Review

# Interventions to increase breast screening uptake: do they make any difference?

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**Abstract**
***Background*—Breast screening has an important role in improving survival from breast cancer through early detection and treatment. Increasing uptake of screening in areas of low uptake is important in improving the effectiveness of the national screening programme. This review looks at which initiatives to boost uptake have been successful.**
***Objective*—To evaluate the effectiveness of the different interventions to increase breast screening uptake.**
***Method*—A systematic review of interventions to promote breast screening uptake was undertaken. Studies were included if uptake was used as an outcome measure of the intervention and if relevant to the UK screening programme.**
***Results*—Twenty eight studies were found among 25 citations. Interventions were grouped into "person directed", "system directed", "social network directed", and "multistrategy" categories. Most were person directed. These interventions were more likely to be effective in boosting uptake, be simple in design, and to have been evaluated by a randomised trial design. Evidence of effectiveness in the other groups is limited both by the number of studies and the study designs. A summary of the interventions reviewed is presented.**
***Conclusions*—Simple, brief, and effective interventions exist to boost breast screening uptake. More complicated approaches are not necessarily any more effective. These findings also have implications for other population based screening programmes of the future. In inner city areas the best approach to raising uptake rates is likely to be multistrategy.**
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Breast cancer remains the leading cause of cancer death for women in the UK, resulting in about 12 000 deaths in women in England and Wales every year.[1] With no clear primary prevention strategies, breast screening by mammography currently offers the best preventive opportunity to cut down the number of deaths from this disease.

It is more than 10 years since the start of the NHS Breast Screening Programme (NHSBSP) as a three yearly screen for women aged 50 to 64.[2] Various interventions to boost uptake and acceptability have been described. It is now timely to review systematically the effectiveness of these interventions.

Despite an overall uptake rate of over 70% nationally, wide regional[3] and inter-practice[4] variations remain. Uptake is an important measure for the programme in two respects. Firstly, for breast screening to be effective in reducing mortality in the target age group, a high proportion of eligible women needs to take part. Secondly, uptake can be used as an indicator of the acceptability of the screening service to women, an important programme quality issue (uptake at subsequent rounds is probably more useful for this than uptake at the first round). Clearly, the acceptability of health services is a wider quality issue than uptake alone, but, as a practical way forward, this review focuses on studies that have used uptake as an outcome.

Although there have been reviews of reasons why women take up an offer of mammography or not,[5] to date no systematic review of the interventions to promote uptake and acceptability has been made.

## Method

A systematic review of interventions to promote breast screening uptake and acceptability was undertaken. Studies were included if uptake was used as a measure of success of the intervention. Box 1 gives the operational definitions for uptake, acceptability, and intervention study.

### DATA CAPTURE

To identify English language studies, the MEDLINE database was searched from 1980 to July 1998 with the search terms given in appendix 1. This was also used as a core search strategy for searching BIDS-EMBASE, PSYCLIT, and Social Sciences Index databases. Relevant citations identified from these articles were retrieved, as were the relevant citations of these articles.

A letter was also sent to all English breast screening units in July 1996 and to the Public

**Box 1 Operational definitions used in the data collection**

*Uptake*—The proportion of women invited for mammography who actually attend. (Applies to the UK programme where women are invited. In Australia and the USA where women may not be automatically invited, it is noted that the proportions for attendance have different denominators.)
*Acceptability*—The degree to which a service is sufficiently tolerable to the women, and thus reflected in the uptake of the service. Further, it encompasses quality issues pertaining to user perception of the technical process of mammography and of the mammography service.
*Intervention study*—A study that examines the effect of an intervention on breast screening uptake rates or acceptability, using "uptake" as a measure of success. A variety of study designs is included.

*Table 1 Relevance criteria for intervention studies*

| *Group* | *Relevance* | *Study* |
|---|---|---|
| 1 | Direct | UK based |
| 2 | Indirect | Non-UK based, but findings are generalisable to an extent because of the nature of the research question or study design—for example free mammography, population based study and invited from the community |
| 3 | Not relevant | Non-UK based. The setting, design, or findings are not applicable to the UK, or it is unclear whether applicable to the UK— For example, looking at organisational elements that do not exist in the UK |

Health Mailbase (an electronic discussion forum) to identify any further unpublished screening intervention studies.

No limitations on study design were imposed as the amount of research studies in this area was expected to be small.

RELEVANCE CRITERIA
Studies were then further subjected to "relevance criteria" (table 1). Only those in groups 1 or 2 were considered suitable for the systematic review.

EXTRACTING DATA AND CATEGORISING
Data were extracted onto structured abstract sheets after applying a checklist of criteria (box 2). Adapted guidelines from the York Centre for Reviews and Dissemination[6] were used.

For descriptive purposes the studies were categorised into four groups (table 2). These were person directed, system directed, social network directed, and multistrategy interventions. This was not intended to be prescriptive and it was noted that some interventions fell into more than one group.

GRADING THE STUDIES
The reliability of each study was graded according to the quality of the study design (table 3). The principles of the method have been widely used by the US and Canadian Preventive Task Forces and by the NHS Centre for Reviews and Dissemination.[6–8]

Studies that had looked at similar interventions were then grouped together, and an indicator about the direction of the evidence for that particular intervention was given (box 3). Where studies of the same intervention showed effects in opposing directions, it was concluded that the direction given by the study of highest quality grading, was the truer effect.

