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Review Article

Prevalence of Suicidal Ideation and Suicide Attempts after Disaster and Mass Casualty Incidents in the World: A Systematic Review and Meta-Analysis

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Abstract

Objective: After accidents and disasters, people suffer from mental disorders due to physical, economic and social injuries. These include anxiety, stress, depression, suicidal ideation, and suicide attempts. Due to the fact that some of these measures can endanger a person's life, it is important to pay attention to these psychological factors. Accordingly, the present study was conducted to investigate prevalence of suicidal ideation and suicide attempts after disasters in the world.

Method: The present study was a systematic review and meta-analysis of the prevalence of suicidal ideation and suicide attempt after disaster in the world. Accordingly, all articles published English-language from the beginning of 2000 to the end of 2020 were extracted from Scopus, Web of Science, PubMed, Psych Info, Science Direct and Google scholar and evaluated. Statistical analysis of data was performed using the fixed and random effects model in meta-analysis and Cochran test.

Results: A total of 33 studies with a sample size of 61,180 people entered the meta-analysis process. Accordingly, the prevalence of suicidal ideation was estimated at 12.9% (CI95%: 10.3% -15.5%) in the whole population, 10.6% (CI95%: 6.1% - 15.0%) in males and 15.8% (CI95%: 10.0% - 21.6%) in females. Moreover, prevalence of suicide attempt after disasters was estimated at 8.8% (CI95%: 6.6% - 11.0%).

Conclusion: Based on the findings of the present study, prevalence of suicidal ideation and suicide attempt is high and prevalence of Suicide idea in women was about three times higher than in men.

Key words: *Disasters; Mass Casualty Incidents; Meta-Analysis; Suicide Attempt; Suicidal Ideation; Systematic Review*

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Natural and man-made disasters have occurred in abundance in the world and have affected over 200 million people (1, 2). Although the occurrence of disasters varies in countries around the world, most countries are facing this phenomenon and its frequent occurrence has caused economic, social, physical and psychological damage to individuals in these societies (2-5). Natural disasters are divided into six classes: meteorological, geological, marine, biological, environmental disasters and fires. In addition to the above, man-made disasters such as explosion of nuclear facilities, breaking of dams and terrorist attacks have also affected human health (6).

Most important consequences after mass accidents and disasters are the occurrence of economic, physical, social and psychological damages imposed on people exposed to this phenomenon. Among the injuries caused, at first, the physical and economic injuries affect the person more, and if appropriate measures are not taken in response to these injuries, due to psychological stressors such as family death, physical illnesses, disability, lack of shelter and living needs, people suffer from mental disorders and diseases (4, 7). Studies on mental health of people affected by disasters have shown that the incidence of mental disorders, fear, stress, anxiety and depression after disasters have increased (8-12). It has also been observed that people who had minor mental disorders before the occurrence of the disasters had severe mental disorders or diseases after the occurrence of the disasters, so that if no intervention measures are taken and these disorders and mental illnesses are not treated, they eventually attempted suicide and, in some cases died (11, 13-15).

One of the most important consequences of post-disaster mental disorders is suicidal behaviors, including suicidal ideation and suicide attempt, which in some cases lead to loss of life. Based on the scenario studies, dealing with accidents and disasters from three ways can affect mental health and subsequent suicidal behavior. These include 1) Increased depression and mental disorders; dealing with disasters can lead to increased depression and subsequent increased suicidal behavior. 2) Proximity and observation of death of other people in disasters; the experience of a disaster for a person is often accompanied by the experience of seeing the body of a dead person, loss of family or friends, which is considered proximity to the death of others. Exposure to death of family and relatives or their suicide increases the risk of suicidal behavior. 3) Decreased quality of parenting after disasters; after the disaster, due to problems that arise for the family, the family's performance in parenting and child support may be disrupted, and children who were supported by parents with high-quality before the disaster are now losing this support. This action can affect their suicidal behavior (15-19).

