



FINAL REPORT

December 2004

**Disclosing to parents
newborn carrier status
identified by routine
blood spot screening**



The Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre) is part of the Social Science Research Unit, Institute of Education, University of London

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A searchable database which includes the studies reviewed in this report is available on the EPPI-Centre website (<http://eppi.ioe.ac.uk/>)

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In partnership with:

Centre for Paediatric Epidemiology and Biostatistics

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List of abbreviations

CF	Cystic fibrosis
DNA	deoxyribonucleic acid
HTA	The Health Technology Assessment programme
IRT	immuno-reactive trypsin
MCADD	Medium Chain Acyl CoA Dehydrogenase Deficiency
MIDIRS	Midwives Information and Resource Service
RCT	Randomised controlled trial

A glossary of terms used in this report is also available in Appendix 5.

Table of Contents

EXECUTIVE SUMMARY	2
Background and aims	2
Methods	2
Findings	4
Implications	6
Aims	7
1. BACKGROUND	9
2. METHODS	13
2.1 Inclusion and exclusion criteria for mapping exercise	13
2.2 Identification of relevant studies	14
2.3 Classification of relevant studies	15
2.4 Selection of studies for in-depth review	15
2.4 Appraisal of studies in in-depth review	16
2.5 Extraction and synthesis of findings from studies reviewed in-depth	17
3. RESULTS: DESCRIBING THE LITERATURE.....	18
3.1 Identification of relevant studies	19
3.2 Characteristics of studies	20
3.2 Characteristics of studies	21
4. RESULTS: IN-DEPTH REVIEW	27
4.1 Characteristics of the studies reviewed in-depth	28
4.2 Quality of the studies reviewed in-depth	30
4.3 Synthesis of health professional's views	34
4.4 Synthesis of parents' views about disclosing newborn sickle cell carrier status	34
4.5 Synthesis of parents' views about disclosing raised IRT results	36
4.6 Synthesis of parents' views about disclosing newborn carrier status for cystic fibrosis	42
5. FINDINGS AND IMPLICATIONS	46
5.1 Summary of principal findings	46
5.2 Strengths and limitations of this systematic review	48
5.3 Other literature	49
5.3 Implications	50
6. REFERENCES.....	51
6.1 Studies included in map and synthesis	51
6.2 Other references	53
APPENDICES	55
APPENDIX 2.2: Search strategy for electronic databases	55
APPENDIX 4.1: Details of studies included in in-depth review	58
APPENDIX 4.2: Details of interventions included in in-depth review	59
APPENDIX 5: Glossary	61

EXECUTIVE SUMMARY

Background and aims

Although designed primarily to detect affected individuals, some newborn screening programmes inadvertently identify newborn infants who are carriers* of the inherited conditions for which screening is offered. With the expansion of newborn blood spot screening for sickle cell disorders and cystic fibrosis (CF) in the UK, and other conditions bringing similar challenges in the USA, there is an urgent need to develop clear guidance as to how to respond. Depending on the condition for which screening is offered, options include employing tests that do not identify carrier status, if available; identifying acceptable ways of disclosing carrier status; identifying acceptable ways of not disclosing carrier status; or not screening. Currently, there are no screening tests available for sickle cell disorders that do not identify carrier status. For cystic fibrosis, the policy decision is between an extended period of testing, and a screening result that is available sooner for most newborns, but inadvertently identifies carrier babies.

The aim of this systematic review is to assess the impact of communication about disclosing carrier status following newborn screening; and to collate the relevant evidence about parents' and health professionals' views.

Methods

We sought communication studies relating to the disclosure to parents of carrier results or false positive results following routine bloodspot screening.

We searched: commercially available electronic databases, specialist registers online journals, online abstracts and conference abstracts. We also scanned the reference lists of included papers for reports that addressed communication about disclosing carrier status to parents following newborn screening for sickle cell disorders or cystic fibrosis.

Two researchers independently scanned titles and abstracts for relevance using the pre-specified inclusion criteria. Full reports of selected citations were then located and screened again for relevance by two researchers independently. At each stage, results were compared and discrepancies resolved by discussion.

Relevant reports were described according to the country in which the study was carried out, the study population, the setting of the study and the study design. Reports were also described in terms of their focus on specific health conditions (sickle cell disorders only, cystic fibrosis only, or sickle cell disorders and cystic fibrosis together). We also described reports in terms of the communication reported between health professionals and parents, which health professionals were involved, the timing of the communication, and whether raised IRT (immunoreactive trypsin: a screening test for cystic fibrosis in newborns) or carrier results were communicated.

* Carriers of sickle cell disorders are often referred to as having or carrying sickle cell 'trait'. For consistency across the conditions, we have chosen to use the term 'carrier' rather than 'trait' throughout this report.

Studies were reviewed in-depth if they:

- addressed the impact of communication about disclosing carrier status using a soundly controlled trial or randomised controlled trial, or
- described parents' or practitioners' views or experiences of disclosing carrier status following newborn screening.

Studies of people's views were appraised for:

- the quality of the reporting of a study's aims, context, rationale, methods and findings;
- the sufficiency of the reported strategies employed to establish the reliability and validity of data collection tools and methods of analysis, and hence the validity of the findings; and
- the appropriateness of the reported study methods for ensuring that findings about disclosing carrier status were rooted in parent's and/ or health professionals' own perspectives.

The included studies were examined by two reviewers independently to seek authors' findings in relation to the following questions:

Are views reported on whether disclosing carrier status (for sickle cell disease or cystic fibrosis) identified as a result of newborn screening

- provides lifetime health information for the child
- informs reproductive planning for the parents
- does not have psychosocial implications for the family
- has no emotional impact on parents
- has no emotional impact on other family members
- has no effect on parental behaviour towards the child
- does not alter relationships between parent and partner, or parents and other family members?

Is disclosing raised IRT results or carrier status acceptable to parents?

Is disclosing raised IRT or carrier status acceptable to health professionals?

Are views reported on whether the outcomes above are independent of:

- the timing and content of pre-test or post-test information (prior to or following the heel-prick test when first blood sample is taken)
- the health professional providing the information

- parental knowledge of conditions screened for (e.g. information received during antenatal period)
- parental awareness of general risk of sickle cell disorders or cystic fibrosis (e.g. ethnic background, antenatal information, pre-test information)
- parental awareness of specific risk for their child (e.g. family history, antenatal screening for same child, knowledge of own status)
- method of disclosing test result (e.g. letter, offer of appointment, letter with telephone number for follow-up support, accompanying information)
- follow-up support for families with carrier babies.

Are views reported on whether the inability always to provide clear diagnosis for cystic fibrosis:

- has psychosocial implications for the family
- is acceptable to parents and health professionals?

The reviewers compared their extracted findings and discrepancies were resolved by discussion. The findings from the studies were pooled under each research question.

Findings

We identified 24 relevant studies. There were nine intervention studies that addressed particular interventions to support communication. There were 16 non-intervention studies: reviews, economic evaluation and needs assessment about disclosing carrier status to parents.

Of the fifteen intervention studies, ten were from the USA; although most of the more recent evidence (three reports) were from England, Wales and Australia. Nine intervention studies were about cystic fibrosis and six were about sickle cell disorders or haemoglobinopathies more generally. Intervention study populations included parents (11), mothers (2) and couples (not necessarily parents yet) (2). Most intervention reports addressed communication at the time of results disclosure (11) or later (9). Two addressed antenatal communication, three at the time of the heel prick, and two at the time of a subsequent test. Interventions included information/ education only (4), advice/ counselling (6) or a combination (5). Interventions were fairly evenly split between community and primary care and secondary care (hospital or specialist clinic). Interventions were provided by a wide range of health professionals (health visitors, doctors and nurses (both specialists and non-specialists) and counsellors. Between them, the intervention studies addressed communication about the full range of possible test results. Six studies met the inclusion criteria for in-depth review: all were studies of parents' views.

In-depth review

We found no controlled trials of interventions and are therefore unable to provide evidence about the impact of communication.

None of the identified studies addressed the views of health professionals

The included studies were mainly from the USA, although more recent evidence came from England and Wales. Five studies addressed universal screening for cystic fibrosis and one addressed selective¹ screening for sickle cell disorders. Five were studies of parents and another was a study of mothers. The study of sickle cell disorders focused on sickle cell counselling; the studies of cystic fibrosis were evenly split between information and education interventions and genetic counselling. Most studies focused on communication in a specialist clinic although some focused on communication in the home or another health care unit or community site. Between them, studies addressed communication throughout the screening pathway, with different health providers involved at each stage in the pathway.

Study designs precluded generating evidence about the impact of disclosure.

Five of the six studies were of sufficient quality to rely on their findings about parents' views. Parents of cystic fibrosis carriers favoured newborn screening and knowing the carrier status, and anticipated telling their child in due course. Cystic fibrosis carrier status led to problems with insurance companies with some families in the USA. A minority of parents used carrier status to inform reproductive planning, although when their child's carrier result was withheld for four years following newborn screening, parents were angry at being denied the opportunity to do so. Discovering their own carrier status could also be an emotional event for parents. Few parents appeared to change their behaviour towards their carrier child. Discussing carrier status with the wider family was perceived as difficult, but necessary.

Raised IRT test results began a roller coaster of emotion for parents; this could also be difficult for the wider family who were simultaneously trying to be supportive. For some parents, false positive results could be a continuing cause for concern.

Parents would like some forewarning of possible results, but not to have 'too much' information. Parents favoured having familiar, non-specialists report test results to them; with these non-specialists being sufficiently briefed and not alarmist. The presence of cystic fibrosis specialists to discuss raised IRT results alarmed parents, as did being given information about cystic fibrosis at that stage.

There is little or no evidence about how outcomes are influenced by: parents' previous knowledge of the screened conditions; the methods of communicating test results; or follow-up support

There is no reliable evidence about the implications for parents of an unclear diagnosis for cystic fibrosis.

¹ Selective screening is screening which takes place on a targeted population selected using some other criteria, eg ethnicity

Implications

Policy

The findings of this review provide some support for a policy decision to include DNA testing early in the screening protocol in order to reduce the numbers of parents experiencing excessive anxiety between hearing of a positive screening result (raised IRT test) and a confirmed result. However little is known about how to support non-specialists communicating with parents about carrier status or the need for further testing.

There is no support for not disclosing newborn carrier status or raised IRT test results to parents.

Parents prefer positive screening results or requests for repeat tests to be communicated by a familiar, non-specialist community/ primary care practitioner. Investment is needed in materials and training to support these health professionals to undertake well a task they may rarely, if ever, encounter. There is a particular need for interventions to support parents who wish to discuss screening results with their wider family.

Parents, older children who are CF carriers and practitioners should be involved in developing these interventions.

Practice

Individual practitioners have a responsibility to forewarn parents about the possibility of positive screening results or requests for repeat tests and, when they occur, to discuss these with parents themselves rather than referring them to specialist services prematurely.

Research

With a dearth of published research findings about disclosing sickle cell carrier status, we recommend seeking grey literature through practitioner networks.

We found no research addressing the issue of disclosing non-paternity through identification of carrier status in newborn screening. This should be addressed with primary research.

Research is particularly needed about the implications for parents of an unclear diagnosis for cystic fibrosis and how to provide appropriate follow-up care.

