Psychological Consequences of Terrorist Threat

Christina W. Hoven, DrPH
Director, Child Psychiatric Epidemiology;
Director, International Center for Child and Adolescent Mental Health
Columbia University-MSPH
NYS Psychiatric Institute

"Radiological Science in the Context of Radiological Terrorism" Conference
Columbia University Medical Center
New York, NY
June 15th, 2007

Objectives

• Historical overview of radiological disasters and their psychological consequences on first responders and children
• Treatment modalities for first responders
• Focus on 9/11 and its effects on children’s mental health
  – Proximity/Plume model
  – Media exposure
  – Familial transmission

History of Radiological Disasters and Their Psychological Consequences

• Hiroshima [Nagasaki (1945)
• Three Mile Island (1979)
• Nuclear Arms Race (1980s)
• Chornobyl (1986)
• Modern Radiological Terrorism (Threats)
Hiroshima-Nagasaki (1945)

- The only instances of the use of nuclear weapons in warfare
- 180,000 of the population (~30%) died within four months of the bombing
- Survivors considered to be likely to suffer from psychological distress (Ohta et al., 2000; Honda et al., 2002) found a significant association between concern about long-term effects of atomic bomb exposure and mental health conditions

Effects of Nuclear Radiation on “Atomic Veterans”

- From 1946 to 1963, ~250,000 members of armed services were routinely exposed to nuclear radiation
- Murphy et al. (1990) conducted in-depth interviews with “atomic veterans” and their families, finding that exposure to low level ionizing radiation had a powerful psychological effect on all family members

Effects of Nuclear Radiation on “Atomic Veterans”

- Murphy et al. (1990) derived four recurrent themes among “Atomic Veterans” and their families.
- They all:
  - underwent repeated invalidation of their experiences
  - expressed deep concern about the effects of radiation exposure on future generations
  - attempted through denial, silence, and positive thinking, to protect themselves and each other from concern about the effects of their exposure
  - tried to give a positive meaning to their experiences by leaving a legacy for future generations

Murphy et al., 1990, “Atomic Veterans and Their Families: Responses to Radiation Exposure”
Three-Mile Island (1979)

- Worst accident in American history of commercial nuclear power generation
- Led to no deaths or injuries to plant workers or members of the nearby community

Psychological Effects of Three Mile Island Workers

- Chisholm et al. (1981) found that working at the site of the accident had a major impact on the psychological experiences of nuclear workers
- In comparison to control group, Three Mile Island employees:
  - experienced more periods of being upset,
  - were more demoralized,
  - perceived greater threat to their physical health,
  - were less certain of their future of their occupation,
  - Considered the public view of their performance during the incident was less than justified,
  - stated that their employer was less than trustworthy in providing information about the accident


Psychological Effects of Three Mile Island on Children and Families

- Studies demonstrated acute, medium (5-6 years), and long-term (10 years) effects, with mothers of young children constituting the highest risk group, although the effects were not transmitted to their children (Dohrenwend et al., 1983; Bromet et al., 1982; Dew et al., 1987; Dew & Bromet, 1993)
- Dohrenwend et al. (1981) found that many families were left demoralized, related to real threats involved in the accident
- There was a lasting level of distrust of authorities with respect to nuclear power, especially among mothers of young children

Nuclear Arms Race (1980s)

• Competition for domination in nuclear weapons between the US and Soviet Union during the Cold War (Sheffet, 1988)

• Other countries also began to develop nuclear weapons, though none engaged in nuclear warhead production as did the US and Soviet Union

Sheffet, 1988, “Adolescents and nuclear arms issues”

Psychological Consequences

• Arms race fostered a climate of fear and concern, especially among children, regarding proliferation of nuclear attack

• Poikolainen et al. (2004) found the risk for common mental disorders significantly related to the increasing frequency of fear of nuclear war among young adults

Poikolainen et al., 2004, “Fear of Nuclear War Increases the Risk of Common Mental Disorders Among Young Adults: A Five-Year Follow-Up Study”; Sheffet et al., 1988, “Adolescents and nuclear arms issues”

Chornobyl (1986)

• Largest nuclear reactor accident ever reported, ultimately causing dispersion of radioactive fallout over large areas, exposing millions of people to varying amounts of radiation

• Much attention paid to the physical health consequences of the radiation-exposed groups: e.g., cancer, birth defects, etc.

