

## Review Article

# Cosmetic Breast Implants and the Risk of Suicide: A Systematic Review and Meta-Analysis

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### Abstract

**Objective:** Having cosmetic breast implants increases a woman's chance of suicide, which is now a global challenge. This systematic review evaluated the possible risk of suicide among women who undergo cosmetic breast implants.

**Method:** This meta-analysis was done based on Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). In the current systematic review and meta-analysis, we systematically searched for all articles written in both English or Persian that estimated the prevalence of suicidal ideation in women who had cosmetic breast implants. We systematically searched different databases, including MEDLINE (PubMed), Web of Science, Embase, Cochrane, Library ProQuest, Scopus, and Google Scholar, from inception to March 2021. There was also a search for references. Suicidal ideation, a suicide plan, or suicide attempts were the outcomes. In order to determine the total pooled prevalence of suicidal ideation, we utilized a random-effects model. To examine the risks of bias in each study, we applied the Joanna Briggs Institute Critical Appraisal method.

**Results:** We identified 218 citations in our initial search. After omitting duplicated citations and excluding irrelevant studies according to the title and abstract selection, 42 studies were chosen for the full text analysis. Finally, 11 research, examining a total of 324,332 women were incorporated into the systematic review and critical appraisal assessment. Eight of these studies were found to be eligible for meta-analysis. The frequency of suicide in women with cosmetic breast implant was 0.2% (95% CI: 0.1% to 0.4%;  $P < 0.001$ ) (Q-value: 168.143, I<sup>2</sup>:95.83). Most of the included studies had moderate quality.

**Conclusion:** There might be a correlation between cosmetic breast implants and suicide risk, which could be stronger in the presence of a history of mental illnesses. The evidence about the possible effects of breast implants on the risk of suicide is still inconclusive, and there is a need for future well-designed studies on this topic.

**Key words:** *Breast Implants; Cosmetic Surgery; Suicide; Systematic Review*

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According to the World Health Organization (WHO), the rate of suicidal death is 700,000 people annually. Suicide is the fourth leading cause of death among 15-29 year-olds (1). Women are more prone to have suicidal thoughts than males due to gender inequalities (2). The majority of women who successfully commit suicide have attempted it before (3). Currently, the most common cosmetic procedure performed worldwide is breast augmentation (4). The Food and Drug Administration (FDA) initially forbade the use of silicone gel-filled breast implants because of increased incidence of cancer, related connective tissue disorders and, more importantly, autoimmune disease among breast implant cases. However, the FDA has now approved the current production of silicone gel-filled implants (5).

The probability of suicide between women who experienced cosmetic breast augmentation has grown nowadays and become a major problem. This unexpected finding has generated discussion on the safety of cosmetic breast augmentation and numerous helpful justifications (6).

Former researchers and most of the plastic surgeons viewed implants as a symptom rather than a reason of sadness (7-9). While other research supports the idea that breast augmentation gives safe protection against suicide in the future, the particular features of those women who experienced cosmetic breast implants, which was linked to an increase in suicide risk, have also been reported as a potential reason (10). The findings of a commentary review on the investigation of the correlation between voluntary breast implants and the probability of suicide demonstrated the risks of these implants for mental health. Suicide rates among women who had implants were reported to be under 1%, but rates among women without implants were observed to be considerably and clinically high, ranging from 0.24% to 0.68% (11). A review study found that the incidence of suicide between individuals who experienced cosmetic breast implants is nearly two times higher than the expected rate, which is in line with general population projections (12). Another study in the same area found no distinction in the suicide risk between women with and/or without cosmetic breast implants (13). Although some previous studies indicate the increased risk of suicide following cosmetic breast implants, others declare that breast augmentation protects women from suicide (14). On the other hand, a 2-3 times increase in suicide risk was predicted using a modified suicide risk model (15). Long-term health and clinical outcomes were investigated in individuals who experienced silicone gel breast implants and the data was published as a systematic review. It was determined that there is insufficient data to draw a conclusion on the existence of a link between current silicone gel implants and various long-term health-related outcomes (5). Since the results of previous studies are contradictory, the

current article aims to review the documented literature concerning the comprehensive evaluation of the risk of suicide attempts among women with various cosmetic breast implants.

#### ***Review question or objective***

The quantitative objective was to estimate the risk of suicide between women who experienced cosmetic breast implants.

#### **Materials and Methods**

The current systematic review and meta-analysis is performed according to the Cochrane Collaboration Handbook and PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), and the proposed systematic review was performed based on the Joanna Briggs Institute (JBI) declared methodology for systematic reviews (16).

#### ***Inclusion criteria***

##### ***Types of research participants***

The quantitative component of the current review was considered as women with a cosmetic breast implant. We excluded the women who had undergone breast implants following the mastectomy.

