



## Trajectory and predictors of depression in a 12-month prospective study after the Madrid March 11 terrorist attacks

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### ABSTRACT

**Background:** Few longitudinal studies have examined the trajectory of and the risk factors for depression in a representative sample of the population exposed to terrorism. A 12 month prospective study was conducted among a sample of Madrid city residents after the March 11, 2004 terrorist attacks. We aimed to document the trajectories of depressive symptoms and determine the risk factors associated with these trajectories.

**Methods:** We conducted telephone surveys among a representative sample of Madrid citizens ( $N = 1589$ ) to recruit baseline respondents approximately 1 month after the March 11 terrorist attacks. Participants were re-contacted at 6 and 12 months after baseline for further telephone interviews.

**Results:** Findings reveal heterogeneity in the longitudinal trajectories of depression ranging from the absence of depressive symptoms over time, to transient or chronic depression. Life and recent stressors, experiencing direct exposure to the attacks, personality traits, poor physical health and other psychological disorders were principally associated with a worse trajectory of depression after this event.

**Conclusions:** Consistent with a stress diathesis model, ongoing stressors and intense event exposure are key drivers of a chronic depression trajectory after a mass traumatic event.

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### 1. Introduction

The study of the psychopathological consequences of disasters has come a long way in the last decade (Galea et al., 2005; Miguel-Tobal et al., 2004). A substantial proportion of this literature has focused on terrorism (Fullerton et al., 2003; Norris et al., 2002).

A growing body of research has assessed the burden of depression following terrorist attacks in both victims and in the general population (see Salguero et al., 2011 for a review). Extant research, primarily cross-sectional in study design, suggests that terrorist attacks are associated with greater risk of depression, mainly in the first months after they occur and in greater trauma-exposed people (Salguero et al., 2011).

Longitudinal investigations documenting the course of depression after terrorism are, however, scarce and inconsistent. For example, in some studies, the prevalence of depression in victims

has decreased (North, 2001) whereas in others it has remained relatively stable (Conejo-Galindo et al., 2008) over a 12-month period. One suggested explanation for these results is that exposure to traumatic events may result in distinct trajectories of depression (Beard et al., 2008), ranging from the absence of depressive symptoms over time to transient or chronic depression (Nandi et al., 2009a). Evidence for these trajectories has been found after the September 11 terrorist attacks (Beard et al., 2008; Nandi et al., 2009b) and in pre-disaster population-based studies (Nandi et al., 2009a).

Explaining the different trajectories of depression after terrorism may facilitate a more complete understanding of this disorder and the risk factors associated with it (Nandi et al., 2009b). A number of factors have been consistently found to be associated with the risk of depression after a terrorist attack (Salguero et al., 2011). These include life stressors (Gabriel et al., 2007; Galea et al., 2002; Person et al., 2006) – being the probability of suffering from depression after a terrorist attack higher among those who had experienced more stressful situations prior to the attack-, per-event panic attacks (Galea et al., 2002; Miguel-Tobal et al., 2006), female sex (Gabriel et al., 2007; Galea et al., 2002), having borne a greater loss of psychosocial resources (Hobfoll et al., 2006), and low perceived social support (Beard et al., 2008; Galea et al., 2002;

*Abbreviations:* DSM, diagnostic and statistical manual of mental disorders; M-11, March 11, 2004 terrorist attacks in Madrid; PTSD, posttraumatic stress disorder; SCID, structured clinical interview for diagnostic and statistical manual of mental disorders, third edition, revised.

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Miguel-Tobal et al., 2006; Nandi et al., 2009b). The literature suggests that having fewer social resources to draw on makes an individual more vulnerable to depression. However, in spite of these results, few studies have examined the relation of these factors with transient vs. chronic depression after terrorist attacks.

In this study, we prospectively followed a representative sample of Madrid city residents over a 12 month period after the March 11, 2004 terrorist attacks. Building on previous work conducted after the September 11, 2001 attacks (Beard et al., 2008) we assessed the trajectories of depressive symptoms and the risk factors that predicted transient vs. chronic depression. In addition to socioeconomic, peri-traumatic and pre-traumatic factors, we also examined the influence of risk factors such as physical health, personality traits, and other psychological disorders, which have been less studied in this context (Salguero et al., 2011) but can increase the risk of developing or maintaining a depressive episode (De Graaf et al., 2002; de Jonge et al., 2006).