Some parents would like to be offered carrier testing for other children. As this contradicts current guidelines, we recommend research to explore the views of parents and children, and the possible implications.

Parents and practitioners should be involved in this research.

Aims

The aim of this systematic review is to assess the impact of communication about carrier status following newborn screening; and to collate the relevant evidence about parents' and health professionals' views.

The objectives of this review are to assemble the evidence to test the following hypotheses:

A) Disclosing raised IRT results or carrier status for sickle cell disorders or cystic fibrosis (CF):

- provides lifetime health information for the child
- informs reproductive planning for the parents
- does not have psychosocial implications for the family
- has no emotional impact on parents
- has no emotional impact on other family members
- has no effect on parental behaviour towards the child
- does not alter relationships between parent and partner, or parents and other family members
- is acceptable to parents
- is acceptable to health professionals.

B) The outcomes above are independent of:

- the timing and content of pre-test or post-test information (prior to or following the initial heel-prick test, when the first blood sample is taken)
- the health professional providing the information
- parental knowledge of conditions screened for (e.g. information received during antenatal period)
- parental awareness of general risk of sickle cell disorders or cystic fibrosis (e.g. ethnic background, antenatal information, pre-test information)
- parental awareness of specific risk for their child (e.g. family history, antenatal screening for same child, knowledge of own status)
- method of disclosing test result (e.g. letter, offer of appointment, letter with telephone number for follow-up support, accompanying information)

- follow-up support for families with carrier babies.

C) The inability always to provide clear diagnosis for cystic fibrosis:

- has psychosocial implications for the family
- is acceptable to parents
- is acceptable to health professionals.

1. BACKGROUND

Outline of chapter

*This chapter sets the scope for the systematic review and will therefore be of interest to **all readers** of this report.*

Key messages

- *Some newborn screening programmes inadvertently identify genetic carriers of conditions being screened*
- *Depending on the condition being screened, the solution may be to employ tests that do not identify carrier status, if available; identify acceptable ways of disclosing carrier status; identify acceptable ways of not disclosing carrier status; or stop screening*
- *There are currently no screening tests available for sickle cell disorders that do not identify carrier status*
- *For cystic fibrosis, the policy decision is between an extended period of testing using a method which does not identify carriers, and a screening result that is available sooner for most newborns, but inadvertently identifies carrier newborns*
- *Existing related reviews have focused extensively on the evidence for the effects on children's health of screening for sickle cell disorders and cystic fibrosis*
- *There are a number of non-experimental studies exploring parents' experiences of newborn screening and the possible psychosocial implications of disclosing results*
- *The scope of this review encompasses both evidence of the effectiveness of communication about disclosing results, and non-experimental studies exploring the views of parents and health professionals*

Newborn screening blood spot programmes aim to identify babies who do not have any symptoms but are at risk of developing serious health conditions. Criteria for quality programmes include screening tests and subsequent diagnostic procedures, treatment and intervention that are clinically, socially, and ethically acceptable to health professionals and the public (National Screening Committee, 2002). This is particularly important for population based screening programmes, even more than selective screening programmes which focus on individuals already known to be at high risk.

The potential quality of some screening programmes may be compromised because the tests inadvertently identify babies who are unaffected, but who carry one copy of a gene for a condition. These babies are referred to as 'carriers'². The health problems of carriers are distinct from the health problems of affected babies, in that the information is of no immediate benefit to their health or treatment. However, there are known short-term as well as long-term problems, such as misdiagnosis if the presumptive screening result is incorrect, inadvertent exposure of non-paternity, social stigma for the individual and family, and adverse psychological effects for the individual and family (Laird *et al.*, 1996 Marteau *et al.*, 1992). Depending on the condition for which screening is offered, the solution may be to:

- employ tests that do not identify carrier status, if available;
- identify acceptable ways of disclosing carrier status; or
- identify acceptable ways of not disclosing carrier status.

Two screening programmes that raise this dilemma screen for sickle cell disorders³ and cystic fibrosis. While screening programmes for these conditions may benefit affected babies and their families, they also pose important social, ethical, psychological, and medical challenges at a societal level.

Biochemical tests for sickle cell disease carried out on blood spots collected by heel-prick test inadvertently identify carrier babies. Depending on the ethnic composition of the population screened, between 17 and 100 carrier babies will be identified for each affected child detected. Carrier status may have implications for the baby's future reproductive choices, but it is unclear whether families do indeed make use of this information when making future decisions. While babies who are carriers for sickle cell disease do not need medical attention, the implication is that, once their carrier status is revealed, it also reveals the carrier status of the parents. Rarely, this may expose a case of 'non-paternity', revealing that the child's putative father is not the biological father (Macintyre and Sooman, 1991). There are currently no screening tests available for sickle cell disorders that do not identify carrier status. There is therefore a clear need to understand the perceptions of parents and health professionals, and the impact of methods for disclosing, or not disclosing, carrier status.

Cystic fibrosis screening can raise different dilemmas. Babies who are carriers of cystic fibrosis, and their parents, may face the challenge of a series of tests spread over time with possibly uncertain results and no subsequent benefit.

² Carrier status for sickle cell disorders may also be described as 'sickle cell trait'.

³ Sickle cell disorders affect the haemoglobin and fall into a broader group of conditions known as haemoglobinopathies. A number of studies identified in this review refer to screening for haemoglobinopathies and discuss the communication of carriers of haemoglobinopathies. Whilst newborns are only screened for sickle cell disorders, most pregnant women are screened for other haemoglobinopathies, notably thalassaemias. We have tried to be accurate in our use of terms for these overlapping, but different, groups of conditions.

Blood spots are tested biochemically for immunoreactive trypsin (IRT): if the IRT is raised, some, but not all, of these babies are at higher risk of developing cystic fibrosis. The test is repeated on a repeat sample taken some weeks later in order to reduce the number of false positive screening results. If the IRT remains raised with the second test, the baby's sweat is tested for its saltiness (sweat test) in order to confirm or refute a diagnosis of cystic fibrosis. A sweat test is always conducted in hospital. Results at all stages may be equivocal and parents may have to cope with an extended period of uncertainty about their baby's health.

DNA-based testing for cystic fibrosis was originally introduced to reduce the number of babies undergoing relatively late diagnostic testing with the sweat test. DNA tests identify common mutations that quickly identify affected babies. Unfortunately, this can raise problems for some babies and their families, as the DNA test will also identify babies that are either carriers or unaffected, but for whom a diagnosis of cystic fibrosis cannot be reliably excluded. This is because cystic fibrosis can arise from many different mutations but only the more common ones are identified in routine screening.

Consequently, the choice of tests (biochemical, genetic and physiological) for screening and subsequent diagnosis, the order in which the tests are conducted, and the mutations that are tested for in the babies' DNA all influence the length of the testing period and the degree of uncertainty of the results. For cystic fibrosis the policy decision is between an extended period of testing that may leave some families with equivocal results, and a screening result that is available sooner for most babies, but inadvertently identifies babies who are carriers. Evaluating the options may include direct comparisons of the different screening options, including the views of parents and health professionals, or comparing methods of disclosure and non-disclosure of carrier status in the context of DNA testing.

Newborn screening also identifies babies who are carriers for other conditions, although we shall not include them in the scope of this review for various reasons that are explained here. Carrier testing and disease detection of maple syrup urine disease has been reported for a particular high-risk group, but not sufficiently so for comprehensive population screening to be employed (Love-Gregory *et al.*, 2001). Detection of Medium Chain Acyl CoA Dehydrogenase Deficiency (MCADD) may involve DNA analysis for a common gene mutation, but the number of carriers detected is very small. Also, because there are many secondary biochemical markers available, reliance on mutation testing can be reserved for when there is doubt about diagnosis, rather than being employed for population screening (Carpenter *et al.*, 2001).

Existing related reviews have focused extensively on the evidence for the effectiveness of screening for sickle cell disorders and cystic fibrosis. This evidence has been systematically retrieved and assembled in two Cochrane reviews and in three reviews commissioned by the UK Health Technology Assessment (HTA) programme. The Cochrane review on sickle cell disease (Lees *et al.*, 2000) found no trials on the reduction of adverse short- and long-term outcomes of neonatal screening compared with symptomatic diagnosis. In the Cochrane review on cystic fibrosis (Merelle *et al.*, 2000) only two trials were identified, one in the UK and one in Wisconsin, USA. Neither of the trials

examined the impact or acceptability, of disclosing carrier status.

Two of the HTA-commissioned reviews focus primarily on the cost-effectiveness of screening rather than the effects of information disclosure (Davies *et al.*, 2000); (Zeuner *et al.*, 1999). The HTA review on cystic fibrosis (Murray *et al.*, 1999) predominantly covers antenatal screening, but found little information on parents' knowledge of neonatal screening, or the psychological implications, other than anxiety measures, of disclosing results, or effects on reproductive planning of parents of carrier babies. Two studies were identified examining effects on the parent-child relationship following the disclosure of results, but these only included affected babies.

There are a number of non-experimental studies exploring parents' experiences of newborn screening and the possible psychosocial implications of disclosing results. In relation to the Wisconsin trial mentioned above is the Wisconsin Study (Ciske *et al.*, 2001), a questionnaire study involving parents of screened children, focusing on the communication of carrier status of cystic fibrosis. This showed that genetic counselling increased knowledge of the condition as well as decreased the emotional implications of guilt and confusion. A review of reviews identified other studies that focus heavily on the emotional implications of genetic testing, but a notable gap about communicating sickle cell carrier status following newborn screening (Stewart and Oliver, 2003). Anxiety is often used as a measure of emotional impact on parents of the disclosure of results following newborn screening (Hall *et al.*, 2000); (Shaw *et al.*, 1999), usually in the context of the timeline inherent in the communication of results.

With regard to sickle cell disorders, some studies concentrate on the social impact of being affected or of being a sickle cell carrier (Antley *et al.*, 1973); (Wooldridge and Murray, 1988), or on the knowledge base of parents with carrier infants (Hampton *et al.*, 1974). Another psychosocial implication is the issue of false paternity (non-paternity) and is relevant for both conditions. One study clearly illustrates a central dilemma inherent in disclosing carrier status (Lucassen and Parker, 2001) which is the issue of confidentiality. The debate emphasises the question of to whom the information belongs: the child, the mother, the couple or the health service. This may raise social and ethical issues involving other members of the family, in some cases leading to cascade testing (in which relatives of carriers are tested for mutations) (Holloway and Brook, 1994; Turner, 1993).

The scope of this review encompasses both evidence of the effectiveness of communication about disclosing results, and evidence of the views of parents and health professionals from non-experimental studies.

2. METHODS

Outline of Chapter

This chapter describes the methods used in the review. It was carried out in two broad stages:

- *an initial mapping exercise to describe the range of studies available and relevant to disclosing carrier status to parents following newborn screening*
- *an in-depth review focusing on a sub-set of these studies, chosen to gather evidence of people's views and the effects of communication*

The mapping exercise was carried out in three stages: (i) defining the scope of the mapping and developing inclusion and exclusion criteria; (ii) identifying studies falling within that scope; and (iii) describing these studies.

The in-depth review was also carried out in three stages: (i) application of inclusion and exclusion criteria; (ii) quality assessment and data extraction; and (iii) synthesising the findings of studies of people's views.

