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Long-term psychopathology changes among the injured and members of the community after a massive terrorist attack

L. Ferrando ^{a,*}, S. Galea ^b, E. Sainz Cortón ^c, C. Mingote ^d, E. García Camba ^e, A. Fernandez Liria ^f, R. Gabriel ^g

^a Instituto IAP, Serrano 178, 28002 Madrid, Spain

^b 3663 SPH 11415 Washington Heights Ann Arbor, Michigan 48109-2029, USA

^c Servicio de Psiquiatría, Hospital General Universitario Gregorio Marañón, 28007 Madrid, Spain

^d Servicio de Psiquiatría, Hospital Universitario 12 de Octubre, 28041 Madrid, Spain

^e Servicio de Psiquiatría, Hospital Universitario de la Princesa, 28006 Madrid, Spain

^f Servicio de Psiquiatría, Hospital Universitario Príncipe de Asturias, 28805 Alcalá de Henares, Madrid, Spain

^g Unidad de Investigación, Instituto IdiPaz, Hospital Universitario La Paz and Universidad Autónoma de Madrid, 28046 Madrid, Spain

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ABSTRACT

Background and aim. – To document long-term prevalence trends and changes in Post-Traumatic Stress Disorder (PTSD), Current Major Depression (MD), Agoraphobia, Generalized Anxiety Disorder (GAD), and Panic Disorder, in two groups of people with different levels of exposure to a massive terrorist attack. **Methods.** – Cohort study. Two random samples of people exposed to a terrorist attack, the injured ($n = 127$) and community residents ($n = 485$) were followed and assessed, 2 and 18 months after the event.

Results. – Among the injured, 2 and 18 months after the attack, the prevalences were respectively, PTSD: 44.1% and 34%, MD: 31.5% and 23.7%, Agoraphobia: 23.8% and 20.7%, GAD: 13.4% and 12.4% and Panic Disorder: 9.4% and 11.3%. The corresponding figures among residents were PTSD: 12.3% and 3.5%, MD: 8.5% and 5.4%, Agoraphobia: 10.5% and 8.7%, GAD: 8.6%, and 8.2% and Panic Disorder 2.1% and 2.7%.

Conclusions. – Two months after the event, the prevalence of mental disorders among both injured and residents was higher than expected levels at baseline conditions. Eighteen months after the event, psychopathological conditions did not change significantly among the injured but returned to the expected baseline rates among community residents.

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1. Introduction

On March 11, 2004, at 7:40 a.m. Madrid (Spain) suffered the most devastating terrorist attack in its history. Ten bombs exploded in four different commuter trains heading towards the Atocha train station in downtown Madrid. More than 1400 people were taken to the emergency rooms of different hospitals and 192 died. This extent of destruction after this terrorist attack was unprecedented in the European Union. The long-term psychological consequences of these attacks must be understood.

Post-Traumatic Stress Disorder (PTSD) is considered the most frequent and debilitating psychological disorder that accompanies exposure to massive traumatic events [9,16,27]. A number of studies have documented the prevalence of PTSD in specific groups such as the general adult population [17] and victims [26] after those events. Some studies have shown that individuals diagnosed

with PTSD are also at high risk for other psychiatric disorders [16,19,27,34] that can persist in the long term and that are correlated with other systematic pathologies [8,22,32]. However, there is relatively little systematic evidence from studies comparing the long-term psychopathological evolution of two samples with different levels of exposure to the same event.

The goal of this study was to document trends in prevalence and changes in a range of common psychopathologies (including PTSD, Current Major Depression (MD), Agoraphobia, Generalized Anxiety Disorder (GAD), and Panic Disorder) in two groups of people with different level of exposure those directly injured and those in the affected community, at two points in time, 2 and 18 months after the March 11, 2004 terrorist attacks in Madrid M11.

2. Methods

2.1. Study design

Cohort study. The two sampling frames were as follows.

* Corresponding author. Fax: +34 91 5644718.

E-mail address: laurferrando@iia.es (L. Ferrando).

