

Psychological and behavioural reactions to the bombings in London on 7 July 2005: cross sectional survey of a representative sample of Londoners

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BMJ 2005;331:606-11

Abstract

Objectives To assess the impact of the bombings in London on 7 July on stress levels and travel intentions in London's population.

Design A cross sectional telephone survey using random digit dialling was conducted to contact a representative sample of adults. Respondents were asked to participate in an interview enquiring about current levels of stress and travel intentions.

Setting Interviews took place between 18 and 20 July.

Participants 1010 participants (10% of the eligible people we contacted) completed the interviews.

Main outcome measures Main outcomes were presence of substantial stress, measured by using an identical tool to that used to assess the emotional impact of 11 September 2001 in the US population, and intention to travel less on tubes, trains, and buses, or into central London, once the transport network had returned to normal.

Results 31% of Londoners reported substantial stress and 32% reported an intention to travel less. Among other things, having difficulty contacting friends or family by mobile phone (odds ratio 1.7, 95% confidence interval 1.1 to 2.7), having thought you could have been injured or killed (3.8, 2.4 to 6.2), and being Muslim (4.0, 2.5 to 6.6) were associated with a greater presence of substantial stress, whereas being white (0.3, 0.2 to 0.4) and having previous experience of terrorism (0.6, 0.5 to 0.9) were associated with reduced stress. Only 12 participants (1%) felt that they needed professional help to deal with their emotional response to the attacks.

Conclusions Although the psychological needs of those intimately caught up in the attacks will require further assessment, we found no evidence of a widespread desire for professional counselling. The attacks have inflicted disproportionately high levels of distress among non-white and Muslim Londoners.

Introduction

The terrorist attacks on central London's transport network on 7 July 2005 caused 52 fatalities and some 700 injuries. The psychological effects of the attacks remain unknown. Shortly after the attacks in the United States on 11 September 2001, about 90% of the residents of New York City and Washington DC reported symptoms of stress, with 44% reporting substantial symptoms.¹ High levels of distress have also been seen among school students after the 1995 bombing of the Murrah Building in Oklahoma City² and in the Israeli population as a consequence of the ongoing intifada.³ Not surprisingly, those most exposed to an attack show the highest levels of distress, but after 11 September emotional reactions were noted across the US and as far away as Italy.^{4 5}

Emotional reactions to terrorist incidents vary. Some people develop well recognised psychiatric disorders such as depression or post-traumatic stress disorder. Others, while not meeting the criteria for a formal psychiatric diagnosis, still report higher levels of general anxiety or stress related symptoms. Still others report no psychiatric symptoms but show considerable changes in their behaviour⁶ or their feelings about the future.³

After the attacks on 7 July, many commentators said that terrorism would have a reduced emotional impact on Londoners because of the city's history of dealing with IRA terrorism and the Blitz.⁷ It has also been argued that Londoners were not unprepared for these attacks: British politicians and security officials have warned on many occasions that acts of terrorism in London were probable, if not inevitable, and British preparations for terrorism have extended to sending a leaflet to every household in the country in August 2004, providing advice about what to do in the event of a major incident.⁸ Whether these experiences and preparations served to minimise the short term psychological effects of the recent attacks remains to be seen.

We surveyed a representative sample of Londoners to assess levels of distress and altered travel intentions after the terrorist attacks on 7 July. This survey will also serve as a baseline for a planned follow-up of this sample in six months' time. We also investigated several potential correlates of distress, including demographic variables, level of exposure, previous experience of terrorism, and uncertainty about the safety of others.

Methods

Market and Opinion Research International (MORI) conducted a telephone survey by using a random digit dialling method for all London telephone numbers. The survey used proportional quota sampling, a standard method for opinion polls that entails setting quotas for participants on a range of demographic factors and ensures that the sample interviewed is representative of the population of interest. In this survey, we set quotas with regard to sex, age, working status, residential location, housing tenure, and ethnicity to make our sample representative of the demographic distribution of London as shown in the most recent census data.

