

Socioeconomic status as determinant for participation in mammography screening: assessing the difference between using women's own versus their partner's

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Abstract

Objectives Earlier research has shown that participation in mammography screening tends to vary across socioeconomic levels. We assessed the difference between using the woman's own socioeconomic status (SES) and using that of her household or partner as determinant of participation in mammography screening.

Methods Participation data from two mammography screening programs in Denmark were linked to a national SES classification system providing data for each citizen, their partner, and household. We calculated the odds ratio of non-participation across SES levels using the woman's own, the household's, and her partner's SES status, respectively.

Results When using the woman's own SES, the odds ratio of non-participation showed a clear U-shape across SES levels, in both programs. When using the partner's SES the difference in non-participation across SES levels was significantly smaller ($p < 0.001$).

Conclusions To what extent SES was a determinant for screening participation strongly depended on whether using the woman's own SES or that of her partner. In a public health perspective it is important to take this into account when addressing the problem of non-attendance in screening.

Keywords Socioeconomic status · Mass screening · Participation · Mammography

Introduction

Breast cancer mortality in a population can be reduced by the use of mammography (Nyström et al. 2002; Olsen et al. 2005; Paci et al. 2005; Parvinen et al. 2006; Tabar et al. 2003). A high coverage is important for the screening to be effective. In Europe, screening is recommended to be organized in population-based programs, and the European guidelines (European Commission, 2006) for quality assurance in mammography screening recommend a participation rate of 70% as acceptable, and a participation rate above 75% as desirable. In consequence, substantial efforts have been made to explore determinants for non-participation in screening programs, with focus on demographic, socioeconomic, and/or psychosocial factors (Blackwell et al. 2008; Lagerlund et al. 2000; Törnberg et al. 2005; von Euler-Chelpin et al. 2008; Willis 2008; Zackrisson et al. 2007). Socioeconomic status (SES) is a measure of the individual's, the household's, or the neighborhood's ranking in society, and income, educational attainment, occupation, housing facilities, tangible possessions, social class, etc. may be used as indicators of socioeconomic status.

Earlier research has shown that participation in mammography screening tends to vary across SES (Baré et al. 2003; Katz et al. 2000; Lagerlund et al. 2002; Luengo-Matos et al. 2006; Zackrisson et al. 2004). However, several studies (Dailey et al. 2007; Krieger et al. 1997), have suggested that measures of SES on individual-, household- and neighborhood level, respectively, all are independently relevant for a comprehensive analysis of health-related outcomes. It is therefore to be expected that the impact of SES on participation in mammography screening varies depending on the choice of SES-indicator.

In household data, the conventional method, at least in Europe and North America, has been to assign single

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women their own SES while married women get assigned the SES of their husband, i.e., a male-dominant household measure. This method was, for example, used by the UK Office of National Statistics until 2001 (Office for National Statistics 2009). Another approach is the ‘gender neutral dominance approach’ where household data are assigned by using the SES of the individual with highest SES in the household (Krieger et al. 1999). The latter approach is used by Statistics Denmark. A third possibility is a combined household approach, most commonly used for SES based on income, where typically an adjusted mean of the total income of all members of the household is used (see for example Zackrisson et al. (2007)).

The objective of this study was to evaluate the impact of SES on participation in mammography screening using measures of SES based on women’s own status, the household status, and partner/spouse’s status, respectively. We were able to do this due to the existence of SES data on individual level as well as on household level, and these data could be linked to data from two mammography screening programs in Denmark. To our knowledge, this is the first time that SES as a determinant of screening participation is evaluated from these different perspectives.

Methods

Mammography screening in Denmark

The population-based mammography screening program in Copenhagen started on April 1, 1991, and offers biennial screening to all women of ages 50–69. The mammography screening program on Fyn started on November 1, 1993 and also offers biennial screening to all women of ages 50–69. In Copenhagen, invitations are sent out to all women in the age-group, unless they have specifically asked not to be invited. The sequence of invitation is planned after dates of birth. On Fyn, invitations are sent to all women in the age-group unless they have requested not to be invited, or have not replied to invitations to earlier rounds. The sequence of invitation in Fyn is planned according to the general practitioners with whom the woman is registered. In both Copenhagen and Fyn the invitation includes a fixed, but changeable, date of appointment, and two reminders are sent to non-responders. While Copenhagen is the capital of Denmark, the county of Fyn is a semi-rural area. All health care in Denmark, including mammography screening, is offered free of charge. The two programs included in this study are the only programs in Denmark which have been running for a sufficiently long time to provide data on continued participation. The use of opportunistic screening in these areas has been reported on previously (Jensen et al. 2005), but was of low magnitude and not considered to have an impact on attendance rates.