##### ***Types of intervention(s)***

The quantitative section of this review included articles that all evaluated different cosmetic breast implants.

##### ***Types of Comparison***

The quantitative section of the current review considered women with no implants (including the general population), or individuals undergoing other forms of cosmetic surgeries.

##### ***Types of outcomes***

The studies that contained the following outcome measures were included in this review:

Primary outcomes: Suicidal ideation, any suicide plan, or suicide attempts

Secondary outcomes: other psychological consequences including self-esteem, various body images, overall satisfaction, and quality of life.

##### ***Types of included studies***

Cohort, case-control, and cross-sectional studies made up the quantitative part of this review.

##### ***Search strategy***

Both published and unpublished papers were to be sought after using the search approach. This study used a three-step search technique. The content of the article, including the title, abstract, and any index terms used to describe it, was inspected after doing a primary, targeted search of MEDLINE. The secondary systematic search was conducted on March 20, 2021, using all recognized keywords and index phrases through all involved databases. All selected reports and articles were then examined for the extra studies documented in their reference lists. This review included studies that were published on any date and in any language. The aforementioned databases included:

Google Scholar, Scopus, Embase, Web of Science, ProQuest, and MEDLINE (PubMed) are the databases used for the search. There was also a search for unpublished studies from conferences and seminars.

**Study selection**

Following the search, duplicate studies were removed, and all discovered citations were collected and uploaded into EndNote 20.4.1. Two impartial reviewers looked at the titles and abstracts to determine whether the papers met all the inclusion and exclusion criteria. The JBI applied System for the Unified Management, Assessment, and Review of Information (JBI SUMARI) was carefully used to retrieve the full texts of possibly pertinent studies and import citation information (Joanna Briggs Institute, Adelaide, Australia). Two reviewers carefully evaluated the entire texts of the chosen citations in accordance with the eligibility requirements. explanations were also provided on why studies in full-text phases were excluded from the review because of not fitting the eligibility requirements. At every step of the study selection procedure, the reviewers' disputes were settled through conversation or consultation with a third reviewer. The details of the screening process are presented in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram (17).

**Assessment of methodological quality**

Prior to being included in this review, two independent reviewers assessed the methodological validity of the quantitative papers that were chosen for retrieval using the appropriate standardized critical appraisal tools from the JBI Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) for cohort or cross-sectional studies. The likely disagreements among the independent reviewers were settled via conversation or with the assistance of another reviewer. The legend of

Table 1 provides a list of the evaluation questions for both cross-sectional and cohort study types. Selected studies were divided into three quality groups considering the results of the critical assessment and the scores assigned to each study. High quality was defined as a score upper than 80%, medium quality was defined within the 60% and 80% range, and low quality was considered as a score lower than 60%. Findings showed that high-quality evidence included studies with a low risk of bias, medium-quality evidence comprised of studies with a medium risk of bias, and low-quality evidence consisted of studies with a high risk of bias.

**Data collection**

Using a customized version of the usual JBI data extraction tool, two independent reviewers carefully extracted the data from all of the included papers. The initial author, publication year, study design, nation, implant type, age at breast augmentation, result, and sample size were chosen specifically from the listed papers. Discussion among all reviewers was used to settle any disputes.

**Data synthesis**

Statistical meta-analysis was performed using the Mantel Haenszel method with Comprehensive Meta-Analysis software (ver. 2.2; Biostat, Englewood, NJ, USA). Heterogeneity was statistically calculated using the standard I<sup>2</sup> test. In this meta-analysis, the levels of I<sup>2</sup> > 50% and a significance amount of P < 0.10 for Cochran's Q were considered as clinically significant heterogeneity. A random or fixed model was used based on heterogeneity analysis. Furthermore, a funnel plot was also generated to evaluate overall publication bias. All of the results were accessible in a narrative form where statistical pooling was not possible. This was performed to aid data presentation if appropriate.

**Table 1. Quality Assessment based on Joanna Briggs Institute Risk of Bias Tool (https://jbi.global/critical-appraisal-tools)**

