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DO EARTHQUAKES INCREASE SUICIDE RATE?

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Anomia- a state of "normlessness." Typically, the condition exists in times of rapid social change, when existing rules, habits, and beliefs no longer hold and alternatives have yet to arise. Durkheim coined the term to describe a type of suicide that he associated with the loss of a particular way of life. (Source: Encyclopedia of Death and Dying).

*Anomic suicide***-** Durkheim stated that economic crisis could lead to personal crises for individuals who once thought of themselves as important providers for their families, but when confronted with persisting unemployment found themselves evicted from their homes, their credit rejected, and prospects for improvement dim. If these individuals and their friends were accustomed to thinking of poor people as responsible for their circumstances, then they found themselves condemned by their own categories of thought. Faced with humiliation and a lack of connection with groups who might ease their self-doubts, such individuals might commit anomic suicide. (Source: Encyclopedia of Death and Dying).

Emile Durkheim (1858-1917) - is considered by many to be the father of sociology. Durkheim's four major works, including: The Division of Labor in Society (1893), The Rules of Sociological Method (1895), Le Suicide (1897), The Elementary Forms of the Religious Life (1912). But one of Durkheim's most influential books is a detailed study of suicide. When it was published in 1897, *Le Suicide* not only changed the way in which suicide was understood, it fundamentally transformed the way sociological research was subsequently conducted. (Source: Encyclopedia of Death and Dying).

Earthquake- a violent shaking of the Earth's crust that may cause destruction to buildings and results from the sudden release of tectonic stress along a fault line or from volcanic activity. (Source: MSN, Encarta Dictionary).

Suicide- the act of intentional taking of one's own life. (Source: Britannica Concise Encyclopedia).

Abstract (in English).

Objective: An earthquake is a terrible event, which implies large and sudden destruction of human lives and properties at the community and individual levels. As a result of severe consequences following earthquakes, the suicide rate may increase. On the other hand, an earthquake may carry a relatively similar impact to that of a war and may lead to decrease of suicide rates. Therefore, we conducted a literature review to clarify whether earthquakes increased suicide rate.

Method. All the articles associated with earthquake and suicide published between 1980 and 2010 were analyzed. *Keywords* that were used: psychiatry, mental health, suicide, psychological distress, depression, posttraumatic stress disorder (PTSD), earthquake, natural disasters. 9 articles investigating 4 different cases of earthquakes were analyzed.

Results. The researchers found an increase in the suicide rate after the earthquake in Taiwan in 1999. Also the upslope of suicide rates was found in a review of 4 earthquakes in USA. On the contrary, in Japan, following the earthquake in 1995 in Kobe and Niigata-Chuetsu earthquake in 2004, the suicide rates decreased, supporting the same findings after Northridge earthquake of 1994.

Conclusion. We found that there were not enough evidences to prove that earthquake caused the excess mortality due to suicide. Thus, we concluded that earthquakes do not increase suicide rate.

Abstract (in French).

Les objectives. Le tremblement de terre est un évènement terrible, qui provoque une destruction massive et soudaine de vies humaines et de biens au niveau communautaire et individuel. Une des conséquence d un tremblement de terre peut etre une augmentation du taux de suicide . D'un autre côté, les tremblements de terre peuvent avoir un impact similaire a celui d'une guerre et peuvent entrainer un déclin du taux de suicides. Ainsi, nous avons realisé une revue de littérature afin de montrer si les tremblements de terre sont responsables d'une augmentation du taux de suicides.

La méthodologie. Tout les articles publiés entre 1980 et 2010 et ayant pour thèmes les tremblements de terre et les suicides ont été analysés. Les mots clés utilisés pour nos recherches sont les suivants: la psychiatrie, la santé mentale, le suicide, le trouble psychologique, la dépression, le stress post-traumatique (PTSD), le tremblement de terre, les désastres naturels. Neuf articles qui analysent quatre cas différents de tremblements de terre ont été analysés.

Les resultats. Les chercheurs ont constaté l'augmentation de taux de suicides après le tremblement de terre à Taiwan en 1999. Un autre exemple est l'augmentation du taux de suicides constatée dans l'analyse de 4 tremblements de terre aux Etats-Unis. Contrairement, au Japon, le taux de suicides a diminué après les tremblements de terre de 1995 à Kobe et à Niigata-Chuetsu en 2004. Les mêmes resultats ont été obtenus lors de l'étude du tremblement de terre à Northridge en 1994.

La conclusion. Nous avons trouvé qu'il n'y avait pas assez d'évidence pour prouver que les tremblements de terre peuvent causer une mortalité excessive. Ainsi, on peut conclure que les tremblements de terre ne sont pas susceptible d'augmenter le taux de suicides.

Introduction.

