Comparison of post-disaster psychiatric disorders after terrorist bombings in Nairobi and Oklahoma City

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Background African disaster-affected populations are poorly represented in disaster mental health literature.

Aims To compare systematically assessed mental health in populations directly exposed to terrorist bombing attacks on two continents, North America and Africa.

Method Structured diagnostic interviews compared citizens exposed to bombings of the US Embassy in Nairobi, Kenya (n=227) and the Oklahoma City Federal Building (n=182).

Results Prevalence rates of post-traumatic stress disorder (PTSD) and major depression were similar after the bombings. No incident (new since the bombing) alcohol use disorders were observed in either site. Symptom group C was strongly associated with PTSD in both sites. The Nairobi group relied more on religious support and the Oklahoma City group used more medical treatment, drugs and alcohol.

Conclusions Post-disaster psychopathology had many similarities in the two cultures; however, coping responses and treatment were quite different. The findings suggest potential for international generalisability of post-disaster psychopathology, but confirmatory studies are needed.

Declaration of interest None.

Africa is poorly represented in the world's disaster mental health literature (Norris *et al*, 2002), although major terrorist attacks have occurred on that continent in the past decade. In the USA, research on the Oklahoma City bombing (North *et al*, 1999) helped guide mental health responses to the 11 September terrorist attacks on the New York World Trade Center (Norris, 2002), but its applicability to terrorist attacks outside the USA, such as those in Africa, is unknown. This report compares consistently examined mental health effects of terrorist bombings of the US Embassy in Nairobi, Kenya, in 1998 and of the Murrah Federal Building in Oklahoma City in 1995.

METHOD

Overview: Oklahoma City and Nairobi bombing studies

Comparison of findings from studies of civilians exposed to bombings in Oklahoma City and Nairobi is possible through use of similar methods in the two studies, both approved by the Washington University School of Medicine and the University of Oklahoma Health Sciences Center Institutional Review Boards prior to their inception. The main instrument used, the Disaster Supplement of the Diagnostic Interview Schedule (DIS/DS; North *et al*, 2001), has been used in studies of more than 2000 disaster victims in the USA.

Oklahoma City

The Oklahoma City bombing was the most severe act of terrorism experienced on American soil at the time. The research methods and findings are described in detail in another publication (North *et al*, 1999). Briefly, 182 survivors were randomly selected from the Oklahoma Health Department's registry of more than 1000 directly exposed individuals and interviewed with the DIS/DS an average of 6 months after the bombing. Diagnosis rates described here vary slightly (2% lower for post-traumatic stress disorder and major depression) from those previously published, because of adjustment to DSM–IV criteria (American Psychiatric Association, 1994; North *et al*, 1999).

Nairobi

Eight to ten months after the bombing, 227 Kenyan civilians directly exposed to the bomb blast were assessed with the DIS/DS. The Nairobi bombing sample was drawn from six major businesses in the immediate vicinity of the embassy, all of which had sustained substantial physical damage. Every fifth individual present at the bombing was selected from rosters of employees of the participating businesses, yielding a list of 271 potential participants. Interviewers contacted individuals from the rosters, 44 of whom refused or were unavailable for interview, yielding 227 participants (84% participation rate). Study participants were interviewed privately at their workplace or in their home, according to the participant's preference. Those interviewed received 200 Kenyan shillings for participating, valued at about US$3 and considered to be equivalent in value to payments provided to research participants in the USA. Participants were informed that a Federal certificate of confidentiality had been obtained for protection of their privacy, and all provided written informed consent prior to participation.

Selected sections (post-traumatic stress disorder, major depression, panic disorder, generalised anxiety disorder, somatisation disorder and alcohol use disorder) of the Diagnostic Interview Schedule for DSM–IV, with adjustments for cultural fit, were used. Previous work has concluded that, with appropriate modifications, existing measures and American conceptualisations of post-traumatic stress disorder (PTSD) and other psychopathology can be applied to African populations (Bolton, 2001; Carey *et al*, 2003; Dinan *et al*, 2004). Diagnostic Interview Schedule diagnoses allowed specification of lifetime occurrence and current, pre-disaster and post-disaster prevalence. Retrospectively made pre-disaster diagnoses allowed specification of post- disaster disorders as new (incident) or persistent/recurrent disorders pre-dating the bombing.

