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Review

The determinants of screening uptake and interventions for increasing uptake: a systematic review

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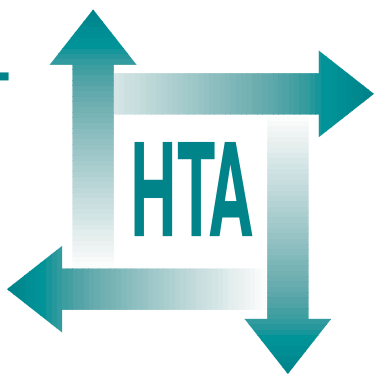
NHS R&D HTA Programme



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The determinants of screening uptake and interventions for increasing uptake: a systematic review

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The overall aim of the NHS R&D Health Technology Assessment (HTA) programme is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and work in the NHS. Research is undertaken in those areas where the evidence will lead to the greatest benefits to patients, either through improved patient outcomes or the most efficient use of NHS resources.

The Standing Group on Health Technology advises on national priorities for health technology assessment. Six advisory panels assist the Standing Group in identifying and prioritising projects. These priorities are then considered by the HTA Commissioning Board supported by the National Coordinating Centre for HTA (NCCHTA).

This report is one of a series covering acute care, diagnostics and imaging, methodology, pharmaceuticals, population screening, and primary and community care. It was identified as a priority by the Population Screening Panel and funded as project number 95/14/01.

The views expressed in this publication are those of the authors and not necessarily those of the Standing Group, the Commissioning Board, the Panel members or the Department of Health. The editors wish to emphasise that funding and publication of this research by the NHS should not be taken as implicit support for the recommendations for policy contained herein. In particular, policy options in the area of screening will be considered by the National Screening Committee. This Committee, chaired by the Chief Medical Officer, will take into account the views expressed here, further available evidence and other relevant considerations.

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Glossary and list of abbreviations

Technical terms and abbreviations are used throughout this report. The meaning is usually clear from the context but a glossary is provided for the non-specialist reader. In some cases usage differs in the literature but the term has a constant meaning throughout this review. Some entries are adapted from the Glossary in *The Cochrane Library* 1998;**4** (Oxford: Update Software, updated quarterly).

Glossary

Blinding (synonym: masking) Keeping confidential the group assignment (e.g. to intervention or control) from the study participants or investigators. Blinding is used to protect against the possibility that knowledge of assignment may affect participant response to intervention, provider behaviours (performance bias) or outcome assessment (detection bias).

Case–control study (synonyms: case referent study, retrospective study) A study that starts with identification of people with the disease or outcome of interest (cases) and a suitable control group without the disease or outcome. The relationship of an attribute (intervention, exposure or risk factor) to the outcome of interest is examined by comparing the frequency or level of the attribute in the cases and the controls.

Cohort study (synonyms: follow-up, incidence, longitudinal, prospective study) An observational study in which a defined group of people (the cohort) is followed over time and outcomes are compared in subsets of the cohort who were exposed or not exposed, or exposed at different levels, to an intervention or other factor of interest. Cohorts can be assembled in the present and followed into the future (a 'concurrent cohort study'), or identified from past records and followed forward from that time up to the present (a 'historical cohort study'). Because random allocation is not used, matching or statistical adjustment must be used to ensure that the comparison groups are as similar as possible.

Confidence interval (CI) The range within which the 'true' value (e.g. size of effect of an intervention) is expected to lie with a given degree of certainty (e.g. 95% or 99%). Note: confidence intervals represent the probability of random errors, but not systematic errors (bias).

Controlled trial A study that compares one or more intervention groups to one or more comparison (control) groups. In this review, the term 'controlled trial' is used to describe trials that used non-random methods to allocate participants to two or more groups (e.g. cohort with concurrent control).

Coverage Screening coverage is sometimes used to refer to the proportion of persons eligible to be screened within a population who have been screened during a specified period. At other times it refers to the proportion of persons eligible to be screened within a population who have been invited for screening during a specified period.[1]

Determinants (synonym: correlates) Factors that significantly influence the uptake of screening for different diseases (such as characteristics of the patient and the health professional, as well as the nature of the screening and intervention process). In this review only those factors found to be significantly associated with screening in a multivariate analysis are described as determinants.

Factorial design Most trials only consider a single factor, where an intervention is compared with one or more alternatives, or a placebo. In a trial using a 2 × 2 factorial

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design, participants are allocated to one of four possible combinations. In this way it is possible to test the independent effect of each intervention and the combined effect of (interaction between) the two interventions.

Fixed effect model A statistical model that stipulates that the units under analysis (e.g. people in a trial or study in a meta-analysis) are the ones of interest, and thus constitute the entire population of units. Only within-study variation is taken to influence the uncertainty of results (as reflected in the confidence interval) of a meta-analysis using a fixed effect model. Variation between the estimates of effect from each study (heterogeneity) does not affect the confidence interval in a fixed effect model.

Generalisability (synonyms: applicability, external validity, relevance, transferability) The degree to which the results of a study or systematic review can be extrapolated to other circumstances, in particular to routine healthcare situations.

Health maintenance organisation (HMO) A managed healthcare plan that integrates financing and delivery of a comprehensive set of healthcare services to an enrolled population. The HMO provides care over a fixed period of time in return for a fixed premium, thereby putting itself at financial risk. There are two types of HMO: the staff model, where the physicians and other personnel are generally employed (salaried) by the HMO; and the group model, where the physicians and other providers' services are on a capitation contract with the HMO (here the providers are also at financial risk). The key is the integration of services (primary care, hospital care, home health, etc.) and the financial incentive of a fixed fee per member.[2]

Heterogeneity In systematic reviews, heterogeneity refers to variability or differences between studies in the estimates of effects. A distinction is sometimes made between 'statistical heterogeneity' (differences in the reported effects), 'methodological heterogeneity' (differences in study design) and 'clinical heterogeneity' (differences between studies in key characteristics of the participants, interventions or outcome measures). Statistical tests of heterogeneity are used to assess whether the observed variability in study results (effect sizes) is greater than that expected to occur by chance. However, these tests have low statistical power.

Intention to treat (synonym: intention to intervene) An intention-to-treat analysis is one in which all the participants in a trial are analysed according to the intervention to which they were allocated, whether they received it or not. Intention-to-treat analyses are favoured in assessments of effectiveness as they replicate the non-compliance and treatment changes that are likely to occur when the intervention is used in practice, and because of the risk of attrition bias when participants are excluded from the analysis.

Logistic regression Logistic regression is used to investigate the relationship between an event rate or proportion and a set of independent variables. In systematic reviews it can be used to explore the relationship between key characteristics of included studies and the results (observed effects) for each study.

Medicaid A state-funded health insurance programme in the USA for certain defined groups of 'poor' individuals (all ages). Eligibility and benefits of the programme vary between states, and low income is only one part of the test for eligibility.

Medicare A health insurance programme for aged persons in the USA, consisting of two main parts (A and B). Part A is generally provided automatically to persons aged ≥ 65 years and covers hospital expenses (i.e. for inpatient, hospice care, skilled nursing facility and home health agency care). Part B is optional, requiring payment of a monthly premium and is available to almost all individuals aged ≥ 65 years regardless of their eligibility to receive Part A benefits. Part B covers expenses for physicians (in both hospital and non-hospital settings) and other services (i.e. laboratory and equipment fees, vaccination and drug fees, and ambulance costs).

Methodological quality (synonyms: validity, internal validity, quality) The extent to which the design and methodology of a trial are likely to have prevented systematic errors

(bias). Variation in quality can explain the variation in results of trials included in systematic reviews. More rigorously designed (better 'quality') trials are more likely to yield results that are closer to the 'truth'.

Multiple regression Multiple regression is used to investigate the joint influences of several variables, taking into account possible correlations between them.

Odds ratio (OR) The ratio of the odds of an event in the experimental (intervention) group to the odds of an event in the control group. Odds are the ratio of the number of people in a group with an event to the number without an event. Thus, if a group of 100 people had an event rate of 0.20, 20 people had the event and 80 did not, and the odds would be 20/80, or 0.25. An odds ratio of 1 indicates no difference between comparison groups. For undesirable outcomes an OR that is < 1 indicates that the intervention was effective in reducing the risk of that outcome. When the event rate is small, odds ratios are very similar to relative risks.

Opportunistic screening The offer of a test for an unsuspected disorder at a time when a person visits a health professional for another reason (e.g. blood pressure screening or antenatal urine testing).

***p* value** The probability (ranging from 0 to 1) that the observed results in a study could have occurred by chance. In a meta-analysis the *p* value for the overall effect assesses the overall statistical significance of the difference between the intervention and control groups, while the *p* value for the heterogeneity statistic assesses the statistical significance of differences between the effects observed in each study.

Proactive screening The mass screening of whole population groups where no selection is made (e.g. the Guthrie test for all neonates) or selective screening of high-risk groups in the population (e.g. breast cancer screening of women over the age of 50 years).[3]

Quasi-randomised trial (quasi-RCT) A trial using a quasi-random method of allocating participants to different forms of care (e.g. date of birth, day of the week, medical record number, month of the year, or the order in which participants are included in the study (e.g. alternation)). There is a greater risk of selection bias in quasi-random trials where allocation is not adequately concealed compared with randomised controlled trials with adequate allocation concealment.

Randomised controlled trial (RCT) (synonym: randomised clinical trial) An experiment in which investigators randomly allocate eligible people to (e.g. intervention and control) groups to receive or not to receive one or more interventions that are being compared. The results assess and compare the outcomes of the intervention and control groups.

Relative risk (RR) (synonym: risk ratio) The ratio of risk in the intervention group to the risk in the control group. The risk (proportion, probability or rate) is the ratio of people with an event in a group to the total number of people in the group. A relative risk of 1 indicates no difference between comparison groups. For undesirable outcomes an RR value < 1 indicates that the intervention was effective in reducing the risk of that outcome.

Review Manager (RevMan) Software developed for the Cochrane Collaboration to assist reviewers in preparing Cochrane Reviews.

Screening The presumptive identification of unrecognised disease or defect by the application of tests, examinations, or other procedures that can be applied rapidly. Screening tests sort out apparently well persons who apparently have a disease from those who probably do not. A screening test is not intended to be diagnostic.[4]

Screening programmes Consist of all activities, from the identification of the population likely to benefit right through to definitive diagnosis and treatment.[5]

Statistical significance An estimate (usually expressed as a *p* value) of the probability of an association (effect) as large or larger than what is observed in a study occurring by chance. The cut-off for statistical significance is usually taken at 0.05, but sometimes at 0.01

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or 0.10. These cut-off points are arbitrary and have no specific importance.

Unit of allocation The entity that is assigned to different comparison groups in a trial. Most commonly, individuals are allocated, but in some trials people are assigned to the intervention and control groups in clusters to avoid contamination or for convenience; for example, practices, hospitals or communities can be allocated. (See: unit of analysis error.)

Unit of analysis error In some studies people are allocated in clusters instead of individually (e.g. by practice, by hospital or by community). Often when this is done the unit of allocation is different from the unit of analysis (i.e. people are allocated by groups and analysed as though they had been allocated individually). This is sometimes called a 'unit of analysis error'. Effectively, using individuals as the unit of analysis when groups of people are allocated increases the power of the studies by increasing the degrees of freedom. This can result in overly narrow confidence intervals and false-positive conclusions that the intervention had an effect when in truth there is greater uncertainty than what is reflected by the *p* value. In the context of a review, it can result in studies having narrower confidence intervals and receiving more weight than is appropriate.

List of abbreviations

ADL	activities of daily living
BSE	breast self-examination
CBE	clinical breast examination
CI	confidence interval
DF	degrees of freedom
DRE	digital rectal examination
FOBT	faecal occult blood test
HMO	health maintenance organisation
OR	odds ratio
Pap smear	Papanicolaou smear
PSA	prostate specific antigen
RCT	randomised controlled trial (synonym: randomised clinical trial)
RR	relative risk
SE	standard error
STD	sexually transmitted disease

Executive summary

Background

Screening has been defined as "the systematic application of a test or inquiry, to identify individuals at sufficient risk of a specific disorder to warrant further investigation or direct preventive action, among persons who have not sought medical attention on account of symptoms of that disorder". Screening can be carried out with the aim of primary prevention (e.g. screening for risk factors such as hypertension), secondary prevention (e.g. cancer screening) or tertiary prevention (e.g. screening for sensorineural deafness).

The original brief of this systematic review was to evaluate the determinants of screening and interventions to increase uptake. There have been many debates in recent years, however, about the desirability of attaining high rates of uptake of screening *per se* without allowing participants to make an informed choice. Therefore, although the primary outcome of interest was actual uptake, data on informed uptake were also collected where available for all included intervention studies.

This review includes all screening programmes, regardless of whether they are of 'proven' effectiveness or are available or relevant in the UK setting. The reasons for taking such a broad approach are as follows:

- Some screening tests and programmes are very new or not routine in the UK, and are still being evaluated. Including all screening tests in the review means that policies for new programmes can be implemented without further reviews being undertaken.
- There is not always agreement as to which programmes are of proven benefit and which are not. Also, as new evidence emerges, programmes may be found to be more or less effective than previously thought.

Objectives

To carry out a systematic review to examine factors associated with the uptake of screening programmes and to assess the effectiveness of methods used to increase uptake.

In particular, the following questions were addressed:

- What factors (i.e. determinants) were associated with uptake of screening for different diseases?
- What interventions were shown to increase uptake of screening programmes (or informed uptake) within populations?

Methods

Data sources

Twenty-three databases of both published and grey literature were searched using strategies designed specifically for each database. Additional references were located through searching the bibliographies of related papers and contacting specialists in the subject area of the review. All published and unpublished studies were assessed for inclusion and there were no language restrictions.

Study selection

Studies of any screening programmes, where the outcome was screening uptake were assessed for inclusion. Randomised controlled trials (RCTs), quasi-RCTs, cohort studies and case–control studies (only when there was a prospective time barrier between collecting information about the determinants being assessed and the uptake of screening) were included in the determinants part of the review. In addition, only studies using some form of multivariate analysis were included. RCTs, quasi-RCTs and controlled trials were included in the interventions part of the review.

Data extraction

One reviewer screened the titles and abstracts of 46,000 studies and a second reviewer checked a random sample (5%) of included and excluded papers. Studies were independently pre-screened for relevance (using the full paper copy) by two reviewers. Data were then extracted from relevant studies by one reviewer and checked by a second reviewer. Any disagreements at any stage were resolved through discussion with a third reviewer.

Information was also recorded for each study relating to five items of methodological quality for

the determinants part of the review, and seven items for the interventions part of the review. These quality criteria were not used to obtain an overall quality score, but are reported descriptively in the text.

Data synthesis

Data reporting the relationship between each determinant and screening uptake were extracted where possible and reported in a narrative. For intervention studies, relative risks and 95% confidence intervals (CI) were calculated for all appropriate RCTs (if enough data were available) using a random-effects model. A test for heterogeneity was performed for all sets of comparisons and there was significant statistical heterogeneity for all but one of the comparisons. The results for the rest of the comparisons were reported in a narrative with diagrams displaying the relative risks (95% CI) for each RCT.

Results

Determinants

Sixty-five studies met all the inclusion criteria for the determinants section of the review. For mammography, women were more likely to attend if they had attended for a previous mammogram, had the intention to attend, had health insurance or received a recommendation to attend by their general practitioner. For Papanicolaou (Pap) smear, women were more likely to attend if they had health insurance. Age was also a determinant, although it was unclear whether older or younger women were more likely to attend. Being older than 65 years, previous participation in screening and being able to carry out the activities of daily living were found to be determinants associated with participation in faecal occult blood test (FOBT) screening. Determinants found to predict attendance at prostate cancer screening included having a higher level of education and being African-American, as opposed to Caucasian. It was not possible to ascertain which factors were important for other specific screening tests (e.g. cystic fibrosis, tuberculosis, well-child and HIV screening) due to a lack of evidence.

Determinants found to be associated with uptake across the five main screening tests (i.e. Pap smear, mammogram, HIV antibody test, FOBT and prostate screening) included attendance for a previous screening test and age.

Interventions

One-hundred and ninety studies met all the inclusion criteria for the interventions section of the review, of which 130 (68%) were RCTs. Interventions aimed at individuals which seemed to be effective at increasing uptake included: invitation appointments, letters (less effective for mammography) and telephone calls; telephone counselling; and removal of financial barriers (e.g. transport and postage costs). Interventions that may be effective included: educational home visits; opportunistic screening; multicomponent community interventions; simpler procedures; combination of different components aimed at individuals; reminders for non-attenders (for mammography only); and invitation follow-up prompts. Interventions that were found to have limited effectiveness included printed and audio-visual educational materials; educational sessions; risk-factor questionnaires; and face-to-face counselling. Interventions that were shown to be ineffective included the use of rewards or incentives. There was either no good-quality evidence or insufficient evidence to evaluate the effectiveness of other interventions.

Reminder interventions were found to be effective for physicians. Further interventions that may be effective included office systems or the use of audit and feedback to increase uptake. For physician education interventions there was insufficient good-quality evidence to assess their effectiveness. Of those interventions aimed at both physicians and individuals, a combination of physician reminders and patient invitations was found to be effective. When comparing interventions aimed at individuals with those for physicians, there was a small but beneficial effect for the interventions targeting individuals.

When assessing informed uptake, only four of the 190 intervention studies (all for antenatal screening) reported giving information on the risks and benefits of screening, and included knowledge as an outcome. Only one study evaluated the effect of this information and knowledge on the decision-making process. Whether informed uptake affects actual levels of uptake, therefore, has yet to be fully evaluated.

Discussion and conclusions

Sixty-five per cent of intervention studies and 82% of determinant studies were undertaken in the USA or Canada. Both these countries differ from the UK in the recommended ages and intervals for screening and in the organisation of screening programmes. While some of these factors may limit the generalisability of findings to the UK setting,

they still provide a useful insight into screening behaviour.

Implications for practice

The authors identified a number of implications for practice arising from this review, and it is important to consider the findings in two ways: in relation to actual uptake and in relation to informed uptake. Any attempts to increase the uptake of screening should be pursued alongside initiatives to increase informed uptake.

- Individuals who previously participated in screening were more likely to be screened subsequently. Efforts could be focused on identifying and encouraging attendance among those who have never previously participated in screening.
- Current practice in the UK national screening programmes using invitation letters and/or appointments is supported by good evidence. Invitation telephone calls could also be considered, although the cost-effectiveness of this approach remains uncertain in the UK. All of these approaches could be considered for other screening tests.
- Telephone counselling where barriers to screening are discussed could be considered.
- Reducing economic barriers (e.g. offering free postage or transportation costs) can increase uptake and may be appropriate for specific groups.
- Healthcare professionals can be prompted either to perform or to recommend screening tests by using reminder systems such as tagged notes. Such reminder systems could be considered in secondary as well as primary care.

Recommendations for future research

- All future studies should measure informed uptake as well as actual uptake and might include a measure of the decision-making process.
- A systematic review of informed uptake is needed. The review should include studies which have measured informed uptake, and/or knowledge, understanding and the decision-making process.
- Further research is needed to investigate how barriers to uptake can be minimised in ethnic groups, where uptake is known to be low.
- Further research is needed to determine whether there are other important factors influencing the uptake of screening that have not been investigated.
- Future studies need to report the outcome of all factors investigated as possible influences on screening uptake, not just those shown to be significant.

Chapter 1
Introduction

Screening programmes can be an effective method of reducing morbidity and mortality from disease by detecting it before symptoms occur. At present over 300 screening programmes have been identified,[5] some of which are still in the research stages, while others are national programmes in the UK. Such programmes include screening for cervical cancer (initiated in 1966), phenylketonuria (initiated in 1969) and breast cancer (initiated in 1986). The uptake of screening programmes is not universal, however,[6] and the use of screening services varies among different population groups and different localities.[1]

Definitions

Screening has been defined as "the systematic application of a test or inquiry, to identify individuals at sufficient risk of a specific disorder to warrant further investigation or direct preventive action, among persons who have not sought medical attention on account of symptoms of that disorder".[5] Screening can be carried out with the aim of primary prevention (e.g. screening for risk factors such as hypertension), secondary prevention (e.g. cancer screening), or tertiary prevention (e.g. screening for sensorineural deafness).[7]

Screening uptake refers to the proportion of persons eligible to be screened within a population who have been both invited for screening and have received an adequate screen during a specified period.[8] In this review, 'uptake' also includes the long-term participation in the screening programme.

Background

Screening programmes in the UK and in other countries

Screening programmes and guidelines for screening (particularly those for cancer screening) vary between countries in several ways (*Table 1*). Firstly, by whether they are proactive or opportunistic (or even offered at all). For example, colorectal cancer screening is not yet routinely offered in the UK, but in the USA it is recommended every year for people aged 50 years or over. Secondly, programmes may vary in their eligibility criteria. In the UK, for example, mammograms are recommended for all women aged 50–64 years, whereas in the USA mammograms are recommended for women aged 40 years and over. Thirdly, countries vary in the screening intervals recommended for programmes. Papanicolaou (Pap) smears are recommended every 5 years in the UK, but yearly in the USA. These variations may result in differences in the issues surrounding screening, such as cost-effectiveness, acceptability, effectiveness of the screening test and uptake. For example, a screening programme that is cost-effective in one country may not be in another because of differences in the screening interval. Fourthly, programmes may vary by the organisation of the healthcare system. In the UK, all national screening programmes are free of charge. In the USA and other countries, charges are made for screening and these are reimbursed in various ways, such as through Medicare. Charging for screening may not only affect uptake, but may also mean that more invasive, expensive tests are performed as it is not the health system that 'pays'.

Uptake of screening programmes in the UK

Table 2 shows the rates of uptake and coverage for screening programmes available in the UK. Rates of uptake and coverage vary widely according to the type of screening. For example, uptake of screening for neonatal metabolic disorders is almost universal, while other more controversial or new screening programmes (such as antenatal HIV) have more variable uptake rates. At the present time, the overall uptake and coverage rates for cervical and breast cancer screening exceed the targets set.[16] However, there is variation by region and health authority, and some fall short of this target.

Issues surrounding screening programmes

There are several issues surrounding screening programmes that are interconnected and cannot be viewed in isolation (see *Figure 1*). For example, the level of uptake may affect both the effectiveness and cost-effectiveness of a programme. These issues are discussed briefly in the following section.

TABLE 1 *Major cancer screening recommendations for asymptomatic individuals in the UK, the USA, Canada and Australia*

Country	Condition	Screening test	Guidelines
UK	Breast cancer	Mammogram[5]	Recommended for all women aged 50–64 years; invited once every 3 years; women > 65 years on request
	Breast cancer	CBE[5]	No recommendations
	Cervical cancer	Pap smear[5]	Recommended for all women aged 20–64 years; invited once every 5 years; every 3 years in Scotland
	Colorectal cancer	Sigmoidoscopy[5]	No recommendations
	Colorectal cancer	DRE[5]	No recommendations
	Colorectal cancer	FOBT[5]	No recommendations, awaiting outcome of research programme
	Prostate cancer	PSA[5]	Explicit policy not to offer this test
USA*	Breast cancer	Mammogram[9]	Recommended every 1–2 years for women aged 40–49 years and every year for women ≥ 50 years
	Breast cancer	CBE[9]	Recommended every 3 years for women aged 20–40 years and every year for women > 40 years
	Cervical cancer	Pap smear[10]	Recommended that all women who are, or who have been sexually active, or who are aged ≥ 18 years should have an annual smear and pelvic examination. After three or more negative smears the test may be performed less regularly at the discretion of the physician
	Colorectal cancer	Sigmoidoscopy[11]	Recommended every 3–5 years for men and women aged > 50 years
	Colorectal cancer	DRE[11]	Recommended every year for men and women aged > 40 years
	Colorectal cancer	FOBT[11]	Recommended every year for men and women aged > 50 years
	Prostate cancer	PSA[11]	Recommended every year for men aged > 50 years and those at high risk aged < 50 years
Canada	Breast cancer	Mammogram[9]	Recommended every year for women aged 40–49 years and every 2 years for women aged ≥ 50 years
	Breast cancer	CBE[9]	No recommendations
	Cervical cancer	Pap smear[12]	Recommended every year for all sexually active women aged 18 years. Every 3 years for women aged 35–69 years after ≥ 3 consecutive normal smears
	Colorectal cancer	Sigmoidoscopy[13]	No recommendations
	Colorectal cancer	DRE[13]	Recommended for men and women aged > 40 years
	Colorectal cancer	FOBT[13]	No recommendations
	Prostate cancer	PSA[13]	No recommendations
Australia	Breast cancer	Mammogram	Available to women > 40 years, but specifically targeted at women 50–69 years every 2 years

* *In the USA no one single organisation establishes national policy. The main organisations producing policies are the American Cancer Society, the National Cancer Institute and the USA Preventive Services Task Force. The guidelines given here are based on those of the American Cancer Society*

Continued

TABLE 1 contd *Major cancer screening recommendations for asymptomatic individuals in the UK, the USA, Canada and Australia*

Country	Condition	Screening test	Guidelines
	Breast cancer	Pap smear[9]	Recommended for all women who are or have been sexually active starting at age 18–20 years, or 1–2 years after first intercourse (whichever is later); recommended to have smear every 2 years. Women who have had two normal smears in the last 5 years can stop at age 70 years
	Cervical cancer	Sigmoidoscopy[14]	No recommendations
	Colorectal cancer	DRE[14]	Recommended annually for men and women aged > 50 years
	Colorectal cancer	FOBT[14]	No recommendations. Australian HTA Report recommends that the country adopts FOBT for people aged > 50 years
	Prostate cancer	PSA[15]	Australian HTA Report does not recommend screening

TABLE 2 *Estimates of uptake and coverage of screening programmes in the UK*

Screening programme	Coverage	Uptake	Notes
Cancer screening			
Breast cancer (mammogram)	England: 66% Wales: 69% Scotland: 69% Northern Ireland: 75%[8]	England: 75%[17] (national target 70%)[16]	National programme. Coverage defined as percentage of target population. Medically ineligible women included in Scottish figures. Northern Ireland figures may include a small number of women who have been counted more than once
Cervical cancer (Pap smear)	England: 85% Wales: 84% Scotland: 85%[18] (national target 80%)[16]	Not known	National programme
Antenatal screening			
Hepatitis B in pregnant women	Not known	Universal: > 90% in 38/50 units[19]	Based on data from 192 obstetric units and 116 public health directorates
HIV in pregnant women	Not known	Universal: > 10% in 8/23 units Selective: > 10% in 0/65; < 0.1% in 50/65 (76%) of selective units	Based on data from all maternity units in the UK. Of those that replied (239/265), 10% had a universal offer strategy, 37% had a selective offer, 52% tested only women who requested it[20]
Down's syndrome	60%[21]	Not known	Serum testing
Neonatal screening			
Phenylketonuria	99%[22]	Not known	Organised programme
Congenital hypothyroidism	99%[22]	Not known	Organised programme

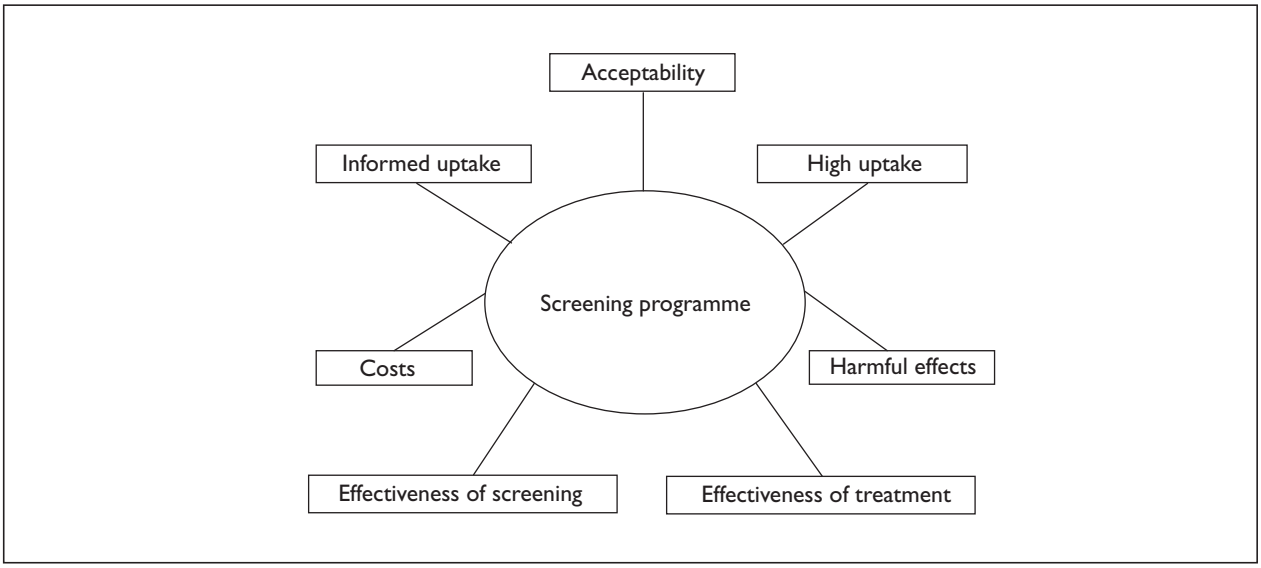


FIGURE 1 *Issues surrounding screening*

High uptake

One of the most important factors affecting the effectiveness and efficacy of a screening programme is the participation of the target group. High rates of uptake need to be attained if screening programmes are to have a significant population impact in reducing mortality and/or morbidity from a disease or condition. Such is the importance of high uptake that targets for breast cancer screening and cervical cancer screening are now one of the performance indicators for general practitioners (GPs) and health authorities;[23] GPs are paid an incentive by health authorities for performing Pap smears. There are two thresholds for payments: coverage of between 50% and 79% of eligible women and coverage of 80% or more.[24] To this end, screening is sometimes promoted as being simple, effective and inexpensive. While targets and incentives may increase uptake, they may also work against the spirit of enabling informed uptake. It has been argued, for example, that target payments for GPs carrying out cervical screening work against the spirit of enabling women to make an informed choice about whether or not they want to be screened.[25]

Informed uptake

An informed decision can be described as one where, "a reasoned choice is made by a reasonable individual using relevant information about the advantages and disadvantages of all the possible courses of action, in accord with the individual's beliefs".[26] There have been many debates in recent years about the desirability of attaining high rates of uptake of screening *per se* without allowing participants to make an informed choice.[27–30]

It has been argued that in order to make an informed decision to participate in screening an explicit sharing of information about risks and benefits is required.[31] Concerns have been raised about the quality of information that is currently available to help inform decisions to undergo screening. For example, a recent survey in Australia of mammography information leaflets found that information about the accuracy of screening tests was provided only occasionally, sensitivity was given in 26% of leaflets and specificity was not considered in any of the leaflets.[32] Similarly, a need to improve the quality of the information that women receive about cervical screening has been identified.[33]

In light of the criticisms about the quality of information available to those undergoing screening, it is not surprising that concerns have also been raised about participants' knowledge of screening. Recent surveys have shown that knowledge about screening is limited. For example, in a report of the first 5 years of operation of the NHS cervical screening programme, women were reported to be less aware of the limitations of screening than of the benefits.[34] If participants are to become truly informed about screening programmes then an explicit sharing of information is required, which is likely to become more visible with the recent guidance issued by The General Medical Council.[35] The guidance states that:

"Doctors should give information on the following:

- the purpose of the screening;

- the likelihood of positive and negative findings and possibility of false-positive/negative results;
- the uncertainties and risks attached to the screening process;
- any significant medical, social or financial implications of screening for the particular condition or predisposition; and
- follow-up plans, including the availability of counselling and support services."[35]

Tensions arise, however, between promoting informed uptake, where the individual may choose not to undertake screening, and promoting effective forms of healthcare (i.e. screening). It has been argued, for example, that if pretest counselling for neonatal screening were more complete and informed consent required, public acceptance and uptake might not be as great as figures from current programmes suggest.[36] There is also some evidence to suggest that informed consent decreases patient interest in prostate specific antigen (PSA) screening.[37,38] Care needs to be taken that any messages about the limits of screening do not reduce the uptake of effective screening tests among those most likely to benefit. Alternatively, it has been argued that, above all, patients' autonomy should be respected, which includes their right to decide not to undergo screening, even when refusal may result in harm to themselves.[27]

A distinction has to be made, therefore, between ways of increasing uptake at all costs (i.e. by emphasising only the benefits of screening) versus ways of minimising barriers to uptake among those who choose screening based on a full understanding of the likely benefits, limitations and harm. Increasing uptake at all costs can lead to great bitterness when the disease develops despite screening. If the purpose of screening is to benefit the whole community, it should not be at the expense of respect for the individual.[5]

Effectiveness of screening programmes and subsequent treatments

The National Screening Committee is presently assessing which programmes meet its stringent criteria on evidence for effectiveness and quality. The criteria are: there should be a simple, safe, precise and validated screening test; the distribution of test values in the target population should be known and a suitable cut-off level defined and agreed; the test should be acceptable to the population; and there should be an agreed policy on the further diagnostic investigation of individuals with a positive test result and on the choices available to those individuals.[5] At the present time, screening guidance exists in the UK for the following programmes: breast cancer, cervical cancer, phenylketonuria, congenital hypothyroidism, physical examination (neonates), child health screening, cardiovascular risk factor screening, elderly – general assessment, bladder cancer and HIV antibody (pregnant women).[5] The effectiveness of some of these national screening programmes, however, is not always clear. In many cases it is not known what proportion of cancer deaths, for example, are preventable by screening. For example, it has been argued that most deaths among women who have been screened (for cervical cancer) would not have been prevented by screening.[39]

One of the criteria for an effective screening programme is that there should be an acceptable treatment for patients with recognised disease.[3] For some diseases there is no acceptable treatment, even though there may be a screening test that is effective in identifying those with a high risk of developing the disease. For example, although screening programmes are currently being evaluated for prostate cancer, it has been reported that there have been no reliable evaluations of the effect of treatments for early prostate cancer on mortality. Active treatments for prostate cancer can result in major complications such as incontinence and impotence.[40] Thus, the National Screening Committee has an explicit policy not to recommend it, as the treatment is not of proven effectiveness and current screening technologies (including the PSA test) have limited accuracy.[5,41]

Harms and benefits

Harms from screening include: complications arising from the investigation; unnecessary effects of treatment; unnecessary treatment of persons with true-positive test results who have inconsequential disease; adverse effects of labelling or early diagnosis; anxiety generated by the investigation; and costs and inconvenience incurred during investigations and treatment.[42] In screening for a disease or condition, a large number of people are tested in order to detect a small proportion of individuals who have preclinical disease. A much larger number of people may experience harm from screening, therefore, than those who experience the potential benefits of screening. Harm from screening is inevitable, and it has been argued that the popularity of screening tests bears little relation to the magnitude of its benefits and harms.[28] Before a screening test or programme is initiated, the benefit from the screening programme should outweigh the physical and psychological harm (caused by the test, diagnostic procedures and treatment).[5] Screening may sometimes wrongly identify some people as suffering

from a disease or condition when they are in fact healthy (false-positive results) and, conversely, may give a falsely reassuring result to some others who do in fact have the disease or condition (false-negative results).[5] Even when the quality of the service provided is high, false-negative results are evident in all screening programmes and they could lead to legal action being taken by those affected, and potentially may reduce public confidence in screening.[43] False-positive results have been shown to cause people high levels of anxiety that do not resolve immediately when subsequent tests show no disease.[44]

Acceptability and ethics of screening programmes

One of the criteria that a screening programme must fulfil is that there should be evidence that the complete screening programme is clinically, socially and ethically acceptable to health professionals and the public.[5] Components of a screening programme include the screening test, diagnostic procedures and the treatment or intervention. Reasons for unacceptability of **screening tests** include barriers such as anticipated or actual pain, discomfort or embarrassment. For many screening programmes, only one effective screening test is available, while for others there are several. For example, faecal occult blood test (FOBT), digital rectal examination (DRE) and sigmoidoscopy are all screening tests for colorectal cancer, but they may have different levels of acceptability to patients and health professionals. **Diagnostic procedures** may be unacceptable because they are more invasive or carry a greater risk of harm (e.g. amniocentesis carries a 1 : 200 risk of abortion of normal babies). Also, individuals may not wish to be screened if a positive screening test is then followed-up by an unacceptable **treatment or intervention**. The treatment or intervention may be unacceptable because of its enormous psychological and physical impact (e.g. mastectomy for breast cancer) and/or its ethical impact (e.g. abortion for Down's syndrome). If a screening programme is unacceptable to the target population, uptake is likely to be low. A systematic review is presently underway to identify interventions that may be able to minimise anxiety and improve people's understanding and experience of screening.[45]

Costs involved in screening programmes

Screening programmes for large populations are expensive and can divert resources from other healthcare programmes. One criterion of a screening programme is that the opportunity costs (including testing, diagnosis, treatment, administration, training and quality assurance) should be economically balanced in relation to expenditure on medical care as a whole (i.e. value for money).[5] The cost-effectiveness of a screening programme is dependent on a number of variables, including high uptake. Furthermore, the cost-effectiveness of screening programmes can be manipulated by restricting the offer of screening to people who are at high risk of disease or by changing the cut-off point defining screen-positive cases.[7] Although appraisal of the costs of screening usually focus on cost-effectiveness (e.g. costs per life-year gained), social and psychological costs of screening should also be investigated before deciding whether individual screening programmes should or should not be provided.[44]

Factors that may affect the uptake of screening

Different behavioural, social, economic and organisational factors are likely to be associated with the provision and use of screening programmes by health services and populations, respectively. Studies of the influences on the uptake of screening have focused on the awareness of the disease and the role of screening, as well as the ability to overcome any barriers to take up the service provided. Participants' knowledge and perceptions of the symptoms and risks of the disease, as well as the nature of the screening process and the consequences of the test results, have been shown to affect uptake in screening programmes.[46] Apathy, lack of concern, low perceived need and unpleasantness of the procedure are factors reported by participants to act as barriers towards screening.[47,48] In contrast, research has shown that personal or family experiences of the disease and/or screening programme may motivate people to attend for screening.[49] Disadvantaged groups, whether defined by age, gender, ethnicity or culture, marital status or socio-economic characteristics, often experience a number of barriers that hinder their access to screening services.[50] Time–space constraints, such as limited access to transportation and/or not being able to afford to take time out from work, can also prevent people from attending for screening.[51]

Different ethnic or cultural groups may have distinct perceptions of disease, causality and prevention that may not reflect those defining the provision of healthcare. To such groups, screening may have limited relevance, resulting in low uptake. Differential uptake by these groups is a particular problem for some screening programmes, as non-attenders tend to be those at high risk of disease. For example, older women are most at risk of cervical cancer, but tend to have a lower uptake of cervical cytology. Consequently, a wide range of participant factors may influence the decision to

attend for screening, including: socio-demographic characteristics (e.g. age, gender and residential location); knowledge (e.g. knowledge of disease and screening); behavioural factors (e.g. past screening behaviours); attitudes and beliefs (e.g. perceptions of the need for and the effectiveness of tests, and willingness to attend); social influences (e.g. positive or negative influences of friends and relatives); and health factors (e.g. previous history of disease or symptoms).

The organisation of the provision of the service, and the knowledge, attitudes and practice of the provider may also influence the uptake of screening programmes.[51,52] Incomplete or inaccurate registers are a major organisational problem, and can result in certain populations (such as the transient or ethnic minorities) not being invited for screening.[53] Furthermore, if practitioners have poor knowledge of and negative attitudes to screening, uptake among their patients may be low. In contrast, providers who are aware of and agree with screening guidelines are likely to have a positive influence on screening uptake. Patients tend to rely on health professionals for information and advice concerning disease, risks, detection and treatment. Conflicting information, uncertainty in advice or inability to communicate with health professionals may affect the uptake of screening.

Interventions to increase the uptake of screening

Several types of intervention have been used to promote the uptake of screening, including:

- Interventions targeting the screening population (including call/recall systems; reminders of the screening programme through letter, leaflet, credit cards, or telephone contact; education programmes; counselling; mass media campaigns; and direct contact from health professionals).
- Interventions to alter the screening test or process (e.g. new screening tests that are less invasive, decrease pain, and are more accurate and timely); patient self-screening tests; mobile screening facilities; opportunistic screening; effectiveness of subsequent screening or treatment interventions.
- Interventions targeted at health professionals (including reminders of screening programmes and guidelines, education concerning the process and guidelines for screening).
- A combination of the above.

The behavioural, cultural, economic and organisational factors thought to determine the uptake of screening have provided a rationale for developing interventions to increase uptake. Within these broad frameworks there are a number of different theories and models that can, and have, been applied to the uptake of screening. Examples of relevant models applied to developing interventions aimed at the screening population include social cognition models such as the Health Belief Model,[54] and the Theory of Reasoned Action/Planned Behaviour.[55] Implicit in these models is a process of rational decision-making, where individuals consider the likely outcomes of different courses of action. The PRECEDE/PROCEDE model, which outlines the steps that should precede an intervention and gives guidance on how to proceed with the implementation, has been used to design interventions aimed at both individual health professionals and organisations.[56] There are also models that can be used to develop interventions aimed at entire communities, such as 'social marketing'.[57] For example, large-scale mass media campaigns are often designed using this approach.

Scope of the review

This review includes all screening programmes, regardless of whether they are of 'proven' effectiveness or are available or relevant in the UK setting. The reasons for taking such a broad approach are as follows:

- Some screening tests or programmes are very new or not routine in the UK, and are still being evaluated. These include screening for cystic fibrosis, Down's syndrome, diabetic retinopathy, fragile X syndrome, haemoglobinopathies, inborn errors of metabolism, ovarian cancer, aortic aneurysm, *Chlamydia trachomatis*, colorectal cancer and hepatitis B in pregnancy.[5] Other screening tests may be added to this list in the future. The inclusion of all screening tests in the review means that policies for new programmes can be implemented without further reviews being undertaken.
- There is not always agreement as to which programmes are of proven benefit and which are not. Benefit and harm are not absolute values and may depend on individual, cultural and religious beliefs, as well as on differences in the incidence of disease in a particular community. Also, as new evidence emerges, programmes may be found to be more or less effective than previously thought.
- Lessons can still be learnt from studies of ineffective screening programmes as interventions

to increase the uptake of screening may be applicable to other screening programmes. It is acknowledged, however, that the ineffectiveness of a programme may affect uptake.

Objectives

To carry out a systematic review to examine factors associated with the uptake of screening programmes and to assess the effectiveness of methods used to increase uptake.

In particular, the following questions were addressed:

- What determinants (i.e. significant factors) were associated with the uptake of screening for different diseases (such as characteristics of the patient and the health professional, as well as the nature of the screening and treatment process)?
- What interventions were shown to increase uptake of screening programmes (and, where available, informed uptake) within populations?

Chapter 2
Review methods

Search strategy

Electronic databases searched were: MEDLINE (1966 to October 1998), BIDS Science Citation Index (1981 to October 1998), BIDS Social Science Index (1981 to October 1998), Econlit (1969 to October 1998), EMBASE (1985 to October 1998), CANCERLIT (1985 to October 1998), DHSS data (1985 to October 1998), Dissertation Abstracts (1985 to October 1998), ERIC (1985 to October 1998), HealthSTAR (1985 to October 1998), ASSIA (1985–1997), Pascal (1985 to October 1998), SIGLE (1980 to October 1998), CINAHL (1982 to October 1998), Sociofile (1974 to October 1998), PsycINFO (1985 to October 1998), SHARE (Kings Fund), Library of Congress database, NHS CRD DARE, Cochrane Database of Systematic Reviews, Cochrane Controlled Trials Register, and the National Research Register (see appendix 1 for a full list of the search terms used in each of these strategies).

Additional references were located through searching the bibliographies of related papers and contacting specialists in the subject area of the review. The *Journal of Medical Screening* was hand-searched for all relevant reports, from Issue 1 (1994) to December 1999. There were no language restrictions, and both published and unpublished studies were included if they met the criteria for either the determinant or intervention parts of the review, which are described below.

Inclusion criteria: studies of determinants of screening uptake

Types of determinant

All factors thought to influence the uptake of different screening programmes, such as socio-demographic, behavioural, sociological and economic variables, were included. In this review factors were described as determinants if, in a multivariate analysis, they were found to be significantly associated with the uptake of screening.

Types of screening programme

All screening programmes that aimed to identify early the presence or absence of a specific condition, disease or disability during the presymptomatic phase or before clinical detection (including antenatal screening of parents). Universal, selective and opportunistic screening programmes were all included.

Types of participant

All people eligible to participate in a screening programme as defined by the entry criteria for that programme. This included population groups such as pregnant women, neonates, children and adults.

Types of outcome measure

Measures of determinants

- Determinants of study participants and health professionals recorded by health service records (such as screening administration system, or hospital or GP records).
- Determinants of patients and health professionals as recorded by questionnaire or interview (i.e. self-report).

Primary measures of screening uptake

- Screening uptake or non-uptake recorded by health service records (such as screening administration system, or hospital or GP records).
- Self-reported uptake or non-uptake of screening.

Intermediate measures of uptake (included in studies using primary outcome measures)

Data on these outcomes (e.g. intentions or beliefs) were extracted and reported in the systematic review, if the primary studies assessed their influence as determinants of screening uptake.

Study design

Randomised controlled trials (RCTs), controlled trials, cohort studies or case–control studies where there was a prospective time barrier between the measurement of determinants and the uptake of screening.