Earthquake is a terrible event, which implies large and sudden destruction of human lives and properties at the community and individual levels. Recently three major such events happened in Haiti, Chili and China, illustrating the amplitude of this type of catastrophe. The consequences, such as bereavement, property loss, disruption of social networks have been associated with mental health problems, mainly depression, substance misuse and post-traumatic stress disorder which are known risk factors for suicide (1). According to a recent Lancet review on suicide, earthquakes are followed by an increase of suicide rates (2). Moreover, in the aftermath, social stressors may appear such as quarrels among families regarding sharing the financial burden of rebuilding the houses, the poor control of mental disease owing to the disorganized health systems, the lack of social and financial support during the harsh rebuilding process, the powerlessness, and the frustration caused by regarded as a slow bureaucracy that made people commit suicide through weakening social bounds and increasing anomia which according to Durkheim theory influence suicide.(3,4)

On the contrary, other dramatic event such as war has been associated with a decline in suicide rates. (2). All age male and female suicide rates decreased in Scotland during World War II (5). A marked drop in suicide rate, particularly among men, was found during and after the war in Sri-Lanka 1980-1989 (6). In 1993 Lester also reported the lower suicide rates in France during years of war than during years of peace (1826-1913) (7). Again one of theoretical explanations was supported by Durkheim theory, which stated that increase of social cohesion lowers the suicide rates, if one considers that war made such effect (4).

In this respect earthquakes by carrying a relatively similar impact to that of a war, may also lead to decrease of suicide rates. As a matter of fact, some studies have shown a decrease of suicide rates (11-15) and causes controversy on the effect of earthquakes on suicide rates, if any, as well as the direction of the social influence hypothesized by Durkheim.

In order to clarify the issue, we propose to carry out a literature review on the topic of suicide and earthquake.

Methodology.

We searched for articles and studies on the topic of suicide after the earthquake. Unfortunately, thus far, there has been a paucity of studies conducted in this field. Moreover, to clarify the issue, we discussed our questions with the authors of the articles through electronic mail and telephone. We were in conference with Professor Andrew Cheng from Taiwan, who is studying earthquakes and its psychiatric consequences on people for many years. Also, Professor Sharon Schwartz made a professional annotation in order to clarify the understanding of the epidemiological background.

Data sources. We used library databases such as PUBMED, BIBLIOINSERM, and BIBLIOTEQUE PARIS DESCARTES: SCOPUS database. All the articles associated with earthquake and suicide published between 1980 and 2010 were analyzed. *Keywords* that were used during the research process are: psychiatry, mental health, suicide, psychological distress, depression, posttraumatic stress disorder (PTSD), earthquake, natural disasters.

9 articles on suicide and earthquake: 5 articles investigating the Taiwan earthquake of 1999, 2 articles observing Niigata-Chuetsu and Great Hanshin-Awaji earthquakes in Japan, and 2 articles describing the studies on Northridge and other earthquakes in Los-Angeles County.

Results.

1. Chi-Chi earthquake of 1999 in Taiwan.

A devastating earthquake rating 7.3 on the Richter scale hit central Taiwan in the early morning of 21 September, 1999. This earthquake is also known as the Chi-Chi earthquake or 9-21 earthquake devastated areas included the counties of Taichung, Nantou and Yunlin, with Nantou County taking the worst punishment (8). It was the biggest earthquake since 1935, killing more than 2400 people, injuring another 11000, and destroying 105000 houses (8). For the survivors, the earthquake aftermath was a dramatic life event. Causal pathways, leading from trauma to psychological consequences upon the death of a spouse or a child, increase physical and emotional stress and grief, the loss of social network, and the diminishing of material support, resulting directly or indirectly from traumatic events may increase the incidence of mental illness, and lead to suicidal ideation or suicides (8).

Chou YJ et al (2003) conducted the research on the basis of individual-level population data to follow up on victims of the 1999 Taiwan earthquake to observe actual occurrences of suicides. National Health Insurance Files, family registrations and death certificates from 1998 to 2000 of the population of Taichung metropolitan area were used as data sources. The Taichung metropolitan area is the largest region in central Taiwan where 22 municipalities have been struck by earthquake and 46 municipalities were virtually unaffected. Therefore, these 22 municipalities are referred to in this study as the affected area, and the other 46 are defined as the unaffected area i.e. control for pre-post area level comparison (8).

The Bureau of National Health Insurance (BNHI) issued quake cards to 301 327 individuals among the 3 432 705 residents who lost co-resident family members, were injured, or experienced property damage (8). The ‘quake card’ recipients are referred to in this study as victims. Hence, the remaining population is referred to as non-victims, and serve as the control group for the individual-level comparison in this study (8).

This study observed that victims had 1.71 times higher risk of committing suicide than non-victims. People in the affected area had 1.31 times higher risk of committing suicide than in the unaffected area (8).

However, after adjusting for residential and affected status, gender, age, pre-quake major disease status, pre-quake physical disability status, pre-quake SES, and level of urbanization, victims still had a 1.46 times greater risk of committing suicide that non-victims (Table 1)(8).