The Disaster Supplement provided information about exposure to the disaster,

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subjective perceptions, functional status, coping methods and treatment, and was administered through interview and self-report questionnaire formats. All assessments were conducted in English, one of two official Kenyan languages.

To maximise the study's cultural interface, eight Nairobi mental health professionals conducted the interviews after completing the research team's formal interview training. Adjustment of the study instruments for cultural acceptability was accomplished during training, soliciting question-by-question input for culturally appropriate and optimal comprehensibility. This usually involved alterations of single words or phrases to replace American idioms with familiar wording for Kenyans: for example, the word 'blue' to describe mood was considered to be culturally inconsistent, and 'empty' was substituted as a best approximation. All interviewers were observed in live interviews until they achieved competency. Interview materials were systematically edited for accuracy and reviewed with the interviewers to answer questions and ensure procedural consistency of the interviewing.

Data preparation and analysis

Data were entered into Excel spreadsheets by personnel in Nairobi and systematically compared with the interviews for consistency. In St Louis, the data were transformed into SAS files for analysis (SAS, 2000). Diagnoses were scored using DSM–IV criteria (American Psychiatric Association, 1994). Nairobi and Oklahoma City data were merged in SAS.

For this report, data are summarised as means with standard deviations and as percentages. Variables are compared in the Nairobi and Oklahoma City post-bombing data-sets. Comparisons of categorical variables between the two sites were accomplished with chi-squared analyses (substituting Fisher's exact tests when expected cell numbers were less than 5), and numerical variables with Student's *t*-tests. To compare rates of the same diagnoses before and after the disaster, McNemar's test was used. Multiple logistic regression models were developed to predict PTSD after the bombings from various independent variables simultaneously. Statistical significance was set at $\alpha=0.05$.

RESULTS

Population and demographics

Slightly more than half of both samples were female; nearly two-thirds were married (Table 1). Sampling from workplaces yielded very few unemployed participants. Participants in the Nairobi sample were all Black, whereas 89% of the Oklahoma City sample were White; otherwise, the Nairobi sample was demographically similar to the Oklahoma City sample, with relatively small, statistically significant educational and occupational differences. More respondents in Nairobi (54%) than in Oklahoma City (46%) had experienced some other serious traumatic event ($\chi^2=20.40$, d.f.=1, $P<0.001$).

Exposure to the bombing and perceptions of the event

The injury rate in Oklahoma City was 87% and in Nairobi it was 88%, lacerations being most common (Table 2). In Nairobi rates of smoke inhalation injuries were double and ocular injuries were treble those in Oklahoma City, and hospitalisation and surgery rates were more than twice as high in Nairobi. More Nairobi than Oklahoma City participants said they recalled thinking they were going to die during the bombing, had witnessed death or injury in the bombing, acknowledged death of a family member or friend in the bombing, reported very high subjective upset associated with the bombing, and described the bombing as the worst event they had ever experienced in their lives.

Post-disaster functioning, social support, coping and treatment

Post-traumatic functional impairment, defined as interference with family, friends or work, was no different between the Oklahoma City (39%) and Nairobi samples (40%) (not shown in tables). However,

Table 1 Demographic characteristics of the two study samples

	Nairobi *n*=227[1]	Oklahoma City *n*=182
Age, years: mean (s.d.)***	34.8 (7.7)	42.9 (11.5)
Gender: % (*n*)		
Male	43.6 (99)	48.4 (88)
Female	56.4 (128)	51.7 (94)
Marital status: % (*n*)		
Currently married	61.3 (133)	63.2 (115)
Ethnicity: % (*n*)		
Black***	100.0 (227)	8.8 (16)
White***	0.0 (0)	89.0 (162)
Other	0.0 (0)	2.2 (4)
Educational level: % (*n*)		
No degree	7.4 (14)	3.9 (7)
High school or equivalent	63.2 (120)	53.3 (97)
College degree*	16.3 (31)	24.7 (45)
Postgraduate degree***	4.8 (9)	18.1 (33)
Other***	8.4 (16)	0.0 (0)
Employment: % (*n*)		
Employed at time of bombing	94.2 (193)	95.1 (173)
Occupation: % (*n*)		
Administrative/managerial**	21.2 (41)	34.7 (58)
Professional*	23.6 (46)	13.8 (23)
Technical/clerical***	31.6 (61)	5.4 (9)
Service***	13.3 (26)	46.1 (77)
Other***	10.3 (20)	0.0 (0)

*$P<0.05$, **$P<0.01$, ***$P<0.001$.
1. Owing to missing data, the Nairobi sample sizes were 217 for marital status, 190 for educational level and 192 for occupation.

