Public Health England

SPH
Solutions for Public Health

Systematic review of interventions designed to improve participation in UK national screening programmes amongst underserved population groups – antenatal and newborn screening programmes

Report produced by Solutions for Public Health in conjunction with Public Health England Screening

Contents

1 Executive summary

1.1 Objective

Participation in screening programmes varies and tends to be lower among those more likely to be affected by the condition that the screening aims to identify. This systematic review explores interventions that improve participation by underserved groups in screening programmes in the UK. This paper reports the findings for antenatal and newborn screening programmes.

1.2 Data sources

Medline, EMBASE, Cochrane, CINAHL, HMIC, and PsychInfo to 10th October 2019.

1.3 Review methods

Randomised trials in national screening programmes in the UK were included if they reported results related to participation in screening for underserved groups at any stage of the screening pathway. Risk of bias was assessed using RoB 2. Outcomes included participation in the screening programme, cohort identification, information about screening, access to screening and to treatment, onward referral, disease outcomes and preference to opt out of screening.

1.4 Results

Forty trials were identified pertaining to UK national screening programmes, of which four relate to antenatal screening programmes. No trials were identified for newborn screening programmes. Underserved groups were defined by age, ethnicity, employment, education level, housing tenure and socioeconomic status.

One trial provided plausible evidence that earlier initiation of sickle cell and thalassaemia screening by GPs reduces the time to completion of screening.

Of two trials in Down's syndrome screening, one focussed on informed choice, and reported no difference between groups provided with decision aids in written or video format compared to a standard patient information leaflet. The authors reported an inverse relationship between systematic decision-making and satisfaction with the decision made. The other trial reported that video information improved knowledge scores.

A trial in HIV screening in pregnancy reported no overall evidence favouring combining a leaflet relating to HIV screening with information on other antenatal blood tests or the addition of a comprehensive midwife discussion relating to these. In a subgroup of older women provided with the combined leaflet, compared to the 'HIV-only' leaflet (36% vs 28%, p=0.02), higher

participation was reported. However, this evidence is not strong given the multiple comparisons tested.

1.5 Conclusion

This review identified very little evidence relating to interventions to reduce inequalities in participation in antenatal screening programmes and none for newborn screening. Further research is needed in this area that covers all stages of the screening pathway for antenatal and newborn screening programmes in their current forms.

2 Introduction

Variation in participation in screening programmes exists both within and between national screening programmes. Moreover, groups at higher risk of the condition targeted by screening tend to be less likely to participate.[1,2] This inequality in screening participation can be due to barriers making it harder for some groups of people to engage with screening services. Screening inequalities can occur at any point along the screening pathway and barriers that persist once a person has started screening may result in some people being unable to maximise the benefits of screening.

Public Health England (PHE) Screening is committed to reducing inequalities in screening as outlined in its screening inequalities strategy[3]. PHE therefore commissioned this systematic review in order to examine outcomes of interventions which may improve participation by underserved population groups, at any stage in the screening pathway, in UK national screening programmes. This follows an earlier rapid review of a similar question for cancer screening.[4]

Screening can do harm as well as good and invitations are based on the principle that all individuals should be able to choose if a screening test is right for them. PHE defines personal informed choice as a decision made to accept or decline a screening test based on access to understandable, accurate, evidence-based information covering: the condition being screened for; the testing process; the risks, limitations, benefits and uncertainties; potential outcomes, and treatment pathways.

“Improving” participation aims to maximise informed decision-making and remove barriers to engagement in NHS screening programmes. The primary focus of this review is to report evidence of interventions that may reduce inequalities in participation in UK NHS antenatal and newborn screening programmes. The evidence found relating to adult screening programmes is presented in a separate report.

3 Methods

The methods are described in detail in the published protocol and more briefly below.

3.1 Protocol

The protocol was developed using the PRISMA[5,6] guidelines and registered on PROSPERO (CRD42019118866) in December 2018. Protocol amendments are listed on PROSPERO.