Suicide attempts and suicidal ideation have different prevalence rates in different regions of the world. The prevalence rates of Suicide idea and suicide attempt in the whole population are 27.5% and 4.3% (20) in Turkey, 20% and 10% (21) in Brazil and 15.2% and 3.2% in Korea, respectively. In a meta-analysis study in China (22), the prevalence rate of suicide attempt was 2.94% (23) and in Mexico 2.7% (24). However, in studies conducted in disaster-prone areas, the prevalence of suicidal ideation and suicide attempts have been reported to be 8.8% and 11.3% in the UK (25), 2.85% and 2.3% in Japan (26), and 9.1% and 3.3% (27) in China, respectively. A study conducted in the United States showed that the prevalence of Suicide idea was 3.8% and in the following year 13.2% of people with suicidal ideation committed suicide (28). As a result, mental health management is essential to prevent its adverse consequences.

In general, various factors and complex relationships are effective in causing psychological disorders and suicidal behaviors. As a result, appropriate interventions are needed to prevent this action. However, in order to adopt these approaches, to estimate and provide the resources needed to perform intervention measures, it is necessary to know the prevalence. The aim of this study was to estimate the prevalence of suicidal ideation and suicide attempt after disasters in the world using a systematic review and meta-analysis and determining heterogeneity and publication bias in studies so that by determining the overall prevalence of this phenomenon in the world, we can highlight the importance of this phenomenon and the people responsible for health system can adopt appropriate intervention approaches to reduce prevalence of Suicidal behaviors in the population affected by disaster and prevent its adverse consequences.

Materials and Methods

Study protocol

The present study was conducted to estimate the prevalence of suicidal ideation and suicide attempt after disasters through systematic review and meta-analysis worldwide, which was carried out according to the PRISMA guideline for meta-analysis studies (29). All stages of research including search, selection of articles, quality assessment and data extraction were performed by two researchers independently.

Search Strategy

In the initial search, all articles published English-language from 2000 to end of 2020 and picked up by searches in PubMed, Science Direct, Web of Science, Psych Info, Scopus, Google scholar databases were extracted. All articles with Mesh and the keywords of Suicide, Prevalence, Suicide Ideation, Suicide Attempted, Disaster, Mass Casualty, Nuclear Disaster, Earthquake, Tsunami, Disease Outbreak, Hurricane, Natural Disaster, Floods, Tornadoes, Drought, Severe Storms, Terrorist Attacks in the title, abstract and text in simple and compound form

using AND/ OR operators as Suicide OR Suicide ideation OR Suicide attempted AND prevalence AND Disaster OR Mass casualty OR Nuclear Disaster OR Earthquake OR Tsunami OR Disease outbreak OR Hurricane OR Natural Disaster OR Floods OR Tornadoes OR Drought OR severe storms OR terrorist attacks were searched.

Inclusion and Exclusion Criteria

All articles published English-language in the world on suicide and disasters, estimate the prevalence of suicidal ideation and suicide attempt after disasters, described prevalence of suicidal ideation and suicide attempt in the whole population and were of desired quality entered the study. Articles of low quality, and those which reviewed suicidal ideation, and suicide attempts in specific population groups (individuals with specific illnesses, such as mental illness) were excluded. Those articles which did not report suicidal prevalence or published in non-English language were also excluded. Additionally, meta-analyses or review studies, series of cases and case report studies were excluded, as well.

Quality Assessment

The quality of the articles was assessed using the Strobe checklist (30). This checklist has 22 sections, each of which receives a different score based on its importance. The minimum and maximum scores were 15 and 33, respectively, and the acceptable score was 20 (31).

Screening and data extraction

First, the articles were reviewed by two researchers independently by reviewing the title and abstract and considering the inclusion and exclusion criteria. Then, the full text of the articles was reviewed and in cases of rejection of the articles by reviewers, the article was evaluated by a third reviewer. Data were extracted using a checklist that included year of study, place of study, study population, type of disaster, prevalence of suicidal ideation and suicide attempt.

Selection of articles

After searching scientific databases, 3683 articles found. Initially, the article references were entered into Endnote software and were evaluated, 984 articles were removed due to duplication. Then the titles and abstracts of the articles were reviewed, 2363 articles were removed due to their irrelevance to the aims of the study. After that, the full text of the articles was reviewed and 20 articles were removed due to lack of investigation and estimate prevalence of suicidal ideation or suicide attempts. Finally, 33 articles entered the process of meta-analysis (Diagram 1).