Table1. Multivariate logistic regression of risk factors for suicide in central Taiwan, November1999- December 2000

Detail	Odds ratio	95% CI
Victim status		
Non-victims	1.00	
Victims	1.46	1.11, 1.92
Residential area		
Unaffected area	1.00	
Affected area	1.13	0.93, 1.37
Gender		
Men	1.00	
Women	0.50	0.42, 0.60
Age		
15–24	1.00	
25–34	4.43	2.81, 6.98
35–44	5.02	3.20, 7.88
45–54	6.59	4.19, 10.38
55–64	9.56	5.98, 15.29
⩾65	10.11	6.46, 15.84
Ethnicity		
Non-Aborigine	1.00	
Aborigine	1.05	0.41, 2.70
Pre-quake major diseases status		
None	1.00	
Non-mental diseases	2.10	1.28, 3.44
Mental diseases	7.84	5.00, 12.30
Pre-quake physical disability status		
None	1.00	
Mild	1.17	0.55, 2.47
Moderate	1.86	1.16, 2.97
Severe	1.01	0.54, 1.87
Pre-quake SES[a]		
⩾NT$40 000	1.00	
NT$20 000 ~ NT$39 999	0.80	0.49, 1.33
<NT$20 000	2.19	1.42, 3.40
Farmers & fishermen	1.77	1.13, 2.77
Local office enrollees	2.98	1.91, 4.64
Other branch enrollees	2.21	1.41, 3.48
Urbanization		
City	1.00	
Municipality	1.28	1.02, 1.61
Rural municipality	1.14	0.93, 1.41
Aborigine municipality	1.62	0.87, 3.03

In the year 2005, another paper investigating 9-21 earthquake has been published. Yang et al conduct a population-based study stratifying the population of the quake-affected municipalities into high-exposed and population of less-affected municipalities into low-exposed groups (9). The demographic characteristics of the two groups were comparable and the only factor that differed between them was the intensity of earthquake damage. The study finding was an increase of the mean monthly suicide rate for the exposed group by about 42% during the 27 months following the earthquake as compared to the average for the entire observation period (72 months). About 98% of the increased suicides among the severely quake-affected population occurred during the first 10 months following the earthquake, and the suicide rate fell to pre-quake rates after 10 months (9).

The next article was published in 2008 by Yung-Po et al. Results of the study were significant for 45-64 male age groups in the two affected townships (10). Those townships Kaoshiung and Puli took second and fourth place among the most affected townships. It is notable that suicide rates in Chugliao and Chichi- the first and third most damaged townships, did not increase after the earthquake (10).

The last article was published in the British Journal of Psychiatry in 2009. Paul Yip et al have found out that the female suicide rate more than doubled immediately from 6.1 in 1998 to

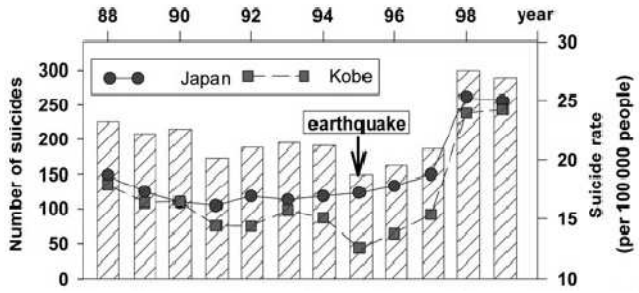
14.2 in 1999. The male suicide rate showed substantial increase in both 2000 and 2001, indicating a delayed effect (11).

2. Great Hanshin-Awaji earthquake in Kobe city, Japan, 1995

On January 17, 1995 at 5.46 am, a devastating earthquake measuring 7.2 on the Richter scale shook the city of Kobe, Japan, leaving 3 879 people dead, more than 13 000 severely injured, 54 000 houses completely or partially destroyed, and 230 000 people were displaced from their homes (12). For the citizens of Kobe, this earthquake was certainly a very notable stress and an adverse life event (12).

Akihiro Nishio et al. in their study have collected data on suicide during the 84 months before and 60 months after the earthquake and compared the suicide rate in Kobe to that in all of Japan. (Fig1) (13).

Figure1. Comparison of annual and monthly suicide rates (per 100 000) between Kobe and Japan as a whole. The upper and lower parts of the figure represent the annual and monthly changes in the suicide rate per 100 000 people in Kobe and Japan, covering 12 years, respectively. The arrow shows the point when the Great Hanshin-Awaji earthquake occurred. The twelve columns show the total number of suicides in each year, respectively.



The suicide rate was lower for the two years following a devastating natural disaster (Fig1). Moreover, this study shows that middle-aged and elderly males had a significant decrease in the 24 months following the earthquake, while the female suicide rate did not change significantly (13).

The same results demonstrate the second study (12); the male suicide rate was significantly reduced in 1995, whereas the female was not significantly different.

3. Niigata-Chuetsu earthquake in Japan of October, 2004

A large earthquake, with seismic intensity of 7 on the Japan Meteorological Agency's intensity scale, jolted mid-Niigata-Chuetsu Prefecture on October 23, 2004 (14). The earthquake occurred in a rural mountainous area and caused a significant ground disaster leading to a great deal of damage, traffic and communication network disruption (14).

Keiko Hyodo et al. in 2010 have published a paper investigating the Niigata-Chuetsu Earthquake. Death certificates were used in this study as a data source. The most damaged Chuetsu region composed of 12 municipalities as disaster area was compared with the control area represented by municipalities outside the disaster area in Niigata Prefecture before and after the earthquake (14).