We invited people aged 18 or over and who spoke English to participate in an interview about "issues facing Londoners." The 20 minute interviews took place in the evenings from Monday 18 July to Wednesday 20 July 2005 and were completed before a second



This is the abridged version of an article that was first posted on bmj.com on 26 August 2005: <http://bmj.com/cgi/doi/10.1136/bmj.38583.728484.3A>

Table 1 Prevalence of stress among a representative sample of Londoners after the bombings on 7 July 2005. Values are numbers (percentages) of respondents unless otherwise indicated

As a result of the London bombings, to what extent have you been bothered by	Not at all	A little bit	Moderately	Quite a bit	Extremely	Substantial stress*	Results for 11 September study†
Feeling upset when something reminds you of what happened	316 (31)	270 (27)	166 (16)	156 (15)	100 (10)	256/1010 (25)	30
Repeated disturbing memories, thoughts, or dreams about what happened	764 (76)	108 (11)	54 (5)	48 (5)	29 (3)	77/1010 (8)	16
Having difficulty concentrating	827 (82)	91 (9)	44 (4)	26 (3)	17 (2)	43/1010 (4)	14
Trouble falling or staying asleep	856 (85)	72 (7)	35 (4)	28 (3)	13 (1)	41/1010 (4)	11
Feeling irritable or having angry outbursts	756 (75)	109 (11)	47 (5)	47 (5)	45 (5)	92/1010 (9)	9
Substantial stress on at least one item	—	—	—	—	—	311/1010 (31)	44

Numbers may not sum to 1010 owing to a small number ($\leq 1\%$) of "don't know" responses.

*Response of "quite a bit" or "extremely" taken as substantial stress.

†Response in US population to identical items immediately after 11 September 2001.¹

failed attack on London's transport network on Thursday 21 July.

A power calculation showed that a sample size of 1000 would provide us with a 95% confidence interval of -3% to 3% for our data.

Primary outcomes

We measured two primary outcomes. Firstly, we assessed whether "as a result of the London bombings," participants had experienced substantial stress, defined as responding "quite a bit" or "extremely" to one or more of five symptoms (see table 1 for wording). Other possible responses were "not at all," "a little bit," and "moderately." This measure was identical to that used in a similar study of the impact of the 11 September attacks on the adult US population.¹ Secondly, we assessed whether, once the transport system had returned to normal, the participant intended to travel "more often," "less often," or "no difference" with regard to tubes, trains, buses, or travelling into central London. We excluded people who did not normally travel by these means for the relevant items. For comparison, we also asked about travel intentions concerning cars and travel elsewhere in the UK.

Secondary outcomes

Secondary outcomes included sense of safety for self and friends or relatives, which we measured by using items identical to those used in a survey of reactions to terrorism in Israel,³ perceived likelihood of another attack on London in "the near future," current sense of safety on a four point scale from "very safe" to "very unsafe" when travelling by tube, train, bus, car, into central London, or elsewhere in the UK, and self efficacy for coping with terrorism.³ Participants were also asked whether they had talked to someone about their thoughts and feelings regarding the bombings on a four point scale from "a great deal" to "not at all," whether they had spoken to any mental health specialist since the bombings, whether they felt they needed to speak to a mental health specialist, and whether they had spoken to a religious leader or adviser.

Respondents with children in a London school on 7 July were asked whether they had attempted to check on their children's safety and whether they went to the school earlier than usual to see or collect their children. All participants were asked whether they had attempted to check the safety of immediate friends and family on the day.

Predictor measures

Demographic predictor variables consisted of all variables used to define the sampling quotas, together with having children under 18, religion, household

income, and social class.⁹ A single item measured whether the participant was in central London when he or she first heard about the explosions. We also measured exposure by using four items assessing whether the participant felt he or she might have been injured or killed, a friend or relative might have been injured or killed, they saw someone who was injured or killed, or a close friend or family member was injured or killed. These categories were not mutually exclusive.

Two items, which we combined for the analyses, inquired whether participants had previously been involved in a real terrorist incident or a false alarm about terrorism. We also asked whether the participant had received and read the government leaflet concerning emergency preparedness.

We asked "how sure or unsure were you about the safety or whereabouts of any close friends or relatives who might have been in central London" to assess uncertainty over the safety of others on a four point scale from "very sure" to "very unsure." We also asked participants whether they had attempted to contact anybody by mobile phone and, if they had attempted to contact two or more people, how easy that had been on a four point scale from "very difficult" to "very easy."

Analysis

Because quota sampling rarely achieves a sample that is exactly representative of the target population, we first weighted our data in order to improve its representativeness. We calculated weights on the basis of the disparity between the demographic distribution achieved and the known demographic distribution of London and applied these to individual participants according to their demographic profile. In practice, because our quota sampling worked well, the effects of this weighting were small. Weighted and unweighted data are available from the authors on request.

