Self examination of the breast: is it beneficial? Meta-analysis of studies investigating breast self examination and extent of disease in patients with breast cancer

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Abstract

The question whether the aggregated published research suggests that breast self examination is beneficial was explored in a meta-analysis of 12 studies including a total of 8118 patients with breast cancer that related the practice of breast self examination to regional lymph node state or tumour diameter. Based on the six studies for which data were available, 39% of patients (1115/2852) who reported having done breast self examination at least once before their illness had evidence of cancer in the lymph nodes compared with 50% of women (1348/2713) who had not done the examination. Logistic regression analysis showed this difference to be significant (odds ratio 0.66, confidence interval 0.59 to 0.74). Combining six studies which reported the circumstances of detection disclosed that 42% of women (272/652) who found their tumour while doing breast self examination had evidence of cancer in the nodes compared with 46% of women (871/1901) who found the tumour accidentally; this difference was not significant. Analysis of eight studies which used the diameter of the tumour to indicate the extent of disease tended to confirm the findings on lymph node state, in particular the benefit of premorbid breast self examination. Significantly fewer women who had practised the examination before the illness (56%; 1205/2137) had tumours of 2 cm or more diameter compared with women who had not practised the examination (66%; 1500/2260). The combined odds ratio for that analysis was 0.56, confidence interval 0.38 to 0.81.

These findings appear to be good evidence of the benefit of encouraging women to practise self examination of the breasts regularly.

Introduction

Self examination of the breasts is one of the few specific behaviours that people can be advised to adopt in order to reduce the risks of cancer. Only during the past decade have there been reports relating breast self examination to extent of disease in patients with breast cancer,¹⁻¹² though for over 30 years the examination has been advocated as a precaution against the disease.¹³ It has been assumed that breast tumours will be found and reported sooner by women who palpate their breasts regularly and that the probability of cure will therefore be enhanced.¹⁴ This reasoning has sometimes been challenged.¹⁵

We have found 12 separate published studies which related self reported premorbid breast self examination practices of patients with breast cancer to disease variables including tumour size, state of the lymph nodes (either "positive," indicating that evidence of cancer was found in the nodes, or "negative," indicating no evidence of cancer), clinical or TNM

(tumour, node, metastasis) stage, and pathological stage.¹⁻¹² Based on statistical tests in which the null hypothesis was rejected at the 5% level, six of the studies found some benefit of breast self examination^{1 3 4 6 11 12} and six did not.^{2 5 7-10} Nevertheless, it would be fallacious to conclude that the evidence is evenly divided. Firstly, some vote counting techniques artificially dichotomise studies into either "positive" or "negative" without considering magnitudes of association. Other grounds for caution include that the null hypotheses tested may not be identical; that studies are not necessarily equally well designed and executed; and that they generally vary in statistical power.

Meta-analysis is a method of combining research results from several studies so that for all studies in the analysis the statistical power and direction of results make an appropriate contribution to a single overall estimate of effect and its associated confidence limits.¹⁶ We report such an analysis of the 12 studies of breast self examination cited above.

Methods

A library search, in particular for work relating to cancer published between 1970 and 1986, was undertaken to discover papers on the relation between the self reported premorbid breast self examination practice of patients with breast cancer and the extent of the disease at diagnosis. Studies included in the analysis were found from the combined resources of Medline and Cancerlit computer databases, personal reprint collections, communications with other professionals, and recent editions of *Current Contents*. Database searches were conducted by looking for the key terms "breast self examination," "BSE," "breast neoplasm," "breast cancer," "prognosis," "diagnosis," and "survival" in the titles and abstracts of papers published between 1980 and 1986.

Eighteen potentially relevant papers were found. The criteria for including papers in the meta-analysis were that they reported the breast self examination practice of patients before their illness and the extent of the disease at diagnosis. Of the 18 papers, two were updated versions of earlier reports,^{17 18} and the earlier papers were therefore excluded. Four other papers were also excluded: two reported the findings of other studies,^{19 20} one did not relate the extent of disease to breast self examination practice before the illness,²¹ and one examined only the effect of receiving information about breast self examination on stage of disease.²² Thus 12 studies met the inclusion criteria.

