



Original Contribution

Mortality among Canadian Women with Cosmetic Breast Implants

Paul J. Villeneuve^{1,2}, Eric J. Holowaty³, Jacques Brisson⁴, Lin Xie¹, Anne-Marie Ugnat¹, Louis Latulippe⁴, and Yang Mao¹

¹ Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, Ottawa, Ontario, Canada.

² Department of Public Health Sciences, University of Toronto, Toronto, Ontario, Canada.

³ Informatics Research and Development, Cancer Care Ontario, Toronto, Ontario, Canada.

⁴ Department of Social and Preventive Medicine, Laval University, Laval, Quebec, Canada.

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There is widespread concern about possible long-term health effects among women who have received breast implants for cosmetic purposes; few studies have reported on the mortality patterns of such women. The authors examined cause-specific mortality in a cohort of 24,558 women with breast implants and 15,893 women who underwent other plastic surgery procedures in Ontario and Quebec, Canada, between 1974 and 1989. Deaths through 1997 were identified through linkage to the national mortality database. The authors compared the mortality of women who received implants with that of the general population by using standardized mortality ratios; Poisson regression was used to perform internal cohort comparisons. Overall mortality was lower among women who received breast implants relative to the general population (standardized mortality ratio = 0.74, 95% confidence interval: 0.68, 0.81). In contrast, higher suicide rates were observed in both the implant (standardized mortality ratio = 1.73, 95% confidence interval: 1.31, 2.24) and other plastic surgery (standardized mortality ratio = 1.55, 95% confidence interval: 1.07, 2.18) patients. No differences in mortality were found between the implant and other surgeries group for any of the 20 causes of death examined. Findings suggest that breast implants do not directly increase mortality in women. Further work is needed to evaluate risk factors for suicide among women who undergo elective cosmetic surgery.

breast implants; cohort studies; mortality; suicide

Abbreviations: CI, confidence interval; SMR, standardized mortality ratio.

The potential for silicone-gel-filled breast implants to adversely affect the health of women continues to be widely debated and a source of controversy. In 1992, the US Food and Drug Administration placed restrictions on the availability of silicone-gel-filled implants; these implants were made available to women undergoing breast reconstruction or for other medical purposes. At that time, there were no reliable estimates of the incidence or prevalence of complications among women who had received breast implants (1). Manufacturers of silicone-gel-filled implants were asked to demonstrate that these devices were both safe and effective.

Since then, several epidemiologic studies have reported on the adverse health effects associated with both saline and silicone-gel-filled breast implants. Health outcomes most widely studied among women who received breast implants for cosmetic purposes have included breast cancer, hematopoietic disorders, and connective tissue disorders (2–7). In contrast, relatively little attention has been given to the impact that psychological risk factors before and after surgery may have on the long-term health of these women. The observation by Borah et al. (8) that psychological complications were more prevalent than postoperative infections or

Reprint requests to Dr. Yang Mao, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, 120 Colonnade, Address Locator 6702A, Ottawa, Ontario, Canada K1A 0K9 (e-mail: Yang_Mao@phac-aspc.gc.ca).

hematomas among individuals who underwent cosmetic plastic surgery procedures underscores the importance of investigating these health effects.

In recent years, four cohort studies have reported on the mortality experience of women who received breast implants for augmentation purposes (9–12). All four of these studies reported increased suicide rates among women receiving these implants when compared with rates in the general population. Despite the consistency of these findings, the studies have been severely limited by small sample sizes. In particular, across the four studies, there were a combined 58 deaths from suicide compared with an expected number of 25.2 (standardized mortality ratio (SMR) = 2.3, 95 percent confidence interval (CI): 1.7, 3.0) (13). These small numbers make it difficult to characterize suicide risk by age group and time since surgery was performed. While some consistency has been noted for suicide outcomes in these studies, findings for other causes of deaths across these cohorts have been equivocal. When compared with overall mortality patterns for the general population, lower rates in two of the studies (9, 12) and higher rates in the other two (10, 11) were found for women who had received implants.