3.2 Eligibility criteria

The eligibility criteria were: randomised, quasi-randomised, or cluster-randomised trials; comparing methods to improve participation in one of the NHS screening programmes at any stage of the screening pathway; reporting subgroup analysis or results for at least one underserved group; excluding outdated controls or interventions which have already been adopted as standard (trials reporting at least one relevant comparison remained eligible but ineligible arms were excluded from the analysis); published from 1990 onwards with a full-text peer-reviewed report available.

Systematic reviews and economic evaluations were also sought based on similar criteria; systematic reviews had to include at least one trial which would be eligible for this review and economic evaluations had to be directly relevant to the UK context to be considered for inclusion. Results of these studies provided context to some of our findings.

The current NHS antenatal and newborn screening programmes are: Fetal Anomaly Screening Programme (FASP),[7] Infectious Diseases in Pregnancy Screening (IDPS),[8] Newborn and Infant Physical Examination (NIPE),[9] Newborn Blood Spot (NBS),[10] Newborn Hearing Screening Programme (NHSP),[11] and Sickle Cell and Thalassaemia (SCT).[12]

Underserved groups were defined as: those experiencing socio-economic deprivation, those with any of the protected characteristics described in the 2010 Equality Act, those not registered with a GP, homeless people, rough sleepers, asylum seekers, gypsy and traveller groups, sex workers, those in prison, and those experiencing severe and enduring mental health problems, drug or alcohol harm issues or communication difficulties.

Only UK trials were included because of the potential for differences between countries in screening programmes, health services and socioeconomic disadvantage to substantially complicate interpretation of non-UK trials while adding a disproportionate resource requirement.

3.3 Outcomes

All outcomes relating to participation in screening at any point in the screening pathway, from cohort identification to management after screening, were considered relevant. The primary outcome was participation in screening programmes measured as acceptance of the offer of screening because it was anticipated that it would be the only outcome with reasonably consistent measurement across trials and would be reported by most trials. Secondary

outcomes included cohort identification, information about screening, access to screening, onward referral, access to treatment, disease outcomes and preference to opt out of screening.

3.4 Literature searches

Searches of Medline, EMBASE, Cochrane, CINAHL, HMIC and PsychInfo databases were conducted on 28th November 2018 and updated on 10th October 2019. The search strategies included a UK filter, based on a validated published filter with some additional geographical terms included.[13] The Medline search strategy is included in the protocol. Reference lists of relevant trials and systematic reviews were checked for additional trials.

3.5 Risk of bias assessment

The RoB 2 instrument[14] was used to assess risk of bias. Quasi-randomised trials were treated as equivalent to fully randomised trials where the quasi-randomisation was likely to produce a truly random sample. This does not introduce bias when there is no informed consent or opportunity for researchers to selectively include or exclude people based on predictable allocation.

For practical reasons some trials excluded participants after randomisation, technically a violation of intention-to-treat (ITT), but in most cases this is unlikely to introduce bias because the exclusions were usually done blind of allocation and were consistent with the usual screening process. In some cases there was a risk that post-randomisation exclusion may have been influenced by allocation and these concerns were noted. Results were not corrected for ITT because this was only possible for a subset of trials and it made no substantive difference in those which reported sufficient information.

3.6 Data extraction

Data extraction forms were developed and piloted. Two reviewers independently completed summary tables for each included trial, including risk of bias and reported results within underserved groups. Disagreements were resolved by discussion, consulting a third reviewer where necessary. Authors were contacted to request missing information. The completed tables are provided in Appendix 2.

3.7 Analysis

In this review most trials contribute several different results defined by the underserved groups they report and, for trials with more than two arms, the comparison made. Results relevant to this review were extracted by underserved group and intervention/comparison made. Interventions are defined by the stage of the screening process, the nature of the intervention, and the mode of delivery.

All the reported results that are within the scope of this review are included in the trial summary tables in Appendix 1.

