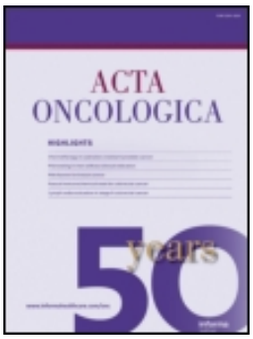

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ORIGINAL ARTICLE

Socioeconomic position and breast reconstruction in Danish women

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Abstract

Few studies have been conducted on the socioeconomic position of women undergoing breast reconstruction, and none have been conducted in the Danish population. We investigated the association between educational level and breast reconstruction in a nationwide cohort of Danish women with breast cancer. *Material and methods*. From nationwide registers, 13 379 women aged 30–80 years who had been treated by mastectomy for breast cancer in Denmark in 1999–2006 were identified and followed up through November 2009. Multivariate logistic regression models were used to investigate the simultaneous influence of educational level on the likelihood of having immediate or delayed (up to three years after mastectomy) breast reconstruction, with adjustment for age, breast cancer characteristics, comorbidity, socioeconomic variables and availability of plastic surgery services at each woman's affiliated hospital. *Results*. The odds ratios (ORs) for both immediate and delayed breast reconstruction increased significantly with level of education. Being affiliated to a hospital with a plastic surgery department increased the likelihood of both immediate (adjusted OR, 4.02; 95% confidence interval [CI], 2.81–5.75) and delayed breast reconstruction (adjusted OR, 1.41; 95% CI, 1.26–1.66). There was no association between education and breast reconstruction among 30–44 year old women, regardless of type of breast reconstruction; however, medium or higher education was significantly associated with a fourfold increase in the OR for immediate breast reconstruction in women aged 45–59 years and a more than twofold increase in the OR for delayed breast reconstruction in women aged 60–80 years compared to women with short education. *Conclusion*. Increasing education was associated with increasing odds for having immediate or delayed breast reconstruction, but only in the older age groups. The offer of breast reconstruction appears to be unequally distributed in Denmark, and living in an area where the hospital has a plastic surgery department significantly increased the odds for having breast reconstruction.

Breast cancer is the most common cancer among women in Denmark, with about 4 000 new cases per year [1]. Even though greater use of breast-conserving therapy has decreased the number of women undergoing mastectomy, 37% of women with breast cancer in Denmark in 2008 underwent this procedure [1].

Consistent associations between socioeconomic position and survival from many cancers have been found in many populations. Population-based studies in Denmark showed an association between higher socioeconomic position and an increased incidence of breast cancer [2] but also better overall survival among affluent breast cancer patients [3]. In a previous Danish study of prognosis among women who underwent delayed breast implant reconstruction, a significantly lower rate of recurrence and a nonsignificantly lower risk for death were found in comparison with matched controls who did not have breast reconstruction [4], raising the question of whether socioeconomic differences in the uptake of breast reconstruction contributed to these findings. Another Danish study showed that more women in a high socioeconomic position underwent breast-conserving therapy [5]; a similar differential selection is likely for breast reconstruction but has not been studied in Denmark. In a Swedish study a significantly higher proportion of women who underwent breast reconstruction after mastectomy had longer education and were more frequently employed than women who did not undergo breast reconstruction [6]. In Australia, Hall et al. [7] observed that women receiving breast reconstruction were younger,

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white and had less comorbidity. Similarly, Christian et al. [8] observed that in USA, younger women who were highly educated, more affluent and had less comorbidity were more likely to receive breast reconstruction.

Access to medical care in Denmark is free, as the health system is tax-financed, and breast reconstruction is in principle offered to all eligible, interested breast cancer patients. Plastic surgery services are, however, unevenly distributed throughout Denmark, and living in a municipality where the referral hospital has access to a plastic surgeon might increase the chance of receiving information about breast reconstruction and thereby the opportunity to opt for this intervention. In a French study Ananian et al. [9] observed that most women opted for breast reconstruction when it was offered systematically.

The aim of this population-based cohort study of women with breast cancer treated by mastectomy was to investigate the relation between socioeconomic position, measured as level of education, and breast reconstruction. We hypothesized that a higher level of education was associated with having breast reconstruction. We also hypothesized that the relation would be stronger for immediate than for delayed breast reconstruction, as higher education could help women to relate to and deal with a breast cancer diagnosis and choosing breast reconstruction at the same time. We further investigated whether education is similarly associated with breast reconstruction in different age groups. Finally, we investigated whether being affiliated to a hospital with a plastic surgery department affected the likelihood of having breast reconstruction.