Statistical Analysis

Fixed effects model and random effects model in meta-analysis were used to combine the results of homogeneous and heterogeneous studies, respectively. Moreover, heterogeneity of studies was determined using I2 index and Cochran's test, and publication bias was specified using the funnel plot and the Egger test. Statistical analysis of data was performed using STATA ver14 software.

Results

Number of 33 articles with a sample size of 61,180 people between 2000 and 2020 were included in the meta-analysis process. Of these, 30 studies were conducted on suicidal ideation after disaster and 12 studies were conducted on suicide attempts after disaster. The characteristics of the reviewed articles are presented in Table 1.

Based on the findings of the present meta-analysis, the prevalence rates of suicidal ideation were estimated at 12.9% (CI95%: 10.3% -15.5%) in the general population, 10.6% (CI95%: 6.1% - 15.0%) in the male population and 15.8% (CI95%: 10.0% - 21.6%) in the female population (Figure 1, Table 1).

Based on findings of meta-analysis studies on after-disaster suicide attempts, the prevalence rate of suicide attempts was estimated at 8.8% (CI95%: 6.6% - 11.0%) (Figure 2). The prevalence of suicide attempts after disaster by gender in the world was studied in only two studies in Japan and China after earthquakes. Accordingly, the prevalence rate of suicide attempts in Japan (13) and China (32) were 14.8% and 2.5% in men and 31.1% and 4% in women, respectively.

Publication bias was evaluated using the funnel plot and the Egger test. Due to the symmetry of the funnel diagram, it can be concluded that publication bias did not occur, which was confirmed based on the results of the Egger test (P = 0.1) (Figure 3).

Table1. General Characteristics of the Studied Articles that Were Eligible for Systematic Review

Author	Year	Country	Type of disaster	SS	Prevalence Rate (percent)			
					Suicide idea in population	Suicide idea in men	Suicide idea in women	Suicide attempt
Stratta P(42)	2014	Italy	Earthquake	343	8.7	10.2	6.6	
Adebäck P(43)	2018	Sweden	Tsunami	210	23.3			
Reed Bell T(44)	2020	USA	oilrig disaster	213	10.3			
Xu Q(26)	2018	Japan	Earthquake	1019	2.8	2.2	3.3	34.7
Contis G (45)	2015	Ukraine	Chernobyl radiation	15399	5.3			
Wu C (46)	2020	Taiwan	Burn disaster	315	24.4			
Loganovsky K (36)	2008	Ukraine	Chernobyl accident	295	9.2			
Kessler AC (47)	2006	USA	Hurricane	1043	2.9			0.5
Brown LA (48)	2019	seven countries	Earthquake and tsunami	2832	24.1			0.9
Tang W (49)	2018	China	Earthquake	5563	12.9			
Ran MS (50)	2015	China	Earthquake	737	35.5	25.9	43	
Zuromski KL(51)	2019	USA	Natural disaster	2000	5.2			
Stratta P(52)	2012	Italy	Earthquake	426	5.9	3.7	7.6	0.9
JingG (53)	2018	China	Earthquake	1369	9.1	5.3	11.9	3.2
Kar N(54)	2010	India	Super-cyclone	540	38			12.6
Vehid HE(55)	2006	Turkey	Earthquake	3609	16.8	19.4	14.3	
Fujiwara T(16)	2017	Japan	Earthquake	133	11.3	4.4	18.5	
Tang TC(56)	2010	Taiwan	Typhoon	271	4.4			15.1
Kessler RC (57)	2008	USA	Hurricane	815	6.4			0.9
Galindo JC (58)	2007	Spain	Terrorist attack	44	13.6			
Fergusson DM (59)	2014	New Zealand	Earthquake	137				3.6
Graham H(25)	2019	England	Flood	354	8.2			11.6
Reifels L (60)	2018	Australia	Natural disaster	8841	16.3			4.6
Yang HJ (61)	2015	Korea	Ferry ship	1771	18.4	14.3	22	
Aoki Y (13)	2014	Japan	Nuclear accident	488				26.2
Amstadter AB (62)	2009	USA	Hurricane	607	3.1			
Ying L (63)	2015	China	Terrorist attack	4404	13.4	10.4	17	
Caldera T (64)	2001	USA	Hurricane	496	10.5			
Chou FH (65)	2007	Taiwan	Earthquake	216	4.6			
Pietrzak RH (66)	2012	United States	Hurricane	487	2.9			
Kane JC (67)	2018	Nepal	Earthquake	513	13.1			
Tang W (49)	2018	Chinese	Earthquake	5505	27.8			
Morali D (68)	2008	France	heat wave	185	12.9			

USA: United States of America; SS: sample size.

