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Influence of socioeconomic status on immediate breast reconstruction rate, patient information and involvement in surgical decision-making

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Background: **Immediate breast reconstruction (IBR) rates in breast cancer differ between healthcare regions in Sweden. This is not explained by regional differences in patient age distribution or tumour characteristics, but by differences in patient-reported information and patient involvement in the decision-making process. As socioeconomic status may play a significant role in surgical decision-making, its potential associations with IBR rates were analysed.**

Methods: **Women who had undergone therapeutic mastectomy for primary breast cancer in Sweden in 2013 were included in the analysis. Tumour and treatment data were retrieved from the Swedish National Breast Cancer Register, and socioeconomic background data from the Central Bureau of Statistics Sweden. Postal questionnaires regarding information about reconstruction and perceived involvement in the preoperative decision-making process had been sent out in a previous survey.**

Results: **In addition to regional differences, lower tumour and nodal category, independent factors increasing the likelihood of having IBR for the 3131 women in the study were living without a registered partner, having current employment and high income per household. Patient-reported perceived preoperative information (odds ratio (OR) 12·73, 95 per cent c.i. 6·03 to 26·89) and the feeling of being involved in the decision-making process (OR 2·56, 1·14 to 5·76) remained strong independent predictors of IBR despite adjustment for socioeconomic factors. Importantly, responders to the survey represented a relatively young and wealthy population with a lower tumour burden.**

Conclusion: **Several socioeconomic factors independently influence IBR rates; however, patient-reported information and involvement in the surgical decision-making process remain independent predictors for the likelihood of having IBR.**

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Introduction

Oncologically equivalent surgical choices in primary breast cancer are either breast-conserving surgery (BCS) followed by whole-breast irradiation, or mastectomy. Breast conservation has been shown[1] to have a positive influence on health-related quality of life, and may even offer survival benefits[2,3]. In about 40 per cent of patients[4], however, mastectomy is the selected treatment option, and reconstructive options should then be discussed. Breast reconstruction may be undertaken as an immediate procedure (at the same session as the mastectomy itself), which allows for skin- or nipple-sparing options, or as a delayed procedure (delayed breast reconstruction, DBR). Immediate breast reconstruction (IBR) is an increasingly common reconstructive option, even in the setting of postmastectomy radiotherapy[5]. Despite the negative impact of postmastectomy radiotherapy on surgical and patient-reported outcomes after IBR[6], this option is widely accepted today, possibly due to the use of autologous techniques[7], different radiation strategies[8] in the USA, or the increased use of meshes and matrices, with the implant placed in the prepectoral or subpectoral space[9,10].

Known contributing factors in the choice of IBR *versus* DBR *versus* no reconstruction are tumour characteristics, expected oncological treatment, surgical competence and resources, patient co-morbidity and body habitus, and patient preference. Moreover, retrospective cohort studies[11–13] have shown that non-white ethnicity, lower education, older age and single status decrease the likelihood of having IBR. In a Danish study[14], the rate of IBR was significantly higher among women with higher education and in hospitals with plastic surgery departments. Few studies, however, have focused on the association between socioeconomic factors and patient-reported preoperative information regarding reconstructive options, even though low satisfaction with information before breast cancer surgery is associated with an increased likelihood of experiencing anxiety and postoperative regret[15,16]. Alderman and colleagues[17] showed that only 33 per cent of women aged less than 80 years undergoing breast cancer surgery had discussed breast reconstruction with surgeons before surgery, and younger, more educated women with larger tumours were significantly more likely to have had this discussion. In another American study[18] using retrospective chart review, disparities in preoperative discussion about IBR depended on race, education and age. Economic reimbursement patterns in the USA may partly explain these observations. It is therefore important to explore the associations between socioeconomic factors, preoperative information and IBR rates in a setting, such as Sweden, where a public healthcare system aims to provide equal treatment options for every citizen at the same low cost.

