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Psychopathological sequelae of the 11 March terrorist attacks in Madrid

An epidemiological study of victims treated in a hospital

■ **Abstract** *Objective* To describe the prevalence and correlates of post-traumatic stress disorder (PTSD), depressive and anxiety disorders, or any other mental disorder among adult victims treated in a hospital at different points in time after the 11 March 2004 terrorist attacks in Madrid. *Design, Setting, and Participants* A random sample of 56 individuals injured in the attacks was interviewed in person at one, six, and twelve months after the attacks. *Main Outcome Measures* Current DSM-IV mental disorders: depressive disorders and anxiety disorders (PTSD, generalised anxiety, agoraphobia, social phobia, and panic disorder) were assessed with the Spanish version of the MINI (Mini International Neuropsychiatric Interview), a structured, lay-administered psychiatric interview. *Results* PTSD was the most prevalent psychiatric disorder (35.7% at month 1, 34.1% at month 6, and 28.6% at month 12), followed by major depression (28.6%, 22.7%, and 28.6%, respectively). Others relevant conditions were suicide risk, generalised anxiety disorder (GAD), agoraphobia, and panic disorder. No significant differences in the prevalence of the disorders were found between the different assessment times. Patients with a psychiatric history prior to 11 March had a higher prevalence of PTSD, major depression, GAD, and panic disorder at month 1. Females had higher prevalence of PTSD, agoraphobia, and panic disorder at month 1. The only predictive factor for PTSD at month 12 was PTSD at month 6 (OR = 14.007). The only predictive factor for major depression at month 12 was major depression at month 6 (OR = 15.847). *Conclusion* The prevalence of PTSD and major depression was high and remained stable between month 1, month 6, and month 12. The only predictive factor for PTSD at month 12 was PTSD at month 6.

■ **Key words** post-traumatic stress disorder · depression · terrorism · prevalence · predictors

Introduction

On 11 March 2004, Madrid experienced the worst terrorist attack in its history. Ten bombs exploded on four different commuter trains headed for the central station in Madrid. The death toll rose to 192 (177 pronounced dead at the scene and 15 more in the ensuing days). Approximately 2000 people were injured [1]. This terrorist attack was unprecedented in scope, both in Spain and in the European Union. The social repercussions of this tragedy and its long-term economic effects are still unknown [8].

Gregorio Marañón University General Hospital is a public teaching institution dependent on the Autonomous Community of Madrid. Hospital Gregorio Marañón was the closest hospital to the scene of the attacks, so it was the first to receive the injured and it treated the greatest number of victims on 11 March, i.e., a total of 325 patients [26]. On 11 March, our hospital's Department of Psychiatry implemented a plan for treating both victims of the attacks and their relatives, as well as follow-up of victims after 11 March [28].

Post-traumatic stress disorder is the most studied psychopathologic sequela and, plausibly, the most common change in individuals exposed to traumatic incidents or disasters. The marked discrepancies among the PTSD prevalence studies and in the course of PTSD are partially attributable to the methodological differences in the studies (i.e., different samples, scales used to assess PTSD, types of trauma, exposure, injures, times of assessment, specific groups, etc.).

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Different prevalences have been measured in the populations of different continents (the US lifetime prevalence of PTSD: is 6.8% [17] and the 12-month prevalence of PTSD is 3.5% [18], the European population lifetime prevalence of PTSD is 1.9%, and the 12-month prevalence is 0.9% [2]). There are also studies of PTSD in specific groups of victims [23] or rescue workers [25] after disasters.

The longitudinal course of PTSD symptoms after terrorist attacks tends to decrease with time [35]. However, the different studies on the course of PTSD report a wide variation in stability of PTSD symptoms. In a community sample, approximately 26% of PTSD cases remitted by 6 months and 40% by 12 months, [7]. In contrast, a nation-wide longitudinal study conducted in the United States, outside of New York City, found that only 17% of the sample reported post-traumatic stress symptoms 2 months after the September 11 attacks and 5.8% at 6 months [35]. 36.8% of patients admitted to an emergency room in Jerusalem subsequent to a terrorist attack met PTSD diagnostic criteria at 4 months after the attack [30]. The PTSD prevalence in victims of a bomb attack in Paris was 38.5% at 6 months and 25.0% at 32 months [16].