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Table 2 Disaster exposure, perceptions and reactions

	Nairobi *n*=227 % (*n*)[1]	Oklahoma City *n*=182 % (*n*)[1]
Physical illness or injury due to bombing	88.1 (200)	87.4 (159)
Laceration(s)*	68.0 (153)	79.1 (144)
Smoke inhalation***	66.7 (150)	33.5 (61)
Contusion(s)	60.4 (136)	56.6 (103)
Foreign body embedded in skin*	43.2 (96)	53.3 (97)
Ocular loss or injury***	36.1 (79)	11.0 (20)
Hearing loss or injury	28.0 (61)	29.1 (53)
'Thought I would die' in bombing***	90.7 (205)	46.1 (83)
Witnessed injury or death***	98.2 (221)	81.9 (149)
Family or friends killed***	79.8 (178)	39.0 (71)
Knew someone who was killed***	92.9 (209)	51.1 (93)
Bombing was most traumatic lifetime event***	94.7 (215)	81.3 (148)
How upset by the disaster?		
Very upset***	98.2 (223)	85.2 (155)
A little/somewhat upset***	1.8 (4)	11.5 (21)
Not upset**	0.0 (0)	3.3 (6)

*$P<0.05$, **$P<0.01$, ***$P<0.001$.
1. Owing to missing data, sample sizes for some variables were less than the total sample sizes. Further details available from the author upon request.

dissatisfaction with performance of their home chores most of the time in the past month was more often acknowledged by respondents in Nairobi (64%) than in Oklahoma City (42%; $\chi^2=18.97$, d.f.=1, $P<0.001$).

More respondents in Oklahoma City (74%) than in Nairobi (30%) reported getting along well with their spouses ($\chi^2=51.66$, d.f.=1, $P<0.001$). However, the proportions reporting a negative change in their marital relationship after the bombing did not differ by site (average 19%). Frequent attendance at religious services (i.e. more than weekly) was more often acknowledged in Nairobi (46%) than in Oklahoma City (15%; $\chi^2=42.80$, d.f.=1, $P<0.001$), and by more Nairobi women (50%) than men (36%; $\chi^2=4.22$, d.f.=1, $P=0.04$). Increased attendance at regligious services after the bombing was reported more often in Nairobi (33%) than in Oklahoma City (10%; $\chi^2=30.02$, d.f.=1, $P<0.001$).

Few Nairobi participants reported increased consumption of alcohol or cigarettes after the bombing (Table 3; equivalent data unavailable for Oklahoma City). Fewer participants in Nairobi than in Oklahoma City drank alcohol or took medication to help them cope with the bombing. Turning to family or friends for support, a popular response in both settings, was even more popular in Nairobi than in Oklahoma City. Respondents were asked if anything else helped them cope, and no new category emerged in the Nairobi study.

Respondents in Nairobi and Oklahoma City used mental health services to a similar extent, although the type of assistance used varied by setting. Psychiatric treatment was exclusive to Oklahoma City, but other mental health treatment was used approximately equally in both settings. Support or debriefing groups and help from religious leaders were more often used in Nairobi.

Psychiatric disorders

Gender differences necessitate the presentation of results separately for men and women (Table 4). The DIS onset and recency specifications provided separate pre- and post-bombing diagnosis rates, allowing separation of incident (new) disorders occurring for the first time after the bombing from pre-existing psychopathology.

Pre-disaster

The only difference in rates of pre-existing diagnoses between Nairobi and Oklahoma City was less alcohol misuse and dependence, found in both men and women in Nairobi.

Post-disaster

In Nairobi, a third of the men and half of the women had bombing-related PTSD, and these rates were similar to those in Oklahoma City men and women. In both Oklahoma City and Nairobi, women's post-bombing rates were higher than men's for all PTSD (Oklahoma City, $\chi^2=5.89$,

Table 3 Post-disaster coping and mental health treatment

	Nairobi *n*=227 % (*n*)[1]	Oklahoma City *n*=182 % (*n*)[1]
Since the bombing, increased consumption of		
Alcohol	5.1 (11)	
Tobacco	4.1 (9)	
Coped with the bombing by		
Taking medication***	20.4 (46)	36.3 (66)
Drinking alcohol*	8.5 (19)	15.4 (28)
Turning to family or friends***	98.2 (223)	89.6 (163)
Received post-disaster mental health intervention		
Debriefing or support group***	78.3 (145)	51.9 (94)
Psychiatrist***	0.0 (0)	15.9 (29)
Other mental health professional	26.9 (61)	31.9 (58)
Primary care physician	10.6 (24)	4.4 (8)
Religious leader***	56.4 (106)	8.2 (15)

*$P<0.05$, ***$P<0.001$.
1. Owing to missing data, sample sizes for some variables were less than the total sample sizes. Further details available from the author upon request.