Material and methods

Identification of breast cancer patients

In Denmark, information about breast cancer patients and their surgical and adjuvant treatment has been recorded since 1977 in the nationwide Danish Breast Cancer Cooperative Group, a clinical database which was designed mainly to evaluate programs for adjuvant trials among women with primary breast cancer [10]. The database receives details of the primary surgical procedure, histopathological examination, adjuvant treatment and clinical follow-up. On the basis of tumor stage and menopausal status, patients are allocated to groups with high or low risk for recurrence and are treated in protocols accordingly [10,11]. The Danish Breast Cancer Cooperative Group has nationwide coverage of approximately 95% of young and middle-aged women with breast cancer [10]. From the database, we identified 16 768 women registered with a primary invasive breast cancer who were treated by mastectomy between January 1, 1999 and December 31, 2006. We excluded 2 189 women below the age of 30 or above the age of 80 at the time of mastectomy and another 435 women for whom information on tumor size, menopausal status or spread to lymph nodes was missing (Figure 1). We excluded women under 30 years of age at the time of mastectomy to avoid potential misclassification of socioeconomic position: younger women are more likely to be undergoing education and thus only establishing their socioeconomic position.

Tumor grade and type were categorized as ductal grade I, grade II or grade III, non-ductal carcinoma or unknown; receptor status as positive, negative or unknown; spread to lymph nodes as positive or negative; and menopausal status as pre- or postmenopausal [11].

The Danish National Hospital Register contains detailed individual data on all non-psychiatric hospital admissions since 1977 and out-patient contacts since 1995 [12]. Information on diagnoses is coded according to a modified version of the International Classification of Diseases (ICD), and information on operations is coded according to the Nordic classification [12]. By linking the personal identification number of each patient to the files of the National Hospital Register, all available information on hospitalizations and surgical procedures was obtained for 14 005 of the 14 144 women identified, thereby excluding 139 women. We further excluded 132 women who could not be identified with a code for a mastectomy ('KHAC') in the National Hospital Register (Figure 1).

Identification of breast reconstruction patients

In the National Hospital Register, we identified 1 885 women in the study who had undergone breast reconstruction by November 1, 2009; 191 had immediate and 1 694 delayed breast reconstruction, leaving 11 494 women who had had a mastectomy but no breast reconstruction. Immediate breast reconstruction was defined as that performed on the same day as mastectomy, and delayed breast reconstruction as that performed later. A woman was categorized as having had breast reconstruction if she was registered with one of the procedure codes 'KHAE00' (reconstruction of breast with implant), 'KHAE05' (reconstruction of breast with autologous tissue and implant), 'KHAE10' (reconstruction of breast with autologous tissue) or 'KHAF20' (reconstruction of breast with implant after breast cancer recurrence), regardless of other coding. The files of women with an additional code for flap dissection, tissue transfer or expander implantation were checked manually, and we decided whether each woman had