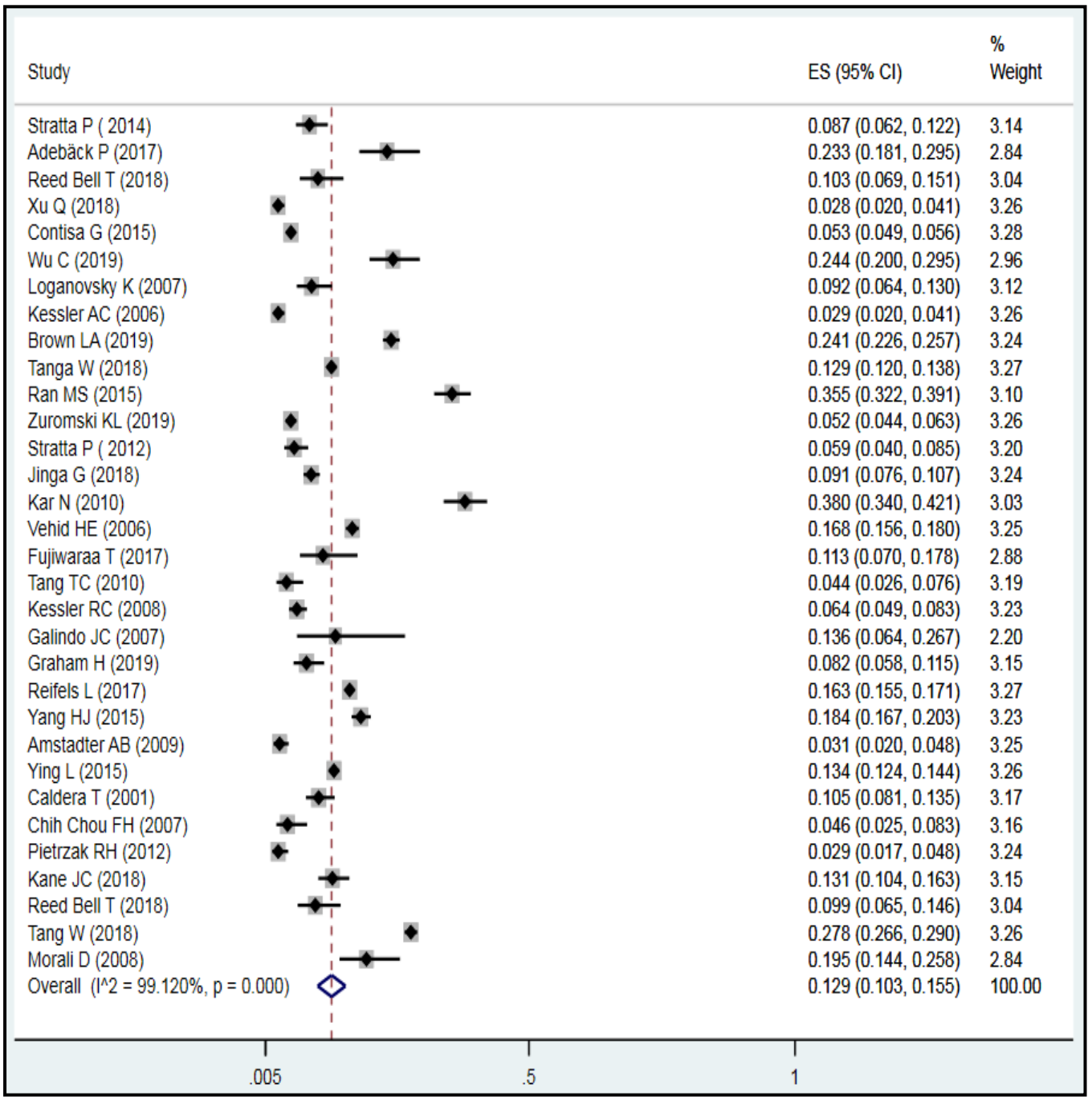

Figure 1. Pooled Prevalence Rate of Suicidal Ideation in Total Population (Percent) after Disaster Based on Random Effects Model