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Table 4 Psychiatric diagnoses

	Men		Women	
	Nairobi (n=99) % (n)[1]	Oklahoma City (n=88) % (n)[1]	Nairobi (n=128) % (n)[1]	Oklahoma City (n=94) % (n)[1]
Pre-disaster disorders (prevalence)				
PTSD	10.2 (10)	5.8 (5)	14.2 (17)	12.8 (12)
Major depression	12.6 (12)	4.6 (4)	18.7 (23)	17.0 (16)
Panic disorder	0.0 (0)	0.0 (0)	0.0 (0)	5.3 (5)
GAD[2]	1.0 (1)	0.0 (0)	3.1 (4)	5.3 (5)
Alcohol use disorder[3]	15.2 (15)	36.4 (32)	0.8 (1)	17.4 (16)
Any diagnosis[4]	25.3 (25)	39.8 (35)	25.8 (33)	33.0 (31)
All post-disaster disorders (prevalence)				
Bombing-related PTSD	33.7 (30)	21.8 (19)	48.8 (59)	40.4 (38)
Any PTSD	34.3 (34)	24.4 (21)	49.2 (63)	41.5 (41)
Major depression	15.8 (15)	11.4 (10)	23.6 (29)	29.8 (28)
Panic disorder	3.0 (3)	5.8 (5)	4.7 (6)	7.5 (7)
GAD	4.0 (4)	0.0 (0)	3.9 (5)	8.5 (8)
Alcohol use disorder[2]	11.1 (11)	10.2 (9)	0.0 (0)	8.7 (8)
Any diagnosis	44.4 (44)	31.8 (28)	53.9 (69)	51.1 (48)
New post-disaster disorders (incidence)				
Bombing-related PTSD	25.8 (23)	19.5 (17)	35.1 (40)	34.0 (32)
Any PTSD	27.6 (27)	19.8 (17)	35.0 (42)	35.1 (33)
Major depression	11.6 (11)	8.0 (7)	15.5 (19)	17.0 (16)
Panic disorder	3.0 (3)	5.8 (5)	4.7 (6)	3.2 (3)
GAD	3.0 (3)	0.0 (0)	3.1 (4)	5.3 (5)
Alcohol use disorder	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Any diagnosis[4]	33.3 (33)	20.5 (18)	40.6 (52)	40.4 (38)

GAD, generalised anxiety disorder; PTSD, post-traumatic stress disorder.
1. Owing to missing data, sample sizes for some variables were less than the total sample sizes. Further details available from the author upon request.
2. In women: $P<0.001$.
3. $P<0.001$.
4. In men: $P<0.05$.

d.f.=1, P=0.015; Nairobi, χ^2=5.05, d.f.=1, P=0.025) and for bombing-related PTSD (Oklahoma City, χ^2=7.23, d.f.=1, P=0.007; Nairobi, χ^2=4.76, d.f.=1, P=0.029). The post-bombing prevalence of major depression in Nairobi did not differ by gender, whereas the rate in Oklahoma City men was about double that in women (χ^2=9.82, d.f.=1, P=0.002). Nairobi women had no post-disaster alcohol use disorders, a prevalence significantly less than in Oklahoma City women after the bombing. No incident (new post-bombing) alcohol use disorders were observed in either Nairobi or Oklahoma City men or women. Although no case of somatisation disorder was diagnosed in men or women before or after the bombing in Nairobi or Oklahoma City, Nairobi men reported more somatoform symptoms than Oklahoma City men: 1.2 (s.d.=1.9) *v.* 0.5 (s.d.=1.1); t=3.04, d.f.=160, P=0.003. Oklahoma City and Nairobi women did not differ in mean number of somatoform symptoms.