There are few studies in the literature that assess depression after a terrorist attack. The few published rates reported for depression range from 9.7% in New York [11], 16% to in Taiwan [20], to 22.5% in the Oklahoma City bombing [23].

Our study population has been previously assessed, and we found that, at month 1, patients presented a PTSD prevalence of 41.1% [9]. At month 6, this figure was 40.9% The prevalence of PTSD symptoms was high and remained stable between month 1 and month 6.

We conducted an epidemiological survey using in-person interviews to assess the survivors of the 11 March train bombings who needed medical hospital treatment.

The purpose of this study was to determine and compare the prevalence of PTSD, depression, and other psychiatrics disorders among victims of the terrorist attacks treated in a hospital emergency room, at three time periods: 5 to 8 weeks, six months, and twelve months after the attacks. Likewise, we aimed to identify the predictors of the most prevalent disorders at follow-up.

Methods

This study is part of a multicenter investigation on the psychological effects of the terrorist attacks that took place in Madrid on 11 March, conducted at four of the city's hospitals [10].

Of the 325 patients treated in the emergency room at our hospital between 8:00 a.m. and midnight of 11 March 2004 as a consequence of injuries sustained in the 11 March attacks, we selected a random sample of 56 persons (using a table of random numbers) and a second random sample to allow substitutions in case some subjects could not be contacted. We interviewed the same sample that was studied in a prior study [9].

The exclusion criteria were: being under the age of 18 years or over the age of 65 years and residing outside of the Community of Madrid.

In order to contact the patients, up to three telephone calls were made at different times and on different days; after three failed calls, the chosen subject was substituted by the first person on the backup list and so on. The calls were placed directly the psychiatrists (DF, ST, JC-G, and OM), authors of the study, with a conversation protocol that was designed in advance so it would be the same for all selected individuals.

Twenty-four patients from the first sample could not be reached and were replaced with 24 patients from the second sample. Once located, all patients agreed to participate in the study. None of the subjects, once they were contacted, refused to participate in the study.

Fifty-six individuals participated in the first data collection between weeks 5 and 8 after the attacks, 44 in the second data collection 6 months after the attacks, and 42 in the third data collection 12 months after the attacks.

Each person interviewed was given a general questionnaire consisting or socio-demographic variables (age, gender, educational level, occupation, religion), general medical and psychiatric history, vital traumatic events in the past year, existence of other victims in his/her entourage, and habitual use of commuter trains.

The diagnostic interview in this study was the MINI (Mini International Neuropsychiatric Interview, Spanish version). The MINI is a short structured diagnostic interview, developed jointly by psychiatrists and clinicians in the United States and Europe, for DSM-IV and ICD-10 Axis I psychiatric disorders [32, 33]. The MINI shows good reliability and validity compared to the Composite International Diagnostic Interview and to the Structured Clinical Interview for DSM-IV [21, 32, 33]. It was administered by psychiatrists who did not have previous diagnoses available for consecutive interviews. History of psychiatry disorders was assessed using the corresponding items of the MINI scale.

Patients were classified according to medical prognosis: "mild" (no life-threatening risk and discharge from the emergency room in the first 24 h), "intermediate" (no life-threatening risk and discharge > 24 h), and "serious" (life-threatening risk).

Statistical analysis: Non-parametric tests were used because the different subgroups analysed had a non-normal distribution in the Kolmogorov-Smirnov analysis. The analysis between the dichotomous variables and the quantitative independent variables was done using the Mann–Whitney U test. The dichotomous variables were evaluated using the χ^2 test.

The analysis of the qualitative related variables was done with the McNemar test. The McNemar test assesses the significance of the difference between two dependent samples when the variable of interest is dichotomous.

Logistic regression analyses, with PTSD and major depression at 12 months as the dependent variables, were performed to assess what variables would explain a significant variance at each evaluation (age, gender, psychiatric history prior to 11 March, number of life stressors in the 12 months prior to the bombing, country of origin, medical prognosis, and PTSD/major depression at month one and/or month six). The significance level for all statistical tests was 0.05. The SPSS 12.0 statistics software package was used [36].