• Psychological stress, anxiety and fear, especially among adults, was also reported
Psychological Effects of Chornobyl on Cleanup Workers

- Rahu et al. (2006) conducted a 17-year longitudinal study of 47,86 Estonian male cleanup workers who responded to the Chornobyl disaster.
- A statistically significant excess mortality rate was found for suicide among cleanup workers compared with the a control group (SMR, 1.32; 95% CI, 1.03-1.67).
- These findings helped to demonstrate that a healthy population exposed to radiation can be significantly impacted psychologically by such a disaster.

Rahu et al., 2006, "Suicide Risk Among Chornobyl Cleanup Workers in Estonia Still Increased: An Updated Cohort Study"

Psychological Effects of Chornobyl on Children

- Bromet et al. (2000) evaluated 300 10-12-year-old children who were in utero or infants at the time of the Chornobyl disaster; using both parent and child self-report, researchers found that children perceived their well-being to be similar to that of their control group classmates, while their parents rated their children’s mental health as significantly worse than the children’s self-report.
- Trauma experienced by the parents was reflected in perceptions of their children’s well-being, but it was not transmitted to the children themselves.

Bromet et al., 2000, "Children’s well-being 11 years after the Chernobyl catastrophe"

Modern Radiological Terrorism

- 1995: “Dirty bomb” found in Moscow park.
- 2001: September 11th attacks increased public’s fear of terrorist attacks.
- 2002: Jose Padilla arrested on suspicion that he was to carry out a “dirty bomb” attack in US (charges were later dropped).
- “Dirty Bomb” is designed to play upon the fear of the unknown, unseen, and inescapable.

"Dirty Bomb" is designed to play upon the fear of the unknown, unseen, and inescapable.
Psychological Effects of Modern Radiological Terrorism on First Responders

• Police Officers
  – PTSD prevalence ranges from 2.7% to 13%
  – US research suggests this occupation has the highest suicide rate of any profession
  – effect of exposure to violent incidents is largely dependent on age and work experience
  – extensive social support system encourages the development of positive coping skills

• EMTs
  – due to inconsistency of work, they don’t have stable peer network to depend upon (Spitzer, 1992)
  – one study of British EMTs found a 21% prevalence of PTSD, with an additional 25% prevalence of moderate to severe level of PTSD symptoms (Clohessy et al., 1999)
  – 95% of EMTs confirm often feeling burned-out and physically and emotionally exhausted due to work
  – EMTs score lower on measures of empathy compared to general population, complicating trauma reactions by propagating distancing and avoidant behaviors (Grevin, 1996)

• Firefighters
  – considered to be the most dangerous occupation in the US (Hildebrand, 1984)
  – Corneil et al. (1999) found 90% of urban firefighters experienced at least one traumatic experience in the past year, with the mean being over 6 incidents
  – PTSD prevalence found between 13% to 22%, with significantly high rates of alcohol abuse or dependence (25% to 47%)
  – personality and individual factors are important predictors of posttraumatic symptoms in firefighters
  – social support is the primary protective factor associated with lower psychopathology for firefighters


Corneil et al., 1999, “Exposure to traumatic incidents and prevalence of posttraumatic stress symptomatology in urban firefighters in two countries”; Hildebrand, 1984, “Stress research: a perspective of need, a study of feasibility.”
Children of First Responders

- Parental PTSD is a risk factor for child PTSD (Yehuda et al., 2001)

Yehuda, et al., 2001, "Relationship of parental trauma exposure and PTSD to PTSD, depressive and anxiety disorders in offspring."