## 2. Method

### 2.1. Sample

We carried out a random-digit-dial household survey to recruit baseline respondents approximately 1 month after the March 11 terrorist attacks (April 13–June 20, 2004). The sampling frame consisted of adults living in households with home telephones in Madrid. It is estimated that 92% of Madrid city residents have a home phone and would therefore be eligible for this study (Instituto Nacional de Estadística, 2004). Households were screened for eligibility by location. In addition, we oversampled residents of Madrid who lived within 1 km of the areas surrounding the different bomb explosions. If eligible, up to 10 attempts were made to conduct an interview. One adult (at least 18 years old) per household was randomly selected by choosing the adult whose birthday was closest to the interview date. The overall survey response rate (38.7%) was within an acceptable range for comparable surveys (Galea et al., 2004). Additionally, we conducted follow-up telephone interviews approximately 6 and 12 months after baseline (October 14–December 18, 2004; April 14–June 30, 2005). We recruited 1589 participants in the baseline sample; among these, 1192 (75.01%) and 1008 (63.43%) completed the 6 and 12 months follow-up assessment (see Table 1). Participants who had not completed the 1 and 6 months assessments were not contacted at 12 months. Sources of attrition were failure to locate respondents and respondents' refusal to participate in further interviews.

Interviews were conducted by trained interviewers using a back-translated version of the survey used in previous work after the September 11, 2001 terrorist attacks; the mean interview time for all questions was approximately 30 min. The Ethical Committee of the Faculty of Psychology of the Complutense University of Madrid reviewed and approved this study and oral informed consent was obtained from all participants. Data collection methods are described in more detail elsewhere (Miguel-Tobal et al., 2006).

### 2.2. Measures

For this study we adapted a survey instrument that had previously been used to document the psychological consequences of the September 11, 2001, terrorist attacks in New York City (Galea et al., 2002; for more details about the survey instrument see Boscarino et al., 2004). The instrument was back translated into Spanish by a bilingual expert. After revising this back-translated text, two independent bilingual experts considered that the

Spanish version was equivalent to the original. Then, this version was adapted to reflect exposure to the March 11 train bombings. It included questions regarding the following domains: socio-demographic variables, experiences related with the attacks, lifetime exposure to traumatic events, recent stressors, health-related variables, personality traits, depression, and other psychological disorders.

Standard demographic information about respondents was collected including age, gender, educational achievement and household income. We evaluated social support using an abbreviated version of the Medical Outcomes Study Social Support Scale (Sherbourne and Stewart, 1991) which tapped emotional ("having someone who loves you and makes you feel wanted"), instrumental ("someone to help you if you were confined to bed"), and appraisal ("someone to give you good advice in a crisis") support in the six months prior to the Madrid March 11 terrorist attacks. Cronbach's alpha was 0.85. To assess whether respondents were directly affected by the March 11 attacks, we asked them if they were inside the trains during the bombings or directly witnessed the events, had a friend or relative killed, were involved in rescue efforts, or lived close to the scenarios where the bombings took place. A list of major life events (e.g., natural disaster, assault with a weapon, directly witnessing a violent event) was used to measure lifetime stressors. Respondents were asked to inform whether or not they had experienced these events in their lives. We divided these responses into three categories: none, one or two, and three or more events. To evaluate pre-event stressors, we asked respondents if they experienced different stressors (e.g., divorce or separation, family problems, problems at work) within the 12 months prior to the attacks. Responses were divided into three categories: none, one or two, and three or more stressors. We surveyed respondents' post-event health status by asking them to rate their physical health, whether they felt physically unhealthy and whether they used, as a result of the latter, medical services during the month following the attacks ("Have you suffered any physical illness during the month after 11-M?"). We assessed participants' negative emotionality and emotional implication through a 12 item scale with 3 items assessing the tendency to experience anxiety (extracted to the State-Trait Anxiety Inventory, Spielberger et al., 1970), 3 items assessing sadness (extracted to the Beck Depression Inventory, Beck et al., 1996), and 3 items assessing the tendency to experience anger (extracted to the State-Trait Anger Expression Inventory, Spielberger, 1991) in the negative emotionality subscale, and with 3 items assessing the tendency to get emotionally involved in certain situations (extracted to the Suggestibility Inventory, González Ordi and Miguel-Tobal, 1999) in the emotional implication subscale. For each scale, we chose the 3 items that showed higher factor loadings in the original version. Cronbach's alpha was 0.81 and 0.69 for the negative emotionality and emotional implication subscale, respectively. Apart from depression, we assessed other mental disorders: suffering peri-event panic attack symptoms and having posttraumatic stress disorder (PTSD), related or unrelated to the attacks, one month after March 11, 2004. To assess panic attacks we used a modified version of the Diagnostic Interview Schedule subscale for panic attacks (Centers for Disease Control and Prevention, 1989), we phrased it to detect symptoms experienced during or shortly after the attacks by asking about panic symptomatology specifically "in the first few hours" after the events of March 11. If a participant reported at least four of the symptoms listed for a panic attack in the DSM-IV, he/she was considered to have a diagnosis of a peri-event panic attack. Cronbach's alpha was 0.76. To assess PTSD we used the National Women's Study –NWS-PTSD module to assess PTSD – (Kilpatrick et al., 1998). The NWS PTSD module is a measure of PTSD that assesses the presence of criterion B (reexperiencing,

**Table 1**  
 Characteristics of the sample and comparison between the final sample included in the analysis and the excluded sample.