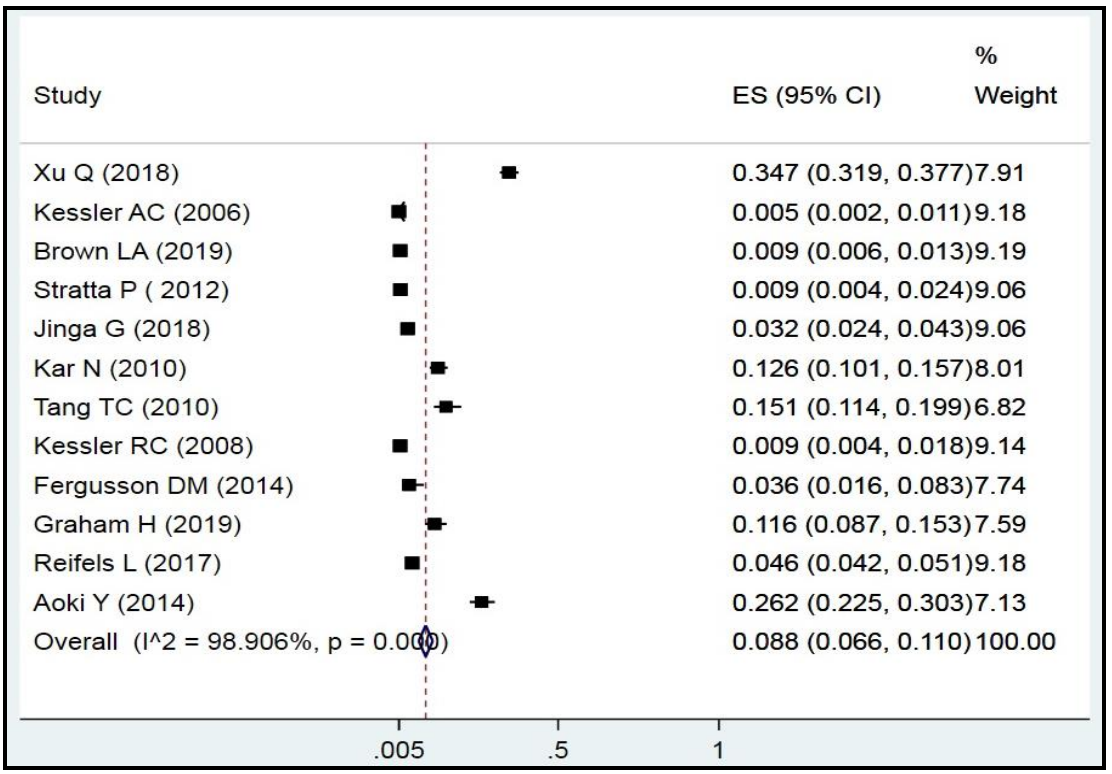

Figure 2. Pooled Prevalence Rate of Attempt Suicide in Total Population (Percent) after Disaster Based on Random Effects Model