## Results

Twenty eight intervention studies were found among 25 citations. Fifteen studies had been evaluated by randomised controlled trials

**Box 2 Criteria for assessment of intervention studies**

Is the *source* of the study clear?
Were the study *objectives* clearly defined?
Is the *population* studied clearly stated?
What is the sampling frame and are *inclusion* and *exclusion* criteria clear?
What is the *study design*?
What are the *interventions* under study?
What is the percentage of participation in the study?
*How many* in the study and in each of the study groups?
If a randomised controlled trial (RCT), how are subjects randomly allocated to groups?
  Are baseline differences in groups discussed?
  Was the control group a *"true" control*?
  Were $\alpha$ and $\beta$ errors considered (if applicable)?
If not RCT, is there a reference group for comparison?
Are *outcome* measures clearly defined?
Are appropriate statistical analyses carried out?
What are the *key results*?
What is the proportion of dropouts and how are they treated in the analysis?
Are confounders discussed?
Is there a clear *statement of the conclusion* relating to the study objectives?
Did authors comment on the clinical significance of the conclusions?
How far are the results generalisable?

*Table 2 Categories of interventions*

| *Intervention type* | *Intervention details* |
|---|---|
| Person directed | Directly aimed at the eligible women. Invitation procedures and reminders are included here. Similarly, interventions aimed at health professionals are included |
| System directed | Aimed at organisational aspects of service delivery. For example, Prior Notification Lists (PNLs) and access issues (distance, transport) |
| Social network directed | Aimed at the social network in which people live |
| Multistrategy | Combinations of the above, where the combined effect is assessed |

*Table 3 Quality of the evidence*

| *Category* | *Quality* |
|---|---|
| I | Well designed randomised trial |
| II | Randomised trial where sample size or power is unclear or insufficient |
| III | Descriptive studies with comparison group — for example between time or places, with or without intervention |
| IV | Descriptive studies with no comparison, opinions of respected authorities based on clinical experience, or reports of expert committees |

Box 3 **Indication of direction of effect**

↑Suggestive that the intervention increases the desired effect.
→Suggestive that the intervention does not increase or decrease the desired effect.
↓Suggestive that the intervention decreases the desired effect.
—Unclear whether there is an effect or size of effect. This may be owing to paucity of data, conflicting data, no non-intervention group (historical or current) against which findings can be assessed, lack of study power to detect effect, etc.

(RCTs) and 13 were descriptive studies, mainly observational before and after accounts.

Twenty one of the interventions were published, five were from grey literature, and two were from unpublished studies.

Most of the interventions were person directed (20 studies). Two were system directed, five social network directed, and one a multistrategy intervention study. Appendix 2 summarises the individual intervention studies.

PERSON DIRECTED INTERVENTIONS

Of the 20 studies in this group, 14 were randomised trials and 6 were descriptive studies. These person directed interventions evaluated methods of encouraging invited women and non-responders of invitations (non-attenders) to attend. No interventions were specifically aimed at increasing reattendance (previously screened women attending at a subsequent round).

*Encouraging invited women to take up the offer*

Appointments on the invitation letter increased uptake compared with open ended invitations. A randomised trial by Williams *et al* showed 86% attendance with fixed appointments compared with 76% with an open ended invitation ($p<0.01$).[9] This finding is supported by a descriptive study, which showed uptake rates of 40% and 27% respectively (total n=1434).[10]

From current evidence, endorsement of the invitation by a general practitioner (GP) does not boost uptake in this group. Two randomised trials looked at sending a general practitioner (GP) signed letter with the screening invitation, either as an accompaniment to the invitation or as the actual invitation.[11 12] Neither study found any advantage compared with the standard invitation from the screening programme. The study of O'Connor *et al* was based at a single inner city practice and the effects of material deprivation cannot be disentangled.[11] On the other hand, the study of Taplin *et al* (USA) comprised subjects who had above national average incomes and educational levels.[12] One descriptive study did show increased attendance, from 16% to 75%, using a GP letter as an invitation.[13] However, this study compared two time periods before the call-recall system existed and it did not distinguish between the effect of receiving an invitation versus no invitation, or a possible GP endorsement effect. It is likely that the invitation itself was the main uptake boosting factor in this study, in view of the later findings from O'Connor *et al* and Taplin *et al*.

One RCT looked at GP interventions in the consultation.[14] Extensive health education by the GP was no more effective than a simple verbal recommendation in increasing uptake. Unfortunately, there was no non-intervention group in this study.

One RCT showed that linkworkers' visits to Asian women in an inner city area several weeks before the screening appointment made no difference to the subsequent uptake.[15]

One RCT was designed to test if cervical screening uptake could be boosted by using the breast screening invitation system. However, the design simultaneously evaluated whether the offer of cervical screening boosts the uptake of breast screening. There was no statistically significant difference on breast screening rates by offering a smear with the invitation.[16]

*Encouraging non-attenders to attend*

In total, six RCTs and one descriptive study evaluated reminder letters to non-attenders. Such letters increased uptake in various settings and the findings were consistent (Mackenzie A, Morkane T, Somerset Health Commission, unpublished data).[17–22] Two RCTs showed an increase in attendance with reminder letters compared with no reminders.[18] King *et al* showed a difference in uptake of 42% compared with 28% ($p<0.001$),[18] and MacKenzie and Morkane (unpublished data) showed 21% compared with 5% ($p<0.001$). Lawler's descriptive study supports these findings (30% attended after reminder letters).[21] One RCT in which a prompt reminder appointment (within two days of missed appointment) was sent did not make any difference compared with a reminder sent later.[22] This study did not say whether there was any difference in the actual date of the rescheduled appointments so it is not clear whether it was the date of the next appointment that was being evaluated or whether it was the prompt sending of the reminder.