Variable	Baseline sample (%)	Final sample (%)	Excluded sample (%)	Chi-square test <i>p</i> values
Total N	1589	1008	581	
Depression 1 month after march-11				<i>ns</i>
Yes	8	7.1	9.5	
No	92	92.9	90.5	
Lifetime depression				<i>ns</i>
Yes	26.8	25.8	26.4	
No	73.2	74.2	73.6	
Gender				<i>ns</i>
Male	45.6	47.6	48.0	
Female	54.4	52.4	52.0	
Age				<0.001
18–29	21.5	24.8	27.3	
30–44	27.5	23.6	20.2	
45–59	23	29.3	19.6	
>60	28	22.3	32.9	
Education				<0.001
No education	2.9	1.4	4.3	
6–12 years (elementary)	16.4	13.2	19.7	
13–16 (junior high school)	11.7	11.9	15	
17–18 (senior high school)	31.9	33	29.4	
19–23 (university)	33.4	36.5	29	
>23 (master's/doctorate)	3.8	4	2.6	
Annual household income				<i>ns</i>
<12,000 €	27.6	23.4	31.5	
12,001 €–24,000 €	35.2	34.2	33.1	
24,001€–36,000 €	20.2	21.2	17.4	
>36,000 €	17	21.2	18.0	
Social support				<i>ns</i>
High	33.5	17.4	22.7	
Medium	44.7	47.7	44.9	
Low	21.8	34.9	32.4	
Directly exposed to the attacks				<i>ns</i>
No	89.1	92.6	94.5	
Yes	10.9	7.4	5.5	
Friend or relative killed				0.008
No	97	97.6	99.4	
Yes	3	2.4	0.6	
Involved in rescue efforts				<i>ns</i>
No	95.8	96.3	96.7	
Yes	4.2	3.7	3.3	
Living close to the bombings				<i>ns</i>
No	79.5	78.5	81.3	
Yes	20.5	21.5	18.7	
Major lifetime stressors				<i>ns</i>
0	28.6	27.4	27.1	
1–2	47.6	49	47.6	
3 or more	23.8	23.6	25.3	
Life stressors 12 months before the attacks				<i>ns</i>
0	45.8	45.1	43.6	
1–2	44.3	44.8	45.6	
3 or more	9.9	10.1	10.8	
Negative emotionality				<i>ns</i>
Low	36.7	36.8	36.1	
Medium	43.1	43.6	44.1	
High	20.2	19.6	19.8	
Emotional implication				<i>ns</i>
Low	32.1	29.9	33.2	
Medium	40.8	43.9	38.4	
High	27.1	26.2	28.4	
Suffering physical illness during the month after 11-M				<i>ns</i>
No	88.1	86.9	89.9	
Yes	11.9	13.1	10.1	
Not feeling physically healthy during the month after 11-M				<i>ns</i>
No	55.4	56.8	58.2	
Yes	44.6	43.2	41.8	
Using medical services during the month after 11-M				<i>ns</i>
No	76.3	76.3	78.3	
Yes	23.7	23.7	21.7	
Panic attack symptoms during or soon after the events				<i>ns</i>
No	88.3	90.3	87.1	
Yes	11.7	9.7	12.9	
Posttraumatic stress disorder one month after de attacks				<i>ns</i>
No	96	96.5	95.2	
Yes	4	3.5	4.8	

e.g., intrusive memories), C (avoidance, e.g., efforts to avoid thoughts associated with the trauma), and D (arousal, e.g., difficulty falling asleep or concentrating) symptoms and determines content for content-specific symptoms if symptom presence is endorsed. We assessed PTSD, related or unrelated to the attacks, one month after March 11, 2004 on the basis of the presence of at least one reexperiencing symptom, at least three avoidance symptoms, and two arousal symptoms. Cronbach's alpha was 0.84.

Episodes of major depression were assessed using an adapted version of the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised (SCID) major depressive disorder subscale (Spitzer et al., 1992), which captures symptoms consistent with DSM-IV criteria. At baseline, the presence of major depression since, or at any point before, the March 11 attacks was assessed; participants who met the criteria for a major depression disorder at baseline were not questioned about their lifetime history for depression. In subsequent follow-up interviews, symptoms since the previous wave were assessed. Cronbach's alpha for the adapted version of this scale in our sample was 0.83, 0.84 and 0.82 in wave 1, 2 and 3, respectively. In a study carried out with World Mental Health surveys in France, Italy, Spain, and the US (Haro et al., 2006), moderate to good concordance of the SCID with the Composite International Diagnostic Interview Version 3.0 (CIDI 3.0) was found for lifetime and 12-month prevalence estimates. SCID's major depression disorder interview has been used in previous surveys that have focused on the effects of the September 11 attacks (Galea et al., 2002; Person et al., 2006) as well as in other population surveys (Kilpatrick et al., 2000).