Type of analysis

Only studies using some form of multivariate analysis (e.g. logistic regression) were included. Numerous factors may influence a person's decision to attend screening, many of which may be interrelated. For the purposes of this review it was

TABLE 3 *Definitions used to classify interventions to increase the uptake of screening*

Intervention	Definition
Interventions aimed at individuals	
Invitations	Invitations to people due for screening (either first round or second round). Does not include people who are overdue for screening. Includes fixed or open appointments, letters, telephone calls, verbal recommendations, prompts and follow-up letters
Reminders	Reminders to people who are overdue for screening and have not responded to the first round of screening. Includes fixed or open appointments, letters, telephone calls, verbal recommendations, prompts and follow-up letters
Education	Educational interventions aiming to increase knowledge of the screening programme or the disease being screened for. Does not contain a counselling component. Includes printed educational materials, audio-visual materials, group and individual teaching, and home visits
Message framing	Messages about screening (either verbal or written) that are framed either positively or negatively
Counselling	Counselling, either face-to-face or on the telephone. Must involve a discussion of barriers to screening as well as an educational component
Risk-factor assessment	Risk-factor questionnaires and computer programmes assessing a person's risk status
Procedures	Interventions to increase screening uptake by making the screening procedure easier or more acceptable to individuals undergoing screening. Includes different screening tests for the same disease, varying diets, or the length of time that the screening test takes, and opportunistic testing and notification of results
Economic	Removal of financial barriers or economic incentives. Includes reduced or free screening tests, transport costs, free postage for returning tests and 'rewards' for completion of a screening test
Community interventions	Interventions aimed at whole communities. Often involve multiple interventions. Include mass media campaigns and community participation
Interventions aimed at physicians or other healthcare workers	
Reminders	Reminders to physicians to prompt or encourage individuals to undergo screening. Include chart reminders, forms, computer-generated reminders and lists of overdue patients
Education	Continuing medical education. Includes seminars, workshops and meetings
Office systems	Assistance to physicians from facilitators in design and implementation of office routines and tools
Audit and feedback	Audit and feedback to physicians on their performance, and sometimes that of their peers

decided that it would be inappropriate and misleading to examine individual determinants in isolation, without using some form of multivariate analysis to consider the influence of confounding factors. Studies of interventions to increase uptake in the interventions section of the review (i.e. RCTs and controlled trials) must have controlled for the effect of the intervention in the multivariate analysis.

Exclusion criteria

- Studies of self-examination procedures such as breast self-examination (BSE) and testicular self-examination.

- Studies using the booking of appointments and reported intentions to attend screening as outcomes, as this may inadequately reflect actual practice and screening uptake.
- Studies where determinants and uptake were measured at the same time (e.g. cross-sectional studies).
- Studies where data on determinants were measured after participants had attended for screening (e.g. both case–control and cohort studies with retrospective collection of determinant data by self-report). The determinant status of participants needs to be ascertained prior to attendance for screening in order to eliminate the possibility of attendance having an influence on the level of determinants (e.g. a woman may be reluctant to attend for mammography as she perceives the procedure to be painful, but after attending she may decide that it is not painful).
- Studies where no form of multivariate analysis had been undertaken.

Inclusion criteria: studies of interventions to increase the uptake of screening

Types of intervention

All interventions, whether targeted at the population, health professional or the provision of the service, that aimed to increase the uptake of screening (or informed uptake). *Table 3* provides information on how the interventions were classified in this review.

Types of screening programme

All screening programmes that aimed to identify early the presence or absence of a specific condition, disease or disability during the presymptomatic phase or before clinical detection (including antenatal screening of parents). Universal, selective and opportunistic screening programmes were all included.

Types of participant

All people eligible to participate in a screening programme as defined by the entry criteria for that programme.

Types of outcome measure

Primary measures of screening uptake

- Screening uptake or non-uptake recorded by health service records (such as screening administration system, or hospital or GP records).
- Self-reported uptake or non-uptake of screening (such as telephone interview or questionnaire).
- Uptake versus informed uptake of screening.

For the purpose of this review, four criteria were used to determine whether the intervention was aimed at informing uptake, rather than just increasing uptake. Studies had to meet three or more of these criteria in order to be classified as informing uptake of screening. These criteria were based on those used in a systematic review of informed decision-making,[26] and from personal communication with the author of the review. The criteria were:

- Was the intervention described in sufficient detail to make an assessment of the information provided to the person undergoing screening?
- Was information provided on the benefits and risks of screening?
- Was knowledge assessed as well as uptake?
- Was informed decision-making assessed as well as uptake?

Intermediate measures of uptake (included in studies reporting primary outcome measures)

- Booking of appointments, reported intentions to uptake screening, attitudes to screening and knowledge of screening.

These data were extracted and reported in the systematic review providing contextual information to assess the effectiveness of the interventions.

Other outcomes (included in studies reporting primary outcome measures)

- Costs of the interventions.

Study design

Any experimental study that evaluated the effectiveness of an intervention(s) that was intended to increase the uptake of a screening programme using one of the following designs:

- RCTs.
- Quasi-RCTs (e.g. using pseudo-randomisation, such as alternation or date of birth).
- Controlled trials (non-randomised cohort with concurrent control).

Exclusion criteria

- Studies of self-examination procedures, such as BSE and testicular self-examination.
- Studies that only reported intermediate measures of screening uptake, such as booking of appointments, reported intentions to uptake screening, or attitudes to and knowledge of

screening. They were excluded from the review as they may inadequately reflect actual practice. Similarly, measures of accessibility and perceptions of barriers or motivations were excluded from the systematic review of interventions to increase uptake of screening programmes.

Data extraction and assessment of study validity

There were five stages to the review process.

Stage 1. Titles and abstracts of papers were screened by one reviewer, with a random sample (5%) of included and excluded papers checked by a second reviewer. Any disagreements were resolved through discussion.

Stage 2. Studies were independently prescreened for relevance by two reviewers (using the full report of the study). Any disagreements were resolved through discussion.

Stage 3. Data were extracted from relevant studies by one reviewer and checked by a second reviewer. Data from the included studies were extracted into data extraction tables (see appendix 2). Any disagreements were resolved through discussion with a third reviewer.

Stage 4. Information was also recorded relating to the methodological quality of each study. Validity checklists in CRD Report Number 4[58] were modified and the validity items were assessed for each study design (see below). Each item was graded as adequate (+), unknown, unclear or partial (±), or inadequate (–). The quality criteria were not used to obtain an overall quality score. Instead, the information was compiled into tables and the results reported descriptively in the text.

The criteria used for assessing the quality of **determinant studies** were as follows:

- What was the proportion of participants, from the initial sample, for whom information about determinants could not be collected?
- Were those assessing determinants blind to the uptake status?
- Were medical records or databases used to assess the uptake of screening?
- Was self-report used to assess the uptake of screening?
- Were medical records or databases used to assess the determinants of study participants?
- Was self-report used to assess the determinants of study participants?
- What proportion of participants, of known determinant status, were followed-up to ascertain their screening status?
- Where participants were lost to follow-up, was an adequate method used to deal with the missing data?

The criteria used for assessing the quality of **intervention studies** were as follows:

- Was the assignment to the intervention groups really random and was randomisation of the participants blinded (allocation concealment)?
- Were those assessing outcomes blind to the intervention allocation?
- Was relatively complete follow-up achieved?
- Were the outcomes of people who withdrew described and included in the analysis (intention to intervene)?
- Were the control and intervention groups comparable at entry?
- Was there adequate outcome measurement (verifiable data versus self-report)?
- Was the analysis appropriate (e.g. cluster randomisation taken into account in the analysis)?

Stage 5. Quantitative and qualitative synthesis, as applicable. Information was extracted from each study relating to the study population, study methods, follow-up and drop-out, assessment of outcomes, results, authors' conclusions and limitations. The data extraction forms are given in appendix 2.

Analyses

Determinant studies

The results from studies examining the association between determinants and screening uptake were presented in a narrative summary and, if possible, in a meta-analysis. Only data from multivariate analyses were included. Data on the measure of effect of each determinant in predicting screening uptake were extracted where possible, but as studies only reported data on those determinants found to be significant in univariate analyses this limited the amount of information that could be extracted. Authors were not routinely contacted for original or additional data. Some attempt was made to contact several authors, but no replies were received. Consequently, it was decided that the time and effort involved in writing to all the

authors concerned would result in little additional information.

Intervention studies

Data for the difference in uptake between the intervention and control groups at the end of the study period were extracted where possible. Only studies with one or more relevant interventions (i.e. direct comparisons only) were included in the sections of the relative effectiveness of different interventions.

Relative risks (RR) and 95% confidence intervals (CI) were calculated only for RCTs; data for all other studies were reported descriptively. Many of the studies, particularly those of physician or community interventions, randomised participants in clusters. The authors' RRs and 95% CI were reported if the data were correctly analysed using the same unit of allocation and analysis (e.g. the physician was both the unit of allocation and analysis). For studies where the unit of allocation (e.g. communities) was different from the unit of analysis (e.g. individuals), only RRs were calculated. CIs were not calculated in studies with such unit-of-analysis errors, as the CIs would be spuriously narrow. The exceptions to this were those where the unit of allocation was households, as the design effect due to clustering would be minimal. Therefore, for the purpose of this review, they were treated as if the individual rather than household had been randomised and both RRs and (95% CIs) were calculated.

RRs were calculated instead of odds ratios (OR), for several reasons. Firstly, the OR is an estimation of the RR in RCTs. Secondly, the OR and RR can be very different in clinical trials, especially when the baseline event rate is high (as in uptake of screening). Thirdly, RRs are more easily interpreted than are ORs.

Data on uptake were entered into the RevMan 4.0 software[59] and a random-effects model was used. It should be noted that when the figures are viewed, uptake is a beneficial outcome. Conventionally, RRs are calculated for adverse events and benefits of an intervention are shown to the left of the centre line. However, when the outcome is positive (e.g. uptake of screening), the intervention benefits are shown to the right of the centre line. Although the term 'relative risk' is used throughout this review, it is really **relative benefit**. A p value of less than 0.05 was considered to be statistically significant.

Initially meta-analyses were undertaken for all comparisons. To determine if differences among the results of the studies were greater than could be expected by chance, a test for heterogeneity was performed for all comparisons, using the RevMan 4.0 software. Significant statistical heterogeneity was found for all comparisons except one (physician reminders versus invitation letters). The heterogeneity could be due to differences in screening test, settings, population characteristics and the screening guidelines followed. RRs (and 95% CIs) were calculated for all comparisons where data from RCTs were available (see figures), but the results were only pooled for the comparison of physician reminders versus invitation letters. The results for the rest of the comparisons were reported narratively with diagrams displaying the RRs (95% CI) for each RCT. Intervention studies were grouped into those aimed at encouraging individuals to undergo screening, those aimed at encouraging practitioners to improve the uptake of screening and those which combined interventions for individuals and practitioners.

Chapter 3

Results of determinant studies

Potentially relevant studies were identified through screening over 46,000 titles or abstracts, of which 124 full paper copies were examined in further detail. In addition, all 190 intervention trials were examined for inclusion as determinant studies.

Excluded studies

Of the studies identified through screening, 78% (97/124) of abstracts or titles were excluded because, upon further examination, they were found not to meet one or more of the inclusion criteria. Tewnty-five per cent (24/98) of studies collected data on determinants after participants had attended for screening; 24% (23/97) did not use multivariate analyses; 19.5% (19/97) did not contain relevant data on determinants; 12% (12/97) were cross-sectional; 7% (7/97) looked at treatment and not screening tests; and 6% (6/97) did not examine both those who attended and those who did not; 6% did not use screening uptake as an outcome (6/97). The majority of intervention trials (152/190, 80%) did not contain any information about determinants or did not meet the inclusion criteria for determinant studies.

Included studies

After independent assessment by two reviewers, 62 studies were identified as meeting all the inclusion criteria. A further three studies were identified through examining the bibliographies of articles. In total, 65 studies (29 RCTs, eight controlled trials, four quasi-RCTs, 22 cohort studies and one case–control study) met all the criteria for determinant studies and were included in the review. Further details of the individual studies included are given in appendix 3.

Studies were categorised by disease or condition (i.e. breast cancer, prostate cancer, colorectal cancer, cervical cancer, HIV and other), and within these categories further subdivided into the specific screening test used. The overall findings relating to the statistical significance of factors determining the uptake of screening were discussed under five headings:

- socio-demographic
- knowledge, behaviour, attitudes and beliefs
- barriers and facilitating conditions
- social influences
- health status.

Box 1 provides examples of how the determinants were categorised. Often, no detailed information was available about the factors examined (e.g. social support or family environment), especially when the variables were found not to be significant predictors of attendance. In such instances the terms used by the authors in the original papers were used and no attempt was made to interpret them.

The studies varied in their settings, population characteristics, the screening guidelines followed and the specific determinants investigated. These factors led to considerable heterogeneity between the studies, making statistical pooling inappropriate. More importantly, problems were also encountered when considering the results of the multivariate analyses. Typically, in these studies univariate analyses were first performed to identify candidate variables for inclusion in the multivariate model. In the majority of cases studies failed to provide information about those factors that were found not to be significant in the univariate analyses and thus were not entered in the multivariate model. Statistical pooling of studies could lead to misleading results, and consequently the results of determinant studies are reported narratively.

Summary conclusions were highlighted within the text where determinants were judged to be 'important' (i.e. they were investigated in more than three studies, the majority of which found the determinant to be significant). This three-study threshold was selected arbitrarily, partly based on comments from the review's expert panel of advisors, in an attempt to summarise the vast amount of data collected. Consequently, the implications of the threshold must be borne in mind when interpreting the review findings.

Quality of the included studies

Interpretation of the review findings depends on the validity of the included studies. The inclusion

criteria adopted in this review ensured that only studies within the highest level of the design hierarchy were included in the review (i.e. RCTs, quasi-RCTs, controlled trials, cohort and case–control studies). In addition, only those studies that assessed determinants using some form of multivariate analysis, which limits the effect of confounding variables and assesses the effect independent of other factors, were included. The review therefore considered the best-quality evidence available. However, differences between studies were identified when individual-study quality was assessed using the quality criteria listed below (see chapter 2). A summary of the overall quality of the studies is shown in *Table 4*. Further details of individual-study quality are given in appendix 4. It is important to note that the criteria used to assess the validity of determinant studies differed somewhat from those used to assess intervention trials. Randomisation and intervention allocation, for instance, are important considerations for the intervention trials, but when analysing determinants all participants are considered regardless of their intervention status, as in a cohort study, with the intervention effect being controlled for in the multivariate model.

Non-participation rate

Non-participation was defined as eligible participants who were approached but not included in the study. A large proportion (21/65, 32%) of the included studies failed to provide details of non-participation rates or how their study sample was derived from the target population.[60–77] For those studies (44/65, 68%) where sufficient information was available, the non-participation rates varied between 0% and 86%, with the majority of studies having non-participation rates of between 1% and 49% (26/65, 40%).[78–103] A 0% non-participation rate was only achieved in 11 out of 64 studies (17%).[104–114] Seven of the 65 included studies (11%) had non-participation rates of 50% or more, which could have consequences for the external validity of their results.[115–121] Where non-participation rates were high it is possible that those who participated in the study were more agreeable to attending screening or differed in a number of other ways from those who did not participate. Four of these studies [115,116,118,120] did find significant differences between those who participated and those who did not, but only one considered how this might affect the validity of their results.[118] The remaining three studies made no attempt to investigate the consequences of their high non-participation rates. However, one study highlighted inaccurate population registers as a contributing factor in their high non-participation rate.[119] This was also cited as a problem in one other study, which failed to report a non-participation rate.[72] Both these studies focused on

BOX 1 Examples of determinants and their classification into the five categories discussed in chapter 3

Socio-demographic
- Age
- Gender
- Education
- Income
- Ethnic origin
- Employment status
- Insurance status
- Sexual orientation

Knowledge, behaviour, attitudes and beliefs
- Knowledge of disease
- Knowledge of screening test
- Knowledge of screening guidelines
- Past screening behaviour and attendance for tests
- Tobacco, alcohol or drug use
- Perceived seriousness of disease or condition for which being screened
- Expressed intention to attend screening
- Participation in regular exercise

Barriers and facilitating conditions
- Lack of transport
- Costs involved in attending screening
- Inconvenience
- Embarrassment of attending and undergoing screening procedure
- Fear of finding test positive
- Fear of pain or discomfort of test procedure
- Inconvenience
- Recommendation by physician or other healthcare professional

Social influences
- Knowing someone with the disease or condition
- Support of family, friends, or significant others
- Support of physician or other healthcare provider
- Membership of a club, church or other organisation
- Knowing someone who has been screened

Health status
- Family history of the disease or condition
- Experiencing symptoms of the disease or condition
- Type of visit to healthcare provider (e.g. gynaecological, hospital)
- Number of previous visits to doctor
- Self-reported health status
- Able to perform activities of daily living

TABLE 4 *Summary of the quality of included studies*

Quality criteria	No. of studies
Non-participation rate (i.e. number of participants who did not have information available on their determinants):	
0% non-participation	11/65 (17%)
1–49% non-participation	26/65 (40%)
≥ 50% non-participation	7/65 (11%)
Insufficient information provided	21/65 (32%)
Blinding (i.e. assessors were blinded to the treatment allocation):	
Blinded	2/65 (3%)
Not blinded	1/65 (1.5%)
Insufficient information provided	62/65 (95.5%)
Assessment of screening uptake (i.e. self-report vs. medical records or databases):	
Self-report	11/65 (17%)
Medical records or databases	42/65 (65%)
Both the above	5/65 (8%)
Insufficient information provided	7/65 (10%)
Assessment of screening determinants (i.e. self-report vs. medical records or databases):	
Self-report	51/65 (78%)
Medical records or databases	9/65 (14%)
Both the above	2/65 (3%)
Insufficient information provided	3/65 (5%)
Follow-up rate (i.e. proportion of participants included in the final multivariate analysis):	
100% follow-up	23/65 (34%)
80–99% follow-up	15/65 (23%)
51–79% follow-up	15/65 (23%)
≤ 50% follow-up	4/65 (6%)
Insufficient information provided	8/65 (12%)
Adequate method used to deal with participants lost to follow-up:	
Adequate method used or not applicable (i.e. follow-up was 100%, or before and after survey used)	30/65 (46%)
No adequate method used	24/65 (37%)
Insufficient information provided	11/65 (17%)

the UK Breast Screening Programme, which uses a call–recall system to prompt women to attend for screening mammograms by using mailed reminders. Inaccuracies in such call–recall systems may have important implications in non-attendance for screening. A number of the other studies also focused on national screening programmes using call–recall systems, but this was not mentioned as a contributing factor in their non-participation rates.[62,71,79]

Blinding

'Blinding' refers to concealing data, on the presence or absence of the determinants being assessed, from the investigators that are measuring the outcome of screening uptake. Only two of the studies stated that the investigator was blinded, and these were both controlled studies.[88,89] The majority of studies (61/65, 95.5%) failed to provide sufficient information to determine the status of the investigator. Only one study

specifically stated that blinding did not occur.[84]

Assessment of screening uptake

Screening uptake can be measured by self-report (i.e. asking the participant whether they attended or not) or by using medical records or databases. Both these sources of information can be flawed, and thus jeopardise the validity of the data. Eleven of the studies (11/65, 17%) used self-reported data, which may be subject to recall bias.[69,70,78,81,83,85,86,88,90,95,98] Individuals may also be more likely to report results that suggest a more favourable outcome, when asked about their screening behaviour, which again could bias the data. The majority of studies (42/65, 64%), however, relied on administrative records or databases, which avoid the problem of recall bias, but can also be flawed if data are missing or inaccurate due to administrative errors. Five of 65 studies (8%) collected information on uptake rates using both methods.[89,105,115–117] Only two of the studies mentioned finding any differences between the two sets of data, one noting evidence of women reporting they had attended for a Pap smear when records suggested they had not, and the other showing less than 1% discordance between the two sets of data for HIV tests.[105,115] Seven of 65 studies (10%) failed to report the method used to determine screening uptake.[62,65,71,84,94,97,122]

Assessment of determinants

In a similar manner to measuring screening uptake, data on the determinant status of participants can be collected by either self-report or medical records or databases. Problems of recall bias and administrative inaccuracies similar to those discussed previously exist. However, in this situation self-report has the advantage of being more flexible with regard to the type of information available for analysis. Self-report allows data to be collected on individual's perceptions, attitudes and beliefs, which are characteristics that are rarely recorded in administrative records or databases. The majority of studies in this review used data from self-report (51/65, 78%) and only nine of 65 studies (14%) relied on medical records or databases alone.[60,61,71,79,80,91,93,106,109] Two of the studies used both data-collection methods.[96,103] The remaining three studies failed to report the method used.[62,65,99]

Follow-up rate

Follow-up was classified as the number of participants that were included in the final multivariate analysis. Those participants not included in the final analysis may have been omitted due to the absence of information about the determinant being assessed or the screening outcome. Overall, the follow-up rate varied between 29% and 100%. Only four studies had a follow-up rate of less than 50%.[70,77,90,103] The remaining studies had follow-up rates of 51–79% (15/65, 23%) and 80–99% (15/65, 23%). Twenty-three studies had follow-up rates of 100%.[68,71–73,76,85,87,91,94,96,101,102,104,106,107,109,110,112,114,119,121,123,124] Those studies that had a high follow-up rate tended to use smaller sample sizes; thus they lacked power and may not be very representative of the target population. Nine of the studies that had follow-up rates of 95% or more, however, included less than 300 participants.[73,76,91,94,101,106,113,118,121] It was not clear in eight of 64 studies (12%) how many of the original participants were included in the final analysis.[62–65,74,84,111,120]

Adequate method used to deal with participants lost to follow-up

Where studies fail to include all of the original participants in the multivariate analysis it is important to assess how this will affect the validity of the results. This can be achieved by substituting missing results with mean results, or assessing how incorporating various substitute data affects the overall robustness of the results. At the very least studies should investigate whether those who were dropped from the final analysis varied from those who were included in any significant characteristics that may influence the validity of the final conclusions. Five studies (5/65, 8%) succeeded in identifying how losses to follow-up may have affected their data.[78,88,90,108,122] Three substituted mean values for the missing data,[88,90,122] and two identified that participants not included in the final analysis were significantly less likely to attend screening.[78,108] In addition, this quality criterion was not applicable to a further 26 studies (26/65, 40%) as all the participants were included in the final analysis or before and after cross-sectional surveys were used to collect data. Eleven of 65 studies (17%) failed to supply sufficient information to determine whether losses to follow-up had been considered.[61,63–65,74,75,100,104,111,116,119] The remaining 22 studies failed to take into account the possible effects of participants lost to follow-up.[66,69,70,77,80–84,86,89,92,93,95,98,99,105,113,115,117,118,120]

Screening tests for breast cancer

Thirty-four studies (16 RCTs, four controlled trials, four quasi-RCT studies, nine cohorts and one case–control study) looked at breast cancer screening tests. The majority of the studies were published within the last 5 years (19 studies), with

15 published prior to 1994, including two published in 1988–1989.[74,111] The studies concentrated mainly on the use of mammograms (34 studies), with only one study investigating the uptake of clinical breast examination (CBE).[84]

Mammography

Twenty-nine of the studies looking at mammography were undertaken in the USA.[60,61,65–67,69,74,75,78,81,83–86,88–91,95,97,98,106,108,111,113,116–118,122] Two of the studies were carried out in the UK,[72,119] two in Australia[63,64] and one in Italy.[71] One RCT specifically looked at physician factors and how interventions aimed at physicians affected mammography attendance.[66] This study collected data from the physicians rather than the patients and so is discussed in more detail in the section relating to healthcare-provider factors. The remaining studies looked at determinants relating to the study participants.

The studies were carried out in a variety of settings, including: health maintenance organisations (HMOs);[60,61,65,74,75,108,118] communities;[64,78,81,83,84,90] primary-care practices;[60,66,67,86,89,98,106,113,116,119,122] community screening programmes;[63,71,72] hospitals;[111,117] universities;[69,97] senior citizens' housing;[85] family practice residency training clinics;[91] workplaces;[95] and the US Cancer Information Service.[88] Some studies also focused on individuals from predominantly ethnic-minority groups, including black African-Americans,[84,89,113,122] Hispanics[81,113] and Native Americans.[89] Populations from low socio-economic areas were also featured in five of the studies.[67,81,113,117,122]

In the UK, current breast screening recommendations suggest women aged between 50 and 64 years attend for mammograms, which are performed free of charge, every 3 years. In the USA guidelines from the American Cancer Society and the National Cancer Institute recommend that women aged between 40 and 49 years obtain a mammogram every 1 or 2 years, and women over 50 years of age annually. In Australia women over 40 years of age are eligible for free mammograms through the National Program for the Early Detection of Breast Cancer, although only women aged between 50 and 69 years are actively recruited into the programme. A large number of studies (16/34, 47%) included women aged 40 years or over,[60,61,65,66,74,78,83,88–91,95,97,98,113,118] while eight (24%) only looked at women aged 50 years or more.[66,72,75,81,91,111,116,122] Older women (> 60 years) were targeted in three studies.[67,85,117] Three of the American studies included women who were below the recommended age for screening, which may bias the results of the studies as these women would not need to attend screening.[69,86,106] One study failed to state the age range of the included participants, although it did state that the study looked at older women.[84]

The determinants that were investigated in the studies and their influence on the uptake of mammography are summarised in *Table 5*.

Socio-demographic determinants

The majority of the studies investigated whether at least one or more demographic variables was associated with the increased uptake of mammography. Patient **age** was examined in 31 of the studies.[60,61,63,64,67,69,71,72,74,75,78,81,83–86,88–91,95,98,106,108,111,113,116–119,122] Twelve of these studies found significant associations between age and attendance for mammography.[60,61,67,72,74,78,85,88,89,91,106,108] There was no overall agreement between the studies as to whether older or younger women were significantly more likely to attend for mammography. Studies varied in the age of the populations they studied and whether they used age categories in their analyses, or considered age as a continuous variable. Those who categorised age often varied in the age ranges they used. Mammography screening guidelines vary with age, and the guidelines themselves vary from country to country. The younger women included in the studies may not have required mammograms as frequently, or may not even have been within the age recommended to attend for screening.

In conclusion, the majority of studies did not find an association between the uptake of mammograms and age, and those that did reported conflicting effects.

Participants' **race or ethnic origin** as a predictor of screening uptake was considered in 15 studies.[67,69,78,81,89–91,95,98,111,116–119,122] Five of the studies identified it as significant predictor of screening.[67,89,98,119,122] A cohort study based in the UK found that black women were more likely to attend for screening than were women who were Asian or of another race (OR = 4.44; 95% CI, 1.28 to 15.41).[119] Another study reported the results of an RCT within communities in North Carolina, USA.[98] Although baseline levels of screening attendance were higher than expected, multivariate analyses indicated a strong interaction between women of black ethnic origin, and the intervention group to which women were assigned. This interaction was significantly predictive of attendance. African-American (versus white) women were found to be significantly more likely to attend in one quasi-RCT.[89] The same study found that Native

TABLE 5 *Summary of evidence from mammography studies (n = 34)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
Individuals with the following determinants are more likely to attend screening:			
Socio-demographic	Having insurance	58% (7/12 studies)	
	Being black	20% (3/15 studies)	
	Being African-American	7% (1/15 studies)	
	Being white	7% (1/15 studies)	
Knowledge, behaviour, attitudes and beliefs	Having had a previous mammogram	65% (13/20 studies)	
	Expressing an intention to attend screening	54% (6/11 studies)	
	Having had a previous Pap smear	33% (1/3 studies)	
	Perceiving own health to be poor	25% (1/4 studies)	
	Knowing about mammograms	20% (1/5 studies)	Study set in a large utility company
	Perceiving self to be susceptible or vulnerable to cancer	12% (1/8 studies)	
Health	Visited GP ≤ 7 times in preceding year	40% (2/5 studies)	
	Having a family history of breast cancer	33% (3/9 studies)	
	Being at moderate risk of breast cancer developing	33% (1/3 studies)	
	Having a history of ≥ 2 major illnesses	25% (1/4 studies)	Only found to be significant at one of two study locations
	Having a history of breast cancer	25% (1/4 studies)	
Health	Visiting GP 4–6 times in preceding year	20% (1/5 studies)	
Barriers and facilitating conditions	Receiving recommendation from doctor	50% (2/4 studies)	
	Being worried about breast cancer	20% (1/5 studies)	
Individuals with the following determinants are less likely to attend screening:			
Socio-demographic	Being Native American	7% (1/15 studies)	
Knowledge, behaviour, attitudes and beliefs	Being a smoker	33% (1/3 studies)	
Barriers and facilitating conditions	Having concerns about radiation and mammography	20% (1/5 studies)	
Determinants where the effect on screening attendance is unclear (i.e. studies found positive and negative effects):			
Socio-demographic	Age	39% (12/31 studies)	Not clear whether older or younger women more likely to attend
	Being single, divorced or widowed	27% (3/11 studies)	
	Having a higher level of education	17% (3/18 studies)	

[*] *A summary of the determinants, that were investigated in three or more studies, and their influence (positive or negative) on the uptake of mammography*
[**] *Level of significance* $p \leq 0.05$

American women (versus white women) were significantly less likely to attend (OR = 0.64; 95% CI, 0.42 to 0.97). Among a sample of older (65–85 years) women in a low socio-economic, minority area of the USA, one RCT reported that women who were white (versus non-white) were four times more likely to attend for screening (OR = 4.23; 95% CI, 1.58 to 11.39).[67] Lastly, one study that also included participants from a low socio-economic, minority area found that black women ($p = 0.04$) were significantly more likely than white women to have had a mammogram in the past 24 months.[122]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and ethnic origin, but several studies reported a higher uptake among black women.

Eleven of the included studies investigated the possibility of an association between participants' **marital status** and their attendance for screening.[71,78,90,91,95,108,113,117–119,122] Three studies found a significant relationship.[71,108,119] The UK-based cohort study reported that participants who were married or single were significantly more likely to attend for screening than were divorced, separated or widowed women (OR = 2.30; 95% CI, 1.36 to 3.89).[119] This study included two cohorts and used different data-collection methods (interview and postal questionnaire) for each. Marital status was only a significant factor among women who were sent postal questionnaires (a response rate of only 36%). Women who had never been married were significantly less likely to obtain a mammogram in another cohort study carried out in the USA ($R^2 = 0.26$, where R is the regression coefficient; $p = 0.01$)[108] and an RCT based in Italy (single women, RR = 0.74; 95% CI, 0.66 to 0.83; widowed or divorced women, RR = 0.92; 95% CI, 0.86 to 0.99).[71]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and marital status.

The level of **education** attained by women was considered to be a potentially relevant factor in 18 studies.[63,64,71,78,81,83–85,88,90,95,98,108,116–119,122] Three studies found it to be significantly predictive of screening behaviour.[64,71,108] Two of these studies found that women who were more educated were significantly more likely to attend for screening.[71,108] A cohort study of American women over 40 years of age found that attendance increased among those who were better educated ($R^2 = 0.23$; $p = 0.01$),[108] and an RCT based in Italy reported that women who had attended school for less than 5 years were significantly less likely to obtain a mammogram (RR = 0.64; 95% CI, 0.55 to 0.75).[71] However, the remaining study, which was based on a cohort of Australian women, reported that women who were better educated were significantly less likely to attend for a mammogram (OR = 0.65; 95% CI, 0.44 to 0.96; measured between each level of education).[64]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and level of education.

Insurance status was investigated in 12 studies, all undertaken in the USA.[60,61,65,69,78,84,89–91,113,116,118] In the USA, fees are charged for all aspects of healthcare, including preventive screening tests, and for this reason health insurance is considered to be a factor likely to influence uptake. Seven of the studies identified it as a significant predictor of mammography uptake.[65,78,84,89,91,113,116] One study reported that computerised reminders were significantly more likely to increase mammography attendance in women who had Medicaid or Medicare insurance (OR = 2.8; 95% CI, 1.6 to 5.0) versus those who had commercial insurance plans (OR = 4.1; 95% CI, 1.8 to 9.2).[65] However, this study did not provide any information on the non-participation rate or the number of participants lost to follow-up, which are two important factors in assessing the quality of the study. Two other studies found that women who had any type of health insurance were significantly more likely to attend for screening (OR = 4.20; 95% CI, 1.70 to 10.35) than were those women who had no insurance (OR = 6.29; 95% CI, 1.06 to 37.34).[78,113] One of these studies featured a predominantly low-income, migrant population,[113] while the other[78] used a predominantly white, well-educated and high-income population. However, the second study found significant differences in the demographic characteristics of participants included in the final analyses and those lost to follow-up (22%).[78] A quasi-RCT based in the USA reported that having Medicare insurance versus no insurance was significantly predictive of attendance for Native American women and minority women who were in the intervention group receiving support from lay health advisors (OR = 1.80; 95% CI, 1.01 to 3.19).[89] Women in the single-practice cohort study who had Medicare insurance alone or no insurance were significantly less likely to obtain a mammogram (OR = 0.39; 95% CI, 0.15 to 0.99).[116] However, this study reported a 54% non-participation rate, and those who did not take part might have differed from those who did. Medicaid and no insurance were significantly associated with

increased mammography attendance in another study, which featured a case–control study conducted in a single family practice, recruiting women who were already attending for Pap smears (OR = 0.32; 95% CI, 0.21 to 0.48).[91] Women in the predominantly older black American cohort study, were significantly more likely to attend for screening if they had HMO insurance (OR = 0.39; 95% CI, 0.20 to 0.76) versus Medi-Cal or any other insurance (OR = 0.54; 95% CI, 0.31 to 0.94).[84]

In conclusion, the majority of studies found a significant association between the uptake of mammograms and insurance status. Those who had some form of insurance were, in general, more likely to attend than those who did not.

One Italian study found that women who were **born in the south of the country** were more likely to attend for screening.[71] The study did not discuss this finding in further detail, and so it is unclear whether it may be linked to other variables such as the socio-demographic characteristics of that region.

A number of other variables were examined, but were found not to be significant in predicting attendance, including: **income**;[78,90,95,98,108,113,117,122] **distance from screening clinic**;[113] **residential postcode area**;[63] number of years of **residence in country** of study;[113] **religion**;[95,119] **height and weight**;[119] **language spoken**;[64] **number of children**;[119] **living status** (i.e. whether they lived alone or with another person);[117] **home ownership**;[119] speaking a **second language**;[63] **car ownership**;[117] **employment status**;[63,64,69,117,118,122] **occupation**;[119] and **partner's occupation**.[119]

Determinants relating to knowledge, behaviour, attitudes and beliefs

Women's knowledge, attitudes and beliefs, and previous health-related behaviours might play a role in predicting their uptake of screening. Several of the studies investigated whether a woman's **knowledge** about breast cancer and mammography were predictive of her screening behaviour. None of the four studies that examined **breast cancer knowledge** found it to be significant.[64,95,98,117] Knowing about **mammography and screening guidelines** was in general not predictive of attendance.[63,78,90,98] Only one study, involving women working for a large utility company, found that those who were knowledgeable about mammography were more likely to attend for screening ($R^2 = 0.25$, $p < 0.07$).[95] **Having recently heard or read anything about breast cancer**[95,119] was not significantly predictive of attendance, nor was being able to **recall the name of the healthcare professional** providing the test.[118] Knowing the **location of the clinic** performing the screening tests, however, was a significant predictor among Australian women living in a rural area of Victoria served by a mobile screening service.[63]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and knowledge about breast cancer or mammography.

A woman's **past mammography behaviour** may also be an important factor. Of the 20 studies that assessed this variable,[60,61,63–65,67, 69,75,78,81,85,90,95,97,98,106,108,117–119] 13 found it to be a significant predictor of future screening behaviour.[61,63–65,67,75,78,81,85,90,95,118,119] Two of the studies were Australian[63,64] and one was a UK study.[119] The remaining studies were from the USA.[61,65,67,75,78,81,85,90,95,118] Four of the studies were cohorts,[63, 64,118,119] eight were RCTs[61,65,67,75,78,81,85,90] and one was a quasi-RCT.[95] A number of different populations were studied, including: those with predominantly rural participants;[63] older women;[67,81] low-income women;[67,81] and black, unemployed women.[118] All the studies showed that those women who had attended for mammograms in the past were significantly more likely to return for future mammograms. The **outcome of previous mammograms** was not found to be significant in a study of women in communities around Melbourne, Australia.[64] A further cohort study set in an HMO in the USA also found no significant association between attending for mammography and having a **screening routine or 'habit'** in place.[108]

In conclusion, the majority of studies found that women who had previously attended for screening (as compared with those who had not) were significantly more likely to attend for further mammograms.

Attendance for other screening tests and **attendance for regular general health checks** were also investigated to determine whether they were predictive of mammography uptake. One study found that among low-income, minority women previous attendance for general health tests was significantly predictive of attendance for mammography (OR = 4.7; $p < 0.001$).[81] Five studies looked at whether previous screening behaviour including **attendance for Pap smears, CBE and dental checks**, was a significant factor in determining mammography uptake.[64,81,91,108,119] One found that women who had previously attended for CBEs were significantly more likely to attend for a mammogram (OR = 3.2; $p < 0.001$).[81] Previous attendance for

smear tests was also found to be significantly predictive of mammography attendance in the inner-city cohort study carried out in the UK (this study included two data-collection methods: women sent postal questionnaires (OR = 3.14; 95% CI, 1.52 to 6.49); women who were interviewed (OR = 2.55; 95% CI, 1.06 to 6.13)).[119] The response rate for the postal questionnaire used in this study was only 36% and women who did not participate might have differed from those who did. **Regular BSE**, however, was not found to be significantly predictive of screening uptake in any of the five studies that looked at this variable.[106,117–120] One cohort study did, however, find that women who were **less confident about recognising changes in their breast** were more likely to attend than those who had more confidence (discriminant function –0.23).[83] However, the study featured a very small sample size (n = 395) that consisted of women randomly chosen from a telephone directory. The study also had a 49% non-participation rate, and those who refused to participate might have differed from those who did.

In conclusion, it was not clear whether attendance for other screening tests (e.g. Pap smears, CBE and dental checks) was significantly associated with the uptake of mammograms. In addition, the majority of studies suggested that there was no significant association between uptake and regular BSE.

Smoking has been identified as a particular risk factor for breast cancer. Three studies investigated whether smoking was predictive of screening uptake.[75, 117,119] Only one of these studies found a significant association.[75] Those women who currently smoked were significantly less likely to adhere to screening than those who did not (OR = 0.48; 95% CI, 0.37 to 0.63). This study was carried out in a group health co-operative (HMO) in the USA and predominantly featured women who were white and of higher socio-economic status and education level than the general population.

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and smoking.

Two studies investigated the effect of **alcohol consumption** on attendance.[117,119] However, only one of the studies found this variable to be significantly predictive.[119] The authors reported that within an inner-city population of women in the UK, women who consumed alcohol at least once a month were more likely to obtain a mammogram than those who did not (OR = 1.83; 95% CI, 1.04 to 3.23).

Other behavioural characteristics investigated by the studies included in this review, but found not to be significant in predicting mammography attendance, included **seat-belt usage**[108] and **calling a health-information line**.[88]

Attitudes and beliefs have been investigated as factors that could potentially affect women's screening behaviour. **Intention** to attend screening was considered to be a potentially important variable in 11 studies.[63,64,69,78,81,85,90,95,97,118,119] Women who had a positive attitude towards screening and showed an intention to attend were found to be significantly more likely to attend in six of the studies.[63,64,69,81,85,95] These studies were conducted in a variety of settings, both in the USA[69,81,85,95] and in Australia.[63,64] Different populations, such as low-income groups,[81] those working in a university environment[69] and individuals working for a large American utility company,[95] all showed a similar significant association. The association between intention and attendance was found to be significantly related to a change in **decisional balance** in two RCTs.[81,122] 'Decisional balance' relates to how a participant's attitude and intention to attend varies over time. In one study the change in participants' decisional balance was followed over a 2-year period after intervention, and it was found that decisional balance was positively and significantly associated with attendance (OR = 1.07; $p < 0.001$).[81] This corresponds to a 7% increase in the odds associated with attendance for each one-point increase in the decisional-balance score. The other study also found that all the decisional-balance items and overall decisional-balance scores were significantly related to having had a recent mammogram ($p = 0.001$).[122] Individuals with a higher **overall general health motivation**, however, were not found to be significantly more likely to attend screening in a USA cohort study.[83]

In conclusion, the majority of studies found that women who expressed an intention to attend for screening were significantly more likely to attend for mammograms.

How **vulnerable or susceptible** a woman perceived herself to be was investigated in eight studies.[63,64,78,83,90,108,118,119] Only one study found this to be a significant predictor of attendance, with women who perceived themselves to be at least at some risk of developing breast cancer being more likely to attend for screening than those who did not have any perception of being at risk

(OR = 2.73; 95% CI, 1.07 to 6.99).[64] Two studies investigated women's perception of the seriousness of breast cancer.[83,108] This was not a significant variable in one of the studies,[108] but in the second study women who perceived breast cancer to be a serious disease with serious consequences were more likely to attend for screening than those who did not (discriminant function 0.18).[83] These findings, however, are based on a small sample (n = 395) of women who were randomly chosen from a telephone directory. The study also reported a 49% non-participation rate, and those who refused to participate might have differed from those who did.

In conclusion, the majority of studies did not find an association between the uptake of mammograms and perceived vulnerability or susceptibility to disease.

If women **perceived themselves to be in fair or poor health** they were found to be significantly less likely to attend for mammography in one HMO-based study (OR = 0.63; 95% CI, 0.45 to 0.90).[75] The women in this study were predominantly well-educated and White. Three further trials looked at this factor but failed to find a significant association.[84,95,119] One of the three studies did, however, report that women who perceived regular breast screening to be as important as a regular Pap smear were significantly more likely to attend (OR = 3.02; 95% CI, 1.14 to 7.96).[119] The study included two separate data-collection methods (postal questionnaire and interview), and this factor was only found to be significant among women who were interviewed.

A number of other variables relating to women's attitudes, beliefs and behaviour were examined but were not found to be predictive of mammography attendance. These included: the perceived seriousness of a positive screening test result;[63,119] the **perceived curability of breast cancer**;[98,118] the **perceived effectiveness of breast cancer screening**;[63,78,90,98,108,118,119] the **perceived benefits of having a mammography**;[72] the **perceived self-esteem** of the woman;[72] and regular **exercise**.[108, 119]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and perceived effectiveness of breast cancer screening.

Determinants relating to barriers and facilitating conditions

A number of potential barriers and facilitating conditions that may influence women's decisions to attend breast cancer screening were investigated in nine studies.[63,64,75,78,85,90,98,117,119] Factors that appeared to be important included women's **concern about radiation**[63,78,90,98,117] and the **fear of finding cancer**.[63,78,90,98,117] Radiation exposure was reported as a significant barrier by one RCT of predominantly white women living in an inner-city area of the USA.[78] Women who were greatly concerned about radiation exposure during a mammogram were approximately two and a half times less likely to obtain a mammogram than those women who were unconcerned (OR = 0.42; 95% CI, 0.27 to 0.66). However, this study reported a significant difference in demographic characteristics of participants in the final analysis and those lost to follow-up (22%). The fear of finding cancer was only found to be a significant factor in one study.[119] Women who were only 'a bit' worried about developing breast cancer were three times more likely to attend screening than those who reported that they were either 'very' or 'quite' worried (OR = 2.99; 95% CI, 1.32 to 6.77).[119] However, the study included two separate data-collection methods (postal questionnaire and interview) and this factor was only found to be significant among women who were interviewed.

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and concern over finding cancer or fear of finding cancer.

How accessible the women found the screening programme was not a significant factor in determining whether women attended for screening.[64,85] However, one study found that among a population of mainly white, well-educated women attending a HMO, those who **lived over 45 minutes away** from the screening clinic were significantly less likely to attend (OR = 0.44; 95% CI, 0.31 to 0.62).[75] The **discomfort of mammography**,[63,98,117] the **embarrassment** of being screened[63,117] and the **length of time that women had to wait before their appointment**[75] were found to be non-significant.

Conditions that were considered to encourage women to attend for mammogram were also examined. Women who participated in two cohort studies in the USA were significantly more likely to adhere to screening guidelines if they received a **recommendation from their healthcare provider** (discriminant function 0.94; OR = 1.99; 95% CI, 1.05 to 5.93).[83,118] However, the findings of one study are based on a small sample of women (n = 395) who were chosen from a telephone directory.[83] Both studies also reported high non-participation rate (49%[83] and 57%[118]) and

those who refused to participate might differ from those who did. Two further studies also examined this variable but found it not to be significant.[90,117]

In conclusion, it was not clear whether recommendations from healthcare providers were significantly associated with the uptake of mammograms.

A combined approach was used in two studies to examine the importance of benefits and barriers to attendance.[108,118] The studies examined whether a **combination of various barriers or facilitators** rather than specific individual components had any effect on women attending for screening. One study[118] found no significant association with combined barriers or facilitators, while the other reported a significant association among women belonging to an HMO ($R = 0.17$; $p < 0.01$).[108]

Perceived benefits and barriers were found not to be predictive of screening uptake in one study based in Australia.[64] A study based in the USA also found that '**peace of mind**' was not a significant factor in predicting screening behaviour in a cohort of predominantly black, unemployed women attending an HMO.[118] However, this study also reported a high non-participation rate (57%).

Determinants relating to social influences

Sources of social influence that might potentially affect a woman's decision to obtain a mammogram include **healthcare professionals**,[63,108] other **household members** also taking part in screening,[64] **significant others**[63,108] and **friends and family**.[63,72,108] None of the studies found social support of any kind to be significantly predictive of screening behaviour. The studies primarily examined Caucasian populations, and did not feature investigations of women from ethnic minorities or those from low socio-economic areas. **Social support** in general was also not found to be predictive of attendance.[64]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and social support from friends and family.

