

**A systematic review of the effectiveness of
interventions to increase the early initiation of
antenatal care in socially disadvantaged and
vulnerable women**

Final Report

Laura Oakley, Ron Gray, Jennifer J Kurinczuk, Peter Brocklehurst, Jennifer Hollowell

National Perinatal Epidemiology Unit, University of Oxford

October 2009

Contents

Executive summary	1
1 Background	4
1.1 Aims of the review	6
2 Definitions and scope of the review	6
2.1 Operational definition of comprehensive antenatal care	6
2.2 'Early' initiation of antenatal care	6
2.3 Types of intervention	7
2.4 NHS relevance	7
2.5 Disadvantaged and vulnerable groups	7
3 Methods	8
3.1 Inclusion Criteria	8
3.1.1 Study design	8
3.1.2 Population	8
3.1.3 Intervention	8
3.1.4 Comparator group	8
3.1.5 Outcome measure	8
3.1.6 Language	9
3.1.7 Time period	9
3.1.8 Geographical areas	9
3.1.9 Types of publication	9
3.2 Exclusions	9
3.3 Methods for identification of studies	9
3.3.1 Overview of strategy to identify relevant studies	9
3.3.2 Bibliographic databases	10
3.3.3 Other online searchable resources	10
3.3.4 Items identified in scoping exercise and antenatal care review	11
3.3.5 Reference lists and citations	11
3.4 Review methods	11
3.4.1 Screening	11
3.4.2 Quality assessment	13
3.4.3 Data extraction	14
3.4.4 Assessment of effectiveness	14
4 Results	14
4.1 Overview of included studies	16
4.1.1 Countries	16
4.1.2 Year of publication/study	16
4.1.3 Study design	17

4.1.4	Outcome measure	17
4.1.5	Quality.....	18
4.1.6	Assessment of whether timing of initiation of antenatal care was an outcome measure	19
4.2	Interventions studied	19
4.2.1	Intervention recipients/target populations.....	19
4.2.2	Intervention content	19
4.3	Effectiveness.....	24
4.3.1	Outreach or other community-based interventions	24
4.3.2	Alternative models of clinic-based antenatal care	25
5	Discussion	29
5.1	Principal findings	29
5.2	Strengths and limitations of this systematic review.....	30
5.3	Findings in relation to other published evidence	31
5.4	Implications and recommendations	32
5.5	Conclusion	33
	Acknowledgement	33
	References	34
	Annex A: Medline search strategy	40
	Annex B: Named intervention searches	42
	Annex C: Characteristics and results of included studies	43

Tables

Table 1. Exclusion criteria	12
Table 2. Reasons for exclusion	16
Table 3. Major flaws identified in included studies.....	18
Table 4. Effectiveness of outreach or other community-based interventions	26
Table 5. Effectiveness of interventions involving alternative models of clinic-based antenatal care	28

Figures

Figure 1. Barriers to equitable healthcare for racial and ethnic groups.....	5
Figure 2. Screening process	15
Figure 3. Year of publication of included studies	17

Executive summary

The systematic review described in this report is part of a programme of work, commissioned by the Department of Health, to strengthen the evidence base on interventions to reduce infant mortality, with a particular focus on reducing inequalities in infant mortality.

Aim

The purpose of this review was to systematically identify and evaluate the evidence relating to the effectiveness of interventions, relevant in the context of the National Health Service (NHS), which aim to increase the early initiation of comprehensive antenatal care in socially disadvantaged and vulnerable women.

Methods

Searches

We searched the major bibliographic databases using a two stage strategy: we initially ran a comprehensive 'generic' search and then ran further searches incorporating text search terms relating to interventions identified in the initial searches. We also searched other online libraries and resources (e.g. Cochrane Library, National Guidelines Clearing House) for relevant secondary reports. The references and citations of included studies and relevant secondary reports were checked.

Inclusion criteria

Studies which met the following "PICO" criteria were eligible for inclusion:

Population

- Intervention evaluated in a relevant disadvantaged or vulnerable population.
- Population recruited in an OECD country (excluding Turkey and Mexico).

Intervention

- We did not place any restriction on the type of intervention. We required only that studies reported the timing of initiation of antenatal care as an outcome measure.

Comparator

- Study included a control/comparator group(s) which did not receive or have access to the intervention.
- Intervention and comparator group were selected using the same and/or similar sampling frames and both groups drawn from broadly similar populations.

Outcome

- The proportion of women initiating comprehensive antenatal care by a given week/month (≤ 20 weeks or before the fifth month of gestation).

Studies relating solely to the provision or extension of health insurance coverage, along with studies relating to models of insurance coverage or reimbursement were excluded. We also excluded studies primarily addressing barriers to antenatal care access that related to structural or financial aspects of the local healthcare system not considered to apply in a predominantly government-funded universal healthcare system such as the NHS.

Quality assessment

Two reviewers independently applied the GATE checklist to assess the internal validity of each study, focusing on the validity of the estimated effect on the timing of initiation of antenatal care. Using this checklist, the internal validity of each included study was rated as 'good', 'mixed' or 'poor'.

Assessment of effectiveness

Two reviewers independently coded the authors' conclusions regarding the effect of the intervention on timing of initiation of antenatal care, and independently assessed and coded the evidence of effectiveness, taking into account the strengths and limitations noted in the GATE checklist.

Results

Over three thousand citations were screened of which sixteen reports (each relating to a distinct intervention) met the inclusion criteria.

Fourteen (87%) of the studies were conducted in the US, 1 in Australia and 1 in the UK.

Thirteen of the sixteen included studies were observational cohort studies (10 were prospective, and three were retrospective; one of the retrospective cohort studies also included a pre-intervention comparator group); and three were before and after studies. All but one of the studies were assessed as having 'poor' internal validity; one study (a retrospective cohort study) was rated as having 'mixed' internal validity.

Twelve studies focussed on specific disadvantaged or vulnerable subgroups of the population. This included six interventions that were targeted at and/or evaluated in ethnic minority women, one that focussed on indigenous Australian women, four that targeted teenagers, and one that was evaluated in substance abusing HIV-positive women. The remaining studies evaluated interventions in more generally socioeconomically disadvantaged populations.

Eleven studies evaluated interventions that involved outreach or other community-based services, and five studies evaluated interventions that involved alternative models of clinic-based antenatal care. The main components of each intervention and the target population are summarised below.

Type of intervention	Target population (number of studies)
Outreach or other community-based interventions	
Lay or paraprofessional home visiting and support	Teenagers (n=2) Socioeconomically disadvantaged women (n=1)
Linkworkers	Ethnic minority women/ non-native language speakers (n=1)
Mobile health clinics	Socioeconomically disadvantaged women (n=1)
Multi-component interventions, including two or more of the following: outreach, case management, home visiting, risk screening, help with transportation to appointments, advocacy and social support	Ethnic minority women (n=5) Indigenous women (n=1)

Type of intervention	Target population (number of studies)
Interventions involving alternative models of clinic-based antenatal care	
Teen clinics	Teenagers (n=2)
Collaborative antenatal care	Socioeconomically disadvantaged women (n=1)
Enhanced antenatal care	Socioeconomically disadvantaged women (n=1) Socioeconomically disadvantaged, HIV-positive substance abusing women (n=1*)

* Intervention targeted at socioeconomically disadvantaged women; study evaluates the intervention in HIV-positive substance abusing women

Effectiveness

Outreach or other community-based interventions

Of the eleven studies evaluating the effect of outreach or other community-based interventions on the timing of initiation of antenatal care, only one (a paraprofessional home visiting intervention described below) was assessed as having adequate internal validity in relation to the estimated effect on the timing of initiation of antenatal care. The quality of evidence relating to the other community-based interventions was poor.

Rogers and colleagues assessed the effectiveness of a home visiting intervention delivered by paraprofessional women ('resource mothers') on the timing of initiation of antenatal care among pregnant teenagers (aged less than 18), using a retrospective observational design. The evaluation used two different comparison groups, one drawn from different but broadly similar geographical areas, and the second drawn from adolescents who resided in the intervention areas before the intervention was implemented. The study was the only study included in the review which adjusted for potential confounding in the analysis of timing of initiation of antenatal care. The evaluation reported a statistically significant increase in the proportion of intervention teenagers initiating antenatal care before the fourth month of pregnancy relative to both comparator groups (intervention group vs. geographical comparator group, 45% vs. 41%, adjusted odds ratio 1.48 (95% CI 1.32, 1.66); intervention group vs. 'pre-intervention' comparator group, 45% vs. 40%, adjusted odds ratio 1.39 (95% CI 1.16, 1.66)). The authors concluded that the study demonstrated a beneficial effect on the timing of initiation of antenatal care. Because of the potential for selection bias and non-random assignment of participants, the reviewers considered the study inconclusive but consistent with a possible beneficial effect.

Interventions involving alternative models of clinic-based antenatal care

The quality of evidence relating to interventions involving alternative models of clinic-based antenatal care was poor. All five of the included studies were assessed as having poor internal validity in relation to the estimated intervention effect on the timing of initiation of antenatal care.

Conclusions

In a comprehensive review of the published literature on the effectiveness of interventions to increase the early initiation of antenatal care, we found insufficient evidence of adequate quality to make any firm recommendations. However, one included intervention was considered 'promising'; and three other intervention strategies were identified that were considered potentially relevant to the NHS and worthy of further consideration and evaluation.

A systematic review of the effectiveness of interventions to increase the early initiation of antenatal care in socially disadvantaged and vulnerable women

The systematic review described in this report is part of a programme of work, commissioned by the Department of Health, to strengthen the evidence base on interventions to reduce infant mortality, with a particular focus on reducing inequalities in infant mortality. The review focuses on interventions to increase the early initiation of comprehensive antenatal care in socially disadvantaged and vulnerable women.

1 Background

Antenatal care is considered to be effective in improving outcomes for pregnant women and their infants.¹ Evidence suggests that there is an association between under-utilisation of antenatal care and perinatal and infant mortality.² Early access to antenatal care is considered a key strategy in meeting targets to reduce inequalities in infant mortality in the UK,³ and improving access to maternity services is an ongoing priority in the UK,^{4,5} with a recent Government PSA target focussing on the proportion of women 'booking' for antenatal care before 12 weeks.^{6,7}

Initiation of antenatal care within the first trimester is desirable, with the most recent UK guidelines recommending initiation by 10 weeks gestation.¹ However, a recent UK survey found that only 56% of women had a 'booking' appointment by 12 weeks gestation.⁸ Women who initiate antenatal care later have a reduced opportunity to fully benefit from the range of interventions offered to pregnant women, for example early identification of risk factors for pre-eclampsia and gestational diabetes, smoking cessation advice, screening for asymptomatic bacteriuria,¹ and other screening tests offered to women in early pregnancy. There is no consensus as to what constitutes 'late' booking. A systematic review of social class, ethnicity and antenatal care attendance⁹ included studies in which the definition of late attendance varied from 14 to 20 weeks; and a review of barriers to access to antenatal care¹⁰ found definitions of 'late booking' ranging from 17 to 28 weeks.

One systematic review has considered the association between socio-demographic factors and attendance for antenatal care in the UK.⁹ The authors of the review identified five UK studies looking at social class, three of which reported an association between manual social class and late initiation and/or under-utilisation of antenatal care. All four of the studies that they reviewed which considered ethnicity reported that women of Asian origin were more likely to have delayed initiation of antenatal care. Other socio-demographic factors associated with late initiation of antenatal care in the UK include younger age,¹¹ smoking,¹¹ non-UK maternal place of birth,¹² and single status (not married or cohabiting).¹²

Evidence from other developed countries has confirmed associations between late initiation of care and lower socio-economic status,^{13,14} belonging to an ethnic minority group,^{14,15} younger maternal age,¹³⁻¹⁷ smoking,^{15,17} and marital status.^{13,14,17} In addition, some studies have reported associations between delayed initiation of care and the following socio-demographic factors: refugee status,¹⁸ low educational attainment,^{13,14,16,17,19} high parity,¹³⁻¹⁵ alcohol use¹⁷ and unplanned pregnancies.^{14,19}

Both the characteristics of users and those of the health services themselves may affect access to care.²⁰ A model developed by Cooper to conceptualise barriers to equitable healthcare for racial and ethnic groups in the USA (Figure 1)²¹ classifies potential barriers into three groups: personal/family barriers; structural barriers; and financial barriers. This model can be used as a starting point to conceptualise barriers to antenatal care, with some barriers relating to the 'demand side' (for example health beliefs, implicit or explicit costs of care), and others relating to the 'supply side' (e.g. quality and availability of services).²² Significantly, this model was devised for a US setting and financial barriers

to care are likely to be different in the UK setting with publicly funded healthcare which is free at the point of access for those considered 'ordinarily resident'. However, although the number of migrant women in the UK ineligible for free maternity care is probably small, there is evidence of confusion among healthcare staff even when guidance is clear that women are entitled to National Health Service (NHS) care.²³ For the majority of women in the UK, financial costs incurred in the receipt of antenatal care are limited to 'out of pocket' expenses such as transportation, childcare, and potential loss of earnings, particularly for 'vulnerable workers' such as hourly paid casual workers and those in the 'informal economy'. However, these may be tangible barriers to care for some groups of women, e.g. those living in rural areas without adequate public transportation, those caring for other children and those in insecure employment.²⁴

Figure 1. Barriers to equitable healthcare for racial and ethnic groups (adapted from Cooper²¹)

Personal/family	Structural	Financial
Acceptability	Availability	Insurance coverage
Cultural	Appointments	Reimbursement levels
Language/literacy	How organized	Public support (i.e. public funding)
Attitudes, beliefs	Transportation	
Preferences	Eligibility	
Involvement in care		
Health behaviour		
Education/income		
Health status		

The precise barriers to care experienced by women may vary according to their socio-demographic characteristics. Neale identified a range of barriers experienced by injecting drug users in the UK as they attempt to access general health care and support services, and many of these may be shared by other vulnerable and disadvantaged groups of women addressed in the present review.²⁵ Although Neale's study concluded that some barriers varied according to the socio-demographic characteristics of participants, others, for example stigma and negative attitudes from staff, were reported as experienced by all interviewees. In addition, a systematic review of access to antenatal care in developed countries highlights the "variety of socio-demographic, economic, cultural and personal factors" that affect the correlation between delayed or infrequent antenatal care and outcomes.¹⁰ A review of the qualitative literature by Lavender et al. suggests that for some high-risk marginalised women, simply providing appropriate services is likely to be insufficient as women may not be health literate and lack the personal autonomy, support and/or ability to make use of the care which is made available to them.²⁶ These findings are supported by work looking at wider issues of access to general healthcare, with one review emphasising the need to address sources of inequalities in care, with "key barriers...unlikely to be uniform across sectors, services, and groups of people".²² This approach is supported by the notion of 'candidacy', a synthetic construct developed to describe "the ways in which people's eligibility for medical attention and intervention is jointly negotiated between individuals and health services" and used to emphasise that the use of health services requires considerable work by individuals.^{24,27} Dixon-Woods gives as an example the evidence suggesting that people from more deprived backgrounds have a lower take-up of preventive services (the "inverse prevention law"²⁸). Although this may be in part attributable to structural barriers, it may also result from a lack of "positive conceptualisation of health", and the tendency to manage health and disease as series of major and minor crises.²⁷ This explanation may be particularly relevant to the discussion of antenatal care, often described as one of the classic examples of preventive medicine.²⁹

Despite the priority placed on early initiation of antenatal care and a developing body of evidence on factors influencing care, few studies have evaluated strategies likely to influence the timing of initiation of antenatal care. In our scoping work, we did not identify any published systematic reviews that looked exclusively at strategies for increasing early initiation of antenatal care. However, we did identify three relevant reviews, primarily focussing on perinatal outcomes but which also synthesised data on the effects of included interventions on the timing of antenatal care initiation:

- One literature review evaluated changes in the delivery of antenatal care for Australian indigenous women. The review looked at care utilisation alongside health/birth outcomes. Ten evaluations were included, four of which reported timing of initiation of antenatal care as an outcome measure.³⁰
- One literature review looked at the effect of lay home visiting on pregnancy outcomes. The author synthesised the effect of included interventions on utilisation of antenatal care for eight studies where these data were reported.³¹
- One literature review focussed on evidence about improving services for disadvantaged childbearing women in the UK. A number of primary studies and systematic reviews were identified, reporting a variety of different outcomes relating to the perinatal period. Only one intervention, focussing on ethnic minority women, reported on timing of antenatal care booking.³²

1.1 Aims of the review

The purpose of this review was to systematically identify and evaluate the evidence relating to the effectiveness of interventions, relevant in the context of the NHS, which aim to increase the early initiation of comprehensive antenatal care in socially disadvantaged and vulnerable women.

