Attachment, Communication, and Delay during the Evacuation of the World Trade Center on September 11th

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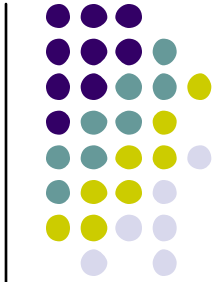
The World Trade Center Evacuation Study

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

The World Trade Center Evacuation Study



- Conducted by the Mailman School of Public Health at Columbia University (Dr. Robyn R. Gershon, P.I.) Grant funding provided by the Centers for Disease Control and Prevention.

- Retrospective questionnaire administered approximately two years after September 11th, 2001 to workers who evacuated from World Trade Center (WTC) towers 1 and 2 (total *N* = 1444).

- Sample population's demographics parallel known demographics of the workers in each respective WTC tower.

Topics of Inquiry

- **1) Was face-to-face discussion of threat level and evacuation plans inside the WTC towers prior to mobilizing evacuation associated with reports of lower threat perception?**

  - Attachment theory explains our “innate” motivation to affiliate with others during disasters by predicting that a retreat from uncertain, ambiguous threats towards familiar figures is a movement towards seeking attachment reinforcement (Bowlby, 1973).

  - Face-to-face discussion of the potential threat and need to evacuate with coworkers in the WTC might therefore have been associated with decreased danger estimations within the towers due to the normalizing reinforcement of interacting with attachment figures.

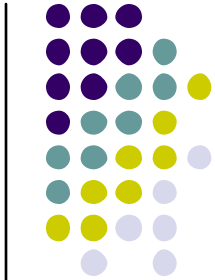
Topics of Inquiry

- **2) Were face-to-face discussions prior to evacuation mobilization associated with a longer delay in physically starting to evacuate?**

  - Emergent Norm Theory – Human tendency to exchange information and create social hierarchy to respond to ambiguous, threatening situations as a group (Turner, 1964; Turner & Killian, 1987).

  - Research findings from the 1993 WTC bombing indicated that most evacuees descended in groups, knew their group members well before the bombing, and that the more that group members discussed the situation's danger the longer the time delay before they physically evacuated (Aguirre, Wenger, & Vigo, 1998).

Topics of Inquiry

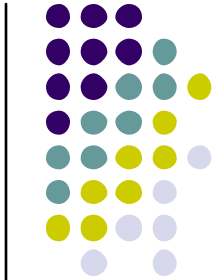


- **3a) What potential role did communication devices play in delaying or expediting the physical initiation of evacuation?**
  - **<u>One-way</u> communication devices:**
    - TV, radio & PA announcements
    - Previous research suggests that survivor exposure to mass media sources during an evacuation can increase the amount of deliberating in groups, which may then further delay the start of evacuation (Aguirre et al., 1998).

Topics of Inquiry

- **3b) What role did communication devices play in delaying or expediting the physical initiation of evacuation? (cont.)**
  - **<u>Two-way</u> communication devices:**
    - Telephone, cell phone, pager/blackberry & email.
    - Studies of multiple large disasters have revealed that humans tend to evacuate towards those with whom they feel safe, rather than towards objectively safe places (Mawson, 2005).
    - Communication with attachment figures outside the immediate area, at the point of decision, might have motivated survivors to evacuate quickly towards those people rather than engage/continue in face-to-face interaction with coworkers.

Social Milling & Variable Definitions



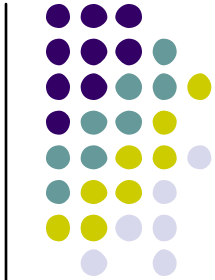
- **Social Milling** – Interpersonal communication directed towards determining accurate threat information and establishing a social hierarchy to determine the group's course of action.
  - Operationally defined as reporting that face-to-face communication within the tower was important when deciding whether to evacuate (dichotomous measure – face-to-face communication was reported as important or not important).

- **Initiation Delay** – Time elapsed between realizing the seriousness of the incident and start of physical evacuation (continuous measure).

Variable Definitions (cont.)