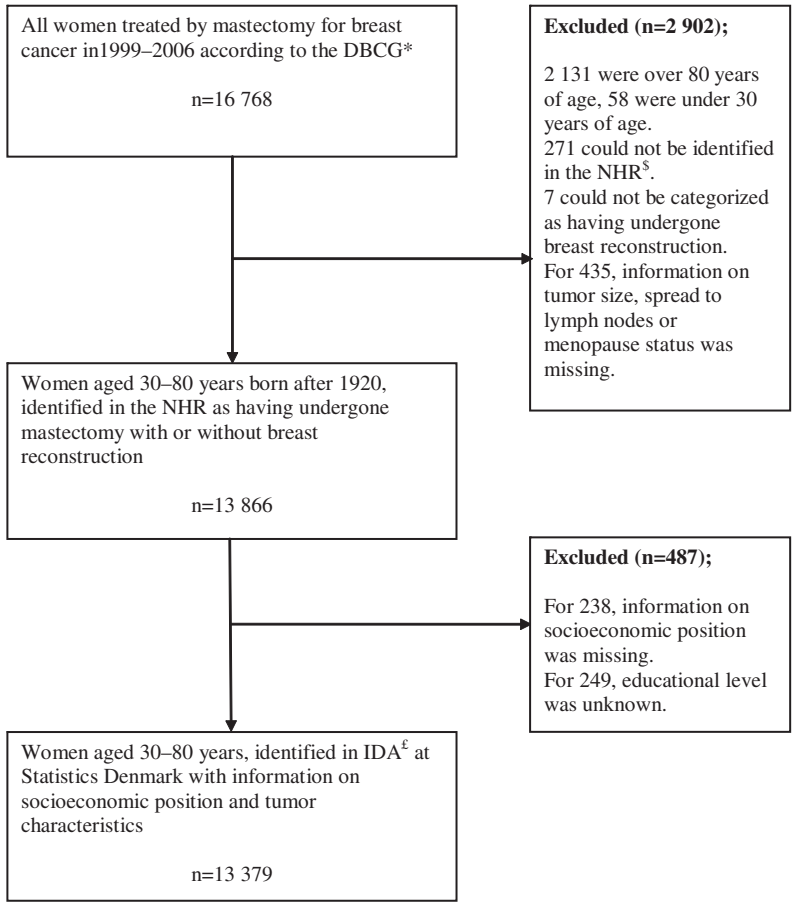

Figure 1. Formation of the study population of Danish women aged 30–80 years treated by mastectomy for breast cancer in 1999–2006.

breast reconstruction; we excluded seven women whom we could not classify as having had breast reconstruction (Figure 1).

Information on socioeconomic position

Information on socioeconomic characteristics was obtained by linkage to the population-based Integrated Database for Labour Market Research at Statistics Denmark [13,14]. Information on socioeconomic position, including highest attained level of education, disposable income, affiliation to the work market and cohabiting status, was obtained one year before the breast cancer diagnosis. For 238 women, it was not possible to obtain information on socioeconomic factors, and a further 249 women had unknown education and were thus excluded (Figure 1).

We chose to represent socioeconomic position by education, as we considered that the overall knowledge-related assets of each woman reflect her ability to communicate and access health services, which are important in the choice of breast reconstruction. Education was categorized as: short (i.e. mandatory education of up to seven and nine years for people born before and after January 1, 1958, respectively), medium (between 8/10 and 12 years, the last grades of primary school, secondary school, and vocational education) and higher education (more than 12 years). Disposable income was categorized as low (first quartile), middle (second and third quartiles) or high (fourth quartile); the affiliation to the job market as working, unemployed/other, early retirement, pensioner, or unknown; and cohabiting status as living with someone or living alone.

Information on comorbidity

For the final cohort of 13 379 women, we used information in the National Hospital Register to compute a modified Charlson comorbidity score for each person [15]. The Charlson index is based on ICD codes for 19 chronic disease categories recorded in the Danish National Hospital Register (ICD-8 for 1977–1993 and ICD-10 thereafter), weighted according to

mortality risk [15]. Breast cancer diagnoses were excluded. The comorbidity score was calculated from hospitalizations for the disease in question from 1978 to one year before the breast cancer diagnosis and categorized as 0, 1 or ≥ 2 [15].

Hospital affiliation

Information about plastic surgery services was obtained from all hospital departments in which mastectomies were performed in 1999–2006. The departments were classified as being in a hospital with no plastic surgery services, with regular consultations by a plastic surgeon or with a plastic surgery department. On the basis of the catchment area of each hospital and the municipal address of the women in the study population, each woman was given a hospital affiliation specifying the plastic surgery services available.

Information on vital status

Through linkage to the files of the Central Population Register, we obtained information on the vital status of all cohort members.

Statistical analysis

Descriptive statistics were computed for socioeconomic, demographic, breast cancer and surgical characteristics, with education as the primary variable.

We conducted two sets of analyses of the association between educational level and breast reconstruction. For immediate breast reconstruction, all women were included (n = 13 379). For the women who had delayed breast reconstruction, we prepared a univariate Kaplan Meier plot with time since mastectomy as the time scale. On the basis of this plot, we included women with a minimum of three years' follow-up after mastectomy (n = 11 520), with delayed breast reconstruction as the outcome. This cut point was chosen to include as many outcomes as possible and at the same time a relevant length of follow-up. Of 1 694 delayed breast reconstructions, 76% (n = 1281) were performed within three years.