Readers who are primarily interested in the findings of the review may skip this chapter, but it may be of interest to:

- **any readers** who want to check how the review was conducted; and
- **researchers and information specialists** or others interested in carrying out systematic reviews, especially those who want to read about how different types of research can be included in a systematic review, in particular research that is 'qualitative' in nature.

2.1 Inclusion and exclusion criteria for mapping exercise

This review focussed on studies about the communication of carrier results to parents following newborn screening for sickle cell disorders or cystic fibrosis.

Four criteria were developed to ensure that only relevant reports were reviewed:

Criteria 1: health intervention

Reports were excluded from the review if they did not describe newborn screening.

Criteria 2: health condition

Reports were excluded from the review if they considered neither sickle cell disorders or cystic fibrosis.

Criteria 3: results

Reports were excluded from the review if they did not consider at least one of the following results: carrier, trait, heterozygote, false-positive.

Criteria 4: communication intervention

Reports were excluded from the review if they did not consider communication with parents.

2.2 Identification of relevant studies

The aim of the literature search was to locate a wide variety of research about disclosing carrier results to parents following newborn screening for sickle cell disorders and cystic fibrosis. Specifically, the search focused on four areas: 1) the health intervention of newborn screening and blood spot test; 2) screening and diagnostic tests and results relevant to sickle cell disorders and cystic fibrosis; 3) disclosure of results, and 4) possible outcomes and factors that may have an impact following screening and disclosure of results (see Appendix 2.2).

A variety of sources of published and unpublished literature were searched to locate relevant reports. These included:

- commercially available electronic databases (Medline, PsychInfo, Cinahl, Cochrane Library, Embase, Social Sciences Citation Index, African Trials Registry),
- specialist registers (MIDIRS, African Health Anthology, LILACS, Cochrane Cystic Fibrosis and Genetics Disorders Group Specialist Register, Cochrane Consumers and Communications Group Specialist Register),
- online journals (Anthropology & Medicine), and
- online abstracts (for the European Meeting on Psychosocial Aspects of Genetics, May 2002), and conference abstracts (25th European Cystic Fibrosis Conference, Genoa, Italy, June, 2002).

For Medline and Embase highly sensitive search strategies were developed using combinations of controlled vocabulary and free-text terms restricted to title, abstract, or keyword fields. A wide range of terms were used combining terms for:

- newborn screening and blood spot test (e.g. infant, newborn, neonatal, baby, perinatal, blood specimen, heel prick, Guthrie card, etc.)
- screening and diagnostic tests and results (e.g. sickle cell, cystic fibrosis, carrier, immunoreactive trypsin, sweat test, etc.),
- the disclosure of results (e.g. communication, confidentiality, duty to warn, information, parents, etc.)
- possible outcomes and factors of screening and disclosure (e.g. stress, psychosocial impact, false paternity, genetic counselling, ethics, etc.).

Search strategies for PsychInfo, and the Social Sciences Citation Index were adapted by replacing controlled medical terms not supported by these databases with free-text terms. Terms combined covered those relating to newborn screening and blood spot test, screening and diagnostic tests and

results, and the disclosure of results.

All other database and registers were searched using simple terms (e.g. sickle cell, cystic fibrosis) or simplified combinations of terms used in the Medline search strategy (see Appendix A for the full details used in these search strategies).

All citations identified by the literature searches were downloaded or entered into a Reference Manager database. They were scanned for relevance using the pre-specified inclusion criteria for this review (see above, 2.1).

The reference lists of all included studies were scanned for relevant citations, and experts in the field were also contacted to ask for relevant literature.

2.3 Classification of relevant studies

Full reports were obtained and first classified according to a standardised keywording system developed by the EPPI-Centre (Peersman *et al.*, 1997). This classifies reports in terms of the type of study (e.g. survey, outcome evaluation, intervention), the country in which the study was carried out, the study population, and the setting of the study.

In order to gain a more detailed description of reports specifically addressing the aim of this review, an additional standardised set of keywords was developed. This keywording system (details of which can be obtained from the EPPI-Centre on request) classified reports in terms of health condition and communication.

Health condition

Reports were described in terms of their focus on specific health conditions, whether this was on sickle cell disorders only, cystic fibrosis only, or broader screening programmes that included both sickle cell disorders and cystic fibrosis.

Communication

Reports were described in terms of whether any form of communication was reported between health professionals and parents, which health professionals were involved, the timing of the communication, and whether raised IRT or carrier results were communicated.

2.4 Selection of studies for in-depth review

Studies were reviewed in-depth if they did one of the following:

- Evaluated the effects of communication intervention with a randomised controlled trial (RCT);
- Evaluated the effects of communication intervention, reporting pre-intervention and post-intervention data for each group, reporting findings for each outcome measure indicated in the aims of the study; and

- employing a control/comparison group equivalent to the intervention group on socio-demographic and outcome variables (soundly controlled trial);
- Evaluated the processes of communication interventions that are also evaluated for their outcomes as in (a) or (b) above (associated process evaluations);
- Described parents' or practitioners' views or experiences of disclosing carrier status following newborn screening (views studies);

2.4 Appraisal of studies in in-depth review

Twelve questions cover three main quality issues. Of these, five relate to the quality of the *reporting* of a study's aims, context, rationale, methods and findings:

- Were the aims and objectives clearly reported?
- Was there an adequate description of the context in which the research was carried out (including a rationale for why the study was carried out)?
- Was there an adequate description of the sample used and the methods for how the sample was identified and recruited?
- Was there an adequate description of the methods used to collect data?
- Was there adequate description of the methods used to analyse data?

A further four questions relate to the sufficiency of the reported *strategies* employed to establish the reliability and validity of data collection tools and methods of analysis, and hence the validity of the findings.

Was there 'some attempt'; a 'good attempt'; or 'no attempt' to establish the following:

- the reliability of data collection tools;
- the validity of data collection tools;
- the reliability of the data analysis methods; and
- the validity of data analysis methods.

The final three questions related to the assessment of the *appropriateness* of the reported study methods for ensuring that findings were rooted in parents' own perspectives. In relation to this, reviewers were asked to judge studies according to whether they:

- used appropriate data collection methods for helping parents to express their views;
- used appropriate methods for ensuring the data analysis was grounded in the views of parents
- actively involved parents in the design and conduct of the study.

Examples of markers that reviewers used for judging appropriateness included: the use of open-ended questions or response categories informed by pilot work; avoiding the use of pre-defined coding strategies for analysing the data from interviews or focus groups; and involving parents in project steering or advisory groups.

2.5 Extraction and synthesis of findings from studies reviewed in-depth

The studies reviewed in depth were examined by two reviewers independently to seek authors' findings in relation to the following pre-determined questions to match hypotheses emanating from the background literature:

Are views reported on whether disclosing carrier status (for sickle cell disease or cystic fibrosis) identified as a result of newborn screening:

- provides lifetime health information for the child;
- informs reproductive planning for the parents;
- does not have psychosocial implications for the family;
- has no emotional impact on parents;
- has no emotional impact on other family members;
- has no effect on parental behaviour towards the child;
- does not alter relationships between parent and partner, or parents and other family members;

Are views reported on whether the outcomes above are independent of:

- the timing and content of pre-test or post-test information (prior to or following the heel-prick test when first blood sample is taken);
- the health professional providing the information;
- parental knowledge of conditions screened for (e.g. information received during antenatal period);
- parental awareness of general risk of sickle cell disorders or cystic fibrosis (e.g. ethnic background, antenatal information, pre-test information);
- parental awareness of specific risk for their child (e.g. family history, antenatal screening for same child, knowledge of own status);
- method of disclosing test result (e.g. letter, offer of appointment, letter with telephone number for follow-up support, accompanying information), and
- follow-up support for families with carrier babies?

Are views reported on whether the inability to always provide clear diagnosis for cystic fibrosis:

- has psychosocial implications for the family;
- is acceptable to parents, and
- is acceptable to health professionals?

The reviewers compared their extracted findings. Discrepancies were resolved by discussion. Taking each question in turn, the agreed findings from each study addressing a question were summarised and reported in a narrative.

3. RESULTS: DESCRIBING THE LITERATURE

Outline of Chapter

This chapter presents:

- *a description of the flow of studies through different stages of the review, including brief details of the studies eventually excluded from the in-depth review*
- *a detailed description of the views studies that met our inclusion criteria for the in-depth review*

A searchable database of all the studies identified for this review is available on-line at <http://eppi.ioe.ac.uk/>

This chapter will be of interest to:

- **researchers or commissioners of research** wishing to set an agenda for future inquiry, or considering conducting a similar mapping exercise
- **practitioners, policy specialists and parents** interested in the types of research conducted

Key findings

- *Twenty-four separate studies were identified for our mapping exercise.*
- *There were 16 intervention and 9 non-intervention studies*
- *Ten intervention studies were from the USA; most of the more recent evidence (three reports) were from England and Wales*
- *Nine intervention studies were about cystic fibrosis and six were about sickle cell disorders or haemoglobinopathies more generally*
- *Intervention study populations included parents (11), mothers (2) and couples, not necessarily parents (2)*
- *Most intervention reports addressed communication at the time of results disclosure (11) or later (9). Two addressed antenatal communication, three at the time of the heel prick, and two at the time of a subsequent test*
- *Interventions included information/ education only (4), advice/ counselling (6) or a combination (5)*
- *Interventions were fairly evenly split between community and primary care and secondary care (hospital or specialist clinic)*
- *Interventions were provided by a wide range of health professionals (health visitors, doctors and nurses (both specialists and non-specialists) and counsellors).*

- *Between them, the intervention studies addressed communication about the full range of possible test results*
- *. There were no controlled trials of communication interventions.*
- *Six studies met the inclusion criteria for in-depth review: all were studies of parents' views*

3.1 Identification of relevant studies

The search strategy for this review yielded 1803 citations in total (see Fig 1). Of these 1717 were excluded on the basis of their title or abstract. Eighty-six papers were identified for inclusion and full reports sought. Unfortunately five reports were unavailable, and these papers therefore had to be excluded on this basis. These five reports could not be traced by the British Library. In two cases the authors were contacted, but no replies were received.

The 81 collected reports were screened again and a further 57 papers excluded at this stage. Twenty-four full reports were therefore eligible for inclusion in the first 'mapping stage' of this review. These 24 reports are described in more detail below.