Significant regional differences in IBR rates in Sweden have been reported previously[19], and were not explained by regional differences in tumour or patient characteristics, but by disparities in patient information, availability of plastic surgery services and patient involvement in decision-making. As socioeconomic factors were not taken into account at that time, the aim of the present study was to determine their potential association with IBR rates, as well as with patient-reported information and involvement in the surgical decision-making process.

Methods

This cohort study included all women operated on by mastectomy for a newly diagnosed primary breast cancer in Sweden in 2013 according to the Swedish National Breast Cancer Register (NKBC). Data on tumour characteristics, surgical procedures and planned oncological treatment were extracted from the NKBC. For a previous study[19], all surviving patients from this cohort had been sent a questionnaire (*Appendices S1* and *S2*, supporting information) in 2015 regarding their experiences of preoperative information regarding reconstructive options and of involvement in the decision-making process, with a response rate of 76·3 per cent. For the present study, however, the cohort was based on renewed data extraction from the NKBC, which produced a slightly higher number of breast cancer cases owing to late incoming registrations. The resulting cohort was linked to socioeconomic data from the Central Bureau of Statistics Sweden concerning family status, country of birth, educational level, occupation, socioeconomic group, and income per person and per household as per year of surgery. Disposable income was classified into three groups by dividing the cohort into equal proportions. The highest level of education was divided into four groups according to the Swedish educational system: primary school, secondary school, postsecondary school for 3 years or less, or postsecondary school for more than 3 years.

The original study was approved by the Ethics Review Board at Karolinska Institutet, Stockholm, in 2014 (2014/2106-31/1) with an amendment in order to update and complete the original database in 2016 (2016/373-32).

Statistical analysis

The study cohort was divided into two groups: women who had mastectomy without IBR and those who had mastectomy with IBR. Unfortunately, data on DBR are not available from the NKBC and there are no other published national data. Regarding cT status, the NKBC lists the option cT0 as 'no obvious tumour' as opposed to cTis, as *in situ* disease only. As cT0 is commonly reported based on palpation only, this was categorized as cT1.

The distribution of categorical data is presented as numbers per group with percentages, and continuous variables as median (range) values. Data were tested for normality, and non-parametric tests used accordingly. The χ^2 test or Fisher's exact test was used to analyse the distribution of categorical variables between groups. Comparison of median values for continuous variables in more than two groups was performed using the Kruskal–Wallis test; for two groups, the Mann–Whitney *U* test was employed.

To adjust for tumour and treatment data, as well as differences in socioeconomic characteristics between the two groups, multivariable logistic regression analyses were subsequently performed. Binary outcomes were: performance of IBR; patient-reported preoperative information on immediate reconstruction; and patient-reported involvement in the surgical decision-making process. Results are presented as odds ratios (ORs) with their respective 95 per cent confidence intervals.

To assess external validity, responders and non-responders to the postal questionnaire were compared.

Table 1 Age, tumour characteristics and socioeconomic status of questionnaire responders *versus* non-responders