Data sources

The Danish Central Population Register (CPR) includes information on all persons ever residing in Denmark since the register was set up in 1968. It includes historical addresses and data on migrations and deaths. The CPR was used to identify the target population for the two screening programs. Databases from the first four rounds of mammography screening in Copenhagen (1991–1999) and Fyn (1993–2001) were used to gather information about attendance (here referred to as the Mammography Registers). These contain personal identification number (CPR-number), data on invitation date, attendance, and examination date for each screening round. A thorough description of data has been reported previously (von Euler-Chelpin et al. 2006).

Statistics Denmark has an SES classification system based on occupational status, differentiating between self-employment and salaried employment as well as levels of skill. The register also includes persons outside of the workforce. The information included is based on data from the Danish tax authorities and the Employment Classification Module (Statistics Denmark 2008a). The classification was developed under the assumption that a person’s status within the labor market is a good indicator of someone’s living conditions, as it combines occupation with certain information of qualifications and skills. The classification is based on recommendations from the International Labour Organization (ILO 1983). For further information on the classification, see Statistics Denmark (2008b). The SES classification is a four digit code and the data for this analysis were aggregated into six levels by the second digit. The SES levels were classified as follows:

1. Self-employed. Included are all persons that are self-employed regardless of type of activity
2. Supervisory white-collar workers (e.g. architects, chief executive officers, doctors, journalists, nurses, programmers, teachers etc.)
3. White-collar workers (e.g. auxiliary nurses, office staff, sales personnel etc.)
4. Skilled workers (e.g. hair dressers, dental technicians)
5. Non-skilled workers (e.g. restaurant staff, cleaning staff)
6. Out of workforce (retired, homemakers).

By using the CPR-number for each woman in the target population, the data from the Mammography Registers were linked with the data from Statistics Denmark to identify the socio-economic status for each woman, her partner (or cohabitant, here referred to as partner) where relevant, and that of the household. Household SES is defined as the SES of the person in a household who has the highest income. The data were adjusted for age, with the 5-year age-groups.

Analysis

Women who had been eligible for three rounds of screening or more were included in the analysis. The women were classified into categories according to attendance or non-attendance. The groups were accordingly (1) those who attended all the rounds they were invited to, “always users”, (2) those who attended some of the rounds they were invited to “sometimes users”, and (3) those who did not attend any of the rounds they were invited to “never users”. Coverage is defined as attenders/target population. A description of the classification has been reported previously (von Euler-Chelpin et al. 2006).

Women were categorized by their own SES, by the SES of their household, and (where relevant) by their partner's SES. Data from the year of first invitation for each individual woman were used. Age adjusted Odds (OR) with 95% confidence intervals (CI) were used as outcome measure for the risk of being a “never user” or a “sometimes user” of mammography screening versus being an “always user”. ORs were calculated separately for each category of SES using the group “white-collar worker” as reference group. Statistical analyses were done with SAS 9.1.

Ethics

This analysis has been based solely on data from registers, and therefore does not require approval from the ethics board. No contact has been taken with patients, relatives or doctors. The study has been registered with Datatilsynet (the Data Inspection Board).

Results

In Copenhagen the number of women included in the analysis was 33,550. In Fyn the number of women included was 39,865. In Copenhagen 53% of these women were always users and participated in all rounds they were invited to. In Fyn the equivalent figure was 76%. Never users were 22 and 10% for Copenhagen and Fyn, respectively (data not shown).

In total, 16,807 of the women in Copenhagen did not have a partner (50%), 48% of the women were out of the workforce and 21% had a partner out of the workforce. In Fyn there were a total of 8,875 women who did not have a partner (22%), 38% of the women were out of the workforce and 24% had a partner out of the workforce, Table 1.