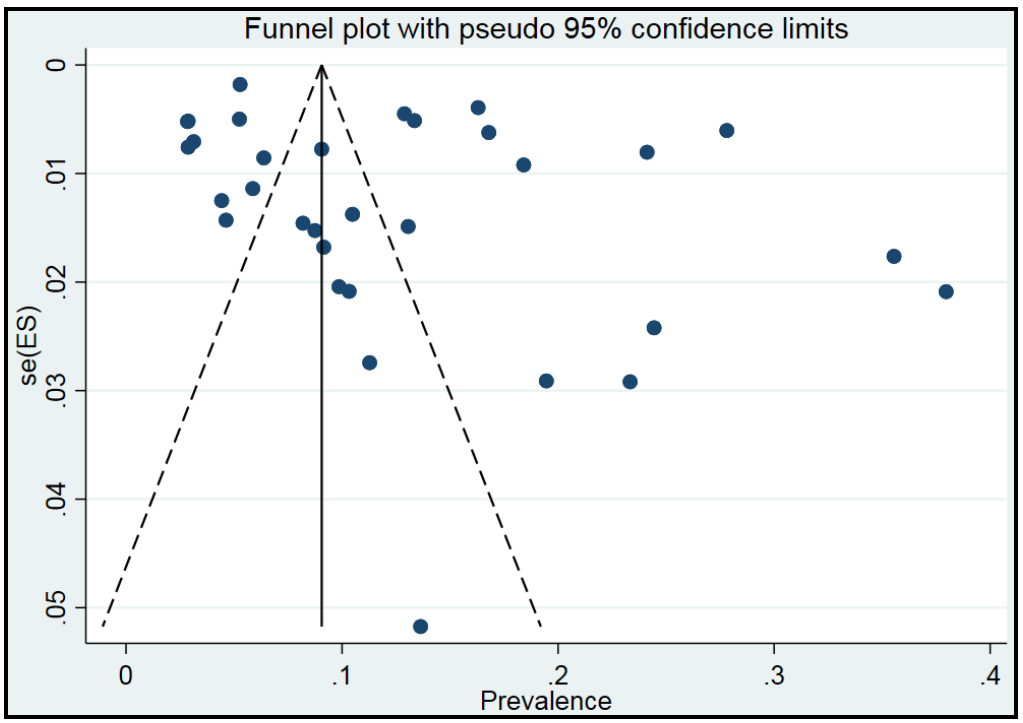

Figure 3. Funnel Plot of the Prevalence of Suicidal Ideation after Disaster

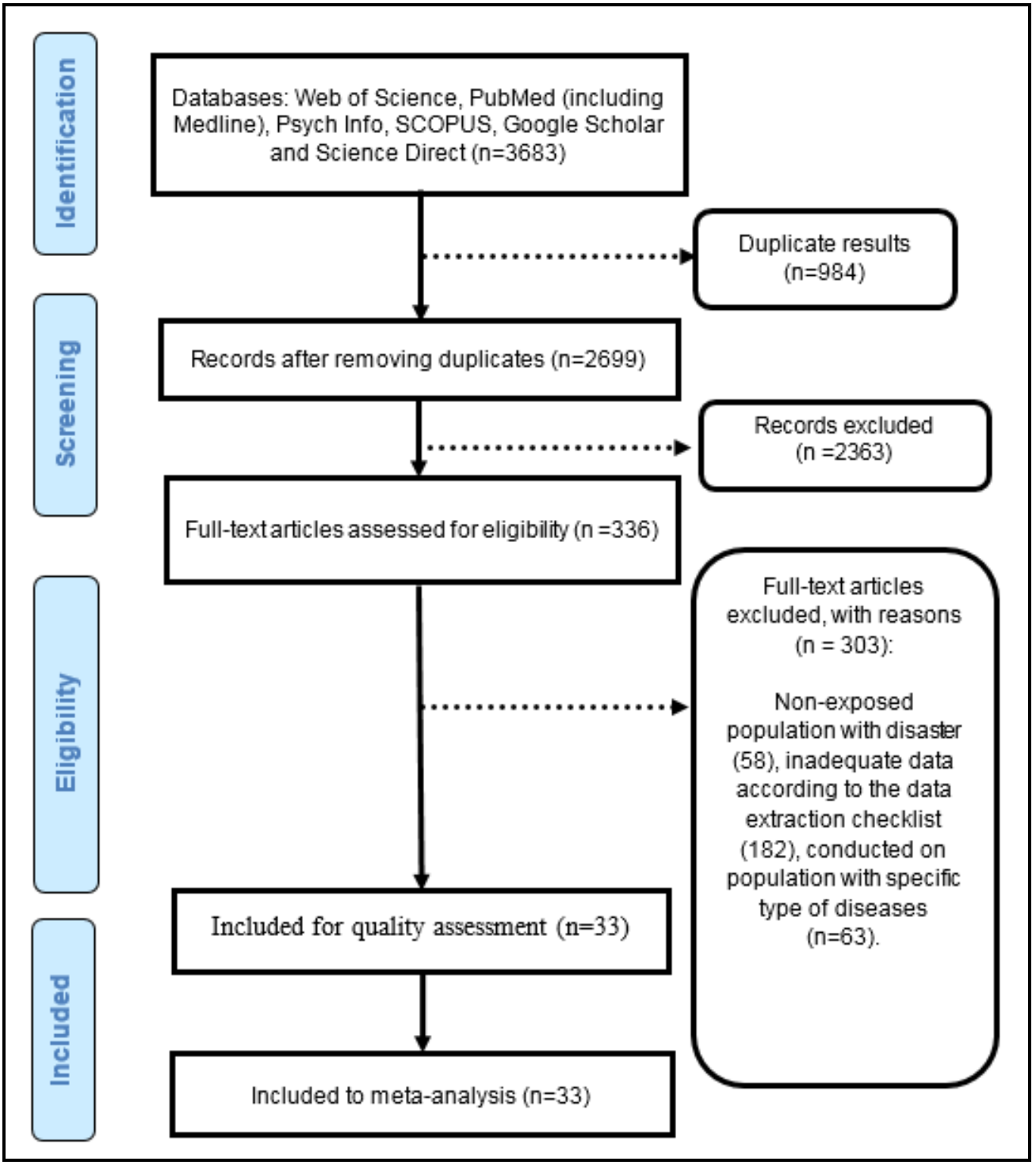

Diagram 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flow Diagram to Select Studies

Discussion

This meta-analysis showed that suicidal ideation has a relatively high prevalence rate in the population affected by disasters. Moreover, this prevalence is higher in women than men. Due to the fact that a relatively large number of people are exposed to this phenomenon during disasters, as a result of the prevalence of people with suicidal ideation also increases.

When people are exposed to disasters, they suffer from mental disorders such as stress, anxiety, fear, depression, suicidal ideation and in some cases suicide due to physical, economic, social difficulties and loss of loved ones (33). A study by Tanaka *et al.* in China (2016) found that people who had previously been exposed to earthquakes had a higher chance of developing anxiety, stress, fear, suicidal ideation, and suicide attempts than those who had not (34). In a meta-analysis study by Tang *et al.* (2014), it was shown that between 5.8% and 54% of people exposed to disasters were depressed (35). In a study by Loganovsky *et al.* (2008) in Ukraine, which examined the prevalence of depression 18 years after the Chernobyl accident, the prevalence of depression in exposed individuals was reported to be 18% (36). As a result, suffering from mental disorders and illnesses causes suicidal ideation and suicide attempt.

One of the limitations of the present study is lack of reporting regarding prevalence of suicidal ideation and suicide attempt before disasters. Accordingly, here we will examine prevalence of suicidal ideation when not facing disasters in some countries. In a study by Chan *et al.