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Is there an impact of global and local disasters on psychiatric inpatient admissions?

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Abstract *Background* Disasters of the magnitude of September 11, 2001 have a serious public health impact. By dominating media broadcasts, this effect is not limited to the site of the disaster. We tested the hypothesis whether such extraordinary burden results in an increase of psychiatric inpatient treatment. As such we analysed all psychiatric inpatient admissions in the Canton of Zurich/Switzerland. To test the influence of proximity to a disaster, we additionally analysed the impact of a local amok run on September 27, 2001. *Methods* Psychiatric inpatient admissions in the Canton of Zurich from September 2000 to September 2002 were analysed based on the data of the psychiatric case register. ARIMA modelling was employed to describe time-series of admissions per week over the 2-year period and to identify the impact of the incidents of 9/11 and 9/27, 2001. *Results* Mean numbers of weekly admissions were comparable in a time span of one month before and one month after the two incidents, thus, no significant changes were detected by the ARIMA modelling. *Conclusion* Against widespread beliefs, for patients with severe mental disorders requiring hospitalisation illness factors seem to play a more relevant role for decompensation than external psychosocial factors such as the described incidents.

Key words disaster · 9/11 · inpatient admission · psychiatric service use · mental illness

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Introduction

Disasters of the magnitude of September 11, 2001 have a serious and widespread public health impact. By dominating all media broadcasts, the attacks on the World Trade Centre and the Pentagon were despite the geographical distance ubiquitous and paralysed parts of public life worldwide. Previous research on trauma demonstrated that deleterious mental health consequences are not limited to those who experience the trauma directly (Dixon et al. 1993; Pfefferbaum et al. 2000; Terr et al. 1999). Furthermore, the degree of consequences is not simply predicted by the intensity of the direct exposure to or bereavement inflicted by the traumatic event. A wide range of feelings of sadness, anger, anxiety and uncertainty may put individuals at risk for developing psychiatric symptoms, regardless of the personal involvement or the geographical proximity to the incident (Lee et al. 2002; Schlenger et al. 2002; Schuster et al. 2001).

The relationship between 9/11 and subsequent mental disorders is well documented. As such, community surveys in the US found significant posttraumatic stress symptoms in the general population after the attacks, most of whom were not escapees or the families of the deceased (Cardenas et al. 2003; Galea et al. 2002; Marshall and Galea 2004; Marshall and Suh 2003; Schuster et al. 2001; Silver et al. 2002). Mental health help hotlines experienced an increase of calls from individuals reporting posttraumatic stress symptoms, anxiety and panic attacks (Wunsch-Hitzig et al. 2002). A Canadian survey among war traumatised refugees in psychiatric treatment revealed a cross-cultural reactivation of their trauma (Kinzie et al. 2002). Those refugees previously diagnosed with PTSD reacted most intensely whereas those diagnosed with schizophrenia responded the least. Furthermore, in a sample of psychiatric and medical outpatients, Franklin et al. (2002) showed that psychiatric patients compared to medical patients were particularly vulnerable to develop traumatic stress

symptoms and were likely to seek professional help succeeding the terror attacks. However, Salib (2003) reported an opposed effect of 9/11. He analysed the suicide and homicide rate in England and Wales and found a brief, but significant inverse effect on suicide rates, but not on homicide rates.

To our knowledge, only one study examined the impact of the attacks on the utilisation of psychiatric services: Rosenheck and Fontana (2003) demonstrated that utilisation of Veterans Affairs Medical Centres providing in- and outpatient psychiatric treatment in the 40 largest US cities did not change after the attacks. However, no study so far analysed changes in the need for psychiatric treatment in Europe as a consequence of the attacks of 9/11.

On September 27, 2001, i.e. two weeks after the attacks in New York and Washington, Switzerland was shocked by a local disaster: In the Cantonal parliament of Zug, a lone gunman ran amok killing 14 people, most of them politicians, before turning the gun to himself. Zug is a small town of approximately 22,000 population, Capital of Switzerland's wealthiest Canton, known for low taxes and penchant for secrecy and safety, located half an hour from Zurich and socio-economically connected to Zurich. Investigators said that there was no link between the attack in Zug and the terror attacks in the United States in the same month. In terms of number of victims and relevance on global security, the two incidents are not comparable. From the local point of view, the two disasters were similar in causing uncertainty and dominating media and public life.