4 Results

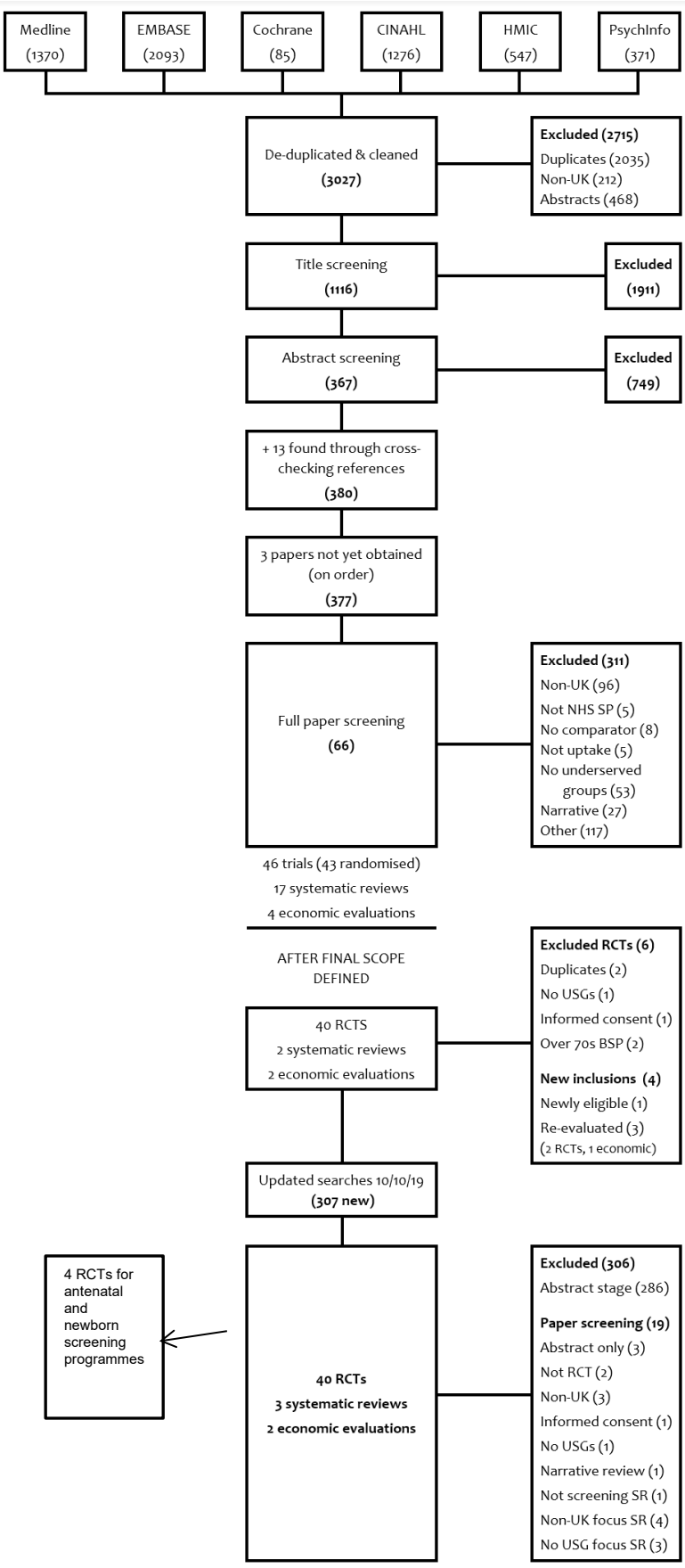
4.1 Literature search

Searches of the six databases identified 3,334 potentially eligible reports after deduplication and cleaning. A further 13 papers were identified through cross checking of references. Following title and then abstract screening, 3,245 were excluded, leaving 89 full papers for review. After final inclusion/exclusion decisions, 40 trials reporting relevant randomised comparisons were found. This paper reports the results of the four trials in the antenatal screening programmes. No papers meeting the selection criteria were identified relating to newborn screening programmes.

The eligible trials identified related to participation in the screening programmes, including knowledge about screening, the decision-making process and informed choice, with no eligible trials for other points in the screening pathway, such as identification of people to be invited for screening or management after screening.

The underserved groups reported by the four trials varied and included groups defined by age, ethnicity, employment, education level, housing tenure and socioeconomic status. No eligible systematic reviews or cost-effectiveness studies for the antenatal or newborn screening programmes were identified.