Table 2 Alterations in travel intentions after the bombings on 7 July among a representative sample of Londoners.* Values are numbers (percentages) of respondents

Response	No difference	More often	Less often
By tube	526/781 (67)	15/781 (2)	231/781 (30)
On an overground train	608/744 (82)	32/744 (4)	96/744 (13)
By bus	639/797 (80)	41/797 (5)	114/797 (14)
By car	712/838 (85)	92/838 (11)	27/838 (3)
Going into central London	719/920 (78)	17/920 (11)	181/920 (20)
Going elsewhere in the UK	853/920 (93)	28/920 (3)	37/920 (4)
Intending to travel less often by one or more of tube, train, bus, or into central London	—	—	318/1010 (32)

Numbers may not sum to the denominator owing to a small number ($\leq 1\%$) of "don't know" responses.

*The question was "Once the London transport system is back to normal, do you think you will travel more often or less often in the following ways, or will the London bombings make no difference to how often you travel in the following ways?"

Table 3 Immediate responses to the 7 July bombings among a representative sample of Londoners

Question	No of positive responses (%)
Did you, your partner, or another member of your family attempt to contact your children or the school to check their safety?*	42/174 (24)
Did you, your partner, or another member of your family go to school earlier than usual to collect or to see your children?*	45/174 (26)
Did you try to check the safety of any immediate family members or friends?	771/1010 (76)

*Only asked of respondents with children in a London school on the day of the bombings.

We calculated univariate odds ratios to assess the association between each predictor variable and substantial stress or reduced travel intentions. We used logistic regressions to calculate a second set of odds ratios controlling for the role of age, sex, and social class—common confounders for psychological distress. We also calculated odds ratios to assess the association of reduced sense of safety while travelling and presence of substantial stress with travel intentions. We calculated all odds ratios separately for each variable. As such they are not independent of each other.

Results

We contacted 11 072 people, of whom 1059 were ineligible or over quota with regard to their demographics. Of the 10 013 eligible respondents, 1207 agreed to participate and 1010 completed the interview (10.1%). This response rate is not unusually low for a telephone survey using quota sampling. Furthermore, given that response rates are not as valid an indication of non-participation in quota surveys as they are in random probability surveys, this figure should be taken as indicative only. We did not record reasons for non-participation. However, of the 197 people who started an interview but withdrew before completion, 21 were unhappy discussing the bombings, 8 did not believe the survey was relevant, 64 did not have time to

continue, 36 refused to supply a reason, and 68 were dropped for technical or other reasons.

Responses to the primary outcomes are given in tables 1 and 2. Thirty one per cent of the sample reported substantial stress, and 32% reported that once the London transport system had returned to normal they intended to travel less by at least one of the methods asked about. Tables 3 and 4 show data for the secondary outcomes.

When we controlled for age, sex, and social class where applicable, the following were significant correlates of substantial stress (see table 5 for comparison groups): being female; being from social class D or E; not owning your own home; being non-white, Muslim, or from another faith; having a household income of less than £30 000; believing that you or a close friend or relative might have been injured or killed; having a close friend or relative who was injured or killed; having no previous experience of terrorism; being unsure about the safety of others; and having had difficulty reaching people by mobile phone. In addition, Muslims reported significantly more stress than people of other faiths.

Similarly, the following showed significant associations with reduced intention to travel by either tube, train, bus, or into central London (see table 6 for comparison groups): being female, being younger, being non-white, being religious, having a household income of less than £30 000, believing that you or a close friend or relative might have been injured or killed, having a close friend or relative who was injured or killed, not having read the government advice leaflet, having been unsure about the safety of others, having substantial stress, and feeling unsafe while travelling.

Discussion

Eleven to 13 days after the London attacks, 31% of respondents reported substantial levels of stress. Although no equivalent measure was taken before the attack, as participants were specifically asked about stress related symptoms experienced “as a result of the London bombings,” it seems reasonable to ascribe most of this stress to the effects of terrorism. Direct exposure to the bombings was limited, with 8% of the sample having thought they might be injured or killed and 3% having seen someone injured or killed. In terms of indirect exposure, 60% had been concerned that a friend or relative might have been injured or killed, and 4% reported knowing someone who was injured or killed. Unsurprisingly, levels of distress were highest among these participants. Overall, the prevalence of distress was less than that reported in the general adult US population after 11 September 2001.¹ Several reasons may explain this difference, including the greater loss of life, dramatic imagery, and live television coverage of the New York attacks. The longer delay between the London attacks and our survey (11-13 days) compared with that between 11 September and the US survey (3-5 days), may also be important. An additional factor implied by our results may be previous experience of IRA terrorism in London, with significantly reduced short term emotional responses being observed among Londoners who had previously been exposed to terrorism or a terrorist false alarm. We also found some evidence

