Contraception in breast cancer survivors from the FEERIC case-control study (performed on behalf of the Seintinelles research network)

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ABSTRACT

Objective: To compare the prevalence of contraception in breast cancer (BC) patients at risk of unintentional pregnancy (*i.e.* not currently pregnant or trying to get pregnant) and matched controls.

Study design: The FEERIC study (Fertility, Pregnancy, Contraception after BC in France) is a prospective, multicenter case-control study, including localized BC patients aged 18–43 years, matched for age and parity to cancer-free volunteer controls in a 1:2 ratio. Data were collected through online questionnaires completed on the Seintinelles research platform.

Results: In a population of 1278 women at risk of unintentional pregnancy, the prevalence of contraception at study inclusion did not differ significantly between cases (340/431, 78.9%) and controls (666/847, 78.6%, $p = 0.97$). Contrarily, the contraceptive methods used were significantly different, with a higher proportion of copper IUD use in BC survivors (59.5% *versus* 25.0% in controls $p < 0.001$). For patients at risk of unintentional pregnancy, receiving information about chemotherapy-induced ovary damage at BC diagnosis (OR = 2.47 95%CI [1.39–4.37] and anti-*HER2* treatment (OR = 2.46, 95% CI [1.14–6.16]) were significantly associated with the use of a contraception in multivariate analysis.

Conclusion: In this large French study, BC survivors had a prevalence of contraception use similar to that for matched controls, though almost one in five women at risk of unintentional pregnancy did not use contraception. Dedicated consultations at cancer care centers could further improve access to information and contraception counseling.

1. Introduction

Breast cancer (BC) is the most common cancer in women. Approximately 11 000 women under the age of 45 years are diagnosed with BC annually in France [1]. Over the last decade, physicians have begun to pay more attention to the possibility of pregnancy following BC. Concerns have been raised over decades about the impact on recurrence of breast cancer after a pregnancy and BC patients have long been advised against conception in the future, due to fears that pregnancy could adversely affect their breast cancer outcome. However, many data have since emerged to indicate that pregnancy does not have a detrimental effect on survival [2], regardless of ER status [3,4], and the presence or absence of a germline *BRCA* mutation [5].

Contraception after BC has been little studied. However, it is a particularly important issue because pregnancy planning in these patients is crucial from a medical point of view, as highlighted in a previous study [6]. Patients who do not wish to become pregnant should actively avoid pregnancy, particularly during tamoxifen treatment, as this drug is known to have potential teratogenic effects [7]. Moreover, chemotherapy-induced amenorrhea might be associated with an unpredictable resumption of menses, potentially resulting in an unwanted pregnancy. Effective, safe, well-tolerated contraception is therefore of considerable importance for this population.

Female hormonal contraception has been available for over 50 years and is used by more than 300 million women worldwide [8]. Hormonal contraceptives are classically contraindicated in BC patients, and women are generally advised to stop hormonal contraceptive use at the time of BC diagnosis. Classic options for alternative contraceptive methods, according to guidelines [9], include intrauterine device (IUD), or barrier methods. Thus, breast cancer survivors have few contraceptive options, mostly non-hormonal methods. Previous studies have shown that sexually active cancer survivors have lower rates of use of World Health Organization tier I-II contraceptive methods [10–12], and are considered at high risk of unintended pregnancy [13]. In the FIRST cohort [10], breast cancer patients were found to be three times less likely to use emergency contraception than other cancer survivors.

The FEERIC study was designed to compare fertility, pregnancy and contraception outcomes in young BC survivors and matched cancer-free women. The objective of the study described here was to analyze contraception use during follow-up and to compare contraceptive use between BC survivors and matched controls.

2. Materials and methods

2.1. Study design and data collection

The design of The FEERIC (Fertility, Pregnancy, Contraception after BC in France) study has been described elsewhere [14]. Briefly, the FEERIC study is a prospective case-control study assessing the impact of BC treatment on fertility, pregnancy, and contraception in young BC survivors. Women were recruited from March 13, 2018 to June 27, 2019. The study was launched by the Seintinelles research network. The scientific board of the Seintinelles approved the FEERIC project in December 2015, and the ethics board of Sud Ouest Outre Mer II approved the project on October 5, 2017. Seintinelles is a collaborative social network created in 2012 to accelerate the recruitment of French volunteers for cancer research studies, by connecting researchers with men and women of various ages, social and medical backgrounds with or without a history of cancer. In September 2022, the network included more than 37 000 French citizens willing to participate in research studies. Cases and controls were recruited by both (i) the Seintinelles network through the sending of a newsletter to the pool of volunteers to invite them to participate to the survey; and by (ii) nine breast care/-oncofertility and gynecology centers (See appendix material and methods).