To provide further insights into the mortality experience of women who receive breast implants, herein we report on a longitudinal study of 24,558 women who received breast implants in Ontario and Quebec, Canada. To our knowledge, this is the largest breast implant cohort assembled to date, with some women followed for up to 24 years. Particular emphasis was placed on comparing the suicide and all-cause mortality rates for those who received breast implants with those for the general population and with those for a comparison group of women who underwent other plastic surgery procedures.

MATERIALS AND METHODS

Study population

The study population consisted of women, 18 years of age or older, who were residents of Ontario or Quebec and who underwent bilateral cosmetic augmentation mammoplasty in their province of residence between January 1, 1974, and December 31, 1989. A control cohort of women who received other common elective cosmetic surgeries was also assembled. These women received other cosmetic procedures, not billable to the publicly funded health insurance plans of Ontario or Quebec, that included the following: chemical peel or dermabrasion, coronal brow lift (eyebrow and forehead lift), otoplasty (ear surgery), rhinoplasty (nose surgery), rhytidectomy (face-lift), or blepharoplasty (eyelid surgery). Controls were frequency matched to the breast implant patients according to a ratio of 1:2 by province of residence, year of entry into the cohort, and plastic surgeon.

In Ontario, eligible subjects were identified through plastic surgeons who performed augmentation mammoplasty in the province between 1974 and 1989. Pilot studies revealed that the surgeons who performed augmentation mammoplasty also performed most of the controls' procedures, thus allowing controls to be selected from the same clinics. Over the study period, it was estimated that 133 plastic sur-

geons ever performed bilateral augmentation mammoplasty; nearly three quarters of these procedures were performed by 24 plastic surgeons.

In Quebec, breast implant recipients and controls were identified from MED-ECHO files and from records of plastic surgeons in private plastic surgery clinics for the period between January 1, 1974, and December 31, 1989. The MED-ECHO database is a computerized system that describes all hospital separations that occur in Quebec. Inpatient and day surgeries performed in public hospitals are reported to MED-ECHO. The implant and control cohorts were recruited from among women operated on by approximately 100 surgeons who have practiced in Quebec since 1974.

Excluded from both the implant and control cohorts were women who had undergone any previous major breast surgery, including reduction mammoplasty, breast lift, and breast cancer surgery. We also excluded women who had received other types of silicone or artificial implants, or had a male genotype, or had a history of cancer (excluding non-melanoma skin cancer) of any site before breast implant surgery. No data were collected on other cosmetic procedures performed subsequent to the initial breast implant or on cosmetic procedures. However, limited data were collected on revision surgeries, where applicable, related to the breast implant.

In total, the cohort consisted of 40,451 women; 24,558 had received breast implants (7,153 women from Ontario and 17,405 from Quebec). The plastic surgery control group consisted of 15,893 women (4,418 from Ontario and 11,475 from Quebec).

Ethics approval for the study was granted by the University of Toronto's Office on Research Studies and the ethics committees of Saint-Sacrement Hospital and Laval University.

Ascertainment of vital status

The mortality experience of the cohort was determined by linking personal identifying information to the Canadian Vital Statistics Database. This database, maintained by Statistics Canada, contains death registrations for all Canadian residents who died beginning in 1950. Records were linked by using a probabilistic procedure that compared common fields in the two files, assigned weights to the resulting links, and calculated a total weight. Links with a sufficiently high weight were accepted as a match, and manual resolution was applied to resolve any questionable links. Date of death and underlying cause of death, based on the *International Classification of Diseases*, Ninth Revision (14), were extracted from the database.

Manual resolution involved inspecting the death certificates for the questionable links. Doing so enabled us to review data not contained in the Canadian Vital Statistics Database, thereby providing additional information so we could better determine whether the cohort member had indeed died. This extra information available on only the death certificate included type of work and industry of employment. In addition, although the database contained only the first and second given names of a cohort member, death certificates may provide more detailed information.