Table 4 Perceived sense of safety, self efficacy, and need to talk to someone about emotions among a representative sample of Londoners after the bombings on 7 July 2005

Question	No of positive responses (%)	% of responses in Israel terrorism study*
Do you feel your life is in danger from terrorism?	560/1010 (55)	60.4
Do you feel the lives of your close family members or those dear to you are in danger from terrorism?	588/1010 (58)†	67.9
Do you think another attack on London is likely in the near future?	870/1010 (86)	—
Do you feel unsafe when travelling by tube?	361/781 (46)	—
Do you feel unsafe when travelling by overground train?	174/744 (23)	—
Do you feel unsafe when travelling by bus?	200/797 (25)	—
Do you feel unsafe when travelling by car?	30/838 (4)	—
Do you feel unsafe when going into central London?	300/710 (33)	—
Do you feel unsafe when going elsewhere in the UK?	91/966 (9)	—
Before the bombings, did you believe you would know what best to do if you were caught in a terrorist attack?	544/1010 (54)	—
How much have you talked with someone else about your thoughts and feelings about what happened?†	721/1010 (71)	—
As a result of the bombings, have you spoken to a psychiatrist, psychologist, counsellor, or other mental health specialist?	8/1010 (1%)	—
As a result of the bombings, do you think you need to speak to a psychiatrist, psychologist, counsellor, or other mental health specialist?	12/1010 (1)	—
As a result of the bombings, have you spoken to a religious adviser or leader?	43/1010 (4)	—

*Response in Israeli population to identical items during the ongoing intifada.³

†Responses of “a great deal” or “a fair amount” were classified as positive responses.

consistent with the idea that preparation for terrorism can reduce its impact, with respondents who had read the government's advisory leaflet being less likely to have altered their travel intentions than those who had not read it. However, the correlational nature of our data makes it possible that some third variable such as personality may account for this latter association.

Given that the attacks disrupted London's transport network, we could not measure the psychological effects of the bombings in terms of actual alterations in travel behaviour. Instead, we assessed travel intentions. Most Londoners reported that the bombings would have no impact on their travel plans. However, a substantial minority (32%) reported that they would now reduce the amount they used the tube, trains, buses, or go into central London. Several factors probably mediate the impact of terrorism on such behaviours. In the case of London, whether the respondent uses public transport for leisure or is compelled to use it for work is probably important. As shown by our results, so too are perceptions of safety. Forty six per cent of Londoners reported not feeling safe travelling by tube, and 33% did not feel safe in central London. Concerns about safety in general were also high at the time of the survey, with 55% believing their lives were in danger and 58% believing the same of their close family and friends. These are similar levels of concern to those expressed by the Israeli population in response to the current intifada.³

People need to be able to communicate

Seventy six per cent of respondents attempted to contact others in the immediate period after the bombings, a situation similar to that in New York after 11 September 2001.¹ Israelis also frequently check on the whereabouts of family and friends after attacks, with 83% of those who do so finding it to be a helpful coping strategy.³ The importance of reassuring oneself about friends and relatives is shown by the significant association we found between being unsure about the safety of others and the presence of substantial stress, although the correlational nature of the data makes it difficult to identify the direction of causality. On 7 July, uncertainty about others was fuelled by the inability of the mobile phone networks to cope with demand. Seventy eight per cent of our sample reported that using their mobile was fairly or very difficult on the day. Again, those who experienced difficulty contacting others on their mobile were also significantly more likely to experience substantial stress. Although there is no doubt that priority should be given to emergency service use of the mobile network in the event of a major incident, these results imply that allowing ordinary people to communicate with each other is also an important function.¹⁰

Demographic predictors of stress

Interestingly, although belonging to any religious grouping was associated with significantly higher levels of stress than belonging to none, Muslim respondents reported the highest levels of stress compared with participants from other religions, with 62% reporting substantial stress. As in previous terrorist attacks,¹ respondents from ethnic minorities also experienced significantly worse emotional effects than white respondents. This increased prevalence of distress is not readily explainable by any pre-existing vulnerability

Table 5 Predictors of the presence of substantial distress after the bombings in London on 7 July 2005