* (2011) in Taiwan, prevalence of suicidal ideation was 6.1% in the total population; 4.4% in men and 7.8% in women (37). In China, the prevalence of Suicide idea was 3.1% and the prevalence of suicide attempt was 1% (38). In South Korea (2013), prevalence of Suicide idea was 14.8% (39), and in Germany (2012) the prevalence of Suicide idea was 8% (40). In the Eastern Mediterranean region (2015), the prevalence of Suicide idea was between 2.9-14.1% and the prevalence of suicide attempt was 0.72 - 4.2% (41). In China (2015), the prevalence of suicide attempt was 2.94% (23). In studies reviewed in the present research, the prevalence of Suicide idea was between 2.8% to 38% and the prevalence of suicide attempt was between 0.5% and 34.7%. Considering the prevalence of suicidal ideation and suicide attempt in studies when not facing disasters, it can be noted that the prevalence is higher when dealing with disasters. Although this difference may not be significant, the prevalence in the present study indicates suicidal ideation and suicide attempt in a large number of people exposed to disasters, which can ultimately endanger the lives of these people. Therefore, paying attention to the mental health of people faced with disasters and taking support measures after disasters is of particular importance.

Limitation

The limitations of the present study are: 1) No reporting of the prevalence of Suicide idea and suicide attempts before disasters, 2) No reporting of the prevalence of suicide attempts based on gender due to lack of data, 3) Inability to use non-English language studies, and 4) Existence of heterogeneity in studies.

Conclusion

Based on the findings of this study, the prevalence of suicidal ideation and suicide attempt is high and the prevalence of Suicide idea in women was about three times higher than in men. As a result, it is important to pay attention to the mental health of people facing disasters, especially women.

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Conflict of Interest

None.

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