The findings of the study present that the decrease in suicide mortality rate during 3 years following the earthquake was significantly higher in the disaster area than in the control area (2.5 vs 1.0) in men, whereas the decrease in suicide mortality rate was 2.1 in the disaster area and 3.0 in the control area in women (14). So, the authors concluded that the long-term mortality from suicide after the earthquake decreases in men and increases in women, suggesting that post-quake suicide mortality is sex-dependent (14).

4. Northridge earthquake of January, 1994 in Los-Angeles County

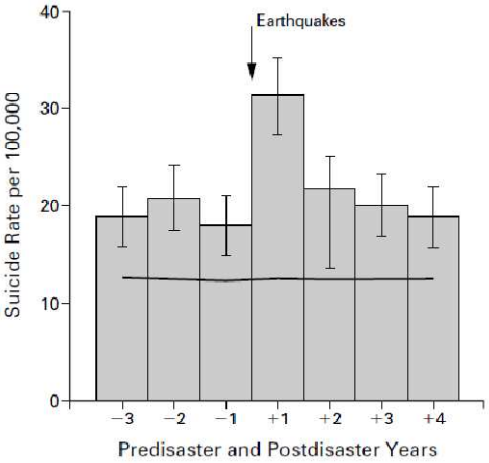
A study done by Kimberly Shoaf et al. investigates the Northridge earthquake in Los Angeles County that occurred on the 17th of January, 1994. The authors used death certificates to obtain data on suicide mortality, and they compared the difference in rates for 1993 with 1994 and for three-year periods (1991-1993 vs. 1994-1996) before and after the earthquake (15). The results of the study show the decrease in suicide mortality rate in the three years following the earthquake. Moreover, the study finds variation by gender and ethnicity. Males and non-Hispanic whites have the highest rates of suicide (15).

On the contrary, Krug et al have reviewed 4 earthquakes in 4 counties of the western United States from 1982 to 1989 and have found a significant increase in suicide rates for both sexes and for all age groups from base line during the first year after the earthquake (1).

Krug G. et al. in their article “Suicide after natural disasters” describe the research of suicide mortality rates in the US after different natural disasters including earthquakes. The authors narrowed the period for disasters to the years 1982 through 1989 to allow for a three-year base-line period for disaster that occurred in 1982 and the four-year follow-up period for disasters that occurred in 1989 (1). The final list consisted of 377 counties affected by a single disaster; among them, 4 counties were affected by earthquakes. County-specific monthly numbers of suicides from 1979 to 1993 were obtained from the National Center for Health Statistics Multiple Cause of Death Data File (1). The rate in the affected areas was compared with the whole USA rates (1).

The finding of the study shows the increase in suicide mortality rate from baseline during the first year after the earthquake, after which the rate returned to baseline level (fig 2) (1).

Figure2. Suicide rates before and after earthquakes in four counties and the United States, 1979 to 1989. The gray bars represent county rates, and the I bars represent the 95 percent confidence intervals for these rates. The black horizontal curve represents the rates for the United States as a whole. The earthquakes occurred between 1982 and 1989.



Discussion.

After having studied the content of articles, the impact of disaster on suicide rate remains unclear because the findings of the studies reviewed are contradictory. Table 2 (see appendix1) specifies the name of the earthquake under investigation in each study. Geographical data of the affected areas, data source, comparative groups and follow-up period are presented, synthesizing the methods and results.

1. **Chi-Chi earthquake of 1999 in Taiwan.**

Chou YJ et al (2003) showed that men, elderly people, individuals with pre-quake mental disease status, population of pre-quake low socio-economic status are at a higher risk for suicide after the earthquake (Table1) (8). However, in most countries, rate of suicide is higher in males than in females, in elderly people than in young, in unemployed people, and in individuals with low physical and psychiatric health status (2). Thus, these groups of people are vulnerable and are at higher risk for committing suicide even without earthquake (2).

Also, in the research of Chou YJ et al (2003), stratification into victims and non-victims (8) has no scientific basis. Earthquake exposed everyone in the affected area regardless of whether their houses had been destroyed or their families injured or killed (3). Non-victims also suffered from the inconveniences resulting from the destruction of public goods or loss of close friends and neighbors (3). Therefore, everyone experienced the earthquake but to different extents. Therefore, individual-level epidemiological studies can identify the causes that distinguish individuals within the population (3,16). For example, are people who have lost their property due to the earthquake at a higher risk for committing suicide or not? But if the question is the cause of an increase in suicide rates or differences in the suicide rates between populations, we need to compare people in the city that had the earthquake with those in a similar city who did not experience the earthquake. Hence, the researchers using an inter-individual comparative method commit a type III error, i.e. providing a right answer for the wrong question (16). Consequently, there were factors other than earthquake resulted in the increased suicide mortality rates (3).