The analyses were performed in three steps. First, we used logistic regression models to investigate the simultaneous influence of educational level on the likelihood of having breast reconstruction, with adjustment for age. Secondly, we also adjusted for tumor size, spread to lymph nodes, grade, receptor status and menopausal status, thus taking into account the severity of the breast cancer and comorbidity. Thirdly, we adjusted further for other socioeconomic variables (disposable income, affiliation to the work market, cohabiting status), enabling adjustment of the complex correlation between attained education level and other factors in the best possible way, including hospital affiliation. Adjustment for age was done using linear splines (piecewise linear functions), with a knot at 60 years of age. For immediate breast reconstructions tumor size was adjusted for as a linear spline with knots at 10 mm and 45 mm respectively, whereas for delayed breast reconstruction a simple linear association with tumor size was assumed.

To explore the influence of age on the findings, we categorized the study population into three age groups characterized by different overall life circumstances. Women aged 30–44 years are having children and getting established in the work market; those aged 45–59 years are generally working and have achieved their professional position; and most of those aged 60–80 years are retired.

All statistical analyses were two-tailed and were performed with SAS version 9.1.

Results

The study population consisted of 13 379 women who had undergone mastectomy due to breast cancer in 1999–2006, who were aged 30–80 years and of whom 3 412 had died by November 2009 (55% or 1873 of them died within three years of mastectomy). More women with medium or higher education than those with short education were under 60 years, had no comorbidity, were working, lived with someone, had undergone breast reconstruction and had a hospital affiliation with plastic surgery services. The women with higher education had the highest income, and more were premenopausal than in the rest of the cohort. Overall, 1 855 (14%) of the women had undergone immediate or delayed breast reconstruction; of these, approximately 90% had medium or higher education, as compared with 70% in the total population (Table I).

The odds ratio for having immediate breast reconstruction increased with increasing level of education and was increased fourfold for women affiliated to a hospital with a plastic surgery department rather than a hospital with no such services (Table II). After stratification by age, level of education had no effect for the youngest or the oldest group of women, whereas medium and higher education were significantly associated with immediate breast reconstruction for women in the age group 45–59 years, with increased ORs of 3.59 (95% CI, 1.38–9.34) and 4.01 (95% CI, 1.49–10.47), respectively (Table III).

The odds of having delayed breast reconstruction also increased significantly with increasing education and with being affiliated to a hospital with a plastic surgery department (Table IV). There was no effect

Table I. Characteristics of the study population of 13 379 Danish women aged 30–80 years treated by mastectomy for breast cancer in 1999–2006, by educational level.