Due to the common cultural and economic background and based on the knowledge that geographic distance has no major influence on the individually perceived impact (Franklin et al. 2002) we hypothesise a possible effect of the disasters of 9/11 and 9/27 on psychiatric service use in Switzerland. Furthermore, we hypothesise a possible additive effect of the two disasters in series.

Inpatient admissions are considered to be a stable indicator for the need of professional help (Bürgy and Häfner-Ranabauer 2000; Giggs and Cooper 1987). Thus, we analysed the impact of the two disasters on the psychiatric inpatient admission rate in the Canton of Zurich in Switzerland from September 2000 to September 2002. This well-defined catchment area comprises a population of 1.2 million inhabitants accounting for approximately one sixth of the Swiss population.

Methods

■ Sample

Data were taken from the psychiatric case register that is containing basic information of all psychiatric inpatients in the Canton of Zurich. This catchment area includes seven general psychiatric hospitals each with regional responsibility. Cantons in Switzerland are responsible for the psychiatric inpatient treatment of their residents. Therefore, our data represent all psychiatric inpatient admissions occurring in the Canton of Zurich.

Overall, 13,347 inpatients were admitted during the observation period from September 2000 to September 2002. In our analysis we only included primary admission diagnoses from inpatients with psychiatric disorders in which in general an influence of external events on the course of the illness eventually can be expected, i.e. substance use disorders, psychotic and affective disorders, neurotic and stress induced, behavioural and personality disorders ($n = 12,195$, i.e. 91.4% of all admissions). Diagnoses were made by residents according to ICD-10 (1992) and confirmed by experienced consultants. Admission rates, a measure for treatment need, correspond to treatment episodes and do not differentiate between individuals admitted once or repeatedly.

■ Statistical analyses

For data analysis, ARIMA (Auto-Regressive Integrated Moving Average) modelling was employed to describe the time-series of inpatient admissions per week from September 2000 to September 2002. This statistical procedure aims at identifying patterns in the sequence of numbers over time that are inter-correlated, but balanced in time. For a detailed description of this procedure see McDowell et al. (1980) or Tabachnik and Fidell (2001). By means of ARIMA patterns in the data set were modelled by three steps: identification, estimation and diagnosis. Among others, time-series data can be examined for time trends or seasonal cycles, but also for the impact of an intervention (here: the 9/11 and 9/27 disasters).

In a first step, the most parsimonious model for the time-series of weekly admissions into psychiatric hospitals (dependent variable) from September 2000 to September 2002 was computed. The level of significance was set at 0.001. Secondly, the week of the terror attacks (week of 11 Sept 01–17 Sept 01) and the week of the amok run (week of 24 Sept 01–30 Sept 01), respectively, were added as "intervention" variables to the model in order to test the effect of these variables on the dependent variable. To that purpose, the incidents of 9/11 and 9/27, respectively, were coded as dummy variables. These variables were defined as "1" for the "intervention" week (11–17 Sept 01 or 24–30 Sept 01, respectively) and as "0" for the period before and after this week. Thirdly, ARIMA-models for the time-series of weekly admissions into psychiatric hospitals (dependent variable) from 9/00–9/02 were computed for a) the patient sample considered (ICD-10 F1-F6, $n = 12,195$), and separately for patients with b) schizophrenia or schizophrenia like disorders (ICD-10 F2, $n = 3185$), c) affective disorders (ICD-10 F3, $n = 2596$) and d) neurotic, stress related, e.g. PTSD or somatoform disorders (ICD-10 F4, $n = 2120$).

