

# *Lessons Learned from Other Disasters*

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Paper presented at National Academies of Sciences Gilbert W. Beebe 2016  
Symposium on 30 Years After the Chernobyl Accident. Washington, D.C.;  
November 1, 2016

# *Overview of Presentation*

- Defining disasters
- Overview of the mental health impact of disaster exposure
- Key factors influencing MH vulnerability and resilience following disaster exposure
- Illustrative findings from research on two disasters
- Aspects of disasters involving potential exposure to radiation/other toxic substances that exacerbate risk of MH/perceived health problems observed in other disasters.
- Implications for improved disaster research and mental health response to disaster.

# *Defining Disasters*

- Disasters impact many people at the same time, distinguishing disasters from other potentially traumatic events that happen to an individual person.
- They involve threats of potential physical injury, other physical harm, or death to many individuals.
- They often result in widespread destruction of property and infrastructure.
- They disrupt access to basic resources (e.g. food, water, shelter, utilities, physical safety), social services, and social networks.
- Although there are many classifications of disaster types (e.g. natural, vs human-made), it is probably better to focus on specific elements of a given disaster that produces harm than trying to classify it into a disaster type.

## *Disaster Research Experience*

My colleagues and I have conducted epidemiological studies of several major disasters:

- Hurricane Hugo – 1989
- Loma Prieta Earthquake – 1989
- Hurricane Andrew – 1991
- Los Angeles Riots – 1992
- Terrorist Attack on WTC – 2001
- Florida Hurricanes – 2004
- Typhoon Xangsane – 2006
- Hurricane Ike - 2008
- Alabama and Missouri Tornados - 2011

# *Overview of the Mental Health Impact of Disasters*

We have studied over 20,000 adults and adolescents. Our findings, as well as those of other disaster researchers (e.g. the Norris et.al, 2002; Goldman & Galea, 2013 reviews), indicate that:

- Disaster exposure increases risk of PTSD, depression, GAD, panic disorder, and substance use problems, but most people are resilient or recover reasonably quickly.
- High disaster exposure involving deaths, fears of death or injury, property damage, and lack of social support are the biggest vulnerability factors.
- What happens before and after disasters also impacts MH outcomes.
- Prior exposure to other traumatic events, preexisting mental health or substance use problems, and poverty are also vulnerability factors.
- Social support is a major resiliency and recovery factor.
- MH response requires a public health approach using a variety of strategies including psychoeducation, not just providing direct clinical services.



# *The September 11 Terrorist Attacks on the World Trade Center*

- **Largest human-made disaster in US history.**
- **Approximately 2,800 people dead, equal number injured and some 12,000 relatives of those who died.**
- **The New York Academy of Medicine, the Medical University of South Carolina, and SRBI (a survey research firm) conducted a series of studies of the MH impact of this attack beginning in October, 2001.**
- **All the studies were conducted via telephone and used highly structured interviews to measure disaster exposure, potential vulnerability and protective factors, and mental health outcomes including PTSD, depression, and increases in substance use.**

# *Study Details*

- SURVEY 1**
- October 16-November 15, 2001
  - Manhattan South of 110<sup>th</sup> street
  - Survey in English, Spanish
  - n=988
- SURVEY 2**
- January 15 – February 21, 2002
  - New York City
  - Survey in English, Spanish
  - n=2001
- COHORT**
- March 25 – June 25, 2002
  - New York City metropolitan area
  - Survey in English, Spanish, Chinese
  - n=2752
  - September 25, 2002 – January 31, 2003
  - n=1939
  - September 25, 2003 - February 29, 2004
  - n=1832