Social-network characteristics were examined among predominately black American women (aged > 55 years) in one cohort study.[84] These variables were measured using the **Social Network Index**.[125] This considers four different types of social variable: marital status, the number of relatives and friends described by the respondents as being close, church participation, and participation in other organisations. Women who had a higher Social Network Index were significantly more likely to attend for screening (OR = 1.27; 95% CI, 1.01 to 1.61). This suggests that older women with larger social networks are more likely to obtain a mammogram, as compared to those with small social networks. When analyses were carried out separately on the different components of the index, only the number of friends and relatives and church participation remained statistically significant ($p < 0.05$ and $p < 0.01$, respectively).

Three studies examined whether particular characteristics of the healthcare provider were predictive of attendance.[86,111,116] Of the studies that looked at the influence of the **gender of the healthcare provider**,[86,111,116] one found that there was a significant association.[111] This study was based in an American hospital, but used a relatively small sample ($n = 395$) to examine the effect of interventions aimed at increasing screening attendance. One further study found the **level of training** possessed by the healthcare provider to be significant in a cohort of women attending a single urban general practice in the USA.[116] Women were significantly less likely to attend if the mammography was recommended by a resident physician (OR = 0.49; 95% CI, 0.27 to 0.92) or a nurse practitioner (OR = 0.30; 95% CI, 0.10 to 0.92) as opposed to an attending physician.

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and gender of the healthcare provider.

Whether women **knew someone, either a friend, a relative or another person, who had breast cancer** and whether this was influential in determining their screening behaviour was investigated in two studies.[63,119] One of these studies, based in the UK, found that women who knew someone with breast cancer were significantly more likely to attend for screening (OR = 1.70; 95% CI, 1.04 to 2.78).[119] However, the study included two separate data-collection methods (postal questionnaire and interview) and this factor was only found to be significant among women who were interviewed. In the same study the investigators found that **knowing another person who had gone for screening** was not predictive of screening behaviour.

Determinants relating to health status

Determinants relating to women's health status were investigated in many of the studies included in this review and a wide variety of characteristics were examined. These can be classified into those

characteristics that are directly related to cancer in terms of risk factors, symptoms and previous history of cancer, and those relating to general health factors such as the number of visits to the healthcare provider and history of major medical problems.

Four studies examined whether women with a **previous history of cancer** were more likely to attend for screening,[64,83,95,119] and two studies whether a **history of breast lumps** was significant.[63,74] Only one of the studies found that women with a previous history of cancer were significantly more likely to attend for a mammogram (discriminant function 0.19, $p < 0.05$).[83] However, the findings are based on a small sample ($n = 395$) of women who were randomly selected from a telephone directory. The study also reported a 49% non-participation rate and those who refused to participate might have differed from those who did. Another study reported that women in an HMO-based study who had a previous history of breast lumps were significantly more likely to attend than those who did not (OR = 1.36; 95% CI, 1.02 to 1.81).[74]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and previous history of cancer.

Nine studies investigated whether **family history of cancer** was a predictive variable of attendance.[63,74,75,78,90,91,95,97,106] Three of these studies found it to be significant.[74,91,106] One of the studies was based in an HMO,[74] another in a family practice residency training programme[91] and the third in a medium-sized medical centre.[106] All three were based in the USA and found that women who had a family history of cancer were significantly more likely to attend for screening.

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and having a family history of cancer.

The presence of **risk factors for breast cancer**[60,74,98] and the **presence of breast cancer symptoms**[63,91,119] were considered in a number of studies. The presence of breast cancer symptoms was not found to be predictive of screening. However, one study did identify a strong association between the presence of risk factors and age.[74] Increasing age was significantly associated with participation only among those women with a 'moderate' risk of developing breast cancer (OR = 1.86; 95% CI, 1.49 to 2.32 for women aged 60–79 years, versus those women aged 50–59 years). Participation among 'high-risk' women was essentially the same or even slightly less in older women (women aged 60–79 years, OR = 3.09; 95% CI, 2.21 to 4.31; women aged 50–59 years, OR = 3.94; 95% CI, 2.61 to 5.96).

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and the presence of risk factors or symptoms of breast cancer.

Four studies investigated the influence of having a **history of any major medical problem** on a woman's decision to attend for a mammogram.[60,61,91,118] Only one study reported that having two or more specific diagnoses (versus none) was significantly associated with attendance for mammography at one of two included practice locations (site 1, OR = 1.84; 95% CI, 1.21 to 2.81).[61] Five studies also investigated the influence of the **number of previous visits to the healthcare provider** on attendance.[60,61,95,117,118] Two RCTs based in the USA noted that mammography uptake was significantly associated with more frequent healthcare visits.[60,61] One study reported that women who had visited their healthcare provider four to six times over the previous year were more likely to attend (OR = 1.57; 95% CI, 1.29 to 1.91), as were those who had attended seven or more times (OR = 2.03; 95% CI, 1.66 to 2.50), versus one to three times.[60] The second study also found that women were more likely to attend if they had visited the healthcare provider seven or more times, as opposed to zero to three times, during the previous year (OR = 1.79; 95% CI, 1.15 to 2.79).[61] However, this factor was only found to be significant at one of two separate practice locations included in the study. This study also analysed the type of visit made, and found that women who had **previously visited a gynaecologist** were significantly more likely to obtain a mammogram. The calculated ORs for this event were significant in both study locations (site 1: OR = 2.32; 95% CI, 1.76 to 3.07; site 2: OR = 2.54; 95% CI, 1.72 to 3.74). Whether the **length of time that a woman had been affiliated with the practice** had any influence on her uptake of mammography was investigated in another study, but no significant association was identified.[116]

In conclusion, the majority of studies did not find a significant association between the uptake of mammograms and history of major medical problems or number of visits to their healthcare provider.

A number of other factors were investigated but found not to be predictive of attendance in the studies included in this review. These variables

TABLE 6 *Summary of evidence from Pap smear studies (n = 11)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
Individuals with the following determinants are more likely to attend screening:			
Socio-demographic	Having insurance	50% (2/4 studies)	
Knowledge, behaviour, attitudes and beliefs	Having had a previous Pap smear	25% (1/4 studies)	
Individuals with the following determinants are less likely to attend screening:			
Socio-demographic	Being single, divorced or widowed	40% (2/5 studies)	
Determinants where the effect on screening attendance is unclear (i.e. studies found positive and negative effects)**:**			
Socio-demographic	Age	78% (7/9 studies)	Not clear whether older or younger women more likely to attend

[*] *A summary of the determinants, that were investigated in three or more studies, and their influence (positive or negative) on the uptake of Pap smears*
[**] *Level of significance* $p \leq 0.05$

included: **regular menstruation**;[74,119] **menopausal status**;[74] **having had a hysterectomy or not**;[122] **general health-related character traits**;[64] **source of regular healthcare**;[84] **whether the woman was due for screening**;[61] **age at first pregnancy**;[74,97,119] and the **type of visit at which mammography was recommended**.[116]

Clinical breast examination

Only one study investigated attendance for CBE.[84] This study looked at the uptake of CBE in a cohort of predominantly black Americans in the USA. A number of variables were considered, including **age**, **education**, **income**, **insurance status**, **Social Network Index** score, **health status** and **regular source of care**. Age (not stated) and the source of regular care were the only significantly predictive factors ($p < 0.05$ and $p < 0.01$, respectively) in determining attendance for CBE.

Screening tests for cervical cancer

Twelve studies that investigated determinants of the uptake of cervical cancer screening were identified, including eight RCTs,[65,71,80,86,87,103,115,122] three controlled trials[62,79,84] and one quasi-RCT.[89] Seven of the trials were based in the USA, where screening is usually provided by medical insurance companies or paid for by the individuals themselves.[65,80,84,86,87,89,122] Three studies were based in Europe, one in Iceland[79] and two in Italy,[62,71] where screening is free. The remaining two studies were based in Australia.[103,115] In the UK and most other European countries the present guidelines recommend screening every 3 years. In Iceland, however, women are invited for cervical screening every second year, while in the USA current regulations recommend annual Pap smears.

The studies were carried out in a variety of settings including primary-care practices,[62,79,86,89,103,115,122] HMOs,[65,80] a community screening programme,[71] a hospital[87] and the community.[84] Three studies focused on individuals from predominantly ethnic-minority groups which included black African-American participants[84,89,122] and Native Americans.[89] Two studies also focused on individuals from low socio-economic areas.[103,122]

The majority of the studies were published between 1995 and 1999.[65,71,79,80,86,87,89,103,115,122] Of the remaining studies one was published in 1993[84] and another, based in Italy, was published in 1989.[62]

One RCT specifically looked at factors related to the physician and how interventions aimed at physicians affected mammography attendance.[87] This study collected information from the physicians rather than the patients, and so is discussed in more detail in the section relating to determinants reported by the healthcare provider. The

remaining studies looked at determinants relating to the study participants.

The determinants that were investigated in the studies and their influence on the uptake of Pap smears are summarised in *Table 6.*

Socio-demographic determinants

Nine studies looked at whether there was an association between **age** and attendance for a Pap smear.[62,71,79,80, 84,89,103,115,122] All but two of the studies found that the age of the participant was a significant predictor of attendance.[89,103] However, the age category most likely to attend screening varied between the studies. The nine studies also varied in terms of the age and screening status of their target population.

In Italy, women aged 25–60 years have been invited by the public health service to attend for a Pap smear every 3 years, since 1980. Both of the Italian-based studies included in the review looked at women who were 25 years of age and older.[62,71] However, one study that was published in 1989 included women up to the age of 59 years[62] and a second study, which was published in 1998, included women up to 64 years.[71] The second study was based on a screening programme, *Prevenzione Serena*, which is funded by the regional health authority and has been ongoing since 1992. This more recent cervical cancer screening programme includes women aged 25–64 years. The earlier study looked at uptake among patients who had not had a Pap smear in the last 9 years, and found a significant and independent association for each subgroup, apart from the youngest (age 25–29 years) with uptake of screening (age 30–39 years, $\beta = -0.272$, $\chi^2 = 18.6$, $p < 0.001$; age 40–49 years, $\beta = -0.575$, $\chi^2 = 77.6$, $p < 0.001$; age 50–59 years, $\beta = -1.020$, $\chi^2 = 222.4$, $p < 0.001$).[62] The study published in 1998 also found that uptake increased with age, peaking in the 45–54 years age group (RR = 1.31; 95% CI, 1.19 to 1.44), with only a marginal decrease in the older age group (55–64 years; RR = 1.24; 95% CI, 1.12 to 1.38).[71]

One study that was based in Iceland included women aged between 35 and 69 years.[79] This study featured a screening programme organised by the Cancer Society in Iceland, which screened women aged between 20 and 69 years. The study found that women who had previously attended, but not during the preceding 5 years, were significantly more likely to be 55–59 years of age (OR = 1.8; 95% CI, 1.09 to 3.25).[79] Another study, based in Australia, found that women aged 18–34 years were significantly more likely to attend for a Pap smear than were those aged 55–70 years (OR = 3.62; 95% CI, 1.59 to 2.26).[115] They looked at a target population of women aged 18–70 years who had not had a Pap smear in the preceding 3 years.

The remaining three studies that found age to be a significant factor for Pap smear attendance were based in the USA.[80,84,122] One study looked at women between the ages of 18 and 40 years who had visited one of two inner-city HMO sites during the preceding year.[80] They found age to be significantly associated with Pap smear completion at only one of the sites, where younger women (18–24 years) were more likely to attend (OR = 1.49; 95% CI, 1.05 to 2.10). The second study, which included women aged 18 years and over, found that women who were younger (18–49 years versus ≥ 50 years) were more likely to have had a recent Pap smear ($p = 0.001$).[122] The third study, however, looked at screening behaviour among older (≥ 55 years) black Americans and found that older women were less likely to have had a smear.[84]

In conclusion, the majority of studies found an association between the uptake of Pap smears and age. However, they reported conflicting effects.

Five studies looked at the **marital status** of the participant as a predictor of attendance for cervical cancer screening.[71,79,103,115,122] Two of these studies found it to be a significant factor.[71,79] One controlled trial looking at women who had been invited for screening for at least 10 years found that women who had never attended, or who had previously attended but not in the preceding 5 years, were significantly more likely to have never been married (OR = 4.31; 95% CI, 2.10 to 8.86; versus OR = 2.76; 95% CI, 1.38 to 5.52).[79] The second study, which was based in Italy, also found that single (RR = 0.74; 95% CI, 0.67 to 0.83) as well as widowed or divorced women (RR = 0.82; 95% CI, 0.73 to 0.92) showed a significantly lower response rate than those who were married.[71]

In conclusion, the majority of studies did not find a significant association between the uptake of Pap smears and marital status. However, there was some evidence to suggest that being single was associated with non-attendance.

One study investigated whether there was an association between **where women lived** and screening uptake.[62] Women who lived in either an urban ($\beta = 0.337$; $\chi^2 = 05.7$; $p < 0.001$) or suburban ($\beta = 0.371$; $\chi^2 = 13.2$; $p < 0.001$) area were significantly more likely to attend than were those who lived in rural areas. However, this study provided

very little information about the trial design. Another study looked for an association between **women's postcode of residence** and attendance for Pap smear, but did not find it to be a significant factor.[103] Two further studies looked at the **place of birth**,[71,103] and one study at the **length of time a person had lived in the country**[103] as predictors of attendance for screening, but did not find these to be significant factors.

Four studies, all based in the USA, looked at whether the **type of insurance** women had influenced their decision to attend for a Pap smear.[65,80,84,89] Two of these studies found a significant association between the type of insurance and attendance for screening.[65,80] Both studies looked at attendance among women who were enrolled with an HMO that served the inner-city area of Detroit. Pap smears are a covered benefit for all female HMO members in the USA. One study, which included women from three separate practice locations (same HMO), found that women from site 3 with commercial insurance, as opposed to entitlement, were significantly more likely to attend for screening (analyses conducted by site; OR = 1.53; 95% CI, 1.03 to 2.26).[80] In the second study, which also included three different clinics in the same HMO, women in site 3 who had Medicare or Medicaid insurance were significantly more likely to attend than were those with a commercial plan (OR = 2.8; 95% CI, 1.6 to 5.0; versus OR = 1.4, 95% CI, 1.8 to 9.2).[65] This study, however, did not present any information on the non-participation and follow-up rates.

In conclusion, it was not clear whether insurance status was associated with the uptake of Pap smears.

Two studies assessed whether **employment status** was a predictor of participation in cervical cancer screening.[115,122] However, only one study found this to be a significant factor, reporting that working women were significantly more likely to have had a recent Pap smear than those not working.[122] Two studies also investigated the **level of income** as a potential factor in predicting attendance.[84,122] One study found that those with a household income of ≥ $20,000/year were significantly more likely to attend for a Pap smear than those earning less than $20,000/year.[122] Both studies included mainly participants on low income or social support. One study investigated **occupation** as a determinant, but this was not found to be a significant factor in predicting attendance.[115]

Two studies looked at whether women's **race** was a significant factor of attendance for cervical cancer screening[89,122] and one study looked at **nationality**.[79] All three studies were based in the USA and none found either race or nationality to be an independent significant predictor of attendance.

Five studies looked at the **level of education**, but did not find this to be a significant factor in predicting attendance.[71,84,103,115,122]

In conclusion, the majority of studies did not find a significant association between the uptake of Pap smears and participant's level of education.

Determinants relating to knowledge, behaviour, attitudes and beliefs

Four studies looked at whether participant's attendance for **previous screening** was likely to influence their decision to attend for a future Pap smear.[65,80,103,115] One study found that women who had received a previously normal Pap smear as opposed to an abnormal smear, were significantly more likely to attend (OR = 1.36; 95% CI, 1.05 to 1.08).[80] However, this study included three inner-city practices from one HMO in the USA. Previous screening was only found to be a significant factor among women who visited site 2. Another study, set in a general practice in Australia, found that women who had previously attended the practice (versus never attended) for a Pap smear were more likely to attend during the study period (OR = 2.32; 95% CI, 1.63 to 3.29).[103]

In conclusion, the majority of studies found no significant association between the uptake of Pap smears and previous screening history.

One study looked at whether women's perceived **need for regular screening** influenced their decision to attend or not.[115] It was found that women who did not perceive screening to be necessary at least once every 3 years were less than half as likely to attend as those who did perceive this to be the case (OR = 0.35; 95% CI, 0.19 to 0.64). However, this study reported an 86% non-participation rate, as well as a significant difference in GP attendance rate in the preceding 12 months, between individuals included in the final analysis and those lost to follow-up (25%). The same study also looked at the **number of sexual partners** and **age of first sexual experience**, while another study investigated the effect of **self-reported health status** as a predictor of Pap smear completion.[84] None of these factors was found to be significant.

One RCT investigated the impact of **decisional balance** on Pap smear uptake.[122] Attendance was

found to be significantly associated with an increase in decisional-balance scores ($p = 0.001$).

Determinants relating to social influences

One study looked at whether the **sex of the provider** was an influencing factor in screening uptake.[86] The study was based in the USA and recruited women while they were waiting to see their physician. Pap smear uptake was then assessed in those women who were due for a smear. The study found that, where screening was indicated, the patients of female physicians were more likely to get a Pap smear than patients of male physicians (OR = 1.47; 95% CI, 1.08 to 2.24). A further study looked to see if screening uptake was associated with the **GP's knowledge of the participating woman**[79] or their **Social Network Index** scores.[84] These were not found to be significant factors.

Determinants relating to health status

A case–control study, comparing attenders with non-attenders, was used to investigate the impact of **mental health** on the screening behaviour of women who had been invited for screening for at least 10 years.[79] Non-attenders were further subdivided into those who had never attended before and those who had previously attended, but not during the preceding 5 years. They found that non-attenders for screening were significantly more likely to have a serious mental disorder or intellectual impairment than those who had received a Pap smear during the preceding 5 years (OR = 16.7; 95% CI, 1.9 to 147; versus OR = 9.45; 95% CI, 1.07 to 83.5).

Two further studies found that having a **chronic illness** was significant in determining screening uptake.[79,80] One of the studies, which looked at three inner-city practices from one HMO, found that only women from site 3 were significantly less likely to attend for screening if they had a chronic illness (analyses conducted by site; OR = 0.54; 95% CI, 0.33 to 0.90).[80] In contrast, a controlled trial found that women who had never attended screening were significantly less likely to have either a single diagnosis of a long-term illness or another chronic disorder (OR = 0.28; 95% CI, 0.10 to 0.79).[79]

Women from the inner-city area of Detroit, USA, who had a **history of sexually transmitted disease** (STD) were significantly less likely to attend for screening than those who did not (OR = 0.67; 95% CI, 0.50 to 0.89).[80]

One Australian study investigated whether women who were taking an **oral contraceptive** were more likely to attend for screening.[115] They found that women who had previously used the pill were more likely to attend for a smear than were women who had never used the pill (OR = 2.46; 95% CI, 1.25 to 4.83). However, this study reported an 86% non-participation rate as well as a significant difference in GP attendance rate in the previous 12 months, between individuals included in the final analysis and those lost to follow-up (25%).

One study investigated whether the **outcome of a previous screening** test or a **previous visit to a gynaecologist** was associated with Pap smear uptake among women who had visited one of three HMO sites in Detroit, USA.[80] They found that women, from only one of the three practice locations who had had a gynaecologic visit during the baseline period were significantly more likely to have a Pap smear than those who had not (OR = 1.57; 95% CI, 1.17 to 2.10). They also found that women who had received a previous normal result were significantly more likely to attend for screening at sites 2 and 3 (analyses conducted by site; OR = 1.36; 95% CI, 1.05 to 1.76; versus OR = 1.43; 95% CI, 1.08 to 1.88).

Three studies looked at other **health-related factors** and their effect on uptake, including **experiencing symptoms of cancer**, **previous hysterectomy**, **menopausal status**, **history of wart virus**, **regular source of care** and **types of visit to the healthcare professional**.[79,84,122] Three further studies also investigated whether the **number of visits to a healthcare professional** influenced Pap smear attendance rates.[79,80,115] None of these factors was found to be significant.

Screening tests for colorectal cancer

Twelve studies were identified that investigated determinants of uptake of screening tests for colorectal cancer, including six RCTs,[92,96,100,102,109,110] one controlled trial[84] and five cohort studies.[93,99,101,107,121] Nine of the studies looked at the use of the FOBT[92,99–102,107,109,110,121] and two studies looked at the uptake of both sigmoidoscopy and FOBT.[84,93] One study investigated the use of sigmoidoscopy only.[96] Ten of the included studies were based in the USA,[84,92,93,99–102,109,110,121] one was set in Italy[96] and one study was Australian.[107] The majority of the studies were published between 1991 and 1998. The Australian study was published in 1984[107] and one of the American studies was published in 1986.[100]

TABLE 7 *Summary of evidence from FOBT studies (n = 11)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
Individuals with the following determinants are more likely to attend screening:			
Socio-demographic	Being older than 65 years	50% (2/4 studies)	
	Having a higher level of education	14% (1/4 studies)	This was only found to be significant in older women (≥ 65 years)
Knowledge, behaviour, attitudes and beliefs	Having had a previous FOBT	80% (4/5 studies)	
	Perceiving self susceptible to cancer	33% (1/3 studies)	
Health	Being capable of performing activities of daily living	67% (2/3 studies)	
Individuals with the following determinants are less likely to attend screening:			
Barriers and facilitating conditions	Being affected by barriers	33% (1/3 studies)	'Barriers' refers to combined barriers, as in the Health Belief Model

[*] *A summary of the determinants, that were investigated in three or more studies, and their influence (positive or negative) on the uptake of FOBT*
[**] *Level of significance* $p \leq 0.05$

The type of participants included in the studies varied. Four of the studies looked at individuals who were members of an HMO.[92,100,109,110] HMO members, over 50 years of age, are eligible for free colorectal cancer screening through the US Healthcare Check Programme, which posts a test to each member annually. All four studies included individuals selected from the same sampling frame, which included new adult members (aged 50–74 years) of HMO Pennsylvania and New Jersey. One further American study also looked at annual FOBT screening; however, this was part of an RCT to examine the effect of annual, biennial and no screening over a 2-year period, among 50–80 year olds.[99] Only participants that were sent an annual screening were included in the study reporting factors influencing the uptake of screening.

One of the included studies, based in Australia, only enrolled English-speaking individuals who were visiting their GP for a routine consultation.[107] This may limit the generalisability of the study, as the screening behaviour of the participants may vary from those individuals who do not visit their doctor as often. Limiting the study to English-speaking individuals may also exclude those belonging to minority groups. A second RCT, based in Italy, also included participants from GP lists.[96]

Four of the American studies looked at the screening behaviour of minority groups.[84,101,102,121] Three of these studies looked at screening uptake among individuals visiting congregate meal sites of the South Carolina Council on Ageing, which provides a hot midday meal for older citizens.[101,102,121] Most of the participants were female with an income below the poverty line (< $5800) and almost half of the participants were African-American. Two of the studies used the same methodology, with the first study being carried out in 1988 and then replicated in 1991.[101,121] Another study, which looked at a cohort of black Americans in California, used mainly participants with a family income of either less than $10,000 or between $10,000 and $20,000.[84] The generalisability of these studies may be limited, due to the setting and the sampling characteristics. Generalisability was also a problem in one of the studies that examined employees of a chemical company in Philadelphia.[93] The individuals working at the plant were deemed to be at an increased risk of developing cancer and were therefore offered free cancer screening.

Faecal occult blood test

The determinants investigated in the study and their influence on the uptake of FOBTs are summarised in *Table 7*.

Socio-demographic determinants

Nine studies investigated **age** as a determinant for the uptake of colorectal cancer screening.[84,92,93,99–101,109,110,121] Seven of these studies found age to be a statistically significant predictor of attendance.[92,93,99,100,109,110,121] Three studies estimated the uptake for men and women separately in the analysis.[92,99,110] Only one of these studies found age to be a significant factor among women only, reporting that women who were older than 65 years of age were significantly more likely to return an FOBT than those who were younger (OR = 2.2; 95% CI, 1.0 to 4.8; $p = 0.043$).[92]

One study found age to be a strong and consistent predictor of increasing screening attendance, for both men and women who were 70 years of age (men, 78.8%; 95% CI, 77.2 to 80.3; women, 79.6%; 95% CI, 78.2 to 81.0).[99] They reported lower attendance rates among the youngest (50 years) and oldest (80 years) participants in the study. Three further studies found that being 65 years of age or older was a significant predictor of uptake (regression coefficient –0.42, standard error (SE) = 0.21, $p = 0.05$;[121] regression coefficient 0.07 to 0.09;[100] men, OR = 1.6; 95% CI, 1.2 to 2.3; women (65–74 years) – OR = 1.7; 95% CI, 1.2 to 2.5). The sampling frame for one study comprised adults between the ages of 50 and 74 years,[110] and the second study looked at individuals who were 45 years of age or older.[100] The final study looked at elderly people (mean age 72.2 years) who were randomly chosen from a congregate meal site.[121] This study was a repeat of a previous study carried out by the same author, using a sample of individuals with a mean age of 71.5 years.[101]

One study found that being older than 60 years was associated with the uptake of screening (OR = 1.7; 95% CI, 1.0 to 2.9).[93] However, the study only looked at two age categories (< 60 years and ≥ 60 years) among employees at a chemical company who were considered at risk of developing colorectal cancer. This limits the generalisability of the study results. Another study also found that age (< 65 years versus ≥ 65years) was positively and significantly associated with repeat uptake of screening (OR = 1.63; 95% CI, 1.13 to 2.36).[109]

In conclusion, the majority of studies found a significant association between uptake and age). In many studies, the return of FOBT was highest among older participants (≥ 65 years).

Seven of the included studies looked at **gender** as a possible determinant of participation in colorectal cancer screening.[92,99–101,109,110,121] Only one study found the gender of the participant to be a significant factor, reporting that women were more likely than men to return their stool samples ($\beta = -2.49$; $p = 0.0004$; $R^2 = 22\%$).[101] The study included participants recruited from congregate meal sites of the South Carolina Council on Ageing, where the majority of the participants were female. Gender was not found to be a significant predictor in the remaining six studies.[92,99,100,109,110,12] However, two of the studies did find a significant interaction between gender and the study intervention group.[92,110] Men from the intervention group in one of these studies were found to be more likely to attend than men who did not receive the intervention ($\chi^2 = 29.3$; $p < 0.0001$), and therefore the logistic model of FOBT uptake for men and women was estimated separately.[92]

In conclusion, the majority of studies did not find an association between the uptake of FOBT and gender.

Seven studies looked at **education** as a predictor of participation in colorectal cancer screening.[84,92,93,100–102,121] One study found that there was a strong and positive interaction between employee age and level of education.[93] Older individuals (> 60 years) with at least a high-school education (12 years) were more likely to undergo screening than those individuals under 60 years of age with less than 12 years of education (OR = 2.0; 95% CI, 1.0 to 4.0). However, the study focused on a cohort of current and former employees of a chemical manufacturing plant, and therefore the results may not be generalisable. The remaining six studies did not find education to be a significant factor.

In conclusion, the majority of studies did not find a significant association between the level of education and the uptake of FOBT.

One study that looked at the uptake of screening among older black Americans investigated the influence of **health insurance** coverage on uptake.[84] Respondents who had HMO insurance, as opposed to Medi-Cal or other insurance, were more likely to have had an FOBT (Medi-Cal, OR = 0.52; 95% CI, 0.31 to 0.86; other insurance, OR = 0.54; 95% CI, 0.36 to 0.81).

Factors predicting the uptake of screening among employees of a chemical manufacturing plant, who were deemed to be at risk of developing colorectal cancer, were investigated in one study.[93] The study looked at the **length of employment** with the company as well as the **length of time working under high-risk** circumstances as predictors of

participation in screening. Neither of these variables was found to be significant in predicting the return of FOBTs.

A number of other variables were examined, but were not found to be significantly associated with the uptake of FOBT. These included **income**,[84,100,102] **employment status**,[93,100] **ethnicity**,[92,93,101,102,121] **marital status**[92,100] and the **region where the participants lived**.[99]

Determinants relating to knowledge, behaviour, attitudes and beliefs

Five of the included studies looked at the influence of having **participated in previous colorectal screening** as a determinant of future participation.[92,99,101,102,109] Four studies found a significant association between participants who had been previously screened and the return of FOBTs.[99,101,102,109] The remaining study did not find past screening behaviour to be significantly associated with uptake. However, the authors looked only at past screening behaviour in the context of having adhered to a first round of screening.[92] Two of the studies looked at the screening behaviour of participants selected from the same sampling frame, which consisted of new members of an independent practice association-type HMO.[92,109] Another included participants who were invited for annual screening for the duration of the study (2 years).[99] The remaining two studies investigated screening behaviour among predominantly low income elderly participants.[101,102] Two of the studies also looked at the effect of receiving **negative results at previous screening**.[99,109] Only one study found that participants who had received an abnormal or negative result during the first round were significantly less likely to attend for repeat screening than those who had not (OR = 0.35; 95% CI, 0.22 to 0.56).[109]

In conclusion, participation in previous colorectal screening was found to be significantly associated with the uptake of FOBT.

Whether **previous prostate cancer screening** was associated with uptake of colorectal cancer screening was examined in one study.[101] The authors found that participants who had ever had a DRE were significantly more likely to participate in FOBT screening than those who had not (regression coefficient 0.86; SE = 0.55; $p = 0.04$).

Three studies looked at whether **perceived vulnerability or susceptibility** was a determinant of screening uptake.[92,100,107] Two of the studies enrolled participants while they attended a routine consultation with their physician.[100,107] Another used a random sample of HMO members whom they contacted by telephone.[92] All three included participants in a similar age category (40–75 years,[107] 50–74 years[92] and ≥ 45 years[100]). Only one of the studies found susceptibility to be a significant factor associated with uptake ($\beta = 0.12$; $p < 0.01$).[107]

In conclusion, the majority of studies did not find an association between the uptake of FOBT and perceived vulnerability or susceptibility.

Participants' perceptions of **salience and coherence of the screening** was found to influence screening uptake among both men (OR = 1.8; 95% CI, 1.0 to 3.1) and women (OR = 2.0; 95% CI, 1.4 to 2.8).[92] The same study also found that the **perception of self-efficacy** related to screening was significantly associated with uptake among men (OR = 1.4; 95% CI, 1.0 to 2.1). This study looked at screening behaviour among HMO members, who may be more prevention-orientated than the general population. Another study also looked at perceived efficacy of screening as a determinant, but did not find this to be a significant factor in screening uptake.[107] Participants in this study were recruited by their GP when they attended the surgery.

Other factors associated with individuals' attitudes and beliefs which were found not to be significant in predicting the uptake of colorectal cancer screening included: participants' **self-reported health status**;[84,100,121] the motivational effect of **general health concerns**;[100] participants' **perceptions of the seriousness of cancer**;[92,100,107] participants' **perceptions of the curability** of cancer;[92] participants' levels of **health motivation** (as in interest and concern);[100,107] participants' **perceived benefit of participation**;[100] the **faith** participants had in their physician;[100] having **read or heard anything** about colorectal cancer or screening;[101] and participants' **intention** to participate in screening.[92]

Determinants relating to barriers and facilitating conditions

Three studies looked at the effect of **barriers** on uptake of colorectal cancer screening. One looked at the influence of various types of barrier, which included **embarrassment**, **distastefulness**, **worry**, **discomfort**, **inconvenience** and **objections to the special diet**.[107] These barriers were, however, entered into the analysis as a single component. Another investigated the influence of the **fear of finding cancer** as a barrier.[92] The final study looked at the influence of any **perceived barriers**.[100]

One study found **combined barriers** to have a significant detrimental effect on colorectal cancer screening participation ($\beta = -0.33$; $p < 0.01$).[107] The authors went on to analyse the difference between attenders and non-attenders in terms of individual barriers using a one-tailed *t*-test. The only anticipated barriers to relate significantly to attendance were 'embarrassment' and 'worry' ($t = 2.6$, $p < 0.005$; $t = 2.18$, $p < 0.025$).

None of the included studies looked at the effect of factors relating to **facilitating conditions** (e.g. receiving a **doctor's recommendation**).

Determinants relating to social influences

Three of the included studies looked at the effect of **social support**,[84,92,100] and one used a modified version of the Social Network Index[125] to measure social-network characteristics.[84] Two of the studies also examined the **influence of the healthcare professional** on the uptake of colorectal cancer screening.[92,100] All three studies failed to find any association between these factors and participation in screening. One further study looked at the influence of 'phone-mates' (whether participants had another member of their household taking part in the study).[99] This study found that there was a significantly higher rate of screening uptake among **participants who lived with other participants**, as compared with households where only one individual participated in the study.

Determinants relating to health status

One study looked at whether participants who had been exposed to cancer, through personal experience or **having a friend or family member who has had cancer**, were more likely to participate in colorectal cancer screening than those who had not.[101] Another study looked at the influence of the participant **having a history of cancer** as a predictor of participation in screening.[121] Neither of these variables was found to be significant in predicting attendance for FOBT. Having a **family history of cancer** was also found not to be significant.[100]

One study found that having **symptoms of cancer** was a predictor of screening uptake.[100] Patients who were experiencing gastrointestinal symptoms were 8–11% more likely to return their FOBT than were those not experiencing symptoms (see appendix 3). The study looked at a sample of individuals who were 45 years of age or older and scheduled for a physical examination at a primary-healthcare practice. Generalisability of the study findings may thus be limited, as the participants were already attending for a medical and therefore likely to be more motivated.

Two studies, which looked at screening behaviour among individuals who visited a congregate meal site, investigated whether the ability to perform **activities of daily living** (ADL) was a predictor of FOBT uptake.[101,121] Two studies found this to be a significant predictor of participation. Those individuals who were more able to perform ADL were more likely to participate in FOBT (regression coefficient 0.86; SE = 0.38; $p = 0.04$[101]) than those who had problems with the ADL (regression coefficient 1.00; SE = 0.39; $p = 0.01$[121]). These studies, however, did not find **sensory ability** (eyesight and hearing) to be a significant predictor of participation.

In conclusion, the majority of studies found that being able to perform ADL was associated with the uptake of FOBT. More able individuals (versus those who had problems performing ADL) were more likely to participate in screening.

Finally, a study, that looked at screening behaviour among older black Americans asked participants if they had any **regular source of care**, which could influence their decision to participate.[84] This was not found to be a significant factor.

Sigmoidoscopy

Two studies investigated the determinants associated with attendance for a sigmoidoscopy examination.[84,96] One was an RCT based in Italy[96] and one was a cohort study conducted in the USA.[84]

Socio-demographic determinants

One study, which set out to examine the relationship between social support and use of cancer-screening tests among black Americans, reported that the only significant predictor of attendance for screening was **level of education**.[84] The more educated (1–3 years of college) the respondents were, the more likely they were to have had a sigmoidoscopy examination ($p < 0.01$). The second study, which recruited participants from 14 GP practices in Turin, also found level of education (intermediate versus elementary) to be a significant predictor of attendance (OR = 1.79; 95% CI, 1.08 to 2.98).[96] The same study also found **gender** to be a significant factor, with male participants being more than twice as likely than female participants to attend for a sigmoidoscopy (OR = 2.36; 95% CI, 1.51 to 3.67).[96]

Other demographic variables that were examined, but found not to be significantly predictive of attendance for sigmoidoscopy, included **age**,[84] **family income**,[84] **insurance**,[84] **marital status**[84] and **birth place**.[96]

TABLE 8 *Summary of evidence from DRE or PSA studies (n = 4)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
Individuals with the following determinants are more likely to attend screening:			
Socio-demographic	Having a higher level of education	67% (2/3 studies)	
	Being older than 65 years	25% (1/4 studies)	Found to be significant among employees of a chemical manufacturing company
Individuals with the following determinants are less likely to attend screening:			
Socio-demographic	Being African-American	67% (2/3 studies)	
	Having an income of $4800 to $9600 or $25,021 to $50,000	33% (1/3 studies)	

[*] *A summary of the determinants, that were investigated in three or more studies, and their influence (positive or negative) on the uptake of DRE or PSA*
[**] *Level of significance* $p \leq 0.05$

Determinants relating to health status

One study found **family history** of colon cancer as well as **gastrointestinal symptoms** within the preceding 6 months to be significantly predictive of attendance for a sigmoidoscopy (OR = 3.25; 95% CI, 1.28 to 8.24; versus OR = 23.56; 95% CI, 3.15 to 175.93).[96]

Other health-related factors that were not found to be significantly associated with attendance for a sigmoidoscopy included **health status**,[84] **regular source of care**[84] and **history of previous diagnostic tests or FOBT**.[96]

Screening tests for prostate cancer

The determionants that were investigated and their influence on the uptake of DRE or PSA tests are summarised in *Table 8*.

Four studies (two controlled trials and two cohorts) that looked at screening tests for prostate cancer were identified.[76,77,84,93] All the studies were published between 1993 and 1998, and were carried out in the USA. In the USA current regulations recommend that men be offered a DRE and a PSA annually from the age of 50 years (American Cancer Society Guidelines, 1997[324]). Screening-test fees are usually paid by the individual, or by the individual's health insurance company. All four studies examined the use of DRE to screen for cancer of the prostate. In addition, two studies also looked at uptake of the PSA test.[76,77] These studies looked at screening visits that included both DRE and a PSA. They did not distinguish between the two different tests, and considered prostate cancer screening (DRE and PSA) as a whole.

Three of the studies examined predominantly African-American populations, which limits the generalisability of their findings.[76,77,84] In general, study participants were over 40 years old for African-American men, and over 50 years old for Caucasians.[76,77,84] One of the studies failed to specify the age limits for its study population.[93] Two of the studies,[76,77] although separate studies, were part of a larger trial looking at the effect of educational interventions designed to encourage African-American men to take part in prostate cancer screening.[126] After attending an educational presentation the men were given a voucher entitling them to receive a free prostate examination. Another study examined the characteristics of employees working in a chemical plant, who through their work were 'at risk' of developing prostate cancer.[93] In this study screening tests were offered free of charge to all current and previous 'at risk' employees. The final study examined a cohort of predominantly older black Americans.[84]

Socio-demographic determinants

All four studies examined the effect of age and three looked at ethnic group as a predictor of the uptake of prostate cancer screening.[76,77,84,93] One of the studies also examined whether the participants' **marital status** was a predictor of their screening attendance, but no significant association was identified.[76]

Age was found to be a significant predictor of attendance among 'at risk' chemical plant workers.[93] Men aged 60 years or over, as opposed to those aged less than 60 years, were significantly more likely to attend for prostate screening (OR = 1.7; 95% CI, 1.0 to 2.9). The same study also identified an interaction between age and education. Older men (≥ 60 years) with at least a high-school education were significantly more likely to adhere to screening recommendations than were those below 60 years of age with a lower educational level (OR = 2.0; 95% CI, 1.0 to 4.0).

In conclusion, the majority of studies did not find a significant association between the uptake of prostate cancer screening and age.

Two studies identified the participants' **ethnic group** as a significant predictor of their attendance for screening.[76,77] One study also showed that both education and income were significantly associated with ethnic group.[77] Taking this into consideration, African-American men were still less likely to attend for screening than Caucasian men (OR = 2.24; $p = 0.028$;[77] $\beta = 0.59$[76]).

In conclusion, African-American men were significantly less likely than Caucasians to attend prostate cancer screening.

Three studies looked at whether **education** was an important predictor of attendance.[76,77,93] One study found the effect of education was strongly linked to that of age.[93] Men aged 60 years or over with > 12 years of education (versus ≤ 12 years) were more likely to attend for screening (OR = 2.0; 95% CI, 1.0 to 4.0). A second study found a strong association between ethnic group, income and education, with men who had a high-school education being significantly more likely to attend screening than men without ($\beta = 0.87$; $p = 0.04$).[77] The third study did not find a significant association between education and attendance.[76]

In conclusion, the majority of studies found a significant association between the uptake of prostate cancer screening and education. Those individuals who had received more years of education were more likely to attend.

One study found **income** to be a significant factor, reporting that men who earned $25,021 to $50,000 per year and those who earned $4800 to $9600 per year were less likely to attend for screening than those individuals who earned $9600 to $25,000 per year.[77] However, two other studies also looked at the effect of income but found it not to be significant.[76,84]

In conclusion, the majority of studies did not find an association between the uptake of prostate cancer screening and income.

A number of other socio-demographic variables were examined, but none of them were found to be significant predictors of attendance. These variables included participants' **insurance status**,[84] **living status** (i.e. whether they lived alone or with another person),[76] their **employment status**,[93] **length of employment**[93] and **length of 'at risk' employment**.[93]

Determinants relating to knowledge, behaviour, attitudes and beliefs

Only one of the four studies considered whether participants' level of **knowledge** influenced their decision to participate in screening. This study assessed participants' levels of **knowledge about prostate cancer and screening** through the use of a six-part questionnaire.[76] Knowledge was found to be a significant factor when the sample included only those who had never previously attended for screening ($\chi^2 = 3.98$; $p = 0.05$). Knowledge was no longer significant when men who had a prior history of screening were included in the study sample.

None of the studies examined the effect of men's **attitudes and beliefs** on their attendance for prostate cancer screening. One study, however, found no significant association between participants' **past attendance** for prostate cancer screening and the likelihood of their future attendance.[77]

Determinants relating to barriers and facilitating conditions

The four studies identified in this review did not examine the relationship between **barriers and facilitating conditions** and the uptake of screening.

Determinants relating to social influences

Only one study examined determinants relating to **social influences**.[84] Social influences can include friends, relatives, and healthcare professionals. The study used the **Social Network Index**[125] to measure the effect of a number of combined social influences (marital status, the number of relatives and friends described by the respondents as being close, church participation, and participation in other organisations). However, this was not found to have a significant effect on attendance for prostate cancer screening.

TABLE 9 *Summary of evidence from HIV-antibody test studies (n = 7)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
Individuals with the following determinants are more likely to attend screening:			
Socio-demographic	Being single or divorced	40% (2/5 studies)	
	Being homosexual or bisexual	33% (1/3 studies)	
	Being African-American	25% (1/4 studies)	
Knowledge behaviour, attitudes and beliefs	Having more sexual partners	33% (1/3 studies)	Number of sexual partners not stated
	Using intravenous drugs or cocaine in the preceding 30 days	25% (1/4 studies)	
Individuals with the following determinants are less likely to attend screening:			
Socio-demographic	Having a degree	67% (2/3 studies)	
	Being younger	17% (1/6 studies)	Age range not stated
Knowledge behaviour, attitudes and beliefs	Having had a previous HIV-antibody test	33% (1/3 studies)	Only among HIV-positive individuals
Health	Using cocaine, heroin or speedball for many years	25% (1/4 studies)	

[*] *A summary of the determinants, that were investigated in three or more studies, and their influence (positive or negative) on the uptake of HIV-antibody tests*
[**] *Level of significance* $p \leq 0.05$

Determinants relating to health status

The influence of participants' health status on their attendance for screening was investigated in three studies, which featured predominantly African-American populations.[76,77,84] Two studies examined whether having a **previous history of prostate cancer** influenced men's attendance, but failed to find any significant association.[76,77] One of the studies did, however, find that men with urinary **symptoms**, which can be associated with prostate cancer, were significantly more likely to attend for screening ($\beta = 1.20$; $p = 0.002$).[76] A further study also examined whether the general **health status** of men and their **source of regular healthcare** had any influence on their attendance. Neither variable proved to have a significant effect on screening behaviour.[84]

Screening tests for HIV

Various factors and their influence on attendance for HIV screening were examined in seven cohort studies.[70,73,104,105,114,123,124] All seven studies were based in the USA and published between 1993 and 1998. One studied a population of homosexual and bisexual men (aged 18–59 years) in three small cities.[73] Another study looked at mixed cohorts of men and women (aged 18–75 years) in cities with a high proportion of HIV-infected individuals.[70] A further study included a sample of out-of-treatment drug users (≥ 18 years) from specific areas of prevalent drug use.[123] The final four studies only included women.[104,105,114,124] One study looked at women attending a family-planning clinic in New York,[124] another at patients attending a primary-care practice[114] and a third included *ante-partum* patients from three city-based private obstetric practices.[104] The final study included adolescent girls (aged 12–19 years) attending paediatric clinics based at a large urban HMO.[105]

The determinants that were investigated in the studies and their influence on the uptake of HIV-antibody tests are summarised in *Table 9*.

Socio-demographic determinants

Six studies investigated whether **age** was associated with increased screening attendance.[70,73,104,105,123,124] However, only one study found age to be a significant factor, reporting that younger age groups (age range not stated) were less likely to attend for screening than older participants (OR = 0.97; 95% CI, 0.95 to 0.98).[70] However, this study reported a 59% loss to follow-up, and those not included in the final analysis may have differed from those that were.

In conclusion, the majority of studies did not find an association between the uptake of HIV-antibody tests and age.

Three studies considered whether **ethnic origin** predicted screening uptake.[70,73,123] Only one of these studies identified it as a significant factor,[70] reporting that African-American participants were significantly more likely to participate in HIV-antibody testing than Caucasians (OR = 1.36; 95% CI, 1.05 to 1.76).[70] However, the study reported that over 50% of participants were lost to follow-up.

In conclusion, the majority did not find an association between the uptake of HIV-antibody tests and ethnicity.

Five studies investigated the possibility of an association between the individuals' **marital status** and participation in HIV-antibody testing.[70,104,105,114,124] Two studies found a significant relationship.[70,104] Both studies found that single or divorced participants were significantly more likely to be tested than participants who were married (OR = 1.48; 95% CI, 1.03 to 2.21; χ^2 test, $p < 0.05$;[70] no actual data were reported for the second study[104]).

In conclusion, the majority of studies did not find an association between marital status and the uptake of HIV-antibody tests. However, where marital status was found to be associated with uptake, uptake was highest among participants who were single or divorced.