The study was approved by the Gregorio Marañón Hospital Clinical Research Ethics Committee. All participants gave their written informed consent prior to enrolment in the study. The medical information collected was strictly confidential.

Results

■ Sampling

The mean age of the sample was 36 (±10.7) years; 54% were male, and 41% were immigrants.

Table 1 shows the characteristics of the sample at month 1, month 6, and month 12. There were no

Table 1 Socio-demographic characteristics of the sample

	Month 1 (n = 56)	Month 6 (n = 44)	Month 12 (n = 42)	Statistics
Age (mean ± SD)	38.2 ± 11.4	37.6 ± 10.7	40.0 ± 11.8	n.s.
Gender (% male)	57.1% (n = 32)	52.3% (n = 23)	54.8% (n = 23)	n.s.
Medical prognosis (% mild)	76.8% (n = 43)	72.7% (n = 32)	73.8% (n = 31)	n.s.
Country of origin (% Spain)	60.7% (n = 34)	63.6% (n = 28)	66.7% (n = 28)	n.s.
Education level				
Primary school	25.0% (n = 14)	22.7% (n = 10)	21.4% (n = 9)	n.s.
Secondary or higher	75.0% (n = 42)	77.3% (n = 34)	78.6% (n = 33)	n.s.
Marital status (% married)	69.6% (n = 39)	72.7% (n = 32)	71.4% (n = 30)	n.s.
Active workers	75.0% (n = 42)	79.5% (n = 35)	73.8% (n = 31)	n.s.
Relatives or friends of victims	51.8% (n = 29)	56.8% (n = 25)	54.8% (n = 23)	n.s.
Use of trains on 11 March	92.9% (n = 52)	90.9% (n = 40)	90.5% (n = 38)	n.s.
Frequency of use of trains before 11 March				
2–3 times a week/daily	82.1% (n = 46)	79.5% (n = 35)	78.6% (n = 33)	n.s.
Occasionally/never	8.9% (n = 5)	9.1% (n = 4)	11.9% (n = 5)	n.s.
Life stressors (past year)				
One	42.9% (n = 24)	45.5% (n = 20)	42.9% (n = 18)	n.s.
Two or more	17.9% (n = 10)	16.0% (n = 7)	4.7% (n = 2)	n.s.
Psychiatric history before 11 March	23.2% (n = 13)	22.7% (n = 10)	19.0% (n = 8)	n.s.

No significant differences were found between month 1, month 6, and month 12

χ^2 n.s.: P > 0.05

Mann–Whitney n.s.: P > 0.05

statistically significant differences in the demographic variables of the subjects evaluated at the three evaluations.

We performed an analysis of the data on the 14 subjects lost to follow-up between the three evaluations. Ten patients were lost to follow-up because they could not be reached and four because they refused to remain in the study. There were no significant differences in the main variables (age, gender, medical prognosis, country of origin, and PTSD prevalence) between those who attended the three evaluations and those who did not.

■ Prevalence of psychiatric disorders

Table 2 shows the prevalence of psychiatric disorders at month 1, month 6, and month 12. No significant differences in overall MINI results were

Table 2 Prevalence of current psychiatric disorders assessed by MINI

	Month 1 (n = 56, %)	Month 6 (n = 44, %)	Month 12 (n = 42, %)
Post-traumatic stress disorder	35.7	34.1	28.6
Major depression	28.6	22.7	28.6
Suicide risk	12.5	15.9	14.3
Generalised anxiety disorder	12.5	11.4	11.9
Agoraphobia	10.7	18.2	7.1
Panic disorder	5.4	9.1	4.8
Dysthymia	1.8	0	2.4
Schizophrenia and other psychotic disorders	1.8	0	0

McNemar n.s.: P > 0.05

There were no cases of manic/hypomanic episodes, social phobia; obsessive-compulsive disorder, alcohol or other substance dependence/abuse

No significant differences were found between month 1, month 6, and month 12 in the McNemar analysis

found between month 1, month 6, and month 12 in the McNemar analysis. PTSD was the most prevalent psychiatric disorder, followed by major depression. The prevalence of psychiatric disorders at month 12 was lower (reports of significant findings only) than at month 1, except for suicide risk (12.5% at month 1 vs. 14.3% at month 12) and major depression (28.6% at month 1 vs. 28.6% at month 12). Most of the suicide risk was assessed as low (items C1 "Have you thought that you would be better off dead?" or C2 "Have you ever wanted to harm yourself?" or C6 "Have you ever tried to commit suicide?" positive in the MINI) (85.5% at months 1 and 6 and 83.3% at month 12).