	Total ($n = 3131$)	Survey responders ($n = 2171$)	Non-responders ($n = 960$)	P*
Age (years)				< 0·001
≤ 40	193 (6·2)	117 (5·4)	76 (7·9)	
41–50	527 (16·8)	382 (17·6)	145 (15·1)	
51–65	883 (28·2)	686 (31·6)	197 (20·5)	
> 65	1528 (48·8)	986 (45·4)	542 (56·5)	
Preoperative cT category				< 0·001
cTis (*in situ* only)	140 (4·5)	116 (5·3)	24 (2·5)	
cT1 (≤ 20 mm)	1396 (44·6)	1034 (47·6)	362 (37·7)	
cT2 (21–50 mm)	1223 (39·1)	809 (37·3)	414 (43·1)	
cT3 (> 50 mm)	290 (9·3)	177 (8·2)	113 (11·8)	
cT4	61 (1·9)	23 (1·1)	38 (4·0)	
Missing	21 (0·7)	12 (0·6)	9 (0·9)	
Preoperative cN category				< 0·001†
cN0	2534 (80·9)	1814 (83·6)	720 (75·0)	
cN1	566 (18·1)	337 (15·5)	229 (23·9)	
Missing	31 (1·0)	20 (0·9)	11 (1·1)	
Immediate breast reconstruction				0·008†
Yes	267 (8·5)	204 (9·4)	63 (6·6)	
No	2864 (91·5)	1967 (90·6)	897 (93·4)	
Family status				< 0·001†
Partnership/married	1651 (52·7)	1229 (56·6)	422 (44·0)	
Single	1454 (46·4)	925 (42·6)	529 (55·1)	
Missing	26 (0·8)	17 (0·8)	9 (0·9)	
Own birth country				< 0·001
Sweden	2708 (86·5)	1916 (88·3)	792 (82·5)	
Europe, not Sweden	269 (8·6)	164 (7·6)	105 (10·9)	
Outside Europe	154 (4·9)	91 (4·2)	63 (6·6)	
Highest level of education				< 0·001
Primary school	871 (27·8)	508 (23·4)	363 (37·8)	
Secondary school	1210 (38·6)	872 (40·2)	338 (35·2)	
Postsecondary school, ≤ 3 years	390 (12·5)	296 (13·6)	94 (9·8)	
Postsecondary school, > 3 years	625 (20·0)	477 (22·0)	148 (15·4)	
Missing	35 (1·1)	18 (0·8)	17 (1·8)	
Occupation				< 0·001
Clerk/civil servant	734 (23·4)	592 (27·3)	142 (14·8)	
Entrepreneur	98 (3·1)	76 (3·5)	22 (2·3)	
Labourer	421 (13·4)	305 (14·0)	116 (12·1)	
Unemployed/retired	1838 (58·7)	1194 (55·0)	644 (67·1)	
Missing	40 (1·3)	4 (0·2)	36 (3·8)	
Income per household				< 0·001
Low	1230 (39·3)	730 (33·6)	500 (52·1)	
Middle	936 (29·9)	693 (31·9)	243 (25·3)	
High	955 (30·5)	742 (34·2)	213 (22·2)	
Missing	10 (0·3)	6 (0·3)	4 (0·4)	
Region				0·054
North	231 (7·4)	145 (6·7)	86 (9·0)	
Stockholm/Gotland	583 (18·6)	410 (18·9)	173 (18·0)	
South	662 (21·1)	462 (21·3)	200 (20·8)	
South-East	383 (12·2)	286 (13·2)	97 (10·1)	
Uppsala/Örebro	661 (21·1)	451 (20·8)	210 (21·9)	
West	611 (19·5)	417 (19·2)	194 (20·2)	

Values in parentheses are percentages. *χ^2 test, except †Fisher's exact test.

Table 2 Age and tumour characteristics of 3131 women treated by therapeutic mastectomy in Sweden in 2013