Volunteers matching the inclusion criteria (11 questions) were sent a link to the survey and were asked to complete a baseline form at inclusion and follow-up forms every six months (a total of six forms). Data were collected via self-administered online questionnaires released through the Seintinelles research platform. The current study concerns baseline characteristics and attitudes to contraception at study inclusion.

2.2. Study population

The inclusion criteria for cases were: female patients aged from 18 to 43 years with a previous diagnosis of localized, relapse-free BC (invasive or *in situ*) and who had completed treatment (surgery, chemotherapy, and radiotherapy) at the time of enrollment. The exclusion criteria were previous hysterectomy and/or bilateral oophorectomy and/or bilateral salpingectomy. The controls were women aged from 18 to 43 years, free from BC or other cancers, who had not undergone hysterectomy, bilateral oophorectomy or bilateral salpingectomy (Fig. S1).

We initially planned to match each BC patient (case) for age (± 2 years) and parity with two volunteers (controls) recruited prospectively within the Seintinelles network and one control from the patient's close circle of friends and relatives. However, too few controls of this second type were recruited. We therefore pooled these controls with the volunteers recruited through the Seintinelles network, and each case was matched to two controls based on age and previous parity.

We excluded the women who were attempting to conceive or pregnant at inclusion (cohort 1 on the study flow chart), to define a subpopulation of women at risk of unintentional pregnancy (cohort 2).

2.3. Contraception

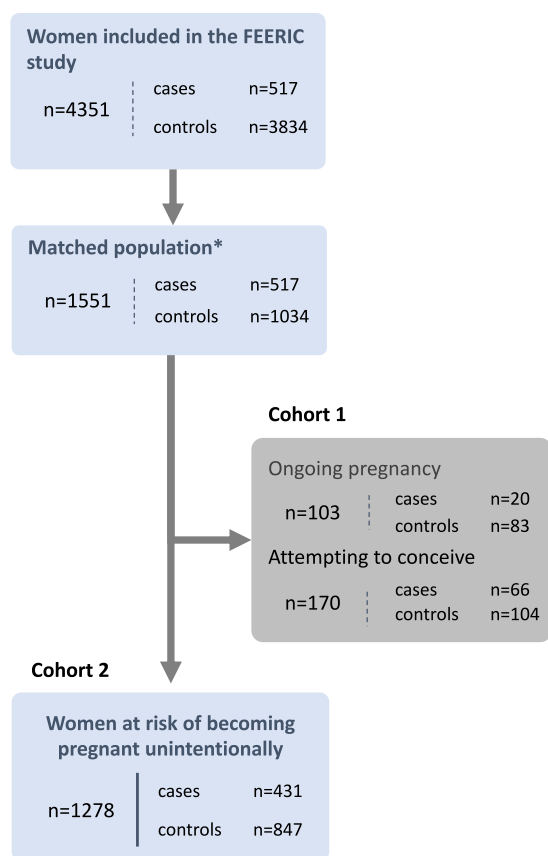#### 2.3.1. Prevalence of contraception

The prevalence of contraception was defined as the percentage of women currently using, or whose sexual partner was currently using, at least one method of contraception, regardless of the method used.

2.3.2. Classification of contraceptive methods

Each contraceptive method was classified according to three classifications: (i) **the WHO contraceptive effectiveness tier classification** [15,16] (*Tier 1/Tier 2/Tier 3 & 4*); (ii) The **hormonal nature** of the contraception method (hormonal *versus* non-hormonal); The **reversibility** of the contraception method (definitive *versus* reversible) (See appendix material and methods).

2.4. Emergency contraception

Emergency contraception was defined as methods of contraception (oral or IUD) used to prevent pregnancy after sexual intercourse. These contraceptive methods were not included in the previous classification of contraceptive methods, and data were collected in a dedicated section of the form.

Fig. 1. Flow chart for the study cohort.

2.5. Study endpoint

The primary outcome measure was a comparison of the prevalence of contraception at study inclusion between cases and controls, for women at risk of unintentional pregnancy. Secondary endpoints included the comparison between the type of contraceptive methods use between cases and controls, the analysis of factor associated with contraceptive use, and the description of the use of emergency contraception.