Treatment Approaches

- What do we know?
  - Only 3% of first responders from 9/11 accessed mental health treatment (Smith et al., 2004)
  - Critical incident stress debriefing found to be ineffective (Robbins, 2002)
  - CBT is promising, but sufficient evidence available regarding efficacy with first responders
  - Engaging first responders
    - Emphasize anonymity and confidentiality
    - Address stigma
    - Avoid judgment of work lifestyle, especially as it affects family life

Study Aims

A. Assess impact of exposure to the WTC attack on children’s mental health;
B. Estimate rates of probable psychiatric disorders (and functional impairment), as well as health problems;
C. Identify risk factors for psychiatric problems;
D. Estimate need for mental health services
Prevalence of Psychiatric Disorders (probable) with Measured Impairment Post WTC Attack Among NYC Public School Students (N = 8,236)

<table>
<thead>
<tr>
<th>Mental Disorder</th>
<th>New York City School Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDD</td>
<td>8%</td>
</tr>
<tr>
<td>PTSD</td>
<td>11%</td>
</tr>
<tr>
<td>GAD</td>
<td>10%</td>
</tr>
<tr>
<td>SAD</td>
<td>12%</td>
</tr>
<tr>
<td>Agor.</td>
<td>9%</td>
</tr>
<tr>
<td>Panic</td>
<td>13%</td>
</tr>
<tr>
<td>Conduct</td>
<td>7%</td>
</tr>
<tr>
<td>Alcohol*</td>
<td>8%</td>
</tr>
</tbody>
</table>

Prevalence of Probable Mental Disorders by Gender and Grade Group, Six Months After September 11

<table>
<thead>
<tr>
<th>Gender</th>
<th>Grade Group</th>
<th>Disorders</th>
<th>Girls</th>
<th>Boys</th>
<th>4-5</th>
<th>6-8</th>
<th>9-12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PTSD</td>
<td>13.3</td>
<td>7.4</td>
<td>20.1</td>
<td>9.1</td>
<td>5.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Major Depression</td>
<td>10.4</td>
<td>5.5</td>
<td>7.3</td>
<td>6.8</td>
<td>9.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Generalized Anxiety</td>
<td>12.8</td>
<td>7.5</td>
<td>10.9</td>
<td>9.2</td>
<td>10.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Separation Anxiety</td>
<td>16.0</td>
<td>8.2</td>
<td>20.2</td>
<td>12.1</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Panic Disorder</td>
<td>11.6</td>
<td>5.4</td>
<td>10.9</td>
<td>8.2</td>
<td>7.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agoraphobia</td>
<td>20.0</td>
<td>9.0</td>
<td>24.1</td>
<td>12.7</td>
<td>16.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age Anxiety/Depressive Disorders</td>
<td>24.7</td>
<td>21.8</td>
<td>34.1</td>
<td>27.8</td>
<td>26.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conduct Disorder</td>
<td>10.6</td>
<td>15.1</td>
<td>9.6</td>
<td>12.4</td>
<td>15.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alcohol Abuse/Dependence</td>
<td>4.3</td>
<td>4.8</td>
<td>---</td>
<td>1.8</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Prevalence of Six Probable Internalizing Mental Disorders, Exposure Level, and Community Rates Pre and Post September 11 (N=8,236)

<table>
<thead>
<tr>
<th>Mental Disorder</th>
<th>Estimated Number of Students</th>
<th>New York City School Rates</th>
<th>U.S. Community Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=3,096</td>
<td>N=2,746</td>
<td>N=8,236</td>
</tr>
<tr>
<td>PTSD</td>
<td>35.3%</td>
<td>21.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Major Depression</td>
<td>48.0%</td>
<td>40.0%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Generalized Anxiety</td>
<td>33.7%</td>
<td>32.5%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Separation Anxiety</td>
<td>48.9%</td>
<td>38.6%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Panic Disorder</td>
<td>33.7%</td>
<td>34.6%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Agoraphobia</td>
<td>33.7%</td>
<td>34.6%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