Variations in the contents of the letter also encouraged attendance. Two RCTs showed an increase in attendance of non-attenders when reminder letters with fixed appointments were used, rather than open appointments (22.8% compared with 12.3%, p<0.001)[17] or rather than no letter at all (33% compared with 9%, p<0.001).[19] Furthermore, one RCT showed that a reminder letter with GP endorsement (a photocopied letter signed by all GPs in the practice) increases response in non-attenders (21% compared with 10%, p<0.01).[20] This contrasts with the lack of effect of this intervention at the initial invitation stage.

One small descriptive report (about 250 "eligible" women), based in a single general practice, described how flagging patient records for opportunistic health education and general staff awareness led to an increase in attendance.[23]

The role for reminders by telephone seems to be limited. When assessed against a GP endorsed reminder letter there was no advantage gained by the telephone approach (25% subsequent attendance for letter compared with 17% for phone, NS) (Mackenzie A, Morkane T, unpublished data). Furthermore, sending a letter is more cost effective because of difficulties in contacting women by telephone. However, for women who were still non-attenders, King *et al* found that telephone counselling worked better than a second reminder letter (29% compared with 12%, p<0.001).[18]

One RCT found a modest improvement in attendance when appropriately trained receptionist staff contacted non-attenders by phone or letter (9% compared with 4%, p=0.04).[24] The study was conducted in an inner city setting and the greatest improvement in attendance was for Indian women.

Reminder contacts by other healthcare staff have been assessed. An RCT by Sharp *et al* found that a nurse visit, with or without extensive health education, was no better than a personalised GP letter at encouraging attendance, and used more resources.[25] One descriptive study found that 33% of non-attenders attended after a health visitor visit, but there was no non-intervention group to assess the added value of the visit.[26]

#### SYSTEM DIRECTED INTERVENTIONS

No strong evidence exists in this category, partly owing to the small volume of intervention studies in this category with uptake as an outcome measure, and partly owing to the study designs used to evaluate the interventions. Of the two intervention studies in this category, both were descriptive.

One small before and after study suggests that bus transport for Asian women (Kelly K, unpublished data) from the health centre to the screening centre could increase uptake (46% before intervention compared with 73% after intervention). However, this was an uncontrolled study and the absolute numbers were not stated.

Another descriptive study used a flowchart of checks to find correct addresses for post office returns.[22] The numbers in the study were small—three out of 16 further attendances resulted.

#### SOCIAL NETWORK DIRECTED INTERVENTIONS

Five interventions, comprising one RCT and four descriptive studies, were directed at the social network in which people lived. None of the studies showed any increase in uptake in the intervention group.

Non-discriminant leaflet drops were evaluated by one RCT[27] and one descriptive study.[13] Neither led to an increase in subsequent attendance when distance and car ownership were taken into account.

Three descriptive studies examined the effect of friendship and social networks in the community. None of these showed an increase in screening uptake. One looked at making health information available at hairdressing salons. Despite the stylists' perceptions that customer awareness about breast screening had increased over time, the overall screening population uptake did not increase.[28] Written information given to women after screening to encourage friends to attend[22] and the distribution of appointment letters to women after screening to pass on to friends[27] have also shown no subsequent increase in attendance.

#### MULTISTRATEGY INTERVENTIONS

There was only one intervention in this category. Majeed *et al* studied clerical help to check addresses of non-attenders and a reminder letter in 93 inner city practices.[29] Subsequent uptake was 58.5% compared with 53.8% before the study. The findings are circumstantial and any real increase probably has a limited role in inner city practices and needs to be supplemented by other measures.

## Discussion

The systematic review approach, more classically used for interventions in the clinical setting, has been applied to the review of non-clinical, population wide interventions. A grading system adapted from widely accepted systems of evidence hierarchies[6–8] was used to take into account the variety of study designs.

#### METHODS AND FINDINGS

Although the number of studies looking at any specific intervention is small, a wide range of initiatives have been explored. Over half of the studies used an RCT design. Most of these were person directed interventions, with few RCTs in the other intervention categories. Nevertheless, it is encouraging that RCTs as an evaluation method for non-clinical interventions are being more widely applied.

Currently, the evidence shows that effectiveness in boosting uptake is greatest for the simple to administer interventions, rather than in depth ones. These tend to be of the "person directed" category—for example, methods of invitation and reinvitation of non-attenders. Indeed most interventions were of the "person directed" category (20/28).This may be, partly, because these interventions are easier to carry out and evaluate than those of the other categories.

It was disappointing that none of the social network directed interventions showed any increased uptake. This is not to say that such interventions do not contribute to the screening effort. It was not within the scope of this review to assess directly more subtle effects, such as the level of health knowledge and motivation, as a result of the interventions. The extent to which these effects contribute to uptake in the longer term is difficult to disentangle. Although a belief in the importance of screening and the intention to attend for mammography can be predictors of attendance, a high amount of worry about breast cancer might lead to lower attendance.[30]

There were also few system directed and multistrategy interventions This partly reflects the arbitrary groupings chosen—for example, some of the invitation methods could arguably be "system directed" interventions.

The four categories of intervention (person, system, social network, and multistrategy) were derived from the studies to provide a useful concept for understanding how interventions fit into the current screening system. Rimer has reviewed interventions to promote breast screening with respect to a women's age and ethnicity (this mainly included American studies and was not a systematic review).[31] Interestingly, despite the methodological differences between Rimer's review and ours, similar categories of interventions were derived to describe the interventions. Of further interest is that Rimer found seven multistrategy approach interventions in contrast with the single study found in this systematic review. In part, this is due to the different definitions used for categorising the studies. For example, our person directed interventions included those directed at healthcare professionals as well as eligible women, whereas Rimer would have classed this as two categories. Also some of the American studies in Rimer's review did not match the "relevance criteria" set in this review—these were used to ensure findings reflected UK practice.