2.6. Statistical analysis

The study population is described in terms of frequencies for qualitative variables, or medians and associated ranges for quantitative variables. Associations between continuous and categorical variables were assessed using Student's *t*-tests or Wilcoxon-Mann-Whitney tests where indicated. Associations between categorical variables were assessed with Chi-squared tests, or with Fisher's exact test if at least one category included fewer than three patients. A value of $p \leq 0.05$ was considered statistically significant. For identification of the factors predictive of contraceptive use in BC patients at risk unintentional pregnancy, variables were introduced into a univariate logistic regression model. A multivariate logistic model was then generated with a forward stepwise selection procedure, with all covariates included having a likelihood ratio test *p*-value ≤ 0.05. Data were processed and statistical analyses were performed with R software version 3.1.2 (www.cran.r-project.org, (R Foundation for Statistical Computing, 2009)).

Table 1
Characteristics of the women (cases and controls) in the population at risk of unintentional pregnancy.

Variable	Class	All	Case	Control	p
n =		**1278**	**431**	**847**	
Age at study inclusion		37.1 (4.2)	37.18 (4.28)	37.00 (4.22)	0,494
Age at study inclusion	<30	98 (7.7)	36 (8.4)	62 (7.3)	0,424
	[30–35 [	344 (26.9)	104 (24.1)	240 (28.3)	
	[35–40 [	514 (40.2)	177 (41.1)	337 (39.8)	
	≥40	322 (25.2)	114 (26.5)	208 (24.6)	
Study level	Bachelor or lower	137 (10.7)	50 (11.6)	87 (10.3)	0,528
	University	1141 (89.3)	381 (88.4)	760 (89.7)	
Profession (class)	Intermediate	547 (42.8)	189 (43.9)	358 (42.3)	0,847
	Low CSP or unemployed	124 (9.7)	42 (9.7)	82 (9.7)	
	Superior	607 (47.5)	200 (46.4)	407 (48.1)	
Marital status (current)	Single	258 (20.2)	77 (17.9)	181 (21.4)	0,161
	Coupled up	1020 (79.8)	354 (82.1)	666 (78.6)	
BMI (4 classes)	Underweight	61 (4.8)	23 (5.3)	38 (4.5)	**0,007**
	Normal weight	828 (64.8)	303 (70.3)	525 (62.0)	
	Pre-obesity	260 (20.3)	74 (17.2)	186 (22.0)	
	Obesity	129 (10.1)	31 (7.2)	98 (11.6)	
Smoking status	Current	205 (16.0)	54 (12.5)	151 (17.8)	**0,017**
	Former	463 (36.2)	174 (40.4)	289 (34.1)	
	Never	610 (47.7)	203 (47.1)	407 (48.1)	
Comorbidities	No	839 (65.6)	305 (70.8)	534 (63.0)	**0,007**
	Yes	439 (34.4)	126 (29.2)	313 (37.0)	
	Stroke	11	3	8	
	VTE	32	11	21	
	Hypertension	26	7	19	
	Diabetes	6	2	4	
	Dyslipidemia	37	7	30	
	Thyroid disease	81	25	56	
	Renal failure	3	0	3	
	Depression	166	48	118	
	Other	189	50	139	
Comedications	No	981 (76.8)	321 (74.5)	660 (77.9)	0,191
	Yes	297 (23.2)	110 (25.5)	187 (22.1)	
Previous pregnancy (at BC diagnosis)	No	353 (27.6)	118 (27.4)	235 (27.7)	0,942
	Yes	925 (72.4)	313 (72.6)	612 (72.3)	
Familial history of BC	No	624 (48.8)	196 (45.5)	428 (50.5)	0,153
	At least 1 first degree relative	255 (20.0)	97 (22.5)	158 (18.7)	
	At least 1 s degree relative	399 (31.2)	138 (32.0)	261 (30.8)	
Gynecological follow-up	No	228 (17.8)	72 (16.7)	156 (18.4)	0,497
	Yes	1050 (82.2)	359 (83.3)	691 (81.6)	

Each BC patient (case) was matched for age and parity to two volunteers (controls). We excluded 103 women currently pregnant and 170 women attempting to conceive from the analyses.
Abbreviations: breast cancer (BC); body mass index (BMI); socioprofessional

category (SPC).

"*n*" denotes the number of patients. Categorical variables are expressed as absolute numbers (percentages in brackets). Continuous variables are expressed as mean values, with the standard deviation in brackets. There were no missing data.