### 2.3. Statistical analysis

Sampling weights were developed and applied to the data to correct for potential bias related to the number of household telephones, persons in household, and oversampling. Poststratification weights were also applied to make the survey samples demographically similar to the Madrid population according to the Madrid 2001 Census (Instituto Nacional de Estadística, 2004). We categorized respondents as persons who either had never met criteria for major depression at any point in the follow-up or had major depression at any wave. We used 2-tailed chi-square tests to assess the bivariate relations between prevalence of depression at any wave with each of the key variables. Multiple logistic regressions were employed to examine predictors of depression at any wave using the category of never meeting criteria for depression as the reference group.

We used polytomous logistic regression to assess the relationships between possible determinants and depression in groups categorized as persons who had either never met criteria for depression during any point of the follow-up, persons who had depression at only one point during the follow-up and those who had depression during two or more time-points. Differences in log-likelihood were used to determine whether variables were retained in subsequent models. Independent variables were retained in the final model if they were statistically significant at  $p \leq 0.05$ . All analyses were carried out using SPSS 15 complex samples module.

## 3. Results

### 3.1. Sample characteristics

Table 2 shows age, sex and residence distributions in our baseline sample and in the sample that completed all three waves (hereafter final sample) compared to the Madrid 2001 Census. There no were statistical differences between the baseline or final

**Table 2**

Comparison of survey samples with the Madrid 2001 census demographic composition.

	2001 Madrid census (%)	Baseline sample (%)	Final sample <sup>a</sup> (%)	Chi square test p values	
				Initial sample vs. Census	Final sample vs. Census
Total N	2.494.709	1589	1008		
Gender				0.95	0.99
Male	45.9	47.4	47.6		
Female	54.1	52.5	52.4		
Age				0.99	0.99
18–29	21.7	26.3	24.8		
30–44	28.7	22.5	23.6		
45–59	20.8	25.5	29.3		
≥60	28.8	25.6	22.3		
Residence by district				1.00	1.00
1	4.5	4.0	3.7		
2	4.5	4.4	4.9		
3	4.2	3.5	3.7		
4	4.9	4.4	4.7		
5	4.5	4.9	4.9		
6	4.8	4.8	4.7		
7	5.0	5.4	5.2		
8	6.8	6.8	9.0		
9	3.7	3.6	2.4		
10	8.6	8.3	8.0		
11	7.5	6.2	5.8		
12	4.0	3.9	4.2		
13	7.5	7.6	6.9		
14	3.6	4.2	4.3		
15	7.5	7.0	6.7		
16	4.8	6.0	7.4		
17	4.2	4.0	2.9		
18	2.0	1.9	2.0		
19	1.7	2.8	3.0		
20	4.6	5.1	4.7		
21	1.2	1.3	1.0		

<sup>a</sup> Sample that participated in all three waves.

sample and the Madrid 2001 Census. Respondents who only completed one wave were excluded from the regression analyses. Prevalence of variables of interest and difference between the final sample and the excluded sample are shown in Table 1. The prevalence of participants directly exposed to the attacks was 10.9%, 2.4% of whom were in a train during the bombings. It is important to point out that the railway system is widely used in Spain, representing an approximate 30% of all interurban journeys (Instituto Nacional de Estadística, 2004). Compared to those who completed the three waves, respondents excluded from the final sample were more likely to be older (more than 60 years old) and less likely to be between 45 and 59 years old, more likely to have a lower educational level and less likely to have friends or relatives killed in the attacks. However, no significant differences were found between the final and the excluded sample in lifetime depression, baseline depression or any other key variable.

### 3.2. Trajectories of depression

Eight percent of the Madrid population showed compatible symptomatology with major depressive disorder one month after the March 11 terrorist attacks. Of those who did not develop depression at wave 1, 74% had never suffered this disorder in their lifetime and 18% had. Differences were found in the trajectory of depression among these three groups. In the first place, the probability of reporting depression at waves 2 and 3 was greater among those who already presented this disorder at wave 1. Accordingly, 6 months after the incident, 48.3% of participants were still suffering from depression and, out of these, 43.3% still presented this

**Table 3**

Bivariate associations between respondents' characteristics and depression at any wave.

Variable	Depression at any wave (%)	<i>p</i> value
<b>Socio-demographic variables</b>		
Gender		<0.001
Male	12%	
Female	24.9%	
Age		0.342
18–29	22.9%	
30–44	17.9%	
45–59	19.1%	
>60	14.4%	
Education		0.307
No education	35.1%	
6–12 years (elementary)	21%	
13–16 (junior high school)	17.3%	
17–18 (senior high school)	22%	
19–23 (university)	15%	
>23 (master's/doctorate)	11.8%	
Annual household income		0.149
<12,000 €	27.5%	
12,001 €–24,000 €	15.7%	
24,001 €–36,000 €	20.7%	
>36,000 €	17.5%	
Social support		0.001
High	13.7%	
Medium	16.6%	
Low	30.9%	
<b>Variables related with the attacks</b>		
Directly exposed to the attacks		0.028
No	17.9%	
Yes	32.1%	
Friend or relative killed		0.584
No	18.8%	
Yes	14.6%	
Involved in rescue efforts		0.943
No	18.9%	
Yes	18.3%	
Living close to the bombings		0.529
No	18.7%	
Yes	20.8%	
<b>Pre-traumatic variables</b>		
Major lifetime stressors		0.023
0	14%	
1–2	18%	
3 or more	25.9%	
Life stressors 12 months before the attacks		<0.001
0	9.6%	
1–2	20.9%	
3 or more	50.4%	
<b>Personality traits</b>		
Negative emotionality		<0.001
Low	10%	
Medium	16.9%	
High	35%	
Emotional implication		<0.001
Low	9.7%	
Medium	17.2%	
High	34.4%	
<b>Physical health-related variables</b>		
Suffering physical illness during the month after 11-M		<0.001
No	16.3%	
Yes	35.6%	
Not feeling physically healthy during the month after 11-M		<0.001
No	10.4%	
Yes	29.8%	
Using medical services during the month after 11-M		<0.001
No	15.8%	
Yes	28.8%	
<b>Other psychological disorders</b>		
Panic attack symptoms during or soon after the events		<0.001