No studies were targeted specifically at increasing reattendance rates. Within the NHSBSP the women most likely to accept a routine screening invitation are those who have attended previously.[3] It is perhaps not surprising that interventions boosting uptake have tended to focus on other subgroups of eligible women. However, four studies in this review did analyse their results according to previous screening behaviour. These confirmed that when the intervention was effective—for example, fixed appointments (to all eligible women[9] or to non-attenders[17]) and GP endorsed reminder letters,[20] it was more effective in women who had been screened before. Conversely, with one RCT where the intervention was not effective, this applied whether or not woman had been screened before.[11]

This review focused on breast screening studies only and did not include studies boosting uptake for cervical screening (the only other major UK population screening programme). Two key organisational differences in the delivery of cervical screening compared with breast screening need consideration before directly relating results from cervical screening to breast screening. Firstly, cervical screening is often carried out in general practice and, secondly, GPs receive target payments for their contribution to cervical screening targets. Nevertheless, with a higher uptake of 85% in cervical screening,[32] it might be argued that these organisational differences do make a difference.

### GENERAL PRACTICE SETTING

Two settings, general practice and the inner city population, deserve extra mention. The former because it plays a crucial part in breast screening organisation, and the latter because of the variations in health and health care associated.

Nine studies were based in general practice. There are specific measures that GPs can consider to optimise their practice uptake. Ensuring completeness and accuracy of the prior notification list is an essential first step, though this can be a significant challenge in highly mobile populations. Simple but clear advice to the woman as she attends the surgery for another matter (opportunistic advice approach) backed up by consistent messages from the rest of the healthcare team has been described and is intuitively appealing. Further, one RCT showed that a simple verbal recommendation at general practice level can be effective and there is little extra gained from more intensive health education from the GP.[14] Similarly, in depth interventions, such as home visits by other healthcare professionals, do not seem to be any more effective than a simple reminder letter. Another simple but effective general practice contribution to consider is the routine inclusion of a GP signed letter with the reminder letters to non-attenders (a photocopied letter with all the practice GP names on it will suffice).

We note that no studies looked at the impact on uptake of GP payments for reaching screening targets. Indeed, it would be very difficult (though not impossible) to design an RCT to evaluate this intervention. There is some indirect evidence from cervical screening and child immunisation programmes to suggest that such payments might boost uptake, but the centralised delivery of mammography screening makes the comparison difficult. Further evaluation of this aspect would be useful, particularly its impact in inner city areas.

### INNER CITY SETTINGS

It is well accepted that many factors contribute to the lower uptake in inner city populations than in the surrounding areas. Five studies were based on inner city populations (Kelly K, unpublished data),[4 11 15 24] and the increase in uptake was modest, if any. Two descriptive studies showed an increased response from non-attenders by using simple administrative procedures. However, more involved interventions using linkworkers for Asian women or

*Table 4 Summary of interventions to increase breast screening uptake with guides for the quality of the evidence and for the direction of effect*

| *Intervention* | *Quality of evidence and direction of effect** |
|---|---|
| Encouraging women to take up the offer: | |
| Fixed appointments on invitation letter[9] | ↑ I<br>(86% *v* 76%, p=0.01, CI 2.9 to 18.4) |
| Simple verbal recommendation by GP, or more intensive health education by general practitioner[14] | —I<br>(82% *v* 91%, NS, CI −18.9 to 0.8)<br>(Not clear whether these two interventions are better than no intervention at all, though they were about as effective as each other.) |
| GP endorsement of the invitation[11, 12] | → I<br>(57% *v* 51%, NS, CI −3.5 to 14.5)<br>(46% *v* 47%, NS, CI −8.8 to 6.4) |
| Offering cervical screening with invitation[16] | → I<br>(52% *v* 55%, NS, CI −6.8 to 2.1) |
| Linkworker visits to Asian women before the invitation[15] | → II<br>(49% *v* 47%, NS, CI −6.0 to 11.6) |
| Encouraging non-attenders to attend: | |
| Reminder letter (Mackenzie A, Morkane T, unpublished data)[18] | ↑ I<br>(21% *v* 5%, p <0.001, CI 11.7 to 21.4)<br>(42% *v* 28%, p <0.001, CI 7.5 to 21.0) |
| Reminder letter with fixed appointment[17] | ↑ I<br>(23% *v* 12%, p <0.001, CI 7.3 to 13.7) |
| Reminder letter with GP endorsement (GP signed letter)[20] | ↑ I<br>(21% *v* 10%, p <0.01, CI 5.0 to 17.9) |
| Reminder by telephone with appointment (Mackenzie A, Morkane unpublished data) | ↑ I<br>(17% *v* 5%, p <0.001, CI 7.2 to 16.2) |
| Receptionist contact by phone or letter[24] | ↑ I<br>(9% *v* 4%, p <0.05, CI 3.2 to 7.4) |
| Nurse visit, with or without health education[25] | – I<br>(11% *v* 8%, NS, CI −1.0 to 8.2) |
| Sending a prompt reminder (within two days of missed appointment instead of within three weeks)[22] | → II<br>(37% *v* 35%, NS, CI −11.2 to 12.8) |
| Flagging notes for opportunistic health education[23] | ↑ IV |
| Health visitor visit[26] | ↑ IV |
| System directed interventions: | |
| Bus transport for Asian women from health centre to screening centre (Kelly K, unpublished data) | ↑ IV |
| Checking post office returned invitations with a flowchart of checks[22] | ↑ IV |
| Social network directed interventions: | |
| Non-discriminant leaflet drops in the community[27] | → II<br>(RR 1.15, NS, CI 0.6 to 2.2) (Number of eligible women is unknown, before and after intervention attendance compared. |
| Health information from hair stylists at hair salons[28] | → III |
| Appointment letters given to women after screening to pass onto friends[27] | → III |
| Written information given after screening to encourage attenders' friends to attend[22] | → IV |
| Multistrategy: | |
| Clerical checking of non-attenders' addresses and reminder letter[29] | ↑ III |

*Size of effect compared with control, 95% confidence interval for the difference and p-values are shown for RCTs where data are available.

provision of transport to the screening centre did not improve uptake. Inner city populations are not homogeneous and the reasons for a low uptake in a particular practice or screening unit are multiple. Multistrategy interventions are probably needed to reverse the effect and single brief interventions alone are unlikely to be sufficient. Efforts to ensure the prior notification list is as valid as possible may have more impact than directly encouraging women to attend.[33] Social network and person directed interventions could also be considered alongside system directed interventions.