	Mastectomy without IBR (*n* = 2864)	Mastectomy with IBR (*n* = 267)	*P*§
Age (years)			< 0·001
≤ 40	147 (5·1)	46 (17·2)	
41–50	416 (14·5)	111 (41·6)	
51–65	790 (27·6)	93 (34·8)	
> 65	1511 (52·8)	17 (6·4)	
Preoperative cT category			
cTis (*in situ* only)	94 (3·3)	46 (17·2)	< 0·001
cT1 (≤ 20 mm)	1269 (44·3)	127 (47·6)	
cT2 (21–50 mm)	1156 (40·4)	67 (25·1)	
cT3 (> 50 mm)	270 (9·4)	20 (7·5)	
cT4	56 (2·0)	5 (1·9)	
Missing or unknown	19 (0·7)	2 (0·7)	
Preoperative cN category			< 0·001¶
cN0	2289 (79·9)	245 (91·8)	
cN1	546 (19·1)	20 (7·5)	
Missing	29 (1·0)	2 (0·7)	
Neoadjuvant treatment	297 (10·4)	23 (8·6)	< 0·001
Postoperative invasive tumour size (mm)*†	22 (0–150)	18 (0–90)	< 0·001#
Postoperative histopathological node status			< 0·001
Negative	1509 (52·7)	186 (69·7)	
Positive	1170 (40·9)	60 (22·5)	
Missing	185 (6·5)	21 (7·9)	
Invasiveness			< 0·001
In situ only	211 (7·4)	92 (34·5)	
Invasive	2354 (82·2)	152 (56·9)	
Missing	299 (10·4)	23 (8·6)	
Presence of multifocality	700 (24·4)	47 (17·6)	< 0·001
Nottingham histological grade			0·254
1	349 (12·2)	32 (12·0)	
2	1360 (47·5)	111 (41·6)	
3	1019 (35·6)	109 (40·8)	
Missing	136 (4·7)	15 (5·6)	
Oestrogen receptor status‡	*n* = 2630	*n* = 2630	< 0·001
Negative	444 (16·9)	23 (13·4)	
Positive	2158 (82·1)	146 (84·9)	
Missing	28 (1·1)	3 (1·7)	
Progesterone receptor status‡	*n* = 2630	*n* = 172	< 0·001
Negative	788 (30·0)	40 (23·3)	
Positive	1804 (68·6)	128 (74·4)	
Missing	38 (1·4)	4 (2·3)	
Her2/neu status‡	*n* = 2630	*n* = 172	< 0·001
Negative	2150 (81·7)	139 (80·8)	
Positive	407 (15·5)	26 (15·1)	
Missing	73 (2·8)	7 (4·1)	
Proliferation (% Ki-67)*‡	25 (0–100)	22 (0–95)	< 0·001#

Values in parentheses are percentages unless indicated otherwise; *values are median (range). †Excluding patients who had neoadjuvant treatment; ‡excluding patients with only *in situ* disease. IBR, immediate breast reconstruction. §χ^2 test, except ¶Fisher's exact test and #Mann–Whitney *U* test.

Table 3 Socioeconomic characteristics of 3131 women who had therapeutic mastectomy in Sweden in 2013

	Mastectomy without IBR (*n* = 2864)	Mastectomy with IBR (*n* = 267)	*P**
Family status			0·007†
Registered partnership/married	1489 (52·0)	162 (60·7)	
Single	1351 (47·2)	103 (38·6)	
Missing	24 (0·8)	2 (0·7)	
Own birth country			0·001
Sweden	2487 (86·8)	221 (82·8)	
Europe, not Sweden	249 (8·7)	20 (7·5)	
Outside Europe	128 (4·5)	26 (9·7)	
Highest level of education			< 0·001
Primary school	841 (29·4)	30 (11·2)	
Secondary school	1106 (38·6)	104 (39·0)	
Postsecondary school, ≤ 3 years	353 (12·3)	37 (13·9)	
Postsecondary school, > 3 years	530 (18·5)	95 (35·6)	
Missing	34 (1·2)	1 (0·4)	
Occupation			< 0·001
Clerk/civil servant	588 (20·5)	146 (54·7)	
Entrepreneur	88 (3·1)	10 (3·7)	
Labourer	360 (12·6)	61 (22·8)	
Unemployed/retired	1792 (62·6)	46 (17·2)	
Missing	36 (1·3)	4 (1·5)	
Income per household			< 0·001
Low	1187 (41·4)	43 (16·1)	
Middle	859 (30·0)	77 (28·8)	
High	808 (28·2)	147 (55·1)	
Missing	10 (0·3)	0	

Values in parentheses are percentages. IBR, immediate breast reconstruction. *χ^2 test, except †Fisher's exact test.

All data analysis was performed using SPSS® version 24 (IBM, Armonk, New York, USA). Statistical significance was set at a level of 5 per cent for all analyses.

Results

The updated number of mastectomies from NKBC was 3210. One patient with missing data on the type of surgical procedure was excluded. For 78 women with bilateral disease, one side was selected at random, so that all subsequent analyses were based on 3131 women, 267 of whom (8·5 per cent) had IBR.