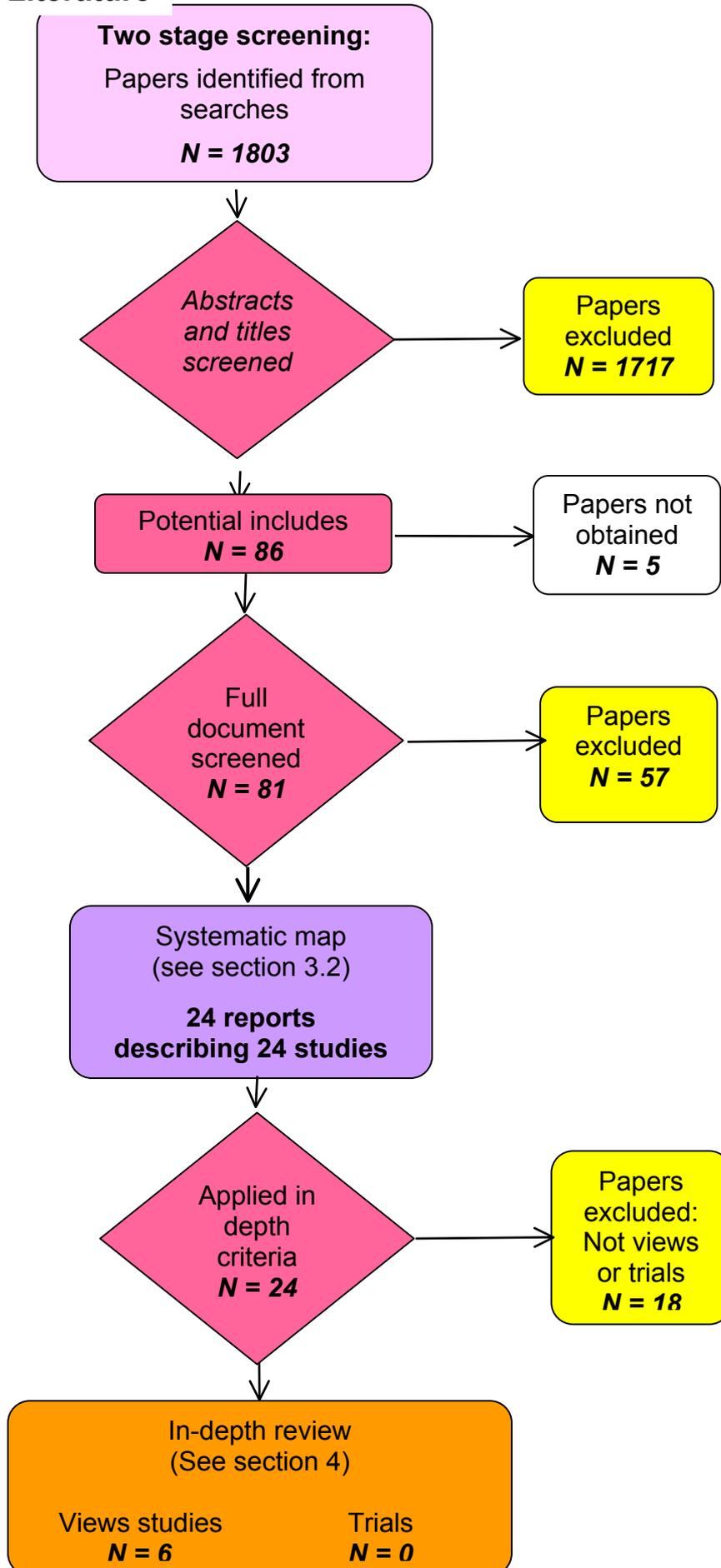
Source of identified reports (see Table 1)

Thirteen of the twenty-four reports were identified through commercially available databases. These included Medline (6 reports), the Cochrane Library (5 reports), and Embase (2 reports). An additional 6 reports were found through specialist registers, including MIDIRS (3 reports), and the Cochrane Cystic Fibrosis and Genetic Disorders Group Register (3 reports). One report was identified through personal contact with other researchers in the UK and the remaining 3 reports were identified by scanning the reference lists of all collected reports.

Table 1: Source of identified reports (N=25)

Commercial bibliographic databases	13
Specialist bibliographic registers	6
Personal contact	2
Reference lists	3

Figure 1: Literature



Disclosing to parents newborn carrier status following routine blood spot screening

3.2 Characteristics of studies

The twenty-four studies included in the mapping stage of the review covered a range of study types; two were guidelines (see table 2).

Table 2: Types of studies included in the map (N=25)

Study type	N
Systematic review	1
Non-systematic review	3
Survey	1
Needs assessment	1
Economic evaluation	1
Guidelines	2
Total non-intervention studies	9
Intervention description	3
Process evaluation	1
Randomised controlled trial	2
Case control study	3
Other outcome evaluations	5
Other qualitative study	1
Total intervention studies	15

3.2.1 Non-intervention studies

Nine non-intervention studies were identified. Two of these were not reports of primary research, but were published guidelines.

We identified one systematic review and three other reviews. The systematic review focussed on the effectiveness and cost of newborn screening for cystic fibrosis, as well as other inborn errors of metabolism (Pollitt *et al.*, 1997). The other three reviews focussed on the potential implementation (Wildhagen and Ten Kate, 1998), potential outcomes (Laird *et al.*, 1996), and effectiveness (Murray *et al.*, 1999), of newborn screening for cystic fibrosis.

Two further reviews commissioned by the NHS Health Technology Assessment programme were excluded because they did not focus on communication of carrier results following newborn screening (Lees *et al.*, 2002); (Zeuner *et al.*, 1999). However, they referred to other studies that did fall within our scope of interest.

We identified one survey, which focussed on policy and practice in state newborn screening programmes for cystic fibrosis in the USA (Farrell *et al.*, 2001). The economic evaluation focused on the cost of population screening for cystic fibrosis (Wildhagen *et al.*, 1998). We identified one relevant needs assessment of haemoglobinopathy educational provision for midwives and senior student midwives (Dyson SM *et al.*, 1996).

None of the non-intervention studies were designed to provide evidence about the impact of disclosure to parents of newborn carrier status following

newborn screening, nor people's views on this issue.

3.2.2 Intervention studies

Fifteen of the identified studies were intervention studies. Nine reports were about cystic fibrosis and five about sickle cell disorders. An additional study focussed on haemoglobinopathies more broadly. We considered: the study designs applied, where the studies were conducted; the populations studied; the screening protocols in use; the timing and type of the communication; where this occurred and with whom; and the type of test results communicated.

Study design

The intervention studies included two randomised controlled trials (RCTs) of screening interventions with communication studies nested in them. Other intervention studies included one case-control study, and five other evaluations addressing impact (mainly post-test only). In addition, we identified one process evaluation and an additional qualitative study.

Where they were conducted

Of the nine studies about cystic fibrosis, six studies were from the USA (Baroni *et al.*, 1997); (Ciske *et al.*, 2001); (Mischler *et al.*, 1988); (Tluczek *et al.*, 1991); (Tluczek *et al.*, 1992); (Wheeler *et al.*, 2001), two from England (McLaughlin *et al.*, 1999); (Moran and Quirk, 2002), and one from Wales (Parsons *et al.*, 2003).

Of the five studies focussing on sickle cell disorders, four were from the USA (Grossman *et al.*, 1985); (Hurst, 1989); (Whitten *et al.*, 1981); (Yang *et al.*, 2000), and one from the UK (Anionwu, 1983). The study which focussed on unspecified haemoglobinopathies was based in the UK (Rao *et al.*, 1996).

Screening protocols

Twelve of the 15 intervention studies described universal newborn screening: nine for cystic fibrosis and three for sickle cell disorders. The other three studies described selective screening for sickle cell disorders.

Study population

Eleven of the fifteen studies described communication with 'parents' and two with 'mothers'. Two studies focussed on communication with 'couples' antenatally.

Timing and type of communication

The timing of communication with parents about newborn screening described in the 15 intervention studies spanned a timeline from the antenatal period, through to discussions after the results (see Table 3). Several studies described communication at more than one point.

Table 3: Timing of communication in intervention studies (N=15)

Timing	Frequency
antenatal	2
neonatal/pre-screening	1
at time of heel-prick test	3
at time of subsequent test	2
result disclosure	11
post-result disclosure	9

NB Some studies describe communication with parents at more than one time.

Routine antenatal appointments or antenatal classes provide one of the earliest opportunities for health professionals to communicate with parents about possible outcomes of newborn blood spot screening. Two intervention studies describe communication with couples in the antenatal period. One study focussed on communication in the neonatal period, after the birth but prior to the heel prick test. Three studies looked at communication at the time of the heel-prick test, and two at the time of a subsequent test. The majority of studies described communication with parents at the time of disclosing results (11 studies), or afterwards, for example during counselling (19 studies).

Two types of interventions were identified: counselling (or giving advice) and information giving (or education). Six of the 15 intervention studies described counselling interventions only, four described education interventions only, while five described interventions that included elements of both counselling and education (see Table 4).

Table 4: Type of intervention described (N = 15)

Intervention type	N
Counselling and information	5
Counselling only	6
Information only	4

Five of the 15 intervention studies included both information giving and counselling. Information was given antenatally (Yang *et al.*, 2000), or following result disclosure (Mischler *et al.*, 1988); (Yang *et al.*, 1990). Information was also given in relation to requesting a second blood sample when a raised IRT was disclosed and parents were counselled on possible outcomes at the same time (Moran and Quirk, 2002). Three of the six identified studies were merely descriptions of interventions: one study described provision of information for parents about the need for further tests for cystic fibrosis, and follow up counselling following disclosure of carrier results (McLaughlin *et al.*, 1999). A similar study described provision of information for parents of babies found to be sickle cell carriers, including giving a card recording the exact result, and follow-up counselling after this disclosure (Rao *et al.*, 1996).

Six of the 15 intervention studies were counselling interventions only; counselling occurred at the time of the heel-prick test and at results disclosure (Ciske *et al.*, 2001), at the neonatal/pre-screening stage and at the time of the

heel-prick (Grossman *et al.*, 1985), at the time of results disclosure and as follow-up (Hurst, 1989), at the time of the subsequent test and as follow-up (Wheeler *et al.*, 2001), and as follow-up after result disclosure (Whitten *et al.*, 1981). Another study described provision of counselling for couples thought to be at risk of having a child with a sickle cell disorder following receipt of their own, or their child's, test results, including communication about the implications of the test results (Anionwu, 1983).

The four intervention studies that were information interventions only described information being given at the time of the heel-prick test (Tluczek *et al.*, 1992), and information given in the form of screening test results (Baroni *et al.*, 1997); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991).

Intervention sites

All 15 intervention studies described the place where the communication took place. This varied widely (see Table 5).

Table 5: The sites of the communication intervention (N=15)

Intervention site	N
Home	7
Community site	1
Primary care	3
Hospital	3
Specialist clinic	8
Educational institution	1
Secondary education	1

NB Some studies describe communication with parents at more than one site.

In seven of the 15 intervention studies, communication took place in the home. One study described communication at a community site, and three described communication taking place in a primary care setting. Three other studies described communication taking place in a hospital. Eight studies described communication taking place in specialist clinics. These specialist clinics varied from a specialist cystic fibrosis clinic (Tluczek *et al.*, 1992), a sickle cell counselling centre (Anionwu, 1983); a mobile health unit (Whitten *et al.*, 1981) and an academic centre (Wheeler *et al.*, 2001). Whilst one study described communication in an educational institution, another specified communication as part of secondary education.

Six studies reported communication in more than one intervention site. For example parents may have been told screening test results through a phone call received at home followed by genetic counselling provided at a specialist clinic.

Intervention provider (health professional)

Twelve of the 15 intervention reports specified which health professional was involved in the communication process (see Table 6). The remaining three reports did not specify who was involved in communication with parents.