NO	Study	Cohort studies											Risk of Bias
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	
1.	Brinton, LA, (2006)	Y	Y	Y	U	U	U	Y	Y	U	U	Y	High
2.	Coroneos, CJ, (2018)	Y	Y	U	N	N	Y	Y	Y	U	U	Y	High
3.	Jacobsen, PH, (2004)	Y	Y	Y	Y	Y	Y	U	Y	Y	U	U	Medium
4.	Koot, VCM, (2003)	Y	Y	Y	U	U	U	Y	Y	U	Y	Y	Medium
5.	Lipworth, L, (2007)	Y	Y	Y	U	U	Y	Y	Y	U	U	Y	Medium
6.	Pukkala, L, (2003)	Y	Y	Y	Y	Y	Y	Y	Y	U	U	Y	Low
7.	Rubin, JP, (2010)	Y	Y	Y	U	U	Y	Y	NA	NA	NA	Y	Medium
8.	Singh, N, (2017)	Y	Y	Y	U	U	Y	Y	Y	U	U	Y	Medium
9.	Villeneuve, PJ, (2006)	N	Y	Y	U	U	Y	U	Y	U	U	Y	High
10.	Soest, TV, (2011)	Y	Y	Y	U	U	Y	Y	Y	U	U	Y	Medium
Cross-sectional studies													
11.	de Paula, PR (2018)	Y	Y	Y	Y	U	U	Y	Y	-	-	-	Medium

Y: yes; U: unclear; N: no; NA: not applicable.

**JBI CRITICAL APPRAISAL CHECKLIST FOR COHORT STUDIES**

Q1. Were the two groups similar and recruited from the same population? Q2. Were the exposures measured similarly to assign people to both exposed and unexposed groups? Q3. Was the exposure measured in a valid and reliable way? Q4. Were confounding factors identified? Q5. Were strategies to deal with confounding factors stated? Q6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)? Q7. Were the outcomes measured in a valid and reliable way? Q8. Was the follow-up time reported and long enough to be sufficient for outcomes to occur? Q9. Was follow-up complete,

and if not, were the reasons to loss to follow-up described and explored? Q10. Were strategies to address incomplete follow-up utilized? Q11. Was appropriate statistical analysis used?

#### JBICRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS-SECTIONAL STUDIES

Q1. Were the criteria for inclusion in the sample clearly defined? Q2. Were the study subjects and the setting described in detail? Q3. Was the exposure measured in a valid and reliable way? Q4. Were objective, standard criteria used for the measurement of the condition? Q5. Were confounding factors identified? Q6. Were strategies to deal with confounding factors stated? Q7. Were the outcomes measured in a valid and reliable way? Q8. Was appropriate statistical analysis used?

## Results

We found 218 citations through the electronic search, manual search, and grey literature. Duplicate citations were removed ( $n = 96$ ), leaving 133 studies for screening. The titles and abstracts were used to choose 43 studies. 31 papers were disqualified in the full-text selection process; seven were research protocols, twelve were review studies, and five had missing or unavailable full texts ( $n = 7$ ). Finally, 11 studies were added to the systematic review and subjected to the critical evaluation procedure, eight of which were determined to be suitable for meta-analysis. The PRISMA flowchart provides more details on the selection procedure (Figure 1).

### Methodological quality

JBIC appraisal checklists critically appraised eleven eligible studies to assess possible biases. According to this evaluation, the most common potential sources of bias were lack of appropriate identification of and dealing with confounding factors and insufficient or incomplete follow-up periods. The results of evaluation of eligible studies are shown in Table 1. According to the results, most of the included studies had medium quality. Nevertheless, we excluded none of the studies due to low quality. The list of questions for the different critical appraisals for all study designs is illustrated in the legend of Table 1.

### Characteristics of included studies and findings

Among the reviewed studies, eleven comparative studies evaluated suicide in recipients of breast implant for cosmetic purposes, including ten cohorts and one cross-sectional study. 324,332 women were enrolled in this systematic review (Table 2). The age range of women in the studied groups was between 18 and 71, and the follow-up period was in the range of 7-27 years. None of the studies reported the type of suicide, and the evaluated factors were systemic harm, self-harm, well-being, and satisfaction.

Four of the included studies were performed in the USA, two in Sweden, and the remaining cases in other European or American countries, including Denmark, Finland, Norway, Brazil, and Canada. The scale or criteria used in detecting suicide ideation and diagnosis were BREAST-Q, BDI-II, or the International Statistical Classification of Diseases and Related Health Problems (ICD). In five of the studies included in the systematic review, the standardized mortality ratios (SMRs) were reported, whereas in three studies, the suicide rate in other cosmetic surgeries was mentioned. Only two of the studies reported the relative risks (RRs) based on the existing comparisons with the other group of patients.

The results of these parameters are summarized in Tables 2 and 3.