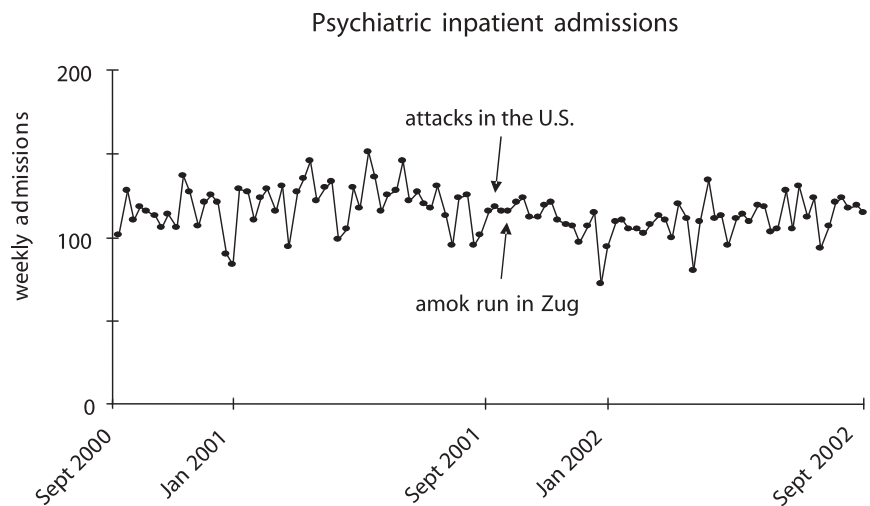
In addition, demographic data of the patients at the time of the two incidents (September 2001) were compared with the demographic data of the patients during the same month one year before the attack and one year after the attack (September 2000 and September 2002). Analysis of variance and Scheffé post hoc tests for continuous and χ^2 -tests for dichotomous variables were calculated.

Results

Mean numbers of weekly inpatient admissions were comparable in a time span of one month before and after the incidents (mean = 113.8 admissions/week; SD = 9.7) (Fig. 1). No specific peak could be found in the week of the terror attacks (number of admissions: 118) nor in the week of the local amok run (number of admissions: 116).

Results of the ARIMA modelling are shown in Table 1. ARIMA modelling of weekly admissions revealed a (0, 1, 1) (1, 1, 0)₄ seasonal model. To achieve stationarity and remove trends, the time series was differenced once and transformed by natural logarithm. To account for seasonal non-stationarity, it was also necessary to subtract the time series seasonally. The seasonal

Fig. 1 Weekly inpatient admissions to psychiatric hospitals in the Canton of Zurich/Switzerland are shown from September 2000 to September 2002. No change in admission numbers is seen after the terror attacks on September 11, 2001 and after the local amok run on September 27, 2001



cycle length was 4 weeks. The final model contained a moving average parameter and a seasonal autoregressive component. In the model, the Ljung-Box Q-test statistics for the residuals revealed no significant spike within the first 12 lags, and goodness of fit (Akaike information criterion, Akaike 1987) was adequate (data not shown, but on request with the authors), thus the model could be accepted. In a next step, the intervention components (the week of the terror attack [1] and the week of the local amok run [2], respectively) were added to the model. Results did not show a significant model improvement (see Table 1).

No changes were found in the computed diagnostic subgroups (ICD-10 F2-F4) (data not shown, on request from the authors), in particular no increase of admission due to stress related disorders (ICD-10 F4).

Comparisons of demographic variables of the patients at three different time points are shown in Table 2. No significant changes were found.

Table 1 ARIMA modelling of weekly admissions from September 2000 to September 2002 with two intervention components, i. e. the terrorist attack of 9/11 in the United States and the local amok run of 9/27 in Zug/Switzerland

ARIMA model (0,1,1) (1,1,0) ₄	Residual variance	Estimate	Standard error	T-ratio	p
Parameter	0.018				
Θ_1		0.99	0.19	4.99	0.000
Φ_1		-0.49	0.09	-5.78	0.000
With intervention component 1 (September 11, 2001)	0.018				
Θ_1		0.99	0.14	6.94	0.000
Φ_1		-0.49	0.09	-5.76	0.000
c		-0.06	0.11	-0.55	ns
With intervention component 2 (September 27, 2001)	0.018				
Θ_1		0.99	0.11	9.48	0.000
Φ_1		-0.49	0.09	-5.85	0.000
c		0.12	0.11	1.08	ns

Θ_1 moving average parameter; Φ_1 autoregressive component; c estimate of impact of the intervention component

Discussion

To summarise, there was *no impact* on psychiatric inpatient admissions in the Canton of Zurich/Switzerland due to the two disastrous incidents in September 2001, the terrorist attacks of September 11, 2001 in the United States and a local amok run in Zug/Switzerland on September 27, 2001. This holds similarly true for different diagnostic groups of mental illness such as psychotic, affective, neurotic and stress-induced disorders (diagnoses according to ICD-10).