FINANCIAL COST

Only three studies estimated the financial cost of the intervention as part of their study.[20 29] These all concerned reminder letters and estimated different aspects of cost incurred. Turner *et al* found that the cost of sending an accompanying GP letter with the existing reminder letter was 1.1p per letter and estimated the marginal cost for each additional attender as 9.6p.[20] This cost increases, of course, if the clerical work required is not easily absorbed into the existing administrative workload. Mackenzie *et al* (unpublished data) estimated that the marginal cost of sending a GP signed reminder was £1.11, including clerical time. Only one study estimated the cost associated with carrying out the mammography on the additional attenders.[29] This estimated the marginal cost for each woman screened as £7 compared with the average cost for each woman screened of £27.

IMPLICATIONS FOR FUTURE SCREENING PROGRAMMES

The approaches used to boost mammography uptake are likely to contain generic lessons for other call-recall, general practice population based screening programmes of the future. For

example, it is plausible that GP endorsement of the invitation, appointment times, and reminder letters improves the acceptance of screening. Future screening programmes could consider incorporating these basic measures from the start.

RECOMMENDATIONS FOR PRACTICE

Probably, some of the interventions have already been adopted as standard procedure by screening services in the UK—for example, invitations with fixed appointments. However, we are not aware of any up to date information to quantify this further. We note that a telephone survey of all NHSBSP screening units, reported in 1997, found that 16% did not offer reminder letters, 49% sent open reminders, and 36% sent a timed appointment with the reminder.[34]

Where the brief and effective interventions are not in place, commissioners and managers of screening services should consider making use of them locally. This review has shown that most interventions are brief and can be applied to the screening population. In practice, the added resources needed are unlikely to be high. Table 4 gives a checklist of interventions that can be used as a guide or checklist of current practice to tailor to local circumstances.

RECOMMENDATIONS FOR RESEARCH

Research on breast screening uptake has clearly moved on from the problem definition stage to the next phase of assessing the value of interventions. If such work is to continue to improve effectiveness and quality of services, some research challenges still need to be met.

Firstly, close attention should be paid to study design in future studies to ensure the highest validity of results from population based research opportunities. In addition, the inclusion of estimated costs of studied intervention would be of great value for those in the field to assess the local cost impact. Secondly, little has been written about effective multistrategy interventions in inner cities to address the inequalities of breast screening uptake. In particular, the possible impact on uptake of using GP target payments as part of a multistrategy or as a single strategy in inner city settings has yet to be evaluated.

Finally, researchers should consider how further measures of breast screening acceptability can be developed and used alongside uptake to monitor the quality of screening.

## Conclusions

Simple, brief, effective interventions exist to boost breast screening uptake. More complicated single interventions are not necessarily any more effective. The effective approaches have implications for other call-recall, population based screening programmes of the future.

Single interventions alone are unlikely to be the best approach to raising uptake rates in inner city areas, where a combination of interventions to suit the local situation is probably needed.

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## Appendix 1: Search descriptors for MEDLINE

*Table A1 Search descriptors for MEDLINE. Right hand column terms were coupled with terms in the left hand column in the search. Words in Italics are thesaurus terms.*

| *English language articles:* | |
|---|---|
| Breast screening | Uptake |
| Mammography | Utilisation |
| | Compliance |
| | Attendance |
| | *Patient acceptability of health care* |
| | *Health service acceptability* |
| | Interventions |
| | Strategy |
| | *Breast neoplasms prevention and control* |
| | Invitations |
| | Open access |
| | Mobile, fixed, location |
| | Registers |
| | Addresses |
| | General practitioner, primary care |
| | Public health, health education |

## Appendix 2: Intervention studies to promote breast screening uptake and acceptability

*Table A2 Intervention studies to promote breast screening uptake and acceptability*