**Table 3 (continued)**

Variable	Depression at any wave (%)	<i>p</i> value
No	16.7%	
Yes	38.7%	
Posttraumatic stress disorder one month after the attacks		<0.001
No	16.4%	
Yes	70%	

disorder at 12 months. Secondly, regarding respondents who were asymptomatic at wave 1, prevalences were higher for those with a past history of depression than for those who had always been depression free. This result remained consistent both during the second (22.1% vs. 5.2%) and third waves (7.1% vs. 3.2%).

81.3% of the cohort did not develop depression during the 12 months following the attacks. Of those who did develop depression at some point during this time period (18.7%), 58.6% had one single episode and 41.4% suffered at least two. In the third place, 1.9% reported compatible symptomatology with depression during the whole follow-up period, whereas 2.5% presented with depression at wave 1 but no longer at waves 2 and 3. It is also important to draw attention to the existence of a large percentage of participants who developed delayed depression after being asymptomatic at wave 1. Such is the case of participants who reported depressive symptoms for the first time at wave 2 (7.8%) and at 3 (3.3%).

### 3.3. Bivariate analyses

Table 3 shows the results of bivariate analyses. The variables associated with having depression at any wave were gender ( $p < 0.001$ ), perceived social support ( $p = 0.001$ ), being directly exposed to the attacks ( $p = 0.028$ ), having suffered major lifetime stressors ( $p < 0.001$ ), and number of life stressors in the 12 months before March 11 ( $p < 0.001$ ). Personality traits (negative emotionality and emotional implication), physical health-related variables, and whether the respondents had a panic attack during or shortly after the events or posttraumatic stress disorder one month after the attacks were all variables also associated with depression ( $p < 0.001$ ).

### 3.4. Risk factors for depression

Table 4 shows the results of the multivariate logistic regression models between individuals categorized as persons who were free from depression during the study or having at least an episode at any wave.

Female sex was a significant predictor of the onset of depression during the twelve months following March 11 (OR = 2.4 for women vs. men, 95% CI = 1.6–3.7). Participants with an annual household income below a threshold of 12,000 € were more likely to develop depression than those who earned between 12,001 and 24,000 € (OR = 0.5; 95% CI = 0.3–0.9), although this effect was only marginally significant ( $p = 0.094$ ). On the other hand, participants with low levels of perceived social support were at higher risk of developing depression than those with medium (OR = 2.2, 95% CI = 1.3–3.8) or high levels (OR = 2.8, 95% CI = 1.6–5.0). In reference to the factors related with the bombings, being directly exposed to the attacks was the sole significant predictor of depression (OR = 2.2, 95% CI = 1.1–4.4). Of all the pre-traumatic variables, the number of life stressors in the year prior to the attacks (OR = 2.5 for one or two stressors vs. none, 95% CI = 1.4–4.3; OR = 9.6 for three or more stressors vs. none, 95%