Comparison with the literature

Regarding the *literature on 9/11*, our results are in line with a previous study performed in the US by Rosenheck and Fontana (2003). Although these authors studied changes in utilisation also of outpatient services,

Table 2 Comparisons of demographic variables of the patients at three different time points from September 2000 to September 2002

Demographic variables	September 2000 (n = 500)	September 2001 (n = 483)	September 2002 (n = 514)	F	p
Age (years): Mean \pm SD	39.6 (\pm 14.9)	40.3 (\pm 14.6)	39.5 (\pm 14.6)	0.47	–
				χ^2	p*
Gender: Female	250 (50%)	215 (45%)	259 (50%)	2.97/3.5	–/–
Nationality: Swiss	387 (79%)	377 (80%)	389 (78%)	0.35/0.64	–/–
Marital status: Single	388 (78%)	384 (81%)	404 (80%)	0.23/0.22	–/–
Employment: None	335 (67%)	341 (71%)	372 (73%)	1.48/0.52	–/–

* Comparisons reported for group 1 versus group 2; group 2 versus group 3

they found no impact of the terror attacks on psychiatric service use either. Regardless of the geographical distance, the need for psychiatric in- or outpatient treatment seems not to be influenced by a disaster such as the terrorist attacks of 9/11 or a local amok run such as the disaster in Zug of 9/27.

Nevertheless, a severe psychological impact on the population is documented. This was shown by several studies from the US which found marked stress responses in community surveys (Cardenas et al. 2003; Franklin et al. 2002; Galea et al. 2002; Marshall, Galea 2004; Schlenger et al. 2002; Schuster et al. 2001; Silver et al. 2002) and an increased use of mental help hotlines (Wunsch-Hitzig et al. 2002). These studies also revealed that emotional concerns about the disaster as well as the hours spent watching television are major risk factors for developing stress related symptoms independent of proximity to the site of danger.

Beyond the literature specifically dealing with these attacks, the *general psychiatric literature* discusses the influence of mass media on mental health and on public beliefs. Our results could not confirm the opinion often expressed in the media that the terrorist attacks and other man-made disasters would lead to an increased need in psychiatric treatment, particularly inpatient treatment.

Mass media often express lay opinions concerning causes of psychiatric illnesses (Gaebel et al. 2002; Lauber et al. 2003 b). A Swiss survey revealed that general population mainly holds a psychosocial illness model identifying external, i. e. psychosocial reasons as causes for mental disorders (Lauber et al. 2001, 2002, 2003 a). Therefore, it does not surprise that this widely held opinion is also applied to a possible impact of the terrorist attacks or the amok run on psychiatric morbidity and in consequence on psychiatric service use, whereas the negative results of our analysis rather point to traditional illness models that do not assign significant importance to external causes for mental illness but which consider endogenous factors to be critical. However, it is evident that the distress due to these two man-made disasters did not reach the threshold of clinical relevance.

■ Limitations of this analysis

We would like to acknowledge some limitations of our study:

- Service use is an imperfect proxy for psychological distress. Low threshold symptoms do not lead to inpatient admission.
- The reported data reflect only the temporal relationship of the number of admissions. In addition, diagnosis does not contain information about the reason for treatment. However, given the fact that there were no significant changes in admission rates in total as well as with respect to diagnostic subgroups, there is no evidence of any change in admissions caused by the two incidents.
- Given that there exists only one psychiatric case register in Switzerland, the one from the Canton of Zurich, there are no local data of the Canton of Zug. Nevertheless, the Zurich situation is a good proxy for the situation in Zug because the two Cantons are situated next to each other and are socio-economically connected.
- We only report data of psychiatric inpatient admissions whereas outpatient consultations are not considered in our analysis as being not available. But we would not expect a change in the rate of outpatient service utilisation either because the respective services in the US did not show any changes after the attacks (Rosenheck and Fontana 2003).

Conclusion

Against widespread beliefs, for patients with severe mental disorders requiring hospitalisation illness factors are probably more relevant for decompensation than external psychosocial factors such as the described incidents.

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