*Any is limited to PTSD, Major Depression, Generalized Anxiety, Separation Anxiety, Panic and Agoraphobia.
Prevalence of Two Probable Externalizing Mental Disorders, Exposure Level, and Community Rates Pre and Post September 11 (N=8,236)

<table>
<thead>
<tr>
<th>Disorders</th>
<th>NYC-BOE WTC School Survey</th>
<th>U.S. Community Studies</th>
<th>Univariate Odds Ratios</th>
<th>Multivariate Odds Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated # students</td>
<td>Total Sample</td>
<td>Pre September 11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N = 2,668</td>
<td>N = 2,668</td>
<td>N = 2,668</td>
<td></td>
</tr>
<tr>
<td>Conduct Disorder</td>
<td></td>
<td></td>
<td>N = 2,746</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Severe</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N = 2,840</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N = 2,840</td>
<td></td>
</tr>
<tr>
<td>Alcohol Abuse/Dependence</td>
<td></td>
<td></td>
<td>N = 2,650</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
<th>Pre September 11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Conduct Disorder</td>
<td>14.3</td>
<td>12.5</td>
<td>11.6</td>
<td>3.9 –– 11.2</td>
</tr>
<tr>
<td>Alcohol Abuse/Dependence</td>
<td>6.0</td>
<td>4.2</td>
<td>3.6</td>
<td>0.9 –– 2.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
<th>Pre September 11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Conduct Disorder</td>
<td>14.3</td>
<td>12.5</td>
<td>11.6</td>
<td>3.9 –– 11.2</td>
</tr>
<tr>
<td>Alcohol Abuse/Dependence</td>
<td>6.0</td>
<td>4.2</td>
<td>3.6</td>
<td>0.9 –– 2.2</td>
</tr>
</tbody>
</table>

Estimated # students: N = 8,236

* OR = unadjusted odds ratio
* AOR = adjusted odds ratio

Logistic regression models predicting Any Internal Disorder (probable) among NYC public school children, Grades 6 – 12, 6 months after September 11th (N=6,991)

<table>
<thead>
<tr>
<th>Any Internalizing Disorder*</th>
<th>OR* (95% CI)</th>
<th>AOR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Live with both Parents</td>
<td>1.13 (0.89, 1.40)</td>
<td>1.05 (0.85, 1.29)</td>
</tr>
<tr>
<td>Attendance in GZA School</td>
<td>1.80 (0.89, 2.46)</td>
<td>0.66 (0.51, 0.85)</td>
</tr>
<tr>
<td>Any Direct Exposure</td>
<td>1.88 (1.45, 2.44)</td>
<td>1.67 (1.24, 2.11)</td>
</tr>
<tr>
<td>Any Family Exposure</td>
<td>2.09 (1.52, 2.88)</td>
<td>1.38 (1.26, 2.55)</td>
</tr>
<tr>
<td>Any Prior Trauma</td>
<td>2.97 (1.64, 5.36)</td>
<td>2.97 (1.55, 5.35)</td>
</tr>
<tr>
<td>High Media Exposure</td>
<td>3.64 (1.30, 10.09)</td>
<td>1.58 (1.25, 2.03)</td>
</tr>
</tbody>
</table>

Weighted data
* Any internalizing disorder = at least one PTSD, MDD, GAD, SAD, Panic, Agoraphobia (probable)
* OR = unadjusted odds ratio
* AOR = adjusted odds ratio
* Continuous variable

Questions

• Was a student’s proximity to the WTC during the attack a risk factor for probable Posttraumatic Stress Disorder?

• If yes:
  – At which distance does it cease to be a risk factor?
Methodology

- A Geographic Information System (GIS) was used to geocode all participating schools.

- The centroid of the block where the WTC towers once stood was calculated in the GIS.