- Work-related consequences for delay: Summation of yes / no responses to four possible reasons for delaying evacuation related to employment:
  - 1) “I thought leaving could hurt my employment”
  - 2) “I believe my immediate supervisor would not have approved”
  - 3) “I wanted to get permission from my supervisor first”
  - 4) “I might have lost pay”
  - Variable Range = 0 to 4

Sample Characteristics (WTC 1)

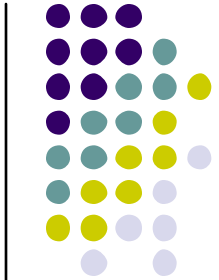


- *n* = 596
- Male – 61.7%
  - Age *M* = 45.5 (*SD* = 10.3); Range = 23 – 73.
- Female – 38.3%
  - Age *M* = 43.7 (*SD* = 9.4); Range = 23 – 66.
- Mean initiation delay (in minutes): 6.9 (*SD* = 8.9)
  - Range = 0 to 80 minutes

Sample Characteristics (WTC 2)

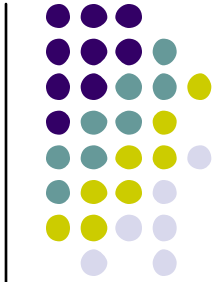
- *n* = 568
- Male – 55.7%
  - Age *M* = 43.0 (*SD* = 10.5); Range = 22 – 80.
- Female – 44.3%
  - Age *M* = 41.6 (*SD* = 11.5); Range = 22 – 72.
- Mean initiation delay (in minutes): 6.3 (*SD* = 6.8)
  - Range = 0 to 45 minutes

Covariates



- Covariates used in all analyses:
  - Floor of origin
    - Significant, negative relation with initiation delay (r = -.07, p < .05, 95% CI for r = -.13 – -.01).
  - Age
    - Significant, positive relation with initiation delay (r = .09, p < .01, 95% CI for r = .03 - .15).
  - Work-related consequences for evacuating
    - Significant, positive relation with initiation delay (r = .07, p < .05, 95% CI for r = .01 - .13).

1: Social Milling and Belief in Danger (Threat Perception)



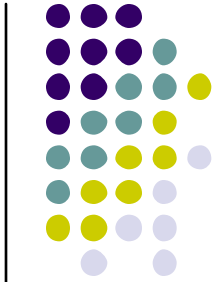
- Being in the company of known persons during confusing, potentially threatening situations is theorized by Attachment and Emergent Norm theories to be reinforcing a sense of normalcy, safety and social order, (Aguirre et al., 1998; Bowlby, 1973).

- Research from the 1993 WTC bombing indicated that the majority of survivors knew those around them during evacuation (Aguirre et al., 1998).

- **Hypothesis:** Those who reported engaging in face-to-face communication (social milling) prior to deciding to evacuate would have been less likely to have reported that they believed they were in danger prior to starting evacuation than those who did not report engaging in social milling.

    - Belief in danger was dichotomized (reported or did not report belief).

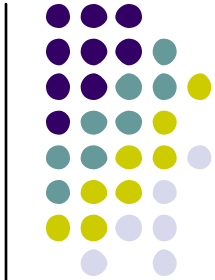
1: Social Milling and Belief in Danger



- Significant relation between social milling and belief in danger (reports of milling associated with decreased probability for having reported belief in danger).
  - $p < .05$, $OR = 0.78$ (95% CI for $OR = 0.63 – 0.98$) for both towers combined (overall effect).

  - However, when investigated in each tower separately, the above significant relation was *only* found from the reports of those who evacuated WTC 2.
    - **WTC 1:** ns., $OR = 1.05$ (95% CI for $OR = 0.68$ - 1.61).
    - **WTC 2:** $p < .05$, $OR = 0.64$ (95% CI for $OR = 0.44$ - 0.96).

1: Social Milling and Belief in Need to Evacuate Completely



- Attachment and Emergent Norm Theories predicts that the increased sense of normalcy and social hierarchy, fostered by contacts with known persons during an emergency, would decrease perceptions of urgency.

- **Hypothesis:** Those who reported engaging in social milling would be less likely than those who did not report engaging in social milling to have reported believing that they would have needed to evacuate the tower completely prior to starting evacuation.

    - Belief in the need to evacuate completely was dichotomized (reported or did not report belief).