3. Results

3.1. Prevalence of contraception and contraceptive methods

3.1.1. Population matching

We matched the 517 BCE patients with a control population of 3834 cancer-free volunteers included in the study on the basis of matching for age (± 2 years old) and parity in a 1:2 ratio, resulting in an overall population of 1551 women (cases *n* = 517, controls *n* = 1034). After exclusion of the patients who were pregnant (*n* = 103) or trying to

Table 2
Factors associated with the use of contraception in patients with contraceptive needs.

Variable	Class	All	With contraception		Univariate			Multivariate		
					OR	OR (95%)	p	OR	OR (95%)	p
Age at study inclusion (continuous)					0,91	[0.85–0.98]	**0,011**			
Age at study inclusion	<30	34	30	88,20%	1					
	[30–35 [	97	89	91,80%	1,48	[0.37–5.07]	0,543			
	[35–40 [	163	134	82,20%	0,62	[0.17–1.71]	0,396			
	≥40	109	87	79,80%	0,53	[0.15–1.52]	0,273			
Study level	Bachelor or lower	44	37	84,10%	1					
	University	359	303	84,40%	1,02	[0.4–2.28]	0,957			
Profession (class)	Intermediate	176	153	86,90%	1					
	Low CSP or unemployed	40	34	85%	0,85	[0.34–2.45]	0,747			
	Superior	187	153	81,80%	0,68	[0.38–1.2]	0,182			
Marital status (current)	Single	59	45	76,30%	1					
	Coupled up	344	295	85,80%	1,87	[0.93–3.6]	0,067			
BMI (4 classes)	Underweight	21	16	76,20%	1					
	Normal weight	287	242	84,30%	1,68	[0.53–4.54]	0,334			
	Pre-obesity	69	61	88,40%	2,38	[0.65–8.19]	0,172			
	Obesity	26	21	80,80%	1,31	[0.32–5.49]	0,703			
Smoking status	Current	53	41	77,40%	1					
	Former	164	138	84,10%	1,55	[0.7–3.3]	0,261			
	Never	186	161	86,60%	1,88	[0.85–4.01]	0,106			
Comorbidities	No	289	248	85,80%	1					
	Yes	114	92	80,70%	0,69	[0.39–1.24]	0,205			
Comedications	No	299	253	84,60%	1					
	Yes	104	87	83,70%	0,93	[0.52–1.75]	0,816			
Prior use of contraception (before BC diagnosis)	No	90	72	80,00%	1					
	Yes	313	268	85,60%	1,49	[0.8–2.69]	0,198			
Previous pregnancy (at BC diagnosis)	No	103	85	82,50%	1					
	Yes	300	255	85%	1,2	[0.65–2.15]	0,551			
Previous children (at BC diagnosis)	No	135	114	84,40%	1					
	Yes	268	226	84,30%	0,99	[0.55–1.74]	0,976			
Number of children (3 classes)	0	135	114	84,40%	1					
	1	91	78	85,70%	1,11	[0.53–2.39]	0,793			
	More than 1	177	148	83,60%	0,94	[0.5–1.73]	0,843			
Pregnancy desire (at BC diagnosis)	Attempted pregnancy	39	31	79,50%	1					
	Future pregnancy desire	156	136	87,20%	1,75	[0.67–4.24]	0,225			
	No	188	155	82,40%	1,21	[0.48–2.77]	0,662			
	Pregnant at diagnosis	20	18	90%	2,32	[0.51–16.52]	0,318			
Gynecological follow-up	No	64	52	81,20%	1					
	Yes	339	288	85%	1,3	[0.63–2.54]	0,455			
Fertility counseling (at BC diagnosis)	No	108	81	75%	1			1		
	Yes	284	251	88,40%	2,54	[1.43–4.47]	**0,001**	2,47	[1.39–4.37]	**0,002**
Contraception counseling	No	136	107	78,70%	1					
	Yes	267	233	87,30%	1,86	[1.07–3.2]	**0,026**			
Quality of contraception counseling	Not satisfied	45	36	80%	1					
	Satisfied	358	304	84,90%	1,41	[0.61–2.98]	0,394			
Fertility preservation	No	270	225	83,30%	1					
	Yes	133	115	86,50%	1,28	[0.72–2.36]	0,416			
Chemotherapy	No	79	69	87,30%	1					
	Yes	324	271	83,60%	0,74	[0.34–1.47]	0,418			
Radiotherapy	No	64	52	81,20%	1					
	Yes	339	288	85%	1,3	[0.63–2.54]	0,455			
AntiHER2 therapy	No	310	254	81,90%	1			1		
	Yes	93	86	92,50%	2,71	[1.27–6.72]	**0,018**	2,46	[1.14–6.16]	**0,034**
Endocrine therapy	No	140	115	82,10%	1					
	Yes	263	225	85,60%	1,29	[0.73–2.23]	0,37			

Abbreviations: socioprofessional category (SPC); breast cancer (BC); body mass index (BMI).