Patients in each study were ascertained within specified periods from one of three sources: a population based cancer registry, a hospital, or a breast cancer detection demonstration project. The 12 study populations were similar with respect to racial make

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up, socioeconomic state, education, and disease history. Three of the 12 studies^{6,7,9} placed restrictions on the age of participants: one admitted only women between the ages of 45 and 65,⁷ one selected women between 35 and 45,⁶ and one selected women under 54 and over 22.⁹ In the remaining nine studies there was no obvious evidence of age selection and examination of the age ranges showed little variation. Age specific details of breast self examination practice and lymph node state were available for only one study.³ Six other studies^{4,5,7,10-12} examined the problem of age confounding but none found any evidence of it.

It was first necessary to identify the measures of breast self examination practice and extent of disease classifications used in the studies. Breast self examination practice was always based on self report, but it was classified by researchers in varying ways. Most strikingly, in some studies extent of disease was related to the patients' self reported history of breast self examination before their illness, and in other studies women were questioned specifically about the circumstances of discovery of their tumour—that is, Was it found while actually doing breast self examination?

Table I lists each study and indicates the breast examination measures and disease variables reported. Though the measures of breast self examination and extent of disease varied greatly, we reject the view of O'Malley and Fletcher that the data from these studies cannot be combined.²³ As shown in table I, one disease variable that was reported in all the studies—either directly or indirectly—was the state of the regional lymph nodes; in some studies nodal state was not reported directly but had to be derived from data that were presented as staging classifications. We therefore took nodal state as the dependent variable on which to do our main assessment of the efficacy of breast self examination in achieving earlier diagnosis and improved prognosis. It is considered reasonable to accept that negative lymph nodes indicate an earlier stage of breast cancer and a better prognosis than positive nodes.²⁴

Six studies¹⁻⁶ (set A) related nodal state to premorbid breast self examination practice, and the six other studies⁷⁻¹² (set B) related breast self examination practice at the time the patient's lump was found to nodal state. In set B patients whose tumours were detected by medical examination or mammography were excluded so that cases detected by breast self

examination could be contrasted with those detected accidentally. Three studies which presumably could have related premorbid breast self examination practice to outcome did not report on this relation.⁹⁻¹¹

Patients who practise breast self examination will not always detect their lump while doing the examination. To the extent that this is so, a given study population may be differently divided into "breast self examination practice" and "non-breast-self-examination practice" groups depending on whether nodal state is being related to breast self examination practice before the illness (as in set A) or breast self examination practice at the time the lump was found (as in set B). If the practice of breast self examination is associated with an earlier stage of disease regardless of whether the lump is detected while doing the examination, then to include patients practising breast self examination but detecting their tumour by other means in the non-breast-self-examination group would be a misclassification. Alternatively, if the practice of breast self examination is only or primarily associated with an earlier stage of disease when it is the means by which a lump is detected it would be a misclassification to include patients practising breast self examination but not detecting their tumour by this means in the breast self examination practice group. We therefore report separately on the results of the six set A and six set B studies. The appropriateness of this separation was tested statistically.

Tumour size is also regarded as an important prognostic sign²⁴ and was reported in 10 of the 12 studies (table I). In nine studies tumour size was categorised into ranges and in one it was reported as means. In every case where tumour size was reported in ranges it was possible to group tumours into those of under 2 cm and those of 2 cm or larger.

Studies varied in the completeness of data reported. Two studies did not disclose the proportion of coverage of the target population that was achieved.^{3,8} Among the remainder coverage ranged from 50% to 100%. Patients were excluded from studies for the following reasons: physicians refused to participate, patients refused to participate, clinical or pathological data were not available, or patients were too ill. Comparisons between participants and non-participants were reported in four studies and no differences found. In all but one of the remaining studies⁷ no obvious differences between the study sample and the target population were detectable. Most studies had data

TABLE I—Summary of studies investigating breast self examination and extent of breast cancer