Three intervention studies involved health visitors communicating with parents (Moran and Quirk, 2002); (Parsons *et al.*, 2003); (Rao *et al.*, 1996). This communication included requesting a second blood sample (Moran and Quirk, 2002), and informing parents of the need for further tests, such as a sweat test (Parsons *et al.*, 2003) and informing parents of the test result (Rao *et al.*, 1996).

Six interventions described doctors communication with parents, either in their capacity as family doctors communicating test results to parents (Ciske *et al.*, 2001); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991), or as specialists in relation to specific conditions. For example paediatricians and respiratory physicians were involved in communicating results of sweat tests for the diagnosis of cystic fibrosis (Hurst, 1989); (Parsons *et al.*, 2003), as were physicians attached to a specific cystic fibrosis centre (Tluczek *et al.*, 1991), whereas a consultant haematologist was involved in communication about sickle cell carrier results (Tluczek *et al.*, 1991).

Follow-up support is usually available for parents in the form of counselling about the genetic implications of their child's test results. Different nurses are described as providing this counselling in six intervention studies. These nurses included: nurse practitioners (Ciske *et al.*, 2001), clinic nurses (Hurst, 1989), specialist nurses (Rao *et al.*, 1996), postgraduate level nurses (Mischler *et al.*, 1988), cystic fibrosis nurse specialists (McLaughlin *et al.*, 1999), and cystic fibrosis nurses (Moran and Quirk, 2002). Three studies included sickle cell counsellors (Anionwu, 1983); (Hurst, 1989); (Whitten *et al.*, 1981). Other health professionals involved as intervention providers included genetic counsellors (Ciske *et al.*, 2001); (Mischler *et al.*, 1998); (Wheeler *et al.*, 2001); , and a non-physician counsellor (Grossman *et al.*, 1985).

Table 6: Person communicating

Person communicating	N
Health visitor	3
Doctor (GP, physician, respiratory physician, paediatrician, consultant haematologist)	6
Nurse (nurse practitioner, clinic nurse, specialist nurse, postgraduate level nurse, cystic fibrosis nurse specialist, cystic fibrosis nurse)	6
Sickle cell counsellor	3
Genetic counsellor	3
Non-physician counsellor – not specified	1

NB Some studies describe more than one information provider.

Communication of screening test results

Since this was a criterion for inclusion in the review, all 15 intervention studies reported the communication of newborn screening results to parents (see Table 7). There are 10 interventions (within 9 intervention studies) that relate

to the communication of cystic fibrosis screening results and six which relate to the communication of sickle cell carrier results.

Five interventions described the communication of CF carrier status to parents. These used varying language to describe the results including: 'CF carrier' (Parsons *et al.*, 2003), 'CF heterozygote' (Ciske *et al.*, 2001), 'CF heterozygote carrier status' (Baroni *et al.*, 1997), and 'carrying one CF mutation' (McLaughlin *et al.*, 1999); (Wheeler *et al.*, 2001).

Five studies described communicating 'false-positive' cystic fibrosis results to parents (Ciske *et al.*, 2001); (Mischler *et al.*, 1988); (Moran and Quirk, 2002); (Tluczek *et al.*, 1991); (Tluczek *et al.*, 1992). This term was used to refer to three different circumstances:

- In the early reports of the Wisconsin screening programme babies with one raised IRT were then given sweat tests. Those babies with negative sweat tests are described as 'false-positive' results (Tluczek *et al.*, 1991, Tluczek *et al.* 1992 and Mischler *et al.* 1988).
- The Ciske *et al.* (2001) paper describes a later stage in the Wisconsin screening programme referring to 'false-positive results' to describe those babies identified as having a raised IRT and one mutation, who then have a negative sweat test.
- Moran and Quirk (2002) interviewed parents of babies who had had an initial raised IRT results, were told about the initial 'positive' result and the need for a second blood sample, but were subsequently given the all clear.

In each case parents are approached and warned of the possibility that their baby has CF, and subsequent tests show that this is not the case.

Six of the 15 intervention studies described the communication of sickle cell carrier results to parents (Anionwu, 1983); (Grossman *et al.*, 1985); (Hurst, 1989); (Rao *et al.*, 1996); (Whitten *et al.*, 1981); (Yang *et al.*, 2000). One of these (Rao *et al.*, 1996) described the communication of 'haemoglobinopathy trait' rather than sickle cell carriers. This broader terms implies that this paper may have considered thalassaemia carriers as well as sickle cell carriers.

Table 7: The different newborn screening results communicated

Newborn screening test results	N
Cystic fibrosis carrier (cystic fibrosis mutation / cystic fibrosis heterozygote)	5
Cystic fibrosis 'false positive' (initial raised IRT, 'normal second IRT)	5
Sickle cell carrier (including 'haemoglobinopathy' carrier)	6

NB Some studies described communication of more than one type of result.

4. RESULTS: IN-DEPTH REVIEW

Outline of Chapter

This chapter presents a synthesis of the findings of the six studies we identified that examined the views of parents about disclosing carrier status following newborn screening. It describes findings from included studies as they relate to each of the research questions.

All types of readers are likely to be interested in this chapter

Key messages

- *No included studies addressed the views of health professionals*
- *The six included studies were mainly from the USA, although more recent evidence came from England and Wales*
- *Five studies addressed universal screening for cystic fibrosis and one addressed 'selective' screening for sickle cell disorders*
- *Five were studies of parents and another was a study of mothers*
- *The study of sickle cell disorders focused on genetic counselling; the studies of cystic fibrosis were evenly split between information and education interventions and genetic counselling*
- *Most studies focused on communication in a specialist clinic although some focused on communication in the home or another health care unit or community site*
- *Between them, studies addressed communication throughout the screening pathway, with different health providers involved at each stage in the pathway*
- *Five studies were of sufficient quality to rely on their findings about parents' views*
- *Parents of cystic fibrosis carriers reported that they favoured newborn screening and knowing the carrier status, and anticipated telling their child in due course*
- *Some parents reported that false positive results could be a continuing cause for concern*
- *Some parents in the US studies reported that cystic fibrosis carrier status led to problems with insurance companies*
- *A minority of parents reported using carrier status to inform reproductive planning, although when results were withheld parents were angry at being denied this opportunity*

- *Raised IRT test results were reported as starting a roller coaster of emotion for parents; this could also be difficult for the wider family who were simultaneously trying to be supportive*
- *Discovering their own carrier status could also be an emotional event for parents*
- *Few parents appeared to change their behaviour towards their carrier child*
- *Discussing carrier status with the wider family was perceived as difficult, but necessary*
- *Parents would like some forewarning of possible results, but not to have 'too much' information*
- *Parents favoured having familiar, non-specialists report test results to them, with these non-specialists being sufficiently briefed and not alarmist*
- *The presence of cystic fibrosis specialists to discuss raised IRT results alarmed parents, as did being given information about cystic fibrosis at that stage*
- *There is little or no evidence about how outcomes are influenced by: parents' previous knowledge of the screened conditions; the methods of communicating test results; or follow-up support*
- *There is no reliable evidence about the implications for parents of an unclear diagnosis for cystic fibrosis*

4.1 Characteristics of the studies reviewed in-depth

The studies reviewed in-depth were described in terms of where they were conducted; the screening protocols in use; the populations included in the study; the communication interventions employed, at what point in the screening pathway and by whom; and the study design applied.

Country of intervention

Most of these studies were conducted in the USA (Ciske *et al.*, 2001; Tluczek *et al.*, 1991; Wheeler *et al.*, 2001; Whitten *et al.*, 1981) although the most recent studies were conducted elsewhere; in England (Moran and Quirk, 2002), and in Wales (Parsons *et al.*, 2003).

Screening programmes

Of the six studies selected for in-depth review, five addressed screening for all newborns (universal newborn screening) for cystic fibrosis (Ciske *et al.*, 2001); (Moran and Quirk, 2002); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991); (Wheeler *et al.*, 2001) and two addressed newborn screening for those perceived as being at higher risk of sickle cell disorders (selective screening)

(Moran and Quirk, 2002); (Whitten *et al.*, 1981).

The details of screening tests and the timing of communication studied were different in each report. Tluczek *et al.* (1991) addressed the communication of a single raised IRT test and the reporting of a negative sweat test. Moran *et al.* (2002) addressed the request for a second blood sample for a repeat IRT test and DNA analysis. They did not report on disclosing carrier status following subsequent DNA analysis. Parsons (2003) addressed the reporting of DNA analysis early in the screening pathway and the request for a sweat test. Ciske *et al.* (2001) studied the acceptability of disclosing carrier status following a sweat test. Wheeler *et al.* (2001) addressed disclosing carrier status following a single IRT test and DNA analysis.

Study populations

Five studies included parents (Moran and Quirk, 2002; Parsons *et al.*, 2003; Tluczek *et al.*, 1991; Wheeler *et al.*, 2001; Whitten *et al.*, 1981) and another addressed only mothers (Parsons *et al.*, 2003). Only two studies reported the ethnic groups of the participants (Tluczek *et al.*, 1991; Wheeler *et al.*, 2001) and none of the studies distinguished between ethnic groups in the provision of the intervention or involvement in the research.

Communication interventions

The study of sickle cell disorders (Whitten *et al.*, 1981) focused on genetic counselling; the studies of cystic fibrosis were split between information and education interventions (Moran and Quirk, 2002); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991) and genetic counselling (Ciske *et al.*, 2001); (Moran and Quirk, 2002); (Wheeler *et al.*, 2001).

Site of communication intervention

Most studies focused on communication in a specialist clinic (Ciske *et al.*, 2001); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991); (Wheeler *et al.*, 2001); (Whitten *et al.*, 1981) although some focused on communication in the home (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991) or a community site (Whitten *et al.*, 1981).

Timing of communication

In terms of the screening pathway, the communication under investigation occurred at the time of the heel-prick test (Ciske *et al.*, 2001), at the time of subsequent tests (Moran and Quirk, 2002); (Wheeler *et al.*, 2001), at the time of disclosing test results to parents (Ciske *et al.*, 2001); (Moran and Quirk, 2002); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991) and at the time of follow-up (Wheeler *et al.*, 2001); (Whitten *et al.*, 1981).

Health intervention provider

Following the initial heel-prick test, communication was between: parents and a health visitor and cystic fibrosis nurse reporting raised IRT levels and explaining the need for further tests (Moran and Quirk, 2002); parents and physicians for a sweat test (Tluczek *et al.*, 1991); parents and a genetic counsellor, nurse practitioner and physician who explained false positive results of IRT testing in the light of a negative sweat test (Ciske *et al.*, 2001); parents and a sickle cell counsellor reporting sickle cell carrier results (Whitten *et al.*, 1981); or parents and genetic counsellors following disclosure of cystic

fibrosis carrier status (Wheeler *et al.*, 2001). In some circumstances, parents communicated with a series of health professionals: with a health visitor or GP to inform them about sweat testing; with a paediatrician, specialist cystic fibrosis nurse and health visitor to arrange the date for the sweat test; and with a paediatrician for receiving the results of the sweat test on the same day (Parsons *et al.*, 2003).

Study design

Intervention studies included a qualitative study of parents' views (Moran and Quirk, 2002), a case control study (Parsons *et al.*, 2003) and studies conducted to address the effects of communication. These latter outcome evaluations were a survey of counselling performance (Whitten *et al.*, 1981) and surveys of parents following a communication intervention (Ciske *et al.*, 2001); (Tluczek *et al.*, 1991); (Wheeler *et al.*, 2001), one of which was embedded in an RCT (Tluczek *et al.*, 1991).