	Level of education			
Characteristics	Short education n = 4 068 (30%) n (%)	Medium education n = 6 428 (48%) n (%)	Higher education n = 2 883 (22%) n (%)	Total n = 13 379 (100%) n (%)
Period				
1999–2000	1 299 (32)	1 809 (28)	787 (27)	3 895 (29)
2001–2002	1 178 (29)	1 771 (28)	776 (27)	3 725 (28)
2003–2004	881 (22)	1 559 (24)	674 (23)	3 114 (23)
2005–2006	710 (17)	1 289 (20)	646 (22)	2 645 (20)
Age (years)				
30–39	53 (1)	315 (5)	223 (8)	591 (4)
40–49	173 (4)	1 190 (19)	709 (25)	2 072 (15)
50–59	777 (19)	202 (31)	934 (32)	3 713 (28)
60–69	1 503 (37)	1 704 (27)	607 (21)	3 814 (29)
70–79	1 562 (38)	1 217 (19)	410 (14)	3 189 (24)
Tumor size (mm)				
≤20	1 702 (42)	2 838 (44)	1 403 (49)	5 943 (44)
21–49	2 006 (49)	3 009 (47)	1 239 (43)	6 254 (47)
≥50	360 (9)	581 (9)	241 (8)	1 182 (9)
Spread to lymph nodes				
Positive	2 243 (55)	3 713 (58)	1 679 (58)	7 635 (57)
Negative	1 825 (45)	2 715 (42)	1 204 (42)	5 744 (43)
Grade				
Ductal grade I	900 (22)	1 271 (20)	551 (19)	2 722 (20)
Ductal grade II	1 494 (37)	2 323 (36)	1 060 (37)	4 877 (36)
Ductal grade III	847 (21)	1 469 (23)	662 (23)	2 978 (22)
Non-ductal	744 (18)	1 226 (19)	548 (19)	2 518 (19)
Unknown	83 (2)	139 (2)	62 (2)	284 (2)
Receptor status				
Positive	3 177 (78)	4 979 (78)	2 290 (79)	10 446 (78)
Negative	807 (20)	1 372 (21)	558 (19)	2 737 (20)
Unknown	84 (2)	77 (1)	35 (1)	196 (2)
Menopause				
Premenopausal	349 (9)	1 921 (30)	1 254 (44)	3 524 (26)
Postmenopausal	3 719 (91)	4 507 (70)	1 629 (57)	9 855 (74)
Charlson comorbidity index				
None	2 927 (72)	5 153 (80)	2 496 (87)	10 576 (79)
1	621 (15)	700 (11)	201 (7)	1 522 (11)
≥2	520 (13)	575 (9)	186 (7)	1 281 (10)
Disposable income				
Low (1st quartile)	1 659 (41)	1 191 (19)	269 (9)	3 119 (23)
Middle (2nd–3rd quartile)	2 000 (49)	3 325 (52)	1 208 (42)	6 533 (49)
High (4th quartile)	409 (10)	1 912 (30)	1 406 (49)	3 727 (28)
Affiliation to work market				
Working	796 (20)	3 278 (51)	1 929 (67)	6 003 (45)
Unemployed or other	305 (8)	700 (11)	176 (6)	1 181 (9)
Early retirement pensioner[$]	767 (19)	549 (9)	153 (5)	1 469 (11)
Pensioner	1 856 (46)	1 662 (26)	552 (19)	4 070 (30)
Unknown	344 (9)	239 (4)	73 (3)	656 (5)
Cohabiting status				
Living with someone	2 560 (63)	4 645 (72)	2 069 (72)	9 274 (69)
Living alone	1 508 (37)	1 783 (28)	814 (28)	4 105 (31)
Surgical treatment				
Mastectomy only	3 854 (95)	5 371 (84)	2 269 (79)	11 494 (86)
Immediate breast reconstruction[*]	15 (0.4)	106 (2)	70 (2)	191 (1)
Delayed breast reconstruction[#]	199 (5)	951 (15)	544 (19)	1 694 (13)
Hospital affiliation				
No plastic surgery	2 031 (50)	2 889 (45)	1 233 (43)	5 836 (44)
Plastic surgery consultant	683 (17)	771 (12)	322 (11)	2 160 (16)
Plastic surgery department	1 354 (33)	2 768 (43)	1 328 (46)	5 450 (41)

[$]Early retirement pension due to illness.
[*]Performed at same time as mastectomy.
[#]Performed at a later time than mastectomy.

Table II. Adjusted odds ratios (ORs) for immediate breast reconstruction according to educational level and plastic surgery services among Danish women aged 30–80 years (n = 13 379) treated by mastectomy for breast cancer in 1999–2006.

		Age-adjusted		Adjusted OR*		Adjusted OR, final model§	
	N#	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Education level							
Short	15	1.00	–	1.00	–	1.00	–
Medium	106	2.31	(1.33–4.01)	2.29	(1.31–3.99)	2.01	(1.13–3.56)
Higher	70	2.84	(1.60–5.05)	2.68	(1.50–4.80)	2.10	(1.14–3.86)
Hospital affiliation							
No plastic surgery	41					1.00	–
Plastic surgery consultant	5					0.47	(0.18–1.19)
Plastic surgery department	145					4.02	(2.81–5.75)

*Adjusted further for tumor characteristics (tumor size, spread to lymph nodes, grade, receptor status, menopause status) and comorbidity (Charlson index).
§Adjusted further for socioeconomic factors (disposable income, affiliation to work market and cohabiting status) and hospital affiliation.
#Number of events in given strata.

of educational level on the probability of having delayed breast reconstruction for the youngest women, but for middle-aged women a 43% increase was found with medium education, and a 32% increase with higher education. The ORs for the oldest women with medium and higher education were increased by more than twofold over that for women with short education (Table V).

Discussion

In this population-based cohort study, we observed overall increased odds ratios for both immediate and delayed breast reconstruction with increasing level of education. The association differed somewhat by age. For immediate breast reconstruction, the association was apparent only for women aged 44–59 years; for delayed breast reconstruction, the association was found to be strongest for women aged 60–80 years but was also present for middle-aged women. There was no educational gradient for the youngest women for either immediate or delayed breast reconstruction. Affiliation to a hospital with a plastic surgery department was significantly associated with having breast reconstruction, especially with immediate but also with delayed breast reconstruction.