Variable	No (%)	No (%) with substantial stress	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)*
Sex:				
Female	529 (52)	195 (37)	1.9 (1.4 to 2.4)	—
Male	481 (48)	115 (24)	Ref†	—
Age:				
18 to 24	126 (13)	43 (34)	1.1 (0.7 to 1.9)	—
25 to 44	476 (47)	144 (30)	0.9 (0.6 to 1.4)	—
45 to 64	259 (26)	76 (29)	0.9 (0.6 to 1.4)	—
≥65	149 (15)	47 (32)	Ref	—
Social class‡:				
A/B	281 (29)	66 (23)	0.4 (0.3 to 0.6)	—
C1/C2	483 (50)	145 (30)	0.6 (0.4 to 0.9)	—
D/E	208 (21)	86 (41)	Ref	—
Working status:				
Working full-time	463 (46)	116 (25)	0.6 (0.5 to 0.8)	0.8 (0.6 to 1.1)
Not full time	547 (54)	195 (36)	Ref	Ref
Residential location:				
Inner London	394 (39)	120 (30)	1.0 (0.7 to 1.3)	1.0 (0.7 to 1.3)
Outer London	616 (61)	191 (31)	Ref	Ref
Housing tenure:				
House owner	562 (56)	145 (26)	0.6 (0.5 to 0.8)	0.6 (0.5 to 0.8)
Rents or other	448 (44)	166 (37)	Ref	Ref
Ethnicity:				
White	718 (71)	170 (24)	0.3 (0.3 to 0.5)	0.3 (0.2 to 0.4)
Other	292 (29)	141 (48)	Ref	Ref
Religion‡:				
Muslim	86 (9)	53 (62)	3.5 (2.2 to 5.5)	4.0 (2.5 to 6.6)
None	218 (22)	37 (17)	0.4 (0.3 to 0.7)	0.5 (0.3 to 0.7)
Other faith	704 (70)	221 (31)	Ref	Ref
Income‡:				
<£30 000	508 (57)	183 (36)	2.5 (1.9 to 3.5)	2.3 (1.6 to 3.4)
>£30 000	376 (43)	68 (18)	Ref	Ref
Parental status:				
Children under 18	313 (31)	100 (32)	1.1 (0.8 to 1.4)	1.0 (0.7 to 1.3)
No children	697 (69)	211 (30)	Ref	Ref
Location at time‡:				
Central London	218 (22)	72 (33)	1.2 (0.8 to 1.6)	1.4 (1.0 to 2.0)
Elsewhere	783 (78)	234 (30)	Ref	Ref
I felt I might be injured or killed:				
Yes	80 (8)	48 (60)	3.7 (2.3 to 6.0)	3.8 (2.4 to 6.2)
No	930 (92)	263 (28)	Ref	Ref
I felt that a family member or close friend might be injured or killed:				
Yes	606 (60)	218 (36)	1.9 (1.4 to 2.5)	1.8 (1.4 to 2.5)
No	404 (40)	93 (23)	Ref	Ref
I saw someone who was injured or killed:				
Yes	27 (3)	12 (44)	1.8 (0.9 to 3.9)	1.8 (0.8 to 3.9)
No	983 (97)	299 (30)	Ref	Ref
A family member or close friend was injured or killed:				
Yes	35 (4)	19 (54)	2.7 (1.3 to 5.3)	2.7 (1.3 to 5.4)
No	975 (97)	292 (30)	Ref	Ref
Prior terror experience:				
Yes	299 (30)	70 (23)	0.6 (0.4 to 0.8)	0.6 (0.5 to 0.9)
No	711 (70)	241 (34)	Ref	Ref
Read government leaflet:				
Yes	375 (37)	101 (27)	0.8 (0.6 to 1.0)	0.8 (0.6 to 1.0)
No	635 (63)	210 (33)	Ref	Ref
Certainty about others‡:				
Very or fairly sure	425 (47)	107 (25)	0.6 (0.4 to 0.8)	0.6 (0.5 to 0.8)
Very or fairly unsure	482 (53)	175 (36)	Ref	Ref
Difficulty in using a mobile‡:				
Very or fairly difficult	449 (78)	156 (35)	1.6 (1.0 to 2.4)	1.7 (1.1 to 2.7)
Very or fairly easy	124 (23)	32 (26)	Ref	Ref

*Controlling for sex, age, and social class by using logistic regression.

†Ref=reference value.

‡Baseline value for analysis is not 1010 because of missing data, "don't know" responses, or previous screening questions.