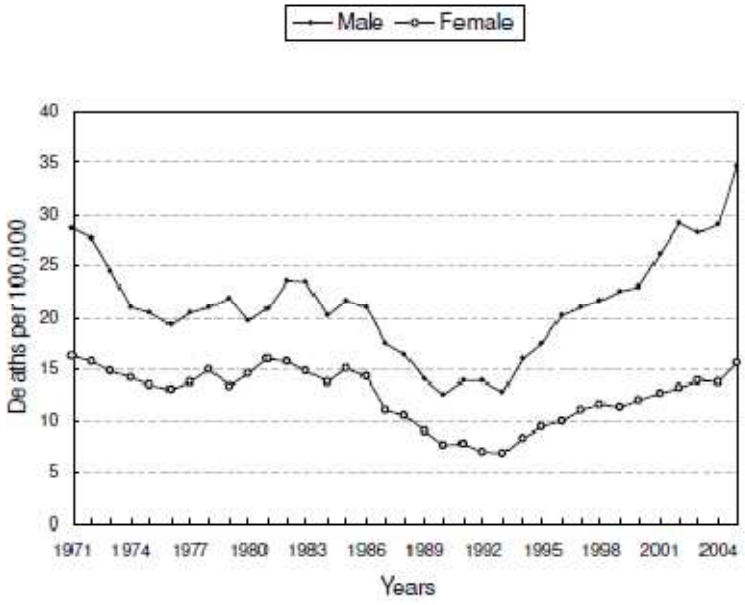
Moreover, the researchers conduct comparisons only within the bounds of the Taichung area with the most affected Nantou County. But it is possible that Nantou County was the area of Taiwan with high suicide rates before the earthquake (Table3) (11).

Table3. Suicide rate for Nantou County and Taiwan Region before and after the earthquake, 1999.

	Male		Female		Overall	
	Nantou	Taiwan	Nantou	Taiwan	Nantou	Taiwan
Suicide rate (per 100 000)						
1998	18.6	12.8	6.1	6.9	12.6	9.9
1999	19.0	13.7	14.2	6.8	16.7	10.3
2000	23.7	14.4	13.1	7.6	18.7	11.1
2001	33.6	16.6	11.2	8.0	22.9	12.4
Change when compared with 1998, %						
1999 *v.* 1998	2.32	6.64	131.92	−1.01	32.36	3.93
2000 *v.* 1998	27.57	12.81	114.01	9.84	47.55	11.68
2001 *v.* 1998	80.99	29.77	82.25	16.21	81.09	24.97

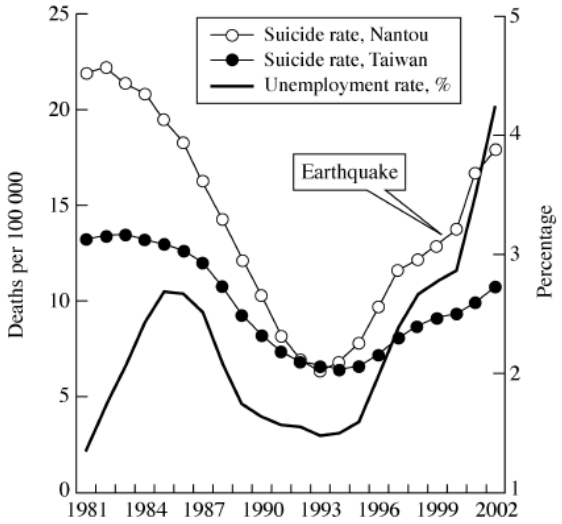
Furthermore, according to figure 3 (17), there is an increased suicidal trend in Taiwan for both males and females, particularly males. Hence, the increased post-quake suicide male's rate in Nantou could not be attributed only to earthquake.

Figure3. Age-adjusted suicide death rates by sex in Taiwan, 1971-2005.



Also, it is possible to assume that suicidal raise may be due to the Asian economical crisis which took place in the late 1990's (21). Consequently, crisis generates unemployment which in turn is one of the widespread ideations for suicides (Figure4) (3).

Figure4. Three-year moving average of age-adjusted death rate rom suicide, 1981-2001 in Taiwan and Nantou, the county most seriously damaged by the 1999 earthquake, and 3-year moving average of unemployment rate for Taiwan.

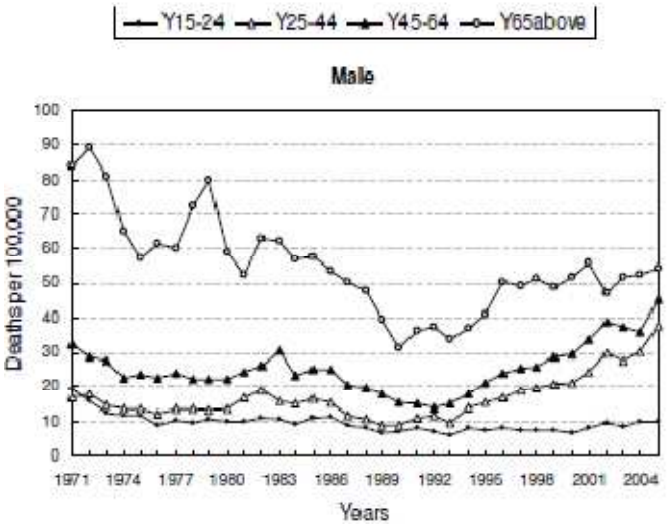


Moreover, it have been mentioned, that the suicide rates may increase 1 or 2 years following the earthquake (8-10). But in this case we may suspect that the population may start migration after the earthquake to the non affected areas. Thus, there can be an expectation that healthy people with middle or high socio economic status could move to another non affected area. Therefore, the greater part of the remaining population may consist of vulnerable people with physical or psychiatric disorders, misuse of alcohol or drugs, low socio- economic status, unemployment or people who are more predisposed to commit suicide. Unfortunately, there is no available data to prove this hypothesis.