Parameter	Reference/study No											
	1	2	3	4	5	6	7	8	9	10	11	12
Premorbid history of breast self examination:												
Monthly	X	X	X	X	X							
Less than monthly				X		X						
Several times yearly	X	X	X						X*	X*		
Every two months	X						X					
Once or twice a year										X*		
Three to five times a year	X											
Once a year/rarely	X		X						X*	X*		
Never	X	X	X	X	X	X	X		X*	X*	X*	
Unspecified frequency								X			X	X
Circumstances of detection:												
During routine breast self examination	X						X	X	X	X	X	X
By woman accidentally	X						X	X	X	X	X	X
By woman (unspecified)		X		X	X							
By a doctor	X	X					X		X	X	X	X
Disease variables:												
Nodes positive or negative	X	X	X†	X	X	X	X†	X	X	X	X	X†
TNM stage	X			X				X		X	X	
Path stage (surveillance, epidemiology, and end result reporting)			X				X	X	X	X	X	X
Tumour diameter { Means												
Ranges	X	X	X	X	X	X		X†	X	X		
Completeness of data:												
% Target sample covered	79	97	NR	83	66	100	50	NR	95	50	71	100
% Breast self examination practice recorded	100	100	100	83	100	96	100	100	100	100	100	9
% Nodal state recorded	87	97	100	66	97	100	100	100	96	95	90	100

*Did not report on relation of premorbid history of breast self examination to extent of disease. †Node classification not directly reported but derived from staging. ‡Raw numbers not reported in form suitable for meta-analysis. NR=Not reported.

TABLE II—Summary of studies relating breast self examination to nodal state of patients with breast cancer

Reference	% Of women with positive nodes among women who did breast self examination	% Of women with positive nodes among women who did not do breast self examination	Women who did breast self examination		Women who did not do breast self examination		Odds ratio	95% Confidence interval
			No with positive nodes (a)*	No with negative nodes (b)	No with positive nodes (c)	No with negative nodes (d)		
Studies of premorbid practice (set A)								
Huguley and Brown ¹	43	50	544	720	280	280	0.76	0.62 to 0.92
Senie <i>et al</i> ²	36	42	124	217	356	483	0.76	0.60 to 1.01
Feldman <i>et al</i> ³	46	60	189	219	356	232	0.56	0.44 to 0.73
Foster and Constanza ⁴	39	56	144	225	164	128	0.50	0.37 to 0.68
Hislop <i>et al</i> ⁵	15	22	44	256	23	81	0.61	0.35 to 1.06
Tamburini <i>et al</i> ⁶	41	51	70	100	169	161	0.67	0.46 to 0.97
Overall	39	50	1115	1737	1348	1365	0.66	0.59 to 0.74
Studies of circumstances of detection (set B)								
Gould-Martin <i>et al</i> ⁷	48	41	29	31	69	100	1.36	0.75 to 2.45
Philip <i>et al</i> ⁸	50	51	30	30	98	95	0.97	0.54 to 1.73
Smith and Burns ⁹	40	50	75	110	67	67	0.68	0.44 to 1.07
Smith <i>et al</i> ¹⁰	41	42	44	63	24	33	0.96	0.50 to 1.84
Greenwald <i>et al</i> ¹¹	33	41	18	37	74	106	0.70	0.37 to 1.32
Owen <i>et al</i> ¹²	41	46	76	109	539	629	0.81	0.59 to 1.12
Overall	42	46	272	380	871	1030	0.85	0.69 to 1.03

*Notations (a) to (d) refer to cross product formula for calculating odds ratios (see text).

on breast self examination practice from a large proportion of cases (all cases in nine studies) and only one¹² had a very small proportion of cases (9%) with these data available. Most studies had data on lymph node state from a high proportion of cases, the lowest being 66% with the state of the lymph nodes known.

For set A studies the ratio of the odds of disease positive lymph nodes in a patient with breast cancer who had practised breast self examination before her illness to the corresponding odds in a patient who had not practised breast self examination was calculated by using the cross product formula (odds ratio = $a/b:c/d = ad/bc$, where a, b, c, and d refer to columns in table II). Similarly, for set B studies the ratio of the odds of lymph node disease in a patient with breast cancer who found her cancer while doing breast self examination to the odds in a patient whose breast cancer was found accidentally was calculated by using the same formula. Confidence intervals based on these estimates were calculated by the log odds approximation method described by Fleiss.²⁵ The computer program GLIM (generalised linear interactive modelling) was used to perform logistic regression analyses of the odds ratios.²⁶ In the separate analyses conducted for the two sets of studies variables included in each model were breast self examination practice (history of breast self examination before the illness or breast self examination as the method of detection) and study number.