Using “white-collar workers” as reference group and using the woman's own SES, the odds for being a never user was 2.19 for “self-employed”, 1.20 for “supervisory white-collar worker”, 1.24 for “skilled worker”, 1.26 for “unskilled worker” and 2.77 for “out of workforce” in Copenhagen. Using the SES of the household, the odds for being a never user were 1.80 for “self-employed”, 1.01 for “supervisory white-collar workers”, 0.91 for “skilled worker”, 1.38 for “unskilled worker” and 2.59 for “out of workforce”. When using the partner's SES, the odds for being a never user was 1.35 for “self-employed”, 0.95 for “supervisory white-collar workers”, 0.96 for “skilled worker”, 1.51 for “unskilled worker” and 1.35 for “out of workforce” in Copenhagen, Table 2 and Fig. 1.

The figures for Fyn, using “white-collar worker” as baseline and using the woman's own SES, were 1.81 for “self-employed”, 1.35 for “supervisory white-collar workers”, 1.11 for “skilled worker”, 1.08 for “unskilled

Table 1 Women targeted by mammography screening by socioeconomic status of the woman, the household and the partner in Copenhagen and Fyn, Denmark, 1991–2001

Socioeconomic status	Copenhagen						Fyn					
	Of women		Of household		Of partner		Of women		Of household		Of partner	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Self-employed	965	2.9	1,211	3.6	1,144	3.4	3,117	7.8	4,160	10.4	5,001	12.5
Supervisory white-collar worker	3,743	11.2	5,675	16.9	3,291	9.8	4,553	11.4	8,597	21.6	7,016	17.6
White-collar worker	7,568	22.6	6,535	19.5	1,655	4.9	7,766	19.5	5,122	12.8	1,896	4.8
Skilled worker	216	0.6	1,619	4.8	1,787	5.3	315	0.8	3,028	7.6	3,649	9.2
Unskilled worker	4,870	14.5	4,362	13.0	1,708	5.1	8,697	21.8	6,852	17.2	3,677	9.2
Out of workforce	16,176	48.3	14,136	42.2	7,158	21.3	15,293	38.4	11,982	30.1	9,751	24.5
Missing ^a	12	0	12	0	16,807	50.1	124	0.3	124	0.3	8,875	22.3
Total	33,550	100	33,550	100	33,550	100	39,865	100	39,865	100	39,865	100

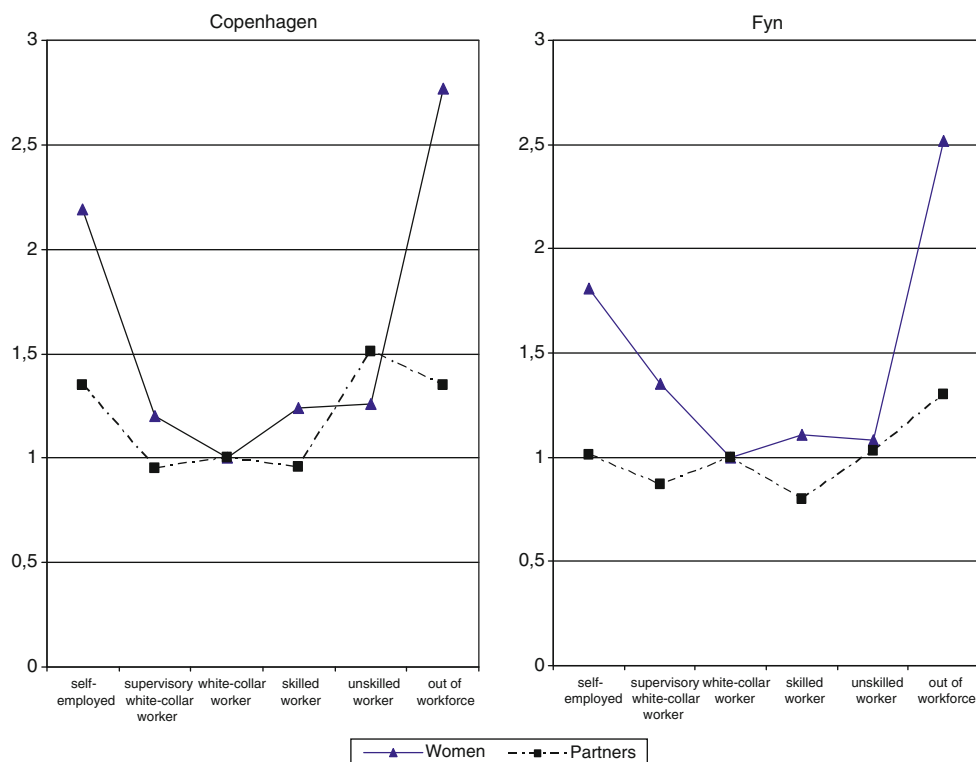
^a For women and household: socioeconomic group could not be found; for partner: socioeconomic groups could not be found and/or women without partner