We chose education as the primary indicator of socioeconomic position but also adjusted for disposable income, affiliation to the work market and cohabiting status. Education is usually completed in young adulthood and to some degree reflects early life circumstances; however, it also represents the overall knowledge-related assets of an individual. Our finding of a difference by educational level in the likelihood of undergoing breast reconstruction is supported by the results of several other studies, which showed that women who have breast reconstruction are more affluent and have higher education than women treated by mastectomy alone [6–8,16–18].

Ninety percent (90%) of the breast reconstructions were performed on women who had medium or higher education. This might be explained by the knowledge and skills attained through higher education which may affect cognitive functioning, make people more receptive to health education messages, or more able to communicate with and access the appropriate health services [19]. Better-educated women might have an advantage when they are dealing with both a diagnosis of breast cancer and making a decision about breast reconstruction. If plastic surgery services are not available in the hospital to which they are affiliated, they would be

Table III. Adjusted odds ratios (ORs) for immediate breast reconstruction among Danish women aged 30–80 years (n = 13 379) treated by mastectomy for breast cancer in 1999–2006 according to educational level by age group*.

	Age group (years)					
	30–44 (n = 1 405)		45–59 (n = 4 971)		60–80 (n = 7 003)	
	N#	OR (95% CI)	N#	OR (95% CI)	N#	OR (95% CI)
Educational level						
Short	4	1.00 –	5	1.00 –	6	1.00 –
Medium	33	0.94 (0.31–2.91)	59	3.59 (1.38–9.34)	14	1.52 (0.54–4.26)
Higher	24	0.95 (0.29–3.08)	42	4.01 (1.49–10.47)	4	1.03 (0.26–4.15)

*Model adjusted for tumor characteristics (tumor size, spread to lymph nodes, grade, receptor status, menopause status), comorbidity (Charlson index), socioeconomic factors (disposable income, affiliation to work market and cohabiting status) and hospital affiliation.
#Number of events in given strata.

Table IV. Adjusted odds ratios (ORs) for delayed breast reconstruction (within three years of mastectomy) after breast cancer according to educational level and plastic surgery services among Danish women aged 30–80 years (n = 11 520) in 1999–2006.

		Age-adjusted		Adjusted OR*		Adjusted OR, final model§	
	N#	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Educational level							
Short	137	1.00	–	1.00	–	1.00	–
Medium	730	1.71	(1.40–2.08)	1.69	(1.38–2.07)	1.52	(1.23–1.86)
Higher	414	1.74	(1.40–2.16)	1.67	(1.34–2.08)	1.41	(1.12–1.77)
Hospital affiliation							
No plastic surgery	518					1.00	–
Plastic surgery consultant	149					1.13	(0.92–1.39)
Plastic surgery department	614					1.45	(1.26–1.66)

*Adjusted further for tumor characteristics (tumor size, spread to lymph nodes, grade, receptor status, menopause status) and comorbidity (Charlson index).
§Adjusted further for socioeconomic factors (disposable income, affiliation to work market and cohabiting status) and hospital affiliation.
#Number of events in given strata.

better able to obtain information on the options elsewhere.

To our knowledge, no previous study has reported that the association between socioeconomic factors and breast reconstruction differs by age group. Among the women who had delayed breast reconstruction, educational level was most important in the elderly group. This might be partly explained by a cohort effect in educational attainment. In general, however, older women probably make more modest demands, are more passive health consumers and are perhaps at higher risk for provider bias, so that the physician has more power in making decisions. Education might therefore play a larger role in which and to what degree older patients are informed about breast reconstruction and choose this option. It has been suggested that older patients tend to receive suboptimal information about the option of breast reconstruction [20], which might be closely related to the increasing risk for comorbidity in the elderly. Although we did adjust for comorbidity, we did not have information on whether the women were informed about or given the option of having breast reconstruction.

Factors such as the meaning of mastectomy for the woman, body image, attractiveness and similar variables vary according to the phase of a woman's life. Stanton et al. [21] found that older women place less importance on maintaining attractiveness, femininity and sexuality than younger women. They might have different priorities and different perceptions of mortality, which might influence their decision about reconstructive surgery [16]. Studies have shown that both immediate and delayed breast reconstruction provide substantial psychological benefits. Women who chose breast reconstruction reported feeling whole again, regaining their femininity and being able to wear any clothes they wished [22]. Wehrens et al. [23] observed that women seeking breast reconstruction were significantly more extroverted and self-conscious, including sexually. They also observed that level of education was associated with some of these characteristics. We did not have the opportunity to take any psychological measurements into account in this study. The effect of educational level in the age groups we studied might be explained by the fact that younger women, regardless of educational level, have other requirements and expectations of physicians and the health-care system than middle-aged and elderly women. In younger women "regaining a breast" might have a higher priority and age is thus a stronger determinant than education in this group.