2 Definitions and scope of the review

We operationalised concepts and definitions as follows.

2.1 Operational definition of comprehensive antenatal care

Antenatal care refers to pregnancy-related services provided between conception and the onset of labour encompassing monitoring of the health status of the woman and the fetus, provision of medical and psychosocial interventions and support, and health promotion.³³ Such services are typically provided as a package of care, which we term 'comprehensive antenatal care', although sometimes elements of antenatal care may be delivered separately, for example home visiting programmes targeting pregnant women.^{34,35} In this review we focus on the timing of initiation of 'comprehensive antenatal care'.

2.2 'Early' initiation of antenatal care

Current UK guidelines recommend that women receive their booking appointment for antenatal care before 10 weeks.¹ Cut-offs used to define 'late' booking range between 14-28 weeks,^{9,10} with no clear consensus regarding the optimal definition. Twenty weeks may be regarded as an upper cut-off point based on the opportunity to receive an ultrasound anomaly scan within the recommended time period (18-20 weeks in the UK¹), although later cut-off points (22 weeks, 26 weeks, 28 weeks) are also used for the purposes of monitoring uptake of care.

For the purposes of this review, we considered the effect of interventions on the timing of initiation of antenatal care up to and including 20 weeks of gestation.

2.3 Types of intervention

We were interested in any intervention which might be delivered to increase the early initiation of antenatal care by socially disadvantaged and vulnerable women. We envisaged that the majority of such interventions would be stand alone interventions or 'outreach' services attached to antenatal care services. However we also considered antenatal care services without specific outreach services within the scope of the review provided that some element of the intervention could be considered to address barriers to care.

2.4 NHS relevance

In line with the aims of the Infant Mortality Project, we decided to focus on interventions that would be considered relevant in the context of the NHS. In particular, given the preponderance of US-based research in the literature, we specifically wished to avoid the inclusion of a substantial volume of research relating to interventions which primarily addressed financial barriers arising from lack of healthcare insurance or interventions relating to structural or financial aspects of the US healthcare systems which were not applicable in the UK context. We were unable to identify any published typology of interventions or a conceptual model which adequately captured this idea of 'NHS relevance'. Therefore we used the concepts and categories underpinning the barriers to healthcare access model developed by Cooper²¹ (discussed in Section 1 above) to operationalise our inclusion criteria relating to NHS relevance.

Using this model, any intervention addressing personal/family barriers was considered to be of potential relevance to the NHS; interventions which were 'primarily' structural or financial were not considered relevant unless components of the intervention addressed barriers relevant to women in the UK that were potentially transferable to the UK healthcare setting.

2.5 Disadvantaged and vulnerable groups

We sought interventions targeting or evaluated in the following groups.

- Specific disadvantaged and vulnerable groups of women at risk of accessing antenatal care late, including:
 - Women in prison
 - Travellers
 - Homeless women
 - Asylum seekers and refugees
 - Recently arrived migrants
 - Other immigrant groups
 - Non-native language speakers
 - Victims of abuse
 - Women with mental illness/mental health problems
 - Women with learning disabilities
 - Sex workers
 - Victims of female genital mutilation/cutting
 - Teenagers
 - Women who are HIV positive
 - Substance users
 - Alcohol misusers
- More general groups of disadvantaged women, including:
 - Women of low-socioeconomic status
 - Women living in deprived areas
 - Socially disadvantaged ethnic minority groups

3 Methods

3.1 Inclusion Criteria

The following inclusion criteria were used:

3.1.1 Study design

No restriction was imposed on study design other than that the study had to include a control or comparator group and the study must be an evaluation broadly designed to compare outcomes in the intervention group vs. the control/comparator group. Thus both experimental and observational studies were eligible for inclusion.

3.1.2 Population

We required that the study evaluated the intervention in a socially disadvantaged or vulnerable population, including, but not limited to the groups listed in section 2.5 above. Studies that evaluated the intervention in a more general population but provided subgroup analysis relating to relevant sub-groups were also eligible for inclusion.

3.1.3 Intervention

We did not place any restriction on the type of intervention. We required only that studies reported the timing of initiation of antenatal care as an outcome measure.

3.1.4 Comparator group

We required that:

- the study included a control or comparator group that did not receive, and/or have access to, the intervention.
- the intervention and comparator group were selected using the same and/or similar sampling framesⁱ and that
- the selection criteria were such that the two groups were drawn from broadly similar populations.

3.1.5 Outcome measure

We included studies which evaluated the effect of the intervention on the proportion of women initiating comprehensive antenatal care by a given week or month of pregnancy up to and including 20 weeks of gestation or before the fifth month of pregnancy.

Some studies assessed the effect of the intervention on other composite measures of utilisation of antenatal care, for example the *Kotelchuck Adequacy of Prenatal Care Utilization Index*³⁶ (a measure which takes account of both the timing of initiation of antenatal care and the number of antenatal care visits, adjusted for the duration of antenatal care). Such studies were eligible for inclusion if the timing of initiation of antenatal care component of the index was reported separately.

Studies that reported the timing of initiation of antenatal care as a baseline characteristic were excluded.

3.1.6 Language

We included only articles published in English.

ⁱ Sampling frames were not considered comparable if, for example, one included women with no antenatal care (e.g. sampled from a birth register) and the other included only women with some antenatal care (e.g. sampled from a clinic population)

3.1.7 Time period

Models of antenatal care have shifted in recent decades from predominantly obstetrician-led/hospital-based models of care to more diverse models with greater involvement of midwives, primary care physicians and others in the provision of antenatal care for non-high risk pregnancies.

In order to focus on models of antenatal care that are relevant in the current context, we included only studies published from 1990 onwards.

3.1.8 Geographical areas

We limited the review to studies carried out in high income countries with well developed healthcare systems and relatively low infant mortality rates. We included interventions evaluated in member countries of the Organisation for Economic Co-operation and Development (OECD), except for Mexico and Turkey, both of which have markedly higher infant mortality rates than the rest of the OECD.³⁷

3.1.9 Types of publication

We included journal articles reporting primary research, with or without an abstract.

3.2 Exclusions

In order to focus on interventions relevant in the context of the NHS, we excluded interventions that related solely to:

- the provision or extension of health insurance coverage, or similar, for example, changes in the eligibility criteria for Medicaid;
- a model of insurance coverage or reimbursement, for example 'managed care' or 'fee-for-service'.

We also excluded interventions that primarily addressed other barriers to antenatal care access that related to structural or financial aspects of the local healthcare system which were not considered to apply in a predominantly government-funded universal healthcare system such as the NHS (see discussion of Cooper's barriers model²¹ in Section 1 above).

3.3 Methods for identification of studies

3.3.1 Overview of strategy to identify relevant studies

Because of the diversity of the interventions which might be relevant and the absence of specific MESH/index terms relating specifically to uptake of antenatal care, we adopted a multi-stage strategy to identify relevant material. We initially carried out a range of scoping searches, including internet searches, to identify potentially eligible interventions. Based on this, we developed a list of potentially relevant text search terms relating to specific interventions and types of interventions, which we then incorporated, together with MESH and index terms, in the searches run on the major bibliographic databases (see section 3.3.2). The titles and abstracts of studies identified in these searches were screened, as described in section 3.4.1 below. During screening one reviewer additionally flagged studies relating to potentially relevant interventions, irrespective of whether the study met the review inclusion criteria. Based on the flagged interventions, a further list of interventions was developed (listed in Annex B) and the major bibliographic databases were again searched using these additional 'free text' terms relating to interventions of interest.

3.3.2 Bibliographic databases

The following bibliographic databases were searched in order to identify reports of primary studies using a combination of text terms and MESH headings relevant to the review (Annex A). We searched for reports published between January 1990 and April 2009, included in the following databases:

- Medline (Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1950 to Present, searched via the OvidSP interface)
- Embase (EMBASE 1988 to 2009 Week 15, searched via the OvidSP interface)
- Cinahl (searched via the EBSCO interface)
- PsycINFO (PsycINFO 1987 to April Week 2 2009, searched via the OvidSP interface)
- HMIC (HMIC Health Management Information Consortium March 2009, searched via the OvidSP interface)
- CENTRAL (searched via the Cochrane Library)

Initial searches were carried out on 16th April 2009.

A further round of searches was carried out using these databases in May 2009, using free text search strings relating to any 'named' interventions identified during the first round of screening, as described in section 3.3.1 above.

Where available, we applied limits and filters to restrict the search results by publication year (1990 onwards), topic (humans), and language (English language only). The main Medline search was additionally restricted on publication type to exclude letters, news, editorials and commentaries.

A copy of the main Medline search strategy is provided in Annex A. A list of the 'named' interventions that we included in the second round of searches is given in Annex B. Copies of search strategies relating to other databases are available from the authors on request.

3.3.3 Other online searchable resources

We searched the following databases through the Cochrane library interface to identify systematic reviews, guidelines, health technology assessments and economic evaluations dealing with access to antenatal care or related topics:

- Cochrane Database of Systematic Reviews
- Database of Abstracts of Reviews of Effects (DARE)
- Health Technology Assessment Database

These databases were searched on 28th April 2009. The strategy used to search these databases was identical to that used to search CENTRAL, and used a combination of text terms and MESH headings relevant to the review.

We additionally searched the following specialist databases and online resources in order to identify any further primary reports, or guidelines, reviews and reports with relevant citations:

- The National Guideline Clearing House
- The National Library for Health
- The National Institute for Health Research Service Delivery and Organisation Programme
- OpenSIGLE
- TRoPHI
- The Health Development Agency (HDA)
- The National Institute for Health and Clinical Excellence (NICE)

These databases and online resources were searched between 23rd and 30th April 2009. Where a search facility existed within a particular database, a basic search was conducted using text terms relevant to the review. The reference lists of the relevant systematic reviews, guidelines, etc. were checked to identify any additional eligible studies.

3.3.4 Items identified in scoping exercise and antenatal care review

We included relevant studies identified during initial scoping work described above (section 3.3.1) Additionally, a small number of items evaluating relevant interventions were identified during the conduct of a related systematic review focussing on antenatal care interventions.³⁸ The items were included for screening alongside material identified from other sources to ensure that inclusion criteria were applied consistently.

3.3.5 Reference lists and citations

Following the full text screening stage, the reference lists of all included studies were checked and full text versions of any possibly relevant citations were retrieved and screened. We also searched the Science Citation Index via the Web of Science to recover any relevant papers that cited any items already screened as eligible for inclusion.

3.4 Review methods

3.4.1 Screening

For the purposes of screening, the eligibility criteria described in section 3.1 and 3.2 above were reformulated as a set of exclusion criteria as shown in Table 1.

3.4.1.1 Abstract screening

Titles and abstracts (where available) were screened independently by two reviewers using the exclusion criteria listed in Table 1. Articles were included for full-text review if either of the reviewers considered the study potentially eligible on the basis of the title/abstract.

Table 1. Exclusion criteria

	Stage 1: Abstract/title screening	Stage 2: Full-text screening
		Stage 1 criteria PLUS:
General	<ul style="list-style-type: none"> • Not English language • Not primary research • Not eligible publication type <i>Not journal article – e.g. dissertation, book, conference abstract</i> 	
Population	<ul style="list-style-type: none"> • Not conducted in an eligible OECD country • Not pregnant women or study population not relevant 	
Intervention	<ul style="list-style-type: none"> • No relevant intervention <i>Study does not evaluate any form of intervention OR evaluated intervention could not reasonably be expected to influence the timing of antenatal care initiation</i> • Ineligible intervention <i>Study intervention relates <u>only</u> to the provision or extension of health insurance coverage or similar, OR the study intervention relates <u>only</u> to the model of insurance coverage/ reimbursement, OR study relates <u>only</u> to other non-relevant structural or financial interventions, for example healthcare fees, cost of malpractice suits, liability cover etc.</i> 	
Comparator	<ul style="list-style-type: none"> • No comparator/control group 	<ul style="list-style-type: none"> • Control group not eligible <i>Inappropriate comparator/control group i.e. the comparator/control group is not drawn from a population of interest and/or the intervention and control group are drawn from different and non-comparable populations</i>
Outcome	<ul style="list-style-type: none"> • No relevant outcome 	<ul style="list-style-type: none"> • No relevant outcome <i>Timing of initiation of antenatal care reported but not an outcome measure</i>

	Stage 1: Abstract/title screening	Stage 2: Full-text screening
		Stage 1 criteria PLUS:
Other		<ul style="list-style-type: none"> • Not an effectiveness evaluation <i>Study does not report an effectiveness evaluation of a relevant intervention with an eligible control group and a relevant outcome measure reported</i> • Selection criteria for study groups not appropriate <i>For example,</i> <ul style="list-style-type: none"> - RCTs where women were randomised after entry into antenatal care - Studies where inclusion/exclusion criteria were based on the timing of initiation of antenatal care, e.g. studies which excluded 'late bookers' - Studies where the intervention and control/comparator groups were sampled from non-comparable sampling frames (e.g. antenatal care clinic records vs. birth records)

3.4.1.2 Full text screening

The full text articles of all items included at the abstract/title screening stage were retrieved and screened independently by two reviewers using the exclusion criteria used previously and additional more specific criteria (Table 1). Reviewers were asked to use their judgement in cases where an item was not explicitly reported. Although we did not restrict by intervention type, studies were excluded at the title/abstract stage if there was no evidence that timing of initiation of antenatal care was reported and reviewers considered that the intervention could not feasibly be expected to influence timing of initiation of antenatal care. Where it was not explicitly stated that the timing of initiation of antenatal care was a study outcome, reviewers were asked to assess whether this was reported as a baseline characteristic or as an outcome measure.