### Study description

According to Von Soest *et al.*, a number of mental health issues may indicate a need for aesthetic surgery. But it does not appear that cosmetic surgery will help these mental health issues (18). Patients with implants show a higher risk of suicide in cohort research; although this association was not seen in people who had other types of plastic surgery (19). Paula *et al.* examined, in both public and private hospitals, the overall prevalence of different depressive symptoms prior to cosmetic breast surgery (reduction mammoplasty or augmentation mammoplasty). Among patients with breast implant indications (augmentation mammoplasty and mastopexy with implants), depressive symptoms were more common (51.4%). The results revealed that 7% of all patients responded affirmatively to the questions about suicidal ideation, with the group with implants having the highest percentage (54.5%). There were significant differences between patients of public and private hospitals. (20). In a multicenter cohort research, Coroneos *et al.* examined the results of individuals who had breast implants. They showed that silicone implants were connected with a much upper rate of scleroderma, Sjogren syndrome, melanoma, rheumatoid arthritis, and stillbirth. However, there was no association with suicide (21). In a cohort survey, Jacobsen *et al.* reported that women with breast reduction surgery had a 3-fold increase in suicide and, overall, had a considerably higher SMR for death compared to women in the general population. Nevertheless, the number of suicide deaths was slightly higher than anticipated (22).

The higher risk of suicide was not discovered by Lipworth *et al.* until ten years after implant. They concluded that an excess of deaths following a suicide, drug and alcohol misuse, dependency, or other associated reasons might be caused by underlying psychiatric morbidities (23). In line with earlier research, Pukkala *et al.* found a statistically significant excess of suicide over the first five years of follow-up, based on 10 fatalities (24). Rubin *et al.* demonstrated an overall lesser quality of life and also emotional well-being. However, they showed a better score on physical functioning. Also fewer role restrictions have been noted concerning physical health according to their results (25). In contrast to the previous study, Singh *et al.* found that, in five to eight years of follow-up, the suicide rate was not noticeably higher than the national average (26). In line with most mentioned studies, Villeneuve *et al.* found that overall mortality was lower among breast

implanted women compared to the general population. In contrast, the mortality rate of suicide has risen in both implant received and other plastic surgery cases. Previous researches propose that breast implants did not directly affect the elevation of mortality in women. Additionally, the risk of suicide was not significantly different between women who had breast implants and those who had other cosmetic surgeries (13). Koot *et al.* (27) demonstrated that the likeliness of committing suicide is higher in women who received cosmetic surgery for the breast augmentation process than in women in the control group (Tables 2 and 3).

### Meta-analysis results

Eight studies were identified as truly eligible for meta-analysis. Based on the results, the frequency of suicide in women who underwent breast implants was 0.2% (95% CI: 0.1% to 0.4%;  $P < 0.001$ ) (Q-value: 168.143,  $I^2$ :95.83) (Figure 2).

### Publication bias

By utilizing Egger's test, there was no notable evidence of publication bias in favor of any research reporting a high frequency of suicide (intercept = -3.979, t-value 0.720, two-tailed  $P = 0.498$ ) (Figure 3).