Table 6 Predictors of altered travel intentions after the bombings in London on 7 July 2005

Variable	No (%)	No (%) intending to travel less	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)*
Sex:				
Female	529 (52)	203 (38)	2.1 (1.6 to 2.8)	—
Male	481 (48)	108 (22)	Ref†	—
Age:				
18 to 24	126 (13)	53 (42)	3.7 (2.1 to 6.5)	—
25 to 44	476 (47)	172 (36)	2.9 (1.8 to 4.7)	—
45 to 64	259 (26)	63 (24)	1.7 (1.0 to 2.8)	—
≥65	149 (15)	24 (16)	Ref	—
Social class‡:				
A/B	281 (30)	83 (30)	0.8 (0.6 to 1.2)	—
C1/C2	483 (50)	148 (31)	0.9 (0.6 to 1.2)	—
D/E	208 (21)	70 (34)	Ref	—
Working status:				
Working full time	463 (46)	130 (28)	0.8 (0.6 to 1.0)	0.7 (0.5 to 1.0)
Not full time	547 (54)	181 (33)	Ref	Ref
Residential location:				
Inner London	394 (39)	125 (32)	1.1 (0.8 to 1.4)	0.9 (0.7 to 1.3)
Outer London	616 (61)	186 (30)	Ref	Ref
Housing tenure:				
House owner	562 (56)	156 (28)	0.7 (0.6 to 1.0)	0.9 (0.7 to 1.2)
Rents or other	448 (44)	155 (35)	Ref	Ref
Ethnicity:				
White	718 (71)	187 (26)	0.5 (0.4 to 0.6)	0.6 (0.4 to 0.8)
Other	292 (29)	124 (42)	Ref	Ref
Religion‡:				
Muslim	86 (9)	36 (42)	1.5 (1.0 to 2.4)	1.3 (0.8 to 2.2)
None	218 (22)	49 (23)	0.6 (0.4 to 0.9)	0.6 (0.4 to 0.9)
Other faith	704 (70)	226 (32)	Ref	Ref
Income‡:				
<£30 000	508 (57)	169 (33)	1.4 (1.1 to 1.9)	1.6 (1.1 to 2.2)
≥£30 000	376 (43)	99 (26)	Ref	Ref
Parental status:				
Children under 18	313 (31)	122 (39)	1.7 (1.3 to 2.3)	1.3 (0.9 to 1.8)
No children	697 (69)	190 (27)	Ref	Ref
Location at time‡:				
Central London	218 (22)	71 (33)	1.1 (0.8 to 1.5)	1.0 (0.7 to 1.4)
Elsewhere	783 (78)	238 (30)	Ref	Ref
I felt I might be injured or killed:				
Yes	80 (8)	40 (50)	2.4 (1.5 to 3.8)	2.2 (1.4 to 3.6)
No	930 (92)	271 (29)	Ref	Ref
I felt that a family member or close friend might be injured or killed:				
Yes	606 (60)	220 (36)	2.0 (1.5 to 2.6)	1.7 (1.3 to 2.4)
No	404 (40)	91 (23)	Ref	Ref
I saw someone who was injured or killed:				
Yes	27 (3)	11 (41)	1.6 (0.7 to 3.5)	1.42 (0.6 to 3.2)
No	983 (97)	300 (31)	Ref	Ref
A family member or close friend was injured or killed:				
Yes	35 (4)	19 (56)	2.9 (1.5 to 5.8)	2.2 (1.1 to 4.7)
No	975 (97)	292 (30)	Ref	Ref
Prior terror experience:				
Yes	299 (30)	77 (26)	0.7 (0.5 to 1.0)	0.8 (0.6 to 1.1)
No	711 (70)	234 (33)	Ref	Ref
Read government leaflet:				
Yes	375 (37)	86 (23)	0.5 (0.4 to 0.7)	0.5 (0.4 to 0.7)
No	635 (63)	226 (36)	Ref	Ref
Certainty about others‡:				
Very or fairly sure	425 (47)	108 (25)	0.6 (0.4 to 0.8)	0.7 (0.5 to 0.9)
Very or fairly unsure	482 (53)	181 (38)	Ref	Ref
Difficulty in using a mobile‡:				
Very or fairly difficult	449 (78)	165 (37)	1.1 (0.7 to 1.4)	1.0 (0.7 to 1.6)
Very or fairly easy	124 (23)	43 (35)	Ref	Ref
Has substantial stress:				
Yes	311 (31)	143 (46)	2.7 (2.0 to 3.6)	2.7 (2.0 to 3.6)
No	699 (69)	168 (24)	Ref	Ref
Feels "very unsafe" on transport:				
Yes	227 (23)	172 (76)	14.4 (10.1 to 20.5)	14.3 (9.8 to 20.9)
No	783 (78)	140 (18)	Ref	Ref

*Controlling for sex, age, and social class by using logistic regression.