Where there was lack of agreement between the reviewers the opinion of a third reviewer was sought and a decision reached following discussion. It was found that the reviewers were sometimes unable to reach a clear consensus as to whether the timing of initiation of antenatal care was an outcome measure; to avoid the exclusion of potentially relevant material, these studies were included but this aspect of the study was coded as 'unclear'.

3.4.2 Quality assessment

An assessment of internal validity was carried out using the GATE checklist.³⁹ Two reviewers independently assessed each study, and awarded an overall grade:

- ++ Good: well reported and reliable;
- + Mixed: some weaknesses but insufficient to have an important effect on usefulness of study;
- Poor: study not reliable, not useful.

Where the two assessments did not agree, the opinion of a third reviewer was sought and a final grade was assigned following discussion.

For analysis purposes, studies assessed as 'mixed' or 'good' were combined to provide an 'adequate' category.

Prior to undertaking the study GATE assessments, reviewers completed and discussed a minimum of five 'training assessments' to ensure that the tool was being correctly and consistently applied.

3.4.3 Data extraction

A data extraction and coding form was developed and loaded into Eppi-Reviewer,⁴⁰ customised software designed to manage screening, data extraction and analysis for systematic reviews.

Basic descriptive data were coded by one reviewer only; other information, e.g. relating to the aims, study design, results and conclusions (assessment of effectiveness, see below) of the evaluation was independently coded by two reviewers and results compared. Discrepancies were resolved by discussion with a third reviewer consulted if necessary.

3.4.4 Assessment of effectiveness

3.4.4.1 Authors' conclusions

Authors' conclusions on the effect of the intervention on the timing of initiation of antenatal care were independently assessed by two reviewers and coded as follows:

- + Statistically significant beneficial effect
- (+) Effect consistent with beneficial effect but effect not statistically significant and/ or cautious interpretation of finding suggested
- X No evidence of beneficial effect
- 0 No conclusion stated

Where the reviewers disagreed, a third reviewer assessed the study and a decision was reached following discussion.

3.4.4.2 Reviewers' assessment of effectiveness

Two reviewers assessed and independently coded the evidence of effectiveness, taking into account the strengths and limitations noted in the GATE checklist, with input from a third reviewer as described previously. Studies were graded using the following categories:

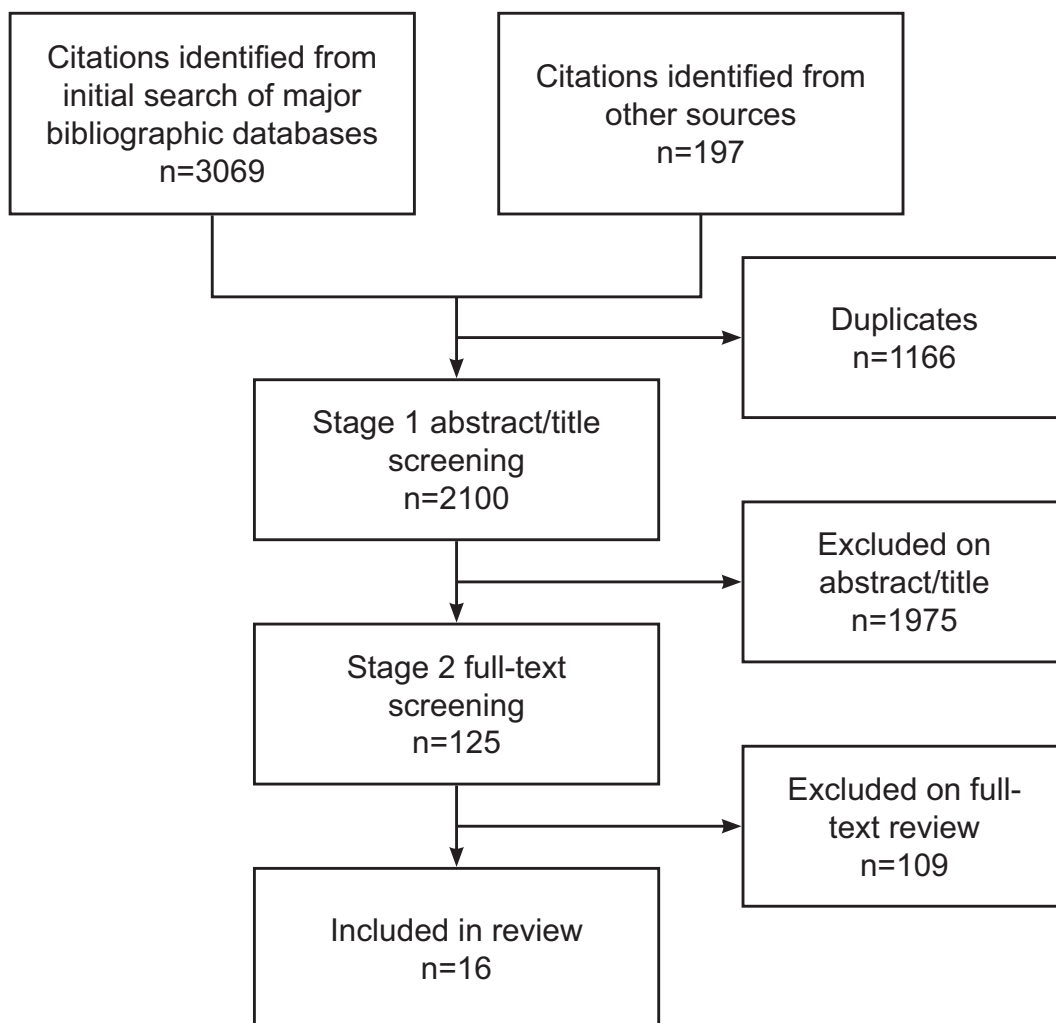
- + Study demonstrates a beneficial effect
- (+?) Study inconclusive but may demonstrate a beneficial effect
- X Study does not provide convincing evidence of a beneficial effect

Studies rated as having poor internal validity (i.e. GATE quality assessment 'Poor: study not reliable, not useful') were not considered further.

4 Results

The number of items included at each stage of the review is presented in Figure 2.

Figure 2. Screening process



Initial searches of the major bibliographic databases identified 3069 citations, of which 1062 were duplicates. A further 197 citations were identified from other sources: from named intervention searches, scoping searches, the antenatal care systematic review, and from checking the reference lists and citations of studies identified for inclusion. One hundred and four of this citations identified from other sources were excluded as duplicates. Overall, 2100 items were screened on title/abstract (stage 1), of which 1975 were excluded. Of the 125 progressing to full text review, 109 were excluded as a result of full-text screening (stage 2). Further information about reasons for exclusion are presented in Table 2.

Table 2. Reasons for exclusion

	Reason for exclusion	Excluded at stage 1: Abstract/title screening (n=1975)	Excluded at stage 2: Full-text screening (n=109)
General	Not primary research	259	16
	Not eligible publication type	52	3
Population	Not conducted in an eligible OECD country	627	0
	Not pregnant women or study population not relevant	149	0
Intervention	No relevant intervention	827	0
	Ineligible intervention	35	1
Comparator	No comparator/control group	5	20
	Control group not eligible	0	11
Outcome	No relevant outcome	18	49
Other	Not an effectiveness evaluation	3	4
	Selection criteria for study groups not appropriate	0	5

4.1 Overview of included studies

We identified 16 eligible evaluations relating to 16 distinct interventions. The following sections describe these 16 primary studies.

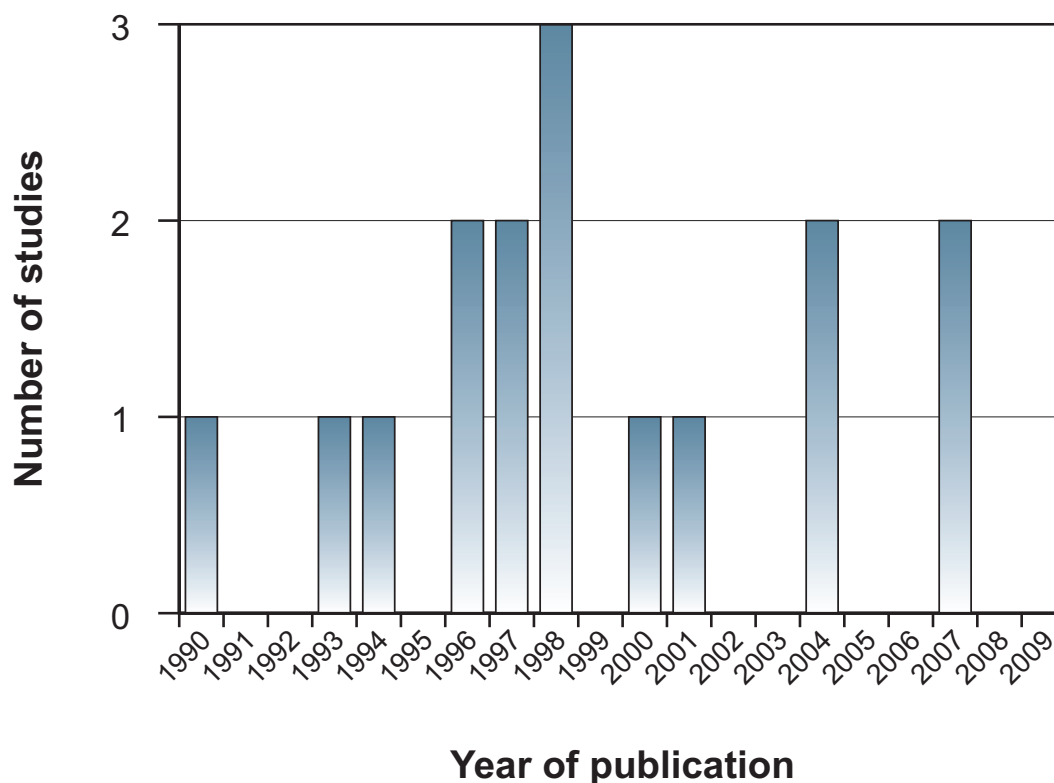
4.1.1 Countries

Fourteen of the included studies were conducted in the USA, one was carried out in Australia,⁴¹ and one in the UK.⁴²

4.1.2 Year of publication/study

The searches identified studies published between 1990 and 2009. The most recent study included in the review was published in 2007. The majority of studies were published between 1996 and 2001. The distribution of studies by year of publication is presented in Figure 3.

Figure 3. Year of publication of included studies



Fourteen studies explicitly stated the study time period for the evaluation. Of these fourteen studies, four were completed before 1990, five were completed before 1995, one was completed before 2000, and three were completed before 2005. For the remaining three studies, the time period of the evaluation was not stated or was unclear.

4.1.3 Study design

All the included evaluations used observational study designs. Two were before and after studies without a contemporaneous comparison group,^{43,44} and one was a before and after study which included a contemporaneous comparator group but did not report data on the timing of initiation of antenatal care for this group.⁴¹ One study was a retrospective observational cohort study with an additional pre-intervention comparator group.⁴⁵ The remaining 12 studies were cohort studies, of which nine were classified as retrospective and three as prospective. One of these included a matched comparator group.⁴⁶

4.1.4 Outcome measure

Just over half of the studies (n=9) reported the proportion of women initiating care in the first trimester.^{41,46-53} Two studies reported measures based on initiation of antenatal care by 12 weeks⁴² or by 14 weeks,⁵⁴ and five studies reported the month of pregnancy when antenatal care started (before the fourth^{44,45,55} and fifth month^{43,56} of pregnancy). The source of data on gestation at initiation of antenatal care varied: six studies (all US-based) used information recorded on the birth certificate,^{43,45-47,50,56} three used clinical records only,^{41,42,44} and one, which recruited recipients of the "Special Supplemental Food Program for Women, Infants and Children" (WIC) services, used the WIC records as the source of data.⁴⁸ In the remaining six studies, the source of information on gestation at initiation of antenatal care was not clearly stated.^{49,51-55} Only two studies explicitly reported the process by which gestational age was ascertained.^{41,54}

4.1.5 Quality

Inter-rater reliability of the GATE tool was low (Kappa=0.18), with 25% of initial assessments discordant (n=4). Fifteen out of sixteen studies were given a final rating of “poor”, and one study was rated as having “mixed” internal validity.⁴⁵ The poor internal validity of the included studies partly reflected the inclusion of a number of studies in which initiation of antenatal care was not the primary focus of the evaluation. The reviewers assessed internal validity in relation to the evaluation of effects on the timing of initiation of antenatal care; in cases where this was not the primary study outcome, this rating does not necessarily reflect the validity of estimated effects on other study outcomes.

The most commonly reported flaw (15 studies) was a lack of adjustment for potential confounding in the analysis of the effect of the intervention on the timing of initiation of antenatal care (some studies reported adjusted analyses for other outcome measures). This was a serious problem as many studies also reported significant baseline differences between the intervention and comparator groups, often a result of the intervention targeting groups with a higher risk profile. Some key flaws identified in the included studies are reported in Table 3.

Table 3. Major flaws identified in included studies

Flaw	Number of studies affected*
Reporting of the study	
No data presented on baseline characteristics by intervention/comparator status	3
Insufficient data presented on baseline characteristics by intervention/comparator status	1
Outcome data presented only in graphical form, no numeric results provided	2
Design of the study	
Intervention and control groups <i>known</i> to differ at baseline with regard to important characteristics, and no adjustment for known differences at the analysis stage	8
Intervention and control groups <i>likely</i> to differ at baseline with regard to important characteristics (insufficient data presented to assess), and no adjustment for likely differences at the analysis stage	2
Small sample size (n=<200)	4
No protection against secular changes (before and after study without contemporaneous comparison group)	3
At least one comparator group includes women who may have received the intervention under study (contamination)	2
Analysis of the study	
No adjustment for potential confounding in analysis of timing of initiation of antenatal care	15
Inappropriate analysis method (unmatched analysis for matched design)	1

* Numbers do not add up to n=15, most studies had multiple flaws

4.1.6 Assessment of whether timing of initiation of antenatal care was an outcome measure

Overall, eight studies were considered to clearly report timing of initiation of antenatal care as an outcome measure. In the remaining eight studies it was considered unclear as to whether timing of initiation of antenatal care was reported as an outcome measure as opposed to a baseline characteristic.

4.2 Interventions studied

4.2.1 Intervention recipients/target populations

By definition, all included studies covered interventions that were targeted at and/or evaluated in one or more of the disadvantaged or vulnerable groups listed previously. Twelve studies focussed on specific subgroups of interest. This included six interventions that were targeted at and/or evaluated in ethnic minority women ("women from 'minority' backgrounds",⁴⁶ Mexican-American,⁴³ African-American,^{47,50,53} Asian-British⁴²), one that focussed on indigenous Australian women,⁴¹ four that targeted teenagers,^{44,45,51,55} and one that was evaluated in substance abusing HIV-positive women.⁵⁶ Four studies covered interventions targeted at and/or evaluated in more generally socioeconomically disadvantaged populations,^{49,52,54} one of which simply described the intervention to be targeted at "at risk families".⁴⁸

4.2.2 Intervention content

The 16 included interventions were broadly classified according to whether they were outreach or other community-based interventions (11 studies^{41-43,45-50,53,55}); or whether they were interventions involving alternative models of clinic-based antenatal care (5 studies^{44,51,52,54,56}).