Socioeconomic differences in questionnaire responders *versus* non-responders

Of 2217 responders from the previous study[19], data for 46 individuals were lost on linkage to socioeconomic

Table 4 Regional variations in immediate breast reconstruction rates, preoperative patient and tumour characteristics, and socioeconomic status for 3131 women treated by therapeutic mastectomy for breast cancer in 2013

	North (*n* = 231)	Stockholm/Gotland (*n* = 583)	South (*n* = 662)	South-East (*n* = 383)	Uppsala/Örebro (*n* = 661)	West (*n* = 611)	*P*†
IBR	10 (4·3)	149 (25·6)	31 (4·7)	23 (6·0)	40 (6·1)	14 (2·3)	< 0·001
Preoperative cT category							< 0·001
cT1	105 (45·5)	224 (38·4)	311 (47·0)	206 (53·8)	265 (40·1)	285 (46·6)	
cT2	85 (36·8)	236 (40·5)	247 (37·3)	131 (34·2)	280 (42·4)	244 (39·9)	
cT3	20 (8·7)	81 (13·9)	36 (5·4)	33 (8·6)	74 (11·2)	46 (7·5)	
cT4	11 (4·8)	12 (2·1)	12 (1·8)	4 (1·0)	16 (2·4)	6 (1·0)	
In situ only	8 (3·5)	27 (4·6)	49 (7·4)	6 (1·6)	24 (3·6)	26 (4·3)	
Missing	2 (0·9)	3 (0·5)	7 (1·1)	3 (0·8)	2 (0·3)	4 (0·7)	
Preoperative cN category							0·657
cN0	180 (77·9)	481 (82·5)	527 (79·6)	315 (82·2)	545 (82·5)	486 (79·5)	
cN1	42 (18·2)	100 (17·2)	124 (18·7)	65 (17·0)	112 (16·9)	123 (20·1)	
Missing	9 (3·9)	2 (0·3)	11 (1·7)	3 (0·8)	4 (0·6)	2 (0·3)	
Age at surgery (years)*	65 (28–97)	62 (21–96)	64 (26–94)	63 (21–93)	65 (24–94)	65 (26–97)	0·001‡
Family status							0·002
Partnership/married	121 (52·4)	308 (52·8)	328 (49·5)	239 (62·4)	331 (50·1)	324 (53·0)	
Single	106 (45·9)	272 (46·7)	327 (49·4)	140 (36·6)	326 (49·3)	283 (46·3)	
Missing	4 (1·7)	3 (0·5)	7 (1·1)	4 (1·0)	4 (0·6)	4 (0·7)	
Own birth country							< 0·001
Sweden	212 (91·8)	467 (80·1)	580 (87·6)	341 (89·0)	570 (86·2)	538 (88·1)	
Europe, not Sweden	13 (5·6)	67 (11·5)	61 (9·2)	25 (6·5)	61 (9·2)	42 (6·9)	
Outside Europe	6 (2·6)	49 (8·4)	21 (3·2)	17 (4·4)	30 (4·5)	31 (5·1)	
Highest level of education							< 0·001
Primary school	70 (30·3)	113 (19·4)	201 (30·4)	115 (30·0)	194 (29·3)	178 (29·1)	
Secondary school	77 (33·3)	211 (36·2)	262 (39·6)	160 (41·8)	285 (43·1)	215 (35·2)	
Postsecondary school, ≤ 3 years	31 (13·4)	83 (14·2)	82 (12·4)	36 (9·4)	77 (11·6)	81 (13·3)	
Postsecondary, > 3 years	51 (22·1)	168 (28·8)	109 (16·5)	69 (18·0)	100 (15·1)	128 (20·9)	
Missing	2 (0·9)	8 (1·4)	8 (1·2)	3 (0·8)	5 (0·8)	9 (1·5)	
Occupation							< 0·001
Clerk/civil servant	53 (22·9)	190 (32·6)	133 (20·1)	84 (21·9)	137 (20·7)	137 (22·4)	
Entrepreneur	6 (2·6)	27 (4·6)	13 (2·0)	15 (3·9)	20 (3·0)	17 (2·8)	
Labourer	21 (9·1)	61 (10·5)	106 (16·0)	68 (17·8)	88 (13·3)	77 (12·6)	
Unemployed/retired	147 (63·6)	301 (51·6)	405 (61·2)	212 (55·4)	404 (61·1)	369 (60·4)	
Missing	4 (1·7)	4 (0·7)	5 (0·8)	4 (1·0)	12 (1·8)	11 (1·8)	
Income per household							< 0·001
Low	102 (44·2)	175 (30·0)	276 (41·7)	124 (32·4)	285 (43·1)	268 (43·9)	
Average	70 (30·3)	171 (29·3)	195 (29·5)	135 (35·2)	206 (31·2)	159 (26·0)	
High	59 (25·5)	236 (40·5)	188 (28·4)	122 (31·9)	168 (25·4)	182 (29·8)	
Missing	0	1 (0·2)	3 (0·5)	2 (0·5)	2 (0·3)	2 (0·3)	