TABLE 1. Characteristics of women who received breast implants, Ontario and Quebec, Canada, 1974–1997

Characteristic	Breast implant patients						Other plastic surgery patients					
	Ontario		Quebec		Total		Ontario		Quebec		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Age at surgery (years)												
18–<30	3,010	42.1	6,616	38.0	9,626	39.2	1,777	40.2	4,768	41.6	6,545	41.2
30–<40	3,106	43.4	7,957	45.7	11,063	45.0	1,377	31.2	2,808	24.5	4,185	26.3
≥40	1,037	14.5	2,832	16.3	3,869	15.8	1,264	28.6	2,899	25.3	4,163	26.2
Period of surgery												
1974–1979	1,498	20.9	5,844	33.6	7,342	29.9	699	15.8	3,902	34.0	4,601	29.0
1980–1984	2,224	31.1	5,926	34.1	8,150	33.2	1,287	29.1	4,508	39.3	5,795	36.5
1985–1989	3,431	48.0	5,635	32.4	9,066	36.9	2,432	55.1	3,065	26.7	5,497	34.6
Total no. of subjects	7,153	100.0	17,405	100.0	24,558	100.0	4,418	100.0	11,475	100.0	15,893	100.0
No. of deaths	106		403		509		75		332		407	

It is possible that some deaths may have been missed because women died outside the country. For out-of-country deaths, only those that occur in the United States are reported, and Canada currently receives abstracted death data for its residents from approximately 20 states (15). The results of previous record linkage mortality studies suggest

that the number of deaths that would be missed would be quite small given the personal identifying information available for the cohort (16, 17). Therefore, underascertainment of observed cases used to derive the standardized mortality ratio should be minimal. For internal cohort comparisons, we know of no reason why mortality ascertainment would

TABLE 2. Observed and expected* numbers of deaths, standardized mortality ratios, and 95% confidence intervals for women who received cosmetic breast implants, Ontario and Quebec, Canada, 1974–1997

Cause of death	ICD-9† codes	Observed	Expected	SMR†	95% CI†
All causes		480	648.8	0.74	0.68, 0.81
Infectious diseases	1–139	8	8.4	0.96	0.41, 1.88
Endocrine diseases	240–279	4	18.3	0.22	0.06, 0.56
Mental disorders	290–319	4	4.5	0.89	0.24, 2.27
Nervous system diseases	320–389	5	18.2	0.27	0.09, 0.64
Circulatory diseases	390–459	75	137.6	0.55	0.43, 0.68
Coronary heart	410–414, 429.2	35	70.7	0.50	0.35, 0.69
Cerebrovascular	430–438	29	32.7	0.89	0.59, 1.28
Respiratory diseases	460–519	16	26.7	0.60	0.34, 0.97
Digestive diseases	520–579	12	22.9	0.52	0.27, 0.91
Cancer	140–208 (excluding 173)	229	303.1	0.76	0.66, 0.86
Breast	174	37	82.6	0.45	0.32, 0.62
Brain	191	6	10.5	0.57	0.21, 1.25
Genital	179–184	24	33.1	0.72	0.46, 1.08
Colorectal	153–154	25	23.0	1.09	0.70, 1.61
Bronchus and lung	162.2–5, .8, .9	70	62.3	1.12	0.88, 1.42
Injuries	800–999	113	82.4	1.37	1.13, 1.65
Suicide	950–959	58	33.5	1.73	1.31, 2.24
Other	800–949, 960–999	55	48.9	1.13	0.85, 1.47
Other deaths	Those not included above	14	26.7	0.52	0.29, 0.88

* Person-years of follow-up and deaths were accrued beginning 1 year after surgery; expected numbers of deaths were calculated by multiplying age, period of surgery, and cause-specific female mortality rates for Ontario and Quebec by the corresponding number of person-years of follow-up observed in the cohort.

† ICD-9, *International Classification of Diseases*, Ninth Revision; SMR, standardized mortality ratio; CI, confidence interval.

