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Original Paper

Mammography Requests in General Practice During the Introduction of Nationwide Breast Cancer Screening, 1988–1995

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Introducing an organised breast cancer screening programme for certain age groups in a population might induce opportunistic screening in adjacent (non-invited) age groups and influence health behaviour in the target population. We analysed the effect of the start of the Dutch national screening programme on the number of mammographies requested by 43–45 general practices for the age groups 30–39, 40–49, 50–69 and 70+ years, using logistic regression analysis. In all age groups an immediate increase was observed in the number of mammography requests after the start of the screening, which was largest and statistically significant in the target population of the screening programme (age 50–69 years). More than 2 years after the start of screening, the number of mammography requests in all age groups had decreased to the level before the start and in the age group 50–69 years the number of mammographies was significantly lower than before the screening started. The unexpected increase in mammographies after the start of the breast cancer screening programme might be related to registry problems or to the process of building up the screening programme. Eventually there was a decrease in the number of mammographies in the target population, probably an effect of the introduction of the national screening programme. Opportunistic screening was not clearly demonstrated in adjacent age groups. © 1999 Published by Elsevier Science Ltd. All rights reserved.

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INTRODUCTION

THE DUTCH national breast cancer screening programme started in 1989. Since then, women aged from 50 to 69 years have been actively invited for biennial screening with mammography. The participation rate is 80% [1, 2]. Before screening was introduced, a cost-effectiveness analysis estimated a 16% reduction of breast cancer mortality in the total female population [3]. Early effectiveness indicators of the screening programme are encouraging [2]. The detection rate at first screening was approximately 6.4 per 1000 screens, in accordance with expectations. The stage distribution of the screen-detected cancers was much more favourable than for breast cancer clinically diagnosed before the start of the screening programme [1, 2].

The expected changes in diagnostic procedures have also been published [4]. One hypothesis was that the number of mammographies undertaken outside the screening programme in the target population would decrease, because of the introduction of screening. However, it was considered that the introduction of screening might induce more mammographies in adjacent (non-invited) age groups. Opportunistic screening in the target population could negatively influence the effectiveness of screening and costs of health care. Induced opportunistic screening in adjacent age groups, where the balance between favourable and adverse effects of screening is considered to be worse, could be seen as a negative effect from the public health perspective. Quantifying these mechanisms is important for a complete evaluation of the national screening programme.

In The Netherlands, the general practitioner functions as a gatekeeper to health care. All women who have symptoms of breast cancer or who are concerned about their breasts, have

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to visit a general practitioner in order to be referred to a radiologist or surgeon for mammography. In an existing registration system of 43–45 general practices, a specific item was introduced that related to mammography practice during the build-up period of the screening programme (1988–1995). Using this registry we examined the effect of the start of the screening programme on the number of mammographies requested in general practice.

MATERIALS AND METHODS

Registration by general practices

A group of 43–45 general practices (sentinel practices) annually register consultations about specific health problems which are collected and processed by the NIVEL (Netherlands Institute of Primary Health Care). The population covered by this registration is approximately 1% of the total population in The Netherlands. These practices are heterogeneous with regard to the degree of urbanisation and geographic area and are considered representative of the total population in The Netherlands [5]. The population covered by the general practice is classified in 5 year age groups and is reassessed every 2 years.

The national screening programme was introduced gradually and complete national coverage was reached at the end of 1997. Between 1989 and 1997 screening took place in some parts of The Netherlands, but not in others.

Since 1988, the number of mammographic examinations requested by general practitioners has been recorded. The present analysis involves all mammographies for which women were referred by their general practitioner and covers the period 1988 to 1995. These mammographies cover the ones made for preventive and for clinical motives (on the basis of complaints or symptoms). These requests were linked to information on the start of the national screening programme (by month and year) in the municipalities of the general practitioners participating in the registry.

Statistical analysis

All analyses were carried out using the SPSS package. Logistic regression analysis was used to model the chance of mammography, depending on whether or not the screening programme had started at that time. Separate logistic regression models were fitted for the age groups studied (30–39, 40–49, 50–69 and 70+ years). In the logistic model, calendar time (in months) was included as a continuous variable.