n=2218 (81%) in  
at least two waves

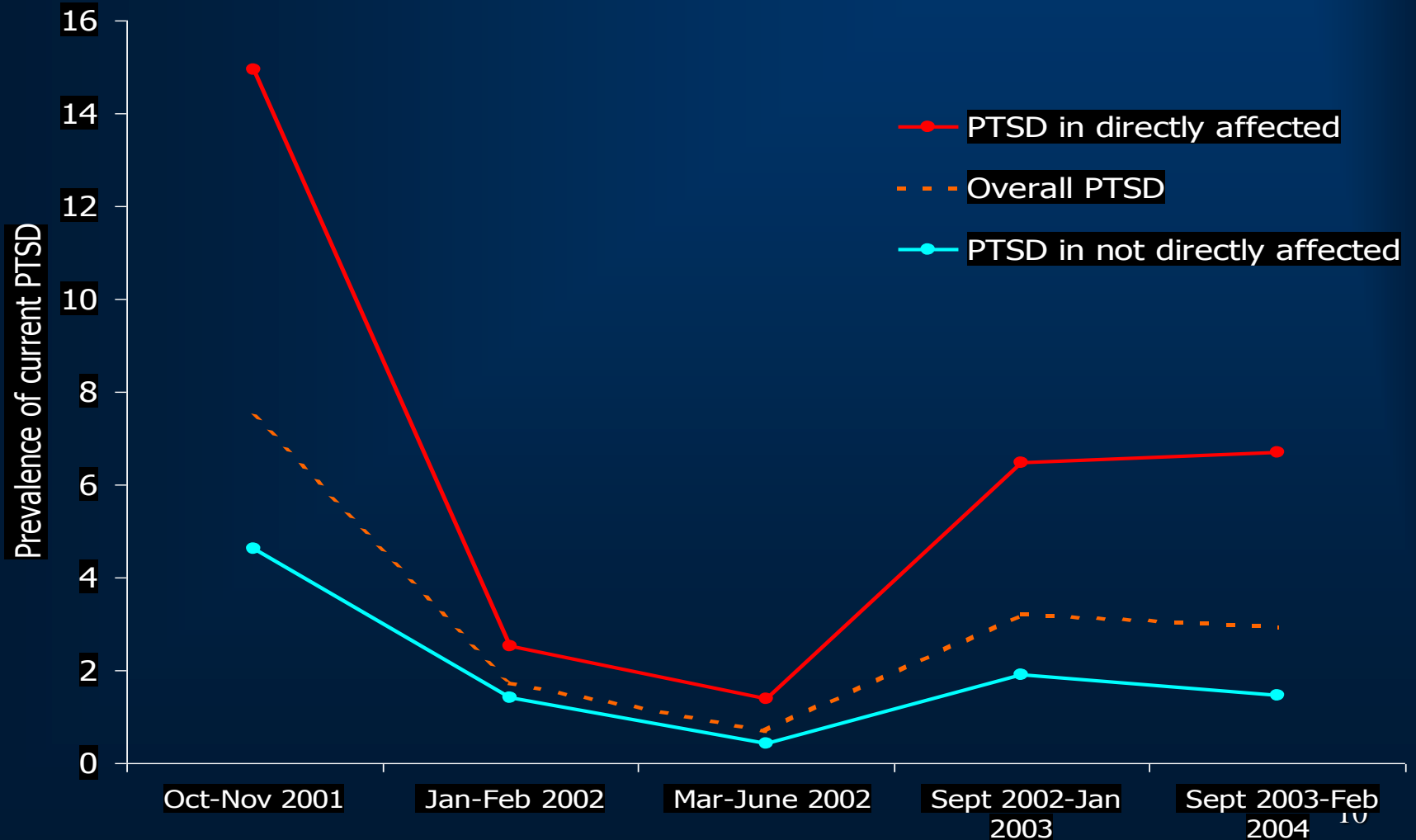


# *Direct Exposure to Terrorist Attack*

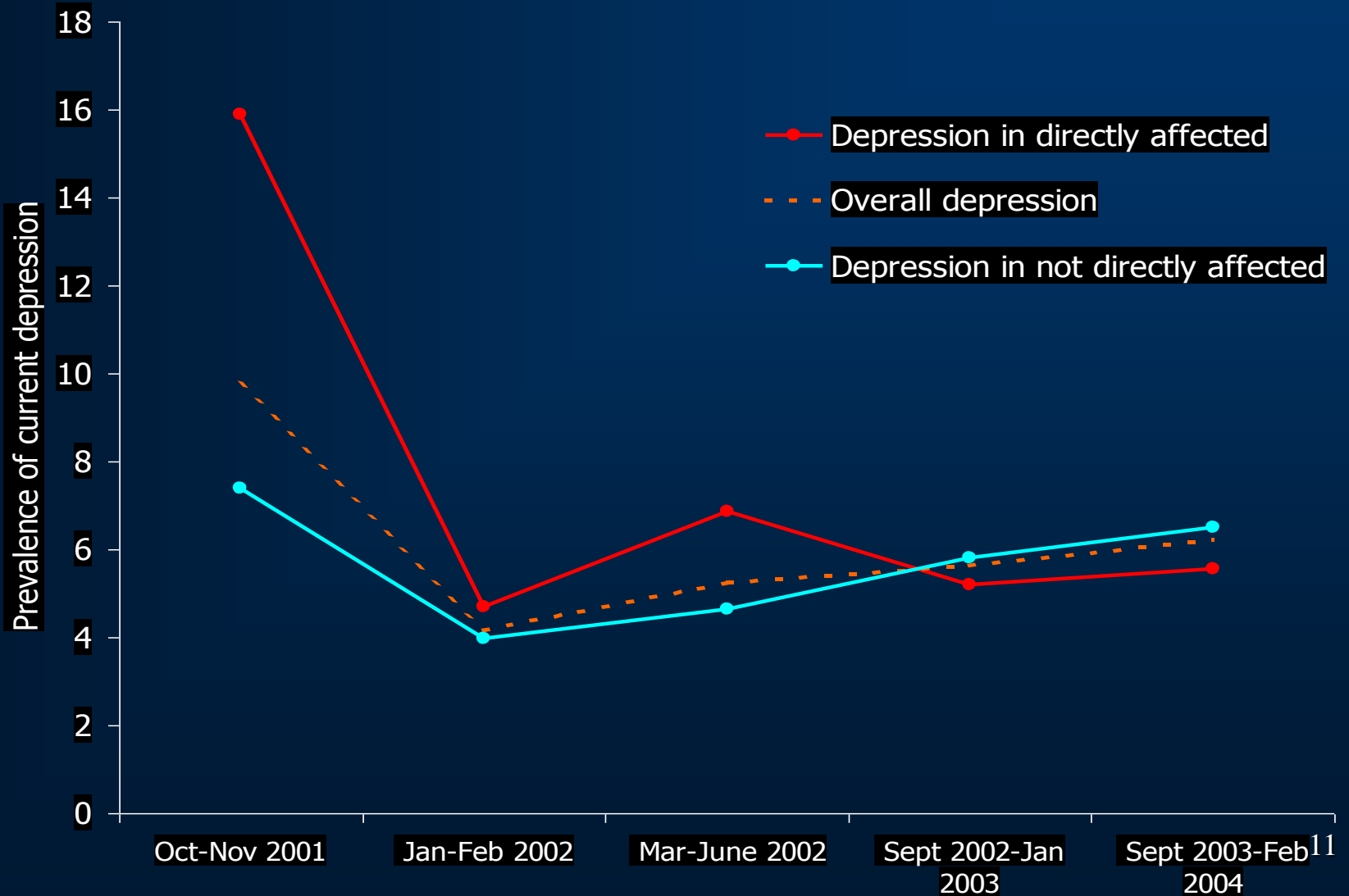
- Fear of injury or death: 21.0%
- Saw in person: 18.1%
- Friend/Relative killed: 15.4%
- Involved in rescue efforts: 9.2%
- Lost job: 5.2%
- Lost possessions: 2.2%