**Table 4**  
Logistic regression models predicting depression at any wave.

		Depression at any wave		
		OR	95% IC	<i>p</i>
<b>Socio-demographic variables</b>				
Gender				<0.001
	Male	1		
	Female	2.4	1.6–3.7	
Age				0.312
	18–29	1		
	30–44	0.7	0.4–1.3	
	45–59	0.8	0.5–1.4	
	>60	0.6	0.3–1.0	
Education				0.177
	No education	1		
	6–12 years (elementary)	0.5	0.1–2.3	
	13–16 (junior high school)	0.4	0.1–1.8	
	17–18 (senior high school)	0.5	0.1–2.1	
	19–23 (university)	0.3	0.8–1.3	
	>23 (master's/doctorate)	0.2	0.1–1.6	
Annual household income				0.094
	<12,000 €	1		
	12,001 €–24,000 €	0.5	0.3–0.9	
	24,001 €–36,000 €	0.7	0.3–1.5	
	>36,000 €	0.5	0.3–1.0	
Social support				0.001
	High	1		
	Medium	2.2	1.3–3.8	
	Low	2.8	1.6–5.0	
<b>Variables related with the attacks</b>				
Directly exposed to the attacks				0.032
	No	1		
	Yes	2.2	1.1–4.4	
Friend or relative killed				0.585
	No	1		
	Yes	0.7	0.2–2.2	
Involved in rescue efforts				0.943
	No	1		
	Yes	1.0	0.4–2.9	
Living close to the bombings				0.529
	No	1		
	Yes	1.1	0.7–1.7	
<b>Pre-traumatic variables</b>				
Major lifetime stressors				0.011
	0	1		
	1–2	1.3	0.8–2.3	
	3 or more	2.1	1.3–3.6	
Life stressors 12 months before the attacks				<0.001
	0	1		
	1–2	2.5	1.4–4.3	
	3 or more	9.6	5.0–18.6	
<b>Personality traits</b>				
Negative emotionality				<0.001
	Low	1		
	Medium	1.9	1.0–3.5	
	High	4.8	2.4–9.5	
Emotional implication				<0.001
	Low	1		
	Medium	1.8	0.9–3.6	
	High	4.8	2.3–10.0	
<b>Physical health-related variables</b>				
Suffering physical illness during the month after 11-M				<0.001
	No	1		
	Yes	2.8	1.7–4.7	
Not feeling physically healthy during the month after 11-M				<0.001
	No	1		
	Yes	3.7	2.4–5.6	
Using medical services during the month after 11-M				<0.001

**Table 4 (continued)**

		Depression at any wave		
		OR	95% IC	<i>p</i>
		1		
No		1		
Yes		2.1	1.4–3.2	
<b>Other psychological disorders</b>				
Panic attack symptoms during or soon after the events				<0.001
	No	1		
	Yes	3.1	1.8–5.4	
Posttraumatic stress disorder one month after the attacks				<0.001
	No	1		
	Yes	11.9	5.0–28.2	

CI = 5.0–18.6) and having suffered three or more major lifetime stressors (OR = 2.1, 95% CI = 1.3–3.6) were shown to be significant predictors of depression. Within personality factors, both negative emotionality and emotional implication were found to be two risk factors for developing depression (OR = 1.9 for persons with medium vs. low levels of negative emotionality, 95% CI = 1.0–3.5; OR = 4.8 for persons with high vs. low levels of negative emotionality, 95% CI = 2.4–9.5; OR = 4.8 for persons with high vs. low levels of emotional implication, 95% CI = 2.3–10.0). Furthermore, participants' physical health during the weeks following the attacks was another important predictor of depression. Respondents who stated they had suffered a physical illness during the month after the incident were three times more likely to develop depression in the following year than those who did not fall ill (OR = 2.8, 95% CI = 1.7–4.7). We found similar results for those participants who acknowledged that they did not feel physically healthy (OR = 3.7, 95% CI = 2.4–5.6) or that they visited the doctor during the first month after the attacks (OR = 2.1, 95% CI = 1.4–3.2). Other significant predictors of depression were having suffered other psychological problems like a panic attack during or shortly after the events (OR = 3.1, 95% CI = 1.8–5.4) or posttraumatic stress disorder one month after the attacks (OR = 11.9, 95% CI = 5.0–28.2).

Table 5 shows the results of the multivariate polytomous logistic regression models between individuals categorized as those free from any depression episode during the study, those with a single episode of depression (transient depression), and those with two or more episodes (chronic depression).

Variables significantly associated with both transient and chronic depression included female sex, low social support, having suffered life stressors in the year prior to the attacks, personality traits, perceived poor health or having PTSD. However, while being older than 60 years was associated with lower symptoms in participants with transient depression, experiencing direct exposure to the attacks, having suffered major life events, physical illness, using medical services the month after the March 11, 2004 attacks, and having panic attack during or shortly after the events were only significantly associated with symptoms in participants with chronic depression. There were also important differences in the influence of different risk factors in predicting transient vs. chronic depression. The risk of chronic depression vs. transient depression was significantly higher among those with high negative emotionality (OR = 7.1, 95% CI = 3.0–16.5), having PTSD one month after the attacks (OR = 22.1, 95% CI = 8.2–59.8), or having suffered recent stressors (OR = 13.6, 95% CI = 5.4–34.1).

#### 4. Discussion

The present work is one of the few to have assessed the course of depression during 12 months in the general population exposed to