2.1.1. People injured in the attacks

The target population (case definition) was any person who was injured in the March 11 attacks and who was seen at the emergency rooms of four large hospitals between 8:00 a.m. and midnight of March 11th: *Gregorio Marañón, 12 de Octubre, La Princesa and Príncipe de Asturias*.

Approximately 1400 people were injured in the terrorist attacks, 754 (54%) of whom were seen in one of those four hospitals: 41, 35, 13, and 9.5%, respectively [28,29]. We obtained a proportional random sample of 132 participants from the 754 injured seen at the hospitals. The response rate at baseline was 96% (127 out of 132 invited) and 76.4% (97 participants among those initially interviewed) at the 18-month interview.

2.1.2. Residents of Alcalá de Henares

Alcala de Henares is the suburb where on March 11 the bombing trains departed. We selected an age- and sex-proportional stratified random sample of individuals aged 18–65 years registered in the city census on December 31, 2003 ($n = 121,461$), according to the Spanish National Institute of Statistics. We invited and contacted 633 individuals, and 485 were interviewed (76.6% response rate for the two-month interview). Some 75.8% ($n = 368$) of those interviewed 2 months after the attacks also participated in the second assessment at month 18.

2.2. Interview methods and tools

The same structured questionnaires were used for the two samples in both interviews (2 and 18 months): A sociodemographics and event exposures instrument [15], the Spanish version [12,3] of the Davidson Trauma Scale (DTS), was used to assess PTSD, and the Spanish version [23,31,4] of the Mini International Neuropsychiatric Interview (MINI), was used to assess other mental disorders. A full description, psychometric properties, and methods and procedures for these assessment tools have been described elsewhere [15].

Psychiatrists performed interviews with all injured participants and 10% of those were supervised by independent experts.

Trained interviewers went door-to-door and administered the questionnaires to residents. A random subsample of 10% of the interviews was supervised by the same independent experts.

2.3. Ethics Committee Approval

The study was approved by the institutional review board of the Hospital General Universitario Gregorio Marañón (HGUGM). A signed statement of informed consent was obtained from every participant.

3. Statistical analysis

Point prevalence and 95% confidence intervals (Cornfield method) were used to measure mental disorder prevalence at 2 and 18 months. For inclusion in the numerator, the prevalent cases had to be living on May 1, 2004 (prevalence day), and the onset of the disorder must have occurred on or before those dates. We calculated the overall (any) and specific prevalence of current mental disorders.

Comparisons between baseline (2 months) and follow-up (18 months) were performed using the paired Students *t*-test. The level of statistical significance was established at a *p*-value < 0.05 .

Finally, in order to identify potential predictors of mental disorders over time, we conducted a multivariate logistic regression analysis separately for victims and for community residents. All independent variables significantly associated with PTSD, MD

or GAD at baseline were included in the logistic model [15]. All analyses were performed with SPSS software version 13.

4. Results

4.1. Sample characteristics

The mean (\pm SD) age of the injured was 36.9 (\pm 10.7) years 54% were men and 41% were immigrants. At the time of hospital discharge, 81% of the injured were classified as having fair medical prognoses, 15.8% as poor medical prognoses, and 3% as grave prognoses (Table 1).

Among residents, the proportions of people in each age, sex, race or ethnic group were similar to estimates obtained from the 2003 Spanish Census for our sampling frame (data not shown). Sociodemographic characteristics of these samples at baseline have been published previously [15].

4.2. Prevalence of current mental disorders

At months 2 and 18, 57.5% (48.4–66.2) and 49.5% (39.2–59.8) of the injured and 25.9% (22.1–30.1) and 19.3% (15.4–23.7) of residents reported symptoms consistent with the diagnosis of any mental disorder (Table 2).

4.3. Prevalence of current Post-Traumatic Stress Disorder (PTSD)

At month 2, 44.1% (35.3–53.2) of the injured and 12.3% (9.6–15.6) of the residents reported symptoms consistent with the diagnosis of PTSD (Table 2). Intrusive ideas were the most frequent symptoms in both groups: 95.9 and 88.3%, respectively. All three categories of symptoms on the DTS scale (intrusive ideas, avoidance behavior, and hyperarousal – criteria B, C, D –), were significantly higher among the injured.