Table 2 Odds ratio for never use versus always use of mammography screening by women's own, household's and partner's socioeconomic status, 1991–2001, Copenhagen and Fyn, Denmark (age adjusted)

	Woman's SES			Household's SES			Partner's SES		
	No.	OR	95% CI	No.	OR	95% CI	No.	OR	95% CI
Copenhagen									
Self-employed	235/453	2.19	1.85, 2.59	288/605	1.80	1.54, 2.11	214/659	1.35	1.10, 1.66
Supervisory white-collar worker	640/2,258	1.20	1.07, 1.33	934/3,503	1.01	0.92, 1.12	487/2,154	0.95	0.80, 1.12
White-collar worker	1,158/4,885	1.00		1,077/4,091	1.00		253/1,062	1.00	
Skilled worker	39/133	1.24	0.86, 1.77	248/1,032	0.91	0.78, 1.06	263/1,162	0.96	0.79, 1.17
Unskilled worker	877/2,933	1.26	1.14, 1.39	885/2,430	1.38	1.25, 1.53	337/947	1.51	1.25, 1.81
Out of workforce	4,499/6,962	2.77	2.56, 3.00	4,016/5,969	2.59	2.38, 2.81	1,422/3,930	1.35	1.16, 1.57
Without partner ^a	NR	NR	NR	NR	NR	NR	4,475/7,717	2.29	1.99, 2.64
Fyn									
Self-employed	330/2,372	1.81	1.56, 2.10	403/3,252	1.32	1.14, 1.54	390/4020	1.01	0.82, 1.23
Supervisory white-collar worker	361/3,560	1.35	1.17, 1.56	628/6,832	1.01	0.88, 1.15	454/5,678	0.87	0.72, 1.06
White-collar worker	478/6,364	1.00		378/4,128	1.00		143/1,565	1.00	
Skilled worker	22/265	1.11	0.71, 1.74	195/2,496	0.86	0.72, 1.03	218/3,032	0.80	0.64, 0.99
Unskilled worker	588/7,223	1.08	0.95, 1.22	553/5,535	1.09	0.95, 1.25	281/2,991	1.03	0.83, 1.27
Out of workforce	2,196/10,634	2.52	2.26, 2.81	1,818/8,175	2.24	1.98, 2.53	1,050/7,313	1.30	1.08, 1.57
Without partner ^a	NR	NR	NR	NR	NR	NR	1,478/5,857	2.49	2.08, 2.99

CI confidence interval, No. number of, NR not relevant, SES socioeconomic status, OR odds ratio

^a The OR for women without a partner has been included for comparison

Fig. 1 Odds ratio for never use versus always use of mammography screening by women's own and partner's socioeconomic group in Copenhagen (1991–1999) and Fyn (1993–2001), Denmark. Age adjusted

worker” and 2.53 for “out of workforce”. Using the SES of the household, the odds for being a never user were 1.32 for “self-employed”, 1.01 for “supervisory white-collar

workers”, 0.86 for “skilled worker”, 1.09 for “unskilled worker” and 2.24 for “out of workforce”. Using the partner's SES, the odds for being a “never user” was 1.01

Table 3 Odds ratio for sometimes use versus always use of mammography screening by women's own, household's and partner's socioeconomic status, 1991–2001, Copenhagen and Fyn, Denmark (age adjusted)