- The Euclidian distance was calculated from the WTC centroid to each of the participating schools.

Sample

Subsample (N=6,189):

- Students not at school during the attack (10.7%) were excluded.
- Grades 4 were also excluded for the purpose of a more homogeneous sample.

Evaluation of Exposure

- Direct Exposure (2 or more)
  - In or near the cloud of smoke or dust (geographical location with respect to the plume)
  - Saw planes crashing into the towers
  - Physically hurt
  - Had to leave their place for safety reasons
  - Worried about loved one’s safety

- Family Exposure (any)
  - Family member died, was hurt, or escaped unhurt
Evaluation of Exposure

- **Media Exposure**
  - Time spent learning about the attack from TV (High: spent a lot of time)

- **Previous Exposure (2 or more)**
  - Had severe injury in violent circumstances
  - Witnessed a death or serious injury of a close friend or family member
  - Lived through war or major disaster before WTC attack

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**Sample Size and Frequencies (Unweighted and Weighted) of Selected Socio-demographic Characteristics and Exposures:** NY C-BOE School Survey, Grades 6-12 (N=6,189)

<table>
<thead>
<tr>
<th>Socio-demographic Characteristics</th>
<th>Sample Size (Unweighted)</th>
<th>Frequency (Weighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-8</td>
<td>2,738</td>
<td>47.21</td>
</tr>
<tr>
<td>9-12</td>
<td>3,451</td>
<td>52.79</td>
</tr>
<tr>
<td><strong>Gender, Female</strong></td>
<td>3,291</td>
<td>52.87</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American</td>
<td>1,379</td>
<td>47.53</td>
</tr>
<tr>
<td>Asian</td>
<td>1,242</td>
<td>13.25</td>
</tr>
<tr>
<td>White</td>
<td>1,556</td>
<td>18.04</td>
</tr>
<tr>
<td>Mixed/Other</td>
<td>246</td>
<td>4.52</td>
</tr>
<tr>
<td><strong>Exposure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attendance in GZA School</td>
<td>1,618</td>
<td>50.48</td>
</tr>
<tr>
<td>Direct Exposure (&gt;2)*</td>
<td>1,583</td>
<td>52.59</td>
</tr>
<tr>
<td>Any Family Exposure</td>
<td>629</td>
<td>10.05</td>
</tr>
<tr>
<td>Prior Exposure (&gt;2)*</td>
<td>1,617</td>
<td>52.92</td>
</tr>
<tr>
<td>High Media Exposure</td>
<td>498</td>
<td>25.95</td>
</tr>
</tbody>
</table>

* >2 = more than two exposures
### Frequency of Specific Posttraumatic Stress Disorder Symptoms Reported by NYC Public School Students, Grades 6-12, by Distance from Ground Zero

<table>
<thead>
<tr>
<th>PTSD Symptom</th>
<th>Total (N=6,189)</th>
<th>&lt; 1 mile (n=1,621)</th>
<th>1–4.99 miles (n=711)</th>
<th>5–9.99 miles (n=2,112)</th>
<th>10–14.99 miles (n=1,308)</th>
<th>&gt; 15 miles (n=437)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Often thinks about WTC event</td>
<td>77.10</td>
<td>66.31</td>
<td>75.59</td>
<td>77.29</td>
<td>78.39</td>
<td>54.35</td>
</tr>
<tr>
<td>Tries not to think/hear/talk about 9/11</td>
<td>38.72</td>
<td>33.19</td>
<td>42.47</td>
<td>36.46</td>
<td>46.19</td>
<td>41.48</td>
</tr>
<tr>
<td>Has problems sleeping</td>
<td>19.53</td>
<td>18.87</td>
<td>18.94</td>
<td>19.41</td>
<td>19.41</td>
<td>25.78</td>
</tr>
<tr>
<td>Keep going places/dating things that remind of 9/11</td>
<td>13.85</td>
<td>9.41</td>
<td>16.63</td>
<td>15.50</td>
<td>13.50</td>
<td>12.07</td>
</tr>
<tr>
<td>Has nightmares</td>
<td>12.89</td>
<td>11.74</td>
<td>13.77</td>
<td>12.40</td>
<td>12.89</td>
<td>10.75</td>
</tr>
<tr>
<td>Tries to keep away from people who remind of 9/11</td>
<td>11.05</td>
<td>9.38</td>
<td>12.48</td>
<td>10.47</td>
<td>11.63</td>
<td>10.03</td>
</tr>
<tr>
<td>Stopped thinking about future</td>
<td>12.34</td>
<td>9.81</td>
<td>15.85</td>
<td>12.81</td>
<td>12.51</td>
<td>10.03</td>
</tr>
<tr>
<td>Any PTSD Symptom</td>
<td>85.91</td>
<td>77.80</td>
<td>85.48</td>
<td>85.15</td>
<td>87.47</td>
<td>90.61</td>
</tr>
</tbody>
</table>