4.2.2.1 Outreach or other community-based interventions

Eleven studies evaluated outreach or other community-based interventions. Three of these interventions consisted primarily of social support and/or home visits delivered by paraprofessional or lay women.^{45,48,55} Of these studies, two evaluated interventions based on the concept of 'resource mothers' – trained paraprofessional women recruited from the local community - providing support to pregnant teenagers.^{45,55} The third intervention encompassed home visiting for socioeconomically disadvantaged "at risk" families.⁴⁸ One intervention consisted of the provision of 'linkworkers' in primary care and antenatal care settings,⁴² and in another study the intervention was a mobile health clinic offering basic antenatal services.⁴⁹ The remaining six studies all evaluated multi-component interventions including two or more of the following components: outreach, case management, home visiting, risk screening, help with transportation to appointments, advocacy and social support.^{41,43,46,47,50,53} Five of the interventions^{41,43,46,47,50} involved lay workers or paraprofessional staff indigenous to the targeted community.

Lay or paraprofessional home visiting and support

Rogers and colleagues evaluated the impact of a *Resource Mothers Program* (RMP) in a sample of rural and moderately urban counties in South Carolina, USA.⁴⁵ The intervention was delivered by resource mothers (paraprofessional women who provided social support through home visits). These women were recruited from the local community and received three weeks of intensive training on a range of subjects including pregnancy and infant care, nutrition and communication skills. Pregnant teenage participants (<18 years), who were predominantly Black, were recruited through outreach activities or through peer-referral or referral from other agencies such as the *Special Supplemental Food Program for Women, Infants and Children (WIC)*, schools, antenatal care clinics and churches. The resource mothers provided "supportive, educational home visits" and helped the teenager "use the health care system". After enrolment, teenagers were visited monthly during pregnancy, after delivery in hospital, and monthly for the first year of their infant's life.

"Each visit was structured, with specific goals and learning objectives. Prenatally, emphasis was on the need for early and regular prenatal care and reduction of risk factors, such as smoking, drug use, and poor nutrition."

"Resource mothers facilitated the teenagers' use of prenatal care and support services by following up on any missed appointments, arranging transportation, and assisting with referrals to community and health services. The resource mother acted as an advocate for the participant by bringing attention to her needs within health and community agencies." ⁴⁵

Julnes and colleagues evaluated another *Resource Mothers Program*, based in Norfolk, Virginia, USA.⁵⁵ The intervention was targeted at pregnant teens (<18 years) with certain risk factors: young maternal age, black, residing in target neighbourhoods with low family income levels, less than a high school education, and no prior pregnancies. As with the intervention evaluated by Rogers, resource mothers were recruited from the community and provided with intensive training to enable them to support pregnant teenagers from disadvantaged backgrounds.

"This program utilizes "resource mothers" to reach out to adolescents considered at high risk for inadequate prenatal care and poor pregnancy outcomes. A resource mother is a lay person – often indigenous to the culture of the adolescents – trained to assist adolescent parents and their families with the non-medical dimensions of pregnancy and child care. The resource mother is responsible for recruiting teens for the program, encouraging them to get prenatal care, providing practical assistance to the teens and their families, and acting as a liaison between the teens and the relevant public agencies." ⁵⁵

Daaleman evaluated the *Kansas Healthy Start Home Visiting (HSHV) Programme*.⁴⁸ This programme was designed to enable at-risk families to become healthier and more self-sufficient by improving access to early intervention services. This evaluation was designed to investigate whether prior exposure to this programme (i.e. before pregnancy) had an effect on the use of antenatal care in the current pregnancy. The evaluation was conducted using a small sample of multiparous women in receipt of WIC services. HSHV was a community-based lay home visiting programme, available to "all pregnant women, infants, adoptive families, and families who have lost a newborn". Participants were referred by their physician, care provider or social service agency.

"The home visitor is an experienced parent with a minimum of a high school diploma or GED, who has undergone an orientation to home visiting under the supervision of a public health nurse. The role of the home visitor is to provide education, support, resource information and referrals to the family, in addition to screening for any current or potential problems. No childcare or transportation services are provided by the home visitor. All visits are reviewed with a public health nurse to assess for any necessary follow-up or referral." ⁴⁸

Linkworkers

Mason evaluated the *Asian Mother and Baby* project in Leicester, UK.⁴² The project (which was partially hospital-based) involved eight Asian linkworkers based across the two main city maternity units (two linkworkers on each site) and four selected GP surgeries (one linkworker at each surgery). GP practices were selected from those which had at least one general practitioner not on the 'obstetric list'ⁱ. The linkworkers were "women aged between 20 and 45 who were able to speak fluent English and at least one Asian language". The linkworkers "worked alongside health professionals, in both hospital and community antenatal clinics, as 'facilitators' and 'interpreters' while also fulfilling an educative role". The aim of the intervention was to improve birth outcomes, aid communication with professionals, and to impart health education.

ⁱ A register of general practitioners who have completed a specified level of training in obstetrics and gynaecology

Mobile health clinics

One study evaluated a mobile health clinic for women in California, USA.⁴⁹ The *Women's Health Van* was staffed by an obstetrician-gynaecologist and nurse practitioner and provided a variety of services for women, including pregnancy testing, sexually transmitted infection (STI) screening, breast exams and contraceptive services. The staff on the van were bilingual (English/Spanish) and the health education literature they provided was available in both languages. The van aimed "to address barriers to health care access such as language, transportation, and cost for undocumented immigrants and the uninsured". Two days a week the van travelled to low-income neighbourhoods and provided free walk-in or appointment services to local women.

*"Women with positive urine pregnancy tests received a dating ultrasound on the van, initial prenatal care, counseling regarding healthy pregnancy, and are given a packet of information and prenatal vitamins. The van acts as a bridging device as the women are then referred to local community clinics for further prenatal visits"*⁴⁹

Multi-component interventions

Cramer and colleagues report an evaluation of a community-based antenatal care programme called *Omaha Healthy Start*, implemented in Nebraska, USA.⁴⁷ The setting was specific census tracts in Douglas County, where 46% of the population were Black. The intervention was designed to "reduce local racial disparities in birth outcomes". The intervention was delivered by outreach workers (indigenous to the targeted Black community), social workers and public health nurses. Outreach workers were responsible for recruiting pregnant women to the intervention, achieved through community outreach among "local churches, clinics, social service agencies, community groups, community leaders, and businesses". Once enrolled in the programme, women were assigned a case manager (a social worker or public health nurse) who provided "weekly contact, through home visits, office visits, or telephone calls". Case managers scheduled medical and other visits, helped to arrange transportation to appointments, and screened and referred participants for risk factors. Case managers also delivered antenatal education according to the programme developed by the National *Healthy Start* programme.

An effectiveness evaluation of the *Rural Oregon Minority Prenatal Program (ROMPP)* is reported by Thompson et al.⁴³ This intervention was targeted at low-income, Mexican-American women at risk of poor birth outcomes in a rural Oregon community in the USA. ROMPP attempted to deliver "culturally appropriate care, outreach, nursing case management, and home visitation" to this group of women, many whom were undocumented immigrants and ineligible for Medicaid. The intervention was delivered by a community health nurse/case manager and outreach workers. The community health nurse/case manager "was responsible for assessment, planning, coordination and evaluation of nursing care". As well as facilitating access to antenatal care, the nurse/case manager was able to refer and liaise with other community services (e.g. WIC) as needed. The outreach worker was drawn from the local Mexican-American farmworker community, and "was responsible for case-finding and recruitment, follow-up to ensure continuity of care and reduce social isolation, and advocacy to lower barriers and increase the acceptability and accessibility of care". ROMPP referred women to third party sources of financial help with care costs, and negotiated payment arrangements for women funding their own care. Most ROMPP visits occurred in participants' homes, with the number of overall visits dependent on the needs of the women. The outreach worker provided transportation to antenatal care appointments and interpreting services where necessary.

Willis and colleagues report an evaluation of the *Black Infant Health (BIH)* programme, targeted at African-American women living in California, USA.⁵³ BIH included "augmented services during the prenatal period, services designed specifically for African-American women, outreach and tracking, office-based services enhanced by telephone and in-home contacts, and preservice risk screening". It was separate to antenatal care "but consistently enabled and supported clients with prenatal care entry and continuance". Exact services provided by BIH varied by programme site. All programme sites implemented the 'Prenatal Care Outreach' model:

*"The Prenatal Care Outreach model utilizes community health outreach workers to conduct intensive outreach to identify and link pregnant African-American women to BIH, general prenatal care, and other appropriate services"*⁵³

Up to three other models were implemented as part of the programme, depending on the results of local needs assessment. These models of care included the "Case Management" model ("utilizes public health nurses to conduct home visits for the purpose of assessments, referrals, provision and coordination of services, monitoring, and follow-up"), the "Social Support and Empowerment" model, and the "Role of Men" model.

An evaluation of the *Minority Health Coalitions Early Pregnancy Project* was carried out by Jewell and Russell.⁴⁶ The intervention, implemented in Indiana, USA, evolved from the Indiana Minority Health Coalitions wider brief to "eliminate health disparities for racial and ethnic minorities". The intervention that forms the focus of their report was designed to increase access to early antenatal care. The project aimed to "eliminate cultural barriers to care".

*"The cultural aspect of care was emphasized in the projects as demonstrated by the use of minority professional and paraprofessional staff and the monitoring of the projects by the minority health coalitions boards [...] Staff provided social support in varying ways from individual support via contact with mothers in the project offices and on home visits, to group support by facilitating linkages of social support with significant others and holding support group meetings of the project mothers. Other interventions included referrals to community services, health education and transportation. The staff also provided advocacy for the mothers if barriers occurred in navigating health and social service systems in their communities."*⁴⁶

The *Maternal Infant Health Advocate Service* programme was implemented in the urban area of Flint, Genessee County in Michigan, USA.⁵⁰ Hunte and colleagues conducted an effectiveness evaluation of this intervention, targeted at, and evaluated among, African-American women. The authors report the objectives of the intervention as follows:

*"1) to identify pregnant African-American women early in their pregnancies; 2) to assist identified participants in navigating the prenatal care system; 3) to identify resources that assure services are adequate to reduce the stress associated with health barriers; and 4) to engage participants in other activities that assist in addressing issues of race and ethnicity as they relate to infant mortality."*⁵⁰

Participants in the intervention (clients) were identified through self-referral, advocate case-finding, and through referral from other services and settings (clinics, WIC, local health departments etc.).

*"Upon entering the MIHAS program, clients meet face-to-face with their advocates to set specific goals to be addressed during their enrolment. While enrolled in the program all clients must be actively working towards their goals."*⁵⁰

Because clients reported that physicians "talked-down" to them, advocates also accompanied women to antenatal and postnatal visits, and infant check-ups.

*"[Advocates also provide] supportive services ranging from providing assistance when seeking employment, and help with school enrolment, to continuing their educational goals. Poor reading skills among many of the clients is a known barrier therefore advocates often accompany their clients to provide assistance and support with filling out necessary paperwork."*⁵⁰

The intervention evaluated by Mackerras and colleagues "had specific goals to increase infant birthweights by earlier attendance for antenatal care and improved maternal weight status".⁴¹ The intervention, named *Strong Women Strong Babies Strong Culture* was evaluated in rural Aboriginal communities in the Northern Territory, Australia. The intervention was developed in consultation with the local Aboriginal population, and lay women indigenous to the community were trained as "Strong Women Workers" (SWWs).

*"...a well respected Aboriginal woman was employed to develop the project. She worked with women selected by the communities (the SWWs) to implement a program that included traditional cultural practices related to childbirth as well as informing pregnant women about Western health and medical practices related to pregnancy and encouraging greater use of antenatal health care."*⁴¹

The intervention also targeted women not yet pregnant, and those women who were pregnant but not yet receiving antenatal care.

4.2.2.2 Alternative models of clinic-based antenatal care

Five studies reported interventions that involved alternative models of clinic-based antenatal care. Two of the reported interventions were teen antenatal clinics,^{44,51} one study evaluated a collaborative care initiative,⁵⁴ and two reported evaluations of enhanced antenatal care services.^{56,52}

Teen pregnancy clinics

Martin and colleagues evaluated the implementation of a teen pregnancy clinic in Cincinnati, Ohio, USA.⁴⁴ The evaluation was conducted through a small before and after study. The clinic was set up to provide comprehensive antenatal care to pregnant teenagers who were previously only able to receive non-specific care through the traditional antenatal clinic.

*"The operational objectives of the teen pregnancy clinic were to increase compliance among teen patients receiving care through GHA in attending prenatal appointments, educational classes and postpartum checkups. Some broader objectives of the clinic included reducing the number of teens who deliver low birth weight and premature infants, improving neonatal outcomes, decreasing the number of repeat pregnancies, decreasing the incidence of sexually transmitted diseases, and ensuring compliance with contraceptive care."*⁴⁴

All teenagers participating in the evaluation were aged <18 years and the majority had their care funded via private health insurance.

Another evaluation of teen pregnancy clinics was conducted by Morris and colleagues in Texas, USA.⁵¹ The setting was a public health clinic serving a multi-ethnic low-income population, the majority of whom were medically indigent. The clinic was designed for pregnant teenagers <18 years and provided:

*"...general monitoring of the course of pregnancy, in addition to special emphasis on educational, social and nutritional support. The care was provided by a team of nurses, physician assistants, obstetrician-gynecologist residents, a social worker, and a nutritionist."*⁵¹

Collaborative antenatal care

Mvula and Miller evaluated a collaborative antenatal care programme in Louisiana, USA.⁵⁴ The clinic, *Neighbourhood Pregnancy Care*, was situated next to low-income housing projects in New Orleans and provided contraceptive services alongside antenatal care. The clinic focussed on "continuity of prenatal care by specific providers, individualized perinatal education, and nursing case management...". Services were delivered by teams of obstetricians and 'advanced practice nurses' (clinical nurse specialists, nurse practitioners, and nurse midwives). To maximise compliance "patients are reminded the day before scheduled appointments".

Enhanced antenatal care services

One study evaluated the *Prenatal Care Assistance Program (PCAP)*.⁵⁶ PCAP was a combined state-federal intervention delivered through selected Medicaid clinics in New York State, USA. Clinics were eligible to be part of the PCAP if they delivered specific services alongside "comprehensive prenatal, diagnosis and treatment services".

The specific services included care coordination, referrals to other services (HIV management, mental health services, and substance abuse programmes), and health and nutrition education. Clinics designated as part of PCAP were able to bill for antenatal and postpartum care services at enhanced rates compared to usual Medicaid costs. Newschaffer and colleagues conducted an evaluation of PCAP concentrating on the outcomes in substance-using HIV-positive women.

Reichman and Florio report an evaluation of New Jersey's *HealthStart program* (New Jersey, USA).⁵² This enhanced antenatal care intervention was designed to increase the quantity and quality of antenatal care, with the aim of increasing birthweight among socioeconomically disadvantaged women. The programme delivered antenatal care to Medicaid eligible women, alongside enhanced services such as care coordination.