27.3% of Sample Directly Affected

# *Prevalence of PTSD (current, WTC-related, N=1553) by Directly Affected*



# *Prevalence of Depression (current, N=1509) by Directly Affected*

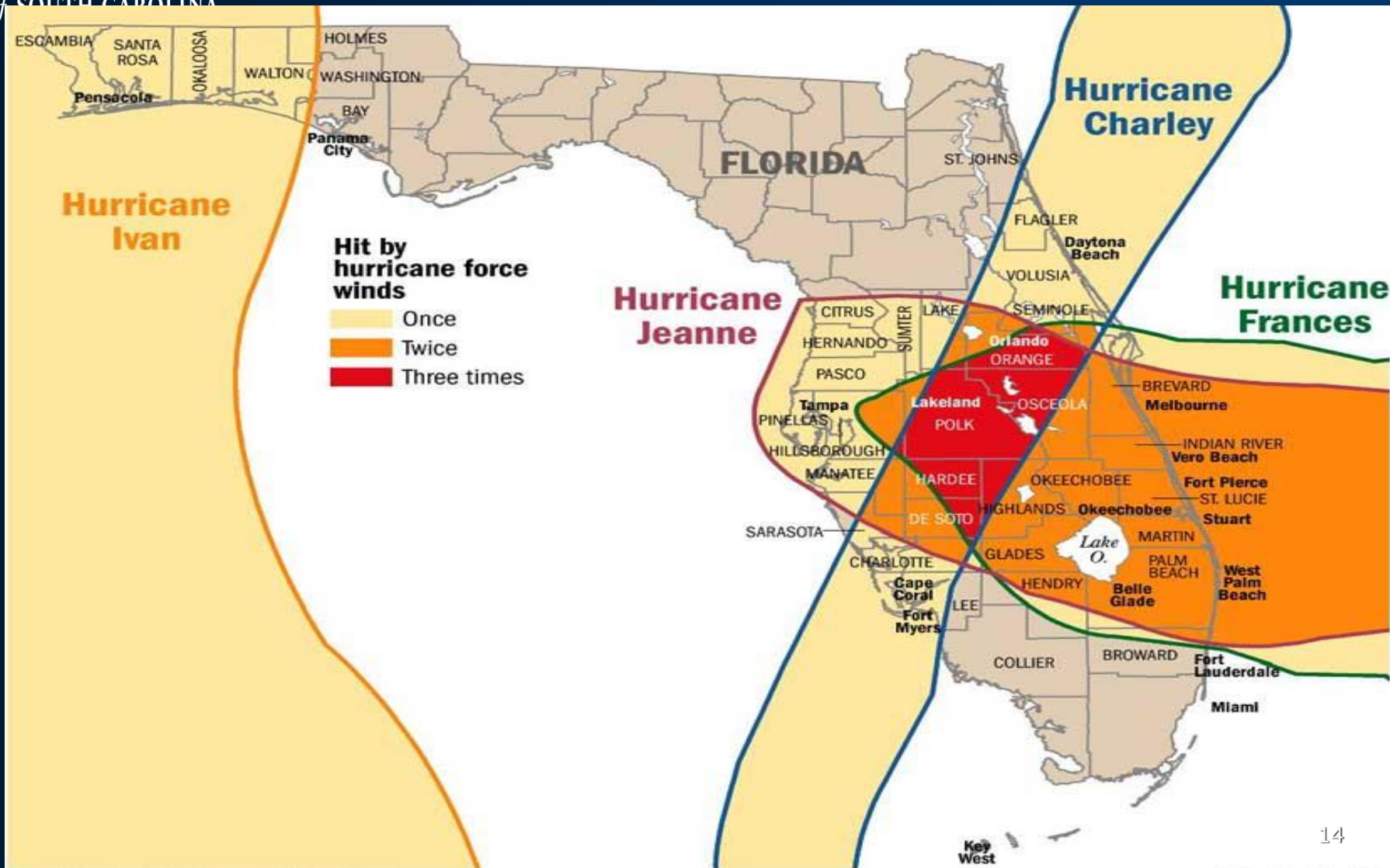


*Do Genes Modify Risk  
of PTSD Given  
Exposure to  
Disasters?*

## *Why Include Genes and Environment in Disaster Resilience and Vulnerability Studies?*

- Numerous environmental factors predict resilience, vulnerability, and recovery, but response to disasters are also influenced by characteristics of the “organism” (e.g. personal characteristics, past history, and biological makeup including genotype).
- Some genes are involved in regulating biological stress response systems, so it is reasonable to assume that some of these genes may influence response to disaster stressors, thereby influencing vulnerability, resilience, or recovery.
- A gene x environment interaction model approach posits that the relation between genes and phenotypes is mediated by the environmental stressor of exposure to a disaster or the environmental protective factor of social support. Viewed from the other perspective, this G x E model posits that the relation between disaster exposure and PTSD is mediated by genotype.