Table V. Adjusted odds ratios (ORs) for delayed breast reconstruction among Danish women aged 30–80 years (n = 11 520) treated by mastectomy for breast cancer in 1999–2006 according to educational level by age group*.

	Age group (years)								
	30–44 (n = 1 209)			45–59 (n = 4 337)			60–80 (n = 5 974)		
	N#	OR	(95% CI)	N#	OR	(95% CI)	N#	OR	(95% CI)
Educational level									
Short	36	1.00	–	75	1.00	–	26	1.00	–
Medium	231	1.03	(0.65–1.64)	408	1.43	(1.09–1.88)	91	2.45	(1.55–3.89)
Higher	162	1.02	(0.62–1.65)	218	1.32	(0.97–1.78)	34	2.28	(1.30–3.99)

*Model adjusted for tumor characteristics (tumor size, spread to lymph nodes, grade, receptor status, menopause status), comorbidity (Charlson index), socioeconomic factors (disposable income, affiliation to work market and cohabiting status) and hospital affiliation.
#Number of events in given strata.

The etiology of health-care disparities is not well understood. It has been suggested that differences in health-care use and outcomes reflect differences in access to care [8]. In Canada, breast reconstruction was strongly associated with available health facilities, with a higher proportion of urban patients among women who underwent reconstruction [24]. In Denmark, the health-care system is tax-funded and free, and the country is small so that geographic differences in health-care provision have traditionally not been regarded as a major issue. However, the choice of treatment (mastectomy vs. lumpectomy) might differ somehow between the different breast surgery departments, as well as the information given on the option of breast reconstruction. With the increasing number of nationwide clinical databases, which set standards for best practice in several areas of medicine, focus is now being directed to these issues, resulting in larger treatment units [25].

The main strength of this study is that it is based on the population-based collection of information in nationwide databases. The information on socioeconomic position was collected prospectively and uniformly for administrative purposes, independently of our study hypotheses, thus eliminating recall and information bias. We did not use education as the overall indicator for socioeconomic position but entered all socioeconomic factors into the model to adjust in the best possible way for the complex correlations, thereby attempting to provide an estimate of the knowledge-related part of education and its effect on breast reconstruction. Further, we included and adjusted for detailed information on the breast cancer of each woman and comorbidity to account for the fact that a clinical decision about whether to offer a woman breast reconstruction is associated with the severity of the breast cancer and comorbidity; women with early-stage breast cancers are more likely to be offered breast reconstruction, especially immediately.

Plastic surgery services are unevenly distributed within Denmark and are found primarily in urban areas. In some parts of the country, plastic surgery services have to be sought outside affiliated hospitals. In this study, we categorized hospital affiliations with and without plastic surgery services in order to evaluate the association with breast reconstruction; information about plastic surgery services during the study years was obtained from the departments performing mastectomies to avoid misclassification. Although education and income distribution might differ between rural and urban areas, there was an independent effect of hospital affiliation with an in-house plastic surgery department on the likelihood of having breast reconstruction. This was especially so for immediate breast reconstruction, with a fourfold increased odds for women affiliated to hospitals with an in-house plastic surgeon. This indicates that direct access is of paramount importance once a woman has been informed about and chooses this procedure. The odds of having delayed breast reconstruction were increased by 40% for women affiliated to a hospital with plastic surgery services.

In our study, 90% of the women who had a breast reconstruction had medium or higher education. A higher level of education significantly increased the odds for having immediate or delayed breast reconstruction, except among the youngest women. The option of breast reconstruction appears to be unequally distributed in Denmark, and living in an area with a plastic surgery department significantly increased the likelihood of breast reconstruction. Although all eligible breast cancer patients in Denmark in principle have free access to breast reconstruction, our finding of differences by educational level suggest that the information that women receive on the possibility for this procedure also differs, posing a challenge for treating clinicians to ensure that all eligible women, regardless of social position, age or residence, receive similar information and options.

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