Liaw YP et al (2008) have found a significant increase in suicide rates for the 45-64 male age group in the Kaoshiung and Puli, two affected townships (8). Those townships took second and fourth place among the most affected townships. It is notable that suicide rate in Chugliao and Chichi- the first and third most damaged townships, did not increase after the earthquake (8).

But after analysis of age-adjusted suicidal rate for males in the entire Taiwan Region, it is clear that the suicidal tendency for males age 45-64 was high. (Figure5) (17).

Figure5. Suicide mortality trends by sex, age and method in Taiwan, 1971–2005.



So, after all the evidence presented, we suppose that the raise in suicide rates in Nantou County may not be due to the earthquake as it was stated.

2. Great Hanshin-Awaji earthquake in Kobe city, Japan, 1995

Authors' findings reflect the reduction in total suicidal mortality rates (12,13). Many authors suppose that this reduction in suicidal rate was due to restricted access to the one of the most prevalent suicide method in Japan- jumping from height, which possibly prevented some potential suicide, as many high buildings collapsed during the earthquake (12,13).

Moreover, such devastating events as war can be associated with a decline in suicide rates (2). Thus, it is possible that the Kobe earthquake was a major disaster and carried an impact similar to that of a war (12). This may also explain the reduction in suicidal rates.

3. Niigata-Chuetsu earthquake in Japan of October, 2004

According to the main findings of Keiko Hyodo et al. (2010) study, suicide death rates in the disaster area decreased among men and increased among women (Table 4) (14). According to the table data, the decrease in suicide mortality rate among men in the disaster area was higher than that in the control area. However, in women, decrease in suicide mortality in the disaster area was smaller than in the control area. In any case, it is notable that the suicide mortality rates decreased in the whole population after the earthquake.

Table4. Differences in suicide deaths between the disaster and control areas during 3 years (2004.10-2007.9) after the Niigata-Chuetsu earthquake on October 23, 2004, by gender.

	Deaths from suicide 3 years after the earthquake (2004.10 - 2007.9)			Chi-square test for difference in the decrease between the two areas
	Expected‡ number	Actual number	Decrease in number (Expected – Actual)	
Male				
Disaster area*	471	447	24 per 972,663 person-years (2.5 per 100,000 person-years)	
Control area†	1,177	1,151	26 per 2,550,512 person-years (1.0 per 100,000 person-years)	chi-square = 10.4, $p = 0.0013$
Female				
Disaster area*	227	206	21 per 1,018,446 person-years (2.1 per 100,000 person-years)	
Control area†	512	430	82 per 2,737,455 person-years (3.0 per 100,000 person-years)	chi-square = 2.36, $p = 0.1246$
Total				
Disaster area*	697	653	44 per 1,991,109 person-years (2.2 per 100,000 person-years)	
Control area†	1,691	1,581	110 per 5,287,967 person-years (2.1 per 100,000 person-years)	chi-square = 0.11, $p = 0.7347$

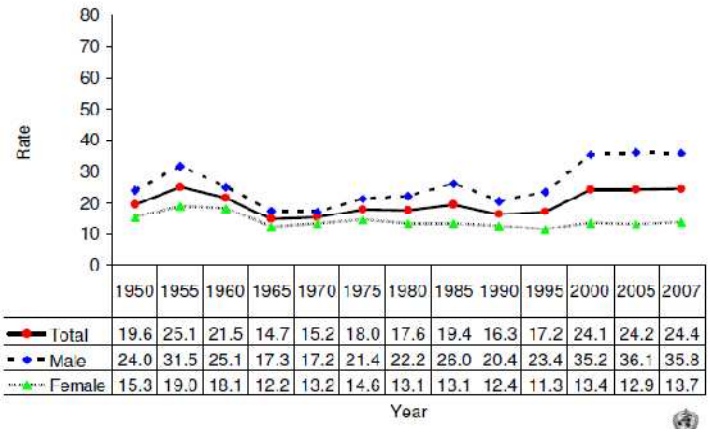
*Chuetsu region, including Nagaoka, Kashiwazaki, Ojiya, Tokamachi, Mitsuke, Uonuma, Minamiuonuma, Kawaguchi, Yuzawa, Tsunan, Izumozaki, and Kariwa, in Niigata Prefecture.
†Other areas in Niigata Prefecture.
‡Calculated based on mortality from suicide 5 years before the earthquake (1999.10 - 2004.9).

However, suicide mortality following the earthquake marked as sex-dependent (12,14), which suggests that adverse life events may have a differential effect on males and females (12).

Moreover, the study does not include the comparative characteristics with the whole Japan.

Table5. (18)

Suicide rates (per 100,000), by gender, Japan, 1950-2007.