TABLE 3. Observed and expected* numbers of deaths, standardized mortality ratios, and 95% confidence intervals for plastic surgery patients, Ontario and Quebec, Canada, 1974–1997

Cause of death	ICD-9† codes	Observed	Expected	SMR†	95% CI†
All causes		383	564.7	0.68	0.61, 0.75
Infectious diseases	1–139	4	6.3	0.63	0.17, 1.62
Endocrine diseases	240–279	5	17.6	0.28	0.09, 0.66
Mental disorders	290–319	4	4.6	0.87	0.23, 2.22
Nervous system diseases	320–389	4	15.5	0.26	0.07, 0.66
Circulatory diseases	390–459	76	140.5	0.54	0.43, 0.68
Coronary heart	410–414, 429.2	35	76.8	0.46	0.32, 0.63
Cerebrovascular	430–438	20	30.0	0.67	0.41, 1.03
Respiratory diseases	460–519	15	27.0	0.55	0.31, 0.92
Digestive diseases	520–579	7	20.6	0.34	0.14, 0.70
Cancer	140–208 (excluding 173)	194	254.8	0.76	0.66, 0.88
Breast	174	40	64.0	0.62	0.45, 0.85
Brain	191	10	8.3	1.21	0.58, 2.22
Genital	179–184	16	27.1	0.59	0.34, 0.96
Colorectal	153–154	14	21.2	0.66	0.36, 1.11
Bronchus and lung	162.2–5, .8, .9	60	53.8	1.12	0.85, 1.44
Injuries	800–999	63	55.4	1.14	0.87, 1.46
Suicide	950–959	33	21.2	1.55	1.07, 2.18
Other	800–949, 960–999	30	34.1	0.88	0.59, 1.26
Other deaths	Those not included above	11	22.4	0.49	0.24, 0.88

* Person-years of follow-up and deaths were accrued beginning 1 year after surgery; expected numbers of deaths were calculated by multiplying age, period of surgery, and cause-specific female mortality rates for Ontario and Quebec by the corresponding number of person-years of follow-up observed in the cohort.

† ICD-9, *International Classification of Diseases*, Ninth Revision; SMR, standardized mortality ratio; CI, confidence interval.

be different between women who received breast implants and those who had other cosmetic surgeries; therefore, incomplete ascertainment of deaths was not expected to bias our estimates of relative risk.

Statistical analysis

For each woman, person-years of follow-up were calculated from 1 year after the date of surgery until the earliest of date of death or December 31, 1997. The first year of follow-up was excluded from analysis to reduce the influence that preexisting disease at the time of surgery may have had on our comparisons.

The numbers of person-years and deaths were tabulated across strata defined by implant or surgical control group, province of residence at the time of implant (Quebec or Ontario), attained age (18–24, 25–29, 30–34, . . . , 75–79, ≥80 years), follow-up interval (1974–1977, 1978–1981, . . . , 1994–1997), period of surgery (1974–1979, 1980–1984, 1985–1989), age at surgery (18–<30, 30–<40, ≥40 years), and time since surgery (1–<5, 5–<10, ≥10 years). Attained age, follow-up interval, and time since surgery were time-dependent variables because women would contribute person-years to different categories within these variables

as they were followed over time. In contrast, women would contribute person-years to only one level of the classification variables of period of surgery and age at surgery. The DATAB module in the Epicure (18) software program was used to tabulate person-years of follow-up.

We compared cause-specific mortality rates for both the breast implant patients and the other cosmetic surgeries group with those for the general population. Rates for the provinces of Ontario and Quebec were obtained from provincial vital registry data (unpublished mortality tabulations, Surveillance Division, Public Health Agency of Canada, Ottawa, 2005). The expected numbers of deaths in the cohort were estimated by multiplying the tabulated person-years of follow-up by the corresponding cause-specific female mortality rates observed in the general population according to province, age (by 5-year age intervals), and follow-up interval (1974–1977, 1978–1981, 1982–1985, 1986–1989, 1990–1993, and 1994–1997). Mortality risk was evaluated by calculating the standardized mortality ratio, which is the ratio of the observed to the expected number of deaths. The 95 percent confidence intervals were calculated by assuming that the observed number of deaths followed a Poisson distribution; we used a formula detailed elsewhere (19). All the *p* values reported herein are two sided.