"*n*" denotes the number of patients. Categorical variables are expressed as absolute numbers, with percentages in brackets. Continuous variables are expressed as the mean value, with the standard deviation in brackets. Analysis performed for cases only, because too many variables of interest were missing for multivariate analysis on the whole population. There were no missing data. Regarding the variable: "Fertility counseling at diagnosis", the exact question collected via self-administered online questionnaires was: "Have you received information about the potential consequences of treatments on fertility and/or the possibility of a subsequent pregnancy?".
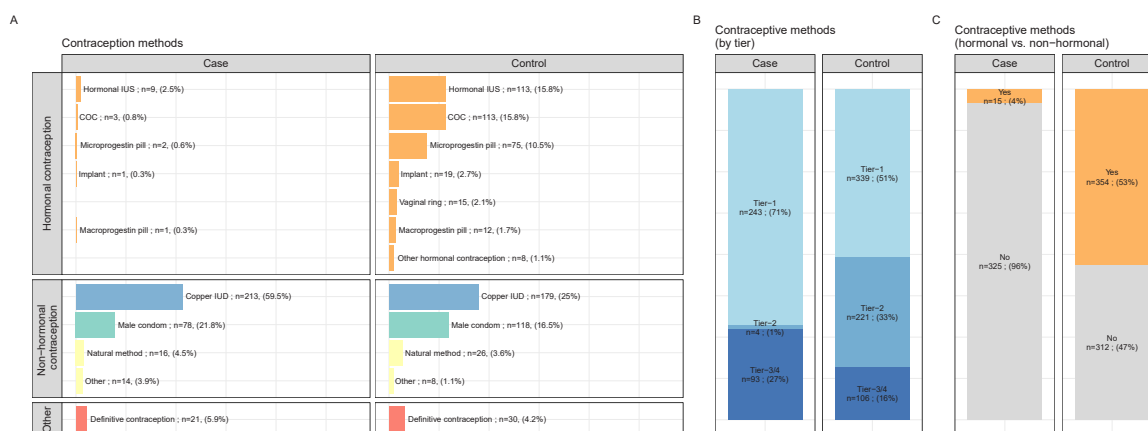
Fig. 2. Comparison of contraceptive methods between cases and controls in the population of patients at risk of unintentional pregnancy. A, Contraceptive methods in cases and controls at inclusion in the study. B, Type of contraception, by tier category, at inclusion, for the cases and controls. C, Use of hormonal contraception by cases and controls at inclusion in the study. All data are reported per contraceptive method (one patient can use several methods). Abbreviations: combined oral contraceptive (COC); intrauterine system (IUS); intrauterine device (IUD).
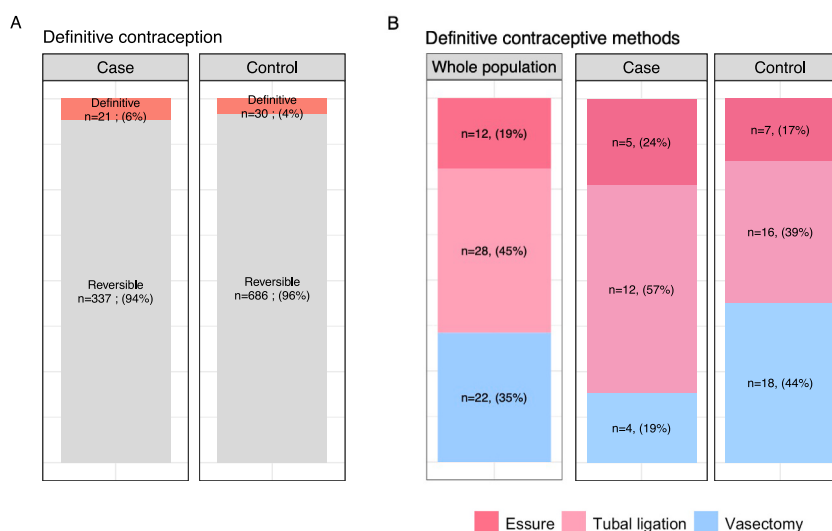
Fig. 3. Use of definitive contraception in cases and controls A, Comparison of the use of definitive contraceptive methods between cases and controls. Data are reported per contraceptive method (one patient can use several methods). B, Comparison of the type of definitive contraceptive methods by cases and controls. Data are reported per contraceptive method (one patient can use several methods).

conceive ($n = 170$), 1278 women remained for the analyses (case $n = 431$, controls $n = 847$) (Fig. 1). Median age at inclusion in this study was 37.1 years. Median time between BC diagnosis and inclusion in the study was 30.8 months. The controls were significantly more obese or overweight and were more likely to be current smokers and to have concomitant comorbidity than the cases (Table 1).