| *Author, year, place* | *Population and setting* | *Study design* | *Interventions (I) (and controls (C) if applicable)* | *Outcome measures and key results.* | *Study conclusions* | *Comments* | *Evidence quality. (see key)* |
|---|---|---|---|---|---|---|---|
| Person directed interventions | | | | | | | |
| Atri *et al* (1997),[24] UK, London | 50 to 64 year old women who had not responded to 2 screening invitations.<br>26 inner city practices | RCT<br>Randomisation by GP practice.<br>Power calculation stated. | I: Receptionists contacted non-attenders by phone or letter after getting 2 hours training. (n=995)<br>C: receptionists received no training or advice (n=1069) | Attendance rates for screening<br>I: 9%<br>C:4% (p=0.04) | Intervention improved attendance modestly | 26/37 eligible practices participated and in only 646/995 of intervention group was contact attempted<br>Improvement in attendance was greatest in Indian women | I |
| Clover *et al* (1992),[14] Australia | 40 to 69 year old women patients of 13 GPs<br>No fee for mammography, though no formal call system at the time of this study | RCT<br>Randomisation: by randomised sets of questionnaires<br>Intervention carried out at end of normal consultation<br>Power calculation not stated | I: Intensive patient education approach by GP (based on health belief principles) (n=83)<br>*v*<br>I: Simple verbal recommendation by GP to have mammogram (n=92) | Attendance rates from screening service attendance records<br>No significant difference in attendance between the two groups; Patient education attendance 91% and simple recommendation 82% (p= 0.13)<br>Dropouts: 1% each group | Promoting mammography in general practice can be as effective as more extensive patient education | No control group set up with no intervention, so cannot say whether GP recommendation was any more effective than no intervention<br>Only 13/20 (65%) of GPs agreed to participate in the study<br>Dropouts not included in any of the analyses | I |
| Haiart *et al* (1990),[13] UK, Edinburgh | 50 to 64 year old women who had not attended previously<br>One group practice | Descriptive, prospective study<br>Mobile van visited a health centre four months after the *initial* visit. Personal invitations from their GPs were sent to previously non-attending women. | I: Personal invitation from GP (n=189) | Attendance rates, acceptability questionnaire or interview<br>1st visit — no intervention, 16% attended, (n=233) 2nd visit — after intervention, 75% attended (n=189) | Personal invitations produced a response rate of 75% among women who had previously failed to attend | One of two intervention studies described in the article<br>GP effect and invitation effect difficult to separate. Also, study compares two time periods before the call-recall programme | III |
| Hoare *et al* (1994),[15] UK, Oldham | 50 to 64 year old Pakistani and Bangladeshi women from GP lists<br>General practices with high proportion of Asian patients | RCT Method of randomisation: not stated<br>Power calculation not stated | I: Trained linkworkers interviewed women (by semi-structured questionnaire) a few weeks before screening appointment. Health education and encouragement given (n=247)<br>C: No visits (n=251)<br>No differences detected between the groups at baseline | Subsequent attendance from screening office computer<br>I: 49% attended<br>C: 47% attended<br>(p)=0.53<br>Dropouts:<br>I: 41% did not receive the intervention. Included in the analysis | This type of intervention was not a successful strategy for promoting uptake by Asian women | A spin-off finding highlighted the wrong address problem. This was 15% in intervention group cf Royal Mail returns of 3% | Ii |
| Hurley *et al* (1994)[10] Australia | 50 to 69 year old women.<br>Community | Descriptive prospective study (There is a public campaign starting six months before the person directed interventions)<br>Method of allocation to groups not stated | After a public campaign, non-attenders are either sent: Invitation with an appointment (n=424) or an invitation without an appointment (n=(1010)<br>Comparison of groups at baseline not stated | Response to invitation with appointment time much higher than without appointment time (40% *v* 27%)<br>Separate analysis of the public campaign detected no effect | Receipt of invitation letter is an important predictor | Mammography is free though there is no formal call system. Relevance to the UK experience is in the difference between the two groups | III |
| King *et al* (1994),[18] USA | Women belonging to a Health Maintenance Organisation (HMO) who had not used their annual free mammogram referral | 2 concurrent RCTs<br>Methods of randomisation for trials(1) and (2) not stated<br>Power calculations not stated | (1) Reminder letter (n=763) *v* no letter (n=761)<br>(2) Reminder letter (n=198) *v* reminder phone call n=172 *v* preventive visit letter (n=198)<br>No differences detected between study groups at baseline | Subsequent attendance for mammograms.<br>(1) 42% of reminder group and 28% of non-reminder group attended (P<0.001)<br>(2) Phone counselling 29%, (p<0.001) compared with the other two interventions (further reminder letter 12%; preventive visit letter 14%) | Reminder letter resulted in significant improvement in mammography. For women still not adherent, phone counselling compared with letters was more effective | Annual mammograms, though the principles behind the different interventions can apply to UK | I for both trials. |