4.2 Quality of the studies reviewed in-depth

4.2.1 Studies of impact of screening communication

Four studies were presented by authors as evaluations of the outcomes of communication about newborn screening (Ciske *et al.*, 2001); (Moran and Quirk, 2002); (Tluczek *et al.*, 1991); (Whitten *et al.*, 1981). However, their designs presented serious shortcomings as outcome evaluations.

Two outcome evaluations which used a single group pre-test post-test design (Whitten *et al.*, 1981) or a post test only design (Moran and Quirk, 2002) were not judged by the reviewers to be rigorous assessments of the impact of counselling (Whitten *et al.*, 1981) or the impact of false positive results on psychosocial measures (Moran and Quirk 2002). However, both studies were considered appropriate for gathering parents' views.

Tluczek *et al.* (1991) aimed to report the psychological impact of false-positive results when screening for cystic fibrosis. However, their randomised controlled trial was useful in addressing the effects of newborn screening rather than the effects of communication of screening results. Their comparison of responses to raised IRT and subsequent negative sweat test (false positive results) with responses to raised IRT test results reported after a delay of four years was not a useful comparison for considering communication policy options.

Ciske *et al.* (2001) aimed to assess the effectiveness of communication between health care providers (physicians, nurses, genetic counsellors) and parents of children identified as heterozygote carriers for cystic fibrosis in the routine Wisconsin Newborn Screening Program, USA, that was implemented using IRT for screening and sweat testing for diagnosis. However, without a control group, evidence of effectiveness is doubtful.

4.2.2 Studies of people's views

All the studies reporting people's views which we reviewed in depth were quality assessed, based on information reported in the publication.

Study methods

All studies reported their aims clearly and all but one described clearly the context of the study either by linking it to an existing body of empirical and/or theoretical research or by explaining why the study was done at that time, in those contexts and with those people or institutions.

Five studies provided adequate descriptions of the study sample and of how the sample was identified and recruited.

Fewer studies reported detailed methods: five adequately described the methods used in the study to collect data; five provided adequate description of the methods of data analysis; only three were judged replicable from the descriptions of the intervention, and methods for data collection and analysis.

Two studies reported how they sought participants' informed consent (Ciske *et al.*, 2001; Moran *et al.*, 2002). Two studies reported involving parents in piloting research instruments (Moran and Quirk, 2002; Tluczek *et al.*, 1991).

Strategies for establishing reliability and validity

Two studies reported making some attempt to establish the reliability and validity of data collection methods and tools, and methods of analysis. Moran *et al.* (2002) and Tluczek *et al.* (1991) piloted their interview schedule with parents and made several changes to procedures in light of this. Moran *et al.* (2002) also calculated the inter-rater reliability of their analysis, whilst the Tluczek *et al.* (1991) study included a group of experienced grounded theory researchers to analyse data from interview transcripts. Data analysis was done both individually and as a group, being careful to remain focused on the parents' perceptions (Tluczek *et al.*, 1991).

Appropriateness of methods for exploring parents' views

Five studies clearly used appropriate data collection methods for helping parents to express their views (Ciske *et al.*, 2001); (Moran and Quirk, 2002); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991); (Whitten *et al.*, 1981); and four of these also reported appropriate methods for ensuring that the data analysis was grounded in the views of parents (Moran and Quirk, 2002); (Parsons *et al.*, 2003); (Tluczek *et al.*, 1991); (Whitten *et al.*, 1981).

Wheeler *et al.* (2001) assessed the communication process solely in terms of parents' decisions about cascade testing.

Overall quality of studies (see Table 8)

Three studies met seven or more of the ten quality criteria (Moran and Quirk, 2002; Tluczek *et al.*, 1991; Tluczek *et al.*, 1992; Whitten *et al.*, 1981) with methods fully reported, and steps taken to ensure that they collected and analysed parents' views appropriately. In addition, Tluczek *et al.* (1991) involved parents in the design of the research instruments.

Ciske *et al.* (2001) and Parsons *et al.* (2003) were less comprehensive in reporting their methods. Although they reported details for data collection, including methods for helping parents express their views, their reporting of data analysis was less detailed.

Wheeler *et al.* (2001) met only three of the quality criteria. They did not report methods of data collection and therefore to the extent to which they present the views of study participants is unclear. For this reason, the findings have not been included in the synthesis of parents' views.

Table 8: Overall quality of studies

Quality criteria	Study					
	(Ciske <i>et al.</i> , 2001)	(Moran and Quirk, 2002)	(Parsons <i>et al.</i> , 2003)	(Tluczek <i>et al.</i> , 1991)	(Wheeler <i>et al.</i> , 2001)	(Whitten <i>et al.</i> , 1981)
The aims of the study are clearly reported	✓	✓	✓	✓	✓	✓
The context of the study is adequately described (in terms of a link to the relevant literature and/ or ...)	✓	✓	✓	✓	✓	
Adequate description of the sample used in the study and how the sample was identified and recruited	✓	✓	✓	✓		✓
Methods used in the study to collect data are adequately described	✓	✓	✓	✓		✓
Adequate description of the methods of data analysis		✓		✓	✓	✓
Study replicable from this report		✓		✓		✓
Authors avoid selective reporting bias (e.g. do they report on all variables they aimed to study as specified in their aims/research questions)	✓	✓	✓	✓		✓
Used appropriate data collection methods for helping parents to express their views	✓	✓	✓	✓		✓
Used appropriate methods for ensuring the data analysis was grounded in the views of parents		✓	✓	✓		✓
Actively involved parents in the design and conduct of the study				✓		

4.3 Synthesis of health professional's views

None of these studies addressed the views of health professionals on communicating raised immunoreactive trypsin (IRT) results or carrier status for cystic fibrosis (CF) or sickle cell disorders.

4.4 Synthesis of parents' views about disclosing newborn sickle cell carrier status

The only relevant study we could find was a study of counselling about sickle cell carrier results that was not restricted to newborn screening (Whitten *et al.* 1981). Counselees were adults who were sickle cell carriers or were parents of a child who was a sickle cell carrier. Of 192 counselees, 153 were women, 62 were married, 97 were under 30, 34 had no children, 110 had between 1 and 3 children and 36 had more than 3; In 79 instances the counsellee had sickle cell trait, in 80 the child did, and in 33 both the counsellee and their child were carriers. Of the total, 140 had 12 or more years education, 47 had less than 12, making this population better educated than average. Although participants' knowledge was significantly higher if they had finished high school, there was no investigation as to whether there was any association between education and attitudes towards disclosing carrier status.

4.4.1 Does disclosing newborn sickle cell carrier status provide lifetime health information for the child?

Whitten *et al.* (1981) in their evaluation of sickle cell counselling speculated that the effects that being a carrier may have or is believed to have on health status or life span is a major cause of anxiety or concern. They reported parents anticipating passing on the information to their child:

'I don't feel bad about it since I know more about it and I will explain it to her when she gets older. When she gets married she will decide' (Whitten *et al.*, 1981), p813.

'I feel terrible, because the chances are that she (the daughter) could run into somebody with the trait (a carrier) and I would have to tell her not to have any children' (Whitten *et al.*, 1981), p813.

Whitten *et al.* (1981) speculated that a major cause of parental anxiety or is the effects being a sickle cell carrier may have on marriage and reproduction.

4.4.2 Does disclosing newborn sickle carrier status provide information for reproductive planning for the parents?

We could find nothing in the Whitten *et al.* (1981) study that shed light on this question.

4.4.3 Does disclosing newborn sickle carrier status have psychosocial implications for parents?

Whitten *et al.* (1981) found that at the beginning of their counselling session, 29% of adults (carriers and parents of carriers) expressed no feelings about the diagnosis, 36% expressed positive or acceptance feelings, and 35% expressed feelings of anxiety. A comparison of feelings expressed before and after counselling showed a decrease from 35% to 17% in those who

expressed anxiety (a 53% decrease). The percentage of people who expressed positive or acceptance feelings more than doubled, increasing from 36% before the counselling to 74% after the counselling session. Only 6.3% (4) of the 63 adults who had positive or acceptance feelings at the beginning expressed anxiety after the counselling session was over.

4.4.4 Does disclosing newborn sickle carrier status alter parental behaviour towards the child?

Whitten *et al.* (1981) did not address this question.

4.4.5 Does disclosing newborn sickle carrier status have implications for other family members?

Whitten *et al.* (1981) did not address this question.

4.4.6 Is newborn screening for sickle cell disorders acceptable to parents of newborns who are identified as carriers?

Whitten *et al.* (1981) did not address this question.

4.4.7 Are outcomes of disclosing newborn sickle carrier status influenced by the timing and content of pre-test and post-test information?

When a sickle cell carrier was identified, many commented that achieving a better understanding of the distinctions between having a sickle cell disorder and being a carrier helped relieve anxiety (Whitten *et al.*, 1981).

'I don't feel bad about it since I know more about it and I will explain it to her when she gets older. When she gets married she will decide' (Whitten *et al.*, 1981), p813.

4.4.8 Are outcomes of disclosing newborn sickle carrier status influenced by which health professional provides parents with information?

No evidence was found relating to sickle cell screening.

4.4.9 Are outcomes of disclosing newborn sickle carrier status influenced by parents' previous knowledge of the screened conditions?

Only one study considered the significance of parents' previous knowledge of the condition, and none of them considered parents' awareness of either population risks, or their specific risks, of having the screened conditions.

Whitten *et al.* (1981) quoted one mother saying:

'It makes you worry. I have a cousin who has sickle cell and she is in and out of the hospital' (Whitten *et al.*, 1981), p813.

4.4.10 Are outcomes of disclosing newborn sickle carrier status influenced by the method of communicating screening test result?

No evidence was found relating to sickle cell screening.

4.4.11 Are outcomes of disclosing newborn sickle carrier status influenced by follow-up support?

No evidence was found relating to sickle cell screening.

4.5 Synthesis of parents' views about disclosing raised IRT results

Parents' views about disclosing raised IRT results were addressed in four studies (Ciske *et al* 2001; Moran and Quirk, 2002; Parsons *et al.*, 2003; Tluczek *et al.*, 1991). The studies on 21 parents in England (Moran and Quirk, 2002) and 11 parents in Wales (Parsons *et al.*, 2003) presented no socio-demographic data. Of the 168 families eligible for the Moran and Quirk (2002) study, 36 were not contactable. Tluczek *et al.* (1991) included parents of 104 infants with false positive IRT test results. Of these, 78% were white; 64% were married; and 40% of mothers and 43% of fathers had education beyond high school. Parents with higher educations had significantly greater knowledge about newborn screening. There was no investigation of variation in parents' views.

Ciske *et al.* (2001) included parents of 138 families. Their educational background was diverse, but again, better educated than a comparable population of Wisconsin young adults. Ciske *et al.* (2001) did not investigate parents' knowledge about raised IRT (only carrier status), or how education may relate to differences in their views.

4.5.1 Does disclosing raised IRT test results provide lifetime health information for the child?

Such information could be a cause for a lifetime of concern. Tluczek *et al.* (1991) found that, despite how carefully the contacts were made, parents who were told much later of their child's raised IRT test seemed to discount or not hear reassurances. These parents continued to believe the worst and described painful images of their child's future.