	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2007
Total	19.6	25.1	21.5	14.7	15.2	18.0	17.6	19.4	16.3	17.2	24.1	24.2	24.4
Male	24.0	31.5	25.1	17.3	17.2	21.4	22.2	26.0	20.4	23.4	35.2	36.1	35.8
Female	15.3	19.0	18.1	12.2	13.2	14.6	13.1	13.1	12.4	11.3	13.4	12.9	13.7

The suicidal tendency of 2004-2007 in Japan was quite stable. Hence, the reduction in suicide mortality rates in the earthquake affected areas may be attributed to the earthquake.

4. Northridge earthquake of January, 1994 in Los Angeles County

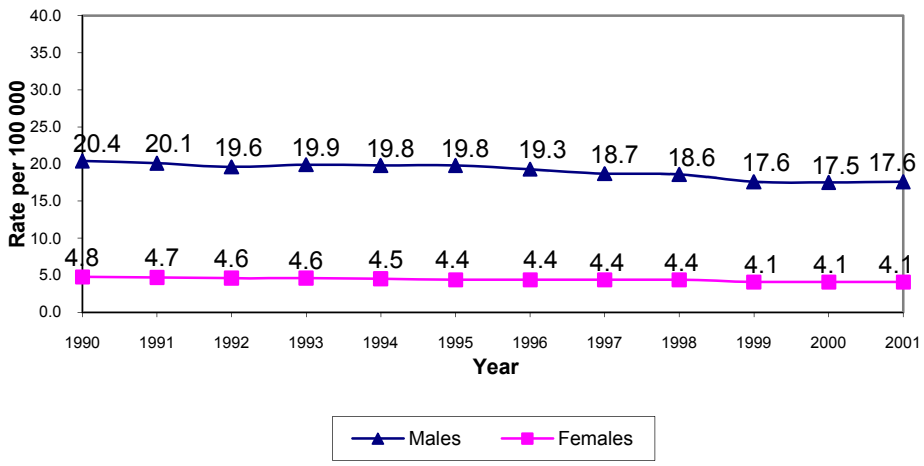
In the two articles, there is a description of two studies investigating earthquakes in the United States of America and the results are inconsistent (1,15).

Krug E et al.(1998) have stated that there was an increase in suicide rates for both sexes for the two years following the earthquake contradicting the findings of Shoaf K et al (2004) who have found the decrease in total suicide rate (1,15).

But slightly afterwards, Krug E et al.(1998) found an error in computer programming. When the error was corrected, a new analysis showed no significant increase in suicide rates after natural disasters (19) supporting the findings of Shoaf K et al (15).

Both research groups have been using the same methodology comparing year-periods before and after earthquakes and their findings revealed the same results. It is reasonable to assume that these findings may reflect a regression of the suicidal tendency for the United States as a whole. However, it was not the case as the suicidal rate dropped from 20.1 to 19.6 per 100 000 in 1992 and stayed particularly stable till 1996 (Fig6) (20). Hence, we may attribute the decrease of suicidal mortality rate to earthquakes.

Figure 6. U.S. Suicide Statistics (1990-2001), Breakdown by Gender



Conclusion.

Looking in detail at the diverse studies it seems that earthquakes did not increase suicide rates in the different countries studied, but on the contrary, decrease them at least in the short term. Then rates seem to be back to normal level after a few years.

However, although many earthquakes have happened around the world, we were able to sort out four case stories with the minimal data for most of them.

Since suicide rates are very different around the world and earthquake management may be rather diverse, we want to stress the need to collect data before and after the disaster, and at a geographical level that will allow us to study the affected areas, to compare them to other areas and general trends in the diverse countries as well as the displacement effect of the concerned populations.

Earthquakes have other psychiatric consequences besides suicide, and a paper will follow with a review on other mental health effects.