General practice was also included to adjust for different levels of mammography requests.

To describe the effect of the start of the screening programme in the model, the total period covered in each general practice was divided into three intervals. The first interval ended at the start of the screening programme in each practice, the second interval covered the 2 years after the start of the programme and the last interval was from 2 years after the start until the end of the observation period. Each interval was modelled, using a separate linear trend with calendar time (termed '*Trend*'). An instant leap to a new value was allowed at the start of the screening programme, that is at the transition from the first to the second interval (termed '*Start*'). The transition from the second to the third interval, however, was continuous (termed '*Rebound*'). The difference between the level before the start of the national screening and more than 2 years afterwards was modelled by DIFF. See Figure 1 for the general pattern of mammography.

The logistic regression model of the start of the screening was somewhat complex. We also fitted models with a 1 and 3 year interval after the start of screening, but this did not result in a better fit. We tested the underlying trend before and after the start of screening, but this was not statistically significantly different.

RESULTS

The number of general practices participating in this study ranged from 43 to 45 per year (average duration of participation from 1988 to 1995: 6.4 years). Three practices were in municipalities where experimental screening projects had already been carried out before the start of the national screening programme in 1989. In 1995, in five practices, the national screening programme had not yet begun. The coverage of the national screening programme accorded well with the percentage of general practices where screening had already started, emphasising the representativeness of the sample of the population covered by the general practitioners (data not shown).

During the whole period mammography was requested each year for an average of 2.7% of the women in the age group 40–49 years, and for 1.8% in the age groups 30–39 years and 50–69 years. For the oldest age group (70+ years) this was 0.5%. The number of mammographies by age and year showed a fluctuating pattern, but overall (and age standardised) a gradual increase occurred from 1988 to 1992, with a gradual decrease from 1993 onwards (Table 1). The

Table 1. Number of participating general practices and number of mammographies by age and start of screening per year (per 10 000)

	1988	1989	1990	1991	1992	1993	1994	1995	1988–1995
Participating general practices	45	45	44	43	43	45	45	45	
% of general practices where screening started*	–	4	16	9	21	24	22	11	
Age									
30–39 years	162	164	147	166	186	192	220	199	180
40–49 years	200	233	231	295	277	275	323	300	269
50–69 years	103	120	158	197	151	323	218	192	184
70+ years	24	25	39	55	41	87	65	59	50
Start of screening									
Before start (age standardised)	129	139	150	170	177	156	190	169	157
0–2 years after start (age standardised)	–	200	212	276	172	376	259	194	267
> 2 years after start (age standardised)	105	164	110	203	138	148	198	207	175
Total (age standardised)	127	141	151	186	170	235	216	195	179
Absolute numbers	471	514	542	646	572	708	718	663	4834

*In three practices screening had already started as the result of an experimental screening project in 1974–1975.

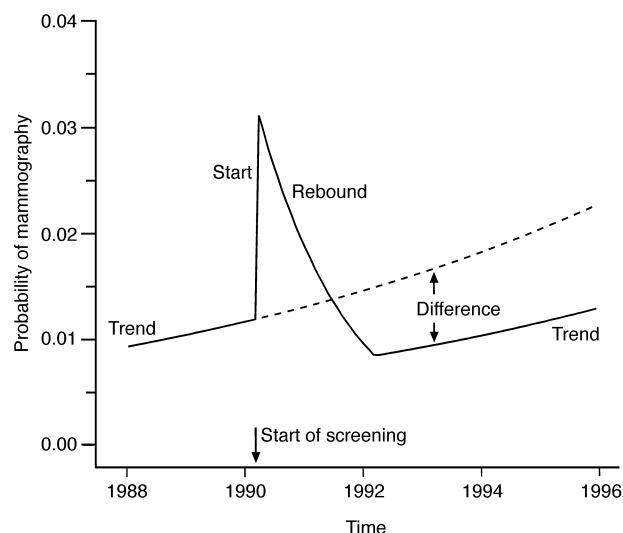


Figure 1. General pattern of mammography requests, age group 50–69 years.

age groups 30–39 years and 40–49 years showed less fluctuations than older ages. For the number of mammographies by start of the national screening programme overall (and age standardised), a higher level was observed 0–2 years after the start than before or more than 2 years after the start (Table 1).