Values in parentheses are percentages unless indicated otherwise; *values are median (range). IBR, immediate breast reconstruction. †χ^2 test, except ‡Kruskal–Wallis test.

data, probably due to the different registration of bilateral cases. In *Table 1*, survey responders are compared with 960 non-responders regarding tumour characteristics and socioeconomic factors. All tested factors, excluding region of residence, were significantly different between the two groups; responders were younger women with more favourable disease and a higher socioeconomic status (*Table 1*).

Tumour data, socioeconomic factors and regional reconstruction rates

Preoperative and postoperative patient and tumour characteristics are shown in *Table 2*. As expected, patients who underwent IBR were younger and had more favourable tumour characteristics. Likewise, socioeconomic background data (*Table 3*) showed that women having an IBR

Table 5 Univariable and multivariable binary logistic regression analysis of clinical and socioeconomic factors, with performance of immediate breast reconstruction rather than conventional mastectomy as the binary endpoint

	Univariable analysis		Multivariable analysis	
	Hazard ratio	*P*	Hazard ratio	*P*
Age (years)				
≤ 40	1·00 (reference)			
41–50	0·85 (0·58, 1·26)	0·425	0·88 (0·43, 1·78)	0·715
51–65	0·38 (0·25, 0·56)	< 0·001	0·54 (0·27, 1·09)	0·087
> 65	0·04 (0·02, 0·06)	< 0·001	0·11 (0·04, 0·30)	< 0·001
Preoperative cT category				
cTis (*in situ* only)	1·00 (reference)			
cT1 (≤ 20 mm)	0·21 (0·14, 0·30)	< 0·001	0·42 (0·23, 0·77)	0·005
cT2 (21–50 mm)	0·12 (0·08, 0·18)	< 0·001	0·23 (0·12, 0·45)	< 0·001
cT3 (> 50 mm)	0·15 (0·09, 0·27)	< 0·001	0·31 (0·13, 0·74)	0·008
cT4	0·18 (0·07, 0·49)	0·001	0·29 (0·02, 3·49)	0·326
Preoperative cN category				
cN0	1·00 (reference)			
cN1	0·34 (0·22, 0·55)	< 0·001	0·30 (0·14, 0·67)	0·003
Family status				
Partnership/married	1·00 (reference)			
Single	0·70 (0·54, 0·91)	0·007	1·81 (1·04, 3·17)	0·037
Own birth country				
Sweden	1·00 (reference)			
Europe, not Sweden	0·90 (0·56, 1·46)	0·677	0·97 (0·44, 2·14)	0·940
Outside Europe	2·29 (1·47, 3·56)	< 0·001	0·83 (0·37, 1·87)	0·653
Highest level of education				
Primary school	1·00 (reference)			
Secondary school	2·64 (1·74, 4·00)	< 0·001	0·62 (0·32, 1·20)	0·155
Postsecondary school, ≤ 3 years	2·94 (1·79, 4·83)	< 0·001	0·76 (0·35, 1·66)	0·498
Postsecondary school, > 3 years	5·03 (3·29, 7·68)	< 0·001	0·85 (0·41, 1·75)	0·659
Occupation				
Clerk/civil servant	1·00 (reference)			
Entrepreneur	0·46 (0·23, 0·90)	0·024	0·63 (0·22, 1·85)	0·403
Labourer	0·68 (0·49, 0·95)	0·022	0·94 (0·55, 1·63)	0·830
Unemployed/retired	0·10 (0·07, 0·15)	< 0·001	0·52 (0·27, 1·00)	0·049
Income per household				
Low	1·00 (reference)			
Middle	2·47 (1·69, 3·63)	< 0·001	1·90 (0·97, 3·70)	0·061
High	5·02 (3·53, 7·14)	< 0·001	2·79 (1·25, 6·22)	0·012
Region				
North	1·00 (reference)			
Stockholm/Gotland	7·59 (3·92, 14·69)	< 0·001	6·62 (2·70, 16·20)	< 0·001
South	1·09 (0·52, 2·25)	0·825	0·98 (0·38, 2·51)	0·958
South-East	1·41 (0·66, 3·02)	0·374	1·45 (0·54, 3·94)	0·462
Uppsala/Örebro	1·42 (0·70, 2·90)	0·329	1·32 (0·50, 3·44)	0·577