Figure 1 Updated PRISMA diagram for all screening programmes (searches to 10/10/2019)



4.2 Quality of trials

The overall quality of the trials, as assessed using RoB 2, is shown in Table 1. Summary tables including the detail of the risk of bias assessments for each trial are provided in Appendix 1. Two of the trials were assessed as having some risk of bias and two as having a high risk of bias. Potential sources of bias included imbalances in baseline characteristics, lack of blinding of midwives and participants to the intervention, and data missing at the time of analysis due to post-randomisation exclusions or participants not completing the trial. This potentially made groups unbalanced and not representative of the wider population. Additionally, trials tended to involve a relatively small number of midwives, which may limit the generalisability of the results.

Table 1 Summary of trials identified and their overall risk of bias (RoB)

Screening programme	Trial (size*)	Interventions tested	Underserved groups	RoB
FASP (Down's syndrome screening component only)	Michie 1997 (n=1,580)	Written or video information designed to assist systematic decision-making.	- no qualifications - minority ethnicity	High
	Hewison 2001 (n=2,000)	Video information (posted).	- tenant - age (not defined)	Some
IDPS	Simpson 1999 (n= 3,505)	Separate versus combined information leaflets for HIV and other blood tests.	- IMD20/40 - unemployed - age <30	Some
SCT	Dormandy 2010 (n=1,708)	Sequential or parallel testing offered by GPs instead of antenatal clinic.	- minority ethnicity - age (undefined)	High

FASP – fetal anomaly screening programme; High – high risk of bias; IDPS – infectious diseases in pregnancy screening; Low – low risk of bias; RoB – risk of bias assessed using RoB 2 tool; SCT – sickle cell and thalassaemia screening; Some – some concerns.
* includes all individuals randomised; number of clusters randomised may be much smaller; some individuals may not be eligible for this review or may have been excluded or dropped out of the study after randomisation.

4.3 Trial results

Table 1 summarises the trials identified for each screening programme, including the interventions tested and the underserved groups for which results were reported. The amount of relevant extractable data was limited and the results are presented in narrative form, with further details in the data extraction table (Appendix 1).

As part of their antenatal care, women are given information about screening to enable them to make an informed choice about participation. Three of the studies tested different interventions related to the information provided and the mode in which it was provided (two for Down's syndrome screening and one for HIV screening in pregnancy), whereas the fourth study related to the timing of the offer of sickle cell and thalassaemia screening.

4.3.1 Decision aids in written or video format (FASP)

One trial concerning informed choice about Down's syndrome screening (Michie 1997[15]), was assessed as having a high risk of bias, and reported no effect of decision aids in written or video format compared to a standard patient information leaflet. The authors reported no effect on knowledge, anxiety, the decision-making process or satisfaction with the decision made.

The primary purpose of this trial was to test the impact of two different approaches to increasing informed choice, and the paper focuses on around one fifth of those randomised who had completed questionnaires at both baseline and follow-up. The standard information leaflet was compared with an expanded leaflet that included pros and cons of screening and a decision tree, and with video information including pros and cons of screening. The trial reported no intervention effects, including in subgroups by low education or ethnicity, in terms of knowledge, anxiety, change in anxiety, process of decision-making[1] or satisfaction with the decision made with respect to screening. Mean knowledge and satisfaction were high in all the intervention groups, whereas scores for the decision-making process were relatively low in all groups.

Michie 1997[15] reported that those who scored higher on the process of decision-making reported statistically significantly more anxiety, a greater increase in anxiety at 16 weeks' gestation and less satisfaction with the decision made, and also that those who made the decision in a more systematic way were less likely to have the test.

This single trial with a high risk of bias reported no difference in informed choice between groups for the different types of information and a negative association between systematic decision-making and satisfaction with the decision made, a finding that would warrant further investigation. However, the study was based on an unrepresentative sub-sample of the originally randomised group, limiting the reliability and generalisability of the findings.