TABLE 4. Comparisons of the mortality experiences* of women who received breast implants for cosmetic purposes with those of other plastic surgery patients, Ontario and Quebec, Canada, 1974–1997

Cause of death	ICD-9† codes	No. of deaths		RR‡	95% CI†
		Breast implant patients (345,116 PYs)	Other plastic surgery patients (225,032 PYs)		
All causes		480	383	1.02	0.89, 1.17
Infectious diseases	1–139	8	4	1.46	0.43, 4.91
Endocrine diseases	240–279	4	5	0.72	0.19, 2.73
Mental disorders	290–319	4	4	1.09	0.27, 4.44
Nervous system diseases	320–389	5	4	1.14	0.30, 4.37
Circulatory diseases	390–459	75	76	0.97	0.70, 1.34
Coronary heart	410–414, 429.2	35	35	1.08	0.67, 1.74
Cerebrovascular	430–438	29	20	1.21	0.68, 2.17
Respiratory diseases	460–519	16	15	1.14	0.56, 2.34
Digestive diseases	520–579	12	7	1.18	0.46, 3.04
Cancer	140–208 (excluding 173)	229	194	0.96	0.79, 1.16
Breast	174	37	40	0.76	0.48, 1.19
Brain	191	6	10	0.42	0.15, 1.15
Genital	179–184	24	16	1.10	0.58, 2.10
Colorectal	153–154	25	14	1.42	0.73, 2.77
Bronchus and lung	162.2–5, .8, .9	70	60	0.94	0.66, 1.34
Injuries	800–999	113	63	1.18	0.86, 1.61
Suicide	950–959	58	33	1.10	0.72, 1.69
Other	800–949, 960–999	55	30	1.26	0.81, 1.98
Other deaths	Those not included above	14	11	1.10	0.49, 2.46

* Person-years of follow-up (PYs) and deaths were accrued beginning 1 year after surgery.

† ICD-9, *International Classification of Diseases*, Ninth Revision; CI, confidence interval.

‡ The relative risk (RR) was adjusted for age and province of residence; the referent group consisted of other plastic surgery patients.

Mortality comparisons between women who received breast implants and the other plastic surgery patients were performed by using Poisson regression. We included in these multivariable models terms for attained age and province of residence. Doing so allowed the resultant relative risks to be adjusted for differences in age, and province of residence, that existed between the implant and other plastic surgery group.

RESULTS

The study cohort consisted of 24,558 women who received breast implants and 15,893 plastic surgery patients (table 1). For the surgical controls, the corresponding figure was 240,874. On average, women who received other cosmetic procedures were slightly older than women who had breast implants. In particular, the mean ages at surgery for Ontario women who received breast implants and those who received other cosmetic surgeries were 31.8 and 33.8 years, respectively. The corresponding figures for Quebec women in the cohort were 32.4 and 33.4 years of age. A larger portion of the Quebec component of the cohort, relative to Ontario cohort members, underwent breast augmentation

during the early part of the study period (1974–1979); consequently, mean follow-up was longer among Quebec women (15.5 years vs. 13.9 years). Among the 24,558 women who received breast implants, 18 percent of the implants contained saline and 66 percent were silicone gel filled, while the implant type could not be determined for 16 percent.

After we excluded the first year of follow-up, 480 deaths were observed among women who received breast implants (table 2). A lower than expected number of deaths occurred among implant patients when compared with the general population (SMR = 0.74, 95 percent CI: 0.68, 0.81). Similarly, women who received breast implants had lower all-cancer (SMR = 0.76, 95 percent CI: 0.66, 0.86), coronary heart disease (SMR = 0.50, 95 percent CI: 0.35, 0.69), and breast cancer (SMR = 0.45, 95 percent CI: 0.32, 0.62) mortality rates. Elevated mortality rates for suicides were observed among women who received breast implants (SMR = 1.73, 95 percent CI: 1.31, 2.24).