Whether the **level of education** attained by participants was a predictor of participation in HIV-antibody testing was considered in four studies.[70,73,105,123] One study found that men with degree-level education were three times as likely not to agree to be tested than those who had obtained a lower level of education ($p = 0.02$; 95% CI, 1.2 to 9.2).[73] One study, which did not find level of education to be a significant factor in the sample as whole, performed a separate analysis on a subset of individuals.[70] Among participants who 'planned to be tested', those who were high-school graduates (OR = 6.36; 95% CI, 1.83 to 22.16) or had at least some college education (OR = 4.12; 95% CI, 1.10 to 15.53) were significantly more likely to have obtained an HIV-antibody test than those with less education.[70] This study, however, reported a 59% loss to follow-up, and those not included in the final analysis might have differed to those that were.

In conclusion, the majority of studies did not find a significant association between education and the uptake of HIV-antibody tests.

Whether the participants' **employment status** was a determining factor in the uptake of HIV-antibody testing was considered in two studies.[73,104] Only one study found this to be a significant factor, reporting that women with occupational exposure to HIV had the highest rate of acceptance.[104]

Two studies investigated whether **level of income** was associated with the decision to undergo HIV-antibody testing.[70,114] Neither study found this to be a significant factor. However, one study performed a separate analysis on subsets of individuals and found that, among participants who 'would get tested if no one could find out', those with an annual income between $20,000 and $40,000 as opposed to below $20,000 were significantly more likely to be tested (OR = 0.62; 95% CI, 0.41 to 0.93).[70] This study, however, reported that over 50% of participants were lost to follow-up. One study also investigated whether **homelessness or receiving public assistance** was a predictor of uptake with HIV-antibody testing.[123] These were not found to be significant factors.

Individuals who are homosexual or bisexual are deemed to be at increased risk of contracting HIV infection. Three studies therefore investigated whether **sexual orientation** was a predictor of undertaking HIV-antibody testing.[70,73,123] One study looked at a population of homosexual and bisexual men,[73] the second study included both men and women from cities with a high population of individuals infected with HIV,[70] and the final study used a sample of out-of-treatment drug users.[123] Only one study found sexuality to be a significant factor, reporting that individuals who were homosexual or bisexual were more than twice as likely to undergo an HIV-antibody test than those who were not (OR = 2.16; 95% CI, 1.09 to 4.27; χ^2 test, $p < 0.05$).[70] This study, however, reported a 59% loss to follow-up, and those not included in the final analyses might have differed from those who were.

Other socio-demographic variables that were examined, but not found to be significantly associated with uptake, included **gender**,[70,105,123] having **children**[124] and **family environment**.[105]

Determinants relating to knowledge, behaviour, attitudes and beliefs

Three studies were interested in determining whether the **number of sexual partners** was a predictor for undergoing HIV-antibody testing.[114,123,124] One study found that a significantly higher proportion of women, attending a family planning clinic, with multiple sex partners decided to have the test

(two partners, slope 0.33; three or more partners, slope 0.58) than those with one or less partners.[124] One study found that among persons who 'would get tested if no one could find out', participants with multiple partners were more likely to opt for testing than those with only one or less partners (OR = 2.36; 95% CI, 1.49 to 3.73).[70] However, the same study did not find this to be the case for the sample as a whole.

The **use of condoms** was considered by two studies.[123,124] Only one study found this to be a significant factor.[124] This study found that women, attending a family planning clinic, who reported never using a condom in the past year were significantly more likely to have the HIV-antibody test than those who did use condoms (slope 0.31). One further study, which included adolescent girls, investigated the influence of **attitudes towards condoms** and **self-efficacy regarding condom use** on the uptake of HIV-antibody testing.[105] These were not found to be significant factors.

The association of **having a sexual partner at risk** of being HIV infected with uptake of HIV-antibody testing was investigated by two studies.[104,124] One study found that among women registering for prenatal care, those with an at-risk sexual partner(s) were significantly more likely to consent to HIV testing than those who did not.[104] The second study, which looked at out-of-treatment drug users, did not find having sex with an intravenous drug user in the last 30 days to be a significant factor.

Participants' **prior HIV testing behaviour** was also considered in three studies.[104,105,123] One study included out-of-treatment drug users[123] and one study looked at women visiting private obstetric practices.[104] The third study investigated the uptake of HIV-antibody testing among adolescent girls attending paediatric clinics.[105] Only one study found this to be a significant factor, reporting that individuals who were HIV positive in a prior test were less likely to take the project HIV test (OR = 0.18; 95% CI, 0.07 to 0.46).[123]

In conclusion, the majority of studies did not find a significant association between the uptake of HIV-antibody tests and previous screening attendance.

One study that included out-of-treatment drug users found that individuals who had **ever received sex for money or drugs** were significantly more likely to take the project HIV test than those who had not (OR = 1.63; 95% CI, 1.05 to 2.53).[123] However, the same study also investigated the influence on participation of ever having **given sex for money or drugs** and **using crack during sex**. These were not found to be significant factors. Four studies investigated whether individuals who **took illegal drugs** were more likely to adhere to testing.[104,105,114,123] The type of population investigated included adolescent girls attending paediatric clinics,[105] women attending urban family-planning clinics,[114] women visiting city-based private practice clinics[104] and out-of-treatment drug users.[123] Only one study found this to be a significant factor, reporting that individuals who had both injected drugs and used crack in the preceding 30 days as well as those who had used cocaine, heroin or speed ball for fewer years were more likely to take the project HIV-antibody test (OR = 1.76; 95% CI, 1.16 to 2.69; versus OR = 0.96; 95% CI, 0.95 to 0.98).[123] The same study also investigated the influence of the **frequency of injecting drugs** in the preceding 30 days, the **number of years using crack** and the **sharing of needles** in the last 30 days on adherence to HIV-antibody testing. These were not found to be significant factors.

Two studies investigated the effect of **alcohol consumption** on participation in HIV-antibody testing.[105,114] Neither study found this to be a significant factor. One study also looked at whether participants who smoked were more likely to adhere to HIV testing, but did not find it to be a significant factor.[105]

One study that aimed to assess psychological predictors of HIV-antibody testing included a sample of non-pregnant heterosexual, sexually active women residing in an HIV-endemic area.[114] The study found that individuals who reported higher levels of disagreement with the **belief that by taking the test 'they might find out that they have HIV or AIDS too late for treatment**' were more than twice as likely to take the test than those who expressed lower levels of agreement with this statement (regression coefficient $r = -0.10$; $\beta = -0.37$; SE = 0.14).

One study that included participants from cities with a high population of HIV-infected individuals found that individuals **who planned to be tested** were significantly more likely to participate in HIV-antibody testing than those who did not (OR = 1.90; 95% CI, 1.26 to 2.87; χ^2 test, $p < 0.01$).[70]

One study that included homosexual and bisexual male volunteers found that those who **read gay magazines** were significantly more likely to undergo HIV-antibody testing than those who did not ($p = 0.02$; 95% CI, 1.16 to 6.29).[73] Interestingly

the same study also investigated the influence of **reading gay newspapers**, but this was not found to be a significant factor.

A number of other variables relating to participants' knowledge, attitudes and beliefs were examined but not found to be predictive of HIV-antibody test participation. These included **previous drug testing**,[114] having **received a class or educational video on HIV/AIDS**,[105] **AIDS knowledge**,[70,73] **age at first sexual intercourse**,[105] **age at first gay experience**,[73] **age at regular gay experience**,[73] **seat-belt use**,[105] **worry about HIV infection**,[105] **trust among sex partners**,[105] **perceived risk of HIV infection**,[70,104,105] **sexual risk behaviour**,[73,105] **anal sex in past year**,[124] **same-day sex in past year**,[124] **anonymity of partners**,[73] **would get tested if no one found out**,[70] **know a person with AIDS**,[73] **attitudes scores favouring safer sex**[73] and **difficulty in disclosing sexual information**.[70]

Determinants relating to social influences

Previous discussion with a healthcare professional about HIV testing was found to be a significant predictor of participation in HIV-antibody testing in a single study (OR = 3.47; 95% CI, 1.26 to 9.52).[105] The study population comprised adolescent girls attending general paediatric clinics at a large urban HMO.

Social influences that were investigated but found not to significantly influence the decision to undergo HIV-antibody testing included **knowing a person with AIDS**,[73,105] **peer sexual activity**,[105] **peers' belief in condom use**,[105] **peers' use of condoms**[105] and **participation in gay organisations**.[73]

Determinants relating to health status

Determinants relating to participants' health status were investigated in five studies.[70,104,105,114,123] These included characteristics such as those directly related to HIV infection in terms of risk factors, medical history and previous medical treatment.

Two studies investigated whether a **history of STD** would influence participants' decisions to undertake HIV-antibody testing.[123,104] One study included out-of-treatment drug users,[123] while the second study looked at HIV testing among women registering for prenatal care at a private obstetric practice.[104] Only one study found that participants with a history of STD were significantly more likely to participate in HIV testing.[104] The same study also investigated the influence of **previous blood transfusion** on participation in HIV testing. This was not found to be a significant factor. One further study of participants from cities with a large number of AIDS cases looked at the potential **effect of risk factors** on the uptake of HIV testing.[70] This was not found to be a significant factor.

Other screening

Six studies (four RCTs and two controlled trials) looked at other forms of screening tests including: cystic fibrosis carrier status (one study), tuberculosis screening (one study), well-child screening (one study), cholesterol tests (one study), Medicare screening visits (one study) and general health screening checks (one study).

Tuberculosis screening

One RCT investigated factors relating to whether or not participants returned for the results of their skin test for tuberculosis.[68] The authors examined a population of recent or active drug users (aged 18–69 years) in California, USA, who were not enrolled in a drug rehabilitation programme.

Participants' **employment status**, **age** and their **intentions to return** were strong predictors of attendance. Those participants who were not in current employment were more likely to return for their skin reading versus those who were employed in some capacity (OR = 2.31; 95% CI, 1.50 to 3.46). Individuals aged 41–50 years were also significantly more likely to attend than individuals in the other age categories (18–30 years, 31–40 years, 51–69 years) (OR = 2.05; 95% CI, 1.17 to 3.61). Participants who stated that they were very likely to return for the results of their skin test were indeed more likely to return than those who were less sure of their intentions (OR = 1.65; 95% CI, 1.01 to 2.68). Individuals who had not previously participated in a similar study were also more likely to attend (OR = 1.57; 95% CI, 1.03 to 2.31). This suggests that previous experience of similar studies was a negative factor in predicting future attendance.

Ethnic group, **gender**, **living arrangements** (e.g. own home, shelter or motel), **prior exposure to tuberculosis**, **alcohol abuse**, **urine drug-screening results** and **drug usage** did not significantly predict whether individuals in the study returned for their skin-test readings.

General health screening

One controlled study of UK patients (aged 40–50 years) examined whether an appointment or open invitation could increase attendance for general health checks.[94] The study was based at one GP practice and had quite a high non-participation rate of 49%.

The author examined the role of the **Health Belief Model** in predicting attendance. This model features seven categories of determinant:

- intention (likelihood of attending for screening)
- benefits (perceived benefits of attending)
- efficacy (perceived efficacy of screening in reducing the chance of developing a serious illness)
- susceptibility (perceived likelihood of developing a number of health problems)
- severity (perceived severity of each health problem were they to develop)
- health value (perceived importance of good health).
- barriers (perceived barriers to attending a health check).

Multivariate analyses showed that the only factor that significantly predicted attendance was how the participants **perceived the importance of their health** ($\beta = 0.62$; $p < 0.05$). Patients who received an appointment were more likely to attend if they had a **prior intention** ($\beta = 0.93$; $p < 0.05$), whereas those individuals who were sent an open invitation were more likely to attend if they **placed a high value on their health status** ($\beta = 0.62$; $p < 0.01$).

Cystic fibrosis carrier screening

One controlled study examined the factors associated with the uptake of cystic fibrosis carrier screening.[120] This study examined a population of individuals and couples, aged 18–44 years, within the setting of an HMO in the USA. The study had a non-participation rate of 52%, and participants who took part in the investigation might have differed from those who did not.

A variety of factors were examined, including sociodemographic characteristics, and the participants' attitudes and beliefs. Overall uptake was found to highest among those enrolees who were **planning children**, **Caucasians** and those with at least a **college education**. Among those individuals who were planning a family, individuals with a **higher tolerance for test uncertainty**, a **lower fear of the stigma** attached to being a cystic fibrosis carrier, and those with a higher **perceived risk of being a carrier** were significantly more likely to have the test. **Gender**, **perceived obligation to know** and/or disclose carrier test results, **perceived burden of having a child with cystic fibrosis**, **rating of the severity of other diseases**, and the **likelihood of choosing prenatal diagnosis and abortion** for these diseases were not predictive of attendance.

Well-child screening

One RCT investigated the uptake of Medicaid well-child screening in medically underserved communities in the USA.[112] This study identified a number of variables that were found to be predictive of attendance for screening. Families with phones were more likely to attend if they belonged to a minority **ethnic group** (OR = 1.72; 95% CI, 1.10 to 2.69), **had children under the age of 6 years** (OR = 1.68; 95% CI, 1.37 to 2.06), **had uninterrupted Medicaid eligibility** (OR = 3.02; 95% CI, 1.43 to 6.39) or **did not reside within a particularly deprived area** of the community (OR = 0.31; 95% CI, 0.19 to 0.50). For families without phones, belonging to a minority group was no longer a significant predictor of attendance; however, **receiving benefits through the Dependant Children Program** was significant (OR = 0.48; 95% CI, 0.28 to 0.84). When separate analyses were carried out for minority families and white families, with and without phones, two variables were significant in all cases. Screening uptake was greatest in those families with more children under the age of 6 years and least in those families living in the most deprived area of the community.

Cholesterol screening

One RCT investigated the effect of **gender of the healthcare professional**, **patient age**, **income**, **education**, **ethnicity** and **perceived risk** on the uptake of cholesterol testing.[86] The study population comprised individuals (aged 18–75 years) who attended a community clinic in the USA. In those patients where cholesterol screening was indicated, patients of female healthcare professionals were found to be more likely to receive the test than patients of male healthcare professionals, when controlling for the other variables (OR = 1.56; 95% CI, 1.08 to 2.24).

Preventive Medicare screening

One RCT from the USA examined the uptake of preventive screening visits under the USA Medicare system.[82] Medicare is a publicly funded system that provides health insurance benefits for persons over 65 years of age. Under the Medicare system individuals are entitled to free preventive healthcare visits, which incorporate a variety of screening and other procedures including mammography, Pap smear, FOBT and immunisations. The study found that, in community practices, male participants were more likely to attend for screening visits if they were **married** (versus not) (OR = 1.52; 95% CI, 1.09 to 2.08) or **had a solo healthcare provider** (versus a provider in a group practice) (OR = 1.95; 95% CI, 1.38 to 2.75). For female participants factors significantly predictive

TABLE 10 *Summary of evidence across all screening tests (n = 65)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
Individuals with the following determinants are more likely to attend screening:			
Socio-demographic	Having insurance	50% (11/22 studies)	
	Being homosexual or bisexual	33% (1/3 studies)	
	Having a particular occupation	33% (1/3 studies)	Study included occupational exposure to HIV
Knowledge, behaviour, attitudes and beliefs	Showing an increase in decisional-balance score	100% (3/3 studies)	
	Expressing an intention to attend screening	60% (9/15 studies)	
	Having attended for previous screening tests (i.e. the same test)	59% (19/32 studies)	
	Having attended for a different previous screening test	37% (3/8 studies)	
	Having more than one sexual partner in the preceding year	25% (1/4 studies)	
	Knowing someone with cancer or disease	25% (1/4 studies)	
	Being a smoker	25% (1/4 studies)	
	Perceiving cancer or disease to be serious	20% (1/4 studies)	
	Consuming alcohol at least once a month	20% (1/4 studies)	
	Using intravenous drugs or cocaine in the preceding 30 days	20% (1/4 studies)	
	Perceiving self to be susceptible or vulnerable to cancer or disease	18% (2/11 studies)	
	Knowing about the screening test	17% (1/6 studies)	
	Perceiving own health to be poor	11% (1/11 studies)	
Social influences	Having a high Social Network Index score	25% (1/4 studies)	
	Having a female healthcare provider	67% (4/6 studies)	One study only included female participants
Health	Being capable of performing activities of daily living	67% (2/3 studies)	
	Having a family history of cancer or disease	36% (4/11 studies)	All studies related to breast cancer
	Having symptoms of cancer or disease	33% (3/9 studies)	All studies related to breast cancer

[*] *A summary of the determinants, that were investigated in three or more studies, across all screening tests and their influence (positive or negative) on the uptake of screening*
[**] *Level of significance* $p \leq 0.05$

Continued

TABLE 10 contd *Summary of evidence across all screening tests (*n = *65)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
	Having risk factors for cancer or disease	25% (1/4 studies)	
	Visited GP > 4 times in preceding year	25% (2/8 studies)	
	Having a history of cancer or disease	14% (1/7 studies)	
Individuals with the following determinants are less likely to attend screening:			
Barriers and facilitating conditions	Being affected by barriers	33% (1/3 studies)	'Barriers' refers to combined barriers, as in the Health Belief Model
	Having concerns about radiation and mammography	20% (1/5 studies)	
Determinants where the effect on screening is unclear (i.e. studies found positive and negative effects):			
Socio-demographic	Living in a particular area	50% (2/4 studies)	One study found those living in an urban area were more likely to attend, and the other found those living in a deprived area were more likely to attend
Socio-demographic	Age	46% (30/65 studies)	Not clear which age category was more likely to attend
	Being married, single, divorced or widowed	31% (8/26 studies)	One study found married men were more likely to attend; two studies found those who had never been married were less likely to attend; two studies found single, divorced or widowed individuals were more likely to attend; and three studies found that single, divorced or widowed individuals were less likely to attend
	Having a higher or lower level of education	28% (12/42 studies)	Two studies found those with a higher level of education were less likely to attend, and the remaining study found they were more likely to attend

[*] *A summary of the determinants, that were investigated in three or more studies, across all screening tests and their influence (positive or negative) on the uptake of screening*
[**] *Level of significance* $p \leq 0.05$

Continued

TABLE 10 contd *Summary of evidence across all screening tests (n = 65)*[*]

Determinant category	Specific determinant	% studies in which found significant[**]	Comments
	Being from a specific ethnic group	23% (7/30 studies)	Not clear which ethnic groups were more likely to attend for screening
	Being unemployed or employed	21% (3/14 studies)	Two studies found employed individuals were more likely to attend, and the other found that unemployed individuals were more likely to attend screening
	Being male or female	15% (2/13 studies)	One study found males were more likely to attend, and the other found females were more likely to attend for screening
	Having a higher or lower income	9% (2/21 studies)	Not clear whether those with a higher or lower income were more likely to attend for screening
Health	Having a history of STD	67% (2/3 studies)	One study found those with a history of STD were less likely to attend, and the other found that they were more likely to attend
	Having a chronic illness	33% (2/6 studies)	One study found those with a chronic disease were more likely to attend, and the other found they were less likely to attend

[*] *A summary of the determinants, that were investigated in three or more studies, across all screening tests and their influence (positive or negative) on the uptake of screening*
[**] *Level of significance* $p \leq 0.05$

of attendance included **having a confidant** (versus not) (OR = 1.53; 95% CI, 1.13 to 2.07), **having a female healthcare provider** (versus male) (OR = 1.93; 95% CI, 1.21 to 3.08), **having a high-school education** (versus 0–8 years of schooling) (OR = 1.34; 95% CI, 1.04 to 1.71) and **having a previous mammogram** within 2 years of the base-line study survey (versus none) (OR = 1.75; 95% CI, 1.38 to 2.23). When gender-specific screening visits were excluded from the multivariate analysis the following factors were found to be significantly predictive for attendance, regardless of gender: male gender (versus female); non-white (versus white); married (versus not); having a confidant (versus not); and having a female provider (versus male) (data not provided).

Studies examining determinants reported by the healthcare provider

Only two studies (both RCTs) included in the review examined factors influencing the behaviour of the healthcare provider.[66,87]

One study assessed whether resident physicians were as likely to carry out a Pap smear on obese

or morbidly obese women as they were on non-obese women.[87] The study was based at a large academic general medicine practice that provides care to an urban (low-income) population in the USA. The medical records of a random sample of eligible women who were due for a Pap smear were identified and a physician reminder and an encounter form placed in their notes. Physicians were asked, where appropriate, to note why a Pap smear was not conducted by choosing one of five predefined response categories. Physicians of morbidly obese women were more likely to respond that the Pap smear was delayed due to the category 'acute illness, vaginitis and menstruation' (OR = 4.59; 95% CI, 1.67 to 12.5). However, only 51.7% of the responses were included in the final analysis, due to physicians either not completing the questionnaire or not including a response to why a Pap smear was not performed. Furthermore there was no response category for the physician to note that they had not conducted a smear because they thought that the patient was overweight.

The second study examined the uptake of mammography in urban community health centres in Massachusetts, USA.[66] Ninety-five physicians in 61 practices and a total of 11,426 women (aged ≥ 50 years old) were included in the study. The effect on mammography referrals of cues and monetary incentives aimed at the physician were examined. Only those women who accepted the recommendation of their physician were finally included in the study. The study failed to identify any significant associations with mammography attendance for the following: the **age of the provider**; the **medical school where the provider was trained**; the provider's **first and additional specialities** and whether they were **certified in those specialities**; whether the provider was **a member of the American Medical Association**; and whether the provider was a **member of the county medical society**.

Summary of determinant results across all screening tests

Table 10 summarises the determinant results across all the screening studies. Only those factors that were investigated in three or more studies (regardless of the screening programme or test) are included in the table. This is an arbitrary limit, as previously stated, which should be borne in mind when interpreting the summary findings.

Chapter 4

Results of intervention studies

Potentially relevant studies were identified through screening over 46,000 titles or abstracts, of which 440 full paper copies were assessed for inclusion by two reviewers. Of these, 190 studies (with a total of 204 references) met all the inclusion criteria for the review.

Excluded studies

In total, 136 studies were excluded from the review. Studies were excluded if they failed to meet one or more of the inclusion criteria (see chapter 2). The majority of studies were excluded because they lacked an appropriate study design. In addition, some studies were excluded because the outcome was an intermediate measure of screening uptake, such as booking of appointments, reported intentions to undergo screening, or attitudes to (and knowledge of) screening. Interventions to increase the uptake of diagnostic tests (e.g. colposcopy for an abnormal Pap smear) and studies of self-examination (such as BSE) were also excluded.

Included studies

Table 11 describes the types of screening test included in the review and the countries where studies were undertaken. Some studies evaluated the effect of an intervention (or interventions) on the uptake a single screening test, while others evaluated the uptake of two or more tests. Overall, 123 (65%) of the studies were undertaken in North America, 35 (18%) were undertaken in the UK, 23 (12%) were undertaken in Australia and New Zealand, eight (4%) were undertaken in Europe and one was undertaken in Singapore. The majority of the studies evaluated uptake of cancer screening programmes, with over half of all studies (56%) evaluating interventions to increase the

TABLE 11 *Number of studies for each screening test, and countries where the studies were undertaken*[*]

Screening test	UK	North America	Australia and New Zealand	Europe	Other	Total studies for test
Mammogram	9	84	7	3	1	104
Pap smear	6	41	13	6	0	
FOBT	10	33	2	0	0	
CBE	0	18	0	0	0	18
Sigmoidoscopy	3	11	1	1	0	16
Cholesterol test	0	7	1	0	0	8
Antenatal test	5	2	0	0	0	7
Tuberculosis test	0	5	0	0	0	5
Blood pressure measurement	1	2	0	0	0	3
Child health screening	1	2	0	0	0	3
HIV test	1	2	0	0	0	3
Bone densitometry	2	0	0	0	0	2
Haemoglobin disorder screening	1	0	0	0	0	1
Diabetes test	1	0	0	0	0	1

[*] *Some studies evaluated uptake for more than one test, and therefore the columns cannot be totalled*

uptake of breast cancer screening (mammography and/or CBE). Sixty-two studies were undertaken in a general or private or health centre setting, 38 studies in the community or community groups, 17 within HMOs, 29 in hospitals or hospital clinics, 18 studies within organised or pilot screening programmes, nine in a university or workplace setting, and 17 in other settings.

The intervention was developed using a theory or model in 37 of the studies. The most common theory was the Health Belief Model, which was

TABLE 12 *Summary of the quality of intervention studies*

Quality criteria	% of studies
Randomisation	
Randomisation method stated and adequate	13% (24/190)
Randomised, but method not stated	56% (106/190)
Quasi-RCT	14% (27/190)
Non-randomised (controlled trial)	17% (33/190)
Blinding of assessors	
Stated that assessors were blinded or used central screening programme computer system	9% (17/190)
Unknown	87% (166/190)
Stated that assessors were not blinded	4% (7/190)
Percentage analysed	
Analysed 100% of those randomised	25% (47/190)
Analysed 80–99%	26% (49/190)
Analysed 50–79%	17% (33/190)
Analysed < 50%	2% (4/190)
Unknown	21% (40/90)
Pre- and post-test design using cross-sectional surveys	9% (18/190)
Intention-to-intervene analysis	
Stated that intention-to-intervene analysis performed	8% (16/190)
Not applicable (100% follow-up)	16% (31/190)
Not enough information	18% (35/190)
Not used	47% (89/190)
Not applicable (cross-sectional surveys)	10% (19/190)
Baseline comparability	
No baseline differences	42% (80/190)
Unknown, or minor	40% (76/190)
Significant baseline differences in one or more variables	18% (34/190)
Outcome assessment	
Medical records or computerised records	67% (127/190)
Unknown	19% (37/190)
Self-report	14% (26/190)
Appropriate analysis of cluster trials **(n = *82*)**	
Analysed using cluster as unit of analysis	26% (21/82)
Analysed using individual as unit of analysis	74% (61/82)

used in 17/38 (45%) of the studies. Other theories used were Cognitive Social Learning Theory (one study), Elaboration Likelihood Model (one study), Hierarchical Weighted Utility Model (one study), Leventhal's Parallel Response Model (one study), Prospect Theory (one study), PRECEDE (six studies), Theory of Reasoned Action (four studies), Transtheoretical Model (two studies) and Social Learning Theory (four studies).

Outcomes assessed in the review

Although uptake was the primary outcome measured in this review, informed uptake was also assessed. Only one study fulfilled all the four criteria for informed uptake (see chapter 2),[127] and three further studies fulfilled three of the four criteria.[120,128,129] All the studies evaluated educational and/or counselling interventions for prenatal testing (HIV, Down's syndrome and cystic fibrosis).

Other outcomes assessed were intermediate measures (e.g. knowledge, intention to undergo screening, anxiety, and attitudes and beliefs) and costs. When informed uptake, intermediate measures and/or costs were assessed by a study, the findings are briefly reported in the text of the review. The findings are also reported in more detail in the data extraction tables for the studies (see appendix 5).

Quality of the included studies

Interpretation of the findings of a systematic review is dependent on the validity of the included studies. The quality of the 190 studies was assessed according to seven criteria, as defined in chapter 2 (one criterion was only relevant for cluster RCTs), and the results are summarised in *Table 12*. The quality of most of the studies was difficult to ascertain due to a lack of reported information. In general, those studies that described the method of randomisation and allocation also gave more information on other aspects of quality. Details of the quality of individual studies are given in appendix 6, and a summary of the overall quality of studies for each group of interventions is included at the end of the relevant sections.

Allocation concealment and method of randomisation

Research has shown that lack of adequate allocation concealment is associated with bias[130] and has been found to be more important in preventing bias than the method of randomisation. Although 131 studies stated that they were randomised, only 24 studies (13%) mentioned the method of randomisation. Even fewer studies reported the method of allocation concealment (i.e. sealed opaque envelope). Twenty-seven studies (14%) used a quasi-randomisation method, such as allocation by days of the week, clinic sessions or social security number. Thirty-three studies (17%) were controlled, and these were usually cluster trials evaluating interventions targeting groups of people in towns, GP practices or health authority areas.

Blinding of assessors

To prevent detection bias (systematic differences between comparison groups in how outcomes are ascertained, diagnosed or verified), persons responsible for outcome assessments should also be unaware of the assigned intervention. Blinding of assessors was only mentioned in nine (5%) studies. A further eight (4%) studies derived uptake from a central screening programme computer system, which would have also meant that assessors were blinded.

Percentage analysed

Systematic differences between groups in losses of participants is called 'attrition bias' or 'exclusion bias'. The approach to handling losses has great potential for biasing the results, especially if there is a large number of exclusions after randomisation. Included studies used different methods of analysing drop-outs, and losses to follow-up. Several studies excluded large numbers of participants from the final analyses, usually because they were found to be ineligible for screening (e.g. the wrong age groups or were already up to date). Other studies only analysed a small subgroup of the total number randomised. Some studies did include losses to follow-up and drop-outs in the analyses, while others did not.

Intention-to-intervene analysis

The majority of studies did not report using an intention-to-intervene analysis. Sixteen studies (8%) did report using an intention-to-intervene analysis, but most did not give enough details about the uptake status assigned to either drop-outs or losses to follow-up. A further 31 studies (16%) reported 100% follow-up of those randomised.

Baseline comparability

If proper randomisation and allocation concealment has been carried out, participants in the intervention and control groups should be comparable in important baseline characteristics such as age, screening status and educational status.

Differences in baseline characteristics can result in differences in screening uptake, which are unrelated to the effect of the intervention. Thirty-four studies (14 RCTs, four quasi-RCTs and 16 controlled trials) had significant baseline differences between intervention and control groups. Fifteen of these studies, however, took account of these differences in subsequent analyses. A higher percentage of controlled trials had baseline differences, compared with other designs: 16/32 controlled trials (50%) compared with 4/27 (15%) quasi- or partially randomised trials and 14/131 (11%) RCTs (eight of which were cluster RCTs).

Measurement of outcome

The main outcome of interest was uptake of screening tests. Most commonly, this outcome was measured either by self-report or by administrative records held by a GP practice or a screening unit. Self-report as the sole measure of uptake was considered inadequate in this review. Self-reported information has been found to be useful in assessing uptake for Pap smear histories, but the resulting screening rates should be treated as high estimates and may be inaccurate.[131,132] Only four studies reported the results for both methods of assessing uptake.[115,133–135]

Analysis of cluster randomised trials

Eighty-two studies (45 RCTs, nine quasi-RCTs and 28 controlled trials) evaluated interventions implemented at the level of organisation or geographical area (e.g. GP practice and streets) rather than at the level of the individual subject. The unit of allocation was community or region in 21 studies, GP practice or hospital clinic or physician in 42 studies, community groups in six studies, households or families in ten studies, and other units in three studies. There are three methods of analysing data from cluster trials: cluster-level analysis, in which cluster means or proportions are used as units of analysis; adjusted individual-level analysis, in which standard univariate statistical methods are adjusted for the design effect; and regression methods for clustered data, which allow for both individual- and cluster-level variation.[136] Twenty-one studies (26%) used one of these three methods. The other studies used the individual as the unit of analysis.

Reporting of the results of included studies

RRs and 95% CIs were calculated for all appropriate RCTs (if enough data were available), but there was significant statistical heterogeneity for all but one of the comparisons. The results for the rest of the comparisons are here reported narratively, with figures displaying individual RRs (95% CIs) for RCTs. Data from non-RCTs are reported descriptively in the text and in appendix 6. Where there were enough studies for a particular intervention, the screening tests were considered separately. Where there were only a few studies, the different screening tests were combined.

Interventions aimed at encouraging individuals to undergo screening

In total, 159 studies evaluated either single- or multicomponent interventions to increase the uptake of screening in individuals. Some studies compared more than one intervention group with usual care, a control group or another intervention. Details of all included studies are given in appendix 5.

Invitations for individuals

Fifty-seven studies (44 RCTs, seven quasi-RCTs and six controlled trials) invited people who were due for screening, but had not been contacted previously in the screening round.[61,71,75,80,96,98,100,103,110,115,137–182] Interventions included appointments, letters/postcards (some with a follow-on reminder letter or leaflet), telephone calls and verbal invitations from a health professional. Follow-up letters, phone calls and cards prompting attendance are also included in this section (see *Table 13* for definitions of the invitation interventions and the countries where studies were undertaken). The studies were conducted in a wide range of settings, including HMOs, GP practices, hospitals and the community. Thirty studies (53%) were conducted in North America (the USA and Canada), eight (14%) were undertaken in the UK, 13 (23%) were undertaken in Australia and New Zealand, and the rest were undertaken in other countries. In this section, interventions are compared firstly with control or with other interventions of the same type (e.g. different types of appointment). The relative effectiveness of different invitation interventions is then assessed, when the comparison is made within a study (e.g. a study comparing letters with appointments).

Appointments

Fourteen studies (11 RCTs, two quasi-RCTs and one controlled trial) evaluated giving or offering appointments for screening versus a control group, or another appointment

TABLE 13 *Invitations: definitions, number of RCTs and countries where the studies were undertaken*[*]

Definition	No. of RCTs (%)	No. of studies				
		UK	North America	Australia and New Zealand	Other	Total
All invitation studies	44 (77%)	9	30	13	5	57
Pre-fixed or open/flexible appointment Given a pre-fixed appointment time, open appointment (invitation to make appointment) or flexible appointment (choice of times)	11 (79%)	5	4	3	2	14
Letter Letter advising that screening is due (either first round or subsequent rounds). Also, letters for people that require a follow-up screening test	28 (97%)	5	16	8	0	29
Letter from different sources Invitation from different sources (e.g. physicians, health authorities or experts)	3 (50%)	0	1	1	4	6
Telephone call Telephone call to people eligible for screening. Does not contain a counselling or educational component	6 (100%)	0	5	1	0	6
Verbal invitation or recommendation Face-to-face talk with a health professional who indicates that it is time for a screening test. Does not contain a counselling or educational component	0 (0%)	0	1	0	0	1
Follow-up Additional phone calls, letters or postcards after the initial invitation or test has been sent out. Control group receives invitation only	5 (50%)	0	9	1	0	10
Prompts to attend Birthday cards, prompt cards, and 'credit cards' prompting people to be screened	1 (33%)	0	2	1	0	3

[*] *Some studies evaluated the effectiveness of more than one intervention, and therefore the columns cannot be totalled*

strategy.[71,103,115,145–147,158,164–170] Four studies were undertaken in the USA, six were undertaken in the UK, one was undertaken in Italy and four were undertaken in Australia. Overall, fixed appointments appeared to be more effective than either control or open appointments (*Figure 2*).

Pre-fixed appointments versus control or usual care. Two RCTs compared giving a fixed appointment versus control for either Pap smear[103] or mammogram.[167] Both showed a statistically significant effect of the intervention (Pap smear – RRs = 1.81; 95% CI, 1.2 to 2.69; mammogram – RR = 3.72; 95% CI, 1.77 to 7.80).

Open or flexible appointments versus control or usual care. One RCT found that a letter inviting women to make an appointment was more effective than usual care (physician recommendation) for uptake of both Pap smears and mammograms (RR = 2.13; 95% CI, 1.72 to 2.64; versus RR = 1.66; 95% CI, 1.41 to 1.95).[165] Another RCT found that an open invitation was no more effective than control in increasing the uptake of Pap smears (RR = 0.95; 95% CI, 0.57, 1.55).[115]

Pre-fixed appointments versus open or flexible appointments. Eight studies (seven RCTs and one controlled trial) compared a fixed appointment with an open or flexible appointment.[71,103,146,147,158,168,169,183] RRs were calculated for all seven RCTs.

For **Pap smears**, two RCTs (one cluster RCT) found a fixed appointment more effective than an open appointment,[71,169] and one reported no difference (see *Figure 2*).[103] The latter study (which compared several interventions) reported that, although the letter interventions (fixed and open appointments) were more successful at recruiting women for screening, the extra cost involved made them marginally less cost-effective than tagging files (physician reminders).

For **mammography**, two RCTs (one cluster RCT) found a fixed appointment more effective than an

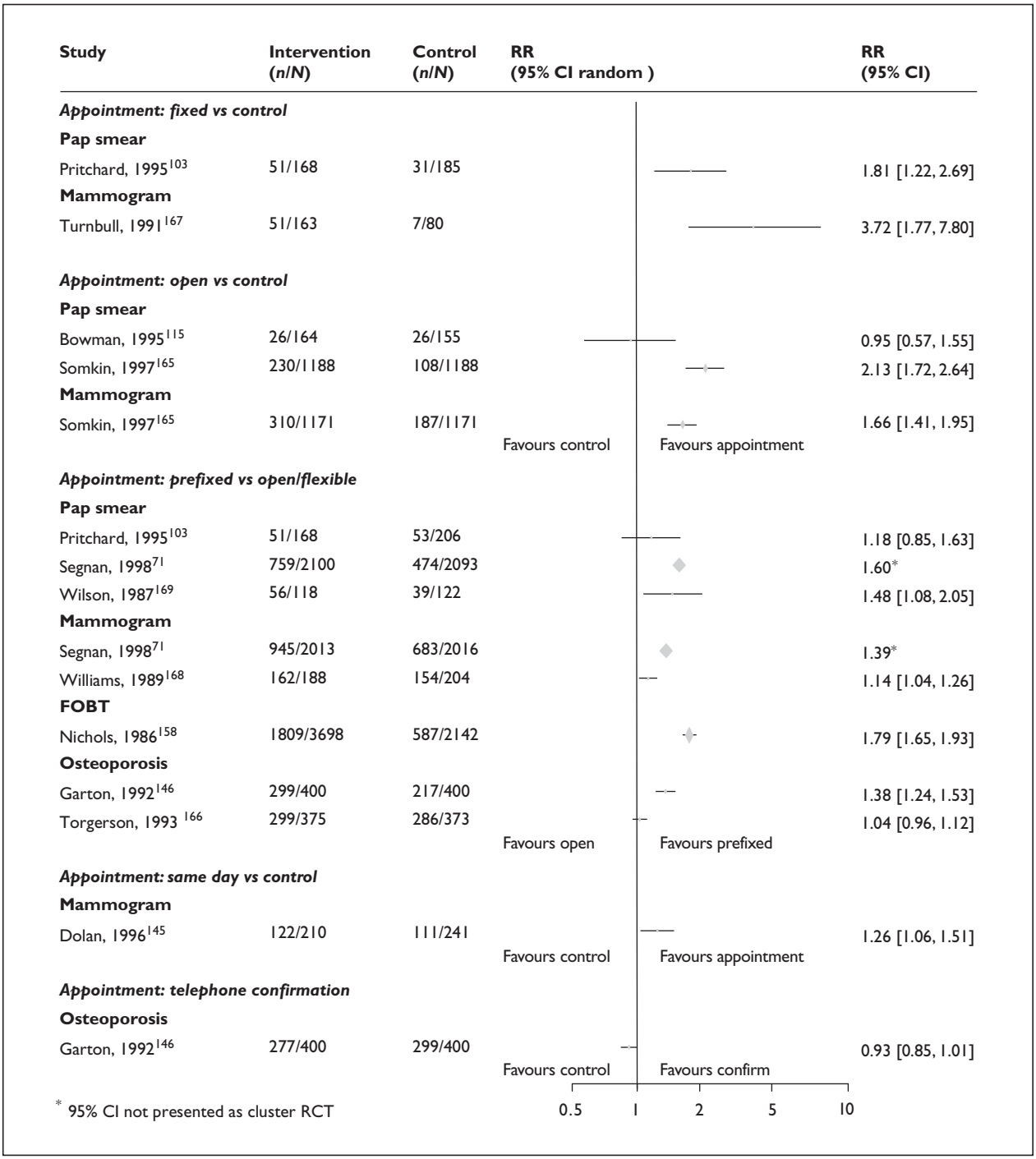


FIGURE 2 *Uptake of screening: invitation appointments*

open appointment (see *Figure 2*).[71,168] A controlled trial found that a fixed appointment was more effective than an open appointment letter (20.1% versus 10.3%).[147] This study reported that the most cost-effective personal recruitment strategy was an invitation letter without a specified appointment time, followed by a second letter to non-attenders (the open invitation).

For **FOBTs**, one RCT found a letter with a fixed appointment was more effective than a letter inviting people to make an appointment (RR = 1.79; 95% CI, 1.65 to 1.93).[158]

For **osteoporosis screening**, two RCTs were undertaken in the same setting, by the same authors. One found that a fixed appointment was more effective than an open invitation (RR = 1.38; 95% CI, 1.24 to 1.53),[146] while the other reported no significant difference (RR = 1.04; 95% CI, 0.96 to 1.12).[183] The former calculated the opportunity cost of the two appointment strategies and reported that open invitation achieved higher uptake at a lower cost.

Other appointment strategies. For mammography, one RCT found that same-day appointments following a physician recommendation were more effective than control for increasing the uptake of mammograms (RR = 1.26; 95% CI, 1.06 to 1.51).[145] A quasi-RCT compared the offer of making a mammogram appointment 'on the spot' (plus reminder) with a control group. Actual numbers were not reported, but the authors report that uptake was 73% in the 'on-the-spot' group and 54% in the control group ($p < 0.001$).[170] A further quasi-RCT found that a screening plastic reminder card and return appointment date with or without a reminder was more effective than giving an appointment card for the next annual mammogram at the time of the first mammogram (72% versus 44%).[164]

For **osteoporosis screening**, an RCT showed that a fixed appointment with the option to change the time was no more effective than a fixed appointment requiring telephone confirmation (RR = 0.93; 95% CI, 0.85 to 1.01).[146]

Letters versus control and different types of letter

Twenty-eight studies (27 RCTs and one quasi-RCT) evaluated the effectiveness of invitation letters.[61,75,80,98,115,138–144,148,150,152–157,159–163,171,179,184] The comparison interventions were letters from different sources, different types of letter or a control group (no intervention or usual care).

One RCT compared a letter with other invitations (this is discussed in the section comparing different invitation interventions).[158] Twenty-four studies evaluated a letter intervention versus no intervention at all, and two RCTs evaluated the additional effect of a letter when both the intervention and control group received either a media campaign[156] or an invitation from the NHS breast screening programme.[159] Two RCTs included a brochure with the invitation[156,159] and five RCTs sent out a reminder (prompt) letter, days or weeks after the initial invitation.[139,154,155,160,163] The effectiveness of sending out prompts after the initial invitation versus an invitation with no prompt is considered in a later section. The studies of invitation by letter were grouped by screening test, and the results are described below. Overall, RRs were calculated for 18 RCTs (eight for Pap smear, eight for mammography, one for blood pressure screening, and one for a dental check) (*Figure 3*). There was significant heterogeneity even within screening tests, and therefore the results could not be pooled. Ten of the RCTs reported a statistically significant effect of the letter intervention (compared with control), while the other eight reported no effect. Of the 18 RCTs, five out of eight reported a statistically significant effect for Pap smears compared with only three out of eight for mammography.

Letters versus control or usual care. For **Pap smear**, 15 studies (14 RCTs and one quasi-RCT) invited women by letter (versus no intervention or usual care) to attend for Pap smear.[80,115,138–144,152,154,156,160–162] Eight studies were undertaken in North America, six in Australasia and one in the UK. RRs could be calculated for eight RCTs. Five showed a significant effect of the intervention, and three showed no effect (see *Figure 3*).

RRs were not calculated for the other seven studies (six RCTs and one quasi-RCT). Data could not be extracted from three RCTs, which evaluated the effectiveness of letters for multiple tests, including Pap smear. One reported no difference in effectiveness between the letter and control group.[162] The other two reported an adverse effect of the intervention.[143,160] The other three RCTs, undertaken in Australia by the same author, evaluated interventions at the community or regional level.[140–142] The unit of allocation was different from the unit of analysis in all three studies, and actual numbers were not reported. Two RCTs of mass letter campaigns found the intervention to have some effect, but results were reported as change from baseline in intervention groups, rather than the differences between intervention and control. Thus these

results and conclusions should be interpreted with some caution. The third RCT found that a GP letter combined with a mass media campaign was more effective than a mass media campaign alone, but the effect varied by community. Lastly, a quasi-RCT inviting women to return after an abnormal smear result found that the letter intervention was no more effective than control.[152]

For **mammography**, 12 RCTs invited women by letter (versus no letter) to attend for mammograms.[61,75,143,148,150,153,157,159,160,162,163,179] Nine studies were undertaken in North America, two in Australasia and one in the UK. RRs were calculated for eight RCTs. Three showed a significant effect of the intervention and five showed no effect of the intervention (see *Figure 3*). Data could not be

Study	Intervention (*n*/*N*)	Control (*n*/*N*)	RR (95% CI random)	RR (95% CI)
Letter vs control				
Pap smear				
Binstock, 1997[138]	403/1526	249/1526		1.62 (1.41–1.86)
Bowman, 1995[115]	52/178	26/155		1.74 (1.15–2.65)
Buehler, 1997[139]	19/178	13/208		1.71 (0.87–3.36)
Burack, 1998[80]	280/964	270/964		1.04 (0.90–1.19)
Del Mar, 1998[144]	36/359	39/330		0.85 (0.55–1.30)
McDowell, 1989[154]	76/367	35/330		1.95 (1.35–2.83)
Mitchell, 1991[156]	74/1177	79/1857		1.51 (1.26–1.80)
Pierce, 1989[161]	45/140	20/134		2.15 (1.35–3.45)
Mammogram				
Hackett, 1996[179]	92/602	83/600		1.10 (0.84–1.45)
Irwig, 1990[148]	91/288	11/152		4.37 (2.41–7.91)
Landis, 1992[150]	6/41	1/43		6.29*
Mayer, 1994[153]	15/32	6/31		2.42 (1.08–5.43)
Mohler, 1995[157]	7/38	4/31		1.75 (0.56–5.49)
O'Connor, 1998[159]	134/236	120/234		1.11 (0.94–1.31)
Richardson, 1994[163]	144/203	119/192		1.14 (0.99–1.32)
Taplin, 1994[75]	150/329	154/329		0.97 (0.83–1.15)
Blood pressure				
McDowell, 1989[155]	391/1094	210/996		1.70 (1.47–1.96)
Dental check				
Zarod, 1992[171]	191/262	102/243		1.74 (1.47–2.05)
			Favours control / Favours letter	
GP letters vs other authority sources				
Pap smear				
Segnan, 1998[71]	759/2100	647/2094		1.17*
Mammogram				
Segnan, 1998[71]	945/2013	837/2015		1.13*
Taplin, 1994[75]	150/329	154/329		0.97 (0.83–1.15)
Sigmoidoscopy				
Senore, 1996[96]	112/382	204/787		1.13 (0.93–1.38)
			Favours other letter / Favours GP letter	
Tailored letter vs control				
Mammogram				
Meldrum, 1994[184]	956/1552	922/1531		1.02 (0.90, 1.11)
			Favours control / Favours letter	
			0.2 0.5 1 2 5 10	

* 95% CI not presented as cluster RCT

FIGURE 3 *Uptake of screening: invitation letters versus control and letters from different sources*

extracted for the four remaining RCTs, but two reported an effect of the intervention and the other two reported no effect (for further details see appendix 5).[61,143,160,162]

For **other screening tests**, one RCT found an invitation letter was more effective than control for blood pressure screening (RR = 1.70; 95% CI, 1.47 to 1.96).[155] An RCT of school dental screening found that sending a referral letter to parents, advising that their child should visit a dentist (plus reminders) was more effective than no letter (RR = 1.74; 95% CI, 1.47 to 2.05).[171] A further RCT reported higher uptake of FOBT in the letter group versus a control group (actual numbers not provided; $p < 0.05$).[162]

For **multiple tests**, one RCT evaluated the effect of a letter (plus leaflet) on a range of screening tests.[143] Actual numbers were not provided, but the authors reported that the intervention was less effective than control ($p = 0.05$). The authors offered no explanation as to why the recall intervention had an adverse effect on uptake of screening. A cluster RCT that looked at a range of screening tests (data could not be extracted) showed a decline in uptake of some screening tests (Pap smear) after the intervention, and no overall effect across tests.[160]

Letters from different authority sources. Six studies (three RCTs and three controlled trials) compared sending a letter from a GP with a letter from a health authority or other source. One study was undertaken in North America, one in Australia, two in Italy and two in The Netherlands.[71,75,96,149,151,177] RRs were calculated for three RCTs, but there was significant heterogeneity, so the results were not combined. Two RCTs found no effect of sending a letter from a GP rather than from another source, and the third found an effect (but this was a cluster RCT with a different unit of allocation from analysis) (see *Figure 3*). Two controlled trials in The Netherlands, undertaken by the same authors, found that a GP letter increased uptake of Pap smears by 9–18% compared to a letter from the local health authority.[149,151] Lastly, a controlled trial found that sending a letter from a GP was no more effective than a similar letter from hospital professor in increasing FOBT uptake.[177] This study evaluated the effectiveness and costs of a number of different interventions. A letter from a GP was less expensive than the letter from the hospital professor (see appendix 5).