Regarding partnered status, the *p*-value for the association between partnered status and contraceptive use (single: 76.3% *versus* coupled up: 85.8%) did not reach statistical significance, though we found a trend in such association ($p = 0.07$).

3.1.2. Prevalence of contraception and contraceptive methods

Overall, the prevalence of contraception did not differ between cases (340/431, 78.9%) and controls (666/847, 78.6%, $p = 0.97$). There were no association between contraceptive use at study inclusion and the prior use of contraception before BC diagnosis after univariate analysis ($p = 0.198$). Within the population of BC patients at risk of unintentional

pregnancy, the factors associated with the use of contraception were younger age, the information about chemotherapy-induced ovary damage received at BC diagnosis, the information about contraception received at BC diagnosis, and anti-*HER2* treatment but were not associated with having visited a gynecologist in the year before breast cancer diagnosis (Table 2).

In the multivariate analysis, only information about chemotherapy-induced ovary damage (OR = 2.47 95% CI [1.39–4.37] and anti-*HER2* treatment (OR = 2.46, 95% CI [1.14–6.16]) were significantly associated with the use of contraception.

The type of contraceptive method used differed significantly between cases and controls (Fig. 2A), with copper IUDs the major contraceptive method in cases, but with a lower frequency of use in controls (59.5% *versus* 25.0%, $p < 0.001$). Contraceptive methods also differed significantly between cases and controls in terms of efficacy according to the tier classification (Fig. 2B) ($p < 0.001$), and the use of hormonal versus non-hormonal methods ($p < 0.001$) (Fig. 2C).

Table 3
Knowledge and use of emergency contraception in cases and controls.

Variable	Class	All	Case	Control	p
n =		1278	431	847	
Knowledge of emergency contraception	No	13 (1.0)	5 (1.2)	8 (0.9)	0,946
	Yes	1265 (99.0)	426 (98.8)	839 (99.1)	
Knowledge of IUD use as emergency contraception	No or not known	1146 (89.7)	400 (92.8)	746 (88.1)	0,011
	Yes	132 (10.3)	31 (7.2)	101 (11.9)	
Believe contra-indication hormonal emergency contraception in case of BC	No		93 (21.6)		
	Not known		174 (40.4)		
	Yes		164 (38.1)		
Emergency contraception history	No	661 (51.7)	250 (58.0)	411 (48.5)	0,002
	Yes	617 (48.3)	181 (42.0)	436 (51.5)	
Type of emergency contraception	Emergency pill	615	181	434	
	IUD	4	2	2	
	Not known	2	0	2	
Emergency contraception use since BC diagnosis	No		162 (89.5)		
	Yes		19 (10.5)		
Type of emergency contraception since BC diagnosis	Emergency pill		16		

Abbreviations: intrauterine device (IUD); breast cancer (BC).

"n" denotes the number of patients. Categorical variables are expressed as absolute numbers, with percentages in brackets. Continuous variables are expressed as the mean value, with the standard deviation in brackets. For non-normal continuous variables, the median value is reported, with the interquartile range in brackets.

Missing data: type of emergency contraception pill, n = 2; type of emergency contraception pill used since BC diagnosis, n = 3.

3.2. Definitive contraception

The prevalence of definitive contraception was low and did not differ significantly between cases and controls (21/358 (5.9%) *versus* 30/716 (4.2%) respectively, p = 0.29) (Fig. 3A). Most of the definitive contraception methods used were female rather than male methods (66.7% *versus* 33.3%), with this tendency more marked among the cases than the controls (male methods: 19% for cases *versus* 44% for controls, p = 0.17), although this difference was not statistically significant (Fig. 3B).

3.3. Emergency contraception

The patients' knowledge and use of emergency contraception are summarized in Table 3. All but 13 patients (1.0%) from this population were aware of the existence of emergency contraception. The proportion of women who had used emergency contraception was smaller for cases than for controls (42.0% *versus* 51.5%). In total, 617 women (48.3%) had used emergency contraception at least once in their lifetime (cases n = 181 42%, controls n = 437 51.3%), and 19 patients (4.4%) had used emergency contraception since BC diagnosis.