4.3.2 Video information included with information leaflet (FASP)

One trial concerning informed choice about Down's syndrome screening (Hewison 2001[16]), assessed as having some risk of bias, reported an improvement in knowledge in a group who were posted a video along with the

[1] Scores for the decision making process were based on questions regarding the time spent making the decision, the number of reasons considered and the number of people consulted, together with a 7 point rating scale on how difficult it was for them to make up their mind.

information leaflet about screening compared to those who were sent the information leaflet alone.

Hewison 2001[16] reported an improvement in knowledge and no difference in psychological distress or the proportion taking up the offer of a screening test with the addition of a video posted to the participant's home together with the standard information leaflet about screening for Down's syndrome. There was no interaction with housing tenure or age for any outcome measure.

The finding from this single trial, with some risk of bias (due to lack of blinding of midwives to the intervention), of an improvement in knowledge scores and no increase in psychological distress with video information about screening for Down's syndrome is unconfirmed but important. Video information might improve understanding of the factors that need to be taken into account when making an informed decision about screening for Down's syndrome.

4.3.3 Leaflet and midwife discussion for HIV screening in pregnancy (IDPS)

One trial in IDPS (Simpson 1999[17]), assessed as having some risk of bias, reported no difference in rates of testing for HIV in pregnancy overall and in most subgroups when information was provided using an 'HIV-only leaflet' or a leaflet combining information on all antenatal blood tests. There was also no difference for participants who received minimal discussion with their midwife and those who received a comprehensive midwife discussion or for different combinations of leaflet and level of midwife discussion (factorial design). The authors reported reasonably high levels of knowledge about antenatal tests, with the 'all tests leaflet' group unsurprisingly having better knowledge than the 'HIV-only leaflet' group.

Anxiety was higher in both groups at follow-up with no difference found between the groups. Satisfaction with the consultation was high and did not differ between groups. Attitudes towards pregnancy and the baby were not affected by the method of offering testing. Perceived benefits were high with the comprehensive midwife discussion groups perceiving greater benefit for the baby.

Simpson 1999[17] also investigated the effect of these interventions in relation to age, socioeconomic status and employment status. They reported that women aged 30 years or more were more likely to have the HIV test when given the combined leaflet compared to the HIV-only leaflet (36% vs 28%, p=0.02), and this difference was not observed for women aged under 30 years. No differences were reported in relation to age with different levels of midwife discussion or in relation to socioeconomic or employment status with the different combinations of single or combined leaflet and minimal or comprehensive midwife discussion. However, rates of HIV testing varied from 15% to 48% between the 10 midwives, and this was the most important predictor of testing other than being invited.

This single trial, with some risk of bias, reported no effect of the interventions tested overall or in most subgroups except for some evidence favouring

combining a leaflet relating to HIV with information on other antenatal blood tests (with minimal midwife interaction) for women aged ≥30. However, this evidence is not strong given the risk of bias, the number of hypotheses tested and the negative results reported for the rest of the study.

4.3.4 Offer of SCT testing at first GP appointment (SCT)

One trial in SCT (Dormandy 2010[18]), assessed as having a high risk of bias, reported evidence that earlier initiation of sickle cell and thalassaemia screening by GPs reduces the time to completion of screening. No difference was reported in the proportion assessed as making an informed choice.

Dormandy 2010[18] compared standard sequential testing in maternity clinics with an earlier offer of testing at the first GP appointment where pregnancy is confirmed, with both sequential testing (mother tested then father if the mother is a carrier) or parallel testing (mother and father tested at the same time). The primary aim of the study was to obtain results of screening in a shorter timeframe. The adjusted estimates from this trial suggest an increase of the order of 16% to 27% in the proportion of mothers screened by week 10 (statistically significant) and around 10% by week 26 (not statistically significant). Less than a third were assessed as having made an informed choice, and this was usually linked to poor knowledge and reported as being equally likely in the primary care and secondary care settings.

This single trial, with a high risk of bias, reported a substantial reduction in time to completion of screening when screening was initiated earlier by GPs. The cluster randomisation did not produce well balanced groups and so the estimates from the trial may not be reliable. However, a substantially higher proportion of pregnancies were screened by 10 weeks and a difference remained, albeit much smaller, at 26 weeks and although the (adjusted) numerical estimates may not be reliable due to the imbalances produced by the cluster randomisation, the effect is large and the direction of effect plausible.