Personalised tailored letters. One RCT compared sending a personalised tailored letter that referred to a woman's screening history with a standard letter; the former did not increase the uptake of mammography (RR = 1.02; 95% CI, 0.97 to 1.08).[184]

Non-personalised tailored letters. An RCT found that tailored letters increased uptake of mammography versus a standard letter only in black and low-income women (actual numbers not provided).[98] The study also reported that women who received tailored letters were more likely to remember them than were recipients of standardised letters ($p < 0.05$) and were more likely to read the contents thoroughly ($p < 0.01$).

Telephone calls

Telephone calls versus control. Five RCTs of telephone invitations versus no intervention were assessed. All were undertaken in North America.[138,154,155,157,181] RRs were calculated for all five RCTs. Two RCTs of mammography and two for Pap smear all showed a statistically significant effect of the intervention. One RCT of blood pressure screening showed no effect[155] (*Figure 4*).

Telephone calls from different authority sources. One RCT compared inviting women for mammograms by a telephone call from either a medical assistant or physicians.[157] There was no statistically significant difference between the two groups, but uptake was less in the physician group (RR = 0.67; 95% CI, 0.36 to 1.24). The sample size was small, however, and no sample-size or power calculations were performed. The costs per intervention were calculated and the authors concluded that the telephone calls made by medical assistants were a cost-effective strategy.

Follow-up and prompt letters, phone calls and postcards versus no follow-up. Ten studies (six RCTs, three quasi-RCTs and one controlled trial) evaluated the effect of follow-up and prompt contacts after an initial invitation or test had been sent, versus just sending the invitation or test.[75,100,110,137,172–175,178,182] Interventions included letters, telephone calls, postcards and verbal prompts. RRs were calculated for five RCTs, three of which showed a statistically significant effect, one showed an adverse effect and one showed no effect (*Figure 5*). The effect varied by screening test.

For **Pap smears**, a quasi-RCT of women with abnormal smears found no effect of a pamphlet (with prompt) plus a notification letter, compared to a letter alone (64.2% versus 51.3%; $p = 0.097$).[174]

For **mammography**, an RCT found that uptake was higher after a follow-up postcard (RR = 1.28; 95%

CI, 1.11 to 1.49).[75] A quasi-RCT evaluating the addition of a follow-up phone call by a breast care nurse found that uptake of mammography increased significantly (27% versus 5%),[178] while another quasi-RCT found no statistically significant effect of a mailed reminder before a mammography appointment (see appendix 5).[173]

For **FOBTs**, two RCTs found that uptake was higher in the follow-up groups, as compared to control after sending out FOBTs (see *Figure 5*).[100,110] One of the RCTs also reported the costs and cost-effectiveness of different interventions. Analysis of a cohort of 10,000 persons over 50 years, in which FOBT was offered with or without postcard reminders, suggested that initial costs of a formal postcard reminder for FOBT testing would be likely to be offset by savings in long-term care.[100]

For **cholesterol testing**, an RCT assessing the use of a follow-up letter (plus education) found it less effective than control.[137]

For **tuberculosis testing**, an RCT found that a follow-up letter had no effect (RR = 0.98; 95% CI, 0.89 to 1.09) on the return for tuberculosis tests reading.[175] This RCT also found that the return for

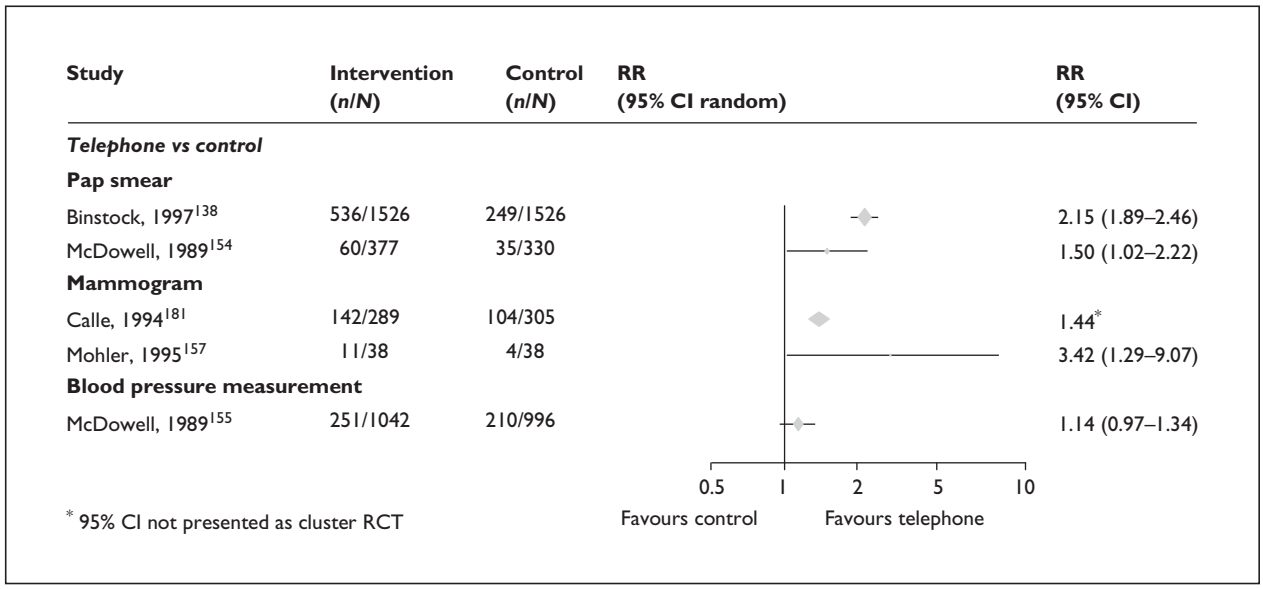


FIGURE 4 *Uptake of screening: invitation telephone calls*

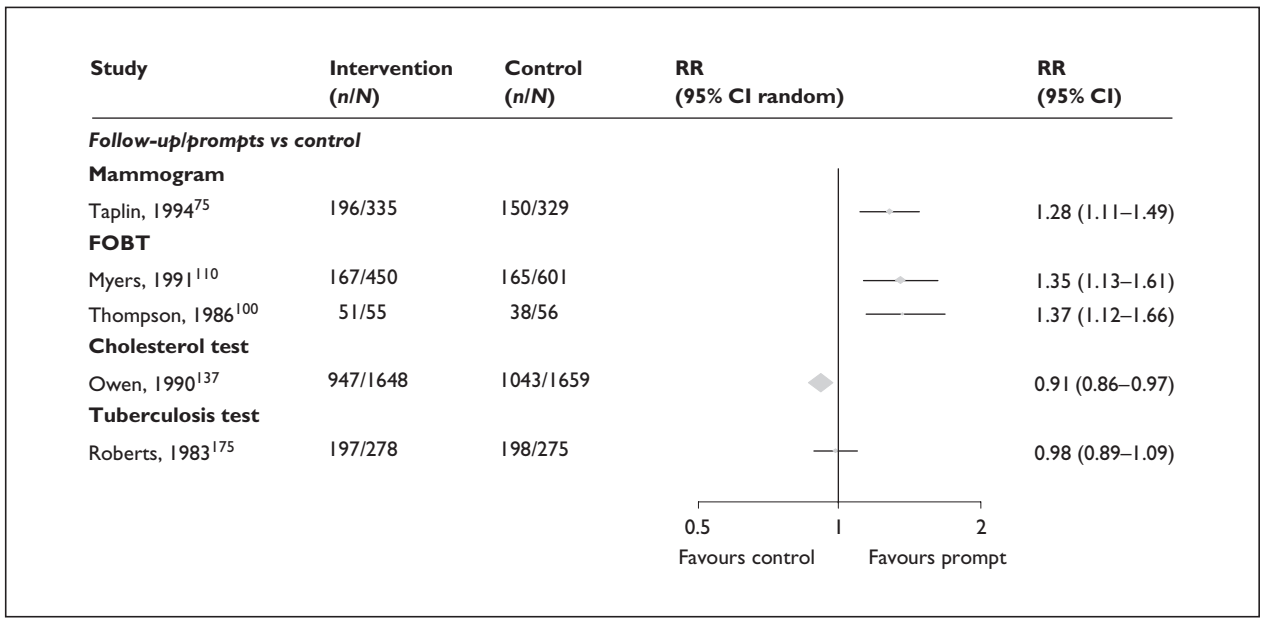


FIGURE 5 *Uptake of screening: invitation follow-up prompts*

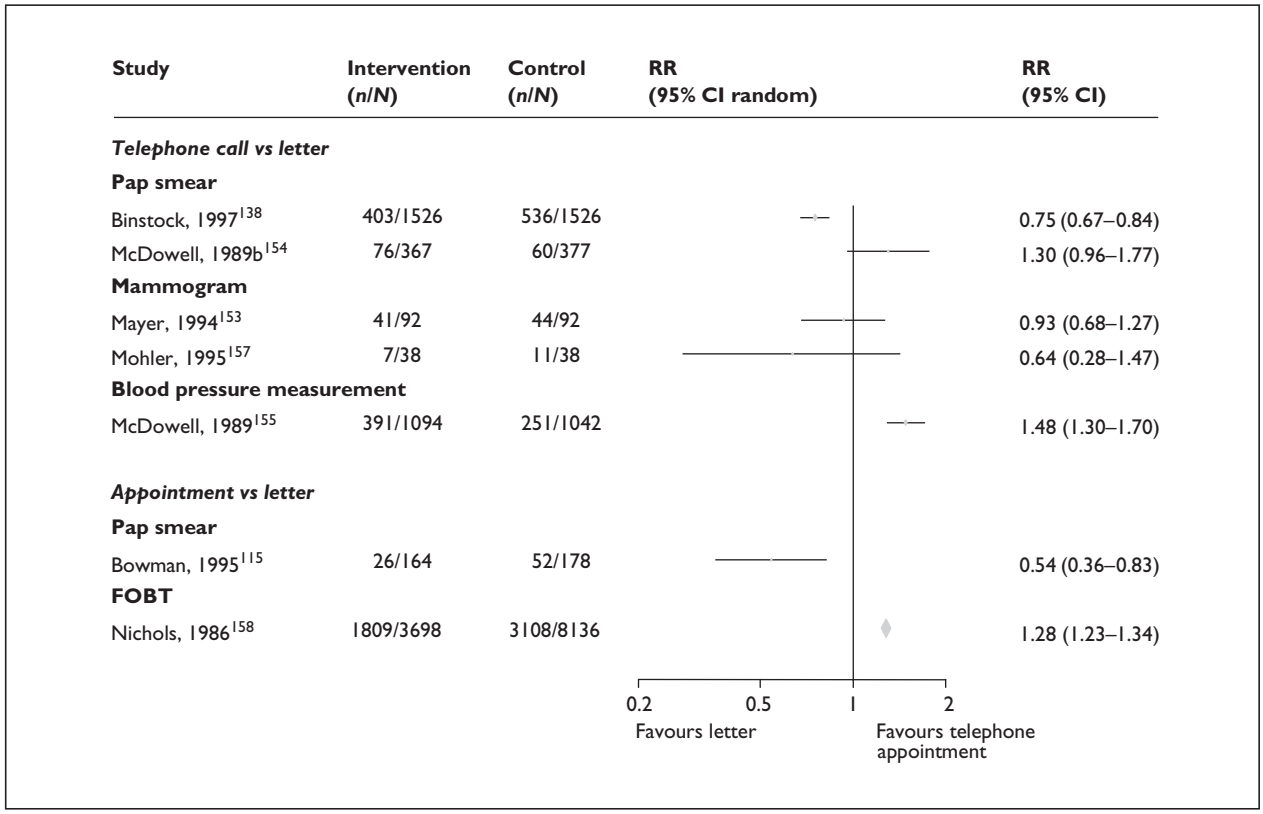


FIGURE 6 *Uptake of screening: comparison of different types of invitation*

tuberculosis tests reading did not increase with a prompt message from an expert (delivered either verbally or written down) at the time of giving the test (RR = 0.96; 95% CI, 0.85 to 1.09).[175] A controlled trial of tuberculosis screening in children evaluated the effectiveness of various follow-up interventions, but none was found to be more effective than control.[182]

For **multiple tests**, an RCT assessing the effectiveness of reminders for all types of appointment (including screening) found that reminding inpatients in advance (versus no reminder) could reduce appointment breaking (80–83% versus 55%, actual numbers not provided).[172]

Prompt cards and 'credit cards'

Three studies (one cluster RCT and two quasi-RCTs) evaluated prompt cards or credit cards versus control or another intervention, but RRs were not calculated for any of the studies.[141,164,176] The cluster RCT assessed the effectiveness of a personally addressed letter combined with a series of five prompt cards to increase Pap smear uptake compared with a letter only or control.[141] Both interventions resulted in a similar increase in attendance (around 40%), and no increase was seen in the control group. However, baseline rates in the control group were already high (74%) and no adjustment for this difference was made in the analyses. A quasi-RCT found that, compared to no reminder card, a patient-carried health maintenance reminder card increased uptake of several screening tests.[176] The other quasi-RCT found that 'credit cards' increased uptake of mammograms compared with a verbal recommendation or other strategies.[164] For more details of these three studies see appendix 5.

Studies comparing different invitation interventions

Eight studies (seven RCTs and one quasi-RCT) evaluated the relative effectiveness of different invitation interventions (*Figure 6*).[115,138,153–155,157,158,164] Six studies were undertaken in the USA, one was undertaken in the UK and one was undertaken in Australia.

Letter versus telephone call

Five RCTs, all undertaken in North America, compared letter invitations with telephone calls for Pap smear, mammogram or blood pressure measurement.[138,153–155,157] There was significant statistical heterogeneity in the results, with the two largest studies reporting conflicting results, although they were for different screening tests (see *Figure*

6).[138,155] Two RCTs estimated the cost-effectiveness of letters, telephone calls and also physician reminders.[154,155] The telephone call was more cost-effective than the letter, but less cost-effective than physician reminders.

Appointments (fixed or open) versus letter

One RCT found that an open appointment at a health clinic was less effective than a letter from a GP in increasing the uptake of Pap smears (RR = 0.54; 95% CI, 0.36 to 0.83).[115] Another RCT found that a letter plus FOBT was less effective than being given a specific appointment (RR = 1.28; 95% CI, 1.23 to 1.34).[158] (See also open versus fixed appointments.)

Appointments versus verbal recommendation

One quasi-RCT for mammography compared offering an appointment with a verbal recommendation for screening from a physician. Uptake was 44.2% in the appointment group compared with 35.6% in the verbal-recommendation group.[164]

Quality of invitation studies

Overall the quality of the studies evaluating the effectiveness of invitations for screening was reasonable. Forty-four of the 57 studies (77%) were RCTs, and in four studies the assessor was blinded. Twenty-seven studies (47%) analysed 80% or more of those randomised. Of these, 11 reported no losses to follow-up (i.e. analysed 100% of those randomised) and four used an intention-to-intervene analysis. Six studies (11%) excluded participants after randomisation, for reasons such as ineligibility, left an HMO, or non-attendance at a clinic or appointment. Seven studies (12%) had significant baseline differences, but none took these differences into account in subsequent analyses. Thirty-nine studies (68%) used an adequate measure of uptake such as medical records. Fifteen studies (10 RCTs, two quasi-RCTs and three controlled trials) allocated clusters rather than individuals, but none took account of the clustering in the analysis. For more details about the quality of individual studies see the tables in appendix 6, and for a summary of the results see *Box 2*.

BOX 2 Summary of the results from invitation studies

- Evidence of effectiveness of appointments:
  - Fixed are more effective than open
- Evidence of effectiveness of letters:
  - More effective in increasing the uptake of Pap smears than mammograms
  - Not enough evidence to detect whether GP letters are more effective than those from another source
- Evidence of effectiveness of telephone calls
- Evidence of some effectiveness of follow-up prompts
- Inconsistent evidence of effectiveness of letters versus telephone calls

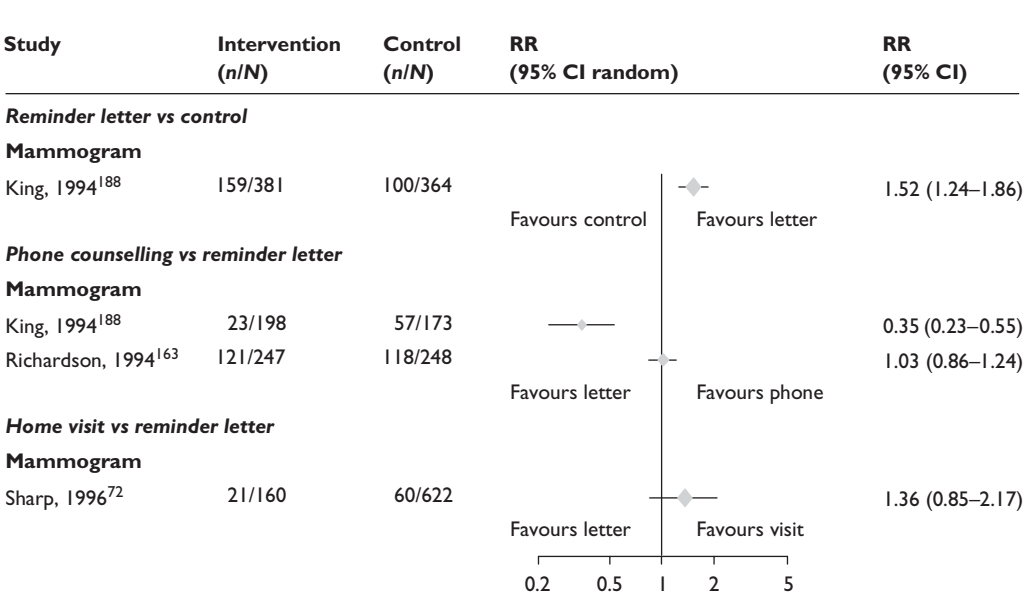


FIGURE 7 *Uptake of screening: reminders for non-attenders*

Reminders for non-responders

Eight studies (three RCTs, two quasi-RCTs and three controlled trials) assessed the effectiveness of reminder interventions to increase uptake in people who had not responded to an initial invitation (*Figure 7*).[72,79,147,163,185–188] These interventions differed from follow-up interventions (see invitations) in that reminders targeted specific people who had not responded. Reminder strategies included letters and second invitations, appointments and telephone calls. Four studies were carried out in the UK, one in the USA, two in Australasia and one in Iceland.

Reminder letters versus control or another intervention

Six studies (three RCTs and three controlled trials) assessed the effectiveness of a reminder letter for Pap smears[79] or mammograms.[72,163,186–188] RRs were calculated for the three RCTs (see *Figure 7*).

For **mammography**, one RCT found that a letter was more effective than no intervention (RR = 1.52; 95% CI, 1.24 to 1.86), but for participants who did not respond to two reminders a letter was less effective than telephone counselling (RR = 0.35; 95% CI, 0.23 to 0.55).[188] Another RCT reported that there was no difference in uptake between women who had telephone reminders and those who received postal reminders (RR = 1.03; 95% CI, 0.86 to 1.24).[163] A letter was at least as effective as a nurse-delivered home interview with or without patient-specific health education in another RCT (RR = 1.36; 95% CI, 0.85 to 2.17).[72] A quasi-RCT reported that a letter from a GP was more effective than a letter from a screening centre (21% versus 10%).[187] A controlled trial allocated GP practices with less than 60% uptake to a reminder letter and those with over 60% uptake to no intervention.[186] Uptake increased by 4.6% in the intervention group, and by 1.6% in the control group ($p < 0.0001$).

Three of the studies assessed the costs of the interventions. One RCT reported costs for several different interventions, and all were considered reasonably inexpensive by authors.[188] A controlled trial calculated that the marginal cost of the intervention worked out to about £7 for each additional woman screened (compared with an average cost of about £27 for each woman screened).[186] A quasi-RCT found that the average cost of a GP letter included with the invitation was 1.1 pence and the marginal cost for each extra attender was 9.6 pence.[187] For further details see the individual data extraction tables in appendix 5.

For **Pap smears**, one controlled trial allocated 'never attenders' to a GP letter and 'previous attenders' to a usual reminder from the Cancer Society (control).[79] The uptake was 10% and 11%, respectively.

Reminder telephone calls versus control or another intervention

One controlled trial reported that 25.5% of women responded to a telephone call asking them to attend for mammography, compared with no intervention (authors' calculated OR = 0.25; 95% CI, 0.21 to 0.29).[147] This trial was poorly designed, with unclear methodology.

BOX 3 Summary of the results from reminder studies

- Evidence of some effectiveness of reminders for mammograms

Reminder appointments versus control or another intervention

One quasi-RCT found that a 'fixed' appointment was more effective than an 'open' appointment (22.8% versus 12.3%) for increasing uptake of mammograms in women who had not attended following an initial invitation.[185]

Quality of studies of reminder interventions

Overall the quality of the studies evaluating the effectiveness of invitations for screening was reasonable. Three of the eight studies (37%) were RCTs, and in three studies the assessor was blinded. Four studies (50%) analysed 80% or more of those randomised. Of these, one reported no losses to follow-up (i.e. analysed 100% of those randomised) and none used an intention-to-intervene analysis. None of the studies excluded participants after randomisation. Two of the controlled trials selected specific groups to have the intervention or control (i.e. non-random).[79,186] Such allocation resulted in baseline differences between the two groups, which were not taken into account in the analysis. Six studies (75%) used an adequate measure of uptake such as medical records. One controlled trial allocated by clusters, but analysed by individuals.[186] For more details of the quality of individual studies see the tables in appendix 6, and for a summary of the results see *Box 3*.

Educational interventions

Forty-two studies (32 RCTs, six quasi-RCTs and four controlled trials) evaluated the effectiveness of educational or information

strategies to increase uptake of screening.[29,68,72,77,78,92,100,102,112,115,122,127–129,152,158,180,182,189–212] Strategies included printed information, audio-visual materials, group teaching, individual teaching and home visits (see *Table 14* for definitions of the educational interventions and the countries where the studies were undertaken). Twenty-six studies were undertaken in North America, four in Australia, one in Singapore, one in the Netherlands and ten in the UK. In this section, interventions are compared firstly with control or usual care. The relative effectiveness of different educational interventions is then assessed, when the comparison is made within a study (e.g. a study comparing group education with home visits).

Printed educational materials

Twenty studies (15 RCTs, three quasi-RCTs and two controlled trials) assessed the effectiveness of printed educational materials. Eight studies were undertaken in the USA, seven in the UK, one in Singapore, one in The Netherlands and three in Australia.[29,78,112,115,122,127,129,158,180,189,194,195,198,202,204,205,207–210] Eighteen of these studies evaluated printed materials versus control. RRs were calculated for 11 RCTs, but there was significant statistical heterogeneity in the results. Overall, printed materials were limited in their effectiveness in increasing the uptake of screening, with nine studies finding no effect of printed materials, one finding a small effect and one finding a large effect (*Figure 8*).

Printed educational materials versus control. For **Pap smears**, three RCTs found no effect of printed materials.[115,122,208] A controlled trial evaluating the effect of giving educational material to women while they were in hospital found that there was no significant difference in uptake between the education and control groups (24% versus 20.1%).[180]

For **mammography**, two RCTs for which RRs could be calculated found no effect of printed materials (see *Figure 8*).[78,194] RRs were not calculated for seven other studies (four RCTs, two quasi-RCTs and one controlled trial). One RCT found that printed materials were more effective than control,[209] and the other six studies found no effect.[122,195,198,202,204,205] One RCT also evaluated knowledge, attitudes and beliefs, but found no difference between those who received printed

TABLE 14 *Educational interventions: definitions, number of RCTs and countries where the studies were undertaken*[*]

Definition	No. of RCTs (%)	No. of studies				
		UK	North America	Australia and New Zealand	Other	Total
All educational studies	32 (76%)	10	26	4	2	42
Printed Leaflet, pamphlet, extended text	15 (75%)	8	7	3	2	20
Audio-visual Video, tape–slide, computer	2 (50%)	1	3	0	0	4
Group teaching Teaching in groups or workshops, in any setting	7 (70%)	1	9	0	0	10
Home visits Home visits with an educational component	9 (90%)	3	6	0	1	10
Individual teaching Teaching of individuals in a setting outside the home. Includes teaching by phone	5 (100%)	2	2	1	0	5
Combination Combination of one or more of the above	1 (50%)	0	2	0	0	2

[*] *Some studies assessed more than one educational intervention, and therefore the columns cannot be totalled*

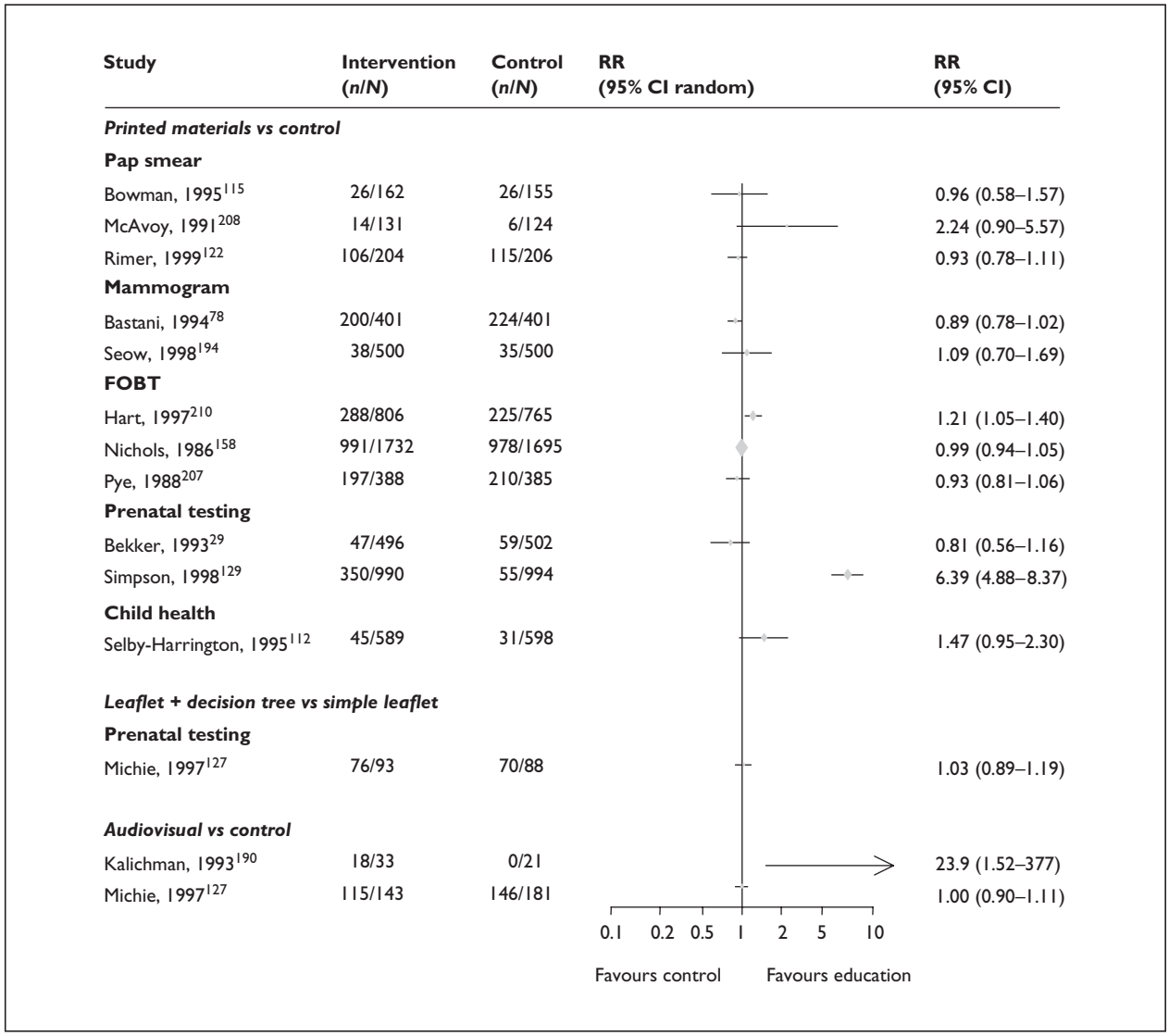


FIGURE 8 *Uptake of screening: printed educational and audio-visual interventions*

materials relating to mammograms and those who received other cancer-related material, which did not specifically target breast cancer.[78]

For **FOBTs**, RRs were calculated for all three RCTs. One RCT found an effect of printed materials,[210] while the other two found no effect (see *Figure 8*).[158,207]

For **prenatal testing**, two RCTs evaluated the effect of printed materials.[29,129] One found no additional effect of sending a leaflet with a letter compared with a letter alone (RR = 0.81; 95% CI, 0.56 to 1.16).[29] The other RCT found a highly statistically significant effect (RR = 6.39; 95% CI, 4.88 to 8.37).[129] This was an RCT of HIV testing in pregnant women, a relatively new screening test with low baseline uptake (prior to the study uptake was only 1%). The study compared other methods of education, with and without individual teaching, but found that uptake was the same in all intervention groups (approximately 35%) compared with only 5% in controls. The study provided women with enough information to make an informed decision (informed uptake). The authors reported that general knowledge of HIV did not differ significantly, however, according to the method of offering the test. A separate analysis was performed without the RCT of HIV testing, but significant statistical heterogeneity remained.

For **child health screening**, one RCT found no additional effect of giving a leaflet with other strategies (RR = 1.47; 95% CI, 0.95 to 2.30).[112]

Simple leaflet versus expanded information leaflet with decision tree. One RCT assessed the impact on women's decisions (informed uptake) by

RIGHT: FIGURE 9 *Uptake of screening: other educational interventions. CBE, clinical breast examination; CF, cystic fibrosis; DS, Down's syndrome; mam; mammography*

presenting information about a screening test for Down's syndrome in different ways (see audio-visual materials).[127] An expanded information leaflet with a decision tree did not increase uptake (RR = 1.03; 95% CI, 0.89 to 1.19), knowledge, decision-making or anxiety.[127]

Non-personalised tailored leaflets. One quasi-RCT found that a leaflet with peripheral cues (glossy paper, colours and opinion of an expert) did not increase the uptake of mammograms compared with either a simple version (black and white, no photographs) or a standard leaflet (control) (90% versus 90% versus 89%).[189] Furthermore, the study found no significant differences regarding beliefs about re-participation between the three groups.

Audio-visual (videos, tape–slide shows and computers)

Four studies (two RCTs and two quasi-RCTs) evaluated the effectiveness of educational videos or tape–slide shows (see *Figure 8*).[127,152,190,201] One small RCT of HIV testing found that a video that had a cultural context was more effective than either a standard public health video or one presented by African-American women (RR = 23.94; 95% CI, 1.52 to 377.28).[190] The study also found that knowledge and attitude changes occurred across the intervention groups, but did not differ significantly between the groups. A further RCT for screening for Down's syndrome (informed uptake) found that a video in addition to a simple or expanded leaflet did not increase uptake (RR = 1.00; 95% CI, 0.90 to 1.11), knowledge, decision-making or anxiety.[127] The other two studies (quasi-RCTs) had methodological flaws and both had difficulties implementing the intervention. One found that an educational video placed in a waiting room increased mammography uptake in low-income, inner city African-American and Latino populations compared with control.[201] The other found no effect on the uptake of Pap smears of a tape–slide programme playing in a clinic waiting room compared with control (authors' calculated OR = 0.97; 95% CI, 0.63 to 1.49).[152]

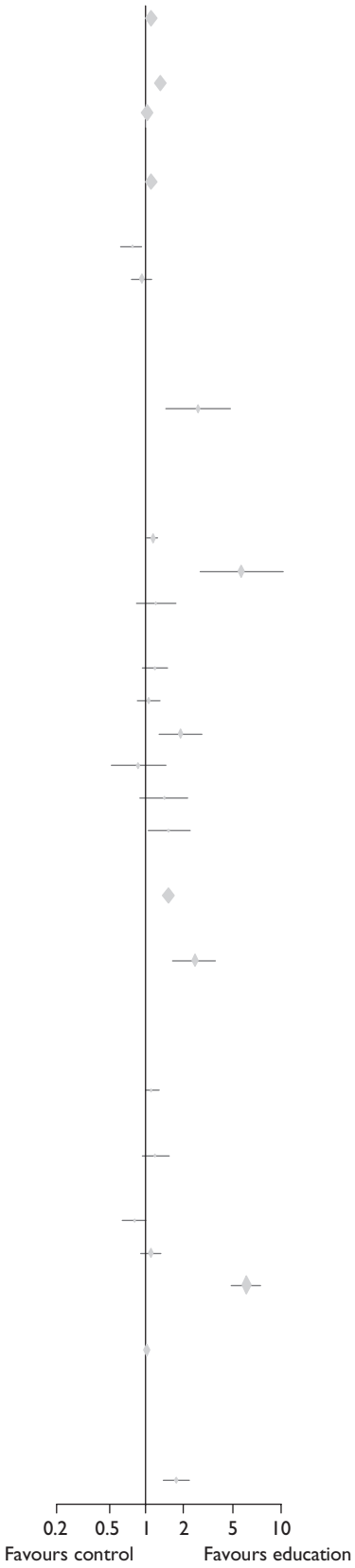
Group teaching (classes and workshops)

Ten studies (seven RCTs and three controlled trials) evaluated the effectiveness of classes or workshops in increasing the uptake of screening.[77,102,128,191,192,195,200,204,211,212] Nine studies were undertaken in the USA and one in the UK.[128] There was considerable statistical heterogeneity in the results, possibly due to the variety of screening tests that were assessed (and thus differences in uptake). RRs were, therefore, not combined (*Figure 9*).

For **Pap smears and mammography**, one cluster RCT compared two types of group education (*por la vida* and community living skills) to increase mammography, Pap smear and CBE uptake in Latina communities.[191] When using the unit of allocation as the unit of analysis, there was no difference in uptake between the two interventions for any of the tests. One RCT published as an abstract found that women receiving a group educational programme had significantly higher mammography uptake than women receiving an educational brochure or usual care (29% versus 18% versus 21%; $p < 0.05$).[195] A further cluster RCT of mammography used a different unit of allocation as the unit of analysis, but there were no statistically significant differences in uptake between the three groups (group education, group education with a psychological component, or control).[200] This study also reported that women who received the group education with a psychological component had a greater intention to obtain a mammogram than did control women ($p = 0.002$). Furthermore, both intervention groups had higher levels of knowledge and higher levels of perceived benefit of mammography than control women did ($p = 0.001$). Two controlled trials found that uptake was greater in the group education session compared with control (printed materials) for mammograms[204] and Pap smears.[211]

For **FOBTs**, one cluster RCT evaluated the effects of four different group educator methods on uptake.[102] Participants who were taught by elderly educator methods did not have a significantly higher uptake than those who received traditional teaching methods (control) (RR = 1.09) or adaptation for ageing changes (RR = 1.66). A combination of elderly educator and adaptation for ageing changes resulted in the highest uptake compared with control (RR = 1.66) Another RCT evaluated the effectiveness of five different methods of increasing the uptake of FOBT.[212] The group method was the most effective intervention, but uptake was not high (28%) (see also the comparison of different educational interventions).

Study	Intervention (*n*/*N*)	Control (*n*/*N*)	RR (95% CI random)	RR (95% CI)
Group teaching vs control				
Pap smear				
Navarro, 1995[191]	130/199	99/162		1.07*
Mammogram/CBE				
Navarro, 1995 (mam)[191]	45/80	34/78		1.29*
Navarro, 1995 (CBE)[191]	119/199	96/162		1.01*
FOBT				
Weinrich, 1993[102]	36/59	23/41		1.09*
Prenatal testing				
Thornton, 1995 (CF)[128]	43/69	61/77		0.79 (0.63–0.98)
Thornton, 1995 (DS)[128]	135/427	146/431		0.93 (0.77–1.13)
Telephone education vs control				
Child health				
Selby-Harrington, 1995[112]	35/284	14/298		2.62 (1.44–4.77)
Home visits vs control				
Pap smear				
Dignan, 1996[206]	282/385	275/430		1.15 (1.04–1.26)
McAvoy, 1991[208]	272/964	6/124		5.8 (2.65–12.81)
Sung, 1997[203]	27/44	26/51		1.20 (0.84–1.72)
Mammogram/CBE				
Champion, 1994[197]	55/75	48/78		1.19 (0.95–1.49)
Hoare, 1994[199]	122/247	117/251		1.06 (0.88–1.27)
Seow, 1998[194]	57/428	35/500		1.90 (1.27–2.84)
Sharp, 1996[72]	36/315	21/160		0.87 (0.53–1.44)
Sung, 1997 (mam)[203]	27/54	22/62		1.41 (0.92–2.16)
Sung, 1997 (CBE)[203]	27/38	20/43		1.53 (1.05–2.23)
Prenatal testing				
Sorenson, 1997[193]	208/309	91/205		1.52*
Child Health				
Selby-Harrington, 1995[112]	75/582	31/598		2.49 (1.66–3.72)
Individual teaching vs control				
Mammogram				
Clover, 1992[196]	75/82	75/91		1.11 (0.99–1.25)
FOBT				
Thompson, 1986[100]	42/52	38/56		1.19 (0.95–1.49)
Prenatal testing				
Thornton, 1995 (CF)[128]	48/74	61/77		0.82 (0.67–1.00)
Thornton, 1995 (DS)[128]	164/441	146/431		1.10 (0.92–1.31)
Simpson, 1998[129]	350/990	55/994		6.26 (5.03–7.79)
Tuberculosis test				
Malotte, 1998[68]	388/527	458/633		1.02 (0.95–1.09)
Combined approaches vs control				
FOBT				
Myers, 1994[92]	126/250	72/251		1.76 (1.40–2.21)



* 95% CI not presented as cluster RCT

For **prenatal testing**, one RCT informed women of both the risks and benefits of screening and also measured knowledge (classified as informed uptake). The study evaluated the effectiveness of offering pregnant women prenatal testing information, before 16 weeks' gestation, in a group setting.[128] Compared to the provision of routine information, this intervention did not increase uptake of Down's syndrome screening (RR = 0.93; 95% CI, 0.77 to 1.13) and was less effective than routine information in increasing uptake of cystic fibrosis testing (RR = 0.79; 95% CI, 0.63 to 0.98). Attendance at extra sessions was 52% overall and lower at classes than individual sessions (authors' adjusted OR = 0.45; 95% CI, 0.35 to 0.58). The authors concluded that the offer of extra information reduces uptake of blood tests when background uptake rate is high (cystic fibrosis), but not when it is already low (Down's syndrome). Anxiety was also measured, and at 20 weeks those offered individual information were significantly less anxious than those in the control group ($p = 0.02$). At 30 weeks the group given individual information was still less anxious on two scales (hospital anxiety and depression scale; $p = 0.049$), but at 6 weeks after delivery the difference was only significant on the state-trait anxiety inventory scale ($p = 0.018$). Women in both intervention groups felt that they had received more relevant information. They were also more satisfied with the information they had received, although this did not translate into feeling surer that they had made the right decision.

For **child health screening**, one RCT compared group well-child care (a healthcare provider led a discussion of child health in groups of parents with similarly aged children, followed by individual examinations) with individual well-child care (traditional one-to-one healthcare advice and examinations).[192] The results were poorly reported, but no differences were found between the two groups.

For **prostate cancer screening**, one controlled trial, undertaken in the USA, evaluated different types of group teaching: peer educator method (using men of the same age and race as teachers and demonstrators); client navigator method (using a social worker to assist the men in navigating the healthcare system, making their appointment, arranging transportation, and remembering to attend); combination method (peer educator and client navigator methods combined); and traditional method (control). The main outcome was knowledge, but the effect of the intervention was taken into account in a multivariate analysis. Men who received the client navigator method or the combination method were more likely to attend the free prostate cancer screening than men who received the control or traditional intervention ($p < 0.05$).[77]

Educational telephone calls

One RCT of child health checks found that an educational phone call by a nurse (plus appointment and transport if desired) was more effective than control (RR = 2.62; 95% CI, 1.44 to 4.77).[112]

Home visits

Ten studies (nine RCTs and one quasi-RCT) compared home visits, conducted either by a lay health educator or a health professional, with a control group (see *Figure 9*).[72,112,182,193,194,197,199,203,206,208] Six were undertaken in the USA, three were undertaken in the UK, and one was undertaken in Singapore. RRs were calculated for all nine RCTs, with five showing an effect of the intervention (including one cluster RCT), one showing an effect for CBE but not for mammography or Pap smear, and the other three RCTs reporting no effect. The effectiveness of the intervention varied by screening test (see *Figure 9*).

For **Pap smears**, two of three RCTs found an effect of the intervention, and all three RCTs targeted minority women. Two RCTs evaluated educational programmes in which women were visited at home by a lay health educator.[203,206] Both were well-conducted RCTs of Pap smears and breast cancer screening, targeting either eastern-band Cherokee women or inner city African-American women. One of the RCTs included several screening tests, and each one was included separately in the analysis as the denominators differed for each screening test.[203] The third study targeted women from India and Pakistan in the UK.[208] This RCT compared home visits with either a video or a leaflet, but generalisability of the results may be limited as there was an over-representation in the study of Urdu speakers, Moslems and women born in Pakistan. One study also assessed the effect of the intervention on knowledge. Women who received the intervention were more likely to answer all knowledge items correctly at post-test (authors' calculated OR = 2.18; 95% CI, 1.08 to 4.39).[206]

For **mammography and CBE**, four of the five RCTs showed no effect of the intervention compared with control in increasing mammography uptake (see *Figure 6*),[72,194,197,199,203] but one did find that CBE uptake increased.[203] One RCT also found that the interventions (home visits and counselling)

significantly influenced all belief variables (susceptibility, seriousness, benefits, barriers, health motivation and perceived control) except susceptibility ($p < 0.05$).[197] Beliefs also changed in the control group, however, which could be the effect of being included in the study, having three interviews and being exposed to questions about breast cancer screening.

For **prenatal testing**, one cluster RCT of cystic fibrosis testing compared the effectiveness of an education session and testing either in the home or in the clinic.[193] Uptake was greater in the home setting (RR = 1.52).

For **child health screening**, one RCT evaluated a range of interventions for increasing the uptake of child health visits (e.g. printed educational materials, telephone calls and home visits).[112] Home visits were more effective than control (RR = 2.49; 95% CI, 1.66 to 3.72), but in absolute terms these increases were small (uptake at the end of follow-up was only 13% in the intervention group versus 5% in the control group). The other study, a quasi-RCT, also evaluated a range of interventions (reminders, incentives and home visits) to encourage uptake of a tuberculosis test in children.[182] The home intervention did increase uptake as compared with control (72% versus 58%), but the intervention was terminated after only 98 participants because of scheduling difficulties with the visiting nurse.