Results

Table II categorises the 12 studies in the analysis according to whether premorbid history of breast self examination (set A) or the circumstances of detection of the patient's tumour (set B) were described. In studies of the circumstances of detection the classification of breast self examination was based on whether the patient discovered her current tumour while practising breast self examination, regardless of previous practice. In the studies of premorbid practice patients were grouped according to whether they had ever practised breast self examination or never practised breast self examination; this distinction, however, was not possible for the data of Senie *et al*,² for which it was necessary to include occasional practitioners in the never practised group.

Table II shows that in every set A study the percentage of women with positive nodes was lower among those who had practised breast self examination than among those who had not. Overall 39% (1115/

2852) of women who had practised the examination before their illness had positive nodes compared with 50% (1348/2713) of those who had not done breast self examination. In five of the six set B studies the percentage of women with positive nodes among those who found their cancers while doing breast self examination was lower than the percentage with positive nodes among those whose cancer was detected accidentally. The overall difference was small but favoured the breast self examination group (42% (272/652) v 46% (871/1901)).

As planned, the significance of this pattern of results was explored with logistic regression. Table II shows individual study odds ratios for positive nodes and their 95% confidence intervals in women who practised breast self examination compared with others for each of the six set A studies and six set B studies. Combined logistic regression analysis of all 12 studies showed a significant interaction between set type and breast self examination practice ($\chi^2=4.56$; $df=1$; $p=0.03$), validating the strategy of separate analyses.

For set A studies the odds ratios were all less than 1.0 and the upper 95% confidence limits less than 1.0 for all but two.²⁵ The combined odds ratio was 0.66, 95% confidence interval 0.59 to 0.74. The logistic model showed a significant effect due to premorbid practice of breast self examination ($\chi^2=49.9$; $df=1$; $p<0.001$) and the goodness of fit statistic was satisfactory ($\chi^2=7.92$; $df=5$; $p=0.16$).

For only one study concerned with the method of detection⁷ was the odds ratio greater than 1.0. Nevertheless, all the 95% confidence intervals included 1.0. The overall estimate of the odds ratio for set B studies was 0.85 (confidence interval 0.69 to 1.03) but the effect due to method of tumour detection was not significant ($\chi^2=2.7$; $df=1$; $p<0.1$). There was no evidence of heterogeneity among the six studies ($\chi^2=4.1$; $df=5$; $p=0.54$).

In all the above analyses the outcome variable was the presence or absence of the disease in lymph nodes at the time of diagnosis. An alternative indicator of severity of the disease is tumour size, and eight studies^{1-6,9,10} related breast self examination practice to the diameter of the primary tumour (2 cm or more or less than 2 cm). Table III shows that in the six set A studies the percentage of patients with tumours 2 cm or more in diameter was lower (or in one case the same) among women who had practised breast self examination than among those who had not, the overall percentages being 56% (1205/2137) and 66% (1500/2260) respectively. In the two available set B studies,

TABLE III—Summary of studies relating breast self examination to tumour size in patients with breast cancer