*"The key features of this program, available to pregnant Medicaid recipients, are an increased number of prenatal visits, increased provider reimbursement, case coordination with other social programs and integrated health support services such as psychological counselling and health education. Case managers, trained in cultural sensitivity, provide individualized plans of care and follow-up consultations through the pregnancy and for 60 days postpartum. To encourage women to get prenatal care early, community outreach efforts are mandated for all HealthStart providers. A system of presumptive eligibility, not part of the HealthStart program per se, was also established to enable financially eligible unenrolled pregnant women to obtain early care. The combination of provider supply incentives, enhanced services, and streamlined enrolment procedures was expected to increase the use of prenatal care and improve birth outcomes among Medicaid women in New Jersey."*⁵²

4.3 Effectiveness

4.3.1 Outreach or other community-based interventions

The overall strength and quality of evidence relating to these studies was poor. All of the eleven studies evaluating the effect of outreach or other community-based interventions on the timing of initiation of antenatal care were observational study designs (nine cohort studies and two before and after studies), and only one of the eleven evaluations was assessed as having adequate internal validity in relation to the outcome relevant to this review. Eight studies were assessed as clearly reporting the timing of initiation of antenatal care as an outcome measure; in the remaining three studies it was unclear as to whether this measure was reported as an outcome measure.

Lay or paraprofessional home visiting and support

Rogers and colleagues assessed the effectiveness of a *Resource Mothers* intervention on the timing of initiation of antenatal care among pregnant teenagers, using a retrospective observational design. The evaluation used two different comparison groups, one drawn from different but broadly similar geographical areas, and the second drawn from adolescents who resided in the intervention areas before the intervention was implemented. The study was considered to have no major weaknesses, and was the only study included in the review to adjust for potential confounding in the analysis of timing of initiation of antenatal care. The evaluation reports that a higher proportion of intervention adolescents initiated antenatal care before the fourth month of pregnancy (45% of the intervention group vs. 41% in the geographical comparator group and 40% in the 'pre-intervention' comparator group), with this increase significant in comparison to both control groups. An adjusted odds ratio for early initiation of antenatal care is reported for the intervention group compared to the geographical comparator group (1.48, 95% CI 1.32, 1.66) and 'pre-intervention' comparator group (1.39, 95% CI 1.16, 1.66). The authors concluded that the study demonstrated a statistically significant beneficial effect on the timing of initiation of antenatal care. Because of potential for selection bias largely attributable to the observational study design and non-random assignment of participants, the reviewers considered the study inconclusive but consistent with a possible beneficial effect.

Results are summarised in Table 4.

4.3.2 Alternative models of clinic-based antenatal care

The quality of evidence relating to interventions involving alternative models of clinic-based antenatal care was also poor. Four of the five studies in this category were observational cohort studies, and one was a before and after study without a contemporaneous comparator group. All five of these studies were assessed as having poor internal validity in relation to the outcome relevant to this review. However, the reviewers considered that in none of these studies was it clear whether timing of initiation of antenatal care was reported as an outcome measure. This reflected the fact that many of these interventions were primarily designed to improve antenatal care utilisation as measured by attendance for appointments rather than timing of initiation.

Results are summarised in Table 5.

Table 4. Effectiveness of outreach or other community-based interventions

Author and year	Design	Assessment of internal validity ⁽¹⁾	Timing of antenatal care initiation clearly an outcome measure?	Effect of intervention on timing of initiation of antenatal care		Reviewer comments
				Authors' conclusion ⁽²⁾	Reviewer assessment ⁽³⁾	
Cramer 2007	Retrospective observational cohort study	Poor	Yes	X	X	No data presented on baseline characteristics, intervention and control groups likely to differ with respect to important risk factors due to targeting of intervention, no adjustment for potential confounding in analysis of timing of initiation of antenatal care.
Daaleman 1997	Retrospective observational cohort study	Poor	Yes	(+)	X	No data presented on baseline characteristics by intervention/control status, intervention and control groups likely to differ with respect to important risk factors due to targeting of intervention, no adjustment for potential confounding in analysis of timing of initiation of antenatal care, small sample size, outcome data only presented in graphical form, authors' conclusions do not appear to correspond to data presented.
Edgerley 2007	Retrospective observational cohort study	Poor	Yes	+	X	No adjustment for potential confounding in analysis of timing of initiation of antenatal care, insufficient data presented on baseline characteristics.
Hunte 2004	Retrospective observational cohort study	Poor	Unclear	X	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care.
Jewell 2000	Retrospective observational cohort study	Poor	Yes	+	X	No adjustment for potential confounding in analysis of timing of initiation of antenatal care, inappropriate statistical analysis (matched data, unmatched analysis), unclear whether individuals may have been referred by their antenatal care provider.
Julnes 1994	Retrospective observational cohort study	Poor	Yes	+	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care, small sample size.
Mackerras 2001	Before and after study	Poor	Yes	(+)	X	No data presented on baseline characteristics of control (pre-phase) and intervention (post-phase) groups, no adjustment for potential confounding in analysis of timing of initiation of antenatal care, no protection against secular changes.

Author and year	Design	Assessment of internal validity ⁽¹⁾	Timing of antenatal care initiation clearly an outcome measure?	Effect of intervention on timing of initiation of antenatal care		Reviewer comments
				Authors' conclusion ⁽²⁾	Reviewer assessment ⁽³⁾	
Mason 1990	Prospective observational cohort study	Poor	Unclear	X	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care.
Rogers 1996	Retrospective observational cohort study with additional pre-intervention comparator group	Mixed	Yes	+	(+?)	Generally well designed/reported study, although some potential for selection bias.
Thompson 1998	Before and after study	Poor	Yes	X	X	No adjustment for potential confounding in analysis of timing of initiation of antenatal care, small sample size, outcome data only presented in graphical form, no protection against secular changes.
Willis 2004	Prospective observational cohort study	Poor	Unclear	X	X	Intervention and control groups drawn from different sampling frames, intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care, intervention group included in comparison group.
(1) Quality assessment (GATE criteria)						
(2) Authors' conclusion						
(3) Reviewers' assessment						
Good	Well reported and reliable;	+	Statistically significant beneficial effect on PTB/IM	+	+	Study demonstrates a beneficial effect
Mixed	Some weaknesses but insufficient to have an important effect on usefulness of study;	(+)	Effect consistent with beneficial effect but effect not statistically significant and/or cautious interpretation of finding suggested	(+?)	(+?)	Study inconclusive but may demonstrate a beneficial effect
Poor	Study not reliable, not useful	X	No evidence of beneficial effect	X	X	Study does not provide convincing evidence of a beneficial effect
		0	No conclusion stated	N/A	N/A	Not applicable – outcome not assessed

¹A number of the included studies reported timing of initiation of antenatal care by trimester or other similar measure and assessed whether there was a trend towards earlier initiation. The conclusion reported here relates to the test of effectiveness reported by the author.

Table 5. Effectiveness of interventions involving alternative models of clinic-based antenatal care

Author and year	Design	Assessment of internal validity ⁽¹⁾	Timing of antenatal care initiation clearly an outcome measure?	Timing of antenatal care initiation outcome results		Comments
				Authors' conclusion ⁽²⁾	Reviewer assessment ⁽³⁾	
Martin 1997	Before and after study	Poor	Unclear	X	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care, small sample size, no protection against secular changes.
Morris 1993	Retrospective observational cohort study	Poor	Unclear	+	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care.
Mvula 1998	Prospective observational cohort study	Poor	Unclear	X	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care.
Newschaffer 1998	Retrospective observational cohort study	Poor	Unclear	(+)	X	No adjustment for potential confounding in analysis of timing of initiation of antenatal care.
Reichman 1996	Retrospective observational cohort study	Poor	Unclear	0	X	Intervention and control groups differ with respect to important risk factors, no adjustment for potential confounding in analysis of timing of initiation of antenatal care.
(1) Quality assessment (GATE criteria)						
Good	Well reported and reliable;		(2) Authors' conclusion		(3) Reviewers' assessment	
Mixed	Some weaknesses but insufficient to have an important effect on usefulness of study;		+	Statistically significant beneficial effect on PTB/IM	+	Study demonstrates a beneficial effect
Poor	Study not reliable, not useful		(+)	Effect consistent with beneficial effect but effect not statistically significant and/or cautious interpretation of finding suggested	(+?)	Study inconclusive but may demonstrate a beneficial effect
			X	No evidence of beneficial effect	X	Study does not provide convincing evidence of a beneficial effect
			0	No conclusion stated	N/A	Not applicable – outcome not assessed
			N/A	Not applicable – outcome not assessed		

¹A number of the included studies reported timing of initiation of antenatal care by trimester or other similar measure and assessed whether there was a trend towards earlier initiation. The conclusion reported here relates to the test of effectiveness reported by the author.

5 Discussion

5.1 Principal findings

The purpose of this review was to systematically identify and evaluate the evidence relating to the effectiveness of interventions, relevant in the context of the NHS, which aim to increase the early initiation of comprehensive antenatal care in socially disadvantaged and vulnerable women.

We identified over thirty potentially relevant interventions (see Annex B) but only 16 eligible evaluation studies: eleven of the sixteen related to community-based interventions involving outreach or community based services designed to increase the early initiation of antenatal care; and five studies evaluated the effect of alternative models of organising and delivering antenatal care on the timing of initiation of antenatal care.

Of the eleven studies relating to community-based interventions, three evaluated interventions which consisted solely of social support and/or home visits delivered by lay or paraprofessional workers, one evaluated the provision of bilingual 'linkworkers' (working in both primary care and obstetric clinics), one evaluated a 'mobile women's health bus', and six evaluated other, multi-component interventions.

Of the five studies relating to alternative models of organising and delivering antenatal care, two evaluated 'teen clinics', one evaluated a 'neighbourhood clinic' and two evaluated 'enhanced prenatal care' models.

We found eligible studies relating to only a few of the disadvantaged and vulnerable groups of interest: four interventions targeted pregnant teenagers, seven targeted and/or were evaluated in socially disadvantaged 'ethnic minority' populations (including Australian indigenous women and non-native language speakers), and five were aimed at socio-economically disadvantaged women. We did not find eligible studies relating to interventions seeking to increase early initiation of antenatal care in other vulnerable or 'at risk' subgroups such as homeless women, travellers, refugees, substance and alcohol users and women with mental health problems or learning disabilities.

Overall, the quality of evidence was poor. We did not identify any eligible randomised controlled trials (RCTs) and only one study - a retrospective cohort study with an additional pre-intervention comparator group - was assessed as having adequate internal validity.⁴⁵ This study evaluated a *Resource Mothers Program*, which used paraprofessional women to deliver social support, health promotion/education and other assistance to pregnant adolescents at home and for one year after delivery. The evaluation, which was conducted in a predominantly black, non-urban US population found that the intervention was effective in increasing the proportion of pregnant adolescents initiating antenatal care by the fourth month of pregnancy. This intervention could be considered to address barriers to care grouped under two of the three headings suggested by Cooper's access model.²¹ Personal and family barriers were addressed by the provision of culturally-appropriate antenatal education and social support, delivered by the 'resource mothers', many of whom had been teenage mothers themselves. The resource mothers facilitated access to antenatal care by acting as an advocate and drawing attention to the needs of the adolescents within the healthcare system. Structural barriers to care were attenuated by the resource mother following up appointments and arranging transportation. Therefore, this intervention moved beyond simply providing services, an approach criticised by Lavender and colleagues,¹⁰ while also taking into account the complex interplay between individuals and healthcare services.^{27,57} It would also appear to address the differential conceptualisation of health described by Dixon-Woods as associated with socially disadvantaged groups,²⁷ in particular the lack of appreciation of preventive care, as one of the roles of the resource mother was to emphasise the need for "early and regular prenatal care". The intervention was adequately described and contained some potentially transferable elements but the generalisability of the findings to a UK population is unknown. For example, routes of referral into the programme included WIC (a US specific welfare programme) and churches.

Evidence relating to other interventions was inconclusive due to the methodological limitations of the included studies. However, although their effectiveness is unproven, some of the interventions identified in this review included elements of potential relevance in the UK which the reviewers considered might plausibly affect the timing of initiation of antenatal care in socially disadvantaged and vulnerable groups. These included:

- Mobile health clinics, providing free walk-in or appointment services including initial antenatal care.⁴⁹ This intervention strategy may address structural barriers to care such as lack of transportation or the need to negotiate an appointment system. Another outcome evaluation of a similar intervention in the USA has recently been published⁵⁸ (outside the time period of this review), reporting a beneficial effect of the intervention consistent with the conclusions of the evaluation included in the present review.
- Linkworkers situated in GP surgeries, acting as “‘facilitators’ and ‘interpreters’ whilst also fulfilling an educative role”.⁴² This form of intervention may work well for some ethnic minority groups and women for whom language difficulties may be a barrier to antenatal care. The included evaluation showed no effect on the proportion of women booking before 12 weeks. However, the included study was not well designed to evaluate the effect on this outcome.
- Culturally appropriate community-based programmes, where lay women encourage greater use of antenatal care through integrating traditional beliefs and practices alongside more conventional antenatal education.⁴¹ Programmes such as this are most likely to influence personal barriers to care such as acceptability, attitudes/beliefs and cultural preferences. Although this intervention targets a subgroup which has no directly equivalent group in the UK, the emphasis on addressing cultural beliefs and practices is considered relevant to ethnic minority groups in the UK.

These interventions merit further consideration and possibly further, more robust evaluation in a UK setting.

5.2 Strengths and limitations of this systematic review

We used a comprehensive, multi-stage search strategy which enabled us to identify a wide range of relevant interventions described in the literature. The relatively small number of studies eligible for inclusion in this systematic review reflects the paucity of effectiveness evaluations in this area.

We did not restrict inclusion to specific study designs, other than requiring some form of comparator/control group, and hence the material described here reflects the breadth of the effectiveness evidence available in the scientific literature. Given some of the reporting limitations of the included material, we found it challenging to develop reproducible inclusion/exclusion criteria relating to the aims of the intervention/evaluation. We resolved this by including studies where the reviewers could not easily reach a consensus as to whether or not the timing of initiation of antenatal care was reported as an outcome measure. We considered that this inclusive approach was preferable to excluding potentially relevant studies but a consequence is that we have included some studies – particularly those relating to alternative models of organising and delivering clinic-based antenatal care – of questionable relevance. A further consequence of this was that we assessed internal validity of the study in relation to the estimated effect of the intervention on the timing of initiation of antenatal care, even when this was not necessarily the aim of the study. This enabled us to assess whether the study provided robust evidence of an effect on timing of initiation of antenatal care. However, our quality assessments should not be interpreted as reflecting the quality of the study in relation to the aims stated by the author where these are different from the effectiveness question addressed by this review.

For pragmatic reasons, we did not include evaluations reported in the grey literature. We identified but did not include a small number of potentially relevant studies in the grey literature: these were predominantly identified through screening references of

included studies, rather than through the bibliographic database searches, and most related to interventions targeting Australian indigenous women. Although the inclusion of such studies would potentially have added to the descriptive elements of this review, we consider it unlikely that the inclusion of such reports would have influenced our conclusions regarding effectiveness.