Comorbidity occurred in 44% of the bombing-related PTSD cases in Nairobi and in 67% of cases in Oklahoma City (χ^2=7.28, d.f.=1, P=0.007). In Oklahoma City, 63% of women with PTSD had comorbid major depression after the bombing, compared with 40% of women with PTSD in Nairobi (χ^2=5.07, d.f.=1, P=0.024). Oklahoma City men with PTSD had a 47% rate of comorbidity with major depression after the bombing, compared with 30% of Nairobi men, a non-significant difference. Only 13% of participants in both cities had another psychiatric disorder after the bombing in the absence of PTSD.

Besides female gender, another major predictor of bombing-related PTSD after the disorder in both sites was pre-existing psychiatric disorder. In Oklahoma City, PTSD was present in 41% of participants with pre-disaster psychiatric disorder and 26% of those without (χ^2=4.43, d.f.=1, P=0.035), and in Nairobi, PTSD occurred after the bombing in 60% of participants with pre-disaster psychiatric disorder and 36% of those without (χ^2=9.55, d.f.=1, P=0.002). The number of injuries sustained in the bombing predicted PTSD in Oklahoma City (t=2.23, d.f.=179, P=0.027) but not in Nairobi. In Oklahoma City, individuals with PTSD averaged 6.3 (s.d.=4.3) injuries and those without PTSD reported 4.9 (s.d.=3.7) injuries. Death or injury to a family member or friend in the bombing (reported by 77% of people with and 61% of those without PTSD) was associated with PTSD in Oklahoma City (χ^2=4.64, d.f.=1, P=0.031) but not in Nairobi. Post-traumatic stress disorder was not predicted in either site by having thought one would die in the bombing, witnessing injury and death, or family history of mental illness.

People in Nairobi who attended religious services weekly were less likely than less frequent attenders to experience post-disaster PTSD (34% *v.* 50%; χ^2=5.60, d.f.=1, P=0.018) and major depression (11% *v.* 28%; χ^2=9.02, d.f.=1, P=0.004). Frequency of church attendance was not associated with PTSD or major depression in Oklahoma City.

Symptoms of PTSD

Nairobi bombing survivors had significantly more bombing-related symptoms than the Oklahoma City bombing survivors (Table 5). The most commonly reported symptoms were being jumpy or easily startled, intrusive memories, insomnia and poor concentration, each reported by 75% or more of the two samples considered. The least prevalent PTSD symptom was psychogenic amnesia for the bombing, especially in Nairobi. The majority of participants in both sites met DSM–IV PTSD criteria B and D, but far fewer met criterion C. Of those with three or more criterion C symptoms, 84% of the Nairobi sample and 86% of the Oklahoma City sample met the full criteria for PTSD.

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Table 5 Post-traumatic stress disorder symptoms

	Men		Women	
	Nairobi (n=99)[1]	Oklahoma City (n=88)	Nairobi (n=128)[1]	Oklahoma City (n=94)
Group B symptoms				
Prevalence: % (n)				
Intrusive memories***	91.0 (81)	55.7 (49)	97.4 (110)	79.8 (75)
Dreams or nightmares***	67.4 (60)	31.8 (28)	89.4 (101)	70.2 (66)
Flashbacks (**women, ***men)	68.5 (61)	34.1 (30)	73.9 (82)	52.1 (49)
Upset by reminders***	75.3 (67)	29.6 (26)	85.0 (96)	57.5 (54)
Physiological reactivity (*men)	48.9 (43)	34.1 (30)	58.4 (66)	55.3 (52)
Meets criterion B (***men)	87.9 (87)	65.9 (58)	91.4 (117)	91.5 (86)
Number of symptoms: mean (s.d.)***	3.4 (1.5)	1.9 (1.8)	4.0 (1.1)	3.1 (1.6)
Group C symptoms				
Prevalence: % (n)				
Avoids thoughts or feelings (*women, **men)	65.2 (58)	40.2 (35)	74.6 (82)	55.3 (52)
Avoids reminders (*men)	51.7 (46)	29.6 (26)	72.1 (80)	43.6 (41)
Psychogenic amnesia	2.3 (2)	8.0 (7)	7.4 (8)	16.0 (15)
Loss of interest	47.2 (42)	33.0 (29)	55.0 (61)	51.1 (48)
Detachment or estrangement (*women)	30.7 (27)	34.1 (30)	31.2 (34)	44.7 (42)
Restricted range of affect (*men)	23.6 (21)	11.4 (10)	21.8 (24)	13.8 (13)
Sense of shortened life (*men, **women)	27.3 (24)	12.5 (11)	42.7 (47)	24.5 (23)
Meets criterion C (*men)	42.7 (42)	27.3 (24)	51.6 (66)	44.7 (42)
Number of symptoms: mean (s.d.)	2.4 (2.0)	1.7 (1.8)	3.0 (2.0)	2.5 (1.9)
Group D symptoms				
Prevalence: % (n)				
Insomnia (*men, **women)	79.8 (71)	58.0 (51)	98.2 (97)	77.7 (73)
Irritability or anger (*men)	60.7 (54)	44.3 (39)	69.1 (76)	58.5 (55)
Difficulty concentrating	69.7 (62)	69.3 (61)	81.8 (90)	86.2 (81)
Hypervigilance***	86.5 (77)	35.2 (31)	90.8 (99)	62.8 (59)
Jumpy or easily startled (*men, ***women)	85.4 (76)	65.9 (58)	96.4 (107)	87.2 (82)
Meets criterion D (*men)	84.9 (84)	72.7 (64)	87.5 (102)	90.4 (85)
Number of symptoms: mean (s.d.) (**women)	3.8 (1.4)	2.7 (1.7)	4.2 (1.2)	3.7 (1.3)