In Table 2, the average number of mammographies requested by general practitioners is presented, stratified by start of screening. Since screening had already started before 1988 in some municipalities and in others screening did not start in the period studied, Table 2 compares the results from these two groups. In all age groups, the rate of mammography requests was significantly higher if the screening programme had started, compared with practices where screening had not yet started. This could still, however, be only a reflection of differences by general practices or area without reference to the introduction of the screening programme.

In the logistic regression model, general practice, calendar time and three parameters for the start of the screening

programme (see Materials and Methods) were included. The logistic regression model contained the same variables for all age groups in order to achieve a consistent presentation. The general pattern that emerged from the analyses is shown in Figure 1.

For the youngest age group (30–39 years), almost none of the parameters corresponding to intervals of the start of screening was statistically significant. For all age groups, an increase after the start of screening was observed, but it was most prominent for the age group 50–69 years. The overall time trend in mammography requests was also largest for the age group 50–69 years and for the 70+ years group (12% and 14% increase per year; Table 3). During the third interval (more than 2 years after the start of screening), the level of mammography was lower in all age groups, except the youngest. This reduction in mammography examinations was largest and statistically significant for the target population (age 50–69 years) of the national screening programme (odds ratio (OR) 0.56, 95% confidence interval (CI) 0.46–0.69), but not significant in the adjacent age groups (Table 3). It should be noted that this is over and above the increasing background trend (see Figure 1).

DISCUSSION

The introduction of the national screening programme has significantly influenced the number of mammography requests by general practitioners, except in the age group 30–39 years. The number of requests first increased after the start of the programme and then decreased. As expected, the number of mammography requests was significantly lower more than 2 years after the start of the programme in the target age group of the national screening programme (50–69 years) than before. In the adjacent age groups, the number of mammographies was also lower more than 2 years after the start of the screening programme, but the difference was small and not statistically significant.

Increased opportunistic screening under the age of 50 years after the introduction of the screening programme could not be demonstrated in these data. The temporary increase after the start of the national screening programme

Table 2. Number of mammographies per 10 000 women by age and start of screening, 1988–1995

Screening	Age group			
	30–39 years Rate (95% CI)	40–49 years Rate (95% CI)	50–69 years Rate (95% CI)	70+ years Rate (95% CI)
Not (yet) started	166 (156–176)	237 (224–250)	151 (142–160)	36 (30–42)
Started	208 (192–223)	329 (309–350)	238 (224–253)	70 (60–80)

CI, confidence interval.

Table 3. Relationship between the start of screening, age and mammography requests with adjustment for calendar time and general practice (separate age models, see also Figure 1)

	Age group			
	30–39 years OR (95% CI)	40–49 years OR (95% CI)	50–69 years OR (95% CI)	70+ years OR (95% CI)
Underlying TREND (per year)	0.99 (0.96–1.02)	1.03 (1.00–1.06)	1.12 (1.09–1.16)	1.14 (1.05–1.24)
START	1.12 (0.90–1.38)	1.29 (1.08–1.54)	2.79 (2.40–3.24)	1.74 (1.13–2.67)
REBOUND (0–2 years; trend per year)	1.05 (0.92–1.20)	0.88 (0.79–0.98)	0.50 (0.46–0.55)	0.84 (0.66–1.07)
DIFF (level before START—level after REBOUND)	1.26 (1.01–1.56)	0.93 (0.77–1.13)	0.56 (0.46–0.69)	0.94 (0.57–1.56)

OR, odds ratio; CI, confidence interval.

was less prominent in this age group than for women aged 50–69 years. We would have expected a permanent increase in the number of mammographies that might last more than 2 years after screening had started in the case of opportunistic screening. In some European countries (Sweden, Iceland) screening is carried out for women under the age of 50 years. Screening women under 50 years is still a controversial topic, according to the results of the NIH Consensus Panel. This panel recently concluded that the data currently available do not warrant a universal recommendation for mammography for all women in their forties [6].