Individual teaching in other settings

Five RCTs evaluated individual teaching programmes versus control for a number of screening tests.[68,100,128,129,196] RRs were calculated for all five RCTs, but only one of them found the intervention to be effective (see *Figure 9*).[129] This RCT evaluated the effectiveness of a 'minimal' discussion protocol (with or without a tailored leaflet) to increase the uptake of HIV testing in pregnant women. This study also assessed the acceptability and level of satisfaction with the screening services, but no significant differences were observed between intervention groups for either outcome.[129]

Combined educational approaches

An RCT found that a mailed educational booklet and an educational telephone call significantly increased the return of FOBTs compared with control (RR = 1.76; 95% CI, 1.40 to 2.21).[92] A quasi-RCT evaluated a combination of an educational programme and a brochure.[198] The authors concluded that the custom-made programme plus brochure demonstrated a statistically significant effect on mammography utilisation in the short term (6 months) compared with a brochure alone or control. The beneficial effect of this one-time intensive intervention had disappeared at later follow-up (24 months). For more details see appendix 5.

Studies comparing different educational interventions

Six studies (five RCTs and one controlled trial) compared different educational interventions (*Figure 10*).[112,128,195,204,208,212] Four studies were undertaken in the USA, and two were undertaken in the UK.

Audio-visual material versus printed material

One RCT found that a home visit plus video was no more effective than a home visit with a leaflet (RR = 1.24; 95% CI, 0.83 to 1.85).[208]

Printed material versus educational programmes

One RCT[195] and one controlled trial[204] compared printed materials with more complex educational interventions, but both were only reported as abstracts. Both studies found that the complex educational intervention was more effective than printed information such as a leaflet or brochure (for more details see appendix 5).

Group education versus individual education

One RCT found no difference between individual and group education for uptake of Down's syndrome screening (RR = 1.18; 95% CI, 0.98 to 1.42) or cystic fibrosis screening (RR = 1.04; 95% CI, 0.81 to 1.33).[128] However, not all of those who were offered the intervention attended the educational sessions. This study gave individual information about the risks and benefits of screening (classified as informed uptake).

Group education versus home visits

One RCT evaluated a number of different interventions to increase the uptake of FOBT, including home visits and group meetings.[212] The group meeting was more effective than home visits (RR = 1.41; 95% CI, 1.23 to 1.61) or other interventions, but uptake was not high for any of the groups (7–28%). The authors reported that the most cost-effective method was the home visit (see appendix 5).

Home visits versus printed materials

One RCT of interventions to increase the uptake of child health visits found that a home visit was more effective than a pamphlet (RR = 1.69, 95% CI, 1.19 to 2.40).[112] Uptake in both groups, however, was low (13% versus 8%).

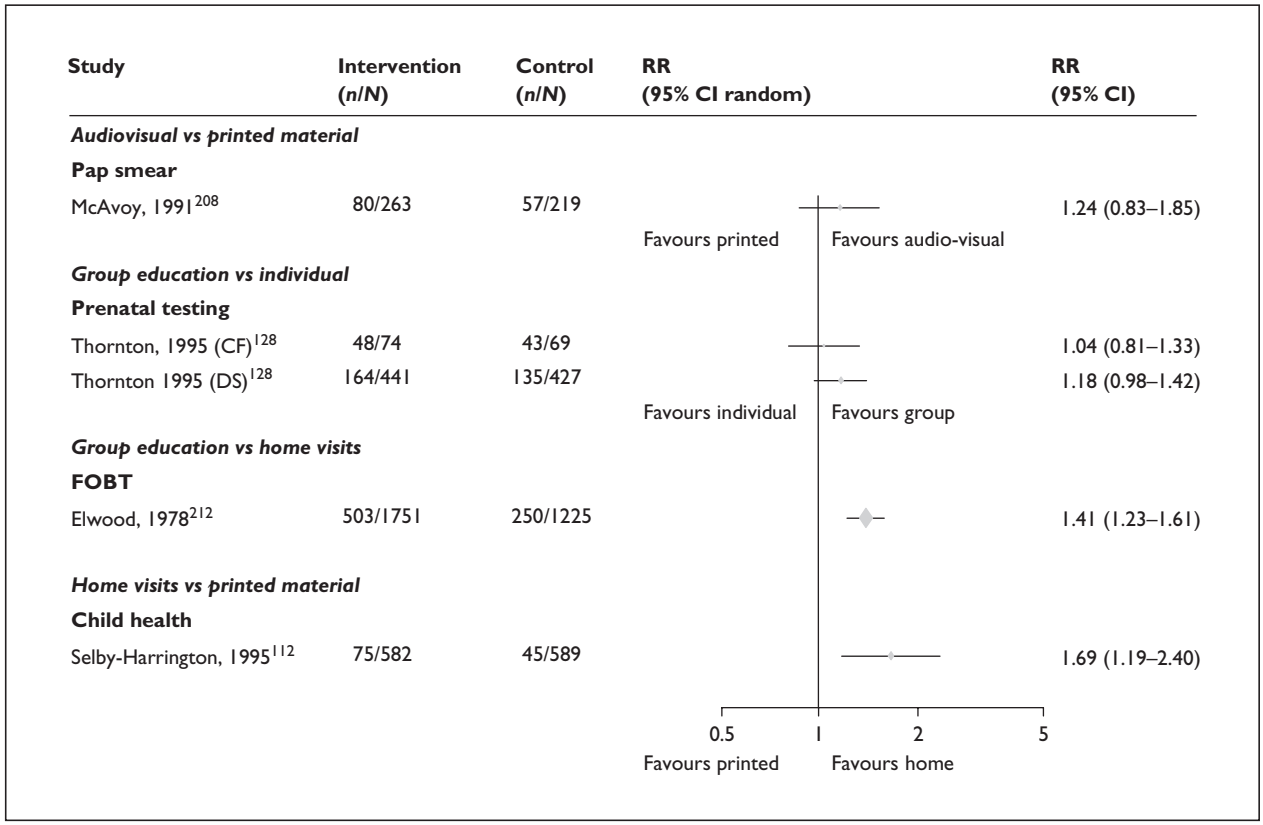


FIGURE 10 *Uptake of screening: comparison of different types of educational intervention. CF, cystic fibrosis; DS, Down's syndrome*

Quality of education studies

The quality of the studies was variable. Thirty-one studies (76%) were RCTs, and in four studies the assessor was blinded. Twenty-two studies (52%) analysed 80% or more of those randomised. Of these, three reported no losses to follow-up (i.e. analysed 100% of those randomised) and six used an intention-to-intervene analysis. Six studies (15%) had significant differences in baseline characteristics between groups, and only two of these studies took account of such differences in the analyses. Twenty-eight studies (67%) used an adequate measure of uptake such as medical records. Twelve studies (eight RCTs, two quasi-RCTs and two controlled trials) allocated by clusters, and all but four analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 4*.

Message framing

Five studies (three RCTs, one quasi-RCT and one controlled trial) evaluated message framing to increase uptake of screening.[95,106,110,175,213] Participants in the studies received messages about screening (either written or verbal). Studies used loss or gain messages (e.g. 'If you do not get screened you may have a 10% chance of getting cancer'; 'If you do get screened you will reduce your chances of getting cancer by 90%'). All studies were undertaken in the USA. Overall, messages (positive or negative) had no effect on the increased uptake of screening (*Figure 11*).

Two RCTs found no effect of either loss or gain messages for either tuberculosis testing[175] or FOBT (see *Figure 11*).[110] A further RCT of women returning for a repeat mammogram found a small effect of loss messages versus control (RR = 1.26; 95% CI, 1.01 to 1.59), but no difference between loss or gain messages.[213] A controlled trial found that there was no difference in attendance for mammography appointments between women sent

BOX 4 Summary of the results from educational studies

- Evidence of limited effectiveness of printed educational materials
- Evidence of limited effectiveness of audio-visual educational materials
- Evidence of limited effectiveness of group educational sessions
- Some evidence of effectiveness of home visits
- Evidence of limited effectiveness of individual educational sessions

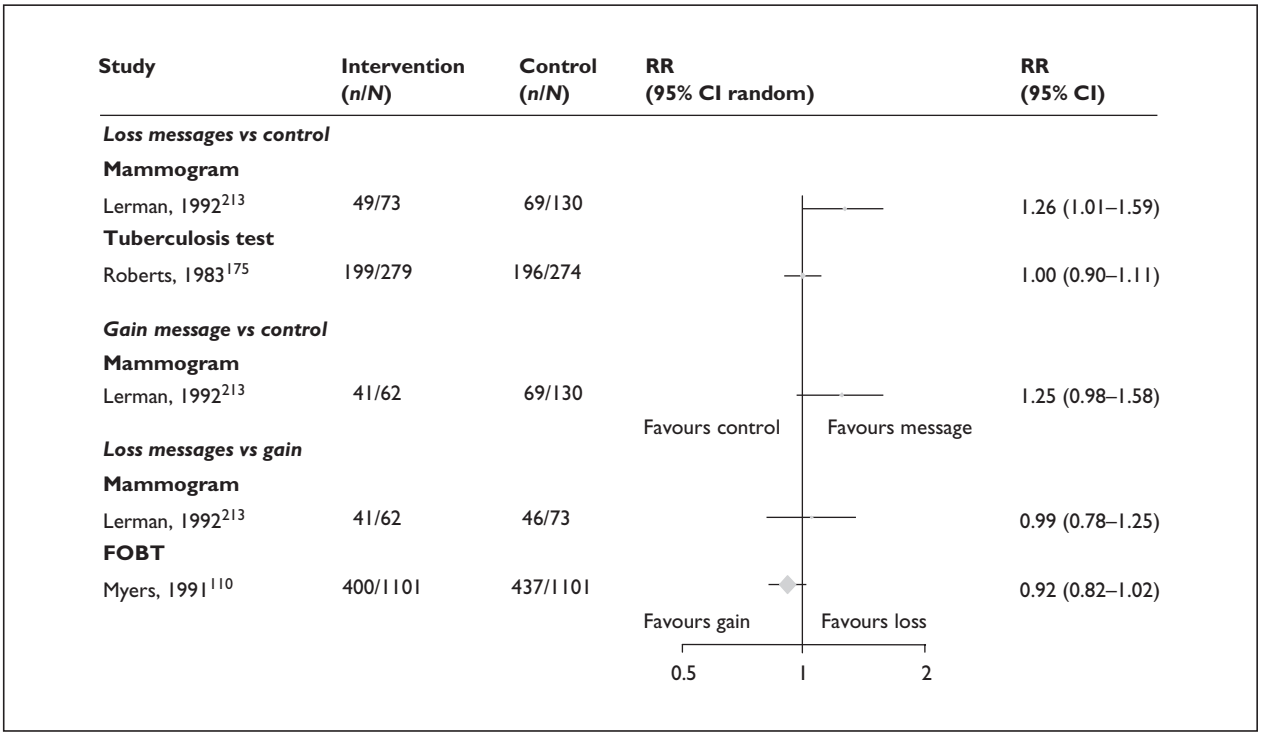


FIGURE 11 *Uptake of screening: message framing*

reassuring letters and those sent anxiety-provoking letters.[106] Another quasi-RCT found that uptake of mammography was significantly higher in women shown a video that emphasised the woman's own responsibility, as compared to those who were shown a video that emphasised the doctor's responsibility, or an information video (control) (65.9% versus 57.1% and 55.2%).[95] This study also found that participants' positive and negative reactions to the video presentation did not vary by intervention, nor did they vary in the amount of knowledge about breast cancer and mammography that they acquired from the presentation.

Quality of message-framing studies

The quality of the studies was reasonable. Three studies (60%) were RCTs, and in no studies was the assessor blinded. Only one study (20%) analysed 80% or more of those randomised and none used an intention-to-intervene analysis. None of the studies had significant differences in baseline characteristics between groups. Three studies (60%) used an adequate measure of uptake such as medical records. None of the studies allocated by clusters. For more details of individual study quality see the tables in appendix 6, and for a summary of the results see *Box 5*.

BOX 5 Summary of the results from message framing studies

- Not enough evidence of any difference between loss or gain messages

Risk factor assessment and management

Six studies (five RCTs and one quasi-RCT) assessed the effectiveness of making people aware of their risk status as a way of increasing uptake.[133,207,214–217] Four were undertaken in North America, one in Australia and one in the UK. Overall, only one of the five RCTs found that such interventions increased uptake (*Figure 12*).

Four RCTs evaluated risk-factor questionnaires and risk appraisal.[207,215–217] One found no effect of a risk-factor questionnaire (for bowel cancer) given either 2 weeks before (RR = 0.88; 95% CI, 0.76 to 1.01) or with an FOBT compared with control (RR = 0.88; 95% CI, 0.76 to 1.01).[207] Another RCT of worksite FOBT testing (available only as an abstract) reported that the intervention group had 4.3% higher completion rate of FOBT during the follow-up period compared to the control group ($p = 0.10$) (no further information given).[217] The study also reported that the largest effect of the intervention was on the employees' intention to get an FOBT within the next year (62.6% versus 36.2%; authors' calculated OR = 3.18; $p < 0.001$). An RCT evaluating a questionnaire appraising risk of coronary heart disease found that it was effective in increasing

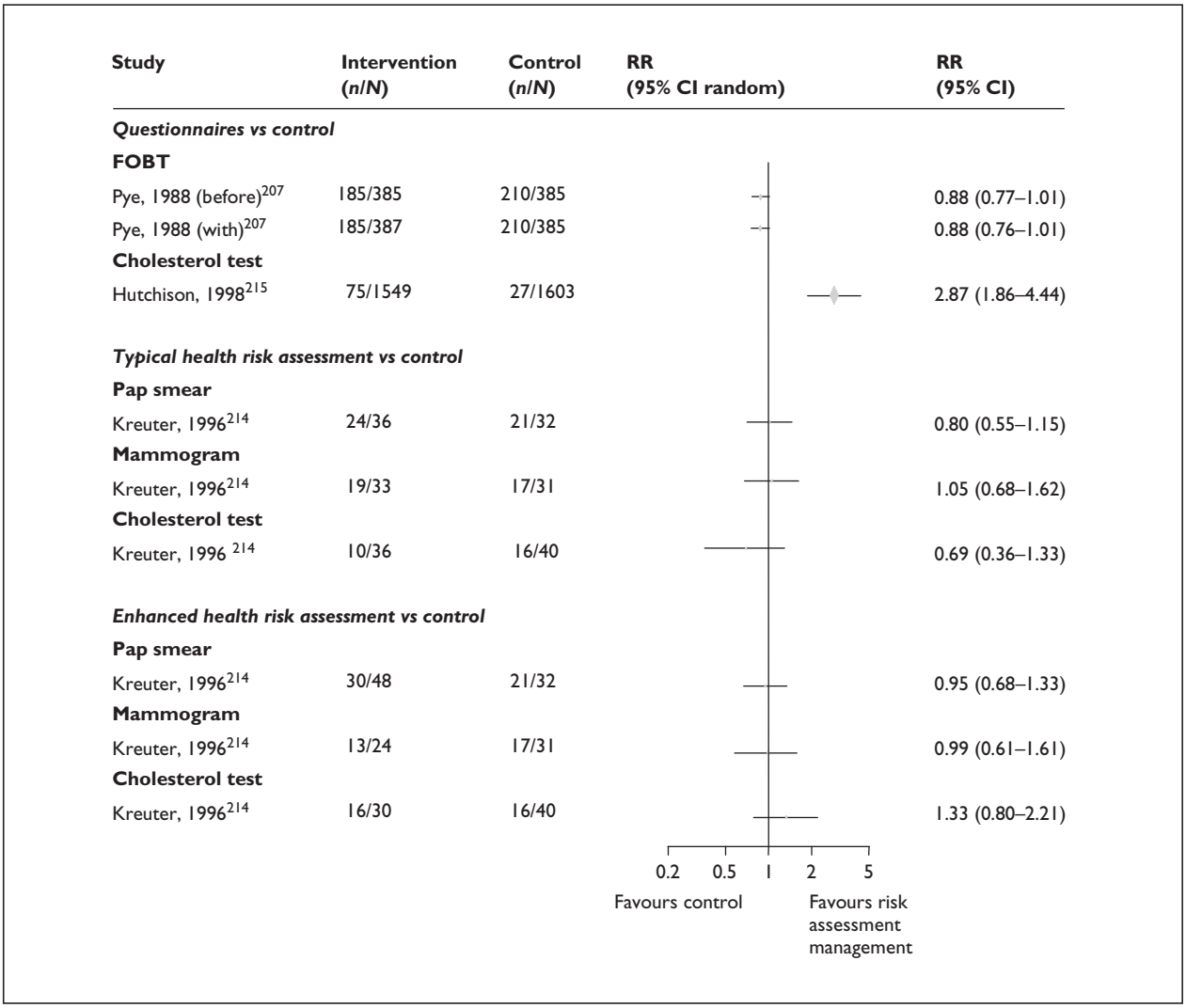


FIGURE 12 *Uptake of screening: risk factor interventions*

uptake of cholesterol screening for all participants (regardless of risk status) (RR = 2.87; 95% CI, 1.86 to 4.44).[215] It also increased uptake among those who met predefined screening criteria (high risk of coronary heart disease) (RR = 5.99; 95% CI, 2.96 to 12.10). However, the effect was small (10.7% versus 1.8%), and most at-risk participants who received the questionnaire did not respond by having the test. One RCT evaluating the effect of personal and generic risk-factor questionnaires plus invitations found no significant difference between the groups (uptake range 33–39.7%).[216]

Two studies evaluated the impact of computer-generated, printed feedback but neither found the intervention to be effective.[133,214] One RCT compared typical health-risk assessment or enhanced health-risk assessment (assessed benefits and barriers) with a control for a number of health-related behaviours, including Pap smear, mammography or cholesterol screening. Neither typical health-risk assessment nor enhanced health-risk assessment was more effective than control for these three tests. The other study (a quasi-RCT) of women who were underscreened for cervical cancer allowed all women access to the computer, but only those in the intervention group received a printout.[133] The authors found no effect of the intervention, but analysed only 20% of those randomised to the intervention.

Quality of risk-factor intervention studies

The quality of the studies was variable. Five studies (83%) were RCTs, and the assessor was not blinded in any of the studies. Two studies analysed less than 50% of those randomised.[133,215] One study had significant differences in baseline characteristics between groups, which were not taken account of in subsequent analyses. Five studies (83%) used an

BOX 6 Summary of the results from risk-factor assessment and management studies

- Evidence of limited effectiveness of risk-factor questionaires

adequate measure of uptake such as medical records. Two studies (both RCTs) allocated by clusters, and one analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 6*.

Counselling of individuals or couples

Eleven studies (nine RCTs, one quasi-RCT and one controlled trial) evaluated the effect of individual counselling on the uptake of mammograms, Pap smear or prenatal testing.[81,88,122,129,173,188,197,218–221] Eight studies were undertaken in the USA, two were undertaken in the UK and one was undertaken in Australia. Settings and participants varied considerably between the studies and there was significant heterogeneity in the results (for more details of all studies see appendix 5). Overall, telephone counselling was found to increase uptake of screening in three of four RCTs for which RR were calculated. Face-to-face counselling was only found to be effective in one of three RCTs for which RRs were calculated. A fourth RCT also reported no effect of the intervention (*Figure 13*).

Telephone counselling

Five studies evaluated the effectiveness of telephone counselling (by either a breast nurse or other specialist) to increase mammography uptake (one also included Pap smear and CBE).[81,88,122,188,218] All studies had a control group that received no intervention or usual care, and all were undertaken in the USA. RRs were calculated for four RCTs, but as there was significant statistical heterogeneity the results were not combined. Uptake increased significantly in three of the RCTs (see *Figure 13*). The fourth reported no difference in uptake of mammograms in the telephone or control group at 2 years' follow-up (RR = 1.07; 95% CI, 1.00 to 1.15).[81] The final number of participants analysed, however, was only 61% of the number randomised (non-responders to the questionnaire were excluded from the analysis). The same study also reported the costs of the telephone intervention (see appendix 5). A quasi-RCT of telephone counselling reported a statistically significant effect at

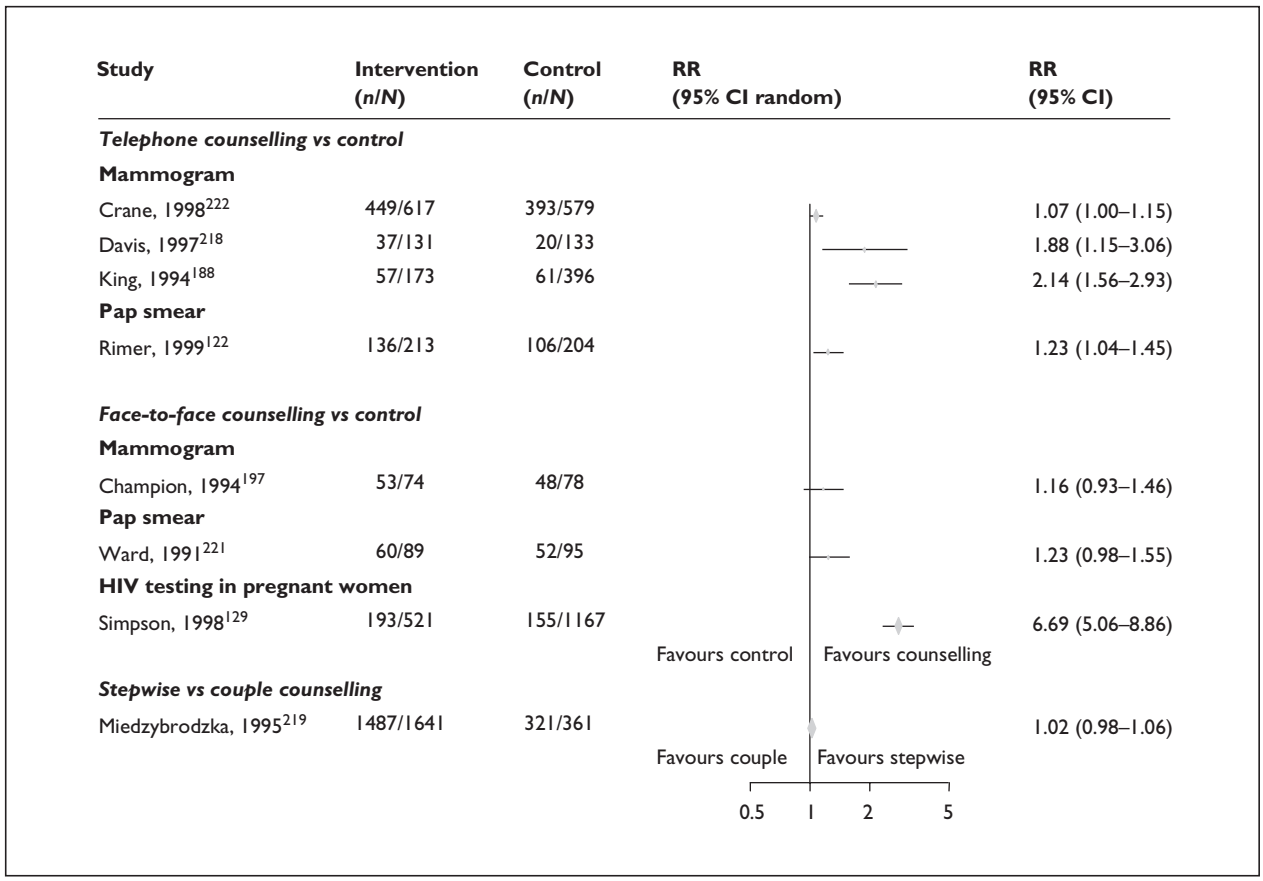


FIGURE 13 *Uptake of screening: counselling*

one site (out of two) and only among callers with a total family income of $30,000 or more (OR = 1.38; $p = 0.04$).[88] The study also assessed women's intention to get a mammogram, but found no differences between the groups when stratified by stage (of intention) at baseline.

Face-to-face counselling

Five studies (four RCTs and one controlled trial) evaluated face-to-face counselling by a health professional in either the home or in a healthcare setting.[129,173,197,220,221] All studies had a control group that received no intervention or the usual care. RRs were calculated for three RCTs, but there was significant statistical heterogeneity and so results were not combined. There was no effect of the intervention for either mammogram[197] or Pap smear (see *Figure 13*).[221] Only one RCT showed a significant effect of the intervention, which was counselling pregnant women for HIV testing where the control group was not routinely offered the test.[129] This RCT also gave women information about the risks and benefits of the screening test (classified as 'informed uptake'). A controlled trial found very little additional effect of nurse counselling over mailed reminders or control for mammograms.[173] Data were not available for one further RCT, but the authors reported no statistically significant differences in uptake of mammography and CBE.[220]

Stepwise (women only offered counselling) versus couple counselling

One RCT evaluated stepwise and couple approaches to antenatal carrier screening for cystic fibrosis.[219] Counselling and carrier testing for cystic fibrosis was offered either to women in the first instance (stepwise) or to couples. There was no difference in uptake between the two groups (RR = 1.02; 95% CI, 0.98 to 1.06), or in knowledge, but couple screening allowed carriers to avoid transient high levels of anxiety.

Quality of counselling intervention studies

Overall, the quality of the studies was good. Nine studies (82%) were RCTs, but the assessor was not blinded in any of the studies. Seven studies (64%) analysed 80% or more of those randomised. Of these, two used an intention-to-intervene analysis. Two studies (18%) had significant differences in baseline characteristics between groups and one of these studies took account of such differences in the analyses. Six studies (54%) used an adequate measure of uptake such as medical records. Two studies (one RCT and one quasi-RCT) allocated by clusters, but both analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 7*.

BOX 7 Summary of the results from counselling studies

- Evidence of effectiveness of telephone counselling
- Evidence of limited effectiveness of face-to-face counselling

Procedures, service provision and opportunistic screening

Twenty-nine studies (21 RCTs, three quasi-RCTs and five controlled trials) evaluated interventions to increase screening uptake by making the screening procedure, or the provision of screening, easier or more acceptable to participants (see *Table 15* for definitions of the interventions and the countries where the studies were performed).[29,89,96,110,115,120,158,177,179,180,209,212,223–238] Ten studies were undertaken in the USA, 13 in the UK, one in Italy and five in Australia and New Zealand. It could be the case that these studies should be classified as evaluations of determinants. For the purpose of this review, however, they are classified as interventions. Fifteen studies evaluated either different screening tests (e.g. sigmoidoscopy, colposcopy or FOBT), or different procedures for colorectal cancer screening.[96,110,158,177,212,224,227–233,235,238] Overall, uptake was less when more invasive tests were offered, but imposing dietary restriction, or increasing the number or duration of FOBTs did not appear to affect uptake significantly (*Figure 14*). Interventions aimed at changing the provision of service such as allowing health professionals other than doctors to organise screening did appear to be effective. Opportunistic testing increased uptake in three out of four studies.

Dietary restrictions, test period and number of tests

Seven studies (six RCTs and one controlled trial) evaluated whether dietary restrictions, the timing of tests or the number of tests affected uptake of screening.

For **FOBTs**, two RCTs reported that test uptake was slightly reduced by asking participants to restrict their diet, but this was not statistically significant.[212,233] A further RCT found that dietary restrictions decreased uptake, but the sample size was small (RR = 0.71; 95% CI, 0.55 to 0.91).[229] A controlled trial reported similar results (see appendix 6).[177]

An RCT assessing the effect on uptake of giving either a single or double enema prior to sigmoidoscopy found that uptake was similar in both groups (27.8% versus 26.4%; RR = 0.95; 95% CI, 0.79 to 1.15).[96]

Two RCTs compared uptake when participants were required to perform FOBTs over a 3- or 6-day period.[227,229] One found a small but significant decrease in uptake among those offered 6-day testing (57.8% versus 53.9%; RR = 0.93; 95% CI, 0.92 to 0.95),[227] while the second study (a small RCT) found no difference (RR = 1.02; 95% CI, 0.80 to 1.31).[229]

For **diabetes testing**, one RCT assessed the uptake of self-testing for glycosuria using foil-wrapped dipsticks. Preprandial and postprandial tests were compared with a single postprandial test.[226] Uptake rates between the two groups did not differ significantly (78% versus 80%; RR = 1.02; 95% CI, 0.99 to 1.06). This study also reported the total costs of screening, but not the difference in costs or the cost-effectiveness of the two interventions (see appendix 5).

Different types of colorectal cancer screening test

Six RCTs assessed the effect of different screening tests on the uptake of colorectal cancer screening. Three RCTs compared offering sigmoidoscopy plus FOBT with FOBT alone. Although the main objective of these studies was to assess neoplasia yield, uptake was also assessed, as sigmoidoscopy is a more invasive test than FOBT.[228,232,235] Two of the three RCTs found that offering both tests resulted in significantly lower uptake than offering FOBT alone (see *Figure 14*). Furthermore, one RCT found that uptake was significantly higher in a group offered flexible sigmoidoscopy compared

TABLE 15 *Procedural or service provision interventions: definitions, number of RCTs and countries where the studies were undertaken*[*]

Definition	No. of RCTs (%)	No. of studies				
		UK	North America	Australia and New Zealand	Other	Total
All procedures, provision of service and opportunistic studies	21 (72%)	13	10	5	1	29
Dietary restrictions, test period, number of tests Dietary restrictions, such as no meat; length of time that screening test takes or number of times screening test performed	6 (86%)	4	1	1	1	7
Screening tests Different screening tests for the same disease	6 (100%)	5	0	1	0	6
Provision of service Provision of services, such as access, gender of screener and referral procedures, to remove barriers	5 (63%)	3	5	0	0	8
Opportunistic testing Screening performed, or appointment for screening made, whilst participant attending for other healthcare	2 (33%)	3	2	1	0	6
Notification of results Direct notification of results on follow-up of abnormal smears	1 (100%)	0	1	0	0	1

[*] *Some studies evaluated more than one intervention, and therefore the columns cannot be totalled*

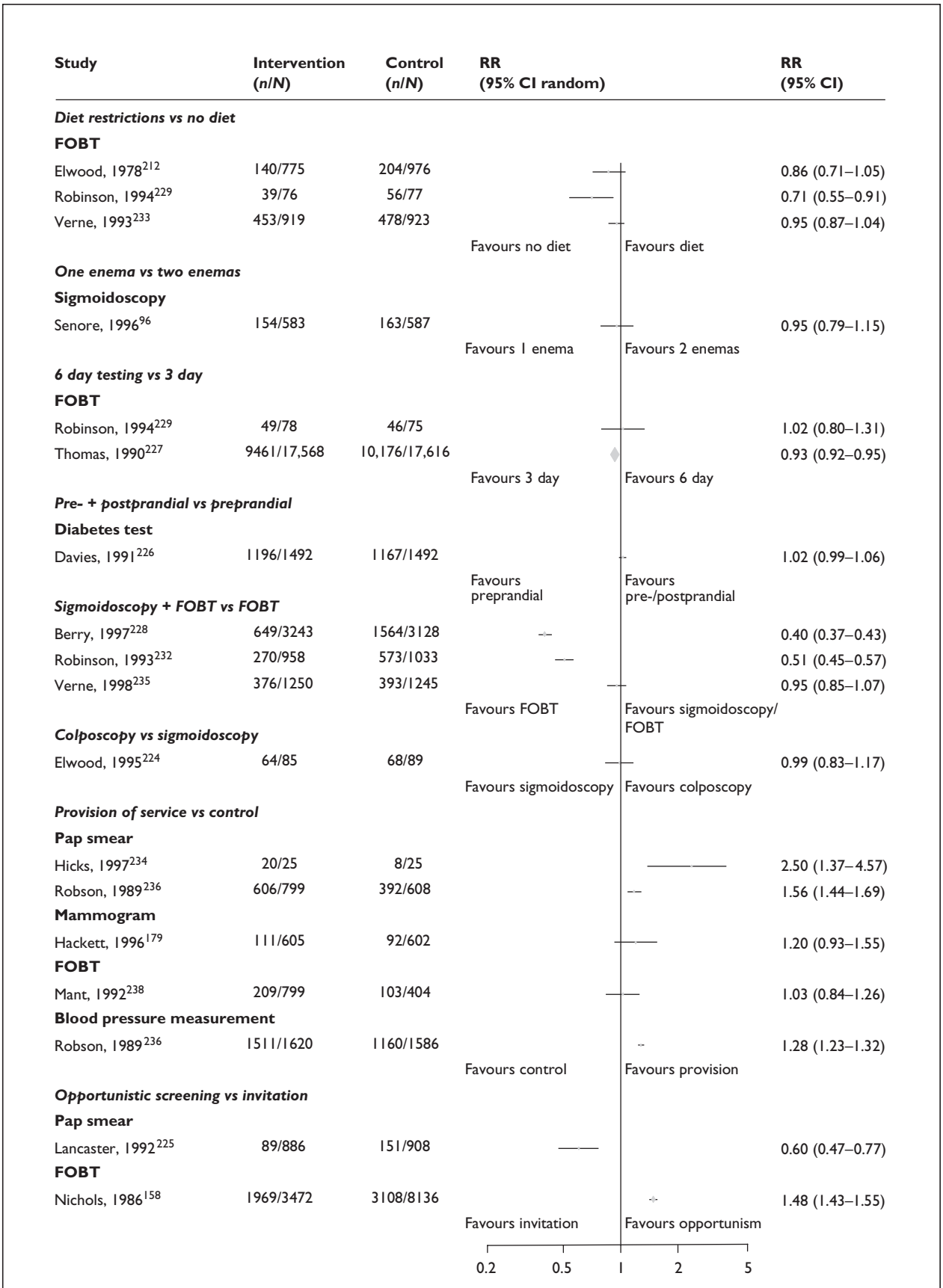


FIGURE 14 *Uptake of screening: procedures, service provision and opportunistic testing*

with those offered an FOBT only (RR = 1.48; 95% CI, 1.33 to 1.63).[235]

One RCT found that uptake of FOBT plus sigmoidoscopy was similar to that of FOBT plus colposcopy (RR = 0.99; 95% CI, 0.83 to 1.17).[224] Participants found the preparation for sigmoidoscopy easier, but the procedure more uncomfortable and embarrassing, as colposcopy was performed under sedation.

One RCT found no significant differences in uptake between several types of self-administered screening tests (Haemoccult, 49.1%; Early Detector™, 52.1%; and Coloscreen Self-Test™, 50.6%).[233]

Provision of service

Eight studies (five RCTs, two quasi-RCTs and one controlled trial) evaluated interventions aimed at changing the way in which a screening service was provided.[89,179,209,230,234,236–238]

For **Pap smears**, an RCT evaluated the effectiveness of an organised programme of prevention, including the use of a health-promotion nurse.[236] The intervention was so effective (Pap smear – RR = 1.56; 95% CI, 1.44 to 1.69; blood pressure screening – RR = 1.28; 95% CI, 1.23 to 1.32) that it was discontinued after 2 years (instead of 3 years) as GPs were no longer willing to exclude half the participants from accessing the health-promotion nurse. One RCT evaluated whether revealing the gender of the smear-taker in the letter of invitation would influence women's attendance for cervical screening.[234] Uptake was higher when the gender was known to be female (but the difference was not statistically significant) (RR = 1.43; 95% CI, 0.96 to 2.13). Uptake when the gender was known to be male was lower (but not statistically significant) (RR = 1.75; 95% CI, 0.90 to 3.42). However, the difference in uptake between knowing the gender was female and knowing the gender was male was statistically significant (RR = 2.50; 95% CI, 1.37 to 4.57). The sample size was small (25 in each group) as this was a pilot study. A quasi-RCT found that Pap smear rates were improved in women attending non-primary-care outpatient clinics using lay health advisors and a nurse practitioner to perform screening. The effect was strongest in women in greatest need of screening.[89]

For **mammography**, one RCT found no additional benefit on uptake of a self-referral strategy plus invitation over invitation alone (RR = 1.20; 95% CI, 0.93 to 1.55).[179] Two studies undertaken in the USA evaluated whether training non-physicians (nurses and medical assistants) and allowing them to complete a mammography request form would increase uptake. A cluster RCT found that the prevention team (non-physicians) showed higher uptake rates of mammograms compared with control ($p = 0.002$).[209] A controlled trial also found an effect of the intervention.[237]

For **FOBTs**, an RCT found that test uptake was not significantly increased by including it with a health check (RR = 1.03; 95% CI, 0.84 to 1.26).[238] Uptake was higher, however, when the FOBT was enclosed with the health-check invitation than when it was offered at the health check (RR = 1.54; 95% CI, 1.21 to 1.95). A quasi-RCT found that more completed FOBTs were returned when they could be posted rather than handed in (57% versus 37%).[230]

For **blood pressure screening**, one RCT (see Pap smears) found that an organised programme of prevention, including the use of a health-promotion nurse, was more effective than control (RR = 1.28; 95% CI, 1.23 to 1.32).[236]

Opportunistic screening

Six studies (two RCTs and four controlled trials) evaluated the uptake of opportunistic screening (i.e. when an individual was attending a healthcare session for another reason) compared with other interventions or control.[29,120,158,180,223,225]

For **Pap smears and mammography**, one RCT found that opportunistic testing for Pap smear was less effective than a combined invitation for cervical smear testing and breast screening (RR = 0.60; 95% CI, 0.47 to 0.77).[225] A controlled trial compared uptake of breast and cervical screening among poor, elderly black women when nurse practitioners recruited women for screening in two ways: directly from the waiting room, or by asking clinic providers and nurse counsellors to refer patients. The study was poorly designed, but found that opportunistic testing was effective in increasing uptake.[223] Another controlled trial found that offering women Pap smears while they were in hospital significantly increased uptake compared to an education or control group (71.7% versus 24% and 20.1%).[180]

For **FOBTs**, an RCT found that uptake was higher when GPs offered an FOBT opportunistically as compared with sending the FOBT with a letter (RR = 1.48; 95% CI, 1.43 to 1.55).[158]

For **prenatal screening**, one study of cystic fibrosis (partially randomised, but the opportunistic testing

was not offered in a randomised manner) compared opportunistic testing with a letter from the GP and other methods.[29] An opportunistic approach by a health professional offering immediate testing was the most effective approach. Another controlled trial of cystic fibrosis testing compared offering the test after an education session (which meant an extra visit and was a prerequisite for having the test) or offering the test without having to make an additional visit (opportunistic).[120] Uptake was considerably higher when testing could be carried out without making an additional visit (23.5% versus 3.7%). Knowledge was also measured for each group, but not compared across groups (see appendix 5).

Notification of results

Only one cluster RCT, undertaken in the USA, evaluated the effect of a cervical smear request form offering direct notification of results on follow-up of abnormal smears.[239] GPs were randomised to receive or not receive a redesigned form that had an extra address section. GPs were asked to consider inviting participants to complete the address section for direct notification of the test result. Loss to follow-up of women with reports of 'atypia' in the intervention group (13% (15/116)) and the control group (10% (10/104)) was not significantly different. When the outcome was assessed by a GP questionnaire the loss to follow-up of women with reports of cervical intraepithelial neoplasia was 0% (0/52; upper 95% CI, 7.0) in the intervention group and 23% (9/39; 95% CI, 11.0 to 39.0) in the control ($p < 0.001$). When the outcome was assessed by laboratory files alone, adequacy of follow-up for women with cervical intraepithelial neoplasia was not statistically significant (40% in intervention versus 36% in control). Few details of the study were reported, and the unit of randomisation (GP) was different from the unit of analysis (individual). The results and conclusions from this study should be interpreted with caution.

Quality of studies aimed at changing procedures or the provision of screening

Overall, the quality of the studies was good. Twenty-one studies (72%) were RCTs, but the assessor was not blinded in any of the studies. Thirteen studies (45%) analysed 80% or more of those randomised. Of these, four reported no losses to follow-up (i.e. analysed 100% of those randomised) and three used an intention-to-intervene analysis. Four studies (14%) had significant differences in baseline characteristics between groups and two studies took account of such differences in the analyses. Twenty-five studies (86%) used an adequate measure of uptake such as medical records. Eleven studies (seven RCTs and four quasi-RCTs) allocated by clusters, but all analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 8*.

BOX 8 Summary of the results from procedures, provision of service and opportunistic testing studies

- Simpler procedures seem to increase the uptake of screening
- Some evidence of effectiveness of opportunistic screening

Economic interventions (rewards and removal of financial barriers)

Fourteen studies (10 RCTs and four quasi-RCTs) evaluated economic interventions, aimed at individuals, which either removed or reduced financial barriers to screening or offered rewards and incentives.[68,82,113,117,137,152,153,182,212,230,240–243] Thirteen studies were undertaken in the USA, and one was undertaken in Australia. Overall, eight of nine studies found that offering to remove financial barriers increased the uptake of screening, but only two of five studies found that offering rewards or incentives increased uptake (*Figure 15*).

Removal of financial barriers (free or reduced-cost tests, transportation or postage)

For **mammography**, three studies (two RCTs and one quasi-RCT) evaluated reduced charges or free screening to increase the uptake of mammography.[113,117,243] One well-designed RCT found the provision of free screening (vouchers) was very effective in encouraging uptake of screening mammography among low-income older women (RR = 4.28; 95% CI, 1.91 to 9.60).[117] The sample size was small however, and study entry stopped after an interim review, as results were considered more than sufficient to test the main hypothesis. The authors also reported that an improvement in knowledge was observed in each of the groups, but it was not significantly different between groups. The other two studies also reported a statistically significant effect of the intervention. One was a quasi-RCT[113] and the RCT did not report actual uptake numbers.[243] Both studies targeted minority women (Hispanic women and rural farming women).

For **FOBTs**, three RCTs all found that sending a postage-paid envelope with an FOBT resulted in significantly higher uptake than an envelope with

no postage.[212,230,241] However, one of the RCTs reported that, although the no-postage intervention did not achieve the highest uptake rate, its cost per completed test was the lowest (data not provided).[230] Another RCT found that giving a free FOBT plus an educational intervention increased uptake compared with an educational intervention alone (RR = 35.73; 95% CI, 2.25 to 567.86).[242]

For **Pap smears**, **tuberculosis screening** and **preventive visits**, an RCT comparing a voucher for free preventive visits with a control group (no results reported for the control group) concluded that older individuals will respond to preventive programmes, and such services will result in modest health gains.[82] One quasi-RCT evaluated the impact of transport incentives (bus tickets and parking permits) with or without other interventions for women with abnormal Pap smears.[152] Overall, the authors found that incentives had a statistically significant positive impact on return rates.

'Rewards' and incentives

Five studies (four RCTs and one quasi-RCT) assessed rewards or incentives to encourage people to undergo screening.[68,137,153,182,240] Giving active or recent drug users $5 or $10 for returning a tuberculosis skin test was very effective (for $5 and $10 combined versus control RR = 2.64; 95% CI, 2.16 to 3.22).[68] Small rewards in the form of nutritional 'kits' or small gifts on completion of a mammo- gram were effective in one study (RR = 1.33; 95% CI, 1.01 to 1.75)[240] but not another (RR = 0.89; 95% CI, 0.60 to 1.33).[153] The former RCT reported that the incentive procedure was relatively inexpensive (i.e. approximately $106, including $2 per stay-fit kit plus postage for coupons) and was cost-effective for the radiology facility as well as from the cancer-control perspective.

Adding an incentive of being entered into a competition to win a microwave did not increase the uptake of cholesterol screening (RR = 0.98; 95% CI, 0.93 to 1.03).[137] The offer of toys and transportation incentives was no more effective than other interventions to increase uptake of tuberculosis screening in healthy children (see appendix 6).[182] Overall, only two of the five studies found that offering rewards or incentives increased uptake.

Quality of economic interventions

Overall, the quality of the studies was good. Ten studies (71%) were RCTs, and the assessor was blinded in one of the studies. Eight studies (57%)

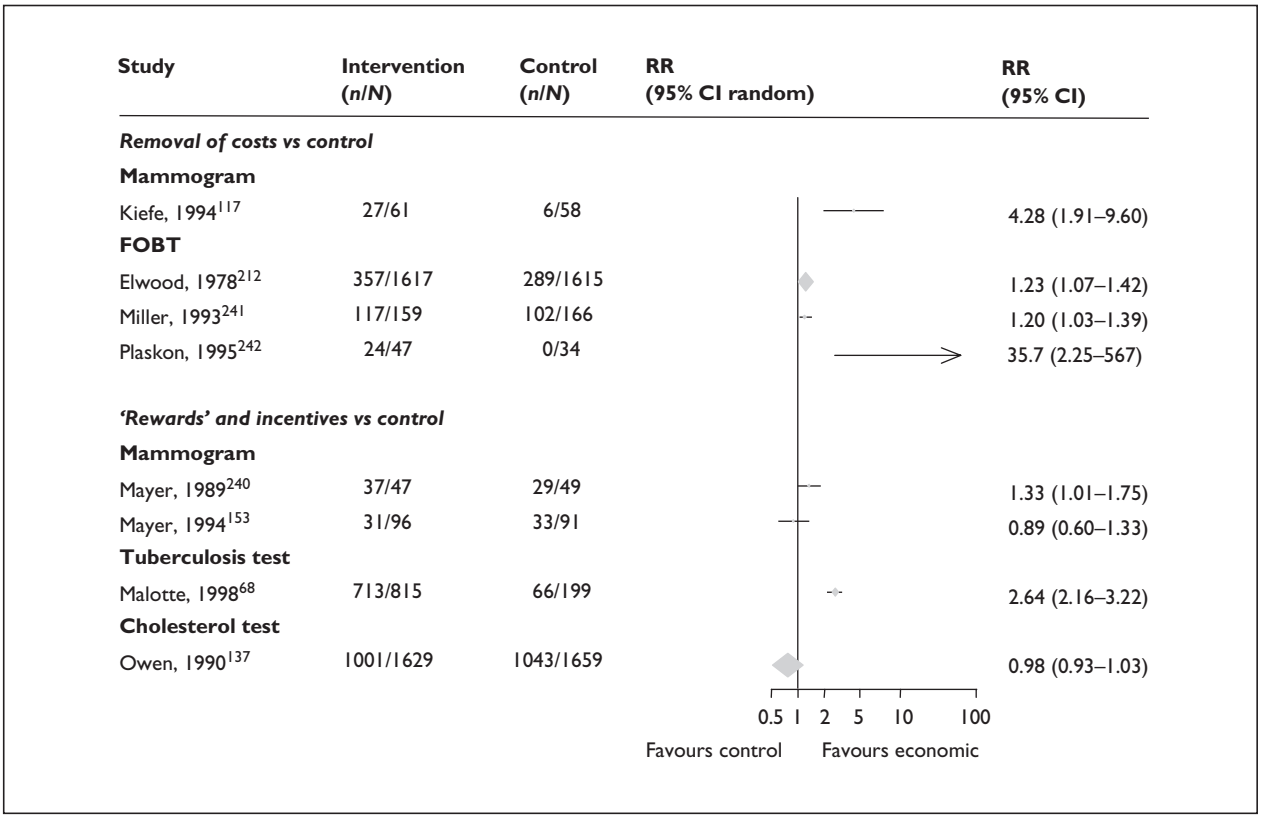


FIGURE 15 *Uptake of screening: economic interventions*

analysed 80% or more of those randomised. Of these, four reported no losses to follow-up (i.e. they analysed 100% of those randomised) and two used an intention-to-intervene analysis. Three studies (21%) had significant differences in baseline characteristics between groups, and one study took account of such differences in the analyses. Two studies (64%) used an adequate measure of uptake, such as medical records. Eleven studies (10 RCTs and one quasi-RCT) allocated by clusters, but both analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 9*.