Mortality comparisons between other cosmetic surgery patients and the general population are presented in table 3. Overall, these patients were found to have lower mortality rates (SMR = 0.68, 95 percent CI: 0.61, 0.75) and for nearly

TABLE 5. Standardized mortality ratios for suicide* among breast implant patients and other plastic surgery patients relative to the general female population, by period of surgery, age at surgery, time since surgery, and follow-up interval, Ontario and Quebec, Canada, 1974–1997

	Breast implant patients			Other plastic surgery patients			All patients combined		
	No. of deaths	SMR†	95% CI†	No. of deaths	SMR	95% CI	No. of deaths	SMR	95% CI
Period of surgery									
1974–1979	24	1.69	1.08, 2.52	13	1.50	0.80, 2.56	37	1.62	1.14, 2.23
1980–1984	21	1.79	1.11, 2.74	16	1.98	1.13, 3.22	37	1.87	1.32, 2.58
1985–1989	13	1.71	0.91, 2.93	4	0.90	0.24, 2.29	17	1.41	0.82, 2.26
Age at surgery (years)									
18–<30	21	1.77	1.09, 2.70	15	1.81	1.01, 2.98	36	1.78	1.25, 2.47
30–<40	25	1.52	0.98, 2.25	13	1.65	0.88, 2.82	38	1.56	1.11, 2.15
≥40	12	2.31	1.19, 4.04	5	0.99	0.32, 2.31	17	1.66	0.97, 2.66
Time since surgery (years)									
1–<5	15	1.84	1.03, 3.03	8	1.52	0.66, 3.00	23	1.71	1.09, 2.57
5–<10	21	1.81	1.12, 2.76	12	1.65	0.85, 2.87	33	1.75	1.20, 2.45
≥10	22	1.60	1.00, 2.43	13	1.49	0.79, 2.56	35	1.56	1.09, 2.17
Follow-up interval									
1974–1979	3	4.12	0.83, 12.05	1	2.12	0.03, 11.78	4	3.33	0.90, 8.54
1980–1984	6	1.27	0.46, 2.77	9	2.97	1.36, 5.65	15	1.94	1.08, 3.20
1985–1989	18	1.94	1.15, 3.07	7	1.16	0.47, 2.40	25	1.64	1.06, 2.42
1990–1997	31	1.65	1.12, 2.34	16	1.37	0.78, 2.22	47	1.54	1.13, 2.05
Total	58	1.78	1.31, 2.24	33	1.55	1.07, 2.18	91	1.66	1.34, 2.04

* Person-years of follow-up and deaths were accrued beginning 1 year after surgery.

† SMR, standardized mortality ratio; CI, confidence interval.

all cause-specific types of deaths. In contrast, other plastic surgery patients experienced higher suicide rates than the general population (SMR = 1.55, 95 percent CI: 1.07, 2.18).

For the 20 different causes of death examined, we found no statistically significant differences in mortality rates between women who received breast implants and those undergoing other cosmetic surgeries (table 4). These comparisons were adjusted for the age and province of residence of the cohort members.

For suicides, we undertook more detailed comparisons between the general population and women who received breast implants and those undergoing other cosmetic surgeries. Specifically, we examined variations in the standardized mortality ratio according to time since surgery, age at surgery, follow-up interval, and period of surgery; the findings are presented in table 5. Among women who received breast implants, the standardized mortality ratios for suicides were higher for those who underwent the procedure at a later age (≥40 years) and during the calendar period between 1974 and 1979. Conversely, among the other plastic surgery patients, the standardized mortality ratio was higher for women who underwent the procedures at an earlier age. There was no trend in the standardized mortality ratio according to “time since surgery” in either the breast implant or other cosmetic surgeries group.