Until 1993, women aged 70 years and older were allowed to participate in the screening programme. From 1994 onwards, these women were excluded from the programme. This could have resulted in more mammographies via the general practitioner. Furthermore, these measures have directed attention to screening older women that could itself have resulted in more requests for mammography.

Although it has to be noted that some of the mammographies as requested by the general practitioner were for preventive motives and some for diagnostic motives, we conclude that opportunistic screening in adjacent age groups did not increase after the introduction of the national screening programme for women aged 50–69 years.

During the period of introducing screening for women aged 50–69 years, a continual increase in mammographies was observed in those aged 40 years and over. This could be caused by more breast awareness generated by the programme and other factors, as was suggested in part to be the cause of the decreased mortality from breast cancer in the U.K., pre-dating the effect of screening [7]. In the period before the introduction of the screening programme, the total number of mammographies (radiology departments included) had already shown an increase in The Netherlands, implying that other factors also act on this trend. Furthermore, this increasing background trend was very small in the age group 40–49 years, who would be expected to be most sensitive to breast awareness resulting from the screening programme.

The temporary rise (followed by a decline) in the number of mammography requests 0–2 years after the local introduction of the national screening programme is somewhat surprising for the age group 50–69 years. When asked about this result, the participating general practitioners said they were confident that only mammographies outside the national screening programme had been registered, even in this age group. These were, however, self-reported data (data not shown).

The increase could be an artefact caused by extra alertness of the general practitioners to register mammographies after the start of screening. This would imply that the real number of mammography requests before the start of screening and possibly also more than 2 years after screening was introduced was underestimated. Another explanation of these results might be that women who had not yet received an invitation, were encouraged by publicity surrounding the introduction of screening in their municipality to have a mammography via their general practitioner. Furthermore, women who already have breast problems or symptoms might not wait for the screening invitation but consult their general practitioner immediately. It is also possible that the general practitioners refer, for a clinical mammography, women who did not attend screening. A small loss in attendance at the

population level could have a relatively high impact on mammography numbers in general practice. Literature regarding these issues is scarce. Garstin and colleagues observed a 42% increase in mammographies after the start of the national screening programme in the U.K., which was mainly caused by referral by menopausal clinics and general practitioners [8]. In that study, concern was raised that double screening might take place or a false sense of security would occur.

The decrease in mammography requests by the general practitioner in the target population of the Dutch national screening programme can be interpreted as an effect of the introduction of screening. Part of this reduction may be due to false reassurance after a negative screen result. Still, a considerable number of breast cancer cases are diagnosed in the interval between two screening examinations [9, 10]. False reassurance might result in less cancers detected in the interval and, thus, an undesirable delay of diagnosis and treatment. Additional (qualitative) research is needed to unravel further the occurrence of false reassurance and to interpret the sudden rise (and decline) as observed in this study.

The population covered by the general practices of the NIVEL is representative of the total Dutch population with respect to degree of urbanisation and geographic spread [5]. The general practitioners may not be representative of all general practitioners. Participating in the registration is on a voluntary basis and it could be argued that this implies some selection. These general practitioners could, for example, be more restrictive in referring patients for mammography. Such selection would influence the overall level of mammography referrals, but is unlikely to lead to other conclusions. Some general practices contributed more to the time trend before the start of the screening programme whilst others contributed more to the trend after the start. By including the general practice as a confounding variable, we adjusted for this.

Only 1.8% of all women have a mammography via their general practitioner each year, whilst 80% of all women aged 50–69 years attend the biennial screening in The Netherlands. The relative changes, as represented by the ORs, observed in this study were quite large, but have to be interpreted within this perspective.

In this study, the start of a national screening programme had a large temporary effect on the level of mammography requests by general practitioners. We have no information on whether this is caused by a change in requests by the women themselves, a change in policy of the general practitioner, or both. A decrease of mammography requests in the target population of the screening programme (age 50–69 years) was observed after some time. It may reflect the increased uptake of breast cancers and true negative results by the national screening programme and certainly supports the hypothesis that a screening programme reduces the number of clinical mammographies. Our study shows that at the same time it seems not to result in a permanent increase in opportunistic screening in women from adjacent age groups.

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