5 Discussion

5.1 Summary of findings

This review identified four trials in the UK related to antenatal screening programmes and no trials in newborn screening. Underserved groups were defined by age, ethnicity, employment, education level, housing tenure and socioeconomic status. Two of the trials were assessed as having a high risk of bias and two have some risk of bias.

One trial provided plausible evidence that earlier initiation of sickle cell and thalassaemia screening by GPs reduces the time to completion of screening.

Of two trials in Down's syndrome screening, one focussed on informed choice and reported no difference between groups provided with decision aids in written or video format compared to a standard patient information leaflet. The authors reported an inverse relationship between systematic decision-making and satisfaction with the decision made. The other trial reported that video information improved knowledge scores.

A trial in HIV screening in pregnancy reported no evidence favouring combining a leaflet relating to HIV with information on other antenatal blood tests or the addition of a comprehensive midwife discussion relating to these, except for higher participation among older women provided with the combined leaflet compared to the 'HIV-only' leaflet (36% vs 28%, p=0.02). However, this evidence is not strong given the number of hypotheses tested.

5.2 Strengths and weaknesses of this review

This was a systematic review of studies in NHS screening programmes published between 1990 and October 2019 and should have identified all the studies with results reported for underserved groups. However, only a small number of studies were identified and these were very heterogeneous in nature, covering different screening programmes, types of intervention and outcome measures. They are therefore not amenable to meta-analysis and provide unconfirmed results for the interventions tested. Additionally, the risk of bias in the trials, largely due to imbalances between the groups, lack of blinding, relatively small numbers of midwives or general practices involved and relatively large numbers of exclusions and missing data, limits the reliability and generalizability of the results.

Only RCTs which had reported at least one underserved subgroup were included. It is likely that other UK RCTs exist which collected information relating to at least some underserved subgroups (such as postcode, age, and sex) but did not include this analysis in their published reports.

The review included only evidence from the UK, which is likely to be the most applicable to the population eligible for NHS screening programmes. Differences in screening programmes elsewhere, the nature of socioeconomic disadvantage and its association with ethnicity would substantially complicate interpretation of non-UK trials. This does not imply that there is no useful information from elsewhere. In particular, the paucity of eligible studies about decision aids does leave an important gap, with several potentially useful non-UK studies available [19-22].

5.3 Gaps in the evidence

The evidence identified in relation to underserved groups was very limited. Although some information was available in relation to age, ethnicity, employment, education level, housing tenure and socioeconomic status, this was limited in nature and no evidence was identified for the many other groups for which it was sought, including those with other protected

characteristics described in the 2010 Equality Act, those not registered with a GP, homeless people, rough sleepers, asylum seekers, gypsy and traveller groups, sex workers, those in prison, and those experiencing severe and enduring mental health problems, drug or alcohol harm issues or communication difficulties. Difficulties in engaging these groups would need to be considered in designing the trials. It is also important that larger trials have the power to investigate whether interventions are more or less effective in underserved groups compared to the screening population as a whole.

The evidence identified was limited to a small number of antenatal screening programmes, with no evidence for newborn screening. Interventions were mainly related to the way in which information was provided to and discussed with participants and the decision-making process. No evidence was identified for other points in the screening pathway such as follow-up after screening tests, where screening inequalities can also occur. It is plausible that people who face barriers at one stage in the screening pathway will also face barriers at other stages. Designing trials to examine this can be complex, because of the confounding effects of the questionnaires used to assess screening knowledge, attitudes and informed choice and because of the large numbers required and the need for informed consent for trials relating to diagnosis and treatment. However, improvements at all stages of the screening pathway are important if screening inequalities are to be reduced.

This review only included RCTs, and some potentially useful interventions do not lend themselves to RCT designs. This may include intensive community-based interventions for extremely marginalised groups, addressing things like language, financial barriers and transport difficulties, which are often heavily reliant on local context and would be complex to test in a randomised setting. They are also difficult to evaluate in a non-randomised setting as they may be prompted by particular local circumstances such as a change in local service configuration.