# Paths of the 2004 Florida Hurricanes



*2004 Florida Hurricanes Project:  
A Gene x Environment Epidemiological  
Study*

*Dean Kilpatrick, Karestan Koenen, Kenneth Ruggiero Ron Acierno,  
Sandro Galea, Heidi Resnick, John Roitzsch, John Boyle, and Joel  
Gelernter*

*American Journal of Psychiatry (2007)*

*Karestan Koenen et al.*

*American Journal of Epidemiology (2009)*

# *Florida Hurricanes Study*

## *Methodology*

- RDD telephone household probability sampling methodology used to locate and interview one adult per household in counties affected by the 2004 hurricanes. Total N=1543.
- Interview measured demographic characteristics, prior PTE exposure, pre-disaster social support, amount of disaster exposure, and PTSD, Depression, and GAD symptoms. Participation and completion rate was 81%.
- Respondents asked to return saliva sample via mail for use in genetic testing; 42% returned kits. No significant differences between those who did and did not return kits.
- Also collected county-level data on unemployment and reported crime rates.

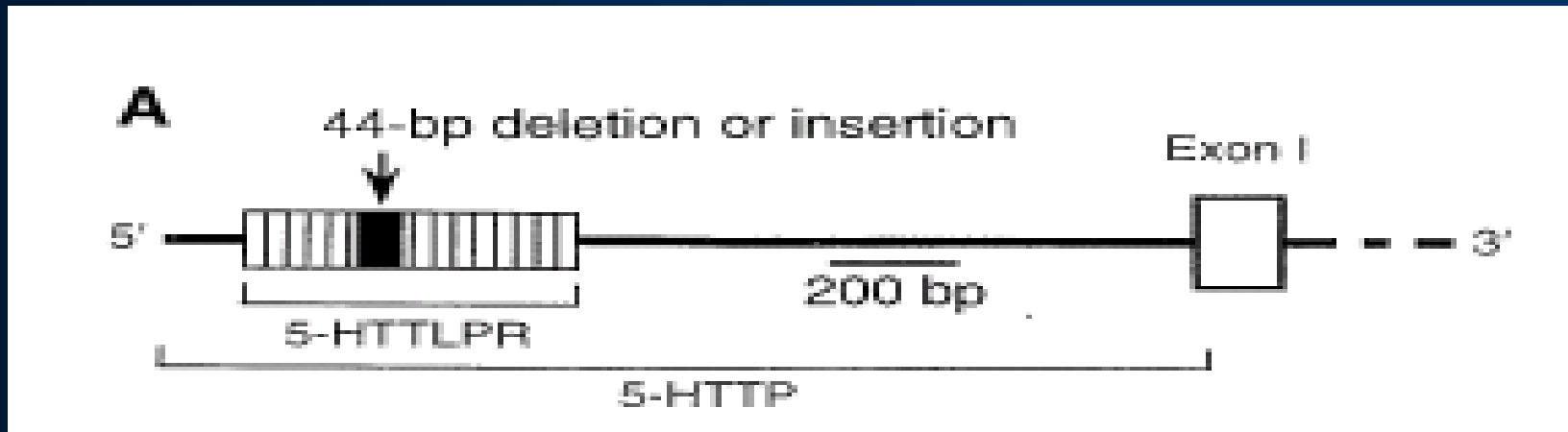


# *Prevalence of Post-Disaster Disorders*

*10.9% of sample met criteria for PTSD, GAD, or MD in the 6-9 months since the hurricanes. Florida population estimate =approximately 800,000 adults with at least one of these disorders.*