Table 3 shows that patients with a psychiatric history prior to 11 March had higher prevalence of PTSD, major depression, GAD, and panic disorder at month 1 than those with no such history. At month 1, females had a higher prevalence of PTSD, agoraphobia, and panic disorder than males.

There were no statistical differences in gender or psychiatric history at the month 6 and month 12 evaluations, except for patients with a psychiatric history prior to 11 March who had higher prevalence of GAD at month 6 than those with no such history (GAD 30% (3/10) vs. 5.9% (2/34), χ^2 P = 0.035).

The immigrant population presented results similar to the Spanish population in the three evaluations (Table 3).

■ Analysis of drop-outs

A χ^2 analysis showed that PTSD and depression at month 1 were not more common among those who dropped out. Furthermore, we did a Cox regression analysis with loss to follow-up as the dependent var-

Table 3 Psychiatric disorders at month 1 by gender, psychiatric history, and country of origin

	PTSD	Major depression	Generalised anxiety disorder	Agoraphobia	Panic disorder
Male	18.8% (6/32)	18.76% (6/32)	9.4% (3/32)	3.1% (1/32)	0% (0/32)
Female	58.3% (14/24)	41.7% (10/24)	16.7% (4/24)	20.9% (5/24)	12.5% (3/24)
Comparison by gender	χ^2 P = 0.002	χ^2 n.s.	χ^2 n.s.	χ^2 P = 0.034	χ^2 P = 0.040
Psychiatric history	63.7% (7/11)	54.5% (6/11)	36.3% (4/11)	18.2% (2/11)	27.3% (3/11)
No psychiatric history	28.9% (13/45)	28,6% (10/35)	6.7% (3/45)	8.9% (4/45)	0% (0/45)
Comparison by psychiatric history	χ^2 P = 0.031	χ^2 P = 0.033	χ^2 P = 0.008	χ^2 n.s.	χ^2 P < 0.001
Native	38.2% (13/34)	29.4% (10/34)	5.9% (2/34)	14.7% (5/34)	5.9% (2/34)
Immigrant	31.8% (7/22)	27.3% (6/22)	22.7% (5/22)	4.5% (1/22)	4.5% (1/22)
Comparison by country of origin	χ^2 n.s.	χ^2 n.s.	χ^2 n.s.	χ^2 n.s.	χ^2 n.s.

χ^2 n.s.: P > 0.05

iable, and both PTSD and depression (at month 1 and 6) as covariates. Presence of PTSD or depression was not related to loss to follow-up.

■ Logistic regression analysis

A multiple logistic regression analysis was done, using presence of PTSD as a dependent dichotomic variable and psychiatric history prior to 11 March, age, gender, number of life stressors (12 months prior to 11 March), medical prognosis, and country of origin as independent variables. At month 1, only gender was associated with PTSD (OR = 14.117; 95% CI (2.685–74.214); df = 1; P = 0.02).

There were no predictive variables for PTSD at month 6 (including PTSD or depression at month 1).

We made three regression models for PTSD at month 12. We used the shared independent variables and PTSD at month 1, PTSD at month 6, or both for each regression model. In the first model (using PTSD at month1), the only predictive variable was PTSD at month 1 (OR = 13.316; 95% CI (1.402–126.489); df = 1; P = 0.024).

In the second model (using PTSD at month 6) the only statistical association was with PTSD at month 6 (OR = 19.064; 95% CI (2.526–143.854); df = 1; P = 0.004).

In the third model (using PTSD at months 1 and 6), the only statistical association was with PTSD at month 6 (OR = 14.007; 95% CI (1.845–106.325); df = 1; P = 0.011) (see Table 4). Major depression at

month 1 or 6 was not a predictive variable of PTSD at month 12.