Only 10.3% of women were aware that an IUD could be used as an emergency contraceptive method. Overall, 38.1% of BC patients thought that oral emergency contraception was contraindicated due to their history of cancer.

4. Discussion

This large study comparing BC survivors with age-matched controls

provides important new insight into the contraceptive practices of BC patients. We found that the overall prevalence of contraceptive use during follow-up was similar to that in matched controls from the general population.

Conflicting evidence has been published on this point and is summarized in Table 4 [17–22]. The discrepancies between published data and our findings may be explained by the origin of the patients, as the volunteers enrolled in the Seintinelles network have a higher social status than all-comers, and social status is also strongly related to adequate contraception [23]. Difficulties in accessing healthcare services, unemployment, or unstable family relations are hypotheses potentially explaining a lower contraceptive use in women from lower social backgrounds. Lambertini et al. found significant associations between contraceptive use after breast cancer and having visited a gynecologist in the previous year in multivariable analysis [18]. In contrast to the CANTO study, most of the patients in our study (339/403, 84%) reported regular gynecological follow-up before diagnosis, and this pattern was not associated with a greater likelihood of contraceptive use after cancer. This discrepancy might reflect the fact that the women of our study may lack contraception by personal choice rather that difficulties to access healthcare system. Finally, despite the higher prevalence of contraception in our study than in previous works, one on five of the women at risk of unintentional pregnancy declared no use of contraception, leaving room for improvement in the contraceptive coverage in this population. In previously published data on cases from the current cohort [14], unplanned pregnancies were more frequent than the use of ART after BC. Prospective follow-up will help determining if contraceptive use is associated with a decreased likelihood of unplanned pregnancies and elective abortions, and if the magnitude of this effect is similar in cases and controls.

The most frequently used contraceptive method after BC was, by far, the copper-IUD. Our study confirms that this method, which is recommended as the preferred option in guidelines [9], is feasible for BC survivors in real life. LNG-IUS were also used, but only in a very small subset of patients (n = 9, 0.3%). The level of evidence concerning the risk of BC recurrence in patients using LNG-IUS remains very low [25–28]. However, LNG-IUs is still considered as contra-indicated after BC, also this last advisory is not consensual [29].

Definitive contraceptive methods were used in no more than 5% of BC patients after treatment. This proportion is consistent with the rarity of definitive contraception in France [30], possibly due to cultural barriers, a lack of knowledge, or such methods not being proposed by doctors. When definitive methods were chosen, they were predominantly of the female type, particularly in BC patients. Tubal ligation and Essure* are both considered to be more invasive than vasectomy, a minimally invasive technique that can be performed under local anesthesia. Definitive contraceptive methods are particularly appropriate for BC survivors not intending to have children in the future. Efforts should therefore be made to inform doctors; BC patients and their partners correctly, so that such contraceptive methods can be offered more widely. We also identified unfounded beliefs, such as the belief that hormonal emergency contraception is contraindicated in patients with a history of BC, which was held by up to one third of patients, highlighting the critical need for appropriate contraceptive counseling.

One of the strengths of this study is that it is one of the largest study to date providing a detailed description of contraceptive methods, in terms of effectiveness, hormonal content and reversibility. Women with BC are more likely to be older, to have already had several pregnancies and to be living with a partner or married, and educated than other young adults and teenage cancer survivors [12]. Together with the contraindication of hormonal contraceptive use, dedicated analyses in this specific population are of interest. The limitations of this study include the recruitment of women via online networks, which may have led to an overestimation of the prevalence of contraception, as most of the women in the FEERIC study came from high-level socioprofessional backgrounds. In addition, due to self-reporting data collection, we might

Table 4
Table summarizing studies analyzing contraception in BC survivors.