# *Serotonin Transporter Gene*

- Common polymorphism (variant) in gene promoter region



- Promoter region regulates gene expression
- Long variant = more efficient, more serotonin
- Short variant = less efficient, less serotonin
- Genotypes: ll or ls or ss

## *Testing G x E Interactions*

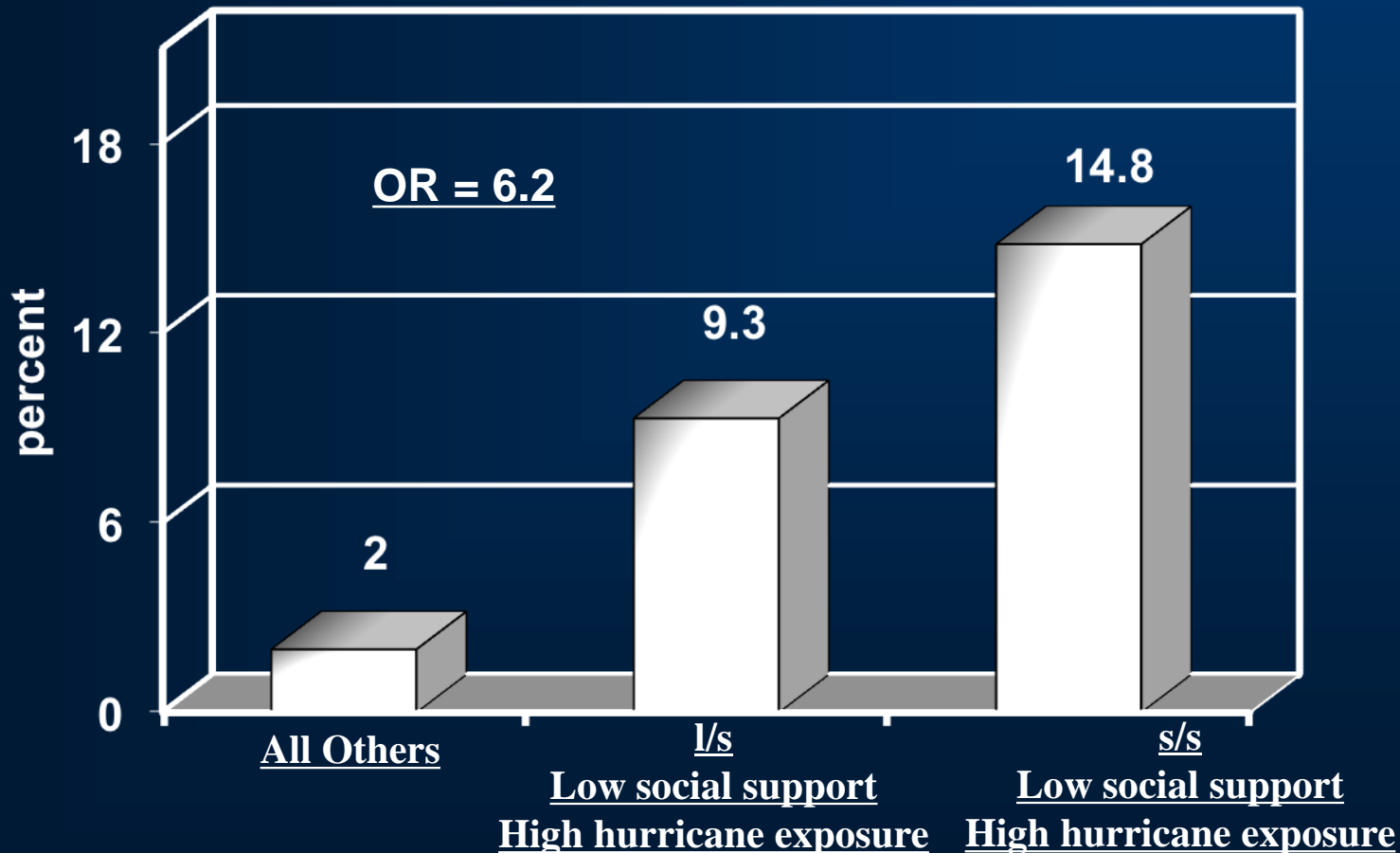
- We predicted there would be a 3-way interaction between serotonin transporter genotype, hurricane exposure and social support for outcomes of MD and PTSD.
- Prevalence of PTSD and MD should be highest among those with s/s or s/L genotype groups *but only* if they also have the environmental risk conditions of high hurricane exposure and low social support.

