Merton 1969, p. xxxiv).

Objective 14.5 Discuss the components that comprise an evacuation compliance model.

Requirements:

Use Overheads 14-7 through 14-9.

Remarks:

- I. Group 3 report: 2 minutes.
- II. Evacuation compliance model.
 - A. **Elaborate** as required and integrate with Group 3 report with examples of propositions like these from Perry, 1994.
 1. “. . . unless family members are accounted for, citizens will not comply with an evacuation warning.” (p. 89).
 2. “. . . the more precise the adaptive plan, the greater the likelihood of evacuation compliance.” (p. 89).
 - B. **Display** Overhead 14-7; “Evacuation Compliance Model.”
 1. **Briefly review** the variables listed:
 - a. Family context.
 - b. Adaptive plan.
 - c. Confirmation.
 - d. Credibility.
 - e. Content.
 2. **Ask students:** “How does this model parallel the model we reviewed previously regarding college grades?” (**Answer:** a series of independent variables, e.g., credibility and content are related to a dependent variable, i.e., evacuation compliance).
 3. **Ask students:** “Using one of the variables not mentioned so far, how would you state the proposition?” (May not be necessary depending on Group 3 report) (**Answer:** the greater the specificity of warning

message content, the greater the likelihood of evacuation compliance; see Perry 1994, p. 90).

III. Impacts of disaster agent.

A. Group 4 report: 2 minutes.

B. **External validity.**

1. **Remind** students of Step 11, in the model construction process; i.e., external validity (see Overhead 14-6).
2. **Remind** students of discussion in Session No. 13; “Disaster Research Methods”, Section 13.5, sub-section 5.
3. **Definition:** to what universe can we generalize the study results?

C. **Display** Overhead 14-8; “Disaster Agent Impacts.”

D. **Review** topics listed and **integrate** with Group 4 report.

1. **Length of forewarning** (Perry 1994, p. 96).

- a. Warning source credibility was most important in Mt. Vernon (hazardous materials) where forewarning was short.
- b. Warning source credibility was least important in Abilene (flood) where forewarning was long.

2. **Event familiarity** (Perry 1994, p. 96).

- a. Warning source credibility was **most** important in Mt. Vernon (hazardous materials) where event familiarity was **low**.
- b. Warning source credibility was **least** important in Abilene (flood) where event familiarity was **high**.

IV. Revision of model.

A. Lindell and Perry (2004) have reviewed new studies, plus completed additional studies, so as to **revise** the model of evacuation compliance.

B. **New name** for model: “Protective Action Decision Model” (PADM) (Lindell and Perry, 2004, pp. 45-65).

C. **Display** Overhead 14-9; “Revised Model of Evacuation Compliance.”

D. **Review** the components of the model and illustrate as required (adapted from Lindell and Perry, 2004, pp. 68-92).

1. Situational factors.

- a. Environmental cues, e.g., ash plume after volcano.
- b. Social context, e.g., friend/kin networks, community participation.

2. Warning components.

- a. Sources.
- b. Channels.
- c. Content.

3. Receiver characteristics.

- a. Previous experience.
- b. Prior beliefs.
- c. Demographics, e.g., age, gender, ethnicity.
- d. Personality.

4. Confirmation actions.

- a. Information needs assessment.
- b. Communication action assessment.
- c. Communication action implementation.

5. Decision dimensions.

- a. Risk identification.
- b. Risk assessment.
- c. Protective action search.
- d. Protective action assessment.

e. Protective action implementation.

- D. **Ask students:** “Looking at the list of independent variables in this model, what would be an example of a proposition?” (**Answer:** using “social context” as an example; the greater the intensity of friend/kin networks, the greater the likelihood of evacuation compliance.”

Supplemental Considerations:

The **message** of this section is to illustrate the **utility** of and **precision** in a theoretical model. Given the topics and readings in the course to this point, this section also may serve to **integrate several** of the prior sessions for students. It is possible that a few students may ask for clarification regarding the meaning and use of “**standardized partial regression coefficients**” which are discussed at the end of the Perry (1994) chapter (pp. 96-97). Professors **should be prepared** to explain that these statistics provide estimates of the proportion of the variance in the independent variable that the particular dependent variable accounts for with all **other factors controlled**. Thus, it is a guide to select which variables are “**most important**” at least in the statistical sense. Also, it could be pointed out that the **models accounted** for substantiate portions of the **variance** in evacuation compliance, e.g., in the Mt. Vernon case the model accounted for 75 percent of the variance ($R^2 = .75$) (see the bottom row listed in Table 3 in Perry, 1994, p. 93).

Course Developer References:

- I. Barton, Allen H. 1969. *Communities in Disaster: A Sociological Analysis of Collective Stress Situations*. Garden City, New York: Doubleday and Company, Inc.
- II. Lindell, Michael and Ronald W. Perry. 2004. *Communicating Environmental Risk in Multiethnic Communities*. Thousand Oaks, California: Sage Publications.
- III. Merton, Robert K. 1969. “Foreword.” Pp. vii-xxxvii in *Communities in Disaster: A Sociological Analysis of Collective Stress Situations*. Allen H. Barton. Garden City, New York: Doubleday and Company, Inc.
- IV. Perry, Ronald W. 1994. “A Model of Evacuation Compliance Behavior.” Pp. 85-98 in *Disasters, Collective Behavior, and Social Organization* edited by Russell R. Dynes and Kathleen J. Tierney. Newark, Delaware: University of Delaware Press.
- V. Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1981. *Evacuation Planning in Emergency Management*. Lexington, Massachusetts: Lexington Books.

- VI. Sorensen, John H. 1991. "When Shall We Leave? Factors Affecting the Timing of Evacuation Departures." *International Journal of Mass Emergencies and Disasters* 9:153-165.