West	0·52 (0·23, 1·18)	0·119	0·57 (0·19, 1·77)	0·334
Received preoperative information				
Yes	1·00 (reference)			
No	32·99 (18·26, 59·59)	< 0·001	12·73 (6·03, 26·89)	< 0·001
Involved in decision-making				
Yes	1·00 (reference)			
No	13·71 (7·21, 26·07)	< 0·001	2·56 (1·14, 5·76)	0·023

Values in parentheses are 95 per cent confidence intervals.

tended to have a higher socioeconomic status. When the six Swedish healthcare regions were compared (*Table 4*), socioeconomic background, tumour data and IBR rates differed significantly among the women treated with mastectomy. The region of Stockholm/Gotland, with the highest IBR rate of 25·6 per cent, had the lowest rate of small cT1 tumours and the youngest age at surgery, but also the highest rate of non-Swedish born women, a higher level of education, fewest unemployed or retired individuals, and the largest high-income group.

In the previously reported study[19] of a similar cohort, younger age, non-invasive tumours, no clinically involved lymph nodes and residence in the Stockholm/Gotland region were independent predictors of undergoing IBR, as well as the availability of in-house plastic surgery services, patient information and involvement in decision-making. This raised the question of whether the observed regional differences could be associated with differences in socioeconomic factors. To assess this, univariable and multivariable analyses were performed. Apart from the above-mentioned clinical factors, which retained their independent significance, socioeconomic factors that independently increased the likelihood of having an IBR are shown in *Table 5*. Although being single appeared to decrease the likelihood of IBR in univariable analysis, this association reversed when adjusted for age, as being single strongly interacted with younger age. Despite these adjustments for socioeconomic status, the single most important independent predictor remained patient-reported preoperative information about the possibility of IBR. Patient-reported involvement in the surgical decision-making process was also confirmed as a significant independent factor for IBR.

Socioeconomic factors and patient-reported received information about breast reconstruction

As patient-reported received information about IBR was a significant factor for the likelihood of having an IBR, factors associated with self-reported patient information were examined. Independent predictive factors for patient-reported preoperative information were having a non-invasive tumour (OR 3·56, 95 per cent c.i. 2·29 to 5·55), living in the Stockholm/Gotland region (OR 2·64, 1·70 to 4·11) and being born outside Europe (OR 2·83, 1·68 to 4·77). Negative predictive factors were being more than 65 years old (OR 0·43, 0·26 to 0·71) and having no current employment (including retirement) (OR 0·69, 0·49 to 0·97). The small group of 154 women with a non-European background, mostly born in Asia, were younger and had a higher educational level than the Swedish or European-born women, and most of them lived in the Stockholm/Gotland area.