The generalisability of findings and the transferability of interventions present a methodological challenge in reviews of this kind. By developing inclusion criteria based on a conceptual 'barriers to care' model²¹ we were able to operationalise criteria that enabled us to exclude a number of structural and financial interventions not relevant in the context of a publicly funded universal healthcare system. We were thus able to focus on interventions most likely to be relevant in the context of the NHS. We note above some issues relating to both transferability and generalisability of findings to other populations but this is an area where further theoretical work to develop a conceptual framework might be helpful.

5.3 Findings in relation to other published evidence

Three published literature reviews have evaluated the effect of different antenatal intervention strategies on a range of outcomes and have included results relating to the timing of initiation of antenatal care. Rumbold and Cunningham evaluated the effect of changes in the delivery of antenatal care on outcomes for Australian indigenous women.³⁰ Four of the ten interventions included in this review reported timing of initiation of antenatal care as an outcome.⁵⁹⁻⁶² Two of these reported a statistically significant beneficial effect on timing of initiation of antenatal care: one was a community based support programme for pregnant women (included in the present review),⁶⁰ and the other a "culturally appropriate midwifery program".⁵⁹ The latter intervention was not included in the present review as the relevant results were reported only in the grey literature. Neither of the two interventions identified in the Rumbold review as having no effect on timing of initiation were included in the present review, both because the comparator groups did not meet our eligibility criteria.^{62,63} In discussing their results, the authors comment on the challenges of synthesising results across different studies, referring in particular to the lack of consistency in outcomes and the diversity of comparison groups. However, they conclude that the results suggest "modest increases in indicators of antenatal care utilization, most notably increases in the proportion of women accessing antenatal care in the first trimester".³⁰

A second relevant literature review by Persily evaluated the effect of lay home visiting on pregnancy outcomes.³¹ In Persily's review, all eight studies that reported an effect on antenatal care use found a beneficial effect of the intervention. However, only four of these studies looked specifically at timing of initiation of antenatal care. Three of these studies are included in the present review and described in some detail in earlier sections.^{45,48,55} The fourth study evaluated the effect of a lay home visiting programme targeted at Hispanic pregnant women in an urban area,⁶⁴ and was excluded in the present review because it used an ineligible control group. The author of this review highlighted the methodological weaknesses of included studies, but nevertheless concluded that "lay workers may be especially successful in...impacting on social and environmental risk factors as well as on health care utilization".³¹

The review conducted by D'Souza and Garcia³² considered a variety of different interventions to improve perinatal outcomes, evaluated in different subgroups of disadvantaged women. Only one intervention described in their report looked at timing of initiation of antenatal care. This intervention - health advocacy for ethnic minority women⁶⁵ - was assessed as unlikely to have a beneficial impact on late booking for antenatal care. This intervention was not included in the present review because the timing of initiation of antenatal care was reported as a continuous measure (mean gestational age at 'booking'), and it was not possible to derive the proportion of women booking by a given date from the data reported. D'Souza and Garcia comment on the

limited evidence of effectiveness across all the studies reviewed, concluding that little or no reliable evidence is available regarding promising interventions applicable to disadvantaged groups of pregnant women in the UK.³²

Overall, our findings are broadly consistent with the results of these previous reviews, and echo the authors' conclusions about the methodological limitations of the available evidence.

5.4 Implications and recommendations

The results of this review, considered alongside the existing literature on this topic, suggest that there is insufficient evidence to recommend that any of the interventions described in the literature should be implemented as a means of increasing the early initiation of antenatal care in socially disadvantaged and vulnerable groups of pregnant women. In reviewing the included studies, we focussed specifically on the timing of initiation of antenatal care, although this was not the primary outcome of many of the included studies. Our findings do not therefore necessarily indicate that the included interventions do not have a beneficial effect on other outcomes, for example improved adherence to a recommended schedule of appointments once antenatal care is initiated.

Major methodological and/or reporting weaknesses were identified in many of the included studies. Such fundamental methodological flaws need to be avoided through the careful design of future evaluations. Poor reporting, another weakness observed in many of the studies, might be minimised by adherence to relevant reporting guidelines such as SQUIRE⁶⁶ (quality improvement studies) and STROBE⁶⁷ (observational studies in epidemiology).

All of the evaluations included in this review were observational studies. The potential weaknesses of such study designs have been well documented. RCTs are considered the most robust design for assessing effectiveness, although we are aware that many of the interventions considered in this review would have been challenging to evaluate using standard randomised approaches such as cluster or individually randomised RCTs. However, a variety of experimental methods potentially suitable for 'complex' interventions have been proposed.⁶⁸ Furthermore, it may be possible to greatly improve the quality of evaluations without recourse to standard randomised designs. For example a controlled before and after study (CBA) can provide moderately robust evidence provided that the study is carefully planned and conducted and the control group is appropriately selected to create study groups with similar 'baseline' characteristics.

Although we did not identify interventions for which there was sound evidence of effectiveness, our review nevertheless identified a number of interventions that could plausibly affect the timing of initiation of antenatal care and which were considered to be potentially relevant in the UK context. Some of these might provide a means of addressing the concern raised by Dixon-Woods et al. in their review on access to healthcare for vulnerable groups that "many interventions and policies are not well matched to what we have identified as the major barriers to access".²⁴ The material identified during this review (including the interventions described in the literature for which no eligible evaluations were found) provides a source of data that might be further 'mined' to identify the interventions which most plausibly address the barriers to accessing antenatal care experienced by socially disadvantaged and vulnerable groups in the UK. In particular, further work might usefully be undertaken to explore and describe the mechanisms of action and barriers addressed by some of the more relevant interventions, in combination with a synthesis of the qualitative literature aimed at identifying the barriers to and facilitators of antenatal care uptake by socially disadvantaged and vulnerable subgroups in the UK. A synthesis of these two sets of findings could potentially guide future service development and research priorities by identifying the interventions which best address the 'barriers and facilitators' relevant in the UK context.

5.5 Conclusion

In summary, we found insufficient evidence to conclude that interventions that aim to increase the early initiation of antenatal care in socially disadvantaged and vulnerable populations of women are effective. However, the absence of evidence should not be interpreted as evidence that the interventions evaluated are necessarily ineffective. One intervention based on home visiting for pregnant adolescents was considered 'promising', and several other intervention strategies were considered to contain elements that would merit further consideration and possibly evaluation. Overall, the results of this review highlight the paucity of evidence and the need for further well designed evaluations to ensure that services designed to increase the early initiation of antenatal care are evidence based.

Acknowledgement

This is an independent report from a study which is funded by the Policy Research Programme in the Department of Health. The views expressed are not necessarily those of the Department.

References

1. National Institute for Clinical Excellence (NICE). Antenatal care: routine care for the healthy pregnant woman (clinical guideline). London: NICE, 2008.
2. Confidential Enquiry into Maternal and Child Health (CEMACH). *Perinatal Mortality 2007*. London: CEMACH, 2009.
3. Department of Health. *Implementation Plan for Reducing Health Inequalities in Infant Mortality: A Good Practice Guide*. London: DH, 2007.
4. House of Commons Health Committee. *Inequalities in access to maternity services: eighth report of session 2002-03*. London: The Stationery Office, 2003. <http://www.parliament.the-stationery-office.co.uk/pa/cm200203/cmselect/cmhealth/696/696.pdf>
5. Department of Health. *Maternity Matters: Choice, access and continuity of care in a safe service*. London: DH, 2007.
6. Department of Health. *The NHS in England: the Operating Framework for 2008/09*. London: DH, 2007.
7. HM Government. *PSA Delivery Agreement 19: Ensure better care for all*. London: HMSO, 2007.
8. Redshaw M, Rowe RE, Hockley C, Brocklehurst P. *Recorded delivery: a national survey of women's experience of maternity care*. Oxford: National Perinatal Epidemiology Unit, 2006.
9. Rowe RE, Garcia J. Social class, ethnicity and attendance for antenatal care in the United Kingdom: a systematic review. *J Public Health* 2003; 25(2):113-119.
10. Lavender T, Downe S, Finnlayson K, Walsh D. *Access to antenatal care: a systematic review*: University of Central Lancashire, 2007.
11. Kupek E, Petrou S, Vause S, Maresh M. Clinical, provider and sociodemographic predictors of late initiation of antenatal care in England and Wales. *BJOG: An International Journal of Obstetrics and Gynaecology* 2002; 109(3):265-273.
12. Rowe RE, Magee H, Quigley MA, Heron P, Askham J, Brocklehurst P. Social and ethnic differences in attendance for antenatal care in England. *Public Health* 2008; 122(12):1363-1372.
13. Essex C, Counsell AM, Geddis DC. The demographic characteristics of early and late attenders for antenatal care. *Australian & New Zealand Journal of Obstetrics & Gynaecology* 1992; 32(4):306-308.
14. Delvaux T, Buekens P, Godin I, Boutsen M. Barriers to prenatal care in Europe. *American Journal of Preventive Medicine* 2001; 21(1):52-59.
15. Trinh L, Rubin G. Late entry to antenatal care in New South Wales, Australia. *Reproductive Health* 2006; 3(1):8.
16. Alderliesten ME, Vrijkotte TGM, van der Wal MF, Bonsel GJ. Late start of antenatal care among ethnic minorities in a large cohort of pregnant women. *BJOG: An International Journal of Obstetrics & Gynaecology* 2007; 114(10):1232-1239.
17. Raatikainen K, Heiskanen N, Heinonen S. Under-attending free antenatal care is associated with adverse pregnancy outcomes. *BMC Public Health* 2007; 7(1):268.
18. Lalchandani S, MacQuillan K, Sheil O. Obstetric profiles and pregnancy outcomes of immigrant women with refugee status. *Irish Medical Journal* 2001; 94(3):79-80.

19. Braveman P, Marchi K, Egarter S, Pearl M, Neuhaus J. Barriers to Timely Prenatal Care Among Women With Insurance: The Importance of Prepregnancy Factors. *Obstetrics & Gynecology* 2000; 95(6, Part 1):874-880.
20. Gulzar L. Access to Health Care. *Journal of Nursing Scholarship* 1999; 31(1):13-19.
21. Cooper LA. Designing and evaluating interventions to eliminate racial and ethnic disparities in health care. *Journal of General Internal Medicine* 2002; 17(6):477.
22. Szczepura A. Access to health care for ethnic minority populations. *Postgrad Med J* 2005; 81(953):141-147.
23. Bragg R, Cook J. Money and Maternity: charging vulnerable pregnant women for NHS care. *UK Public Health Association Conference*. Brighton, UK, 2009.
24. Dixon Woods M, Kirk D, Agarwal S, Annandale E, Arthur T, Harvey J, et al. *Vulnerable groups and access to health care: a critical interpretive review*: NHS Service Delivery and Organisation R & D (NCCSDO), 2005.
25. Neale J. Barriers to accessing generic health and social care services: a qualitative study of injecting drug users. *Health & Social Care in the Community* 2008; 16(2):147.
26. Downe S, Finlayson K, Walsh D, Lavender T. 'Weighing up and balancing out': a meta-synthesis of barriers to antenatal care for marginalised women in high-income countries. *BJOG: An International Journal of Obstetrics & Gynaecology* 2009; 116(4):518-529.
27. Dixon-Woods M, Cavers D, Agarwal S, Annandale E, Arthur A, Harvey J, et al. Conducting a critical interpretive synthesis of the literature on access to healthcare by vulnerable groups. *BMC Medical Research Methodology* 2006; 6:35.
28. Acheson D. *Independent Inquiry into Inequalities in Health*. London: HMSO, 1998.
29. Short R. *Perinatal and neonatal mortality. Second Report from the Social Services Committee 1979-80*. London: HMSO, 1980.
30. Rumbold A, Cunningham J. A Review of the Impact of Antenatal Care for Australian Indigenous Women and Attempts to Strengthen these Services. *Maternal and Child Health Journal* 2008; 12(1):83-100.
31. Persily CA. Lay Home Visiting May Improve Pregnancy Outcomes. *Holistic Nursing Practice* 2003; 17(5):231-238.
32. D'Souza L, Garcia J. Improving services for disadvantaged childbearing women. *Child: Care, Health & Development* 2004; 30(6):599-611.
33. Fiscella K. Does prenatal care improve birth outcomes? A critical review. *Obstetrics & Gynecology* 1995; 85(3):468-479.
34. Bryce RL, Stanley FJ, Garner JB. Randomized controlled trial of antenatal social support to prevent preterm birth. *British Journal of Obstetrics and Gynaecology* 1991; 98(10):1001-1008.
35. Moore ML, Meis PJ, Ernest JM, Wells HB, Zaccaro DJ, Terrell T. A randomized trial of nurse intervention to reduce preterm and low birth weight births. *Obstetrics and Gynecology* 1998; 91(5 Pt 1):656-661.
36. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. *American Journal of Public Health* 1994; 84(9):1414-1420.

37. Organisation for Economic Co-operation and Development (OECD). OECD Health Data 2009: Statistics and Indicators for 30 Countries: <http://www.oecd.org/health/healthdata, 2009>.
38. Hollowell J, Gray R, Kurinczuk JJ, Oakley L, Brocklehurst P. A systematic review of the effectiveness of antenatal care programmes to reduce infant mortality and its major causes in socially disadvantaged and vulnerable women Oxford: National Perinatal Epidemiology Unit, 2009.
39. Jackson R. The GATE frame: critical appraisal with pictures. *Quality & Safety in Health Care* 2006; 11(2):35.
40. Thomas J. Information systems for conducting systematic reviews: a case study. Sixth International Campbell Colloquium. Los Angeles, 22-24 February 2006. Poster available at <http://eppi.ioe.ac.uk/cms/>.
41. Mackerras D. Birthweight changes in the pilot phase of the Strong Women Strong Babies Strong Culture Program in the Northern Territory. *Australian & New Zealand Journal of Public Health* 2001; 25(1):34-40.
42. Mason ES. The Asian Mother and Baby Campaign (the Leicestershire experience). *Journal of the Royal Society of Health* 1990; 110(1):1-4.
43. Thompson M, Curry MA, Burton D. The effects of nursing case management on the utilization of prenatal care by Mexican-Americans in rural Oregon. *Public Health Nursing* 1998; 15(2):82-90.
44. Martin RD, MacDowell NM, Macmann JM. Effectiveness of a teen pregnancy clinic in a managed care setting. *Managed Care Quarterly* 1997; 5(3):20-7.
45. Rogers MM, Peoples-Sheps MD, Suchindran C. Impact of a social support program on teenage prenatal care use and pregnancy outcomes. *Journal of Adolescent Health* 1996; 19(2):132-40.
46. Jewell NA, Russell KM. Increasing access to prenatal care: an evaluation of minority health coalitions' early pregnancy project. *Journal of Community Health Nursing* 2000; 17(2):93-105.
47. Cramer ME, Chen L-W, Roberts S, Clute D. Evaluating the social and economic impact of community-based prenatal care. *Public Health Nursing* 2007; 24(4):329-36.
48. Daaleman TP. The effect of a paraprofessional home visiting program on utilization of prenatal care. *Kansas Medicine* 1997; 98(2):6-9.
49. Edgerley L, El-Sayed Y, Druzin M, Kiernan M, Daniels K. Use of a Community Mobile Health Van to Increase Early Access to Prenatal Care. *Maternal and Child Health Journal* 2007; 11(3):235-239.
50. Hunte HER, Turner TM, Pollack HA, Lewis EY. A birth records analysis of the maternal infant health advocate service program: A paraprofessional intervention aimed at addressing infant mortality in African Americans. *Ethnicity and Disease* 2004; 14(3 SUPPL. 1):S1-102-S1-107.
51. Morris DL, Berenson AB, Lawson J, Wiemann CM. Comparison of adolescent pregnancy outcomes by prenatal care source. *Journal of Reproductive Medicine for the Obstetrician and Gynecologist* 1993; 38(5):375-380.
52. Reichman NE, Florio MJ. The effects of enriched prenatal care services on Medicaid birth outcomes in New Jersey. *Journal of Health Economics* 1996; 15(4):455-76.