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### Rates of PTSD (probable) Associated with Previous Trauma Exposure, According to Distance from Ground Zero (Grades 6-12)

#### Rates of PTSD (probable) Associated with Various Direct Exposures According to Distance from Ground Zero (Grades 6-12)

- In cloud smoke
- Leave place
- Difficulty getting home
- Smell smoke

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Rates of PTSD (probable) Associated with Various Family Exposures According to Distance from Ground Zero (Grades 6-12)

Distance Measures

- **Model 1**
  - Student attendance at a Ground Zero Area (GZA) school.

- **Model 2**
  - GIS was used to calculate Euclidean distance from the WTC and was used as a continuous variable (range: 0.17 to 18.56 miles; mean: 7.59 ± 4.27 miles).

- **Model 3**
  - Categorical distance variables (< 1 mile, 1-4.99, 5-9.99, 10-14.99, and >15 miles) were used in the logistic regression of model 1.

Logistic Regression Models Predicting PTSD* (probable)
an among NYC Public School Children, Grades 6 – 12, Six Months after 9/11
(N = 6,189)

<table>
<thead>
<tr>
<th>Attendance in GZA School</th>
<th>AOR* (95%CI)</th>
<th>AOR* (95%CI)</th>
<th>AOR* (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.78 (0.30, 2.02)</td>
<td>0.97 (0.94, 1.00)</td>
<td>0.97 (0.94, 1.00)</td>
<td>0.97 (0.94, 1.00)</td>
</tr>
</tbody>
</table>

- **Model 1**
- **Model 2**
- **Model 3**

---

*PTSD (probable) > 5 positive items from 8 PTSD questions

b Distance as Attendance to GZA School (sample stratum 1); c Distance as a continuous variable; d Distance in 5 categories; e AOR = adjusted odds ratio; f (≥2) = two or more exposures
Questions

Children were asked, “on Sept. 11th, were you in or near the cloud of smoke or dust from the WTC?”

• Is the perception of being at risk more important than actual physical location?

Participating Schools and Zip Codes Near the Plume on September 11, 2001

Analytic Strategy

Three measures of geographical location in relation to the plume were calculated

1. Students attending schools in and within 1 KM of the plume

2. Proportion of students residing in zip codes under the plume were randomly selected as being in and within 1 KM near the plume.