BOX 9 Summary of the results from economic studies

- Removal of financial barriers increases uptake
- Rewards or incentives do not seem to increase uptake

Community intervention studies (community education, community participation and mass media)

Fourteen studies (three RCTs and 11 controlled trials) evaluated interventions at the community level, including community participation, community education and mass media (see *Table 16* for definitions of the interventions and countries where they were undertaken).[85,134,135,156,244–253] Ten studies were undertaken in the USA, and four studies were undertaken in Australia. RRs could not be calculated for any of the studies, but *Table 17* gives a summary of the results. Overall, eight of the 14 studies reported an effect of the community interventions, and six reported no effect. The effect varied by screening test.

Mass media

One RCT assessed the effectiveness of mass media interventions compared with community interventions for increasing uptake of mammography.[250] The study found that there was significantly lower uptake of mammograms by women in the media-promotion towns compared with community-intervention towns ($p < 0.001$). The results were based on post-test results only, and no details of baseline uptake were given. A controlled trial of a mass media campaign versus control to increase breast and cervical cancer screening found that the intervention had no effect on being up to date for any of the tests compared with a control.[252] The

TABLE 16 *Community interventions: definitions, number of RCTs and countries where the studies were undertaken*[*]

Definition	No. of RCTs (%)	No. of studies				
		UK	North America	Australia and New Zealand	Other	Total
All community intervention studies	3 (21%)	0	10	4	0	14
Mass media Leaflets, posters, television adverts	1 (50%)	0	1	0	1	2
Community participation Formation of a committee of community representatives, promotion of the screening service, and implementation of an appointment system by the committee	2 (100%)	0	0	2	0	2
Community education Interventions, such as engaging natural opinion leaders in organising and hosting small group education programmes	1 (33%)	0	3	0	0	3
Combined community approaches Mass media plus community education and/or community participation	1 (11%)	0	7	2	0	9

[*] *Some studies evaluated more than one intervention, and therefore the columns cannot be totalled*

TABLE 17 *Summary of the results of public recruitment and community intervention studies*

Study	Intervention	Pre-test	Post-test	Absolute effect (post-test minus pre-test)	Intervention effect	Notes
Mass media/community participation						
Clover, 1996[250] Test: mammogram	Mass media (2 towns)	Not stated	31% and 32%	Not stated	31% (95% CI, 21 to 41), $p < 0.001$, small towns	Post-test results only. Baseline differences not accounted for in analyses
	Community participation (2 towns)		62% and 47%		15% (95% CI, 9 to 21), $p < 0.001$, large towns	
Clover, 1996[250] Test: mammogram	Community participation (2 towns)	Not stated	55% and 47%	Not stated	5% (95% CI, 7 to 17), $p < 0.001$, small towns (favours GP intervention)	Post-test results only. Baseline differences not accounted for in analyses
	GP intervention (2 towns)		60% and 65%		18% (95% CI, 11 to 25), $p < 0.001$, large towns (favours GP intervention)	
Jenkins, 1999[252] Test: mammogram, Pap smear	Mass media	Up to date: Pap, 54.4% CBE, 63.0% Mammogram, 52.6%	47.7% 53.5% 55.1%	–6.7% –9.5% 2.5%	Pap: 10.7% ($p = 0.002$) CBE: 10.6% ($p = 0.002$) Mammogram: 9.5% ($p = 0.039$)	Logistic regression analysis undertaken to adjust for confounding variables
	Control	Pap, 43.6% CBE, 50.0% Mammogram, 46.6%	37.0% 42.9% 45.6%	–9.6% –7.1% –1.5%	After controlling for confounders, there was no positive effect on being up to date for any of the screening tests	
Community education						
Flynn, 1997[134] Test: mammogram	Community education (women and physicians)	Not stated	Mammogram, 82% and 64% CBE: 75%	Not stated	Mammography: test in last 2 years (10%, $p < 0.01$), test in last year (4%, $p = 0.03$). Impact on CBE: CBE in last year (–3%, $p = 0.10$)	Analysis based on post-test cross-sectional surveys. Baseline differences between groups not taken into account in analyses
	Control		Mammogram, 72% and 60% CBE, 78%			
Fox, 1998[249] Test: mammogram	Community education	12%	27%	15% ($p = 0.02$)	OR = 0.63 (95% CI, 0.2 to 9.8), $p = 0.44$	Logistic regression analysis undertaken
	Control	23%	24%	1% ($p = 0.89$)		
King, 1998[85] Test: mammogram	Community education	Not stated	18%	Not stated	OR = 0.60 (95% CI, 0.18 to 2.02), $p = 0.42$	Logistic regression used to adjust for confounding variables
	Access		21%		OR = 1.7 (95% CI, 0.48 to 6.12), $p = 0.41$	

Continued

TABLE 17 contd *Summary of the results of public recruitment and community intervention studies*

Study	Intervention	Pre-test	Post-test	Absolute effect (post-test minus pre-test)	Intervention effect	Notes
	Combination (community education + access)		15%		OR = 0.13 (0.02 to 1.16), $p = 0.07$	
	Control		13%			
Combined community interventions						
Brown, 1996[248] Test: Pap smear	Women's health nurses + media, community education	39%	Not stated	22.1%	When the values for all regions that received the intervention were combined, the difference between the observed values and the expected values was highly statistically significant (only reported as figures). This increase was statistically significantly greater than the difference between observed and expected values in the control regions	Used observed and expected values to assess effectiveness of intervention. Adjusted for 20% estimated hysterectomy rate
	Control	42%	Not stated	–4.3%		
Fletcher, 1993[135] Test: mammogram	Combination of community interventions	35%	55%	20%	10% (95% CI, 1 to 18), $p < 0.03$	Logistic regression analysis undertaken to adjust for confounding variables
	Control	30%	40%	10%		
Heath, 1995[251] Test: cholesterol test	Combination of community interventions	Not stated	73%	Not stated	Net intervention effect: 8.6 % ($p < 0.001$)	Logistic regression analysis undertaken to adjust for confounding variables
	Control		67%			
Mitchell, 1991[156] Test: Pap smear	Campaign ± letter	4.1% and 4.8%	12.6% and 8.1%	8.5% and 3.3%	OR = 1.86 (95% CI, 1.49 to 2.33), $p < 0.001$	Logistic regression performed. Pre- and post-test values based on estimates
	Control ± letter	3.3% and 4.4%	3.3% and 4.4%	3.0% and –0.1%		
Shelley, 1991[247] Test: Pap smear	Mass media, community activities and educational package to GPs	–	–	–	Women > 50 years: 30% increase overall; 50% increase among those who had a smear in the previous 2 years. Smaller increases observed in control States (no numbers given)	Logistic regression used to control for confounders

Continued

TABLE 17 contd *Summary of the results of public recruitment and community intervention studies*

Study	Intervention	Pre-test	Post-test	Absolute effect (post-test minus pre-test)	Intervention effect	Notes
	Control				Women < 50 years: increase in Pap smear rates from 14% to 32%, and from 19% to 52% among those overdue for screening. Three times higher than one control group, and 5 times higher than another (no actual numbers provided	
Suarez, 1997[246] Test: mammogram, Pap smear	Intervention	Pap, 45.5% Mammogram, 21.4%	Pap, 51.4% Mammogram, 38.1%	Pap, 5.9% Mammogram, 16.7%	Pap: OR = 1.00 (95% CI, 0.68 to 1.47)	Logistic regression controlled for age, education and insurance status
	Control	Pap, 50.1% Mammogram, 24.1%	Pap: 56.7% Mammogram, 43.4%	Pap, 6.6% Mammogram, 19.2%	Mammogram: OR = 1.01 (95% CI, 0.66 to 1.55)	
Taylor, 1996[253] Test: CBE	Community organisation effort targeting physicians and women	48%	84%	24%	There was no significant difference in CBE practices between the intervention and control communities at either baseline or follow-up (no figures given)	Multivariate analyses performed to control for confounding variables. Outcome was ordering by physicians
	Control	52%	88%	26%		
Urban, 1995[245] Test: mammogram	Community (2 towns)	55.7%	69.9%	Mammogram: 22.3% and 16.5% CBE: 3.3% and –2.9%	Intervention effects were negligible and not statistically significant	Results of logistic regression confirmed that the secular trend in screening was very strong
	Control (2 towns)	55.8%	74.9%	Mammogram: 21.6% CBE: 4.2%		
Zapka, 1993[244] Test: mammogram, CBE	Combined community interventions	51	Not stated	Not stated	Over the entire study period, the difference between cities in the amount of change was not significant ($p > 0.005$)	Logistic regression used to control for confounders
	Physician interventions	41				

intervention did, however, increase knowledge of screening tests and the intention to have a Pap smear, CBE or mammogram.

Community participation

Two cluster RCTs, undertaken in Australia and written up in one paper, compared community participation interventions with either mass media or family practitioner involvement (see also previous section) for increasing uptake of mammography.[250] The authors reported that in the first study there was significantly higher uptake of screening by women in the community-intervention towns compared with media-promotion towns ($p < 0.001$). In the second study, there was a significantly higher uptake of screening by women in one family practitioner intervention town compared with its matched community-intervention town ($p < 0.01$). In both studies the effect varied by the size of the town.

Community education

Three studies (one RCT and two controlled trials), all conducted in the USA, evaluated community education programmes versus control to increase the uptake of mammograms.[85,134,249] The RCT compared a community education programme with a standard group (leaflet), an access group (leaflet, mammography appointment and transportation) and a combination of community education and access.[85] The results of multivariate analyses found that the community education programme alone was no more effective than control (authors' calculated OR = 0.60; 95% CI, 0.18 to 2.02), but the community education programme plus the access was more effective than control (authors' calculated OR = 0.13; 95% CI, 0.02 to 1.16; $p = 0.07$). However, the authors also report that the combined intervention was more effective for women who might be more predisposed to having a mammography – women who had had mammography at least once before were intending to have it again and were younger.

One of the controlled trials evaluated a community education programme targeting both women and physicians versus control.[134] The study found that the difference between the two groups for mammography in the last 2 years was 10% ($p < 0.01$), for mammography in the last year was 4% ($p = 0.03$) and for CBE in the last year was –3% ($p = 0.10$). The results were based on post-test results only; no details of baseline uptake were given and baseline differences were not taken into account in the analyses. The study also reported that there were no differences between groups in knowledge of recommended mammography frequency for women aged < 50 years or ≥ 50 years. Statistically significant differences were observed between the intervention and control groups, however, for the reinforcing factors of perceived support from friends (68% versus 56%; $p = 0.003$) and perceived normative use of mammography ($p = 0.004$).

The other controlled trial reported that there were no significant differences between the control and the intervention communities for uptake of mammography (authors' calculated OR = 0.63; 95% CI, 0.2 to 9.8; $p = 0.44$) or knowledge (87% versus 82%; $p = 0.38$).[249]

Combined community interventions

Nine studies used a combination of community approaches to try and increase uptake of screening.[135,156,244–248,251,253] All had a control group who received no intervention or usual care. All except two[247,248] were undertaken in the USA. Overall, five found an effect of the interventions and four found no effect (see *Table 17*). The effect varied by screening test (four of five studies of mammography found no effect) and it was not possible to evaluate which of the components was most (or least) effective.

For **mammography and/or CBE**, five controlled trials evaluated the effect of combined approaches on mammography and/or CBE versus control.[135,244–246,253] Only one of the studies found any effect of the intervention and reported that the net intervention effect over control was 10% (95% CI, 1 to 18; $p < 0.03$).[135] This study also reported that the intention to get a mammogram rose by 30% in the intervention county compared to 17% in the control county ($p < 0.01$) This difference was found to be even greater among black women, with a 32% increase in the intervention county compared with a 7% increase in the control county. There was little change, however, in women's knowledge or attitudes about breast cancer screening in either county. Another study found that the intervention community had a greater increase in knowledge about mammography than the comparison (19.7% versus 11.4%; $p < 0.05$).[246] A further study found that the intervention city showed more improvement in selected variables than did the comparison community in the early phases of the project between baseline and midpoint. These variables included increased advice by physicians to have a mammogram, increased knowledge and decreased perceptions of barriers to CBE.[244]

For **Pap smears**, four studies (one RCT and three controlled trials) evaluated the effect on uptake of combined approaches versus control.[156,246–248] Three of the studies reported that these interventions increased the uptake of Pap smears compared to control.[156,247,248] One study, however, reported that the comparison community had a greater increase in knowledge about Pap smear and mammogram guidelines than the intervention community.[246] The RCT calculated the costs of the intervention and reported that an invitation letter might be a more cost-effective method of improving screening rates than a combined campaign and invitation strategy. The cost of the campaign was at least three times higher than that of invitation letters.[156] A further controlled trial also calculated the costs of the intervention (see appendix 5).[248]

For **cholesterol testing**, one controlled trial assessed the impact of cholesterol education, targeted media-intensive screening campaigns with organised screening events at worksites, public areas, churches and special events.[251] The net intervention effect compared to control was 8.6%

BOX 10 Summary of the results from community intervention studies

- Some evidence of effectiveness of multicomponent community interventions
- Not enough evidence for mass media campaigns and community education as single strategies

($p < 0.001$). The study also assessed knowledge, and significant intervention increases were seen for knowledge of good cholesterol level (increase of 16.4%; $p < 0.001$) and knowledge of personal level of blood cholesterol (increase of 16.0%; $p < 0.01$) compared to control.

Quality of community intervention studies

Community intervention studies rated poorly on the quality criteria, but such studies do have different methodological issues from those aimed at individuals. Three studies (21%) were RCTs, and the assessor was blinded in three studies. All but two studies[156,248] used cross-sectional surveys to assess uptake of screening. A sample of people was surveyed both before and after the test in all but one of the studies.[250] Nine studies had significant differences in baseline characteristics between groups, and all but two[134,250] adjusted for these differences in subsequent analyses. The assessment of uptake was by an adequate method in only four studies (29%). All studies used a cluster design, but only two used the cluster as the unit of analysis.[247,252] For more details of individual study quality see appendix 6, and for a summary of the results see *Box 10*.

Other interventions

One RCT assessed the willingness of individuals who were substance misusers to consent to HIV testing.[254] Individuals entering either a drug-free outpatient programme or a methadone maintenance programme were assigned to one of three informed-consent conditions (required consent, voluntary consent or delayed consent). The required-consent condition was more effective than either the voluntary-consent condition (RR = 1.27; 95% CI, 1.10 to 1.47) or the delayed-consent condition (RR = 1.52; 95% CI, 1.24 to 1.86).

Combined interventions aimed at encouraging individuals to attend for screening

Fifteen studies (10 RCTs, two quasi-RCTs and three controlled trials) evaluated a combination of interventions to increase uptake of screening.[67–69,75,100,110,111,129,152,158,197,255–258] Thirteen studies were undertaken in the USA and two were undertaken in the UK. Some studies only evaluated combined interventions compared with control, while others compared combined interventions with control and/or one or more single intervention (see *Figure 16*).

Invitation plus education versus control

One RCT compared invitation plus education.[152,158] The RCT used a factorial design to compare various strategies to encourage colorectal cancer screening (FOBT).[158] A personal letter from a GP with an appointment and an educational booklet was more effective than a letter alone (with no appointment) (RR = 1.25; 95% CI, 1.17 to 1.33).

Invitation plus prompt reminder versus control

One RCT found that a recommendation letter plus a prompt postcard was more effective than control (RR = 1.32; 95% CI, 1.14 to 1.52) and the letter alone (RR = 1.28; 95% CI, 1.11 to 1.49) for increasing mammography uptake.[75]

Invitation plus counselling

A quasi-RCT, conducted in the USA, evaluated the effectiveness (on the use of Pap smears and mammograms) of a physician invitation letter and a follow-up call from a health educator (nurse or social work intern) 7–10 days after the letter was sent, to offer barrier counselling and/or assistance with appointment making.[255] The authors concluded that a physician reminder letter combined with telephone contact is an effective strategy for increasing uptake of cervical and breast cancer screening by low-income women (for more details see appendix 5). Generalisability of the results may be limited, as the study population comprised women enrolled in an American low-income health programme.

Multiple interventions versus control

One RCT of mammography, undertaken in the USA, found that an invitation letter, follow-up telephone counselling (for those who did not respond within 2 months) and a $15 grocery incentive was more effective than control (38% versus 16%; RR = 2.44; 95% CI, 1.74 to 3.43).[67] One RCT compared an invitation letter plus education and mammography van with control for increasing mammography uptake.[257] The unit of allocation was different from the unit of analysis, but 45% of the intervention group and 12% of the control group reported having a mammogram at the 3-month follow-up interview ($p < 0.001$). The study also found that there were significant differences in beliefs about mammography post-intervention.

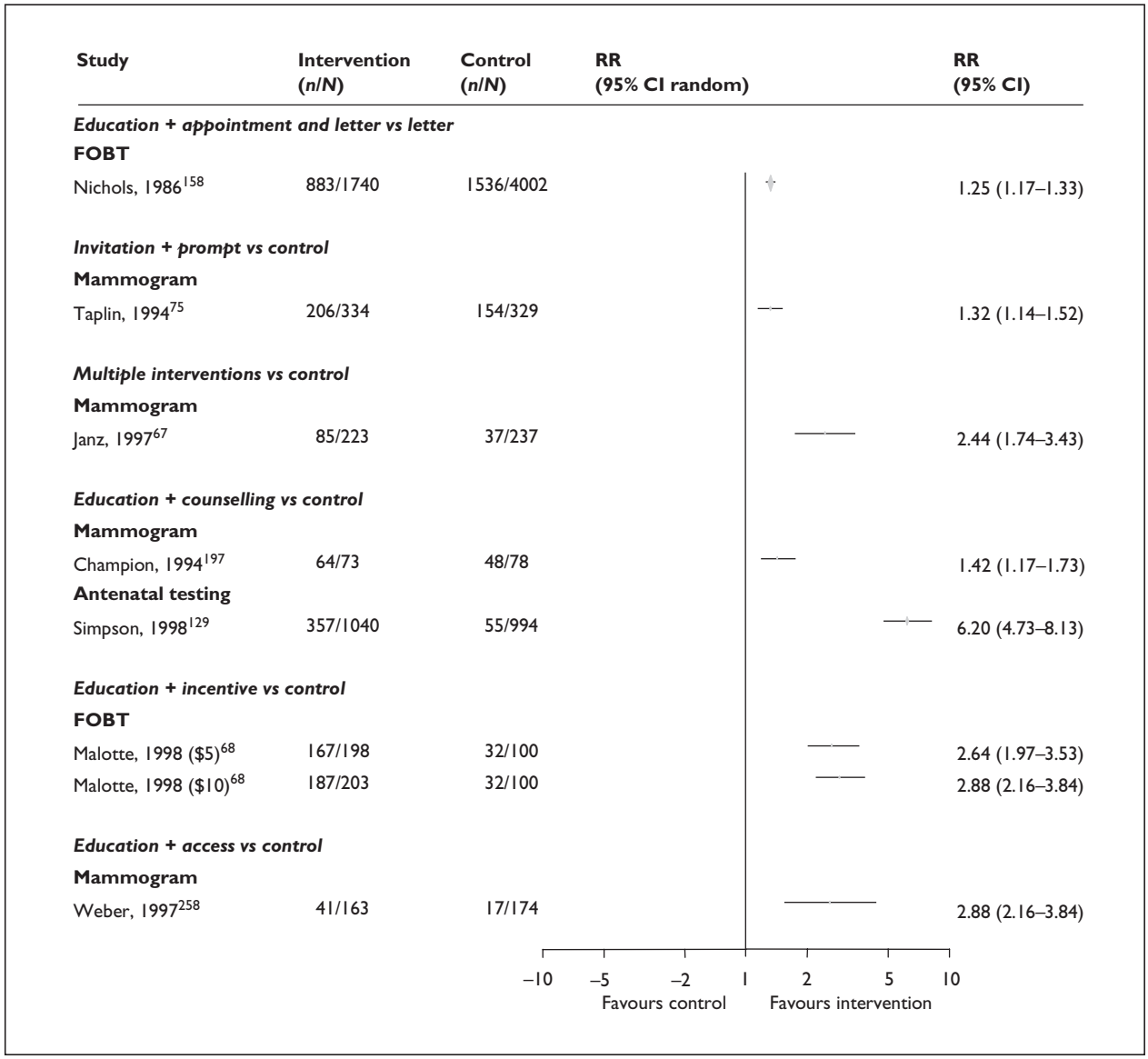


FIGURE 16 *Uptake of screening: combined interventions aimed at individuals*

A quasi-RCT used a factorial design to compare combinations of personalised follow-up (notification of abnormal smear and advice to return for follow-up), transportation incentives and educational tape–slide programmes for women with abnormal smears.[152] The study had a different unit of allocation from analysis, and there were difficulties implementing the tape–slide education programme. However, the authors concluded that, for the sample as a whole, both transport incentives and the personalised follow-up combined with the tape–slide programme had a significant positive impact on return rates.

Education plus reminders or prompts versus control

Two RCTs conducted in the USA evaluated the effectiveness of education plus prompt reminders for FOBT.[100,110] RRs were not calculated for all the possible combinations in one study, which used a factorial design, but the authors concluded that printed Haemoccult instructions followed by a reminder postcard could achieve uptake comparable to that achieved by more complex or multiple interventions (uptake for that intervention was 91.7%).[100] The other RCT evaluated the effectiveness of a self-held screening booklet (Colorecord™) with or without an instruction call and a call at 30 days. The combination of instructional phone call, Colorecord booklet and reminder phone call at 30 days was more effective than control (RR = 1.75; 95% CI, 1.50 to 2.03), but the addition of the instruction call and booklet to a reminder call did not increase uptake (RR = 0.99; 95% CI, 0.84 to 1.18). The authors concluded that it was the reminder phone call that increased uptake.[110]

Education plus counselling versus control

One well-designed RCT, conducted in the UK, evaluated the effectiveness of education ('all blood tests' leaflet or HIV-specific leaflet) plus counselling ('minimal' discussion protocol or 'comprehensive' discussion protocol) on the uptake of HIV testing in pregnant women.[129] A comprehensive discussion protocol plus a leaflet was more effective than control (RR = 6.20; 95% CI, 4.73 to 8.13), but no more effective than a leaflet with a minimal discussion protocol (RR = 0.96; 95% CI, 0.86 to 1.80). The study gave a description of risks and benefits of testing (classified as 'informed uptake'). A further RCT assessed the effectiveness of counselling and informational home visits both as separate interventions and as a combined intervention (see also home visits and counselling). The combined intervention was more effective than control (RR = 1.42; 95% CI, 1.17 to 1.73).[197]

Education plus economic incentives

Two studies, both undertaken in the USA, evaluated the effectiveness of education plus economic incentives.[68,69] One RCT used a factorial design to assess the effectiveness of monetary rewards ($5 and $10) and a brief educational session on the return of tuberculosis skin tests by intravenous drug users.[68] The combined intervention was more effective than either control ($5 – RR = 2.64; 95% CI, 1.97 to 3.53; $10 – RR = 2.88; 95% CI, 2.16 to 3.84) or the educational session alone ($5 – RR = 2.46; 95% CI, 1.86 to 3.25; $10 – RR = 2.68; 95% CI, 2.04 to 3.53), but no more effective than the monetary incentive alone ($5 – RR = 0.98; 95% CI, 0.91 to 1.07; $10 – RR = 0.99; 95% CI, 0.94 to 1.03). The second study, a controlled trial, compared print media, onsite mammography workshops and incentives (lottery draws) with control (no details given), and the authors concluded that mammography uptake increased in both groups. The authors only calculated pre- and post-test values for the two groups, and did not compare the difference between the two groups (see appendix 5).[69] The study also found that there was no significant difference in the increase in knowledge between the intervention and control groups.

Education plus access

An RCT compared a letter followed by a standardised case-management protocol, including patient education, reminders, telephone calls, home visits, office visits, mailed cards, identification and removal of barriers (transportation, dependants' care, etc.), with a letter only (control group).[258] The RR was 2.88 (95% CI, 1.67 to 5.16) for the combined effect of the intervention, but it was not possible to determine which components were most effective. The study also calculated costs of the interventions (see appendix 5). Two further controlled trials by the same author found that a visit-based strategy that included a patient handout (with a request card attached, completed apart from the doctor's signature) was more effective than control (47% and 53% versus 33%; $p < 0.05$).[111,256]

BOX 11 Summary of the results from combined intervention studies

- Some evidence of effectiveness of a combination of different components

Quality of combined intervention studies

Overall, the quality of the studies was good. Ten studies (66%) were RCTs, but the assessor was not blinded in any studies. Eight studies (53%) analysed 80% or more of those randomised. Of these, three reported no losses to follow-up (i.e. analysed 100% of those randomised) and three used an intention-to-intervene analysis. Three studies (20%) had significant differences in baseline characteristics between groups, but all took account of such differences in the analyses. Eleven studies (73%) used an adequate measure of uptake, such as medical records. Five studies (one RCT, one quasi-RCT and three controlled trials) allocated by clusters, but all analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 11*.

Single interventions aimed at physicians or healthcare workers

Thirty-three studies (24 RCTs, five quasi-RCTs and four controlled trials) were undertaken to change physician behaviour by using chart reminders, providing education, changing office systems or giving feedback on individual or group performance.[61,62,66,80,103,111,138,140,150,154,155,160,161,256,259–278] One further cluster RCT evaluated a 2-hour training programme for GP reception staff.[259] *Table 18* gives a description for each intervention, the number of RCTs and the countries where the studies were undertaken.

Physician reminders

Twenty-one studies (16 RCTs, three quasi-RCTs and two controlled trials) were evaluated, 18

of which were undertaken in North America, one in the UK, one in Italy and one in Australia.[61,62,66,80,103,138,150,154,155,160,161,262–265,268,270–273,275] The studies focused on increasing uptake of either Pap smear, mammography or a combination of screening tests. All the studies included a control group that received no intervention or usual care. Overall, the use of physician reminders seemed to increase the uptake of screening (*Figure 17*).

Physician reminders versus control

For **Pap smears**, six studies (five RCTs and one controlled trial) evaluated the effectiveness of physician reminders in increasing the uptake of smears (as opposed to multiple screening tests, which are described separately).[62,80,103,138,154,161] RRs were calculated for five RCTs, but were not combined as there was significant heterogeneity. Two of the RCTs showed a significant effect of the intervention and the other three showed no effect (see *Figure 17*). Two of the RCTs, however, limited analyses to individuals attending a clinic or appointment.[154,161] A further RCT randomisation was undertaken in two stages, with over 20% of participants excluded after the first stage.[80] One controlled trial evaluated the effectiveness of sending lists of individuals overdue for screening to physicians.[62] The authors reported that uptake was 8.2% in the list group compared with 2.9% in the control group.

Two RCTs calculated the costs and cost-effectiveness of the interventions. One RCT assessed the costs of the physician reminders, as well as interventions targeting individuals.[154] The authors conclude that the physician reminder is very cost-effective, and costs were less than for the other interventions. Another RCT reported that, compared with the control group, tagging notes had lowest incremental cost-effectiveness ratio; the two letter interventions had incremental cost-effectiveness ratios approximately six times higher. So, although the letter interventions were more successful at recruiting women for screening, the extra cost involved makes them less marginally cost-effective than tagging files.[103]

TABLE 18 *Interventions aimed at physicians or healthcare workers: definitions, number of RCTs and countries where the studies were undertaken*[*]

Definition	No. of RCTs (%)	No. of studies				
		UK	North America	Australia and New Zealand	Other	Total
All physician and healthcare worker interventions	25 (74%)	2	27	3	2	34
Reminders Prompted physicians either to perform a screening test or to encourage eligible individuals to have a test performed at a future date. Strategies included chart reminders, other types of form and lists of overdue individuals	16 (70%)	1	20	1	1	23
Education Educational sessions or workshops, printed or audio-visual materials	3 (75%)	0	1	1	2	4
Office systems Assistance from facilitators or nurses in the design and implementation of office routines and tools	6 (100%)	1	5	0	0	6
Audit and feedback Feedback to physicians on their performance and/or that of their peers	2 (40%)	0	5	0	0	5

[*] *Some studies evaluated more than one physician intervention, and therefore the columns cannot be totalled*

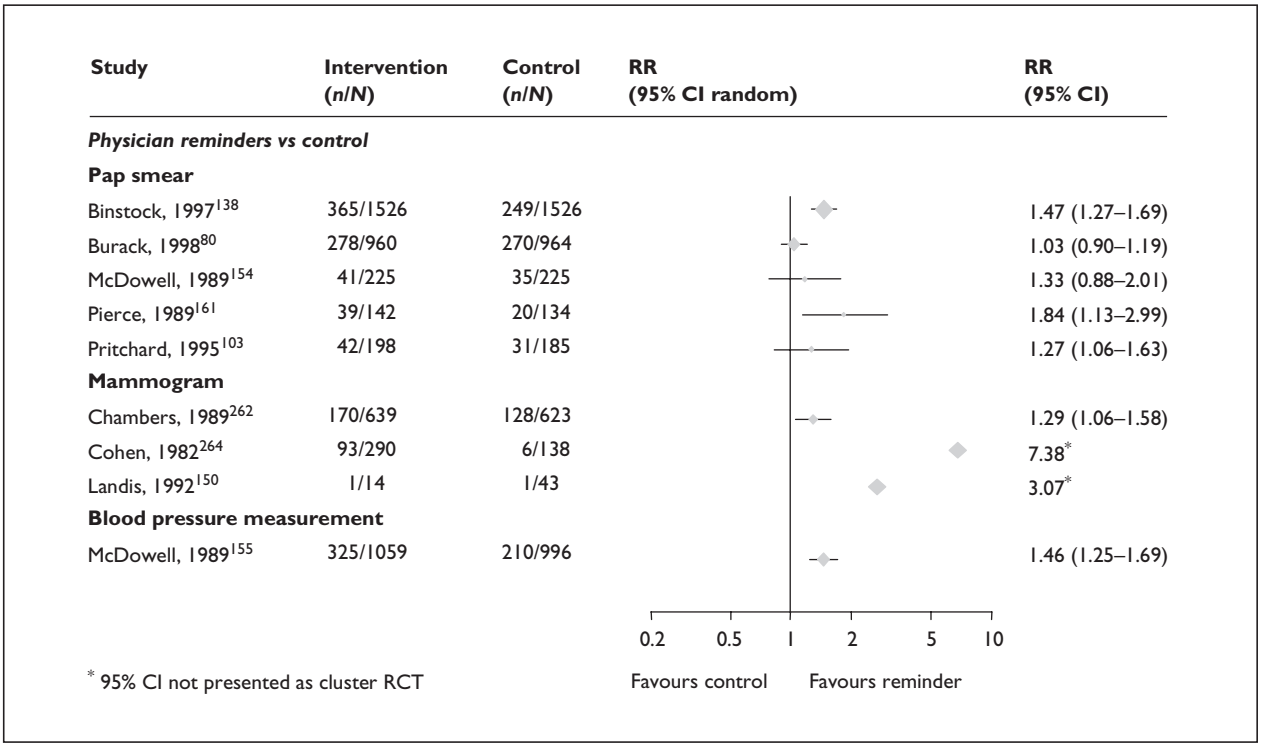


FIGURE 17 *Uptake of screening: physician reminders*

For **mammography**, five RCTs evaluated the effectiveness of physician reminders in increasing uptake.[61,66,150,262,264] RRs were calculated for three of the RCTs (two were cluster RCTs, so CIs were not calculated). All three RCTs reported an effect of the intervention, but one was only a small cluster RCT.[150] One further RCT presented the results only as figures, but the intervention was reported to be more effective than control.[61] Lastly, one good-quality RCT, which allocated and analysed at the practice level, reported that the mean mammography completion rate was 47.9 for the reminder group and 34.6 for the control group which was statistically significant (p value not reported).[66] One study also assessed physicians' knowledge and attitudes, but found no statistically significant differences between the intervention group and the control group after the test.[264]

For **blood pressure screening**, one RCT found a modest effect of physician reminders compared to control, but ineligible participants (17% of those randomised) were excluded from the analysis (RR = 1.46; 95% CI, 1.25 to 1.69).[155] The authors also reported that the physician reminder was more cost-effective than a letter or telephone call to individuals.

For **multiple screening tests**, eight studies (five RCTs, two quasi-RCTs and one controlled trial) assessed uptake for multiple screening tests, but RRs could not be calculated for any of the studies due to lack of available data.[160,263,265,268,271–273,275] Two studies (an RCT and a quasi-RCT) found that, overall, checklists were associated with a higher rate of physician compliance with recommended screening tests.[263,268] A controlled trial found that computer-generated reminders were more effective than conventional paper medical records, but many physicians using computer systems failed to make use of the resource.[275] Four further RCTs found that the effects of the intervention on physician compliance scores were significant for some screening tests but not others.[160,271–273] A quasi-RCT evaluated the effect of a factsheet reminder on the performance of periodic health examinations, but found no significant differences between intervention and control groups.[265] The study also evaluated knowledge and attitudes, and found that a significant difference was observed in the mean attitudinal and total test scores ($p < 0.05$ in both cases) after testing between the intervention and control groups. One RCT calculated the relative costs of physician interventions and found that the physician reminders were more cost-effective than audit and feedback (see appendix 5).[272]

Different types of chart reminder

One quasi-RCT compared computer-generated reminders, on which physicians had to circle responses, with standard computer reminders (control).[270] Physicians complied more frequently

than did control physicians for all screening tests combined (46% versus 38%; $p = 0.002$; absolute difference 8%; 95% CI, 2 to 12). The study found that physician compliance was statistically significant for mammography and FOBT but not for Pap smear.

Physician education

Four studies (three RCTs and one controlled trial) evaluated the impact of educational sessions, printed materials or educational outreach visits ('face-to-face' visits).[62,140,260,266] Three were RCTs,[140,260] one was a quasi-RCT[265] and the other was a controlled trial.[62] One was undertaken in the USA, one in Italy, one in France and one in Australia. Overall, the studies reported a small increase in the uptake of screening tests in the intervention group. RRs were not calculated due to lack of data. One RCT evaluated a 1-day seminar, four follow-up bulletins during the following year, and notes on mammography and Pap smear techniques.[260] Only 43% of physicians randomised to the intervention attended the seminar, and the average number of Pap smears performed per practice was 40.5% in the intervention group and 46.1% in the control group (mammography was only reported as prescriptions). One RCT of community interventions (all had a mass media component), found that a GP workshop was effective in increasing uptake of Pap smears, but the effect varied by community.[140] Another RCT evaluating a day-long education session for eight screening procedures reported that the intervention only increased the proportion of women having a mammography ($p < 0.01$).[266] A controlled trial reported that an educational outreach visit and educational session by a medical doctor resulted in an increase in uptake of Pap smears (7% compared with 2.9% in the control group).[62]

Office systems

Six studies (five RCTs and one quasi-RCT), four undertaken in the USA and one in the UK,[274] evaluated the effectiveness of office systems.[261,267,269,274,277,279] Overall, there seemed to be some effect of the intervention. Such interventions included assistance from facilitators or nurses in the design and implementation of office routines and tools. RRs were not calculated due to the lack of data. In one RCT, office systems were more effective than continuing medical education. Improvements in FOBT testing were maintained between 12 and 24 months, while improvements in mammography recommendations and CBE testing declined.[279] The use of a nurse facilitator or nurse clinician also improved uptake rates in one quasi-RCT[261] and one RCT[274] compared to control, as did a patient-initiated, touch-sensitive computer system in combination with a liaison nurse.[277] In two RCTs, however, office systems had no significant effect on uptake of any screening tests, as compared to the control group.[267,269]

Audit and feedback

Five studies (two RCTs, one quasi-RCT and two controlled trials), all conducted in the USA, evaluated the effectiveness of feedback to physicians about their performance.[111,256,272,276,278] Overall there appeared to be some effect of the intervention, but it varied by screening test. One crossover, cluster RCT found that feedback was no more effective than no feedback in increasing FOBT uptake (RR = 1.04 for the period prior to crossover).[278] RRs could not be calculated for any of the other four studies. An RCT of multiple screening tests found that audit and feedback was more effective than control for some tests, but less effective than individual reminders (see appendix 5).[272] One quasi-RCT reported that uptake in the feedback group was significant for some screening tests but not others (for more details see appendix 6).[276] The two controlled trials were by the same author and compared the same interventions.[111,256] The first trial was small and was reported as an abstract only. Both studies found that the physician in the feedback groups had a significantly higher proportion of completed mammograms than the physicians in the control group ($p \leq 0.05$).

Interventions aimed at other healthcare workers

One cluster RCT (unit of allocation different from unit of analysis), undertaken in the UK, evaluated whether a 2-hour training programme for GP reception staff could improve screening uptake in individuals who had failed to attend for breast screening, and whether women from different ethnic groups benefited equally from the intervention. The ethnic origins of the group included 31% white, 17% Indian, 10% Pakistani, 14% black, 6% Bangladeshi, 1% Chinese, 4% other ethnic groups and 16% not reported. The intervention resulted in statistically significant improvements in uptake (9% versus 4%; $p = 0.004$) with the greatest increase being in women from India (19% versus 5%).[259]

Quality of studies targeting physicians

Overall, the quality of the studies was reasonable. Twenty-five studies (76%) were RCTs, and the assessor was blinded in two studies. Eighteen studies (53%) analysed 80% or more of those randomised. Of these, 11 reported no losses to follow-up (i.e. analysed 100% of those randomised) and three used an intention-to-intervene analysis.

Seven of the studies excluded a significant percentage (> 20%) of participants from the analysis (those who did not have a physician visit during the study period). Two studies (6%) had significant differences in baseline characteristics between groups, and neither took account of such differences in the analyses. Twenty-seven studies (79%) used an adequate measure of uptake, such as medical records. Twenty-six studies (18 RCTs, four quasi-RCTs and four controlled trials) allocated by clusters, and half took the clustering effect into account in the analyses. For further details of the quality of individual studies see the tables in appendix 6.

Combined interventions aimed at physicians

Seven studies (three RCTs, two quasi-RCTs and two controlled trials) evaluated combined interventions for increasing physician compliance with screening guidelines.[62,66,250,266,276,280,281] Four studies were undertaken in the USA, one in Italy and two in Australia.

Education and reminders

Three studies, undertaken in Australia, Italy and the USA, evaluated the effectiveness of physician reminders with an additional educational component.[62,250,281] Only one study was randomised, but there were not enough data to calculate a RR.[250] The authors reported that the physician intervention (peer support and discussion, reminder system) was more effective in increasing mammography uptake than a community participation intervention in one pair of towns (68% versus 51%; difference 17%; 95% CI, 10 to 24; p 0.01), but not another other pair of towns. One controlled trial found no significant differences of weekly 1-hour presentations and printed reminders as compared with control, for Pap smear, mammography or FOBT.[281] Lastly, a controlled trial reported that a visit from a physician plus reminders was more effective than control, but no more effective than single interventions (visit or reminders). The study was poorly designed, however, and results must be interpreted with caution.[62]

Education and support

One quasi-RCT, undertaken in Australia, evaluated the effectiveness of education and support from a medical physician to the increase in uptake of Pap smears.[280] The authors reported that the OR for the intervention and non-intervention areas was 1.01 (95% CI, 0.94 to 1.09), indicating that there was no overall difference in the screening patterns between the two areas. The authors also reported the costs of the intervention and concluded that it was an expensive intervention that should not be widely implemented (see appendix 5).

Education and office systems

One RCT, undertaken in the USA, compared office systems and education (both individual and combined) for several different screening tests. It was not possible to calculate RRs, but uptake increased significantly (versus control) for mammogram, CBE and FOBT, but not for Pap smear, DRE or sigmoidoscopy (see appendix 5).[266] However, the authors reported that a combination of two interventions was no better than either one alone.

Economic incentives and reminders

One RCT conducted in the USA evaluated the effectiveness of chart reminders plus token monetary rewards (i.e. $50 for a 50% referral rate) for mammograms.[66] RRs could not be calculated, but the authors reported that, at the practice level, mean mammography completion rate was 40.8 for the reminder and reward group, 34.6 for the control group and 47.9 for the reminder group. Thus, addition of rewards to a reminder intervention did not increase uptake compared with a reminder alone.

Audit or feedback and reminders

One quasi-RCT undertaken in the USA, with a complex design, compared feedback and reminders, both separately and combined, for a number of screening tests.[276] The authors reported that, although the combined intervention was more effective than control for FOBT and mammography, there was no additional effect in those physicians receiving both reminders and feedback compared with those receiving the other interventions.

Quality of combined physician intervention studies

Three studies (43%) were RCTs, and the assessor was blinded in one study. One study analysed 80% or more of those randomised, and one used pre-

BOX 12 Summary of the results from studies targeting physicians and other healthcare workers

- Evidence of effectiveness of physician reminders
- Some evidence to suggest that office systems appear to increase uptake
- Some evidence to suggest that audit and feedback increase uptake
- Not enough evidence that physician education increases uptake

and post-test surveys. One study had significant differences in baseline characteristics between groups, which were not taken into account in the analyses. Three studies (43%) used an adequate measure of uptake such as medical records. All studies allocated by clusters, and four analysed by individuals. For further details of the quality of individual studies see appendix 6, and for a summary of the results see *Box 12*.

Interventions aimed at both physicians and individuals

Thirteen studies (12 RCTs and one controlled trial) evaluated strategies targeting both physicians and individuals (e.g. physician reminders and individual invitation).[60,61,65,80,150,160,165,272,282–286] All the studies were undertaken in the USA. Several of these studies also evaluated the interventions separately (e.g. assessed the effects of invitations to individuals alone, physician interventions alone, and a combination of individual and physician interventions).

Physician reminders and invitations to individuals

Nine RCTs, all undertaken in the USA, and five of which were by the same research group, evaluated a combination of physician reminders and invitations to individuals versus control.[60,61,65,80,150,160,165,284,285] Overall this combination of interventions increased the uptake of screening for a range of screening programmes (*Figure 18*).

For **Pap smears**, three RCTs evaluated the effect of physician reminders combined with individual letters or reminders to increase Pap smear.[65,80,165] RRs were calculated for two of the RCTs. A significant effect of the intervention was found in one (RR = 2.51; 95% CI, 2.04 to 3.09)[165] but not the other (RR = 1.14; 95% CI, 1.00 to 1.31).[80] An RCT (published only as an abstract) compared reminders and invitations promoting Pap smear and mammography with those prompting only mammography.[65] The authors reported that there was some evidence to suggest that completing both screening tests was more effective than completing one screening test.

For **mammography and CBE**, five RCTs, three by the same author, evaluated the effect of physician reminders combined with individual letters or reminders to increase mammography uptake.[60,61,150,165,285] RRs were calculated for four RCTs (one of which was a cluster RCT), and they all reported a statistically significant effect of the intervention compared with control (see *Figure 18*).[60,150,165,285] The other RCT did not present enough details of uptake, but did report a statistically significant effect of the intervention.[61]

For **multiple screening tests**, one RCT, undertaken in the USA, evaluated physician reminders and invitations to individuals, both combined and individually.[160] RRs could not be calculated, as the unit of allocation was different from the unit of analysis. However the authors reported that improvement in uptake of FOBT and cholesterol

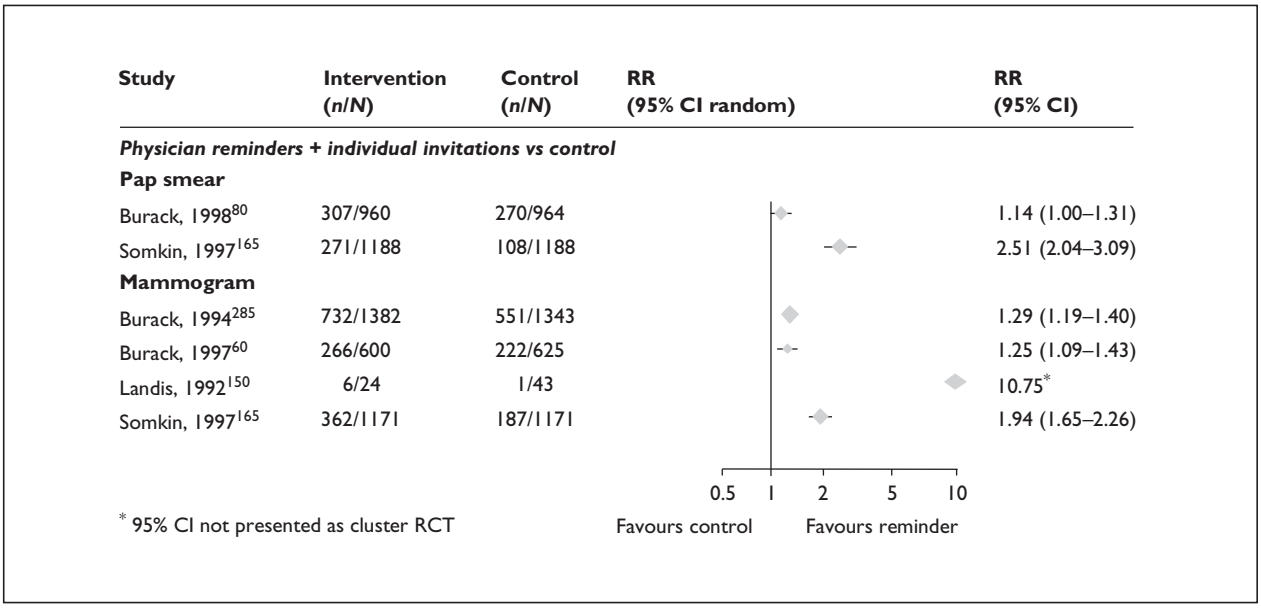


FIGURE 18 *Uptake of screening: physician and individual interventions versus control*

BOX 13 Summary of the results from studies of interventions aimed at both physicians and individuals

- Evidence that physician reminders and invitations to individuals increase uptake

screening (but not Pap smear or mammography) was significantly greater in the individual or physician reminder group compared with usual care ($p < 0.05$).