4.5.2 Does disclosing raised IRT test results provide information for reproductive planning for the parents?

Tluczek *et al.* (1991) found that most families of newborn carriers for CF (69%) did not change their reproductive plans based upon their experience with neonatal screening. However, 8% reported that they had changed their minds about having additional children, and 22% were uncertain at the time of the sweat test. Neither education nor the method of communicating test results was significantly related to these changes in plans. However, when raised IRT results were withheld for four years as part of the blinding of the screening intervention in the Wisconsin Trial, parents expressed anger about the delayed disclosure. They felt misled and robbed of the opportunity to make life decisions regarding reproduction.

4.5.3 Does disclosing raised IRT test results have psychosocial implications for parents?

Between them studies revealed psychosocial implications for parents at each stage of the CF screening pathway.

Moran *et al.* (2002) reported a roller coaster of emotions from the time when parents are told the results of an initial raised IRT test until they are told their child does not have CF. The main feelings in response to this result were 'worry/ concern/ nervous/ anxious' and a number reported being 'devastated/ distraught/ hysterical' and 'upset'. For parents with prior concerns about their newborn's health, this news 'felt like another burden'. One third reported their

mood as 'unhappy/ depressed'.

For 57%, the waiting time between the second heel-prick test and IRT test result was unsatisfactory, three quarters of whom had to wait 7 days. Two reported having waited approximately 3 weeks for the result and two of those waiting over 10 days commented that this had been due to a bank holiday falling in the waiting period. Two thirds stated that reducing the waiting period would have made this time less stressful.

At the time of the second heel-prick test, parents still reported feeling 'nervous/ anxious/ worried/ concerned' and some commented that they were in 'shock/ felt unreal' and also felt 'guilty'. However, nearly half the group stated that they also felt 'glad it was being done' and two parents said they 'wanted an answer'. One third described their mood as being 'low/ depressed' at this time.

Waiting for the test results of the second heel-prick test was the time when parents experienced the widest range of feelings. Most parents (64%) identified with more than one feeling, and several reported four or five. Specifically, nearly one third stated they had 'thought about future with CF', either having convinced themselves their child had CF or preparing themselves for how they would cope emotionally and practically. Just under one third commented that they 'tried to carry on as normal' although they indicated that this was not easy. All parents stated additional feelings. When asked to describe their mood at this time, just under half stated they were 'low/ down/ depressed' and one third said they were 'nervous/ anxious/ apprehensive'. Three respondents reported hyper-vigilance, looking for signs and symptoms of CF and noticing CF in the media, and three were 'upset/ crying'.

When individual participants' responses were examined, 'depressed/ low/ unhappy' and 'nervous/ anxious/ concerned' were the most consistently reported mood states across the time periods. 'Angry' and 'changeable mood' were also reported at two time periods by individuals. Several described moods at each stage and in most cases where one mood remained consistent, other moods varied. This suggests that whilst there were some feelings and moods that were consistent, it seems the majority of parents experience a range and mix of emotions throughout.

All but two parents reported being informed of the final all clear result by the CF nurse. This was usually communicated by telephone. For three quarters, the second result convinced them that their child was not affected by CF. However, several parents made additional comments that they continued to have some anxiety about their child's health (e.g. chest problems, breathing, other illnesses) which led them to question the reason for the initial raised IRT test result. For 86%, a routine follow-up from the CF nurse after the all clear result was not seen to be necessary and several commented that they just wanted to get on with things.

A narrower range of feelings was reported when the final all clear result was given; 70% reported relief and other commonly reported feelings as 'happy/ over the moon/ elated / fantastic'. In addition to these feelings, two noted negative feelings: 'frustrated at what [we] had been through' and 'thinking of other families who receive CF diagnosis'. One reported 'no feelings/ numb'

which was consistent with feelings during the waiting period. Relief and happiness were the overriding emotions.

In the first few weeks after receiving the 'all clear', relief was common. Three parents also reported that they felt angry. For two this was related to the way that they had been told about the initial raised IRT result by the health visitor.

Looking back, 43% of parents reported 'memories of a difficult time'. Three parents reported being 'upset/ sad looking back', two reported still being angry about the experience and three expressed 'feelings for other families going through it or families of sick children'. One parent reported that they 'rarely think of it – doesn't upset me'.

These findings were supported by a study in Wales. When parents were asked about how they felt at the time, (following the raised IRT screening test and prior to diagnostic sweat test) they talked about 'feeling afraid', 'being worried', the news being 'like a dark cloud', 'being in a state', and a feeling of 'shock' (Parsons *et al.*, 2003).

Ciske *et al.* (2001) also found that a majority of responders indicated that the waiting was the worst part of the experience, although only 23% suggested decreasing the waiting time to have a sweat test.

Tluczek *et al.* 1991 mounted a randomised controlled trial of screening for cystic fibrosis. In the intervention arm of the trial, they reported raised IRT test results and offered sweat tests for the newborns. In the comparison arm they took the blood spot, but did not report the results of the IRT test for four years, allowing time for individuals with cystic fibrosis to be diagnosed through symptoms. This provided an opportunity to study how parents reacted when the sweat tests of their newborn indicated that cystic fibrosis was not suspected: false positive results. Parents responded with an array of emotions. The news of the abnormal screening test produced anxiety that was both emotionally and physically disruptive. Parents expressed emotions suggesting grief for an anticipated loss. In many cases, the activities of daily living were significantly altered and parents experienced somatic symptoms. Parents who were given timely information about the raised IRT result, and had to wait 3 days for the sweat test, were thankful that, if their child had a problem, the problem was found early (86%). However, they were also concerned or anxious (98%); depressed/ sad (77%); shocked (76%); disbelieving (52%); confused (61%); or angry (48%). Few had no reaction or were calm (4%). When parents were faced with ambiguous, incomplete, or **uncertain** information, they filled their information gap in any way they could. Information seeking had the consequence of parents accessing inaccurate sources and increased anxiety for parents. In contrast, four parents seemed calm if not indifferent in their response. These parents described having concerns initially, but were reassured by their child's good health and/or statements by their paediatrician that CF was not likely to be diagnosed.

After four years, raised IRT test results were disclosed to parents in the other arm of the trial and they were offered a sweat test for their child. These parents were concerned or anxious (67%), depressed/ sad (67%), shocked (17%), disbelieving (56%), confused (72%), angry (67%) or had no reaction or were calm (17%). Parents of babies where the disclosure of the initial raised

IRT test result was delayed by four years were split into two categories: those with emotionally charged responses (14/18 parents) or those with calm, indifferent responses to the news of an abnormal IRT test that was performed during their child's neonatal period. Parents expressed anger about the delayed disclosure. They felt misled and robbed of the opportunity to make life decisions regarding reproduction. Parents in this group seemed to discount or not hear reassurances. These parents continued to believe the worst and described painful images of their child's future.

4.5.4 Does disclosing raised IRT test results alter parental behaviour towards the child?

Moran et al (2002) found that most parents described themselves as 'sometimes', 'rarely' or 'never' anxious about their child's health. Nine described themselves as 'quite protective', three 'not protective' and two 'over protective' (one due to on-going health difficulties). Only one reported continuing anxieties about the raised result, which was due to her child suffering from repeated chest infections:

'I actually felt half of me didn't want him - rejecting him - one minute I had a perfect baby then next minute this. Not that I didn't love him. Just wanted it all over with and to get on' (Moran and Quirk, 2002), p22.

4.5.5 Does disclosing raised IRT test results have implications for other family members?

Moran *et al.* (2002) investigated the psychosocial effects of false-positive results on parents and families. Whilst a number of feelings reported for partners were the same as or similar to those expressed by the participants. Some participants said they were not aware of how their partners and families were feeling. In some cases it seemed this was associated with fathers' coping strategies; being optimistic, putting on a brave face or trying to support the mother. Alternatively, with fathers at work there may have been limited opportunity for mothers to gauge their partner's coping.

Where partners and families are involved and aware, the repeat screening procedure appears to be a difficult time in terms of the emotions they are experiencing. It was reported that families frequently tried to be supportive and reassuring but they themselves were also experiencing a range of emotions at the different stages. From the news of the initial raised result until the final all clear result, 'upset', 'anxious/ concerned/ worried' were frequently reported feelings for the partner and family. When the all clear result was given, 'relief/ weight lifted' and categories such as 'happy/overjoyed' were most frequent and similar to the participants' responses.

4.5.6 Is newborn screening acceptable to parents who were told of raised IRT results?

Moran *et al.* (2002) found that parents' comments generally indicated that they viewed it as a difficult time that is in the past. Several commented that they viewed the CF screening as necessary despite a false positive result. All parents stated that they were in favour of routine newborn screening for CF. Most reported being 'OK' with the initial heel-prick test and there was a sense that it was viewed as routine and necessary.

Parsons *et al.* (2003) also reported that all the families who had their baby

identified as a carrier were in favour of newborn screening even though they had experienced uncertainty at the time of being told that another test was required.

In contrast, Tluczek *et al.* (1991) reported in detail the anger expressed by parents when, within the context of informed consent for participating in an RCT, raised IRT test results were kept from parents for four years (see above).

4.5.7 Are outcomes of disclosing raised IRT results influenced by the timing and content of pre-test and post-test information?

In a CF programme employing an IRT test (Ciske *et al.*, 2001), DNA test and sweat test, when asked how the newborn screening process should be improved, 55% of parents replied that they wished they had had more background information about the implications of the screening result earlier, before bringing their child for a sweat test. Although only 23% of parents suggested decreasing the waiting time to have a sweat test, the majority of parents indicated that the waiting was the worst part of the experience. The authors concluded that educational materials should be made available earlier and disseminated throughout community clinics. Ciske *et al.* (2001) concluded that educational programmes must be in place for both lay public and healthcare providers regarding the implications of newborn screening programmes.

Moran *et al.* (2002) reported parents' views about initial raised IRT results and requests for a second heel-prick test. For 86%, enough information was available about the repeat test and responses suggested that the information provided included basic written information about CF and information about the possibility of false positives. One parent commented that the nurse asked questions about symptoms but was not in a position to provide any answers or reassurance; this seemed to increase anxiety. At this point some parents also commented that they did not want too much information and responses indicated that the amount of information given varied according to individual need. For 43% of parents, enough information was available about initial raised IRT results. Although over half stated that they did think enough information was available to them at this time, there was a range of views about what they would have liked. Four would have liked more information about the condition and/or procedure at this stage (possibly leaflets) and one wanted more reassurance from the health visitor. However, 43% did not want too much information; some commenting that more would have frightened them. When asked to identify things that were helpful about the way the raised IRT result was given, several parents thought it had been helpful that they had been advised about false positives at this point. Where this had not happened, two would have preferred this. One said that the shock of receiving the initial raised IRT result could be reduced by informing parents at the time of the heel-prick test of the possibility of false positives and the feedback procedure for results.

4.5.8 Are outcomes of disclosing raised IRT results influenced by which health professional provides parents with information?