1: Social Milling and Belief in Need to Evacuate Completely

- Similar to hypothesis 1, a significant relation between social milling and need to evacuate completely was found (reports of milling associated with decreased probability of having reported belief in need to evacuate completely).
  - $p < .01$, $OR = 0.61$ (95% CI for $OR = 0.44 - 0.85$) for both towers combined (overall effect).

  - Again, when investigated in each tower separately, the above significant relation was *only* found from the reports of those who evacuated WTC 2.
    - **WTC 1:** ns., $OR = 0.66$ (95% CI for $OR = 0.38 - 1.15$).
    - **WTC 2:** $p < .05$, $OR = 0.63$ (95% CI for $OR = 0.42 – 0.82$).

2: Social Milling and Initiation Delay

- Emergent Norm Theory predicts that individuals who discuss and deliberate threat level and evacuation plans are likely to delay in mobilizing evacuation (Aguirre et al., 1998).

- **Hypothesis:** Those who reported that face-to-face communication was important in their evacuation decision-making process (social milling) would have reported a longer initiation delay than those who did not report that social milling activities were important in their decision.

- Social milling variable: Dichotomy reflecting whether or not survivors reported engaging in and being influenced by face-to-face communication within the tower while deciding whether to evacuate.

2: Social Milling and Initiation Delay

- Social milling was not related to initiation delay in both WTC 1 WTC 2 combined:
  - ns., *OR* = 1.03 (95% CI for *OR* = .85 – 1.26) for both towers combined (overall effect).

- No relation between social milling and initiation delay was found in reports from either tower separately:
  - **WTC 1:** ns., *OR* = 1.09 (95% CI for *OR* = .81 – 1.46)

  - **WTC 2:** ns., *OR* = 1.03 (95% CI for *OR* = .78 – 1.37)

3a: One-Way Device Use and Initiation Delay

- Exposure to mass media information during a disaster, information which is often incomplete and/or inaccurate, is likely to contribute to the time that it takes for survivor groups to deliberate and decide on an action plan before evacuating (Aguirre et al., 1998).

- **Hypothesis:** Those who reported exposure to any one-way communication devices (TV, radio, PA announcements) prior to evacuation would have reported delaying the start of their evacuation more so than those who did not report exposure to any such devices.
- One-way device variable: Dichotomy reflecting whether survivors reported being exposed to 0 or ≥ 1 one-way communication devices within their tower prior to evacuation.

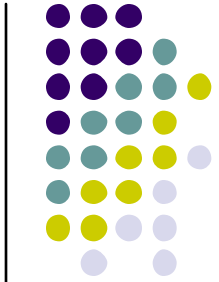
3a: One-Way Device Use and Initiation Delay

- Significant relation between exposure to one-way communication devices (TV, radio, PA announcements) and initiation delay in both towers combined, such that evacuees who reported being exposed to at least one one-way device also reported significantly longer initiation delay than those who reported no exposure to one-way devices:
  - $p < .001$, $OR = 2.32$ (95% CI for $OR = 1.72 – 3.12$).

- This relation was found in reports from both towers:
  - **WTC 1:** $p < .001$, $OR = 2.21$ (95% CI for $OR = 1.46 – 3.28$).

  - **WTC 2:** $p < .001$, $OR = 2.56$ (95% CI for $OR = 1.64 – 3.99$).

3b: Two-Way Device Use and Initiation Delay

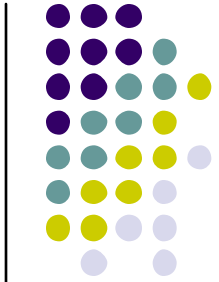


- Sime (1983), following Bowlby (1973) predicted that humans evacuate towards those with whom they feel safe with, rather than towards objectively safe places.

- **Hypothesis:** Those who reported utilizing any two-way communication devices (telephone, cell phone, pager/blackberry, email) prior to evacuation would have reported starting their evacuation more quickly than those who did not report utilizing any such devices.

- Two-way communication device variable: Dichotomy reflecting whether survivors reported utilizing 0 or ≥ 1 two-way communication devices within their tower prior to evacuation.