*$P<0.05$, **$P<0.01$, ***$P<0.001$.
1. Owing to missing data, sample sizes for some variables were less than the total sample sizes. Further details available from the author upon request.

DISCUSSION

Inconsistent research methodology has hindered comparison of the mental health effects of terrorist attacks within the USA, and similar comparisons between different cultures internationally remain virtually non-existent. Further, few studies have systematically assessed psychiatric diagnosis following terrorist attacks. This study breaks new ground in using consistent methodology to provide cross-cultural comparison of diagnostic findings after two separate bombing incidents on different continents.

A recent study of an African sample seeking medical treatment (Carey *et al*, 2003) using a similar diagnostic instrument found higher lifetime rates of PTSD (46% in women and 42% in men) than in the current study, but rates of lifetime non- disaster trauma were higher (94%) than those described in the Nairobi sample. These differences may relate at least in part to differences in the populations studied. A recent African study (Seedat *et al*, 2004) of adolescent schoolchildren found that approximately 85% of both South African and Kenyan children had exposure to one or more traumatic events, but the rate of PTSD was much higher in South Africans (22%) than in Kenyans (5%), possibly relating to cultural biases of the 20% Black South African sample and the 97% Black Kenyan sample.

Pre-disaster comparisons of the two populations

Similarities and differences in psychiatric effects of the bombings in Nairobi and Oklahoma City may relate to pre-existing characteristics of the communities and specifics of the two attacks. Both bombings targeted US government buildings situated in busy downtown areas on weekday mornings at the start of the working day. The population of Nairobi (3 million) is larger than that of the greater Oklahoma City metropolitan area (1 million). An important difference between these two settings is economic: the World Bank ranks Kenya among the poorest countries in the world and the USA as the richest (World Bank, 2002). Based on reports that mental disorders are associated with economic hardship (Lynch *et al*, 2000) and poverty (Ludermir & Lewis, 2000; World Health Organization, 2001), a higher prevalence of mental health problems might be anticipated in the exposed population in Nairobi compared with its Oklahoma City counterpart. The higher numbers of deaths (213) and injuries (approximately 5000) sustained in the bombing in Nairobi compared with Oklahoma City (168 deaths and around 600 injuries) would further predict more serious psychiatric sequelae in Nairobi compared with Oklahoma City.

Despite their geographical separation by nearly half a world, the Nairobi and Oklahoma City populations and their mental health responses to the experience of bombing were remarkably similar. Many of the demographic and psychiatric characteristics of the Oklahoma City and Nairobi bombing survivors were comparable both before and after the respective disasters. Additionally, both samples reported an 87% injury rate in the bombings. Similarities among the bombing survivor groups are more remarkable considering the disparate economic status of the two countries, and the greater scope and magnitude of the Nairobi bombing compared with the Oklahoma City bombing in terms of reported deaths and injuries, loss of loved ones, perceived threat to life and limb in the bombing, the less organised

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rescue and recovery effort, and the less sophisticated emergency medical infrastructure in Nairobi.