*Table A2 Continued*

| *Author, year, place* | *Population and setting* | *Study design* | *Interventions (I) (and controls (C) if applicable)* | *Outcome measures and key results.* | *Study conclusions* | *Comments* | *Evidence quality. (see key)* |
|---|---|---|---|---|---|---|---|
| Lancaster *et al* (1992),[16]<br>UK, Manchester | 50 to 64 year old women<br>Screening unit | RCT<br>Method of randomisation: not stated<br>Power calculation not stated | I: Breast screening invitation + cervical screening invitation (n=965)<br>C: Standard breast screening invitation (then offered a cervical smear on arrival) (n=947)<br>Comparison of groups at baseline not stated | Attendance for breast screening<br>I: 52%, C: 55%<br>No statistically significant difference | Offer of cervical screening did not increase or decrease breast screening uptake | This study was designed to see if breast screening would give a good opportunity to promote cervical smears. The design however, is also an assessment of an intervention on the uptake of breast screening | I |
| Lauder (1995)[26]<br>UK, Hertfordshire | 50 to 64 year old women<br>One general practice | Descriptive, prospective study | I: Health visitor contact opportunistically, preceded by introductory letter (n=32) | Subsequent attendance in this group (33% attended) | Health visitor intervention increased uptake | No control or pre-study group for comparison | IV |
| *Lawler et al (1995)*,[21]<br>UK, Guildford | 50 to 64 year old women<br>Screening unit | Descriptive, prospective study | I: Reminder letter to encourage further appointment to be made (n=214)<br>Questionnaire enclosed for those who did not wish to attend | Appointment history checked at 8 weeks after posting date<br>30% attended. (68 (32%) made further appointments of which 4 failed to attend) | Letter seems to increase uptake | No control or pre-study group for comparison | IV |
| *MacKenzie et al (1995)*,*<br>UK, Somerset | 50 to 65 year old non-attenders<br>Screening unit | RCT<br>Randomisation by date of birth into 3 groups, those born between day 1-10, 11-20, and 21-31<br>Power calculation stated | Group A: Second invitation by GP signed letter (n=350)<br>Group B: Second invitation by telephone. (n=350)<br>Group C: Control group, no intervention. (n=350)<br>Comparison of groups at baseline not stated | Number of women attending for screening having missed first appointment.<br>Group A: 21%<br>Group B: 17%<br>Control: 5%<br>Significant difference in both intervention groups compared with control, (p<0.001), No statistically significant difference between the two intervention groups | Use of second invitation by letter or phone to non-attenders significantly increased the attendance rate for breast screening. Difficulty in contacting a third of women by phone, letter method appears more simple and cost effective | 38% group B could not be contacted, treated in analysis as though contacted<br>Also calculates cost of letter (£1.11) and av. cost of phone contact (1.46) | I |
| O'Connor *et al* (1998),[11]<br>UK, London | 50 to 64 year old women<br>Inner city group practice | RCT<br>Randomised by computer program and stratified by breast and cervical screening attendance and ethnicity<br>Power calculation stated | I: GP signed letter with invitation (n=236)<br>C: Standard invitation only (n= 234) | Attendance for screening after randomisation<br>I: 57%<br>C: 51%<br>Difference not statistically significant, p=0.23 | Personal recommendation by GP best known to woman did not increase uptake<br>Other strategies needed in inner city areas | 100% follow up achieved | I |
| Stead *et al* (1998),[17]<br>UK, West Midlands | 50 to 64 year old women<br>Screening unit | RCT<br>Randomised by odd and even screening numbers<br>Power calculation not stated | I: Fixed appointment letter (n=1001)<br>C: Open appointment (n=1228) | Subsequent attendance in these groups<br>I: 22.8%<br>C::12.3%<br>(p <0.001) | Fixed appointments are more effective | | I |
| Stephenson (1995),[23]<br>UK, Sheffield | 50 to 64 year old women non-attenders<br>One group practice | Descriptive account about intervention used to promote attendance in initial non-responders | Flagging notes for opportunistic health education and counselling<br>(There are also periodic poster campaigns at the surgery) | "About a third" of women not initially attending were encouraged to attend | Not stated | This is letter correspondence to a journal. A useful descriptive report which reflects initiatives based in GP practices . | IV |

*Table A2 Continued*

| *Author, year, place* | *Population and setting* | *Study design* | *Interventions (I) (and controls (C) if applicable)* | *Outcome measures and key results.* | *Study conclusions* | *Comments* | *Evidence quality. (see key)* |
|---|---|---|---|---|---|---|---|
| Taplin *et al* (1994),[12] USA | 50 to 70 year old women belonging to a Health Maintenance Organisation<br>Automated system already sent out recommendations for mammography<br>Mammograms were not fee-for-service | RCT<br>Method of randomisation: not stated<br>2×2 factorial design<br>Power calculation not stated | I: Group 1: Sending recommendation letter from primary care physician (rather than programme director), (n=329),<br>I: Group 2: Reminder postcard after 2 months of 1st letter (n=335),<br>I: Group 3: Primary care physician recommendation and reminder postcard (n=334),<br>C: Letter from programme director, no reminder postcard (n=324),<br>No differences detected in the groups at baseline | Subsequent attendance within 1 year<br>Attendance rates: 46%(1),, 59%(2),, 61%(3), and 47%(C),<br>Groups receiving reminder postcards had significantly more use of mammography than controls. p=0.003 (2), and p=0.001 (3),<br>Letter from primary care doctor did not increase participation (p=0.75),<br>Dropouts: 12% (all groups considered together), | Recommendation alone will not be enough to achieve high rates of participation. Automated reminder systems show promise as a technique | Dropouts included in the analysis<br>A health maintenance organisation breast screening programme, and no fee-for-service for mammography | I |
| Turnbull *et al* (1991),[19] Australia | 45 to 69 year old non-attenders from electoral list | RCT<br>Method of randomisation not stated<br>Power calculation not stated | I: Invitation with appointment time specified (n=163),<br>C: No invitation (n=80),<br>Comparison of groups at baseline not stated | Subsequent attendance<br>I: 33% attended<br>C: 9% attended (p<0.001), | Results suggest that a personalised invitation using electoral list to identify eligible women is an effective method for encouraging attendance | The programme depended on a community based campaign to attract the first wave of attenders. | I |
| Turner *et al* (1994),[20] UK, Aberdeen | 50 to 64 year old non-attenders<br>4 general practices | RCT<br>Randomisation by last digit of community health Index number<br>Non-responders to first invitation within a month were randomly assigned to intervention or control group<br>Power calculation stated | I: Standard 2nd invitation letter plus photocopied letter signed by all the GPs in the woman's practice (n=234),<br>C: Standard 2nd invitation letter (n=231),<br>No differences detected between the groups at baseline | gAttendance rate, 1 month after 2nd invitation for screening<br>Attendance on the intervention group was significantly higher at 21% than the control group's 10% (p<0.01), | Inclusion of a GP letter appeared to be effective and feasible in increasing the attendance to the 2nd invitation | | I |
| *Watkin* (1994),[22] UK, Macclesfield | 50 to 64 year old non-attenders<br>Screening unit | RCT<br>Method of randomisation not stated<br>Power calculation not stated | I: Follow up appointments sent within 2 days of missed appointment (n=122),<br>C: Follow up appointments sent within 2 to 3 weeks of missed appointment (n=122),<br>Comparison of the groups at baseline not stated | Subsequent attendance noted<br>I : 37% attended<br>C: 35% attended<br>No significant difference | No difference detected. Researchers intend to repeat the study with larger numbers | Does not say how soon the appointments were made for.<br>This is 1 of several interventions that Watkin describes.<br>Completed studies with assessed results are tabled here | II |
| Williams *et al* (1989),[9] UK, Aylesbury | 45 to 64 year old women<br>2 general practitioner lists | RCT<br>Randomised by alternate appointments allocated to the 2 groups<br>Both groups had reminders at 3 weeks if not already responded<br>Power calculation not stated | Appointment on invitation letter (n=204),<br>Open ended invitation letter (n=204),<br>No differences detected between the groups at baseline | Proportion screened at 1st, 2nd, and other contacts<br>Total response in appointment group 86%<br>Total response in open invitation group 76%, p=0.01 | Higher compliance is achievable with pre-allocated appointments compared with open ended invitations | | I |
| System directed interventions | | | | | | | |
| *Kelly (1993),** UK, Berkshire | 50 to 64 year old Asian women from one low uptake general practice | Descriptive, prospective study | I: Bus transport arranged from health centre to and from the screening centre. Interpreter greeted women on arrival | Attendance rate of the practice<br>Before intervention 46%<br>After intervention 73% | Over 70% uptake achieved | Total number of women eligible for the intervention was not stated | IV |