	Woman's SES			Household's SES			Partner's SES		
	No.	OR	95% CI	No.	OR	95% CI	No.	OR	95% CI
Copenhagen									
Self-employed	277/453	1.97	1.68, 2.31	318/605	1.60	1.36, 1.83	271/659	1.28	1.07, 1.55
Supervisory white-collar worker	845/2,258	1.21	1.09, 1.33	1,238/3,503	1.06	0.97, 1.16	650/2,154	0.94	0.81, 1.10
White-collar worker	1,525/4,885	1.00		1,367/4,091	1.00		340/1,062	1.00	
Skilled worker	44/133	1.07	0.76, 1.51	339/1,032	0.99	0.86, 1.13	362/1,162	0.99	0.83, 1.17
Unskilled worker	1,054/2,939	1.15	1.05, 1.26	1,047/2,430	1.29	1.17, 1.42	424/947	1.42	1.20, 1.68
Out of workforce	4,715/6,962	2.21	2.06, 2.38	4,151/5,969	2.11	1.95, 2.28	1,806/3,930	1.31	1.14, 1.50
Without partner ^a	NR	NR	NR	NR	NR	NR	4,615/7,717	1.79	1.58, 2.04
Fyn									
Self-employed	415/2,372	1.20	1.06, 1.36	505/3,252	1.04	0.92, 1.18	591/4,020	1.20	1.01, 1.43
Supervisory white-collar worker	632/3,560	1.22	1.10, 1.36	1,137/6,832	1.12	1.01, 1.24	884/5,678	1.30	1.10, 1.53
White-collar worker	924/6,364	1.00		616/4,128	1.00		188/1,565	1.00	
Skilled worker	28/265	0.73	0.49, 1.09	337/2,496	0.91	0.79, 1.04	399/3,032	1.10	0.92, 1.32
Unskilled worker	886/7,223	0.84	0.76, 0.93	764/5,535	0.92	0.82, 1.03	405/2,991	1.13	0.94, 1.35
Out of workforce	2,463/10,634	1.61	1.47, 1.75	1,989/8,175	1.66	1.50, 1.84	1,388/7,313	1.51	1.28, 1.78
Without partner ^a	NR	NR	NR	NR	NR	NR	1,540/5,857	2.14	1.82, 2.52

CI confidence interval, No. number of, NR not relevant, SES socioeconomic status, OR odds ratio

^a The OR for women without a husband has been included for comparison

“self-employed”, 0.87 for “supervisory white-collar workers”, 0.80 for “skilled worker”, 1.03 for “unskilled worker” and 1.30 for “out of workforce”, Table 2 and Fig. 1. The odds for being a “never user” by level of SES differed significantly ($p < 0.001$) between using the woman's own SES and using the partner's SES. The difference between using the woman's own SES and that of her partner showed for “sometimes users” versus “always users”, in Copenhagen, much the same trend as for “never users” versus “always users” although not as strong. In Fyn there were only small differences between using woman's own SES versus her partner's when looking at “sometimes users” versus “always users”, Table 3.

Discussion

To what extent socioeconomic status was a determinant for mammography screening participation in Denmark strongly depended on whether SES was measured based on the women's own standing in society or based on that of her partner. When a measure of SES based on women's own occupational status was used, the relative odds of non-participation showed a clear U-shape across SES levels, in both Copenhagen and Fyn. When instead an SES measure based on the partner's occupational status was used, which equals the conventional male dominance SES classification, the

difference in screening participation across SES levels was much smaller, most notably so in Fyn, Fig. 1.

This study was based exclusively on register data. The CPR, the Mammography Registers as well as the SES register from Statistics Denmark are all considered to uphold a high quality. These registers are not based on self-reporting but, in the case of participation in mammography, on the actual registration of mailed invitations and registered attendance, and in the case of SES, based on information from the Danish tax authorities and the Employment Classification Module (Statistics Denmark 2008a). Outside the Nordic countries it is unusual to have access to high-quality population registers of this kind. Researchers often have to base their studies on questionnaires, interviews and self-reporting, which can lead to both selection bias and reporting bias. A limitation to the data in this study is that, in the “out of the workforce” category one cannot distinguish between homemakers, early retired, disability retired, or retired due to old age.