3. Combined measure (either attending a school or living in a zip code in and within 1 KM from the plume).
### Kappa Assessment of Consistency between Interview Question and Plume Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>% Consistent</th>
<th>Kappa</th>
<th>ASE</th>
</tr>
</thead>
</table>
| School Under/Near Plume:  
  • under plume  
  • within 1 KM of plume | 89.64  
  89.66 | 0.22  
  0.23 | 0.022  
  0.022 |
| Residence Under/Near Plume:  
  • under plume  
  • within 1 KM of plume | 87.69  
  85.08 | 0.07  
  0.11 | 0.017  
  0.018 |
| School or Residence  
  Under/Near Plume:  
  • under plume  
  • within 1 KM of plume | 87.33  
  84.87 | 0.21  
  0.20 | 0.020  
  0.019 |

### Comparison of Odds Ratios

<table>
<thead>
<tr>
<th>Measure of Direct Exposure (2+ exposures)</th>
<th>Odds Ratio</th>
<th>95% Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Perception (Question)</td>
<td>2.12</td>
<td>1.70 ± 2.65</td>
</tr>
<tr>
<td>School under plume</td>
<td>2.06</td>
<td>1.64 ± 2.60</td>
</tr>
<tr>
<td>School within 1 KM of plume</td>
<td>2.06</td>
<td>1.64 ± 2.59</td>
</tr>
<tr>
<td>School or Residence under plume</td>
<td>1.98</td>
<td>1.58 ± 2.48</td>
</tr>
<tr>
<td>School or Residence within 1 KM of plume</td>
<td>1.92</td>
<td>1.54 ± 2.40</td>
</tr>
</tbody>
</table>

### Conclusion

- Family, direct, prior and high media exposure were the strongest predictors of probable PTSD in the NYC public school students post 9/11.
- Distance from the WTC towers did not appear to be a risk factor for probable PTSD, for 6th graders in the NYC public schools.
- Perceived risk is more important in assessing Posttraumatic Stress Disorder than the physical proximity to the plume.
Question

What is the effect on a child when a parent experiences trauma?

Prevalence of Psychiatric Disorders (probable) Post WTC Attack Among NYC Public School Students, with Family Members in the WTC at the Time of the Attacks, Grades 4-12 (N = 7,945)

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Parent/Family Member in WTC</th>
<th>No Family Member in WTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>MDD</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>GAD</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>SAD</td>
<td>5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Panic</td>
<td>2.5%</td>
<td>1.25%</td>
</tr>
<tr>
<td>Agor.</td>
<td>2.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Conduct</td>
<td>1.25%</td>
<td>1.25%</td>
</tr>
</tbody>
</table>

1 Weighted to reflect sampling design. Maximum number of missing values never exceeded 6%.
2 Assessed 6 months post 9/11.
3 Children with family members died in WTC attack were excluded.
4 Rate without Impairment.
5 Grades 6-12 only. Rate without Impairment.

* p ≤ .05; ** p ≤ .01; Corrected for clustering effect.
Possible Mechanisms of Familial Transmission of Trauma

- **Genetic**
- **Non-genetic**
  - Social learning
  - Impaired parenting
Prevalence of Psychiatric Disorders (probable) in Post WTC Attack Among NYC Public School Students, with and without First Responders in the Home, Grades 4-12 (N=8,236)

1. Weighted to reflect sampling design. Maximum number of missing by disorder never exceeded 8%.
2. Assessed in random sample.
3. Children who had a Police Officer and EMT living at home were excluded from this comparison (N=154).
4. At least one EMT and no Police Officers living at home.
5. At least one Police Officer and no EMTs living at home.

** Grades 6-12 only. Rate without impairment.

---

Demographics Among NYC Public School Students With First Responder (FR) Family Members (N = 8,236)*

<table>
<thead>
<tr>
<th>PTSD and Exposure</th>
<th>Police Officer</th>
<th>Firefighter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Only FR (n=760)</td>
<td>Only FR (n=288)</td>
</tr>
<tr>
<td></td>
<td>EMT (Ref. group)</td>
<td>(95% CI)</td>
</tr>
<tr>
<td>PTSD (probable)</td>
<td>10.6 (18.9)</td>
<td>5.6</td>
</tr>
<tr>
<td>Prior Trauma</td>
<td>32.6 (42.3)</td>
<td>31.2</td>
</tr>
<tr>
<td>Attendance in GZA school</td>
<td>0.7 (1.1)</td>
<td>0.5 (1.4)</td>
</tr>
<tr>
<td>Direct Exposure</td>
<td>29.5 (30.6)</td>
<td>35.6 (23.4)</td>
</tr>
<tr>
<td>Family Exposure</td>
<td>12.2 (21.3)</td>
<td>26.6 (17.2)</td>
</tr>
<tr>
<td>TV Exposure</td>
<td>64.2 (72.6)</td>
<td>73.1 (62.6)</td>
</tr>
</tbody>
</table>