53. Willis WO, Eder CH, Lindsay SP, Chavez G, Shelton ST. Lower Rates of Low Birthweight and Preterm Births in the California Black Infant Health Programs. *Journal of the National Medical Association* 2004; 96(3):315-324.
54. Mvula MM, Miller Jr JM. A comparative evaluation of collaborative prenatal care. *Obstetrics and Gynecology* 1998; 91(2):169-173.
55. Julnes G, Konefal M, Pindur W, Kim P. Community-based perinatal care for disadvantaged adolescents: evaluation of The Resource Mothers Program. *Journal of Community Health* 1994; 19(1):41-53.
56. Newschaffer CJ, Cocroft J, Hauck WW, Fanning T, Turner BJ. Improved birth outcomes associated with enhanced Medicaid prenatal care in drug-using women infected with the human immunodeficiency virus. *Obstetrics and Gynecology* 1998; 91(6):885-891.
57. Sword W. A socio-ecological approach to understanding barriers to prenatal care for women of low income. *Journal of Advanced Nursing* 1999; 29(5):1170-1177.
58. O'Connell E, Zhang G, Leguen F, Prince J Impact of a Mobile Van on Prenatal Care Utilization and Birth Outcomes in Miami-Dade County. *Maternal and Child Health Journal* 2009, DOI: 10.1007/s10995-009-0496-8 (published online: 15 August 2009)
59. Daruk Aboriginal Community Controlled Medical Service. Evaluation of the Daruk Antenatal Program 1998. Sydney: Daruk Aboriginal Medical Service and Western Public Health Unit, 1998.
60. Mackerras D. Evaluation of the Strong Women, Strong Babies, Strong Culture Program: Results for the period 1990–1996 in the three pilot communities. Issue No. 2/98. Darwin, Northern Territory: Menzies Occasional Papers, 1998.
61. Perkins S, Simon S. The Ngua Gundi (Mother/Child) Project 1997–2000. Queensland, Australia: Queensland Health, 2000.
62. Carter E, Lumley J, Wilson G, Bell S. 'Alukura...for my daughters and their daughters and their daughters'. A review of Congress Alukura. *Australian and New Zealand Journal of Public Health* 2004; 28(3):229-234.
63. Dorman R. The Ngua Gundi (mother and child) program. *Aboriginal and Islander Health Worker Journal* 1997; 21(5):2-6.
64. Bray M, Edwards L. A primary health care approach using Hispanic outreach workers as nurse extenders. *Public Health Nursing* 1994; 11(1):7-11.
65. Parsons L, Day S. Improving obstetric outcomes in ethnic minorities: an evaluation of health advocacy in Hackney. *Journal of Public Health* 1992; 14(2):183-191.
66. Ogrinc G, Mooney SE, Estrada C, Foster T, Goldmann D, Hall LW, et al. The SQUIRE (Standards for Quality Improvement Reporting Excellence) guidelines for quality improvement reporting: explanation and elaboration. *Qual Saf Health Care* 2008; 17(Suppl_1):i13-32.
67. Vandembroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. *PLoS Med* 2007; 4(10):e297.
68. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008; 337:a1655.

69. Murrell NL, Scherzer T, Ryan M, Frappier N, Abrams A, Roberts C. The AfterCare Project: an intervention for homeless childbearing families. *Family & Community Health* 2000; 23(3):17-27.
70. Covington D, Peoples-Shep MD, Paul A, Buescher PA, Bennett TA, Paul MV. An Evaluation of an Adolescent Prenatal Education Program. *American Journal of Health Behavior* 1998; 22(5):323-333.
71. Jansson LM, Svikis D, Lee J, Paluzzi P, Rutigliano P, Hackerman F. Pregnancy and addiction. A comprehensive care model. *Journal of Substance Abuse Treatment* 1996; 13(4):321-9.
72. Affonso DD, Mayberry LJ, Graham K, Shibuya J, Kunimoto J. Prenatal and Postpartum Care in Hawaii: A Community-Based Approach. *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 1993; 22(4):320-328.
73. Jan S, Conaty S, Hecker R, Bartlett M, Delaney S, Capon T. An holistic economic evaluation of an Aboriginal community-controlled midwifery programme in Western Sydney. *J Health Serv Res Policy* 2004; 9(1):14-21.
74. McFarlane J. De Madres a Madres: an access model for primary care. *American Journal of Public Health* 1996; 86(6):879-80.
75. McFarlane J, Fehir J. De Madres a Madres: A community, primary health care program based on empowerment. *Health Education Quarterly* 1994; 21(3):381-394.
76. McFarlane J, Kelly E, Rodriguez R, Fehir J. De Madres a Madres: women building community coalitions for health. *Health Care for Women International* 1994; 15(5):465-76.
77. Rodriguez R, McFarlane J, Mahon J, Fehir J. De Madres a Madres: a community partnership to increase access to prenatal care. *Bulletin of the Pan American Health Organization* 1993; 27(4):403-8.
78. Jeffers DF. Outreach childbirth education classes for low-income families: a strategy for program development. *AWHONNS Clinical Issues in Perinatal & Womens Health Nursing* 1993; 4(1):95-101.
79. Ovrebo B, Ryan M, Jackson K, Hutchinson K. The Homeless Prenatal Program: A model for empowering homeless pregnant women. *Health Education Quarterly* 1994; 21(2):187-198.
80. Clarke LL, Miller MK, Vogel WB, Davis KE, Mahan CS. The effectiveness of Florida's "Improved Pregnancy Outcome" program. *Journal of Health Care for the Poor & Underserved* 1993; 4(2):117-32.
81. Clinton B. The Maternal Infant Health Outreach Worker project: Appalachian communities help their own. In: Larner M, Halpern R, Harkavy O, editors. *Fair Start for Children: Lessons learned from seven demonstration projects*. New Haven: Yale University Press, 1992:23-45.
82. Tessaro I, Campbell M, O'Meara C, Herrick H, Buescher P, Meyer R, et al. State health department and university evaluation of North Carolina's Maternal Outreach Worker Program. *American Journal of Preventive Medicine* 1997; 13((6 Suppl)):38-44.
83. Panaretto KS, Lee HM, Mitchell MR, Larkins SL, Manassis V, Buettner PG, et al. Impact of a collaborative shared antenatal care program for urban Indigenous women: a prospective cohort study. *Medical Journal of Australia* 2005; 182(10):514-9.

84. Andrus NC, Partner SF, Leppert PC. Analyzing strategies for developing a prenatal health care outreach program to reduce social and cultural barriers. *Journal of Health & Human Services Administration* 1997; 20(2):230-41.
85. Dwyer C, Cooke H, Hort K. Bringing accessible antenatal care to disadvantaged women in outer western Sydney. *Australian Journal of Primary Health* 2004; 10(3):67-75.
86. Clark M. The Peer Support Programme: young mothers offering support to young pregnant women in a clinic setting. *Birth Issues* 2000; 9(2):47-53.
87. Reguero W, Crane M. Project MotherCare: one hospital's response to the high perinatal death rate in New Haven, CT. *Public Health Reports* 1994; 109(5):647-52.
88. Nagy M, Leeper JD, Hullet-Robertson S, Northrup RS. The Rural Alabama Pregnancy and Infant Health project: A rural clinic reaches out. In: Larner M, Halpern R, Harkavy O, editors. *Fair Start for Children: Lessons learned from seven demonstration projects*. New Haven: Yale University Press, 1992:91-114.
89. Baldwin M, Stevenson Y. A model for providing prenatal health care to indigenous women living in remote areas. *International Journal of Circumpolar Health* 2001; 60(4):623-31.
90. Mattson S, Lew L. Culturally sensitive prenatal care for Southeast Asians. *JOGNN - Journal of Obstetric, Gynecologic, & Neonatal Nursing* 1992; 21(1):48-54.
91. Flynn L, Budd M, Modelski J. Enhancing Resource Utilization Among Pregnant Adolescents. *Public Health Nursing* 2008; 25:140-148.
92. Reece EA, Leguizamon G, Silva J, Whiteman V, Smith D. Intensive interventional maternity care reduces infant morbidity and hospital costs. *Journal of Maternal-Fetal & Neonatal Medicine* 2002; 11(3):204-10.
93. Dewart T, Zaengle D. The Door's Perinatal Program for Pregnant and Parenting Teens. *Journal of Perinatal Education* 2000; 9(2):39-46.
94. Meister JS, Warrick LH, de Zapién JG, Wood AH. Using lay health workers: Case study of a community-based prenatal intervention. *Journal of Community Health* 1992; 17(1):37-51.

Annex A: Medline search strategy

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1950 to Present>

Search Strategy:

-
- 1 exp Socioeconomic Factors/ or exp Social Class/
 - 2 (equity or inequalit\$ or equalit\$ or unequal\$ or inequit\$ or disparit\$ or gap or gaps or gradient\$ or disadvantage\$ or socioeconomic\$).ti,ab.
 - 3 health inequalit\$.mp. or Health Status Indicators/ or *Health Status Disparities/ or *Healthcare Disparities/
 - 4 exp Poverty/ or exp Medical Indigency/ or vulnerable populations/
 - 5 exp Minority Health/ or exp Minority Groups/ or population groups/ or exp ethnic groups/ or health services, indigenous/
 - 6 (ethnic or (black adj2 asian)).ti,ab.
 - 7 (multiethnic\$ or multi ethnic\$ or multiracial\$ or multi racial\$).ti,ab.
 - 8 exp Prisoners/ or prison*.ti,ab.
 - 9 exp refugees/ or "Emigrants and Immigrants"/ or "Transients and Migrants"/
 - 10 (immigrant* or refugee* or migrant* or asylum seeker*).ti,ab.
 - 11 exp gypsies/ or travel?er*.ti,ab.
 - 12 exp Homeless Youth/ or exp Homeless Persons/ or homeless\$.ti,ab.
 - 13 exp Spouse Abuse/ or Domestic Violence/ or exp battered women/
 - 14 ((abuse\$ or violen\$) adj4 (partner\$ or wife or wives or spouse\$ or domestic)).ti,ab.
 - 15 ((neighbo?rhood or economic or rural or urban) adj2 (depriv\$ or poverty)).ti,ab.
 - 16 (disadvantag* or deprived area* or innercit* or inner cit*).ti,ab.
 - 17 Mental Disorders/ or exp eating disorders/ or exp mood disorders/ or exp "schizophrenia and disorders with psychotic features"/
 - 18 ((mental\$ or psych\$) adj2 (ill\$ or disorder\$ or impair\$ or disturb\$ or disabil\$)).ti,ab.
 - 19 Learning Disorders/ or Mental Deficiency/
 - 20 ((mental\$ or learning or cognitiv\$) adj2 (retard\$ or handicap\$ or disab\$ or difficult\$ or impair\$)).ti,ab.
 - 21 exp Prostitution/ or sex worker*.ti,ab.
 - 22 Adolescent Health Services/ or exp Adolescent/ or exp Pregnancy in Adolescence/
 - 23 (teen\$ or youth\$ or adolescen\$).ti,ab.
 - 24 exp HIV Infections/ or HIV/
 - 25 (HIV or HIV-pos\$ or HIV-inf\$).ti,ab.
 - 26 exp Street Drugs/ or exp Narcotics/ or exp Cocaine/ or exp Crack Cocaine/ or exp Heroin/ or exp amphetamines/ or exp methadone/ 27 exp substance-related disorders/ or exp Substance Abuse, Intravenous/ or exp amphetamine-related disorders/ or exp cocaine-related disorders/ or exp marijuana abuse/ or exp opioid-related disorders/ or exp heroin dependence/ or exp phencyclidine abuse/ or exp psychoses, substance-induced/ or exp substance abuse, intravenous/ or substance withdrawal syndrome/
 - 28 exp alcohol-related disorders/ or exp alcoholism/ or exp alcohol-induced disorders/
 - 29 exp Circumcision, Female/

30 (female adj (genital mutilation or circumcision or genital cutting)).ti,ab.
31 (clitoridectomy or infibulation).ti,ab.
32 ((language adj3 (second or problem* or additional or barrier*)) or translat* or interpreter*).ti,ab.
33 exp communication barriers/ or exp language/
34 exp culture/ or exp cultural characteristics/ or exp cultural diversity/
35 ((cultur* or sociocultur* or socio-cultur*) adj5 (barrier* or differen* or practice* or sensitiv* or appropriate*)).ti,ab.
36 or/1-35
37 exp Prenatal Care/ or maternal health services/
38 ((antenatal or prenatal) adj2 (care or clinic or program* or service*)).ti,ab.
39 exp Midwifery/
40 or/37-39
41 outreach.ti,ab.
42 41 and 40
43 ((utilis\$ or utiliz\$ or barrier\$ or access\$ or uptake or initiate or initiation or booking) adj5 (prenatal or antenatal or care)).ti,ab.
44 ((late or early) adj5 (uptake or initiat\$ or attend\$ or booking)).ti,ab.
45 (43 or 44) and 40
46 Prenatal Care/ut [Utilization]
47 (42 or 45 or 46) and 36
48 limit 47 to in process
49 limit 47 to in data review
50 limit 47 to pubmed not medline
51 or/48-50
52 47 not 51
53 limit 52 to humans
54 51 or 53 (1622)
55 limit 54 to (english language and yr="1990 - 2009")
56 case reports/
57 (letter or review or comment or editorial or letter or news).pt.
58 55 not (56 or 57)

Annex B: Named intervention searches

In our second round of searches, we used the following list of (potentially eligible) named interventions for text searching:

AfterCare Project ⁶⁹
Asian Mother and Baby Campaign ⁴²
Baby Talk ⁷⁰
California Black Infant Health Program ⁵³
Center for Addiction and Pregnancy⁷¹
Community Health Nursing Prenatal Care Program ⁷²
Congress Alukura ⁶²
Daruk Antenatal Program ⁷³
De Madres a Madres^{74 75 76 77}
Florida Outreach Childbirth Education Project ⁷⁸
HealthStart ⁵²
Homeless Prenatal Program ⁷⁹
Improved Pregnancy Outcome ⁸⁰
Kansas Healthy Start Home Visiting Program ⁴⁸
Maternal Infant Health Advocate Service ⁵⁰
Maternal Infant Health Outreach Worker ⁸¹
Maternal Outreach Worker ⁸²
Minority Health Coalitions' Early Pregnancy Project ⁴⁶
Mums and Babies program ⁸³
Nguá Gundi (Mother/ Child Project) ⁶¹
Omaha Healthy Start ⁴⁷
Opening Doors ⁸⁴
Parenting and the Community Health ⁸⁵
Peer Support Programme ⁸⁶
Prenatal Care Assistance Program ⁵⁶
Project MotherCare⁸⁷
Resource Mothers Program ^{55 45}
Rural Alabama Pregnancy and Infant Health ⁸⁸
Rural Maternal Child Health program ⁸⁹
Rural Oregon Minority Prenatal Program ⁴³
Southeast Asian Health Project ⁹⁰
Strong Women Strong Babies Strong Culture ⁴¹
Teen Parenting Partnership ⁹¹
Temple Infant and Parent Support Services ⁹²
The Door ⁹³
Un Comienzo Sano (A Healthy Beginning) ⁹⁴

Annex C: Characteristics and results of included studies

Notes – how to read this table

- Intervention groups are described in column 7. In most studies there is only one intervention group, labelled I1, denoting Intervention group 1; where there is more than one intervention group, groups are labelled I1, I2, etc.
- Comparator/control group (s) are described in column 8. Where there is only one comparator/control group this is labelled C1, denoting control/comparator group 1; where there are multiple comparator groups these are labelled C1, C2, etc.
- Results are generally presented as a comparison of the outcomes in the intervention group compared with the control group(s), i.e. I1 vs. C1 for studies with one intervention group and one control/comparator group. Where there are multiple control/comparator groups, multiple comparisons are shown.
- Subgroup analyses are presented where the author reports on differential effectiveness across subgroups
- Both unadjusted and adjusted results are presented where available; where the authors have fitted multiple adjustment models we present the results considered most relevant – usually involving adjustment for maternal characteristics/risk factors present at booking.
- 95% confidence interval, 'p-values' and/or a statement that a difference is "not significant" (NS) are included where reported by the authors.
- For studies which compare outcomes before and after the implementation of an intervention, results are presented as C1 ("before") vs. I1 ("after")

Abbreviations

ANC = Antenatal care;

OR = Odds ratio;

RR = Relative Risk;

95% CI = 95% confidence interval;

NS = Not statistically significant at the 5% level.