Similar multiple logistic regression analyses were done, using presence of major depression as a dependent variable and the same covariables (but changing PTSD at month 1 and 6 to major depression at months 1 and 6).

At month 1, only gender predicted major depression (OR = 4.423; 95% CI (1.033–18.940); df = 1; P = 0.045).

There were no predictive variables of major depression at month 6 (including PTSD or depression at month 1).

In the first model at month 12 (using major depression at month 1), there was no statistical association.

In the second model (using major depression at month 6), the only statistical association was with major depression at month 6 (OR = 11.068; 95% CI (1.674–73.192); df = 1; P = 0.013).

In the third model (using major depression at months 1 and 6), the only statistical association was with major depression at month 6 (OR = 15.847; 95% CI (1.922–130.638); df = 1; P = 0.010) (see Table 5). PTSD at month 1 or 6 was not a predictive variable of major depression at month 12.

Discussion

In the present study, there was a high prevalence of PTSD and major depression one year after the ter-

Table 4 PTSD multiple logistic regression analysis at month 12

	OR	95% CI	df	P
PTSD at month 6	**21.503**	**1.777–260.275**	**1**	**0.016**
PTSD at month 1	4.687	0.239–91.957	1	0.309
Psychiatric history prior to 11 March	0.136	0.003–5.711	1	0.296
Age	1.005	0.873–1.158	1	0.941
Gender	1.221	0.083–17.962	1	0.884
No. of life stressors (past 12 months, prior to 11 March)	1.336	1.181–9.867	1	0.776
Country of origin	6.446	0.267–155.790	1	0.750
Medical prognosis	3.795	0.239–60.319	1	0.345

Significant values are indicated in boldface. CI denotes confidence interval

Table 5 Major depression multiple logistic regression analysis at month 12

	OR	95% CI	df	P
Major depression at month 6	**17.050**	**1.951–148.992**	**1**	**0.010**
Major depression at month 1	6.587	0.722–60.072	1	0.095
Psychiatric history prior to 11 March	0.877	0.084–9.133	1	0.913
Age	1.033	0.911–1.171	1	0.610
Gender	0.885	0.122–6.438	1	0.904
No. of life stressors (past 12 months, prior to 11 March)	2.730	0.435–17.151	1	0.284
Country of origin	0.559	0.058–5.400	1	0.615
Medical prognosis	1.334	0.100–17.779	1	0.977

Significant values are indicated in boldface. CI denotes confidence interval

rorist attacks. The prevalence of the disorders decreased during follow-up, but this was not statistically significant. The only predictive factor for PTSD at month 12 was PTSD at month 6.

■ PTSD

In a sample of persons injured in the 11 March attacks, the most prevalent psychiatric disorder was PTSD. 35.7% of victims met criteria for PTSD one month after the 11 March attacks, 34.1% at month six, and 28.6% at month twelve.

PTSD and depression did not seem to be related to drop out during the study.

Individuals directly affected by disasters have higher rates of post-event psychiatric disorders than persons indirectly affected by disasters [9, 11, 14, 29]. For example, 34% of survivors of the Oklahoma City bombing [23] and 31% of direct victims of terrorist bombings in France [16] were documented as having PTSD after six months. A recent study that assessed the same sample as this study [9] with the Davidson Trauma Scale (DTS) found that 41.1% and 40.9% of victims presented PTSD one month and six month following the 11 March attacks. The prevalence in the present study was lower. Vazquez [37] suggests that inferences about the impact of traumatic events on the general population are strongly influenced by the definition of traumatic response. For this reason, the prevalence of PTSD is different when different diagnostic scales are used in the same sample. In the comparison between these studies, the MINI was more restrictive than the DTS.

In this study, the figures for current PTSD in terrorism victims are approximately thirty to forty times higher than the expected baseline values for the general population [2, 11, 12]. Women were more likely to report PTSD, agoraphobia, and panic disorder, which is consistent with the results of other studies [2, 5, 6, 19, 24, 38]. This difference was significant only at the first evaluation. In some previous studies, being female predicted PTSD after 11–13 days [27], 6 months [23], and 32 months [16], and major depression after two months [20].