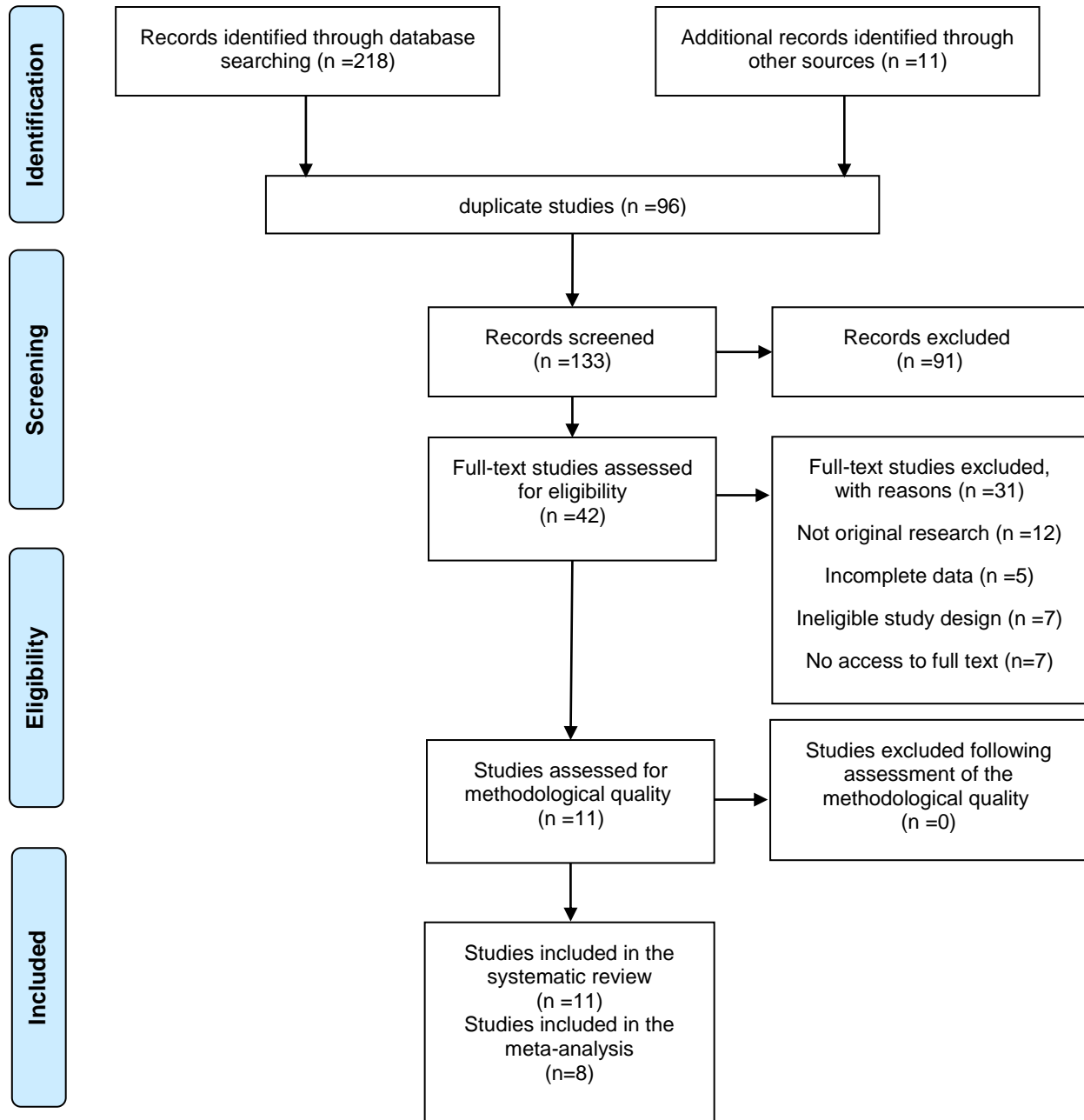


Figure 1. Flowchart of the Search Phases to Select Studies for Systematic Review Based on the PRISMA Statement

Table 2. General Characteristics of the Studied Articles that Were Eligible for Systematic Review

First author (Published year)	Study design	Country	Objective	Outcome related to breast implants	Sample size	Mean age at breast augmentation (years-old)	Evaluated factors	Scale use	Follow up period (years)
Coroneos, <i>et al.</i> (2018)	Cohort retrospective	United states	Assess the long-term safety and efficacy outcomes of breast implants	Increased risk of certain systemic harms No association with suicide	99,993	35	Systemic Harms, Self-harm, Wellbeing, and Satisfaction, Reproduction, Local Complications and Reoperation	BREAST-Q	7
de Paula, <i>et al.</i> (2018)	Cross-sectional	Brazil	Assessing the prevalence of depressive symptoms in patients demanding cosmetic breast surgeries (with and without implants)	Higher score for suicide ideation. The high prevalence of depressive symptoms (18.9%) and 2.3 times greater risk. Possible risk factors for a depressive disorder included age, low income, and schooling. Suicide ideation among all patients (7%) and implants (54.5%). Significant differences among the public and private institutes.	185	18-71	Socio-demographic data include average age, marital status, the difference in skin color/race, education level, and income.	Beck Depression Inventory-II (BDI-II)	
Jacobsen <i>et al.</i> (2004)	Cohort retrospective	Denmark	Assess mortality and suicide among Danish women who experienced cosmetic breast implants.	Increase suicide risk 2-3-fold. Need to check Mental illness history and hospital admission for suicide.	2,761	31	different causes of death in reduction and implantation surgeries in both private and public hospitals	ICD-8, ICD-10	22
Lipworth <i>et al.</i> (2007)	Cohort prospective	Sweden	Evaluation of excess mortality rate between women with cosmetic breast implants by suicide and other causes of death	3-fold risk of suicide. No increased risk of suicide until ten years post-implantation.	3,527	32	mortality with suicide and any other cause	ICD-7, ICD-8, ICD-9, and V01-Y98	18.7