During month 18, 34% (24.6–44.5) of those injured and 3.5% (1.8–5.9) of residents reported symptoms consistent with the diagnosis of PTSD. Intrusive ideas were also the most frequent symptoms among the two groups: 88.3 and 66.0%, respectively. Criterion C symptoms increased significantly among those injured between month 2 and month 18. Among residents, criteria B, C and D symptoms decreased significantly between months 2 and 18 and the overall prevalence of PTSD was significantly different (Table 3).

Table 1
Sociodemographic characteristics of samples.

	Injured (127/97)	Residents of Alcalá (485/368)
<i>Number of individuals interviewed at months 2/18</i>		
Participation rate (%) at months 2/18	96/76.4	76.6/75.8
Age (mean \pm SD) at baseline	36.9 \pm 10.7	39.1 \pm 12
Gender (% men)	54	49
Country of origin (%Spain)	59	99
<i>Education level</i>		
Primary school (%)	21.3	37.5
Secondary or higher (%)	78.7	62.5
Relatives' or friends' victims (%)	41.5	28.8
Use of trains on M11 2004 (%)	100	4.1
<i>Prognoses at hospital discharge (%)</i>		
Having fair	81.1	–
Poor medical	15.8	–
Grave	3.1	–
Life stressors (one year before the event) (%)	52.8	34.6
Psychiatric history before M11 (%)	26.8	20.8
Current use of psychoactive-drugs before event (%)	5.5	8.0
Mental health care pursuit since event (%)	34	0.4

Table 2

Prevalence of mental disorders and mental disorders comorbidity, 2 and 18 months after M11 attack in both samples.

Time of clinical assessment	Injured (%)		p-value	Residents (%)		p-value
	2 months (n=127)	18 months (n=97)		2 months (n=485)	18 months (n=368)	
Any mental disorder	57.5 (48.4–66.2)	49.5 (39.2–59.8)	NS	25.9 (22.1–30.1)	19.3 (15.4–23.7)	< 0.05
PTSD	44.1 (35.3–53.2)	34 (24.6–44.5)	NS	12.3 (9.6–15.6)	3.5 (1.8–5.9)	< 0.001
MD	31.5 (23.5–40.3)	23.7 (15.7–33.4)	NS	8.5 (6.1–11.3)	5.4 (3.3–8.2)	NS
Agoraphobia	23.8 (16.5–32.0)	20.7 (13.1–30)	NS	10.5 (7.9–13.6)	8.7 (6–12)	NS
GAD	13.4 (8.0–20.6)	12.4 (6.6–20.6)	NS	8.6 (6.3–11.5)	8.2 (5.6–11.4)	NS
Panic disorder	9.4 (5.0–15.9)	11.3 (5.8–19.4)	NS	2.1 (1.0–3.8)	2.7 (1.3–4.9)	NS
Single mental disorder	18.9	17.5	NS	15.6	12.8	NS
Two or more mental disorders	38.6	32	NS	10.3	6.5	< 0.05
PTSD + MD	25.2	15.5	NS	4.5	0.5	< 0.001
MD + GAD	11	7.2	NS	3.5	2.4	NS

PTSD: Post-Traumatic Stress disorder; MD: Major Depression; GAD: Generalized Anxiety Disorder; p-values are between 2 and 18 months in each sample.

Table 3

PTSD symptoms among injured and residents of Alcalá after M11 attack.

Time of clinical assessment	Injured (%)		p-value	Residents (%)		p-value
	2 months (n=127)	18 months (n=97)		2 months (n=485)	18 months (n=368)	
Criterion B	95.9	88.3	< 0.05	88.3	66.0	< 0.001
Criterion C	56.7	77.7	< 0.001	23.6	11.1	< 0.001
Criterion D	79.4	64.9	< 0.05	54.1	31.3	< 0.001

Criterion B relive of the traumatic event; Criterion C avoidance of stimuli associated with the trauma; Criterion D symptoms of increased arousal; p-values are between 2 and 18 months in each sample.