Several studies have shown that women from more socio-economically deprived areas are more likely not to attend screening (Banks et al. 2002; Maheswaran et al. 2006; van der Pol and Cairns 2001). Banks et al. found that in Witney and Swindon, UK, the risk of non-compliance among women from the most deprived areas as compared with the those from the least deprived was more than double (OR 2.5, 95% CI 1.49, 3.41). Similar results were

found by Maheswaran et al. in North Derbyshire, UK, where a socioeconomic deprivation score was attributed to each woman within a specific area. In the latter study the authors discussed the potential misclassification on the individual level, which they might have introduced by using a common area score, and which most probably would bias the associations toward null.

Blackwell et al. (2008) used data from the Joint Canada/United States Survey of Health (JCUSH), a one-time telephone survey, and did in the USA, not find any significant association between household income and having had a mammogram the past 2 years, while they found that household income predicted compliance to mammography recommendations in Canada. Having used data from population-based interview surveys, Katz et al. (2000) found a positive association between household income and compliance to mammography recommendations in both the USA and Canada (OR 2.5 and 2.1 for the highest income group as compared to the lowest in the USA and Canada, respectively), and Calle et al. (1993) found an inverse association in the USA between household poverty level and compliance to mammography guidelines (OR 2.3 for the lowest poverty level as compared with the highest). Thus all three studies found fairly linear patterns.

In Sweden, both individual and household data can be retrieved from registers in the same way as described in the present study from Denmark. Using Swedish data, Zackrisson et al. (2007) found a positive association between family income and attendance (OR 0.54 for the highest quartile versus the lowest, 95% CI 0.50, 0.58), while the risk of non-participation was higher for women with the highest education as compared with women with the lowest education (OR 1.26, 95% CI 1.12, 1.42, adjusted model). These seemingly contradictory results might be explained by the fact that the income measure was based on the family income, while the education measure was based on the woman's own education.

In a methodological study from 1991, Krieger (1991) discussed both the lack of social class data in US vital statistics and medical records and the problem of finding a consensus regarding appropriate measures of women's social class. Krieger compared individual-, household-, and census-based measures of social class as predictors for social gradients in reproductive outcomes. She found that household data were significantly associated with the outcome while individual data were not and that census block data functioned like household data while census tract data did not. Dailey et al. (2007) assessed if, in Connecticut, neighborhood-level SES was an independent predictor of non-adherence to mammography screening and found that neighborhood SES was significantly associated with non-adherence after adjustment to individual SES. While Krieger concluded that the problem of lacking individual

social class data might be "addressed through judicious use of census block group data" and that this measure would be as applicable to women as men, Dailey et al. underscored the importance of examining the neighborhood context as well as individual factors. Osler et al. (2002) analyzed the association between areas with different levels of income inequality and mortality in Denmark, but found that the association disappeared after adjustment for individual income. Hence, and perhaps self-evident, the decision to use neighborhood, household, or individual data must be based on the outcome measure under study.

When the "gender neutral" or the combined SES measure for household is used, we do not know who in a household has been the major contributor to the family's SES. Danish women have a high employment rate compared with many European countries. In 2006, 75% of all women in Denmark between 16–66 years of age were in the labor market (for men the figure was 81%). However, in 2005 men had, on average, a 23% higher disposable income than women in Denmark in Figures (2008). It is thus evident that even in a country considered to be one of the world's most gender equal countries in terms of income, men will contribute more towards the family income. It is therefore reasonable to assume that the difference in pattern of screening participation between using a SES based on the household's or the partner's status, and using one based on the woman's own status would be even greater for study populations where women's labor market participation is smaller, or where women have considerably less income.

In conclusion, the present study has shown that the classic gradient of increasing screening uptake with increasing socioeconomic status is, in part, a reflection of the way that socioeconomic status was measured. Other studies have shown that the screening uptake is lowest among women coming from the most deprived areas and among women coming from low income households. However, when the measure for SES is based strictly on the woman's own socio-economic characteristics, different patterns may emerge, as the U-shaped pattern found in the present study. Substantial efforts are made, and substantial resources are used, to ensure high participation in screening programs. If recruitment and information campaigns should be targeted towards specific groups in order to have an effect on the problem of non-attendance, it is important to understand which factors determine or predict non-attendance. The results from this study indicate that the partner's SES is not a strong predictor of non-attendance in comparison with women's own SES. Hence, in a public health perspective it is important to take into account that when addressing the problem of non-attendance, using data based on women's own SES might give a different result from using household or area-based SES data.

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Conflict of interest statement None.

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