Author and year	Country/ Setting	Study design	Study population	Target population (intervention)	Method of allocation to study group(s)	Intervention group(s)	Control/ comparator group(s)	Results – timing of initiation of ANC
Cramer 2007	USA, Douglas County, Nebraska.	Retrospective observational cohort study.	Women giving birth in the study areas between 2002 and 2003.	Ethnic minority women ("Black women"). N.B. study sample not restricted by ethnicity).	Unclear. Retrospective assignment.	I1: 236 women who lived in the 19 targeted census tracts and who participated in the programme. I1: ?* women who had participated in the Kansas Healthy Start Home Visiting (HSHV) programme (had received at least one contact (phone call and/ or home visit)) prior to the index pregnancy. *62 women were enrolled in study overall, but numbers in intervention and comparator group not separately reported. Intervention targeted "at-risk" families.	C1: 1570 women who lived in the 19 targeted census tracts who did not take part in the programme. C2: 15,949 women who gave birth in the county (includes small number of programme participants).	Unadjusted % initiating ANC in 1 st trimester: 2002: I1 67.1%, C1 68.0%, C2 85.5% 2003: I1 79.0%, C1 74.5%, C2 83.3% I1 2002 vs. C2 2002, p = 0.01 Authors present a range of other comparisons. See Table 3 in the paper for further details.
Daaleman 1997	USA, Topeka-Shawnee County, Kansas.	Retrospective observational cohort study.	Multiparous women aged 17-38 receiving WIC services during pregnancy, who had no prior participation in the Kansas Maternal and Infant Program (a separate comprehensive preventative service that serves high risk childbearing women and infants). Study period not specified.	Socioeconomically disadvantaged women ("at risk", and in receipt of WIC).	Retrospective assignment based on care received.	I1: 108 women who initiated antenatal care on the Women's Health Van.	C1: ?* women who had not participated in the HSHV programme prior to the index pregnancy. *see note in previous column	Numeric results not reported; data derived visually from bar charts, approximate. Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 63% vs. 75% Test for trend across three trimesters and no care group: p = 0.36. Stratified analysis Single women: I1 vs. C1: 73% vs. 57% Test for trend across three trimesters and no care group: NS.
Edgerley 2007	USA, Palo Alto, California. Low-income neighbourhoods.	Retrospective observational cohort study.	Women whose antenatal and delivery care was funded by MediCal (Medicaid) and who delivered a singleton infant at Stanford University Medical Center between 01/01/00 and 04/07/04.	Socioeconomically disadvantaged women (Medicaid recipients).	Selection by site of care/birth.	I1: 111 women who were MIHAS clients and had given birth at the time of the birth records extraction in August 2003, living in the 4 targeted zip codes.	C1: 127 randomly selected from 2,121 women who initiated antenatal care in a local community clinic.	Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 79.6% vs. 59.8% Test for trend across three trimesters: p = 0.002.
Hunte 2004	USA, Flint, Genesee County, Michigan. Urban area.	Retrospective observational cohort study.	African-American women living in 4 selected zip codes who gave birth during the group-specific study periods.	Minority ethnic women ("African-American women").	Unclear. Retrospective assignment based on care received?	I1: 111 women who were MIHAS clients and had given birth at the time of the birth records extraction in August 2003, living in the 4 targeted zip codes.	C1: 350 women, a "uniform probability sample" of all births during the first 6 months of 2003 to women who were not MIHAS clients and who lived in 3 of the 4 targeted zip codes.	Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 66.7% vs. 67.7%, test of statistical significance not reported.

Author and year	Country/ Setting	Study design	Study population	Target population (intervention)	Method of allocation to study group(s)	Intervention group(s)	Control/ comparator group(s)	Results – timing of initiation of ANC
Jewell 2000	USA, Indiana.	Retrospective observational cohort study. Matched.	Women who gave birth during the two year study period (dates not specified).	Ethnic minority women ("minority women").	Unclear. Retrospective assignment based on care received?	I1: 95 women receiving care coordination through enrolment in one of the three Minority Health Coalition projects. Intervention targeted at women from minority backgrounds, but sample not restricted by race.	C1: 188 women, a stratified random sample of women who did not receive care coordination. Each intervention birth was matched with approx. 2 controls from birth certificate records, matched on: race, age, marital status, and education attainment.	Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 73.3% vs. 53.3% Chi square test for trend across three trimesters and no care group: p = 0.010.
Julnes 1994	USA, Norfolk, Virginia. City with high rate of infant mortality and adolescent pregnancy.	Retrospective observational cohort study.	Adolescents <19 years who gave birth during the 12 month study period (dates not specified).	Teenagers.	Unclear. Retrospective assignment based on care received?	I1: 49 adolescents who were clients of the Resource Mothers Program (RMP). Intervention targeted "high-risk" adolescents.	C1: 46 adolescents who did not participate in the RMP (instead, they were clients of the clinic-based multi-disciplinary programme).	Unadjusted % initiating ANC before the 4 th month of pregnancy: I1 vs. C1: 53.1% vs. 32.6% , p <0.05
Mackerras 2001	Australia, Darwin Rural and East Arnhem regions, Northern Territory.	Before and after study.	Aboriginal women who gave birth in the three pilot communities.	Indigenous women (Aboriginal women).	Selection by year of care/birth (pre- and post-intervention).	I1: 228 women who gave birth between 1994 and 95, after the implementation of the Strong Women Strong Babies Strong Culture (SWSBSC) intervention.	C1: 246 women who gave birth between 1990 and 1991, before the implementation of the SWSBSC intervention.	Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 24.4% vs. 16.7% , p = 0.03
Martin 1997	USA, Cincinnati, Ohio.	Before and after study.	Adolescents aged 14-17 years who received antenatal care through Group Health Associates.	Teenagers.	Selection by year of care/birth (pre- and post-intervention).	I1: 72 adolescents who gave birth between 1992 and 1994, receiving their antenatal care after the implementation of the Teen Pregnancy Program (TPP).	C1: 33 adolescents who gave birth 1991, receiving in their antenatal care before the implementation of the TPP. All private patients (clinic did not accept Medicaid until 1992).	Unadjusted % initiating ANC before 4 th month of pregnancy: I1 vs. C1: 79.8% vs. 69.7%, NS.
Mason 1990	U.K, Leicester. Two maternity units and four GP surgeries.	Prospective observational cohort study.	Asian women registering for antenatal care at selected practices between 01/05/85 and 30/04/86.	Ethnic minority women (Gujarati, Punjabi, Hindi, Urdu and Bengali speakers).	Unclear. Non-random selection.	I1: 213 women who had at least one contact with a community and/or hospital linkworker.	C1: 244 women who did not have any contact with a community and/or hospital linkworker.	Unadjusted % initiating ANC before 12 weeks gestation: I1 vs. C1: 70% vs. 70%, NS
Morris 1993	USA, Galveston, Texas. Clinics provided by the University of Texas Medical Branch.	Retrospective observational cohort study.	Adolescents aged <18 years who received antenatal care at the study clinics and gave birth between 1985 and 1986. The majority of adolescents were medically indigent.	Teenagers.	Selection by site of care/birth. Self-selection.	I1: 660 adolescents who received antenatal care at the teen pregnancy clinic.	C1: 277 adolescents who received "traditional prenatal care".	Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 45.2% vs. 19.5% Distribution of trimester of booking, chi square test: p = 0.001.

Author and year	Country/ Setting	Study design	Study population	Target population (intervention)	Method of allocation to study group(s)	Intervention group(s)	Control/ comparator group(s)	Results – timing of initiation of ANC
Mvula 1998	USA, New Orleans, Louisiana. Publicly funded clinics serving "low socioeconomic populations, with most below poverty level".	Prospective observational cohort study.	Medically low-risk women registering for antenatal care between 01/01/94 and 31/12/94, excluding women with multiple pregnancies and specific complications (including diabetes, hypertension, HIV, sickle cell).	Socioeconomically disadvantaged women (low income).	Selection by site of care/birth.	I1: 179 women who registered for antenatal care at the Neighbourhood Pregnancy Care (NPC).	C1: 181 randomly selected women who registered for antenatal care at the Louisiana State University obstetric clinic.	Unadjusted % initiating ANC before 14 weeks: I1 vs. C1: 37% vs. 29%, Distribution of trimester of booking, chi square test: NS
Newschaffer 1998	USA, New York State. Medicaid Antenatal Clinics.	Retrospective observational cohort study.	HIV-positive substance abusing women claiming Medicaid who gave birth to a singleton infant between January 1993 and September 1994.	Socioeconomically disadvantaged women (Medicaid recipients), though intervention evaluated in HIV-positive substance abusing women.	Unclear. Selection by site of care/birth?	I1: 240 women who received antenatal care at a Prenatal Care Assistance Program (PCAP) clinic (women with at least one Medicaid PCAP claim during pregnancy).	C1: 113 women who received antenatal care from a source other than PCAP.	Unadjusted % initiating ANC before the 5 th month of pregnancy: I1 vs. C1: 76% vs. 68%, p = 0.11.
Reichman 1996	USA, New Jersey.	Retrospective observational cohort study.	Medicaid claimants who had a singleton live birth between 1989 and 1990.	Socioeconomically disadvantaged women (Medicaid recipients).	Selection by site of care/birth	I1: 24,036 women (10,908 Black, 13,128 White) who participated in New Jersey's HealthStart programme.	C1: 16,719 women (8,671 Black, 8,102 White) who did not participate in New Jersey's HealthStart programme.	Unadjusted % initiating ANC in 1 st trimester: Only stratified data reported by authors. Blacks: I1 vs. C1: 49.5% vs. 49.6% (NS) Whites: I1 vs. C1: 56.4% vs. 59.0%, p <0.01
Rogers 1996	USA, South Carolina. Rural (<50 % urban) and moderately urban (between 50-75% urban) counties.	Retrospective observational cohort study with additional pre-intervention comparator group.	Primiparous adolescents (<18 years at delivery) who gave birth to a single infant between 01/01/86 and 31/12/89.	Teenagers.	Unclear. Retrospective assignment based on care received?	I1: 1901 adolescents who participated in the Resource Mothers Program (RMP) and resided in the 16 counties in which the RMP was implemented.	C1: 4612 adolescents who resided in 16 comparison counties (broadly matched to the RMP counties on selected sociocultural, perinatal status and health resource indicators) who did not take part in the RMP programme. C2: 712 adolescents who resided in 10 of the 16 RMP counties and gave birth before the RMP programme was implemented in their county of residence (intervention was implemented in a stepwise fashion).	Unadjusted % initiating ANC before the 4 th month of pregnancy: I1 45.3%, C1 40.9%, C2 40.0% Adjusted* odds ratio for early initiation of ANC (1-3 months) I1 vs. C1, OR 1.48 (1.32, 1.66) I1 vs. C2, OR 1.39 (1.16, 1.66) *adjusted for age, marital status, race, and previous pregnancies

Author and year	Country/ Setting	Study design	Study population	Target population (intervention)	Method of allocation to study group(s)	Intervention group(s)	Control/comparator group(s)	Results – timing of initiation of ANC
Thompson 1998	USA, Oregon. "Very rural county".	Before and after study.	Low-income Mexican- American women living in rural areas.	Ethnic minority women ("Mexican-American women").	Selection by year of care/birth (pre- and post-intervention).	I1: 100 high risk* pregnant women recruited between September 1991 - May 1994 who received Rural Oregon Minority Prenatal Program (ROMPP) services and were considered to have completed the intervention (received a minimum of 3 visits). *high risk: included history of preterm or LBW, history of pregnancy complications, pre-existing medical conditions, age <17 years.	C1: 100 women "demographically similar" to intervention sample who gave birth in the study county between 1989-91 (the years before the ROMPP intervention was implemented).	Numeric results not reported; approximate data derived visually from bar charts. Unadjusted % initiating ANC before the 5 th month of pregnancy: I1 vs. C1: 66% vs. 52% Distribution of grouped month of booking (1-2, 3-4, 5-6, 7+ or no care), Mann-Whitney test: NS.
Willis 2004	USA, California.	Prospective observational cohort study.	African-American Medicaid claimants who gave birth during relevant study period and resided in targeted ZIP codes.	Ethnic minority women ("African-American women").	Unclear.	I1: 2,031 women who had a singleton live birth between July 1996 and September 1990 and who participated in the Black Infant Health (BIH) programme.	C1: 11,622 women who gave birth in 1997 and did not participate in the BIH programme.	Unadjusted % initiating ANC in 1 st trimester: I1 vs. C1: 60.8% vs. 75.8%, test of statistical significance not reported.

Please cite this document as:

Laura Oakley, Ron Gray, Jennifer J Kurinczuk, Peter Brocklehurst, Jennifer Hollowell, A systematic review of the effectiveness of interventions to increase the early initiation of antenatal care in socially disadvantaged and vulnerable women. Oxford: National Perinatal Epidemiology Unit, 2009

This report and other Inequalities in Infant Mortality Project reports are available at:

www.npeu.ox.ac.uk/infant-mortality