Patients with a history of a psychiatric disorder were more likely to report most of the psychiatric disorders assessed (PTSD, depression, GAD, and panic disorder). This finding is consistent with previous research, which suggests that persons with previous psychiatric histories are at substantially greater risk of further psychopathology after traumatic event experiences [13, 31].

These results need further investigation to be understood, but based on these data, we can suggest that women and people with a history of psychiatric disorders are more likely to develop psychiatric disorders soon after direct exposure to trauma.

■ Others psychiatric disorders

It has been also reported that, in the aftermath of terrorist attacks, the incidence of several mental disorders increases dramatically [4]. However, the vast majority of the literature concerning mental disorders after disasters pertains only to PTSD. In an empirical review of the literature, Norris et al [22] found that depression was, after PTSD, the second most commonly observed mental health problem in post-disaster studies, as in our study at months 1 (28.6%) and 6 (22.7%). The prevalence one year after the attacks (28,6%) was the same as for depression at month 1. This increased rate could be explained by loss to follow-up or by patients developing a psychiatric disorder after the month 1 evaluation.

Others relevant psychiatric disorders reported were GAD, agoraphobia, and panic disorder. The prevalence of most of the psychiatric disorders decreased over time (only suicide risk and dysthymia increased), but there were no significant differences in any psychiatric disorder between month 1, month 6, and month 12 in the McNemar analysis. One possible reason for this result is the small size of the sample.

■ Immigrant population

A large proportion of the sample were immigrants (39.7%). Prior studies have found differences in PTSD response between native and immigrant populations [13, 31]. Our study did not find significant differences between natives and immigrants in any psychiatric disorder (see table 3).

■ Predictive factors

One of the objectives of this study was to determinate risk factors for developing or maintaining a psychiatric disorder. In the case of PTSD and major depression, we found similar findings. PTSD at month six was the most important predictive factor for PTSD one year after the attacks and depression at month six was the most important predictive factor for depression one year after the attacks. This risk factor was more relevant than PTSD/depression at month one, or gender and history of psychiatric disorder combined at month one. This could indicate that PTSD and depression closer in time to the traumatic event is different from those found at months six and twelve. It could suggest initial individual vulnerability.

■ Implications

The high rates of psychiatric disorders at 1, 6, and 12 months lead us to think about the implications for health services in the aftermath of psychiatric screening. Psychiatric sequelae are an acute problem. In this study, the prevalence of several psychiatric

disorders remained high during follow-up. Long-term follow-up study (32 years) of war veterans in Israel points out the importance of early and sustained health care in order to reduce the psychological sequelae of trauma [34].

A prospective study of post-traumatic stress and depressive reactions in adolescents affected by a devastating earthquake in Armenia found that psychological treatment, even when provided 18 months after the trauma, is effective in reducing PTSD symptoms [15]. Our hospital designed a plan for treating both victims and their relatives based on the importance of early and sustained treatment [28]. Available data show that there is a large subgroup of patients affected by PTSD and others psychiatric disorders who do not seek treatment, mainly because they do not believe they have a problem [3]. To our knowledge, this is the first long-term follow-up study on the most important psychiatric disorders after a terrorist attack.

The results of our study also support the importance of being alert to psychiatric symptoms, so they can be correctly diagnosed and treated. They provide the further benefit of offering the patients the opportunity to receive mental health care.

Some limitations of our study should be noted: Firstly, the lack of information about the victims prior to the attacks limits the possibility of drawing causal inferences. Secondly, this study is part of a multicenter study and the size of the sample was determined based on the multicenter criteria. Thirdly, the small size of the sample may be a possible cause of type II errors. Fourthly, the results cannot be generalised to victims of a terrorist attack who are not injured and treated in an emergency room. Fifthly, the existence of a psychiatric history prior to 11 March was evaluated using the MINI scale, but it is not a scale specifically designed for that function. Sixthly, the randomised sample may not be a representative sample of the total injured population.

The long-term follow-up, the high level of victim participation, and the similar socio-demographic characteristics between participants and subjects lost to follow-up provide reasonable protection against other possible selection biases.

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