## *Results of G x E Analyses*

For phenotypes of both MD and PTSD, there were:

- No significant main effect for genotype
- A significant main effect for high hurricane exposure
- A significant main effect for social support
- As predicted, a significant three way (genotype) x E (hurricane exposure) x E (social support) interaction

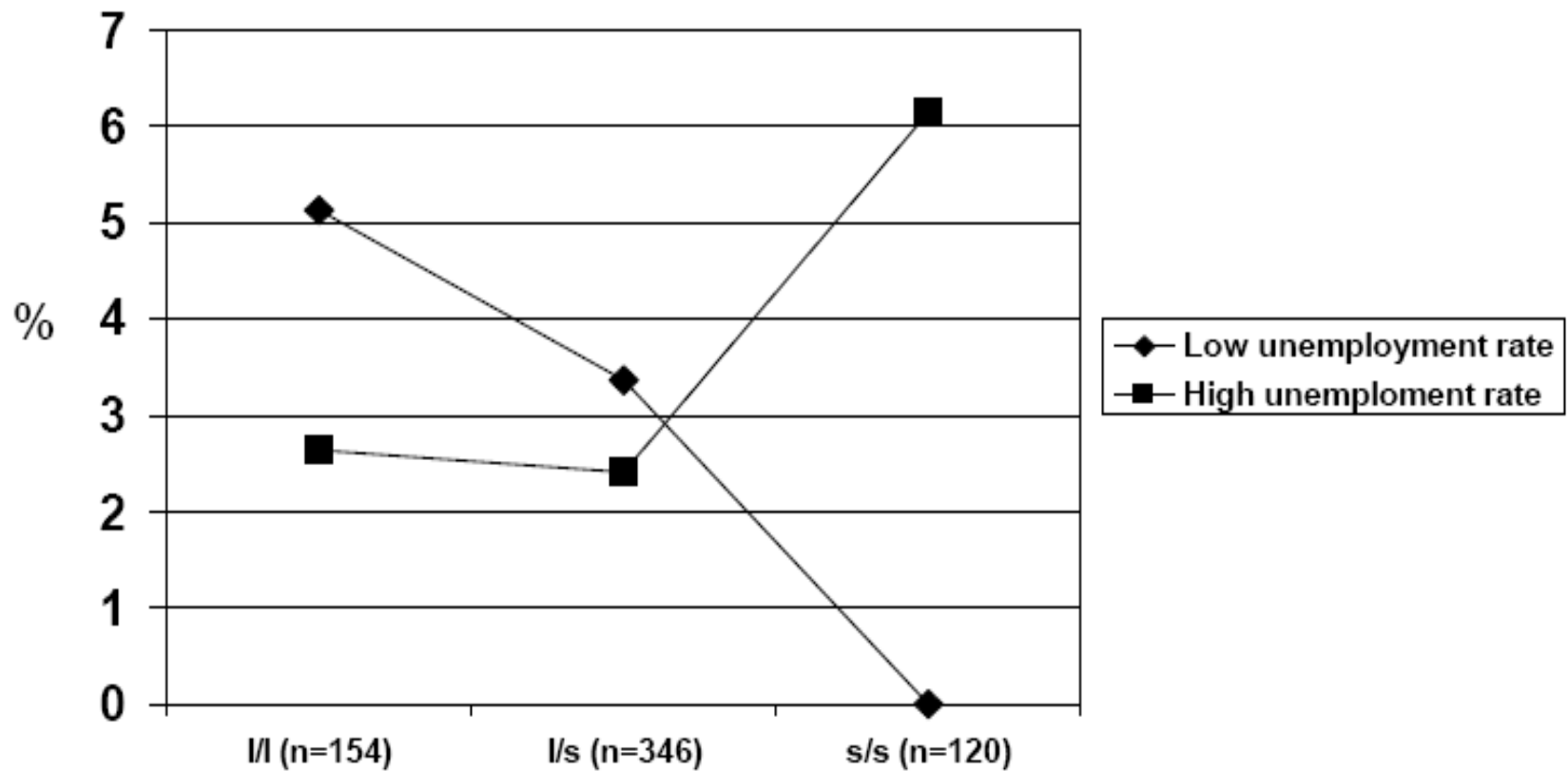
# *6 month Post-event PTSD Prevalence by Serotonin Transporter Genotype, Social Support, & Hurricane Exposure*