Pukkala <i>et al.</i> (2003)	Cohort retrospective	Finland	Assess the death reason in Finnish women who experienced cosmetic breast implants	2 to 3-fold increased suicide risk. Association of the psychopathology factor and suicide risk. Six suicidal deaths during the first five years post-implantation and five during the later follow-up period.	2,166	< 30 (47% of patients)	Age, different causes of death	ICD-10	10.3
Rubin <i>et al.</i> (2010)	Cohort retrospective	United States	Health Characteristics of Postmenopausal Women with Breast Implants	High suicidal deaths (7%) versus controls (0.4%). Significant differences in health characteristics and quality of life measures in women who experienced breast implants decades following implant surgery.	93,676 (86,686 women without implant); 1257 with implant	50-79	Body mass index, age, Ethnicity, Region, education, Income, Hormone Use, Smoking status, Baseline Disease History, Weight at Different Ages, Dietary Data, Baseline Exercise Data, quality of life, cause of death	Numerous self-administered questionnaires.	
Singh, <i>et al.</i> (2017)	Cohort prospective	United States	Comparison of rare adverse event rates in individuals with Silicone Implants versus National Norms and saline implants	No significant higher rate of suicide in women with silicone implants than in the general female population.	55,279	≥ 22 years = both primary augmentation and revision augmentation, ≥18 years or older = both primary reconstruction or revision-reconstruction	adverse events (diseases and suicide) and the number of related deaths	Numerous questionnaires	5 to 8 years
Villeneuve <i>et al.</i> (2006)	Cohort retrospective	Canada	Evaluating mortality among Canadian women with cosmetic breast implants	No differences in suicide rates among implant women and patients with other cosmetic plastic surgeries.	40,451 (24,558 breast implants and 15,893 plastic surgery patients)	32	Age, all-cause mortality	ICD-9	15

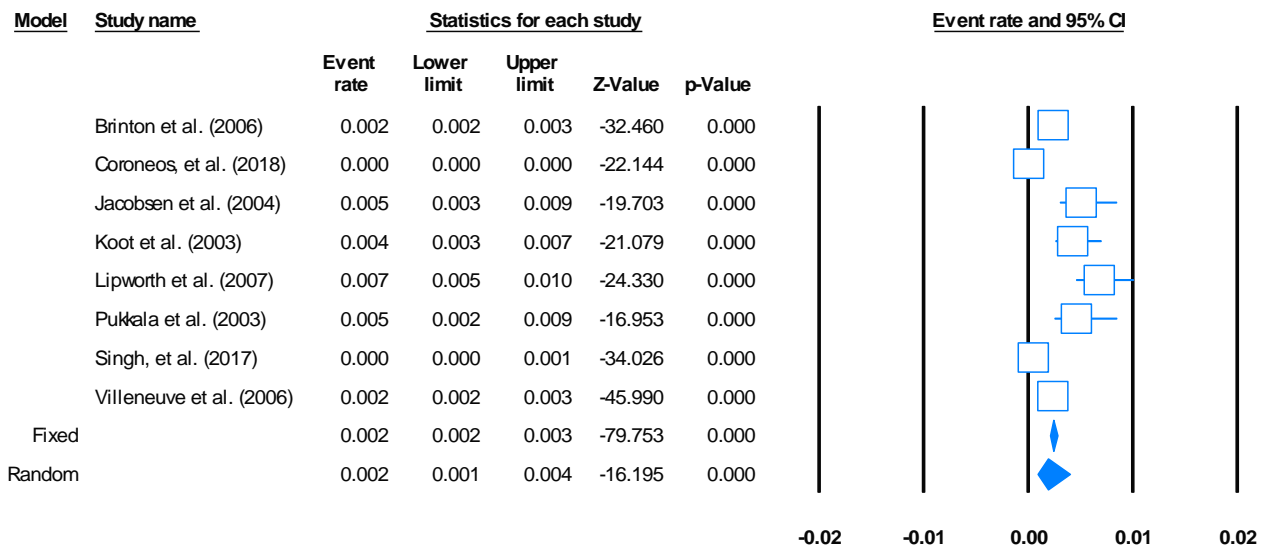
Von Soest <i>et al.</i> (2012)	Cohort prospective	Norway	Evaluation of predictors of cosmetic surgery and its effects on mental health and psychological factors	Increases in suicide attempts from T2 to T4 compared to normal controls by surgery prediction. Surgery did not predict changes in deliberate self-harm. Various mental health symptoms predict cosmetic surgery but cosmetic surgery does not reduce such mental health disorders.	1,597 (78 had cosmetic surgery; and 44 breast implant)	24.61 ± 3.90 (adolescents)	Body Areas Satisfaction, Physical Appearance, Mental health, Sexual functions, Drug use, Behavior problems, Sociodemographic variables, Deliberate Self-harm, Suicidal ideation, Parasuicide, Smoking, illicit drug use, Age, Urbanization, Parental unemployment, Occupation, and Education	Body Areas Satisfaction, Self-Perception Profile for Adolescents, Hopkins Symptom Checklist, Eating Attitude Test-26, DSM-III-R	13
Brinton <i>et al.</i> (2006)	Cohort retrospective	United states	Assessing the rate of mortality between women with augmentation mammoplasty	Elevation of the risk of suicide among implant patients. Unclear reason for risk of suicide among implant patients. Predisposing personality characteristics suggested as a possible factor for suicide.	12,144	< 35 - 45+	All causes of death	ICD-9	5
Koot <i>et al.</i> (2003)	Cohort prospective	Sweden	Mortality among Swedish women with cosmetic breast implants	Increased risk of suicide. Greater prevalence of psychopathology is an associated risk factor.	7,585	31.6	Cause of death		28

