

ABSTRACT

**Background.** PTSD has been found to be associated with abnormalities in memory functions. The Deese-Roediger-McDermott (DRM) memory paradigm uses semantically related and unrelated intrusions in an immediate test of recited word lists. PTSD is hypothesized to be associated with false alarms to critical lures in the DRM paradigm. **Methods.** Three years after the 9/11 attacks, a volunteer sample of 281 survivors was recruited from members of 8 participating agencies affected by the attacks. The sample was assessed for disaster experience and psychopathology using a fully structured diagnostic interview to assess full *DSM-IV-TR* criteria and with the DRM paradigm to test participants’ recognition of words. **Results.** There were no associations between PTSD and DRM memory variables. The only predictor of false alarms to critical lures was direct 9/11 trauma exposure, which was not associated with correct identification of recited words or with false alarms to unrelated lures. **Discussion.** The main hypothesis was not supported. The finding that 9/11 trauma exposure was associated with critical lures was unexpected. The results suggest that neural processing of trauma exposure may involve associative processes of overgeneralization in cognitive processing coupled with insufficient inhibition of responses to associated but harmless stimuli. The findings also support the need for future research to differentiate psychopathology from normal physiologic responses to trauma in studies of memory and neurobiological investigations of trauma and its effects.

INTRODUCTION

- ◆ Memory processing abnormalities likely contribute to PTSD
- ◆ In PTSD, trauma memories to non-traumatic contexts become overgeneralized and lack appropriate inhibition
- ◆ The Deese-Roediger-McDermott (DRM) paradigm evaluates memory overgeneralization
  - ✧ Measures semantically related and unrelated intrusions in immediate test of recited word lists
- ◆ DRM paradigm examined associations of memory with disaster exposure and PTSD in survivors of 9/11 attacks on the World Trade Center (WTC)
- ◆ Hypothesis: false alarms to critical lures will be associated with PTSD

MATERIALS AND METHODS

- ◆ Volunteer sample (n=281)
  - ✧ Members of 8 participating agencies that were 9/11-affected:
    - 3 agencies in WTC towers
    - 1 nearby agency (1.5 blocks away)
    - 3 agencies providing 9/11 disaster recovery services
    - Airline that lost personnel and property on 9/11
  - ◆ Participants assessed for individual disaster experience and psychopathology using the Diagnostic Interview Schedule for DSM-IV/Disaster Supplement (DIS-IV/DS) 3 years after 9/11 attacks
- ◆ DRM paradigm was administered at end of interview
  - ✧ Four lists of 15 words each recited by interviewer
  - ✧ Words recited on each list were strongly associated with one word not recited (e.g., word list including “sour, candy, sugar, bitter, good, taste...” but not “sweet”)
  - ✧ After recitation, participants were asked to recognize words on a written list that they remembered being recited by interviewer
  - ✧ Types of responses to the test:
    - Words correctly identified from recited lists = **hit**
    - Incorrect selection = **false alarm**
- Types of false alarms :
  - ❖ Words not on the recited lists and not related to the words on the recited lists (reflects general memory error) = **unrelated lures**
  - ❖ Words not on recited list but strongly related to the recited words (reflects overgeneralization) = **critical lures**

A STUDY OF TRAUMA MEMORY IN SURVIVORS OF THE 9/11 ATTACKS USING THE DEESE-ROEDIGER-MCDERMOTT (DRM) MEMORY PARADIGM

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RESULTS



- ◆ **DRM**
  - ✧ Hit rate for recited words: 79%
  - ✧ False alarms
    - Unrelated lures: 11%
    - Critical lures: 84%
- ◆ **Bivariate analysis**
  - ✧ Hit rate:
    - Positively associated with younger age, having a close associate exposed to 9/11 trauma, and longer interview duration
    - Negatively associated with being currently married, employment at WTC agency on 9/11, and closer proximity to WTC towers
  - ✧ False alarms
    - Unrelated lures:
      - ❖ Positively associated with racial/ethnic minority membership, more years of education
    - ❖ Critical lures: employment in WTC agency on 9/11, direct exposure to 9/11 trauma, having a close associate exposed to 9/11 trauma
- ◆ **Contrary to the hypothesis: false alarms to critical rate not associated with PTSD**

**Table 1.** Three multivariate regression models predicting hit rates and false alarm rates to unrelated lures and critical lures (one dependent variable for each of three models), based on demographic and main exposure variables (independent variables)

Variable name	p
<b>Hit rate</b>	
Intercept	<.001
Sex	.295
Age	<b>.042</b>
Nonwhite ethnicity	.775
Years of education	.520
Currently married	.128
Income	.203
Worked in WTC agency	.071
Directly exposed to 9/11 trauma	.358
Duration of interview	<b>.003</b>
<b>False alarm rate for unrelated lures</b>	
Intercept	<.001
Sex	.462
Age	.166
Nonwhite ethnicity	.102
Years of education	<b>.010</b>
Currently married	.653
Income	.738
Worked in WTC agency	.716
Directly exposed to 9/11 trauma	.986
Duration of interview	.202
<b>False alarm rate for critical lures</b>	
Intercept	<.001
Sex	.261
Age	.204
Nonwhite ethnicity	.481
Years of education	.957
Currently married	.133
Income	.756
Worked in WTC agency	.567
Directly exposed to 9/11 trauma	<b>.029</b>
Duration of interview	.694

CONCLUSIONS

- ◆ No associations between PTSD and DRM memory variables
- ◆ Only predictor of false alarms to critical lures was direct 9/11 exposure
  - ✧ Direct 9/11 trauma exposure was not associated with hit rate or with false alarms to unrelated lures
- ◆ Creation and maintenance of trauma memories may involve overgeneralization and insufficient inhibition of responses to associated, harmless stimuli
  - ✧ Normative brain function as part of physiologic fight-or-flight response
  - ✧ Not necessarily a pathological process