*Weighted data

---

Logistic Regression Models Predicting Probable PTSD Among Children with First Responder (FR) Family Members

<table>
<thead>
<tr>
<th>Probable PTSD</th>
<th>Model 1: FR OR (95% CI)</th>
<th>Model 2: FR + Exp. OR (95% CI)</th>
<th>Model 3: FR + Exp. + Dem. OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMTs (Ref. group)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Police Officers</td>
<td>0.51 (0.21, 1.26)</td>
<td>0.56 (0.21, 1.46)</td>
<td>0.62 (0.23, 1.68)</td>
</tr>
<tr>
<td>Firefighters</td>
<td>0.26 (0.08, 0.79)</td>
<td>0.23 (0.07, 0.76)</td>
<td>0.30 (0.08, 1.08)</td>
</tr>
<tr>
<td>2+ FRs</td>
<td>0.88 (0.52, 2.40)</td>
<td>0.76 (0.26, 2.19)</td>
<td>0.88 (0.30, 2.62)</td>
</tr>
<tr>
<td>No FRs</td>
<td>0.48 (0.23, 1.01)</td>
<td>0.57 (0.26, 1.26)</td>
<td>0.58 (0.26, 1.27)</td>
</tr>
</tbody>
</table>

Note: Weighted data. OR = odds ratio; AOR = adjusted odds ratio; CI = confidence interval.
Results for the complete model are available upon request.
Controlling for being in a Ground Zero school, direct, family, prior, and media exposures.
Controlling for all exposures (police, family, higher maternal education, and single parent family).
**Objectives**

- Understand the pattern of response to trauma in children of first responders.

- Develop a methodology for the evaluation of children following a traumatic situation, so that an emergency assessment strategy is in place in case a disaster happens.

**Methodology**

- Multi-site longitudinal study

- U.S. (New York City) and Israel (Tel Aviv)

- Participants: Children 9 to 15 years, whose parents represent three different categories of First Responders (FR):
  - Emergency Medical Technicians (EMT)
  - Police Officers
  - Emergency Room Nurses (ERN) plus a control group of randomly selected school children in the same age range.
## Acknowledgments

**NYC-Board of Education**
- Francine Goldstein
- Vincent Giordano
- Lori Mei
- Henry Solomon
- Linda Wernikoff

**Applied Research & Consulting, LLC**
- Michael Cohen, Contract Principal Investigator
- Chris Bumcrot
- Nellie Gregorian
- Victoria Francis
- Craig Bross

**Advisors to Columbia Univ.**
- Elissa Brown, NYU
- Claude Chemtob, VA, Honolulu
- Steven Marans, Yale
- Robert Pynoos, UCLA
- Alan Schore, UCSD
- William Axline, UCLA
- Better Pfefferbaum, Univ. Oklahoma
- Members: National Child Traumatic Stress Network

**Columbia University-NYS Psychiatric Institute**
- Barbara Aaron
- Larry Alter
- FaR Bia
- Robert Chan
- Patricia Cohen
- Mark Pfefferbaum
- Christine Swedish
- Catherine Parks
- Renu Gokhale
- Steven Greenwald
- Christopher P. Lucas
- Donald J. Mandell
- George J. Minas
- Ezra Smer
- Judith Weeks
- Ping Wu
- Paul Zlotny

**Centers for Disease Control & Prevention**
- Bradley Woodruff
- Victor Balaban

**Partnership for Recovery of NYC Schools**
- Pamela Cantor