Physician reminders and individual education

Two RCTs, both undertaken in the USA, evaluated the effectiveness of physician reminders and individual education (printed materials).[272,286] RRs could not be calculated, but one cluster RCT of colorectal cancer screening reported significantly higher uptake among the intervention group than the control group for both sigmoidoscopy and FOBT ($p < 0.05$). Numbers were small, however, and sample sizes differed between groups.[286] Another cluster RCT evaluated the effect of individual education and physician reminders for screening. The addition of an educational component significantly increased the uptake only for mammography uptake, not CBE uptake.[272]

Multiple interventions aimed at individuals and physicians

Four studies (three RCTs and one controlled trial) compared multiple strategies aimed at both physicians and individuals. All studies were undertaken in the USA.[282–284,286] RRs could not be calculated. One RCT found that implementation of an HMO-mediated, multicomponent intervention to improve cancer screening was effective for Pap smear, FOBT, and CBE, but not for mammography.[284] Another RCT of FOBT screening found that physician reminders and educational information combined with a recall letter for individuals was more effective than control ($p < 0.05$), but the recall letter did not have any additional effect.[286] A further RCT evaluated the use of full Medicare reimbursement to physicians for preventive care and free health-promotion packages for individuals, regular prompting of the physician to schedule preventive-care visits, a new office system whereby nurses carried out many preventive procedures and the use of charting forms.[282] The intervention resulted in an increased uptake of all screening tests (see appendix 5). The study also found that less deterioration in quality of life had occurred among participants in the intervention group as compared to those in the control group. One controlled trial found that education, training and free mammograms significantly increased uptake compared to control ($p < 0.0001$; rate ratio 1.4; 95% CI, 1.2 to 1.5).[283]

Quality of studies aimed at both physicians and individuals

Overall, the quality of the studies was reasonable. Twelve of the 13 studies (92%) were randomised and one was a controlled trial. The assessor was blinded in one study. Two studies (15%) reported no losses to follow-up (i.e. analysed 100% of those randomised) and none used an intention-to-intervene analysis. Three studies (23%) had significant differences in baseline characteristics between groups, and one took account of such differences in the analyses. Nine studies (69%) used an adequate measure of uptake, such as medical records. Seven studies (six RCTs and one controlled trial) allocated by clusters, and five of these analysed by individuals. For further details of the quality of individual studies see the tables in appendix 6, and for a summary of the results see *Box 13*.

Physician interventions compared with interventions aimed at individuals

Eleven studies (nine RCTs and two controlled trials) evaluated the effectiveness of physician interventions compared with interventions aimed at individuals due for screening.[61,80,103,111,138,150,154,155,160,161,256] Nine were undertaken in the USA, one in Australia and one in the UK. Overall, interventions aimed at individuals were more effective than interventions aimed at physicians (*Figure 19*).

Physician reminders versus invitations to individuals

Nine studies evaluated physician reminders as compared with invitations to individuals.[61,80,103,138,150,154,155,160,161] RRs and 95% CIs were calculated for six RCTs (five for Pap smear and one for blood pressure screening). There was no significant heterogeneity between the studies, so the individual RRs were pooled. Overall, interventions to individuals were more effective than physician reminders (combined RR = 1.18; 95% CI, 1.07 to 1.29). Of the three remaining RCTs, two reported no difference between interventions.[150,160] The other RCT reported that physician reminders were more effective than invitations to individuals.

However, the analysis of the physician intervention group was limited to those who visited during the study year.[61]

Audit and feedback (physician) versus handout and request form (individual)

Two controlled trials, by the same author, compared audit and feedback aimed at the physician with education and a request form for mammography given to eligible women.[111,256] The difference between the uptake rates in the two intervention groups was not statistically significant as compared with control (45.4–49% versus 47–56%).

Quality of intervention studies comparing interventions aimed at physicians and individuals

Overall, the quality of the studies was reasonable. Ten studies (91%) were RCTs, but the assessor was not blinded in any of the 11 studies. Five studies (45%) analysed 80% or more of those randomised. Of these, two reported no losses to follow-up (i.e. analysed 100% of those randomised) and two used an intention-to-intervene analysis. Four of the studies excluded a significant percentage of participants from the analysis (e.g. those who did not receive a physician visit during the study period). One study had significant differences in baseline characteristics between groups, which were not taken account of in the analyses.[150] Seven studies (58%) used an adequate measure of uptake, such as medical records. Five studies (two RCTs and two controlled trials) allocated by clusters, and none took account of the clustering effect in the analyses. For further details of the quality of individual studies see the tables in appendix 6, and for a summary of the results see *Box 14*.

BOX 14 Summary of the results from studies of interventions aimed at physicians versus interventions aimed at individuals

- Small beneficial effect of interventions aimed at individuals rather than interventions aimed at physicians

Summary of the results of intervention studies

Below is a brief summary of the evidence, primarily from good-quality studies (RCTs), as to which interventions seemed to be effective, ineffective, or for which there was not enough evidence. Interventions aimed at individuals were slightly more effective than those aimed at physicians.

Interventions aimed at individuals

Interventions shown to be effective:

- invitation appointments (fixed are more effective than open)
- invitation letters (more effective in increasing the uptake of Pap smears than mammography)
- invitation telephone calls

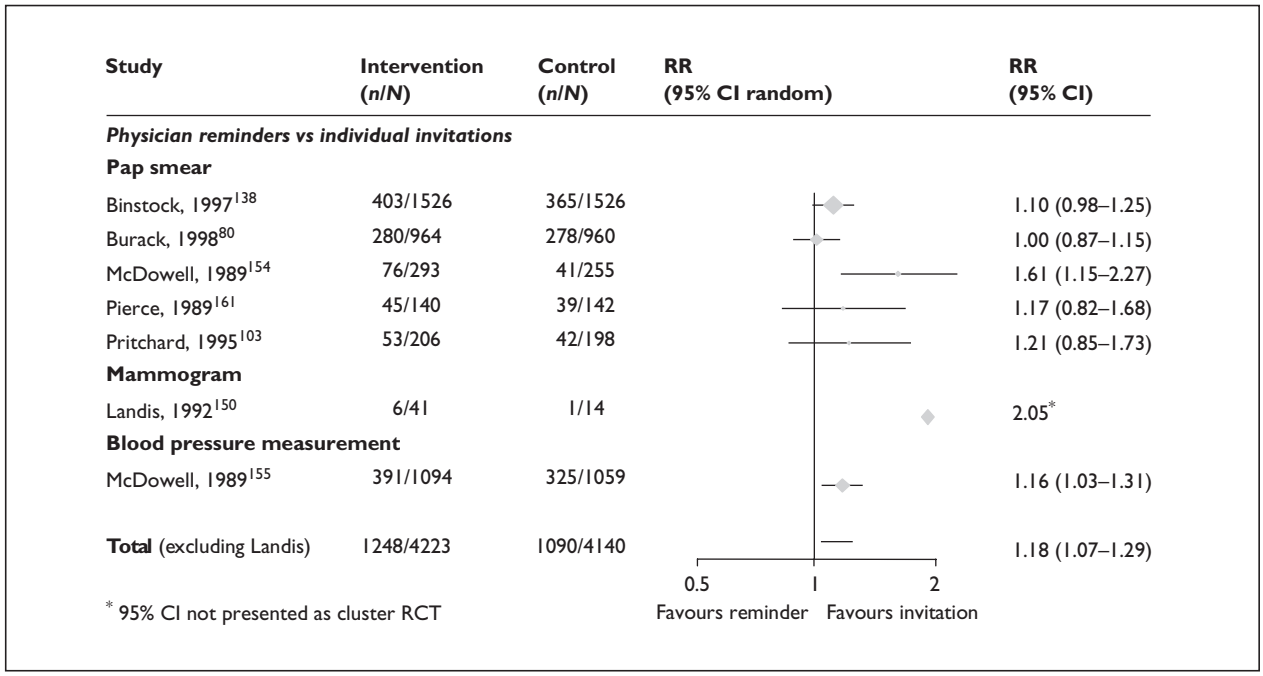


FIGURE 19 *Uptake of screening: physician interventions versus interventions aimed at individuals*

- telephone counselling
- removal of financial barriers.

Interventions that may be effective:

- educational home visits
- opportunistic screening
- multicomponent community interventions
- simpler procedures
- a combination of different components aimed at individuals
- reminders for non-attenders appear to be effective for mammography
- invitation follow-up prompts.

Interventions with limited effectiveness:

- printed educational materials
- audio-visual educational materials
- group educational sessions
- individual educational sessions
- risk factor questionnaires
- face-to-face counselling.

Interventions shown to be ineffective:

- rewards or incentives.

Interventions for which there is no good-quality evidence, or not enough evidence:

- inconsistent evidence of effectiveness for letters versus telephone calls
- not enough evidence to detect whether GP letters are more effective than those from another source
- mass media campaigns and community education as single strategies
- loss versus gain messages.

Interventions aimed at physicians and other healthcare workers

Interventions shown to be effective:

- physician reminders.

Interventions that may be effective:

- office systems
- audit and feedback increase uptake.

Interventions for which there is no good-quality evidence, or not enough evidence:

- physician education.

Interventions aimed at both individuals and physicians

Interventions shown to be effective:

- physician reminders combined with invitations to individuals.

Interventions aimed at individuals versus interventions aimed at physicians

- Small beneficial effect of interventions aimed at individuals rather than interventions aimed at physicians.

Chapter 5
Discussion

This review brings together a large body of evidence on the determinants of screening and interventions to increase the uptake of screening. The review examines evidence concerning uptake of all screening programmes, regardless of proven effectiveness. Where possible, evidence was assessed both across different screening programmes and within screening programmes. Meta-analyses were not performed for either the determinants or the interventions part of the review due to heterogeneity between studies. The major findings are based on a narrative synthesis of the included studies.

Major findings

Determinants

The majority of the studies included in this review examined determinants relating to the individual rather than those relating to the physician or healthcare provider. Although there are numerous literature reviews featuring both qualitative and quantitative evidence, few systematic reviews of determinants were identified. One systematic review of determinants in mammography was identified, but it differed from the current review in several ways (i.e. it only included UK studies and did not exclude studies that failed to use a multivariate analysis).[287]

Of the determinants relating to the individual, those most frequently examined were concerned with socio-demographic characteristics (64/65 studies), as often these were relatively easily obtained from medical records or databases. All studies that included information on individuals' perceptions, attitudes, knowledge and beliefs used either interviews or questionnaires to collect the data. In the majority of studies very little information was provided as to why and how certain determinants were chosen for investigation. Therefore, in general, the studies provided little insight into the reasons why certain determinants might be important. However, 17 studies did use theoretical models such as the Health Belief Model,[75,78,83,94,98,100,107] the Theory of Reasoned Action Model,[68,78,108] the Transtheoretical or Stages of Change Model,[86,122,222] PRECEDE;[77,85,112] the Behavioural Model of Utilisation[70]and the Preventative Health Model[92] to provide a framework for directing the process of determinant selection (see appendix 3). In addition, three further studies discussed at least some of their findings in the context of a theoretical model.[64,74,119]

Assessing the overall effect of determinants both for individual screening programmes and across screening programmes was difficult for the reasons highlighted in chapter 4. In summary, heterogeneity and inadequate reporting (within and across tests) of the effects and determinants studied were major concerns that prevented the statistical pooling of data and also made it difficult to derive definitive conclusions. All these factors should be borne in mind when interpreting the review findings.

Specific findings for individual screening tests

In many cases there was little evidence available to assess the overall effect of a determinant. In order to try and discuss the review findings in the context of the availability of evidence, only those determinants and screening tests that were investigated in three or more studies were considered. Where determinants were found to be significant in 50% or more of the studies they were classed as 'important', and therefore worthy of consideration when implementing a screening programme or intervention to improve the uptake of screening. This three-study threshold was selected arbitrarily, and even though it was based on comments from the review's expert panel of advisors, the implications of the threshold must be borne in mind when interpreting the review findings. For instance little comment can be made about well-child screening, CBE, sigmoidoscopy or screening programmes for tuberculosis, cystic fibrosis and cholesterol.

Determinants that were found to be 'important' varied according to the screening test. For **mammography**, women were more likely to attend if they expressed an **intention to attend**. This is supported by the Theory of Reasoned Action, which highlights this determinant as the best single predictor of screening behaviour.[288] Women were also more likely to take part in screening if they had attended for **previous mammograms** or had **medical insurance** versus no insurance (i.e.

insurance status). This latter finding was based solely on US studies, and therefore its relevance to countries such as the UK, which do not use an insurance-based healthcare system, is limited. It was unclear whether those individuals who received a **recommendation from a healthcare provider** to participate in screening were more or less likely to attend for screening. Receiving a recommendation from a healthcare provider, however, has been conceptualised as an important cue to action in the Health Belief Model, and not receiving a recommendation has been identified as a major barrier to screening.[288] The importance of recommendations in determining screening behaviour was also highlighted by the systematic review of UK mammography studies.[287] A number of other studies also looked at other determinants, including age, ethnicity, education, marital status, attendance for other screening tests, screening knowledge, medical history, perceived vulnerability and worries about screening. However, the majority of studies did not find these factors to be significant.

Attendance for **Pap smear** was associated with **age**. The fact that age plays a role in determining screening uptake is not surprising, as screening recommendations cover both younger and older women, who are likely to vary in their beliefs, attitudes and motivations to attend. However, it was unclear from the studies included in this review whether younger or older women were more likely to attend. **Insurance** status was also an 'important' factor in predicting attendance for Pap smear, but it was unclear whether those who had insurance were more or less likely to attend. A number of studies also looked at other determinants, including marital status and participants' level of education, but the majority did not find these factors to be significant.

Previous screening history and **age** were identified as important determinants for **FOBT**. Individuals who participated in FOBT were more likely to have had a previous FOBT and were often older than 65 years of age, although age categories varied across the studies. Individuals who were **able to perform the ADL** were also more likely to participate in FOBT. This is not surprising as inability to perform ADL may act as a barrier to screening participation, and colorectal cancer screening is targeted at older individuals who are more likely to be affected by debilitating conditions. A number of studies also investigated the influence of gender, education level and perceived level of vulnerability or susceptibility on uptake, but the majority of these studies did not find these factors to be significant.

Ethnicity was identified as 'important' in predicting attendance for **DRE or PSA**. Attendance was found to be significantly lower among African-American, as opposed to Caucasian, individuals. However, the relevance of this finding is limited with regard to the UK setting as the lack of FOBT studies conducted in the UK makes it difficult to comment on whether similar ethnic differences exist. Insufficient evidence in other screening tests makes it difficult to assess the impact of ethnicity on UK screening behaviour. **Education** was also an 'important' determinant, with those men who had spent more years in education being more likely to attend for screening. A number of other FOBT studies investigated the effect of age and income on uptake, but the majority found these factors not to be significant.

There was no clear evidence to suggest which determinants were important in predicting attendance for **HIV-antibody tests**. A number of studies looked at the influence of age, ethnic origin, marital status, education and previous screening history, but the majority did not find them to be significant. In addition, risk factors for HIV infection were also investigated, in particular those relating to risk behaviours such as intravenous drug use and sexual intercourse with multiple partners. However, the data gathered tended to relate to a specifically defined determinant, which made it difficult to synthesise evidence across studies.

Findings across screening tests

Examining findings across screening tests may help to identify determinants that could be important for screening in general, and as such may be useful when implementing new screening programmes. Two methods for comparing the findings across screening tests were identified:

The **first method**, which is potentially the more robust of the two, first examined determinants within tests, and those found to be significant in individual screening tests (as outlined above) were compared across screening tests. Using this method only three determinants (**insurance status**, **previous screening history** and **age**) were found to be 'important' across screening tests (i.e. they were 'important' in two or more of the five main screening tests). Insurance status was important for both mammography and Pap smear screening, but as previously discussed is not relevant to the UK setting. Previous screening history (i.e. having had a previous test) was important in predicting the uptake of mammograms and FOBTs. In both screening tests those who had previously been tested were significantly more likely to agree to be

screened again. Age was also found to be a significant predictor in determining the uptake of Pap smears and FOBTs. However, it was not clear either between or within screening tests which age categories were more likely to participate in screening. This was not surprising, as participants' ages varied between studies, and countries differed in screening guidelines, which meant that the screening tests were not necessarily targeted at the same age ranges. Similar problems were identified in a review of prospective and retrospective studies (1973–1996) of colorectal cancer in which age was also identified as a significant factor.[289]

The **second method** considered determinants across screening tests regardless of whether they were found to be 'important' within individual tests. By examining the data in this way all the determinants and screening tests (i.e. well-child screening, CBE, sigmoidoscopy and screening programmes for tuberculosis, cystic fibrosis and cholesterol) were considered. It should be borne in mind, however, that the problem of heterogeneity between the different screening tests may be heightened using this method of analysis, and so the findings may be less robust. Determinants that were assessed across three or more studies and identified as significant in ≥ 50% of the studies are discussed below. Using this method of analysis a number of other variables were identified, which could potentially play a role in determining screening behaviour (see *Table 10*). Interestingly **previous screening history** was again identified as significant, but in this instance it was not clear whether individuals who had previously attended screening were more or less likely to attend for future tests. In contrast to the previous analysis, age was not identified as potentially important and was found to be significant in less than 50% of studies. This was due in part to the fact that a large number of studies looked at the significance of age when performing mammograms and HIV-antibody tests. Age was not found to be significant for these tests. The majority of studies looking at FOBT did find age to be significant, but there were only nine FOBT studies that looked at this determinant, as compared to 31 mammography studies.

Additional determinants that were identified as potentially 'important' via this second method of analysis suggested that individuals with a **female healthcare provider**, those who had an **intention to attend** and those who had some form of **medical insurance** were more likely to attend for screening. Intention to attend and insurance have already been discussed. With regard to the gender of the healthcare provider there are a number of reasons why having a female provider may be important. For instance, the gender of the screening provider may in some instances act as a barrier (e.g. many women do not participate in cervical cancer screening due to the unavailability of a female screener).[290,291]

A number of other determinants were also potentially 'important', but were only investigated in three or four studies. These findings suggested that individuals were more likely to attend screening if they showed an increase in their **decisional-balance scores** (which are related to an intention to attend) or were able to carry out **ADL**. Although 'important' there was no overall consensus as to whether those individuals with a **history of STDs** or those living in **rural versus urban areas** were more or less likely to attend. The residential area of participants (i.e. rural versus urban) is likely to require further investigation as it is probably interrelated with other socio-economic factors.

Examining determinants across screening tests was problematic, as the procedures varied so widely in terms of their acceptability to individuals and their target population. Therefore it is likely that determinants identified as important for one screening test may not be important or even relevant to another. For instance the ability to carry out ADL was mainly identified in FOBT studies of older individuals (> 50 years), and for this reason may not be relevant to those screening tests that include younger participants, such as cervical cancer screening. A history of STD is an important risk factor for certain diseases such as HIV and cervical cancer, but it is not particularly relevant to those studies looking at screening for colorectal cancer or mammography.

A number of theoretical models, including the Health Belief Model, the Theory of Reasoned Action and the Transtheoretical Model, predict that attitudes, perceptions and beliefs should be important factors in influencing uptake. In addition, a number of intervention strategies have also been directed at changing these variables as a way of increasing screening uptake (e.g. through counselling and education). However, both across screening tests and within screening tests there was little evidence to suggest that attitudes, perceptions and beliefs were 'important'. Across screening tests, conclusions could only be based on the effects of intention and decisional-balance scores on uptake, and within individual screening tests there was only sufficient evidence to comment on the importance of perceived vulnerability or susceptibility for mammography and FOBT (see specific findings for individual screening tests, above).

Interventions

Invitation letters were effective in encouraging women to attend for Pap smear but less effective for mammograms. Breast and cervical cancer screening programmes in the UK already invite women via a letter (with or without an appointment) as part of the national call–recall system. A **fixed appointment** time appeared to be more effective than an open appointment, and this is the policy currently favoured by the NHS Breast Cancer Screening Programme. There was also evidence that **telephone invitations** increased uptake, but these are not routinely used in organised screening programmes in the UK. An **additional prompt** following on from the initial invitation may also increase uptake, as may a reminder to those who had not responded to the first invitation for mammography.

Current UK practice involves invitation letters from GPs and/or health authorities.[24,292] The effectiveness of **sending letters from different sources** was evaluated in several studies, but it was not possible to detect which approach was more effective. A recent survey of general practices in the UK found that 52% of responders reported that women received written invitations from both their health authority and from their GP.[24] Not only may this process cause duplication or unnecessary effort, it does not appear to be supported by current research evidence.

For breast cancer screening, the target for health authorities is 70% of the invited population. For cervical cancer screening, the target for health authorities is to screen 80% of the eligible population.[16] In the UK as a whole, these targets have been met although the effect varies by health authority.[17,18] A key issue influencing uptake of screening programmes, however, is the accuracy of population registers. Studies of invitations for cervical screening, for example, have found that 30–60% of invitations were sent to the wrong addresses in London and Manchester.[293] Furthermore, at the present time, only 60% of health authorities attempt to locate women due for Pap smear no longer living at the address held by the health authority.[24] While it is appropriate to continue using existing invitation approaches, which may also be worth considering for newer screening programmes, the issue of inaccurate registers needs to be addressed.

Overall, **educational materials** were found to be of limited effectiveness, apart from **home visits** for which there was some evidence of effectiveness. Although educational materials may not directly increase uptake, they are likely to be important in increasing informed uptake, providing they cover all aspects of the screening process. For example, the Cervical Screening Action Team has recommended that a leaflet emphasising the risks and benefits should be included with every invitation for screening.[294] Only a few studies have attempted to evaluate the effectiveness of intervention to increase informed uptake, and in one study neither leaflets nor a video appeared to affect the decision-making process.[127]

Telephone counselling appeared to be effective, but **face-to-face counselling** was of limited effectiveness. It is worth noting that **telephone invitations** were also effective in increasing uptake.

Reducing financial barriers (e.g. free screening tests, bus passes and paying postage costs) was effective in increasing uptake across a range of screening programmes. Some of these interventions, however, are not relevant to the UK setting, as screening is provided free of charge. Several studies also evaluated the effectiveness of giving rewards or incentives, but these were generally found to be ineffective. While it may be acceptable to minimise financial obstacles by providing free screening and by reimbursing travelling expenses, it is important that this process does not become coercive. People must be supported in deciding for themselves whether the benefits they may receive from screening outweigh any side-effects they experience or any possible adverse consequences. Furthermore, if the benefits of screening are self-evident, payments or gifts should not be necessary.[295]

Although there was some evidence to suggest that **combined community interventions** can be effective, there was not enough evidence to assess the effectiveness of **mass media** or **community education** as individual strategies. A systematic review of mass media interventions and its effects on health-services utilisation, however, found evidence to suggest that mass media may have an important role in influencing the use of healthcare interventions.[296] Mass media campaigns alone may not necessarily increase uptake but may influence other factors, such as knowledge, attitudes or beliefs.

There was some evidence to suggest that **opportunistic screening** may be effective, but such an approach must avoid being persuasive. It has been suggested that the uptake of screening using opportunistic testing may reflect a desire to co-operate rather than a true interest in the test

itself.[120,297] It has also been suggested that people should be allowed sufficient time to reflect before and after they make a decision to undergo screening, which may be difficult to ensure in the context of opportunistic screening.[297]

There was evidence that **chart reminders for physicians** were effective at increasing uptake (but this depended on participants visiting the health professional). A meta-analysis of RCTs that evaluated strategies to encourage women to attend for Pap smear reported similar findings for the effectiveness of physician reminders.[298] Furthermore, a systematic review of RCTs of continuing medical education for physicians reported that effective strategies to increase physician performance and all healthcare outcomes included reminders, patient-mediated interventions and multifaceted approaches.[299] Success of reminder interventions may support the PRECEDE model, which suggests that interventions that best succeed in changing performance and healthcare outcomes are those using practice-enabling strategies or reinforcing methods in addition to predisposing or disseminating strategies.[56] There was some evidence to suggest that **educational interventions, audit and feedback** and **office systems** may all increase uptake, but the number of studies evaluating each intervention was small. Other systematic reviews of these strategies in improving health-professional practice and healthcare outcomes have also reported small increases in uptake.[300,301] **Interventions targeting both physicians and individuals** also appeared to increase uptake, with **interventions aimed at individuals rather than interventions aimed at physicians** having a small beneficial effect. Several of the included studies evaluated the costs of physician and individual interventions, and the majority found that physician reminders were the most cost-effective option.

Informed uptake

The purpose of any screening test needs to be adequately explained to those participating, and given alongside information about what the results of the screening test actually mean and the risks and benefits of screening.[27] In this review, however, only four of the 190 intervention studies reported giving information on the risks and benefits of screening, and included knowledge as an outcome. Only one study evaluated the effect of information and knowledge on the decision-making process.[127] All trials were for neonatal screening of cystic fibrosis or Down's syndrome, which are relatively new screening programmes in the UK. Whether informed choice affects actual levels of uptake, therefore, has yet to be fully evaluated. All the other trials included in this review were undertaken on the premise that screening was beneficial and high uptake should be achieved at all costs.

Any future intervention studies should aim to minimise barriers to uptake among those who choose screening, based on a full understanding of the likely benefits, limitations and harm. Studies should include a measure of knowledge and whether the information provided is used in the decision-making process. Just as an intervention to increase uptake may be ineffective, an intervention to increase informed uptake might also be ineffective. For example, it should not be assumed that giving a leaflet on the risks and benefits of screening will necessarily increase informed uptake. It may be that some interventions, which are effective for increasing uptake (such as appointments), are not effective at increasing informed uptake, and the opposite may also be true.

Quality of included studies

Determinants

A large number of studies investigated which determinants might influence an individual's decision to attend for screening. Although as a result of the stringent inclusion criteria the review was based on the best-quality evidence available, individual study quality did vary. A large amount of the evidence discussed in the review was derived from RCTs and controlled trials. However, the primary purpose of these studies was not to examine the determinants of screening uptake, but to assess the effectiveness of interventions aimed at improving screening uptake. Only as a secondary aim did they investigate the factors influencing uptake. Therefore, when analysing the effects of determinants, different groups were considered as a whole in a similar manner to a cohort. The issues surrounding the quality of studies were therefore quite different from those considered when assessing intervention trials. In particular, the quality assessment raised a number of issues that should be borne in mind when examining the evidence from these studies. In addition, studies often failed to report in sufficient detail the findings and implications of their work. Often, terms relating to determinants were not defined and the rationale for which determinants were included and why was not discussed. Possible explanations for study findings were also limited and offered little insight into the complexity of the decision-making process. Further studies that possibly incorporate both quantitative

and qualitative research methods may help to resolve this problem. Studies should comprise good quantitative research into the direction and size of any effect associated with individual factors, which have been highlighted as potentially important through good qualitative research.

In addition to issues of design, studies were also assessed on their method of analysis. Only studies that used some form of multivariate analysis to limit the effect of confounding variables and assess the effect of individual determinants independently of each other were included in the review. Typically these studies first performed univariate analyses to identify candidate determinants for inclusion in the multivariate model. In the majority of instances studies neglected to provide information about those determinants that were not found to be significant in the univariate analyses and thus not entered into the multivariate analysis. This made it difficult to identify all the determinants studied and assess whether they were appropriate for the screening test and setting. More importantly, this lack of information was instrumental in preventing the statistical pooling of data from different studies and made comparisons between studies difficult.

Another important issue was how the information on determinant status and uptake rates was collected (i.e. whether self-report or medical records or databases were used). In the majority of cases data on determinant status were collected via self-report, whereas uptake rates were collected mainly from medical records or databases. Data collected via self-report are subject to recall bias, but do offer the advantage of allowing attitudes, beliefs and perceptions about screening to be assessed. Medical records or databases rarely record this type of data, but they do avoid the problems of recall bias. However, medical records or databases suffer from administrative errors and the incomplete recording of data. A number of studies have investigated discrepancies between self-reported data and administrative records, including studies of Pap smear,[302,303] mammography[304] and prostate cancer screening.[305] There may even be differences in recall validity across different age and ethnic groups.[306] Five of the studies included in this review used both methods to assess the uptake of screening and two identified discrepancies. One noted that women had reported Pap smear tests that were not confirmed by their medical records, and the other reported a discordance rate of less than 1% between medical records and self-report for HIV-antibody tests.

If only administrative records are used, an important factor is the issue of how to classify those for whom no record of attendance is available. It should not be assumed that just because an individual has no record of attendance they made a conscious decision not to be screened. By following-up individuals either by mail or by phone (i.e. by using self-reported data) it may be possible to identify other reasons for non-attendance. For instance, individuals may not have received or been aware of an invitation to attend screening, they may have died or moved from the area, or an individual may have wanted to attend but for a number of other reasons was unable to fulfil that intention. Ideally, in order to avoid bias and gain more insight into the screening process, data should be collected from both sources.

Another important issue, which may be related to the method used to assess determinant status and screening rates, is the loss of study participants to follow-up. Participants may be lost to follow-up for a number of reasons, including the fact that the data-collection method may have failed to provide all the required information. Many of the studies included in the review reported that participants were lost to follow-up and so they were excluded from the final multivariate analysis due to missing data. As previously discussed, it is important to assess why participants could not be contacted or their data not recorded in administrative records. It is also important to determine if they differed in any way from those who remained in the study. Many of the studies failed to assess why participants were lost to follow-up, although two studies included all participants in the final multivariate analyses by substituting mean values for the missing data. Ideally, in these situations multivariate analyses should be repeated to take into account all the possible outcomes and how this might affect the robustness of the final result. This can have important consequences for the external validity of the study findings. Among the studies included in the review there was a general lack of consideration as to the impact this may have on study findings.

Many studies also had the problem of not being able to contact individuals because they had moved, or did not answer phone or mail requests for information. This issue was particularly relevant for those studies relying on call–recall systems, such as those adopted in the major breast and cervical cancer screening programmes in the UK. A number of studies have highlighted the problem of inaccurate population registers for screening programmes relying on such call–recall systems, including two of the UK studies

featured in this review.[72,119,307] In such cases this can be an important factor in non-attendance for screening.

Interventions

In general, the quality of the studies was difficult to determine. Reporting of the methodology in many of the studies was inadequate or vague. Sixty-eight per cent (130/190) of the included studies were RCTs, but only 18% (24/130) reported the method of randomisation and/or concealment of allocation. Eight studies (6%) reported blinding of assessors, and a further nine used a centralised database to retrieve data on uptake. Only 46 studies (24%) stated that all those who were randomised were included in the analysis. Of these, 26 had 100% follow-up, and 20 used an intention-to-intervene analysis. Several studies excluded participants after randomisation. The most common reasons for this were ineligibility of the participants (e.g. not due for screening) and non-attendance at a GP clinic (and therefore could not receive an intervention). Such exclusions resulted in baseline differences in uptake or other important variables between the groups, which could have resulted in bias. Thirty-four studies had baseline differences between groups for one or more important variable, and only 15 (44%) took account of these differences in the analyses. One-hundred and twenty-seven studies (67%) used an adequate measure of uptake, such as medical records or a database. Eighty-two studies (42%) used clusters as the unit of allocation, but only 21 of these (26%) used the clusters as the unit of analysis. The other cluster trials used individuals as the unit of analysis, which results in the CIs being too narrow and p values which are too small.[136]

Only 37 out of 190 studies reported using a theoretical model to guide the development of the intervention and, interestingly, of those studies that did none recorded any outcomes other than uptake. It was surprising that these studies did not measure variables thought to influence the decision-making process, such as beliefs and intentions.

The quality of the studies varied considerably according to the intervention and the target population. Those intervention studies aimed at individuals known to be due or overdue for screening were, in general, of higher quality than those aimed at groups of people (e.g. GP practices or communities). Studies of community interventions generally met few of the quality criteria, but it is acknowledged that there are different issues involved in undertaking studies of this type.

Most of the community studies had baseline differences between the groups, but the majority took these differences into account in the analyses.

Generalisability of the results to the UK setting

The majority of the **determinant** studies were from the USA (53/65 studies, 82%). Only 5% (3/65 studies) of the studies were based in the UK, and the remainder came from Australia (5/65 studies, 8%), Italy (3/65 studies, 5%) and Iceland (1/65 studies, 2%). Eighteen per cent (35/190) of the **intervention** studies were undertaken in the UK. The remaining studies were based in the USA or Canada (163/190, 65%), Australia or New Zealand (23/190,12%), Europe (8/190, 4%), and one in Singapore. The lack of UK studies must be considered when considering the relevance of the evidence. Screening guidelines or recommendations vary between countries and thus within the studies included in the review (see *Table 1* for cancer screening guidelines).

Screening is provided free at the point of delivery in the UK. The majority of studies, however, were undertaken in the USA where individuals either pay for screening, or obtain reimbursement through their insurance. This factor therefore has limited relevance to the UK setting. Screening intervals differed between studies, as did the recommended ages to begin screening. Studies undertaken outside the UK may include individuals who would not have been considered eligible for screening here. These individuals may differ in terms of their motivation and other characteristics. Furthermore, while the UK has several organised screening programmes for breast and cervical screening (call–recall) and some neonatal disorders, screening in some other countries is not organised on a national basis. For example, in the USA cancer screening guidelines are issued by three separate bodies, and providers of screening (e.g. HMO or private insurance) vary in the guidelines they adopt.

It was disappointing to find that there were few UK studies of either determinants or interventions targeting minority groups. Only three UK trials evaluated the effectiveness of interventions among minority groups, such as women from India and Pakistan.[199,208,259] Ethnic minorities vary between countries, and studies undertaken in the USA may not always feature ethnic groups relevant to the UK setting. There may be some similarities between

the two countries in terms of the determinants that affect ethnic-minority groups (which could therefore influence the effectiveness of the intervention), but there may also be important differences.

While some of these factors may limit the generalisability of findings to the UK setting, they still provide a useful insight into screening behaviour.

Relevance of the results to the UK setting

At the present time there are several organised screening programmes in the UK, such as the Neonatal PKU (phenylketonuria) Screening Programme, the Neonatal Hypothyroidism Screening Programme, the Breast Cancer Screening Programme and the Cervical Cancer Screening Programme. Some of the screening programmes included in this review, however, are neither routinely offered (e.g. tuberculosis screening, HIV screening and colorectal cancer screening) nor recommended (e.g. screening for prostate cancer) in the UK. In the future, however, some of these may become organised programmes. For example, planning has already begun for a national colorectal cancer screening programme.[308]

It may be possible to use information gathered in this review about determinants that seem to influence uptake, and interventions that appear to be effective (or ineffective) in the implementation of new screening programmes. Some interventions, although shown to be effective in other countries, may not improve on the already high rates of uptake for some screening programmes in the UK (e.g. cervical cancer screening). In addition, some of the interventions are already routine, such as letter invitations for cervical and breast cancer screening.

Limitations of the review

The comprehensive search strategy used in the review is likely to have located most of the published and unpublished studies (the last search was conducted in October 1998). Due to the size of the review it may be possible that some published studies have been missed. It was not possible to obtain full copies of all the 46,000 references to studies identified by the search strategy. Decisions on the relevance of the majority of the studies were made by one reviewer who prescreened titles and abstracts of the search results for both the determinant and intervention studies. Another reviewer checked a random sample. In cases of disagreement, the full article was ordered. It is also acknowledged that, although some abstracts and unpublished reports were found (through contacting experts in the field and searching the grey literature and reference lists), some may have been missed. Unpublished studies are most likely to be those that show no effect of the intervention or a negative effect.[309]

Cross-sectional and other studies that measured determinant status retrospectively were excluded from the review. These studies failed to assess an individual's determinant status prior to making the decision of whether to attend screening or not. This is an important consideration, as a person's attitudes and beliefs about screening may be altered by their attendance. For instance, a woman who perceives mammography as painful or frightening may alter her opinion having gone through the experience. This is particularly important as a number of determinants relate to individuals' perceptions, attitudes and beliefs. For this reason cohort and case–control studies where information was collected after participants had attended for screening were also excluded, with the exception of studies that relied on data collected from patient records or databases, which had been compiled prior to screening. However, such information sources were limiting, as they usually focused only on demographic and socio-economic variables and failed to record individuals' attitudes and beliefs about screening. Qualitative studies may provide an interesting insight into the reasons why determinants are important, but they do not identify which determinants are important, and were therefore excluded from the review. Time and resource constraints meant that it was not feasible to include the large number of qualitative studies identified.

A further limitation of this review is that it was not possible to combine the results of the determinant studies in a meta-analysis. One of the most important factors in the decision not to carry out a meta-analysis was the lack of information in each study about the determinants that were found not to be significant in the univariate analyses. In order to carry out a meta-analysis, information on all the determinants was required, whether they were found to be significant or not. This lack of information was also problematic when discussing the results in a narrative form. Without any information on the effect sizes of non-significant determinants it was not possible to comment on the

overall significance of determinants across different studies. Statistical pooling of the studies would also have been inappropriate due to heterogeneity between the studies (study design, the screening guidelines followed, the populations studied and the determinants examined). For certain screening tests and determinants there was also insufficient data available for pooling. Measurement of determinants also differed between studies, which limited any overall comparison. For instance, age was measured as a continuous variable in some studies, while it was categorised into different age ranges in others. The age ranges used also varied between studies.

For the intervention part of the review, even though RRs were calculated for most of the RCTs, meta-analyses were also not performed for most comparisons because of the statistical heterogeneity. Thus the conclusions are based on a narrative synthesis of a large number of good-quality studies.

Integration of the determinants and interventions

Analysis of the determinants of screening uptake can be used to investigate why certain interventions are effective while others are ineffective. For instance, knowledge about cancer and cancer screening tests was not found to be an important factor in determining whether individuals attended for screening tests. It is not surprising, therefore, to find that most educational interventions were of limited effectiveness.

Information about the factors associated with screening uptake may be important for future research examining the effectiveness of interventions to increase uptake. For example, women who had had a previous mammogram were more likely to attend at the next round of screening. Interventions, which aim to get the highest possible uptake at the first round of screening, may find that screening is higher in subsequent rounds.

Chapter 6
Conclusions

The inclusion criteria used in this review were developed so that a broad range of good-quality evidence was included. However, as study design was the only aspect of quality used as an inclusion criterion, individual study quality did vary. The overall quality of both the determinant and intervention studies was difficult to determine, as most did not give sufficient details of important aspects of quality.

Conclusions and implications for determinant studies are formulated only when determinants were found to be significant in three or more studies. Those determinants for which there was sufficient evidence to suggest an association with screening attendance varied according to the screening programme. There was insufficient evidence to assess the importance of determinants in well-child screening, CBE, sigmoidoscopy or screening programmes for tuberculosis, cystic fibrosis and cholesterol. However, there is some evidence to suggest that **age**, **insurance status** and **previous screening behaviour** are important determinants across a number of screening programmes. Other determinants that may also be important (but the evidence is less robust) include female healthcare provider, intention to attend, ability to carry out ADL, history of STD, residential location (i.e. urban versus rural) and an increase in decisional-balance scores. However, most studies assessed socio-demographic determinants and are unlikely to have investigated all the factors that influence uptake. This may give an incomplete or misleading picture. In particular further well-designed studies are needed to assess determinants relating to individuals' perceptions, attitudes, knowledge and belief.

Sixty-eight per cent (130/190) of the included intervention studies were RCTs. Conclusions and implications for practice for the intervention part of the review are based on those interventions for which there is evidence from several RCTs. Less than 20% of RCTs were undertaken in the UK, however, and thus generisability may be limited for some interventions. Interventions for which there is evidence of effectiveness are **invitation appointments**, **letters** (less effective for mammography), **telephone calls**, **telephone counselling**, **reduction of financial barriers** (such as postage costs) and **chart reminders for physicians**. Most educational materials have limited effectiveness, but educational home visits may increase uptake. To increase informed uptake, future interventions should include information on the likely harms and risks, as well as the benefits of screening. These studies should include a measure of knowledge and whether this knowledge was used in the decision to undergo screening. Furthermore, more studies are needed that target ethnic-minority groups and other groups where uptake is low.

Research into screening uptake is still expanding, with a significant number of new studies being published each year. The focus of future research, however, is likely to change through the issue of informed uptake, and this may result in a further increase in the number of publications.

Implications for practice

The following implications for practice are based on findings for which there was judged to be sufficient evidence. For determinant studies, implications were formulated only when determinants were found to be significant in three or more studies. Implications about the effectiveness of interventions were, where possible, based on evidence from a number of RCTs. Where there was limited or no good-quality evidence the effectiveness was judged to be inconclusive, and no implications for practice have been made.

From the determinant part of the review there was only sufficient evidence relevant to the UK setting to make one implication for practice:

- Individuals who had previously participated in screening were more likely to attend for screening subsequently. Efforts could be focused on identifying and encouraging attendance among those who have never previously participated in screening

There was also sufficient evidence to suggest that age and insurance status were significant influences on screening uptake, but it is difficult to formulate an implication for UK practice based on these findings. Findings about age varied both between and within screening tests, and medical

insurance is not relevant to the UK setting. With regard to individual screening tests, additional determinants for which there was sufficient conclusive evidence included education and ethnicity for DRE or PSA. However, screening for prostate cancer is not recommended in the UK.

There was sufficient evidence from good-quality RCTs to suggest a number of implications for practice regarding interventions to increase screening uptake. It is important to consider the findings in two ways: in relation to actual uptake, and in relation to informed uptake. The original brief of this review was to evaluate interventions to increase actual uptake, so it is beyond the scope of the review to give implications for informed uptake. Only when full information about all aspects of the screening test is provided does true individual choice become possible. Participants will then be able to access screening services with realistic expectations of what the service can and cannot offer. Through informed participation it is hoped that there will be a greater satisfaction with national screening programmes. Thus attempts to increase the uptake of screening should be pursued alongside initiatives to increase informed uptake.

- Current practice in UK national screening programmes using invitation letters and/or appointments is supported by good evidence. Invitation telephone calls could also be considered, although the cost-effectiveness of this approach remains uncertain in the UK. All these approaches could be adopted for other screening tests.
- Telephone counselling, where barriers to screening are discussed, could be considered.
- Reducing economic barriers (e.g. offering free postage or transportation costs) can increase uptake and may be appropriate for specific groups.
- Healthcare professionals can be prompted to either perform screening tests or to recommend screening tests by using reminder systems such as tagged notes. Such reminder systems could be considered in secondary as well as primary care.

Recommendations for future research

Should uptake be the primary outcome of an intervention?
The majority of interventions used uptake as the primary outcome to measure effectiveness. Few studies considered the issue of informed uptake and how information is used in the decision-making process. All future studies should measure informed uptake as well as actual uptake, and might include a measure of the decision-making process.

Which interventions are effective in increasing informed uptake?
There was very little evidence about the effectiveness of interventions to increase informed uptake. Different methods of maximising choice in national screening programmes need to be developed and rigorously evaluated. Furthermore, a systematic review of informed uptake is needed. The review should include studies that have measured informed uptake, and/or knowledge, understanding and the decision-making process.

Should interventions be targeting groups where uptake is known to be low?
In the UK, it has been recognised that uptake for some screening programmes is lower in some ethnic groups such as Bangladeshi women.[323] Evidence about the effectiveness of interventions for minority groups in the UK is very limited, and further research is needed to investigate how barriers to uptake can be minimised.

What is the relative cost-effectiveness of interventions that appear to be effective?
GP reminders and invitation letters, phone calls and fixed appointments appear to be effective. Further research into relative effectiveness and cost-effectiveness would help inform decision-making.

Are there other important factors influencing the uptake of screening that have not been investigated?
Most studies assessed the importance of socio-demographic variables and there was little evidence available to assess the effect of a number of other variables such as participants' perceptions, attitudes and beliefs. A number of theoretical models predict that these factors may be important in determining screening behaviour, and so more good-quality research is needed in these areas. Studies that span both qualitative and quantitative methods (i.e. studies combining good-quality quantitative research into the direction and size of any effect associated with aspects of participants' perceptions, attitudes and beliefs, which have been highlighted through good qualitative research) may be of benefit.

Which factors have been shown not to influence the uptake of screening?
From this review it has only been possible to suggest which factors influence the uptake of

screening. This is because studies generally only included variables that were found to be significant in univariate analyses. Very little, if any, information was provided about those factors that were found not to be predictive of screening uptake. It is important to know which variables have been shown not to influence uptake, and future studies need to report the outcome of all factors investigated, not just those shown to be significant.

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We look forward to hearing from you.

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