†Ref=reference value.

‡Base for analysis is not 1010 because of missing data, "don't know" responses, or previous screening questions.

among these groups as there is little evidence that ethnic minorities in the UK have consistently higher rates of minor mental disorder.^{11 12} Whether these results partly reflect a response bias, with Muslim respondents attempting to maintain a distinction between themselves and the bombers, is unknown. Many of the other demographic predictors of stress that we identified have been reported previously, with women,^{3 13 14} those on lower incomes,³ and younger adults¹⁴ all reporting greater stress.

Limitations of the study

Our study has some limitations. In particular, although the quota sampling and weighting ensured that our sample was demographically representative of London, the low response rate means that some bias may have affected our data. For example, individuals who were unaffected by the attacks may have been less interested in participating, as too many individuals with high levels of distress. These effects could potentially result in either underestimation or overestimation of the true prevalence of distress. To mitigate against this, interviewers were instructed to introduce the survey as concerning "issues facing Londoners," the bombings themselves not mentioned until part way through the interview. The fact that relatively few of those who withdrew from the study after the interview had begun stated that the survey was not relevant to them or that they were too upset to talk about the attacks provides some reassurance that these biases were limited.

Therapeutic implications

What, if any, are the therapeutic implications of our results? Firstly, the psychological needs of people who were intimately caught up in the bombings through direct exposure or bereavement will need to be assessed after a reasonable time has passed. An appropriate response of this sort is being coordinated by the four mental health trusts covering the main hospitals who dealt with the injured. But what about the rest of us? Less than 1% of respondents had sought professional help for their negative emotions, and only 12 respondents felt they needed such help. On the other hand, 71% had spoken to friends or relatives about the attacks "a great deal" or "a fair amount." Our results therefore confirm those of previous studies that show that most people are able to turn to lay support networks after traumatic events.¹⁵ Given that psychological debriefing in the immediate aftermath of a major incident is at best ineffective and at worst counter-productive,¹⁶ these results are reassuring. We do not believe that it will be necessary to conduct large scale population based psychological interventions such as those used in New York after 11 September 2001.

Contributors: SW had the original idea for the study and developed the study design and interview questions with GJR, CRB, NG, and JS. We are also grateful to Avi Bleich, Mark Gelkopf, Mark Gill, Ron Kessler, Claire Lambert, and Robert Ursano for making additional suggestions at this stage. Interviewers working for MORI collected the data. GJR performed the statistical analyses and wrote the first draft of the paper. All authors contributed to further drafts. SW is the guarantor.

Funding: This study was funded by King's College London in advance of a grant application made to the Home Office.

Competing interests: None declared.

Ethical approval: South London and Maudsley NHS Trust Research Ethics Committee.

What is already known on this topic

Terrorist attacks can have emotional effects on people directly exposed to an attack as well as those in the wider population

In the short term, these effects can be seen in the presence of stress symptoms and changes in behaviour

Identifying correlates of these effects can be helpful in planning responses to future attacks

What this study adds

The bombings in London on 7 July 2005 resulted in substantial stress among 31% of London's population and altered travel intentions in 32%

Muslims suffered disproportionately greater levels of stress than respondents from other faiths

Previous experience of terrorism was associated with reduced likelihood of substantial stress, and difficulty contacting others by using the mobile phone network was associated with higher levels of stress