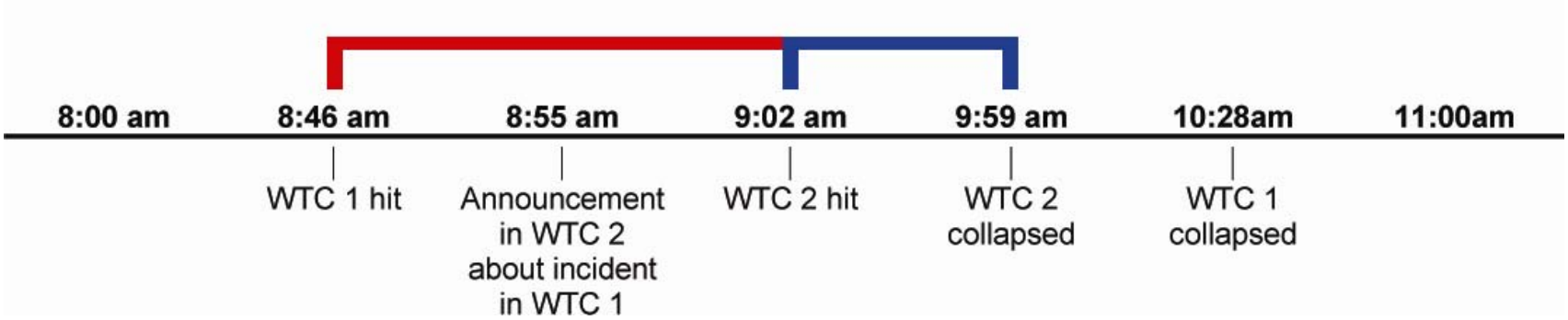
3b: Two-Way Device Use and Initiation Delay



- Significant relation between the use of two-way communication devices (telephone, cell phone, blackberry/ pager, email) and initiation delay in both towers combined, such that use of two-way devices was associated with reports of longer delays:
  - $p < .001$, $OR = 2.21$ (95% CI for $OR = 1.67 – 2.97$).

- As with one-way devices, this relation was found in reports from both towers:
  - **WTC 1:** $p < .001$, $OR = 2.65$ (95% CI for $OR = 1.64 – 4.27$).
  - **WTC 2:** $p < .001$, $OR = 2.14$ (95% CI for $OR = 1.49 – 3.07$).
  - Results indicate a relation opposite the predicted direction.

Exploratory Analysis: Timing of Evacuation Initiation in WTC 2



- Split those who evacuated from WTC 2 into:
  - Those who initiated evacuation *before* 9:02 am in WTC 2 (*n* = 486)
  - Those who initiated evacuation *during* or *after* 9:02 am in WTC 2 (*n* = 81)

Exploratory Analysis: Timing of Evacuation Initiation in WTC 2

Relation between Social Milling and Belief in Danger

- Survivors who reported initiating their evacuation *during/after* impact on WTC 2 (9:02 am) reported the belief that they were in danger prior to starting their evacuation at a significantly higher percentage (80.2%) than those who initiated their evacuation before 9:02 am (64.2%):
  - $p < .01$, $OR = 2.27$ (95% CI for $OR = 1.27 – 4.04$).

- No significant difference in reports of social milling between evacuees who started leaving before (38.1 %) versus during/after impact (33.3 %):
  - ns., $OR = 1.23$ (95% CI for $OR = 0.75 - 2.02$).

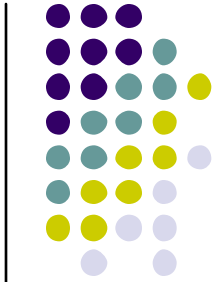
Exploratory Analysis: Timing of Evacuation Initiation in WTC 2

Relation between Social Milling and Belief in Danger

- Significant, negative relation between social milling and belief in danger as reported by those who started evacuating **before** 9:02 am
  - $p < .05$, $OR = 0.67$ (95% CI for $OR = 0.49 – 0.92$).

- A relation between social milling and belief in danger was *not* found from the reports of those who initiated during/after 9:02 am.
  - ns., $OR = 0.36$ (95% CI for $OR = 0.09 – 1.30$).