Most of the studies included in this review are relatively old, and features of the antenatal and newborn screening programmes, such as precise pathways and information available for patients, have changed since these studies were carried out.

5.4 Implications for future research design

5.41 Introduction of new interventions

The introduction of new interventions, especially where the evidence is less secure, should be done via a research design that allows further evaluation in real-world practice. The ability of NHS screening programmes to facilitate this, for example by individually randomising people eligible for screening, is important.

5.42 Cluster trials

Cluster trials should include enough clusters to achieve reasonable balance across sociodemographic factors which often vary considerably between smaller geographical clusters, such as GP practices, especially with respect to granular details of minority ethnicity and the factors contributing to socioeconomic deprivation.

5.43 Competing questions

Trials addressing theories from behavioural psychology should take into account the possibility that large volumes of printed materials may reduce participation in trials and hence reduce the generalisability of the results, and that questionnaires used to study the decision-making process may themselves affect that process and the outcomes being measured.

5.44 Testing interventions that do not lend themselves to RCT designs

For interventions that, because of their nature, cannot be tested through an RCT design, research should aim to include comparator groups that are as closely matched as possible and include collection of data on potential confounding variables.

6 Conclusion

This review identified very little reliable or generalisable evidence relating to interventions to reduce inequalities in participation in antenatal screening programmes and none for newborn screening. Three trials related to information provided about screening and how it is provided, one of which suggested that video information posted along with the standard information leaflet may improve knowledge in relation to Down's syndrome screening. A study in SCT screening reported a substantial and plausible shift to earlier completion of SCT screening when SCT screening was offered earlier, at the first appointment with the GP. All four trials had some or a high risk of bias.

Further research is needed in this area that covers all stages of the screening pathway for antenatal and newborn screening programmes in their current forms.

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8 Glossary

Cluster trials	Trials where groups of people (such as households, GP practices, or hospitals) are randomised, usually because the intervention can only be applied at that level (eg training GPs and measuring the outcome for their patients). Analysis of cluster randomised trials needs to account for the fact that individuals within clusters are more similar to each other than they are to the trial population as a whole. Clustering reduces the effective sample size by an amount which depends on the strength of the intra-cluster correlation coefficient, the number of clusters and the size of the clusters.[2]
Confounding	When a factor associated with an outcome is associated with another factor which is also associated with the outcome, making it difficult to establish the true relationship (eg whether ethnicity has an impact on uptake independently of socioeconomic status)
Factorial design	A trial design which tests two interventions simultaneously and allows for testing any interaction between them. The whole population is randomised to A or not A and also to B or not B, creating four groups who receive: neither treatment, A only, B only, or A and B combined. Each group may be compared to each of the others but the most powerful approach is to analyse A vs not A and B vs not B. An interaction (non-additive effects for A combined with B) can complicate interpretation, and require much larger sample sizes to measure than the main effects, but may also be of interest in its own right.
Intention-to-treat	The principle that all randomised individuals (or clusters) should be analysed in the group they were originally allocated to regardless of the treatment delivered. This is

[2] Higgins JPT, Eldridge S, Li T. Cochrane Handbook, Chapter 23.

	to preserve the integrity of randomisation. Post-randomisation exclusion risks introducing bias because the decision to exclude (or look for reasons to exclude) may be influenced by knowledge of the group allocation.
Interaction	The difference between the effect sizes measured within each level of a subgroup.[3]
Quasi-randomisation	Using a factor which is essentially random, such as day of attendance or odd/even clinic numbers, to allocate individuals to groups. This is generally not an acceptable form of randomisation because the group allocation is predictable in advance and that knowledge may influence the decision to include an individual in the trial. This is of less concern in the group of trials included in this review because pre-randomisation consent cannot be used in trials which are designed to measure effects on uptake and the researchers usually do not have any clinical relationship with the individuals included in the trials.

[3] Matthews JNS, Altman DG. Statistics Notes: Interaction 2: Compare Effect Sizes Not P Values. *BMJ*, 1996; 313: 808