ICD: International Classification of Disease



Table 3. Prevalence Rate of Suicide in the Studied Articles that Were Eligible for Systematic Review

Authors	Sample size		Death due to suicide	Breast Implant		Other cosmetic surgeries			
	Implant group	Other surgeries	SMR (95%CI)	Number	Suicide Rate	SMR (95%CI)	death (N)	Suicide Rate	RR (95%CI)
Brinton A, 2006	443	221	1.63 (1.1-2.3)	29	0.06	0.85 (0.3-2.3)	4	0.03	2.58 (0.9-7.8)
Coroneos, 2018	99,993 (56% silicone)			5 in silicone	0.01				
de Paula, <i>et al.</i> (2018)	185			NM in Allergan	0.1				
Jacobsen <i>et al.</i> (2004)	2761		1.6 (1.0-2.5)	22	3.1 (1.7-5.2)				
Lipworth <i>et al.</i> (2007)	3527		3.0 (1.9-4.5) 45 years of age or older: 6.8 (2.2-15.8)	24					
Rubin <i>et al.</i> (2010)	1257	86686	Rate: 7%	3		Rate: 0.4%	20		
Singh, <i>et al.</i> (2017)	55,279			20	10.6 (7.0 -15.4)				
Villeneuve <i>et al.</i> (2006)	24,558	15,893	1.73 (1.31, 2.24)	58	1.73 (1.31, 2.24)	1.55 (1.07, 2.18)	33	1.55 (1.07, 2.18)	1.10 (0.72, 1.69)
Von Soest <i>et al.</i> (2012)	44				2.91 (1.28-6.60)				
Koot <i>et al.</i> (2003)	7585			15	2.9 (1.6-4.8)				
Pukkala <i>et al.</i> (2003)	2166		3.19 (1.53-5.86)	10					



Meta Analysis

Figure 2. Forrest Plot of the Suicide Prevalence in Cosmetic Breast Implant Patients Reported in Included Studies Based on Fixed and Random Effects Model

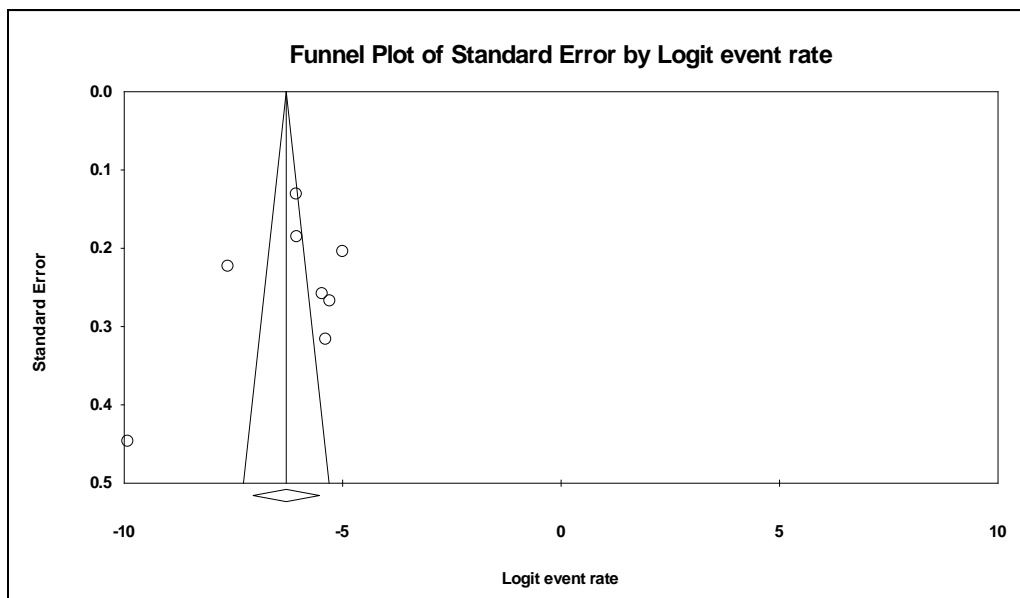


Figure 3. Funnel Chart of the Suicide Prevalence Rate in the Selected Studies

Discussion

There was a correlation between cosmetic breast implants and suicide risk, as suggested by studies included in this systematic review. Although the exact

nature of this association is partly unidentified, it is theoretically possible to demonstrate that neurological changes following breast implants can result in suicidal behavior. As a result, most of the literature on the