Reference	% Of women with tumour diameters ≥ 2 cm among women who did breast self examination	% Of women with tumour diameters ≥ 2 cm among women who did not do breast self examination	Women who did breast self examination		Women who did not do breast self examination		Odds ratio	95% Confidence interval
			No with tumours ≥ 2 cm (a)*	No with tumours < 2 cm (b)	No with tumours ≥ 2 cm (c)	No with tumours < 2 cm (d)		
Studies of premorbid practice (set A)								
Huguley and Brown ¹	53	63	500	444	289	170	0.66	0.53 to 0.83
Senie <i>et al</i> ²	52	57	162	151	457	341	0.80	0.62 to 1.04
Feldman <i>et al</i> ³	44	61	61	79	137	86	0.49	0.32 to 0.75
Foster and Constanza ⁴	45	77	126	156	271	81	0.24	0.17 to 0.34
Hislop <i>et al</i> ⁵	86	86	249	39	84	14	1.06	0.55 to 2.06
Tamburini <i>et al</i> ⁶	63	79	107	63	262	68	0.44	0.29 to 0.66
Overall	56	66	1205	932	1500	760	0.56	0.38 to 0.81
Studies of circumstances of detection (set B)								
Smith and Burns ⁹	79	81	99	26	75	17	0.86	0.44 to 1.70
Smith <i>et al</i> ¹⁰	77	78	44	13	28	8	0.97	0.36 to 2.63
Overall	79	80	143	39	103	25	0.89	0.51 to 1.57

*Notations (a) to (d) refer to cross product formula for calculating odds ratios (see text).

however, there was virtually no difference in tumour size between women who did and did not practise breast self examination.

Table III also gives the estimated odds ratios and 95% confidence intervals for these studies. All but one⁵ of the odds ratios were less than 1.0 but half of the eight studies^{2,5,9,10} had 95% confidence intervals including 1.0. Neither study concerned with the method of detection^{9,10} had estimated odds ratios significantly different from 1.0. In a logistic model of the six studies of premorbid breast self examination practice¹⁻⁶ a significant amount of variation in tumour size was accounted for by breast self examination practice, but this effect was clouded by significant residual deviance ($\chi^2=38.6$; $df=5$; $p<0.001$). After correcting for lack of fit the odds ratio estimate due to breast self examination practice was 0.56, 95% confidence interval 0.38 to 0.81. One study⁴ carried the bulk of the residual deviance ($\chi^2=28.9$, $df=1$). Though tumour size was available for only two studies concerned with the method of detection, the combined odds ratio was calculated and found to be 0.89, 95% confidence interval 0.51 to 1.57.

Discussion

This analysis of papers on breast self examination shows that there is greater consistency of results among studies than has commonly been perceived. Though authors differed on the measures of extent of disease, it was possible to extract a common element from all studies reviewed. Each provided direct or indirect information on the state of the lymph nodes, classified as either disease positive or disease negative, and this was considered to be an acceptable index of prognosis and therefore of the potential effectiveness of breast self examination.

Six studies were concerned with the patient's prior history of breast self examination and six with the method of detecting the tumour. The combined odds ratio for set A studies suggests a beneficial effect of premorbid breast self examination practice on the degree of disease positive lymph nodes at diagnosis with a high degree of statistical confidence. The effect is not so clear cut for studies of the method of detection, as the combined odds ratio fell short of statistical significance. Results from the six studies of premorbid practice in which classification by tumour size was possible confirmed the benefit of breast self examination.

That the overall effect of breast self examination on extent of disease was less when classification of the examination was based on method of detection rather than on premorbid practices was not an unexpected outcome. If we accept the notion that women who

practise breast self examination are more sensitive to breast changes and delay less in reporting them^{1,4,8} it follows that should they accidentally detect tumours between examinations they will be more likely to have the cancer diagnosed early. If so, then results based on the method of detection would disguise some of the effect of breast self examination on extent of disease by classifying women who were in fact deriving a beneficial effect on extent of disease from their usual practice of breast self examination in the non-breast-self-examination (that is, accidental detection) group. We suggest that analyses based on method of detection lead to such misclassification and that our results support this conclusion. We therefore believe that classification by premorbid practice is likely to be the more appropriate approach to assessing the influence of breast self examination practice on extent of disease at diagnosis.

The study by Gould-Martin *et al* produced the only odds ratio greater than 1.0.⁷ This might well have been due to the low coverage achieved (50%) and the systematic exclusion of patients with advanced disease. Seventeen per cent of eligible cases were excluded because the patients "had died or were too ill to be interviewed" or had "presented with distant metastases." Clearly, if patients excluded because of extent of disease were biased in respect of breast self examination practice, then interpretation of results from the study would be problematic.