4.4. Prevalence of current Major Depression (MD)

In the first assessment, 31.5% (23.5–40.3) of those injured and 8.5% (6.1–11.3) of residents reported symptoms consistent with the diagnosis of current MD. In the second assessment, 23.7% (15.7 to 33.4) of the injured and 5.4% (3.3–8.2) of the residents reported symptoms consistent with the diagnosis of current MD. There were no statistically significant differences in prevalence of current MD between month 2 and month 18 in either the injured or residents (Table 2).

4.5. Prevalence of current anxiety disorders other than PTSD

In the first assessment, among the injured and residents respectively, 23.8% (16.5–32.0) and 10.5% (7.9–13.6) reported symptoms consistent with the diagnosis of agoraphobia, 13.4% (8.0–20.6) and 8.6% (6.3–11.5) reported symptoms consistent with the diagnosis of GAD and 9.4% (5.0–15.9) and 2.1% (1.0–3.8) reported symptoms consistent with the diagnosis of panic disorder. In the second assessment, among the injured and residents, respectively 20.7% (13.1–30) and 8.7% (6–12) reported symptoms consistent with the diagnosis of agoraphobia. Some 12.4% (6.6–20.6) and 8.2% (5.6–11.4) reported symptoms consistent with the diagnosis of GAD and 11.3% (5.8–19.4) and 2.7% (1.3–4.9) reported symptoms consistent with the diagnosis of panic disorder. There were no statistically significant differences in prevalence between month 2 and month 18 for agoraphobia, GAD, or panic disorder in either the injured or residents (Table 2).

4.6. Frequency of current comorbid mental disorders

During the first assessment, the proportion of individuals with comorbid mental disorders, among those injured and residents, was 38.6 and 10.3%, respectively, and the most frequent comorbid mental disorder was PTSD + MD, 25.2 and 4.5%, respectively.

At the time of the second assessment the corresponding figures were 32 and 6.5% and the most frequent comorbid mental disorder among the injured was PTSD + MD (15.5%) whereas among residents MD + GAD (2.4%) was more frequent (Table 2).

4.7. Changes in mental disorders during the follow-up

Thirty-nine (69%) out of the 56 injured showing any mental disorder at baseline still had these mental disorders 18 months later. In contrast, among the 41 injured who were free of mental disorder at baseline, nine (24%) developed new mental disorders during follow-up (Table 4).

Forty (41.6%) out of the 96 residents who reported symptoms consistent with mental disorders at baseline remained without changes 18 months later. In contrast, there were only 31 (11.4%) new psychopathological diagnoses among the 272 residents free of mental disorders at baseline (Table 4).

4.8. Use of mental health care services

Thirty-four percent of the injured (59.1% of those with symptoms of mental disorder) but only 0.4% of the Alcalá residents (1.5% of those with symptoms of mental disorder) reported the use

Table 4

Individual changes in mental disorders during the follow-up.

Time of clinical assessment	Injured (n=97)		p-value	Residents (n=368)		p-value
	2 months	18 months		2 months	18 months	
With any mental disorder	n=56	n=39 (69.6%)	< 0.001	n=96	n=40 (41.6%)	< 0.01
Without mental disorders	n=41	n=31 (76%)	NS	n=272	n=241 (88.6%)	NS

of any mental health care service during the follow-up period (Table 1).

4.9. Predictors of mental disorders persistence

None of the variables tested in the logistics model: age, gender, origin, education level, profession, social support, relatives or friends among victims, prognosis at hospital discharge, use of trains on M11, life stressors, psychiatric history and current use of psychoactive drugs, was significantly associated with the persistence of these mental disorders among either the injured or community residents.

5. Discussion

Two months after M11, the prevalence of PTSD among the injured and community residents, was approximately 40 and 12 times higher respectively than might have been expected in baseline conditions [2,20,21]. Eighteen months later, the prevalence of PTSD had not changed significantly among those injured and had decreased significantly, to the range of expected baseline rates, in residents.