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Appendix1. TABLE 2. Authors, article, name and year of earthquake	Result	Geography (affected area)	Data Source	Comparative groups	Follow-up period	Short summary
1. Paul Yip. Effects of an earthquake on suicide rates in Nantou, Taiwan. British Journal of Psychiatry. 2009. ***Sept, 21, 1999 Chi-Chi earthquake in Taiwan (9-21 earthquake).***	The female suicide rate more than doubled immediately from 6.1 in 1998 to 14.2 in 1999. The male suicide rate showed substantial increase in both 2000 and 2001, indicating a delayed effect.	Central Taiwan, Chi-Chi region with Nantou, Taichung and Yunlin Counties.	n/a	Suicide rate for **Nantou county vs. suicide rate in Taiwan region** for male, female and overall	1998-2001	Both male and female rates increased after the earthquake.
2. Liaw YP et al. The suicide mortality rates between 1997-1998 and 2000-2001 in Nantou County of Taiwan following the earthquake of September 21 in 1999. J Forensic Sci. 2008. ***Sept, 21, 1999 Chi-Chi earthquake in Taiwan (9-21 earthquake).***	The suicide mortality rates show higher in 45-64 years than other age groups.	Central Taiwan, Chi-Chi region with Nantou, Taichung and Yunlin Counties.	Damage reports of the 9-21 earthquake, the computerized national mortality registry database, coded death certificates.	Age adjusted specific mortality ratio (ASR)for men and women and different age groups (0-25,25-44, 45-64, 65 and above) were compared according data from calendar years **1997-1998 vs. 2000-2001**, and also standardized mortality ratio (SMR) was used to compare suicide mortality rates among Nantou townships, **1997-1998 vs. 2000-2001**	1997-2001	45-65 years age group showed higher mortality rate than other age groups
3. Yang CH et al. Suicide trends following the Taiwan earthquake of 1999: empirical evidence and policy implications. Acta Psychiatr Scand. 2005. Sept, 21, 1999 ***Chi-Chi earthquake in Taiwan (9-21 earthquake).***	Monthly suicide rate for the exposed group was about 42% higher during 27 months following the earthquake than the average for the entire observation period. About 98% of the increased suicides among the severely quake-affected population occurred during the first 10 months following the earthquake, and the suicide rate fell to pre-quake rates after 10 months.	Central Taiwan, Chi-Chi region with Nantou, Taichung and Yunlin Counties.	Adultcause of Death Data Files	**High- exposed group vs. low-exposed** group in Nantou county	Jan 1998-Dec 2001	The suicide rate of high exposed group was higher than among low exposed group
4. Chou YJ et al. Suicides after the 1999 Taiwan earthquake. Int J Epidemiol. 2003. ***Sept, 21, 1999 Chi-Chi earthquake in Taiwan (9-21 earthquake).***	Earthquake does cause significantly ***excess suicides***. Victims were ***1.46 times likely than non-victims to commit suicide*** following earthquake.	Central Taiwan, Chi-Chi region with Nantou, Taichung and Yunlin Counties.	National Health Insurance Files, family registration, death certificates.	**Victims** vs. **non-victims** in the Central Taiwan	Jan 1998-Dec 2000	Higher suicide rate among victims than non-victims
5. Hyodo K. et al. Long-term suicide mortality rates decrease in men and increase in women after the Niigata-Chuetsu earthquake in Japan. Tohoku J Exp Med. 2010. ***Niigata-Chuetsu earthquake in Japan on the 23 of October, 2004.***	Suicide death rates in the disaster area ***decreased among men*** and ***increased among women.***	Mid-Niigata Prefecture (Chuetsu region)	Death certificates.	**Disaster area** (Chuetsu region composed of 12 municipalities) vs. **control area** (municipalities outside the disaster area in Niigata Prefecture).	10.1999 — 09.2007	In the disaster area suicide rate decreased among men and increased among women
6.Nishio A et al. Influence on the suicide rate two years after a devastating disaster: a report from the 1995 Great Hanshin-Awaji Earthquake. Psychiatry Clin Neurosci. 2009. ***Great Hanshin-Awaji earthquake in 1995, Kobe city, Japan.***	Earthquake led ***to decrease in the total suicide rate*** for the two years following the disaster.	The northern end of Awaji Island, 20 km away from the city of Kobe	Journal of Health and Welfare Statistics, Statistical Data of Kobe, monthly reports on the Vital Statistics of Japan.	Suicide rates in ***Kobe*** vs. suicide rates in ***Japan*** before and after earthquake	1988-1999	Total suicide rate decreased in Kobe. Middle-aged men were at a decreased suicide risk after the earthquake.
7. Toshiki Shioiri et al. The Kobe Earthquake and Reduced Suicide Rate in Japanese Males. Arch Gen Psychiatry/Vol 56, Mar 1999. ***Earthquake of 1995, Kobe, Japan***	Suicide rate ***decreased significantly in men***, for women there was no significant difference in rate after the earthquake.	The northern end of Awaji Island, 20 km away from the city of Kobe	Annual reports of the Medical Examiner's Office of Hyogo Prefecture.	Compare suicide rate in Kobe between male, female and the average of total population.	1985 - 1997	Suicide rate decreased for male, and was stable for female.
8. Shoaf K et al. Suicides in LOS Angeles County in relation to the Northridge earthquake. Prehosp Disaster Med. 2004. ***Northridge earthquake, January 17, 1994***	There was ***no increase of suicide rate*** after earthquake. The rates of suicide ***were lower*** in three years following earthquake.	Reseda, a neighborhood in the city of Los Angeles, California	Death certificate data for Los Angeles County	Suicide rate in **1991-1993** vs. suicide rate in **1994-1996** in Los-Angeles County.	1989 - 1996.	The suicide rate were lower following the earthquake, but males and non-Hispanic Whites are on the highest risk for suicide.
9. Krug EG et al. Suicide after natural disasters. N Engl J Med. 1998. ***Review of 4 Counties affected by earthquakes in USA***	There was a ***significant increase in suicide rate*** for both sexes and for all age groups from base line during the first year after the earthquake	4 counties in the western United States	National Center for Health Statistics Multiple Causes of Death Data Files.	Suicide rates before and after the earthquake in the **affected counties** vs. the **entire United States**.	1982-1989	The suicide rate increased for both sexes and for all age groups.

Appendix2. International Congress of Psychiatry and Public Health.

I will present the results of our study at the International Congress of Psychiatry and Public Health which is taking place in Lisbon on the 11-14th of July.

Appendix3. Acta Psychiatrica Scandinavica.

The article has been sent to the scientific journal Acta Psychiatrica Scandinavica for approval.