The validity of conclusions from meta-analyses is threatened from two main sources. The first has been called the "file drawer" problem.²⁷ This refers to the unknown studies and potential studies that reached negative conclusions but were not published because "positive" results tend to excite researchers and interest editors more than the negative ones. Breast self examination, however, is a relatively controversial area of public health, so that any publication bias in favour of studies with positive findings is unlikely to be large. This observation is supported by the even balance of "positive" and "negative" studies which we have identified.

The second main problem with meta-analysis is the almost certainly false assumption that has to be made that the samples were drawn in the same way from the same population. Except for the one instance noted above,⁷ however, in these studies of breast self examination selection of patients appears in general to have been relatively free of important differences. The target population in four studies was all patients notified over specified periods to population based cancer registries; in a further five studies it was all patients at certain hospitals or groups of hospitals; and in three studies it was all patients in breast cancer demonstration projects. In general the coverage was

close to target size with an average of 79% in the 10 studies for which this was reported.

Given the problems that beset the measurement of breast self examination and the correct classification of patients in terms of breast self examination practice, the consistency of results is impressive. Nevertheless, this consistency may be misleading if the association between breast self examination practice and a favourable prognosis in cases of breast cancer could be explained by systematic bias in reporting and recording breast self examination.

Howe and Hoff, though noting the possibility of reporting bias (the tendency of patients with breast cancer to "overreport" past breast self examination as compared with controls), found little evidence of this in patients with the disease.²⁸ Though Smith and Burns found more patients with breast cancer reporting breast self examination than age matched controls,³ three other studies found patients with cancer reporting no more breast self examination than expected in patients without the disease.^{3,5,12} In any case, reporting bias in patients with cancer would be a confounder in this analysis only if it was negatively associated with the stage of disease. If we assume that reporting bias exists in respect of breast self examination the alternative explanation of the results presented above requires us to reason that patients with early stage disease will exaggerate their prior practices as compared with patients with more advanced disease.

Such a line of reasoning can be sustained by invoking attribution processes,²⁹ but this is to draw a fairly long bow. According to attribution theory we might argue that in "successful" early cases patients are biased towards attributing their good prognosis to their own precautionary behaviour (doing breast self examination), whereas in "unsuccessful" late cases patients might tend to deny the failure of their precautions, attributing their poor prognosis to other factors beyond their control. This attribution explanation, however, requires that the patient knows her prognosis based on the state of her nodes, which seems improbable in general. Firstly, in six of the studies data on breast self examination were collected before dissection of axillary nodes.^{1,3,4,6,8,11} Secondly, it seems unlikely that patients would necessarily be well informed about their node state and its relevance, even after the investigations had been carried out.

We conclude that the evidence for breast self examination as a worthwhile precaution which increases the probability of detecting breast cancer at an early stage is both more consistent and more favourable than is commonly accepted. But can the degree of protection afforded by breast self examination be estimated by such studies as those reviewed here? We could have estimated the protective effect of breast self examination only on the basis of the breast self examination practices of the population from which the cases were drawn, and this information was not available. It cannot be inferred from our results that because the combined odds ratio is 0.66 women who palpate their breasts regularly have 34% less chance of having disease positive nodes should they develop breast cancer than women who do not perform the examination. We emphasise that the degree of "protection" afforded by breast self examination is somewhat less than this proportion. It has been shown that the unequal lead times found in patients with cancer between those who practise and do not practise breast self examination may give rise to biased estimates of the true ratio in the general population.³⁰ Despite this the statistical significance of the combined odds ratio that we have presented is still valid.

The studies reviewed above all suffer from problems in measurement of the independent variable, breast

self examination practice. Observation of breast self examination in studies such as these is practicable only through retrospective self report. Further, length bias may have contributed to the association recorded between breast self examination and local advancement of the disease, and so extrapolations concerning the long term benefits of breast self examination need to be made cautiously. Studies in which deaths from breast cancer were related to breast self examination practice would dispose of length bias as a competing explanation. The results of prospective designs, such as those currently being implemented in the United Kingdom³¹ and the Soviet Union³² are also needed to provide clearer answers about the benefits of breast self examination. In the meantime we contend that the data reviewed above provide good grounds to encourage women to practise breast self examination regularly.

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