**Table 5**  
Multivariate polytomous logistic regression models predicting categories of depression.

	Depression at one wave		Depression at two or more waves		p
	OR	95% IC	OR	95% IC	
<b>Socio-demographic variables</b>					
<b>Gender</b>					
Male	1		1		<0.001
Female	2.4	1.4–4.2	2.3	1.2–4.3	
<b>Age</b>					
18–29	1		1		0.225
30–44	0.8	0.4–1.6	0.6	0.3–1.2	
45–59	0.9	0.5–1.7	0.5	0.2–1.3	
>60	0.4	0.2–0.9	0.7	0.3–1.7	
<b>Education</b>					
No education	1		1		0.269
6–12 years (elementary)	0.4	0.1–1.7	0.9	0.1–8.8	
13–16 (junior high school)	0.3	0.6–1.3	0.3	0.1–2.7	
17–18 (senior high school)	0.4	0.1–1.4	1.0	0.1–7.9	
19–23 (university)	0.2	0.6–1.1	0.5	0.1–4.6	
>23 (master's or doctorate)	0.1	0.1–1.2	0.5	0.1–9.4	
<b>Annual household income</b>					
<12,000 €	1		1		0.384
12,001 €–24,000 €	0.5	0.2–1.0	0.5	0.2–1.3	
24,001 €–36,000 €	0.9	0.4–2.3	0.5	0.2–1.9	
>36,000 €	0.6	0.3–1.2	0.5	0.2–1.4	
<b>Social support</b>					
High	1				0.005
Medium	1.4	0.6–2.3	1.3	0.5–3.1	
Low	2.1	1.0–4.4	3.8	1.6–9.3	
<b>Variables related with the attacks</b>					
<b>Directly exposed to the attacks</b>					
No	1		1		0.044
Yes	1.5	0.6–3.6	3.5	1.3–9.2	
<b>Friend or relative killed</b>					
No	1		1		0.856
Yes	0.8	0.2–3.4	0.6	0.1–3.8	
<b>Involved in rescue efforts</b>					
No	1		1		0.937
Yes	0.9	0.3–2.6	1.3	0.2–9.8	
<b>Living close to the bombings</b>					
No	1		1		0.529
Yes	1.0	0.6–1.6	1.4	0.8–2.6	
<b>Pre-traumatic variables</b>					
<b>Major lifetime stressors</b>					
0	1		1		0.031
1–2	1.1	0.5–2.2	1.6	0.7–3.7	
3 or more	1.7	0.9–3.3	3.1	1.3–7.2	
<b>Life stressors 12 months before the attacks</b>					
0	1		1		<0.001
1–2	2.3	1.1–4.8	2.5	1.1–5.8	
3 or more	7.8	3.3–18.2	13.6	5.4–34.1	
<b>Personality traits</b>					
<b>Negative emotionality</b>					
Low	1				<0.001
Medium	2.2	1.1–4.2	1.6	0.6–4.3	
High	4.0	2.1–7.9	7.1	3.0–16.5	
<b>Emotional implication</b>					
Low	1				<0.001
Medium	2.8	1.4–5.9	1.5	0.5–4.6	
High	5.1	2.3–11.5	5.8	1.9–17.7	
<b>Physical health-related variables</b>					
<b>Suffering physical illness during the month after 11-M</b>					
No	1				<0.001
Yes	1.8	0.9–3.5	4.0	2.0–8.0	
<b>Not feeling physically healthy during the month after 11-M</b>					
No	1				<0.001
Yes	3.2	1.8–5.5	5.3	2.5–11.2	
<b>Using medical services during the month after 11-M</b>					
No	1				<0.001
Yes	1.1	0.7–2.0	3.9	2.1–7.1	
<b>Other psychological disorders</b>					
<b>Panic attack symptoms during or soon after the bombings</b>					
No	1				<0.001
Yes	2.0	0.9–4.5	5.2	2.5–10.9	
<b>Posttraumatic stress disorder one month after the attacks</b>					
No	1				<0.001
Yes	6.3	2.2–17.9	22.1	8.2–59.8	

a terrorist attack. Our results show that depressive symptoms were common in the 12 months following the March 11, 2004 terrorist attacks. Compared with previous general population surveys carried out in Spain, where the lifetime prevalence of depression was 10.6% and 12-month prevalence was 4.0% (Gabilondo et al., 2010), our findings suggest that the terrorist attacks were a risk factor for the development of depression. Furthermore, as we hypothesized, the trajectory of depression did not follow a homogeneous pattern. Instead, consistent with previous work conducted after the September 11, 2001 (Nandi et al., 2009b) and in pre-disaster periods (Nandi et al., 2009a), depression trajectories ranged from the absence of symptoms over time to chronically severe levels of dysfunction. Specifically, while the majority of participants who developed depression at wave 1 were free from this disorder one year after, other participants (especially those with a past history of depression) experienced delayed onset or recurrence of depression, and a minority reported high symptomatology during the whole follow-up period.

Our findings are largely confirmatory of extant literature (see Salguero et al., 2011 for a review), particularly regarding female sex, lower social support, direct exposure to the attacks, and lifetime and recent stressors as risk factors associated with depression. We also assessed other factors that have received less attention in the literature such as personality traits, physical health and other psychological problems. We found that these factors significantly predicted the development of depression during at least one point in the follow-up period. With respect to personality traits, higher levels of negative emotionality and emotional implication predicted depression. Personality traits associated with high negative emotionality have been suggested as an important risk factor for depression (Roberts and Kendler, 1999) and several prospective studies have provided recent evidence of this relation (Boyce et al., 1991; Kendler et al., 1993).