Post-disaster comparisons of psychopathology

The prevalence and presentation of characteristics of PTSD were remarkably consistent in the two sites. The sites also demonstrated similarities in PTSD-related functional impairment and non-PTSD diagnoses (except that alcohol use disorders were less prevalent in Nairobi). In both sites significant predictors of PTSD were a pre-disaster history of psychiatric disorder and female gender, and PTSD was usually comorbid with another disorder. The majority in both samples met DSM–IV PTSD criteria B and D, but criterion C was less often endorsed. Nearly 90% of the survivors interviewed in both sites who met criterion C also met the full diagnostic criteria for PTSD, suggesting the potential for the use of this group of symptoms as a screening tool to identify people with a high likelihood of developing PTSD and to direct them to more intensive psychiatric care. The replication of this finding from the Oklahoma City bombing study in the Nairobi bombing study suggests the potential for its international application.

Major depression showed similar consistency between the sites in both men and women, although the gender difference failed to meet statistical significance in Nairobi. General population research has found the prevalence of major depression in Africa comparable to rates elsewhere (Vadher & Ndetei, 1981; Dhadphale *et al*, 1989), despite contradictory findings of earlier, less systematic studies (Carouthers, 1947). The female predominance of depression, well documented in the USA (Kessler *et al*, 1995; North *et al*, 1999), has also been observed in Africa (Abbott & Klein, 1979; Mitchell & Abbott, 1987; Seedat *et al*, 2004), although not universally (Dhadphale *et al*, 1983; Hollifield *et al*, 1994; Carey *et al*, 2003).

It has been postulated (Mitchell & Abbott, 1987) that women in Africa express mood-related problems in physical terms (somatisation) rather than as depression. The finding that the women in Nairobi had no higher rate of somatisation than women in Oklahoma City does not support this notion, although the higher rate of somatisation in Nairobi men compared with their Oklahoma City counterparts suggests that it might be more characteristic of African men. The equivalent pre-disaster rates of major depression in Oklahoma City and Nairobi women are further evidence against the expression of depressive illness as somatoform symptoms.

Coping and functioning

Although the prevalence and characteristics of psychiatric illness showed more similarities than differences in the two national samples, the participants' responses to the bombings revealed important differences. Treatment by a psychiatrist was not obtained by any Nairobi survivors in this study; in Oklahoma City, psychiatric treatment was more easily available. Support and debriefing groups and religious counselling were used by the majority of Nairobi survivors, but not by survivors in Oklahoma City. It has been independently noted that people in Kenya respond to trauma through religious means (Njenga, 2002). Although the majority of people in both sites coped without alcohol and medication, and most turned to family and friends for support in both settings,

CLINICAL IMPLICATIONS

- The post-disaster prevalence rates of post-traumatic stress disorder (PTSD) and major depression were remarkably similar in people directly exposed to bombings in Nairobi and Oklahoma City, and no new post-bombing alcohol use disorders developed in either site.
- Post-traumatic stress disorder criterion C was strongly associated with full PTSD in both sites.
- Mental health differences were more apparent in terms of social and treatment responses, with greater reliance on religion in Nairobi and more use of medical treatment, drugs and alcohol in Oklahoma City.

LIMITATIONS

- Methodological differences included inconsistent timing of the two research studies (4–8 months after the bombing in Oklahoma City and 8–10 months in Nairobi).
- Further refinement of measurement tools to reflect cultural differences is needed for international studies comparing the mental health effects of disasters.
- There is a lack of pre-disaster comparison data and unexposed comparison populations.

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coping with the help of alcohol and medication was more common in Oklahoma City, and coping through social and religious supports was more often seen in Nairobi.

Methodological issues

The strengths of this study were its consistent use of the same instrument, its diagnostic assessment approach with faithful adherence to diagnostic criteria, and random sampling implemented at both disaster sites. The study was limited by differences in the timing of the studies relative to the respective bombings (4–8 months in Oklahoma City and 8–10 months in Nairobi). Cultural response bias might have played a part in the comparison of Kenya and Oklahoma City samples. In particular, Africans may be less willing to disclose psychiatric symptoms compared with Americans.

The study lacked prospective pre-disaster data for measuring change after the bombing. However, pre-disaster data are virtually never available in disaster studies, and identifying uncontaminated but similar comparison groups is fraught with difficulty in disaster research (North & Pfefferbaum, 2002). Advances in research methods may allow future studies to overcome the difficulties encountered in this line of enquiry, enabling them to generate reliable pre-disaster data, comparison data and experimental data to address causal relationships.

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