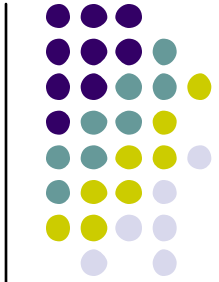
Exploratory Analysis: Timing of Evacuation Initiation in WTC 2



Relation between Social Milling and Belief in the Need to Evacuate Completely

- Marginally significant relation between social milling and belief in the need to evacuate completely as reported by those who started evacuating **before** 9:02 am:
  - p = .07, OR = 0.67 (95% CI for OR = 0.43 – 1.04).
- A relation again was *not* found from the reports of those who initiated during/after 9:02 am.
  - p = .25, OR = 0.45 (95% CI for OR = 0.12 – 1.75).

Exploratory Analysis: Timing of Evacuation Initiation in WTC 2

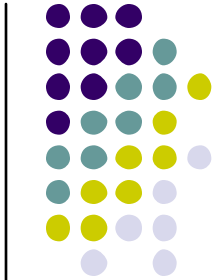


Relation between Social Milling and Initiation Delay

- The relation between social milling and initiation delay was further explored between survivors who initiated before or during/after impact on WTC 2 (9:02 am).

- Consistent with our findings within WTC towers 1 and 2 (see hypothesis 5 results), no relation between reports of social milling and reports of initiation delay were found for survivors who initiated evacuation either before or during/after 9:02 am.
  - **Before 9:02 am:** ns., *OR* = 1.07 (95% CI for *OR* = .78 – 1.44)
  - **During/After 9:02 am:** ns., *OR* = 1.75 (95% CI for *OR* = .81 – 3.74).

Summary, Limitations & Implications



- While reports of social milling were related to a decreased likelihood of having reported a belief in danger in both WTC towers combined, this relation appears to stem mainly from the reports of WTC 2 survivors, and even more specifically from survivors in WTC 2 who started evacuating before 9:02 am.
  - Reports from WTC 2 survivors also indicated less danger perception overall compared to WTC 1 survivors, and again specifically less so from survivors who mobilized before impact on WTC 2 at 9:02 am.
  - During the place and time inside the WTC towers that may have been one of the most ambiguous for survivors in terms of personal danger (inside WTC 2 before impact), engaging in face-to-face communication about the potential for danger was related to decreased threat perception.
  - However, despite the lower percentage of danger perception reports overall from those who mobilized before 9:02 am versus afterwards, and the possible role that face-to-face communication had in modifying this perception, these evacuees did mobilize, indicating the role of motivating factors undefined by the current study.

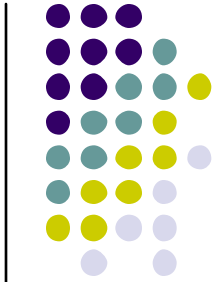
Summary, Limitations & Implications (cont.)

- Utilization of communication devices was associated with increased initiation delay, regardless of whether evacuees simply received information (one-way) or communicated with remote persons (two-way).
  - Several possible explanations exist.
    - Speaking with others remotely prior to evacuation in and of itself would have increased initiation delay. Time spent conversing might therefore be confounded with delay, since it was not controlled for in this study.
    - Information about the nature of the attacks was sparse and contradictory while the towers were still standing. Remote persons with whom survivors spoke may have advised any number of actions (e.g., stay put, evacuate immediately, find more information, etc.)
    - As such, conversations with remote persons who themselves were confused as to the safest course of action might have subsequently further confused survivors, which in turn might have further delayed their evacuation initiation.

Summary, Limitations & Implications (cont.)

- Floor of origin within the towers during the attacks may have moderated the relation between communication, initiation delay and danger beliefs
  - On floors with less direct damage or observable evidence of damage (smelling fumes, seeing smoke and debris) these variables may have been more strongly related, consistent with current findings regarding ambiguity.
  - Age and duration of employment in the position held prior to the attacks might also moderate, indicating the need for further analyses.
- Perceived employment consequences related to evacuation delay accounted for a significant proportion of the variance in many of the above analyses, indicating a potential role of office culture.
- Due to recall limitations, results are likely to underestimate effects of ambiguity and social milling on danger beliefs.

Summary, Limitations & Implications (cont.)



- Providing a clear, directive message to evacuate in disasters may help to override the tendency of some to spend time checking with sources such as the mass media or distant persons before starting to leave which, as suggested by the current and previous results, is likely associated with increased delay time.