# *Summary of Findings and County-Level Environment Study*

- Prevalence of post-disaster PTSD, MD, and GAD was substantial, but most people were resilient.
- G x E interactions were important; L/L genotype and high social support were protective factors even given high hurricane exposure.
- No main effect for genotype.
- We then tested whether county-level social environment Census data on crime rate and unemployment rate modified the relation between genotype and the phenotype of PTSD controlling for individual-level variables .

# *Serotonin Transporter Genotype, County Unemployment, and PTSD Percent*



# *Summary of G x E Post Disaster MH Findings from Florida Hurricane Study*

- G x E interactions were important. At individual analysis level, L/L genotype and high social support were protective even given high hurricane exposure, but county-level social environment was also key.
- Effects of the high risk S/S genotype were offset when individuals lived in communities with low crime and unemployment, demonstrating importance of considering genetic, individual, environmental, and community risk and protective factors to understand responses to disasters.
- There was no main effect for genotype. Without considering impact of environmental factors, we would have concluded that genotype didn't matter in mental disorders following disasters!
- We found G x E interactions for other gene polymorphisms with other phenotypes including GAD, suicidal behaviors, increased tobacco use, increased smoking, and perceived health.



## *Why Disasters Involving Potential Exposure to Toxic Agents Are Worse Than Other Disasters*

*Disasters with potential exposure to toxic agents have characteristics that magnify other disaster impact on mental health:*

- **Uncertainty about extent of exposure to potentially toxic agents**
- **No clear beginning and end to disaster exposure**
- **Uncertainty about extent and nature of health effects of exposure**
- **Health effects of exposure to toxic agents may not be immediate and may require years to develop**
- **Based on findings from Three Mile Island studies, there was no actual release of radiation, but individuals still had increased risk of numerous stress-related physical and MH problems for up to 5 years afterwards; no actual exposure is required!**
- **Managing concerns about potential exposure is a major challenge in these types of disasters**

## *Improving Population Research on the MH Impact of Disasters Requires:*

- Probability sampling of *all* individuals from the impacted area, not just a subset those most affected.
- Assessing key elements of disaster exposure, potential risk and protective factors including prior exposure to other traumatic events and mental health problems. Longitudinal assessment of MH status following disaster exposure needed to determine MH trajectories.
- Obtaining genetic and other biomarkers is a plus, and collecting data on the social and resource environment characterizing the area in which the disaster occurred is essential.
- If disasters involve potential exposure to toxic agents, perceptions of exposure and concerns about exposure should be measured.

## *Improving Disaster MH Response*

- Maslow was right! There is a hierarchy of needs, and addressing basic needs for food, water, shelter, and safety are likely to have a more favorable impact on MH than formal MH treatment. Psychological First Aid is based on this principle.
- Disseminate research-based knowledge about disaster-related MH problems and interventions to MH and public health professionals, disaster relief agencies, and public policy makers.
- Develop, evaluate, and disseminate psychoeducational self-help materials that are useful to the vast majority of disaster survivors who never had mental disorders or developed them after disasters. Web interventions that can be delivered via smart phone apps are of particular interest because they can be delivered at scale at reasonably low cost.

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