Discussion

Socioeconomic factors significantly influenced IBR rates and patient-reported preoperative information on IBR. Despite adjustment for socioeconomic factors, previously reported regional differences in IBR rates, patient information and involvement remained. Patient-reported information and involvement in the decision-making process regarding breast reconstruction were confirmed as strong predictive factors for the performance of IBR. Of note, women who reported their own experiences by responding to the questionnaire were more likely to be younger, and to have less advanced tumours and a higher socioeconomic index; thus, the questionnaire results cannot easily be generalized to all women with breast cancer facing mastectomy. Rather, the presented results might, in reality, be even more pronounced considering that it is the socioeconomically weaker women in this cohort who are under-represented.

The process of patient information cannot be regarded as unidirectional. Reasons for the patient not reporting information on reconstructive options may originate from the informing part (the surgeon or breast nurse) or the receiving part (the patient), or a combination of both. As the patient–physician relationship has evolved from the paternalistic, physician-dominant model to the shared-decision-making and informed-consumerist model, women who adopt a more active role have a higher general patient satisfaction compared with those reporting paternalistic decision-making[18]. This active role may be linked to a general information-seeking behaviour, which is reported to be more common in those with a higher educational level[20]. The questionnaire concerned questions regarding received preoperative information in general, not specifically from the surgeon. Preoperative information may be retrieved from several sources, such as the breast cancer team with specialized nurses, social workers and psychologists, but also from information booklets and online resources. These results may suggest a lack of information given to those with a lower socioeconomic status, but also a need to adapt patient information better to educational level, health literacy and desire to be involved. Involvement in decision-making and health literacy are key components rooted in socioeconomic reality, and may demand more flexibility in patient–physician, or rather patient–professional team, communication, information and choice of decision-making model[18].

Other than socioeconomic factors, patient co-morbidity should affect patient information about reconstructive

options. Known risk factors such as smoking or obesity, as well as co-morbidity such as poor general health or ongoing non-breast cancer treatments, would be expected to lead to less information about reconstructive options. Unfortunately, information on these factors, which are more prevalent in individuals with a lower socioeconomic status, was not available[20–24]. Another limitation of any retrospective audit is the risk of recall bias; patients received questionnaires up to 2 years after their surgical treatment. Interestingly, recall bias may also be influenced by socioeconomic status: women with low income and low educational level reported feeling extremely well informed in a study by Sepucha and colleagues[25], although feeling informed was not associated with the actual level of knowledge. With such a directional recall bias, women with a low socioeconomic status should have reported a higher level of information, which was not confirmed in the present study. This raises the question whether information actually received was still lower than that perceived and reported by this subgroup.

A higher non-response rate in lower socioeconomic groups has been reported previously[26]. Among American women after different types of breast reconstruction, non-white race, Hispanic or Latino ethnicity, and low household income were associated with a higher non-response rate[27]. In the present study, non-responder bias analysis revealed a majority of responders with a higher socioeconomic status, which reduces the external validity of the results. The disparity in received information and involvement, however, would thus have been even more significant if more of the non-responders had completed their survey. There was also a trend towards lower response rates from the North and South-East regions, with no signs that these particular regions differed significantly from the others in terms of socioeconomic factors. Finally, although the reported IBR rates are from 2013, national annual reports have shown persisting regional differences, although the average IBR rate has been slowly increasing over the past few years.

The main strength of this study is the use of continuously registered population-based data on all patients with breast cancer by combining information from two national registries containing detailed clinical and socioeconomic information of high quality and validity[28,29]. Furthermore, the impact of socioeconomic status is of special interest in the Swedish universal healthcare setting, where the influence of reimbursement bias should be negligible.

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Supporting information

Additional supporting information can be found online in the Supporting Information section at the end of the article.