DISCUSSION

Overall, women who received breast implants for cosmetic purposes had lower mortality rates than the general population. A lower than expected number of deaths from cancer and circulatory diseases accounted for most of this reduction. Self-selection is a likely explanation for lower mortality rates because women who choose to undergo an invasive cosmetic procedure are likely to be, on average, in better health than those in the general population. This self-selection phenomenon is similar to the healthy-worker effect (20), in which mortality rates are lower among individuals in an occupational cohort relative to the general population. Women who receive breast implants are also recognized to differ from other women with respect to several factors that may be associated with mortality. In particular, they are frequently of higher socioeconomic status (21), a recognized correlate of improved health status. Lifestyle characteristics of women who receive breast implants, that are risk factors for several diseases, have also been shown to differ from those of women in the general population. To control for these differences, selection of other women who have undergone other cosmetic procedures as a control group has been recommended (22). In our study, there were no statistically significant differences in cause-specific mortality between women who

received breast implants and women undergoing other plastic surgery procedures.

An important strength of this cohort is its relatively large size. The sizes of the four previous cohort studies were only 2,166 (12), 2,761 (10), 3,521 (11), and 13,488 (9). This limited size, coupled with the relatively young age of the women enrolled in previous cohorts, provided limited statistical power to compare mortality rates with either the general population or other groups of patients.

A number of studies of breast implants were designed primarily to evaluate the long-term risk of developing breast cancer after mammoplasty (3, 5, 7). In our cohort, a reduced breast cancer mortality rate was found among women who received implants when compared with the general population. This finding is consistent with those from previous cohort studies. We also observed reduced breast cancer incidence rates among the implant population when compared with the other plastic surgery patients (relative risk = 0.64, 95 percent CI: 0.53, 0.79) (23).

Consistent with previous work (9–12), increased rates of suicide were observed among women who received breast implants relative to the general population. Previous research has suggested that women who receive breast implants are more likely to have undergone psychotherapy treatment and to have lower levels of self-esteem and self-confidence (24, 25). More recently, increased prevalence of mental illness, as measured by admissions to psychiatric hospitals, has been reported among women undergoing cosmetic breast implantation (10). Elevated levels of depression have been reported among women receiving breast implants, with no postoperative signs of improvement (26). Some have speculated that the implants may contribute to increased rates of suicide (27, 28). Recently, it was suggested that complications experienced by women who received breast implants could contribute to increased despair, which may increase the chances of suicide (29). However, our findings do not support this hypothesis because we found no increase in the standardized mortality ratio for suicide with increasing length of follow-up; additionally, there were no differences in suicide rates between implant patients and other plastic surgery patients. Conversely, Brinton et al. (9) found that women who received breast implants had a higher suicide rate than women who received other surgical procedures (relative risk = 4.24, 95 percent CI: 0.9, 19.2). However, their finding is tenuous given that their cohort was much smaller, and only two suicides were observed among women who received other cosmetic surgeries.

Although this study evaluated a large number of mortality outcomes among women with breast implants and those undergoing other cosmetic surgeries, these health outcomes provide limited information about these women's overall health status. In particular, complications arising from breast implantation surgery carry risks, as well as the associated risks that arise from corrective medical or surgical interventions (30). These complications can include pain, disfigurement, serious infection, capsular contraction, and implant rupture or migration of silicone gel. A review of the health-related safety of breast implants concluded that existing studies do not rule out a small, but significant increase

in the risk of connective tissue disease (1). An overall evaluation of the safety of these devices needs to carefully consider these health outcomes. Given that many of the women in our cohort received breast implants at a very young age, continued follow-up of this cohort is important given that some adverse health conditions may not present until much later in life.

In conclusion, our study found that women who received breast implants had a lower mortality risk than the general population and a risk similar to that for women who received other cosmetic surgeries. This finding strongly suggests that breast implants do not directly have an adverse effect on long-term mortality. Nonetheless, further studies that collect detailed risk factor data for suicides among both implant and other cosmetic surgery patient populations are needed. Serious consideration should be given to providing consultation for patients who are considered by the plastic surgeon to be at high risk of psychiatric disorder or suicide.

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