Author and study	Year of inclusion	Country	Design	Total number patients	Patients	Age inclusion criteria	Median age	Number BC patients	Controls	Source of controls	Rate of contraceptive counseling	Contraceptive prevalence in women at risk of becoming pregnant unintentionally	Factors associated with contraceptive prevalence
Quinn et al., [13] *Contraception*	2010	USA	Written or online survey	476	Non gynecological cancer	<40 years old at diagnosis	31,1	**86**	51 277	General population estimation via the 2006–2010 National Survey for Family Growth	66.7%	*Unintended pregnancy risk:* 21%	***Lower use of tiers I-II:*** Increasing age: 1.07 per year; 95% CI [1.02–1.12]; *p* = 0.006 Previous BC history: OR 2.14; 95% CI [1.10–4.17]; *p* = 0.025
Maslow et al., [12] *Contraception*	2011–2012	USA	Online survey	107	Within 5 years of a cancer diagnosis	18–45 years old at study inclusion		**56**			65%	57%	**Higher use of tiers I-II:** Contraceptive counseling: OR 6.92; 95% CI [1.14–42.11]; *p* = 0.036 Non BC diagnosis: OR 3.60; 95% CI [1.03–12.64]; *p* = 0.046
Dominick et al., [10] *Obstetrics & Gynecology*	2011–2013	USA	Annual online or telephone survey	295	Cancer survivors	18–44 years old at study inclusion	31,6	**91**			56%	84%	***Higher use of tiers I-II:*** Family planning consult <1 year: RR 1.; 95% CI [1.1–1.5]; *p* < 0.01 ***Lower use of tiers I-II:*** ≥31 years old: RR 0.62; 95% CI [0.5–0.8]; *p* < 0.01 <2 years since cancer diagnosis:RR 0.66; 95% CI [0.5–0.9]; *p* < 0.01 BC diagnosis: RR 0.45; 95% CI [0.3–0.7]; *p* < 0.01
Hadnott et al., [24] *Fertility and Sterility*	2015–2017	USA	Online survey	483	Cancer survivors	18–40 years old at study inclusion	34	**113**			31%	84%	***Lower use of contraception:*** Chemotherapy: PR 1.7; 95% CI [1.1–2.7] History of infertility: PR 2.; 95% CI [1.9–4.3] Infertility perception: PR 4.0, 95% CI [2.5–7.4]
Mody et al., [21] *J Cancer Surviv*	2014–2015	USA	Online survey	150	History of Breast cancer within 5 years	18–50 years old at study inclusion	37,3	**150**			61%	83%	NA
Lambertini et al, [18] *JAMA Network Open*	2012–2017	France	Longitudinal evaluation	2900	Breast cancer survivors	18–50 years old at study inclusion	43,1	**2900**			45% at year 1 and 65.7% at year 2 during breast cancer follow-up	38.9% at year 1 and 41.2% at year 2 during breast cancer follow-up	***Higher use of contraception*** Using contraception at diagnosis: aOR: 4.02; 95% CI [3.15–5.14], Being younger: aOR, 1.09; 95% CI, 1.07–1.13 per each decreasing year), having better sexual

Table 4 (*continued*)

Author and study	Year of inclusion	Country	Design	Total number patients	Patients	Age inclusion criteria	Median age	Number BC patients	Controls	Source of controls	Rate of contraceptive counseling	Contraceptive prevalence in women at risk of becoming pregnant unintentionally	Factors associated with contraceptive prevalence
													function aOR: 1.13; 95% CI [1.07–1.19], Having children: aOR: 4.21; 95% CI [1.8–9.86], Presence of leukorrhea: aOR: 1.32, 95% CI [1.03–1.7], Tamoxifen treatment alone: aOR: 1.39; 95% CI [1.01–1.92], Gynecologist follow-up at 1 year: aOR : 1.29; 95% CI [1.02–1.63], Partnered status: aOR: 1.61; 95% CI [1.07–2.44]
Our study (2022)	2018–2019	France	Online survey	517	Breast cancer survivors	18–43 years old at study inclusion	37,1	**517**	1034	Controls from the research network matched on age and parity	66,30%	78.9%	*Higher use of contraception:* Younger age: OR 0.91; 95% CI [0.85–0.98]; $p = 0.011$ Information at BC diagnosis about chemo-induced ovarian damage: OR 2.47; 95% CI [1.39–4.37]; $p = 0.002$ Contraception information at BC diagnosis: OR 1.86; 95% CI [1.07–3.2]; $p = 0.026$ Anti-*HER2* treatment: OR 2.46; 95% CI [1.39–6.16]; $p = 0.018$

have missed information on BC characteristics that could potentially impact on reproductive life plans and on the adoption of contraceptive methods. Moreover, we did not report desire for future pregnancies at study inclusion. In addition, we were not able to collect data on sexual preference.

Finally, sexual and reproductive health education programs [31], and survivorship care tools for improving reproductive health issues, including contraception (SCP-R, NCT02667626), could help to facilitate access to contraception and to ensure that patients are offered a wider range of contraceptive methods, including definitive methods, for which take-up remains poor.

Acknowledgments

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.breast.2022.12.033.

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