association among breast implants and the risk of suicide focuses on the psychological features of the women's previous psychopathology (24, 31). Anxiety and depression are among the symptoms which can lead to suicide (32, 33). A lower suicide risk was reported in pregnant women (34) and women who have a child under two years of age (35). On the contrary, single, unmarried, or divorced women who do not have strong social support in their life and also who experience occupational instability (36, 37) and women aged between 35 and 44 years showed an increased risk of suicide (15). Miscarriage is another risk factor for suicide, especially when induced (38). Infertility, chronic illness, residing in cities, and the familial clustering of suicidal tendencies are less-studied factors that contribute to suicide in the female population (15). Female cosmetic breast implant patients with suicidal attitudes share many characteristics with the general population, as shown by Manoloudakis *et al.* (6). These characteristics include the patient's age, alcohol consumption, relationship issues, history of different psychiatric disorders and admission to a psychiatric clinic, reproductive history, as well as the Caucasian race. (5), Despite the higher rates of suicide among women with implants, the range of effect size was large (1.10 to 13.1) and the adjusted analyses were accompanied with nonsignificant results, as were the summary effect size (2.85 [95% CI, 0.77 to 10.50]) in 5 studies) and the summary standardized mortality ratio (1.99 [95% CI, 0.89 to 4.43]) in three studies. Also, the Radio-opaque nature of materials of breast implants may lead to alteration of breast tissue images in mammography and late detection of breast cancer, which may correlate with psychological aspects caused by experiencing survival events (30). Prediction of suicide is a difficult task. Various characteristics, including mental history and demographic, biological, social, and other factors must be looked into separately and according to the situation of each patient. In fact, the evidence about the possible influences of breast implants on suicide risk and other psychiatric problems is still inconclusive. Seven studies reported a significant association among breast augmentation and suicide risk, while 3 others could not detect a meaningful association. In 4 studies, previous mental health problems were suggested as part of the associated factors in this regard. Boosting the sense of self-esteem, less desirability due to macromastia, feeling un-normal due to breast asymmetry, losing shape after pregnancy, and mastectomy are among the most common causes leading to the rise of breast augmentation surgery (29). Breast implant registries are an efficient platform for improved safety for both patients and plastic surgeons (39). A study in 2019 found that although there are numerous national and international registries, only a nominal percentage of conducted surgical breast augmentations are truly documented (40). It seems that there is a need for more reliable administrative governmental structures

for implementing such platforms to evaluate the safety of long-term use of breast implants. Also, the mental aspects of human health should not be neglected in such registries.

In fact, there is no consensus in current research about the possible effect of breast implants on the risk of suicide and other psychiatric issues. While three additional research were unable to find a relevant correlation, seven investigations found a substantial association among breast augmentation and the risk of suicide.

Before deciding on a cosmetic breast implant, a mental health consultation should be conducted if there is a history of psychopathological disorders in women or if the surgeon suspects that the patient may be experiencing some type of psychopathology. To produce stronger data in this area, more carefully planned prospective studies with a bigger sample size, better handling of potential confounders, and a longer follow-up period are required. It is also recommended to explain the relationship between preoperative psychopathology characteristics and subsequent postoperative psychopathological behaviors using large prospective studies utilizing standardized evaluation methodologies, such as the Structured Clinical Interview for the DSM-5. It is also necessary to use other suicide risk indicators, like hopelessness and any suicidal ideation. We did not eliminate any low-quality papers from our systematic review and meta-analysis because there is not much evidence linking cosmetic breast implants to an elevated suicide risk. Additionally, one study (25), which we were unable to include in our meta-analysis, described the mortality rate following suicidal attempts among women with breast implant surgery. The other drawback was that we were unable to conduct a meta-regression in this area, since only a small number of papers supplied participant mean ages, and in most of them, the age range of the women was mentioned. It is advised that additional high-quality follow-up studies be conducted to assess the impact of age and any associations between suicide and the presence of cosmetic breast implants.

### Limitation

In the current systematic review and meta-analysis, the suicide rate among women with cosmetic breast implants was evaluated, and the results are not generalizable to other types of breast implants. The other drawback was that we were unable to conduct a meta-regression in this area since only a small number of papers supplied participants' mean ages, and in most of them, the age range of the women was mentioned. We couldn't find additional data on the suicide attempt in the included studies' data, and it is another study limitation.

### Conclusion

According to this comprehensive review, 0.2% of women who receive cosmetic breast implants commit

suicide. According to the results of included eligible studies, there might be a correlation between cosmetic breast implants and suicide risk, which could be stronger in the presence of a history of mental illnesses.

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## Conflict of Interest

All authors strongly certify that there are no conflicts of interests with any existing financial organization regarding all the material debated in this manuscript.

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