- 2 Pfefferbaum B, Nixon SJ, Krug RS, Tivis RD, Moore VL, Brown JM, et al. Clinical needs assessment of middle and high school students following the 1995 Oklahoma City bombing. *Am J Psychiatry* 1999;156:1069-74.
- 3 Bleich A, Gekkopf M, Solomon Z. Exposure to terrorism, stress-related mental health symptoms, and coping behaviors among a nationally representative sample in Israel. *JAMA* 2003;290:612-20.
- 4 Silver RC, Holman EA, McIntosh DN, Poulin M, Gil-Rivas V. Nationwide longitudinal study of psychological responses to September 11. *JAMA* 2002;288:1235-44.
- 5 Apolone G, Mosconi P, La Vecchia C. Post-traumatic stress disorder. *N Engl J Med* 2002;346:1495-8.
- 6 Grieger TA, Fullerton CS, Ursano RJ, Reeves JJ. Acute stress disorder, alcohol use, and perception of safety among hospital staff after the sniper attacks. *Psychiatr Serv* 2003;54:1383-7.
- 7 London under attack. *Economist* 2005 July 9;9.
- 8 HM Government. *Preparing for emergencies. What you need to know.* www.preparingforemergencies.gov.uk (accessed 19 Aug 2005).
- 9 Market and Opinion Research International (MORI). How to use surveys in management decision. www.mori.com/pubinfo/pfh/how-to-use-surveys-in-management-decision.shtml (accessed 22 Aug 2005).
- 10 Wessely S. Don't panic! Short and long term psychological reactions to the new terrorism: the role of information and the authorities. *J Mental Health* 2005;14:1-6.
- 11 Meltzer H, Gill B, Petticrew M, Hinds K. *The prevalence of psychiatric morbidity among adults living in private households.* London: HMSO, 1995.
- 12 Weich S, Nazroo J, Sproston K, McManus S, Blanchard M, Erens B, et al. Common mental disorders and ethnicity in England: the EMPIRIC study. *Psychol Med* 2004;34:1543-51.
- 13 North CS, Nixon SJ, Shariat W, Mallonee S, McMillen JC, Spitznagel EL, et al. Psychiatric disorders among survivors of the Oklahoma City bombing. *JAMA* 1999;282:755-62.
- 14 Schlenger WE, Caddell JM, Ebert L, Jordan BK, Rourke KM, Wilson D, et al. Psychological reactions to terrorist attacks. Findings from the national study of Americans' reactions to September 11. *JAMA* 2002;288:581-8.
- 15 Greenberg N, Thomas SL, Iversen A, Unwin C, Hull L, Wessely S. Do military peacekeepers want to talk about their experiences? Perceived psychological support of UK military peacekeepers on return from deployment. *J Mental Health* 2003;12:565-73.
- 16 Rose S, Bisson J, Wessely S. A systematic review of single-session psychological interventions ("debriefing") following trauma. *Psychother Psychosom* 2003;72:176-84.

(Accepted 18 August 2005)

doi 10.1136/bmj.38583.728484.3A

- 1 Schuster MA, Stein BD, Jaycox LH, Collins RL, Marshall GN, Elliott MN, et al. A national survey of stress reactions after the September 11, 2001, terrorist attacks. *N Engl J Med* 2001;345:1507-12.

Graffiti, greenery, and obesity in adults: secondary analysis of European cross sectional survey

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Obesity levels are high and increasing worldwide. Being overweight is linked with increased death rates and contributes to a wide range of conditions, including ischaemic heart disease, hypertension, stroke, diabetes, certain cancers, and diseases of the gall bladder.¹ The principal cause of obesity is an imbalance between energy intake and energy expenditure. And there is growing recognition that, independently of individual characteristics, place of residence may be associated with health outcomes, including body size² and health related behaviours, such as level of physical exercise.³

Few studies have explored which features of the local neighbourhood might be related to these outcomes or behaviours, although perceived attractiveness has been found to be related to levels of physical activity.⁴ Levels of incivilities, such as litter and graffiti, are associated with poorer health outcomes such as general wellbeing but not, to our knowledge, with levels of physical activity. Few studies use objectively measured indicators of the residential environment or similar research instruments across different settings. Based on our previous work, we hypothesised that areas which are pleasant with lots of greenery and few

incivilities might encourage people to take exercise and thereby influence levels of obesity.

Participants, methods, and results

To tackle this hypothesis systematically, we drew upon data collected in the LARES study (Large Analysis and Review of European Housing and Health Status), which was done in 2002-3 in eight European countries, varying in their wealth, culture, and history.⁵ This survey includes data on adults (n=6919) in Angers (France), Bonn (Germany), Bratislava (Slovakia), Budapest (Hungary), Ferreira do Alentejo (Portugal), Forlì (Italy), Geneva (Switzerland), and Vilnius (Lithuania). The same survey methods and training of the surveyors were applied in all cities. A strength of the study is that it is not generally subject to same source bias—that is, it does not rely solely on self assessed perceptions of both health and environment. Housing and health questionnaires captured self reported data on the health of occupants (including self assessed height

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BMJ 2005;331:611-2

This article was posted on bmj.com on 19 August 2005: <http://bmj.com/cgi/doi/10.1136/bmj.38575.664549.F7>