Interesting differences emerged when comparing the influence of the risk factors that predicted transient or chronic depression. Pre-traumatic variables (both major lifetime and recent stressors) were a more important risk factor for chronic than for transient depression. This result is consistent with the stress and depression literature (Hammen, 2005) that has repeatedly verified the existence of a positive linear relationship between the number of negative events and the probability of suffering more severe depression (Kendler et al., 1998). Similarly, poor physical health was a more important predictive factor for chronic than for transient depression. The association between physical health and depression is a complex one. Despite the fact that depression has been found to be a risk factor in the development of physical problems (Lenze et al., 2001; Moussavi et al., 2007; Scott et al., 2007), poor physical health has also served to predict depression in prospective studies (Beard et al., 2008). We found that those who acknowledge having poor physical health or used medical services during the weeks following the March 11, 2004 attacks had a four-fold increased risk of developing depression at two or more points during the follow-up. These results may have public health implications for identifying individuals at risk of developing depression in the aftermath of a disaster. In this sense, it is possible that a psychological screening assessment of patients who use medical services with physical health complaints after a terrorist attack may serve to detect those who are suffering depression or who are at higher risk of developing chronic depression. On the other hand, although we assessed the use of medical services for physical problems, it would be an interesting goal for future research to assess the health care utilisation for emotional or mental problems after terrorism and to examine the difficulties that people encounter when obtaining medical services in this context. Other predictive factors that showed more influence in predicting chronic vs. transient depression were having panic

attack symptoms during or soon after the bombings and having PTSD. Different studies have revealed a high comorbidity between depression and other psychological disorders (especially anxiety disorders) in the aftermath of terrorism (Galea et al., 2002; Miguel-Tobal et al., 2006), however, little is known about their influence each other. Our results suggest that the presence of other psychological problems is a risk factor for developing a more prolonged or recurrent depression.

Individuals who were directly exposed to the event also had a higher risk of presenting chronic depression. Taking this into account, it is possible that the association between directly experiencing the event and chronic depression may be mediated by the presence of PTSD; if this were the case, it might help us understand why other variables related with the attacks (e.g., being involved in rescue efforts, living close to the bombings) did not predict depression in a significant manner, neither in our study nor in the post-disaster literature in general (Salguero et al., 2011).

The present study has certain limitations. First, we did not assess other disorders (e.g., bipolar disorder) that could be important in this context. Although the prevalence of bipolar depression appears to be very low according to epidemiological studies (below 1%) (ESEMED, 2004), it is possible that our results may be biased by our not excluding persons with this disorder. Nonetheless, this instrument has been used in similar kinds of research after 9-11 (Galea et al., 2002; Person et al., 2006) or in other longitudinal studies (Beard et al., 2008), which enables comparability of the data across disaster contexts and countries. Second, we have to be cautious in drawing conclusions with respect to pre-traumatic risk factors. In our study, these factors were assessed after the traumatic event. It is possible that pre-event reports are biased in that depressed persons may selectively recall stressful situations that occurred before the disaster much more than non-depressed persons. Third, we did not analyze the influence of stressful or traumatic life events experienced by respondents between waves. New stressors or traumatic events has been related to the onset of depression in previous studies (Beard et al., 2008) and may account for chronic symptoms of depression in our sample. Fourth, although we analysed the influence of other anxiety disorders on the onset of depression, we did not take into account the comorbidity between these disorders in each assessment period. It may be that trajectories of depression are different for individuals who only develop depression than for those who present a comorbid disorder, such as PTSD. It may be of great interest for future investigations to continue analysing the way in which anxiety and depressive symptoms interact with each other in the aftermath of terrorism. Finally, we have focused on the examination of depression using diagnostic criteria. It enables us compare to our findings with previous epidemiological surveys and studies carried out after the September 11, 2001 attacks (Beard et al., 2008). However, future research is urged to examine continuous models of depression symptoms which may account for other forms of depression, such as mild or minor depression.

Despite these limitations, and consistent with previous studies, our results found evidence of heterogeneity in the longitudinal trajectories of depression after terrorism and that the factors associated with depression may vary by trajectory subtype. Few studies have examined this issue in the epidemiology, particularly in the post-disaster literature. Failing to account for heterogeneity of depression and to identify the specific risk factors associated to each depression subtype may lead us to overlook the association between risk factors and depression and make difficult a correct understanding of the specific etiologic factors of this disorder. Furthermore, it has important implications for the development of effective treatment interventions since understanding this heterogeneity



may help us identify preventable factors that are only associated with some subtypes of depression (Nandi et al., 2009a).

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### Contributors

J.M. Salguero and P. Fernández-Berrocal designed the manuscript. J.M. Salguero analysed the data and wrote the manuscript. A. Cano and I. Iruarrizaga designed and supervised the study and contributed to manuscript preparation. A. Cano contributed to data analysis. S. Galea was responsible for revising the paper critically for important intellectual content. All authors read and approved the final manuscript.

### Conflict of interest

All authors declare that they have no conflicts of interest.

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