*Table A2 Continued*

| *Author, year, place* | *Population and setting* | *Study design* | *Interventions (I) (and controls (C) if applicable)* | *Outcome measures and key results.* | *Study conclusions* | *Comments* | *Evidence quality. (see key)* |
|---|---|---|---|---|---|---|---|
| *Watkin* (1994),[22] UK, Macclesfield | 50 to 64 year old women<br>Screening unit | Descriptive, prospective study | I: Efforts made to ascertain correct address using a flowchart of checks involving primary care and family health services authority | Further attendances<br>Post office returns = 16 Addresses not found for 10. 6 appointments sent, 3 attended | None specifically stated. Makes recommendations about ensuring accuracy of addresses | Small numbers involved | IV |
| Social network directed interventions | | | | | | | |
| *Diggle (1996)*,[28] UK, St Helen's, Merseyside | Customers of 31 hair stylists at 11 hair salons. Intervention targeted at women over 50 years. Not stated how it was known that women were over 50 | Descriptive, prospective study | I: Health information made available at hairdressers via posters, leaflets, and further information from stylists | Hairdressers spoke to over 16000 women in 14 weeks All stylists felt increased awareness of breast screening among clients and themselves<br>Local screening uptake remained about the same level as before the intervention, at 59% (local screening unit), | Uptake unaffected, but the project created more positive attitudes towards screening | | III |
| Haiart *et al* (1990),[13] UK, Edinburgh | Leaflet drop in 3 postcode districts.<br>Estimated 1358 women aged 40 to 64 within these postcodes<br>Community | Descriptive, prospective study. With comparison group | I: Leaflet drop (n=1358),<br>C: No leaflet (n=807),<br>Comparison of groups at baseline not stated | Attendance rates<br>I: 43%<br>C: 35%<br>Leaflets had no significant additive effect to response when distance from the mobile van and car ownership taken into account | Leaflet drops did not increase attendance when other variables taken into account | This is one of two intervention studies as part of an evaluation of a mobile screening service | III |
| Turnbull *et al* (1992),[27] Australia | 69 consecutive attendees at a mobile screening van<br>Screening unit | Descriptive prospective studies | I (1),: Women asked to take invitations for 2 friends, (letter, pamphlet, appointment included),<br>I (2),: Same as I (1), but with a lottery scratch card as an incentive for each successfully recruited friend | I (1),: 106 invitations taken, resulting in 8 attendances<br>I (2),: 30 invitations taken resulting in 2 attendances | These attempts to make formal use of these networks at an individual level were unsuccessful | Unclear how many leaflets were given out<br>Small number in the sample<br>No pre-study comparison group<br>This is 1 of 2 intervention studies described in the same paper | III |
| Turnbull *et al* (1992),[27] Australia | 4 geographical areas near a mobile screening unit<br>Community | RCTs (4 — one in each area),<br>Method of randomisation not stated<br>Power calculation not stated | At each location, streets were randomised to:<br>I: receive pamphlets or<br>C: no pamphlets<br>Comparison of I and C groups at baseline not stated | Subsequent attendance<br>Overall estimated increase in attendance due to letterbox drops was 15% (not statistically significant),<br>(RR = 1.15, 95% CI 0.61 to 2.19), | The intervention had no major effect in increasing screening | The number of eligible women in each street was not known, so attendance from these streets before the study was used as a comparison<br>(This is 1 of 2 interventions described in the same paper), | II |
| *Watkin* (1994),[22] UK, Macclesfield | Eligible women for breast screening, including those >65 years<br>Screening unit | Descriptive prospective study | I: Reworded information leaflet about breast screening given to women after screening to encourage dissemination of information to friends and relatives | Number of self-referrals >65years<br>No increase in number of self-referrals | No specific conclusions, but recommended that leaflet should continue | This is one of several interventions that this screening centre undertook to increase the uptake of the mammography service | IV |
| Multistrategy interventions | | | | | | | |
| Majeed *et al* (1997),[29] UK, London | 50 to 64 year old non-attenders.<br>93 inner city practices. | Descriptive prospective study | I: Clerical help to check names and addresses of non-attenders and a reminder letter | Attendance in this group at six months<br>I: 58.5%<br>(53.8% before study), | Reminder letters had a limited role in these inner city practices | | III |

**Key and notes:** Under 'author and year': Normal font = Study in refereed journal. *Italics* = Grey literature. *Italics* * = Completed study but unpublished.
'Quality of evidence in this study': Grades range from I to IV and reflect a hierarchy of study designs with grade I designs having the least inferential error. See table 3 in main text for full description.