These results are consistent with findings previously published after other terrorist attacks, including another independent study conducted after the same M11 attack [11] and a study conducted after bombing attacks in France, which showed a PTSD prevalence of 31% among injured people [33]. In addition, a number of studies [17,30] carried out in the New York City and the US populations during the first 2 months after the September 11, 2001 terrorist attacks, also found a PTSD prevalence ranging between 7.5 and 11.2% for the general population. In our study, we found a PTSD prevalence of 12.3% which is consistent with these studies, but still higher than another study carried out in the city of Madrid among the general population during the same period, which reported a PTSD prevalence of 2.3% [24]. The latter study interviewed the general population of Madrid by telephone, while our study was restricted to a representative random sample of Alcalá residents, a Madrid suburb where a large proportion of people knew somebody injured or dead in the event.

Two months after M11, the MD prevalence reported in our study was nearly 10 times higher among victims than might have been expected in the general population in baseline conditions, and was not substantially different among residents [20]. Our documented prevalence of depression at those times is consistent with that published in a previous population-based study conducted in Madrid, which found that 8% of respondents reported MD [24]. These findings are also generally in agreement with the work carried out after the September 11, 2001 terrorist attacks, which reported a MD prevalence of 9.7% [30].

We also observed a higher prevalence of agoraphobia, GAD, and panic disorder among those injured than might have been expected, at both baseline and follow-up. There was no increase in these disorders among residents.

The observation of a psychopathology increase among the injured that persisted over time, in contrast to a transient elevation of PTSD only in the general population contributes to our growing appreciation of the differences between these two groups and highlights the nature of exposure to massive traumatic events. It has previously been shown, consistent with our observations here, that the typology of PTSD symptoms in these different groups is similar [18]. However, clearly, both the burden and trajectory of these symptoms is quite different over time. This difference reinforces the idea of severity of exposure as a key driver of psychopathology after traumatic event exposure [1].

Many of those with psychological symptoms reported symptoms consistent with two or more mental disorders. In particular,

comorbidity is more common among patients with PTSD than patients without PTSD (80% vs. 30%) [25]. This reinforces the centrality of PTSD as the sentinel psychopathology following traumatic exposure and the idea that it is relatively rare for people to have other anxiety or affective disorders without comorbid PTSD after traumatic event exposure [10].

We found that only a minority of both groups sought mental health services. Our results are consistent with the work conducted after the September 11, 2001 terrorist attacks [6] and other work that suggests important barriers to the access of mental health services among affected individuals [5,13]. However, there was a quantifiable increase in the dispensing of psychoactive drugs following the terrorist attacks of September 11, and this effect varied by geographic proximity to the events [7,14]. High rates of psychopathology and low demand for mental health services following these events suggest the need to develop information programs and a systems approach at this level.

There are three primary limitations in interpreting these results:

- first, concerns about selection bias suggest caution in interpreting these results. However, the sampling strategy used for the two samples, the high participation achieved in the two groups, and the similar demographic characteristics of refusals and participants reasonably protect against these type of bias;
- second, although we used a validated and standardized symptoms scale to assess PTSD and major mental disorders in the two groups, the results shown here do not substitute for clinician-diagnosed psychopathology. We note that we use the ESEMED study as comparison for the purposes of baseline estimation. It is possible that the relative increase in psychological disorders after the M11 terrorist attacks is lower than what is reported here;
- finally, we caution that cross-study comparisons are always limited by the use of different measures of psychopathology in different postdisaster situations. Therefore, comparisons of prevalence should be considered with caveats in mind about cross-study comparisons when different measures of psychopathology are employed.

6. Conclusions

Two months after the March 11 terrorist attacks in Madrid, the prevalence of mental disorders was higher than expected levels in baseline conditions among both the injured and community residents. Eighteen months after the event, psychopathological conditions did not change significantly among the injured and they returned to expected baseline rates among community residents. In both groups, psychopathological comorbidity was frequent and more common among patients with PTSD. The use of mental health services was relatively low in both groups.

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