All three studies that addressed parents' views of the significance of the choice of health professional providing information about newborn screening for CF focused on community services: health visitors (Moran and Quirk,

2002); (Parsons *et al.*, 2003) and specialist CF nurses working with them (Parsons *et al.*, 2003), and community physicians (Ciske *et al.*, 2001).

Over 75% parents stated that the health visitor informed them of the initial raised IRT result and 71% reported the health visitor was the best person to inform them (Moran and Quirk, 2002). One reason given was that this person was more likely to be familiar with the family. Of those who reported that this was not the best person to give the result, the majority commented that the health visitor did not have sufficient information about the illness and screening procedure and false positives and would have preferred her to be more informed on these subjects. In addition to the content of information given, responses revealed that the way in which the news was delivered was important. Several noted how the health visitor's manner contributed to the negative impact of this event: being alarmist, expressing urgency and the need for the partner's presence (Moran and Quirk, 2002).

Policy in Wales is for health visitors to be accompanied by a specialist CF nurse to request a second blood sample. In the study by Parsons *et al.* (2003), on four occasions two health professionals had called on the family to communicate results: the health visitor and a specialist CF nurse. For these families, this visit by a specialist to talk about CF just confirmed their worst fears.

In Wisconsin, USA, 14% of parents experiencing positive screening results felt that community physicians (paediatricians and family physicians) needed better education about the implications of a positive newborn screen for CF to be able to explain possible consequences more effectively to parents (Ciske *et al.*, 2001). The authors concluded that educational programmes must be in place for both lay public and health care providers regarding the implications of newborn screening programmes.

4.5.9 Are outcomes of disclosing raised IRT results influenced by parents' previous knowledge of the screened conditions?

None of the studies considered the significance of parents' previous knowledge of the cystic fibrosis, and none of them considered parents' awareness of either population risks, or their specific risks, of having the screened conditions.

4.5.10 Are outcomes of disclosing raised IRT results influenced by the method of communicating screening test result?

In the Welsh study (Parsons *et al.*, 2003) families had been given details about CF whether they had been visited by their health visitor, or the specialist nurse. Both these approaches raised unnecessary anxiety. In some cases they had been left with a CF Trust leaflet. The majority of families recalled the negative language that had been used:

'they just showed no sympathy, no warning, they just blurted it out' (Parsons *et al.*, 2003), p10.

A CF nurse leaving a leaflet from the CF Trust for parents to read caused parents to believe their child would have CF.

4.5.11 Are outcomes of disclosing raised IRT results influenced by follow-up support?

Follow-up support can be provided in the form of counselling and carrier testing of parents, but few studies addressed this and none related to sickle cell screening. For 86% of parents experiencing false positive raised IRT test results in Moran *et al*'s study (2002), a routine follow up from the CF nurse after the all clear result was not seen to be necessary and several commented that they just wanted to get on with things again.

4.5.12 What are the implications of an unclear diagnosis for cystic fibrosis?

No studies addressed potential psychological implications arising from unclear diagnosis for cystic fibrosis.

4.6 Synthesis of parents' views about disclosing newborn carrier status for cystic fibrosis

Two studies addressed parents' views about disclosing newborn carrier status for cystic fibrosis. Each employed a different screening pathway. Parsons *et al.* (2003) addressed the reporting of DNA analysis early in the screening pathway and the request for a sweat test. Ciske *et al.* (2001) studied the acceptability of disclosing carrier status following a sweat test.

Parsons *et al.* (2003) conducted their study in Wales with 11 parents of carriers identified through newborn screening, but presented no socio-demographic data. Ciske *et al.* (2001) included parents of 138 families who had diverse educational backgrounds but were generally better educated than a comparable population of Wisconsin young adults. They found correct responses to questions assessing knowledge about carrier status were statistically independent of educational background. They did not investigate any variation in parents' views.

4.6.1 Does disclosing CF carrier status provide lifetime health information for the child?

Two studies reported parents' views of this information in terms of their child's lifetime health.

Parsons *et al.* (2003) reported that all the families whose babies were identified as a carrier for CF reported being in favour of newborn screening. Typically, they reported favouring knowing the carrier status, and having the information available when the children start their own families. Parents were all aware that at some point in the future they would have to pass the information on. There was also a feeling that at some point the young person would have to make his or her own decisions.

Ciske *et al.* (2001) reported some problems with insurance companies in the USA. Of 26 cases in which the insurance company was notified of the child's status, 5 reported having some difficulties as a consequence. Two other families who did not inform their insurance company about the child's carrier status also reported difficulties. The remaining 108 families did not inform their

insurance company and did not experience problems.

4.6.2 Does disclosing CF carrier status provide information for reproductive planning for the parents?

Ciske *et al.* (2001) found that antenatal testing for CF was used by 14% of parents in a subsequent pregnancy. In one family, antenatal testing was used in two subsequent pregnancies.

4.6.3 Does disclosing CF carrier status have psychosocial implications for parents?

Newborn carrier status: Ciske *et al.* (2001) found the majority of parents felt better informed and were glad to be aware of their child's CF carrier status. The majority were not confused or experiencing feelings of guilt.

Parental carrier status: The inevitable consequence of a baby being identified as a CF carrier is that at least one parent is also a carrier. Parsons *et al.* (2003) explored parents' attitudes in relation to their own carrier status. In this study 6 of the fathers and 4 of the mothers were carriers. After discovering their own carrier status (as a consequence of newborn screening and subsequent cascade testing) individuals felt 'a bit apprehensive', 'gutted', or 'uncomfortable' or 'guilty' about passing on the gene.

Six months later, all carriers were philosophical about their status. The parents' accounts focused on three main issues. Firstly, they all made reference to the fact that their baby was 'perfectly healthy'. In two families, adult carriers had made the connection between their own continued health and the fact that their baby was going to be the same. Second, the way the families talked about their baby's carrier status indicated that it caused them very little concern. They talked about their children as being 'just a carrier' or 'only a carrier'. Third, they were all aware that at some point in the future they would have to pass the information on.

There were two parents however who felt some guilt about what they might have passed on. One father, although he was not at all concerned about his own carrier state, said: 'I felt uncomfortable, I'd passed something on to my son'. It was the same for one mother: 'You don't like to think you are going to pass anything awful to a child, I don't feel bad about it now but I did have this guilty feeling.'

4.6.4 Does disclosing CF carrier status alter parental behaviour towards the child?

Parsons *et al.* (2003) did not invite parents to give their views on changed behaviour towards their child as a possible consequence of knowing their carrier status. Rather she gathered quantitative data to describe mother/baby relationships. Mothers all made reference to the fact that their baby was 'perfectly healthy' and the way families talked about their baby's carrier status indicated that it caused them very little concern. She found no evidence that the mother/baby relationship had been affected by the carrier identification or that the carrier status was seen by parents as a problem in terms of 'spoiled' identity.

4.6.5 Does disclosing CF carrier status have implications for other family members?

Parsons et al (2003) invited mothers to talk about how carrier identification had been discussed within their wider family. The majority of families talked at length about passing the news to other family members. The language however reflected feelings of 'obligation', with the use of phrases such as: 'it meant contacting', 'I had to pass information on', 'we felt we should', 'it's our responsibility to tell'. In one family, discussions of carrier status had led to difficulties between grandparents. For another the brother, having been told, would not talk about it, and his carrier sister felt a distance not previously there had developed between them. Another couple felt they did not have enough information and were struggling to find the right words. Some parents found it difficult to understand why clinical geneticists were reluctant to test their other children.

4.6.6 Is newborn screening acceptable to parents whose newborns are identified as carriers?

Two studies addressed the acceptability of screening to parents in relation to the identification of carriers (Ciske *et al.*, 2001; Parsons *et al.*, 2003).

Following newborn screening and genetic counselling, Ciske *et al.* (2001) reported that the majority of parents found it acceptable: they felt better informed and were glad to be aware of their child's CF carrier status, they were not confused or experiencing feelings of guilt. Parsons *et al.* (2003) also reported that all the families who had their baby identified as a carrier were in favour of newborn screening. Typically, they favoured knowing the carrier status, and having the information available for when their children might start their own families. Typical comments were:

'...glad I know... I would rather know than not know' (Parsons *et al.*, 2003), p6.

'...sooner things come to light the better... at least we know it's in the family now' (Parsons *et al.*, 2003), p6.

4.6.7 Are outcomes of disclosing carrier status influenced by the timing and content of pre-test and post-test information?

In a CF programme employing an IRT test (Ciske *et al.*, 2001), DNA test and sweat test, when asked how the newborn screening process should be improved, 55% of parents replied that they wished they had had more background information about the implications of the screening result earlier, before bringing their child for a sweat test. Although only 23% of parents suggested decreasing the waiting time to have a sweat test, the majority of parents indicated that the waiting was the worst part of the experience. The authors concluded that educational materials should be made available earlier and disseminated throughout community clinics. Ciske *et al.* (2001) concluded that educational programmes must be in place for both lay public and healthcare providers regarding the implications of newborn screening programmes.

4.6.8 Are outcomes of disclosing carrier status influenced by which health professional provides parents with information?

Parsons (2003) addressed the reporting of DNA analysis early in the

screening pathway and the request for a sweat test. At this point in the pathway, screening results cannot distinguish carriers from affected children.

Policy in Wales is for health visitors to be accompanied by a specialist CF nurse to request a second blood sample. In the study by Parsons *et al.* (2003), on four occasions two health professionals had called on the family to communicate results: the health visitor and a specialist CF nurse. For these families, this visit by a specialist to talk about CF just confirmed their worst fears.

4.6.9 Are outcomes of disclosing carrier status influenced by parents' previous knowledge of the screened conditions?

None of the studies considered the significance of parents' previous knowledge of the cystic fibrosis, and none of them considered parents' awareness of either population risks, or their specific risks, of having the screened conditions.

4.6.10 Are outcomes of disclosing carrier status influenced by the method of communicating carrier results?

No studies have addressed the details of how to disclose confirmed carrier results.

4.6.11 Are outcomes influenced by follow-up support?

The Welsh study (Parsons *et al.*, 2003), highlighted parents' concern about being unable to ascertain the carrier status of their other children. They also highlighted the problems they faced in talking about carrier issues to other members of their family.

4.6.12 What are the implications of an unclear diagnosis for cystic fibrosis?

No studies addressed potential psychological implications arising from unclear diagnosis for cystic fibrosis.

5. FINDINGS AND IMPLICATIONS

Outline of Chapter

This section summarises and discusses the main findings from each stage of this review – the mapping exercise and the in-depth review.

*This chapter should be read by **practitioners, policy specialists and researchers** wishing to implement interventions or design new interventions*

Key messages

- *This systematic review confirms the findings of a previous review of reviews (Stewart et al. 2003) in suggesting that, despite counselling, receiving a false positive screening result for cystic fibrosis can be difficult to understand and lead to anxiety, confusion and depression. Even after a normal sweat test some parents still worry about the health of their child. Although evidence from existing studies is weak, few parents appear to change their reproductive plans.*
- *There is widespread parental acceptance of newborn screening despite short term difficulties; with raised IRT results appearing distressing.*
- *There is very little research about parents' responses to disclosing sickle cell carrier results*
- *There is no research about parents' responses to the risk of CF in infants with one known CF mutation and a possible but unidentified mutation on the other allele.*

5.1 Summary of principal findings

5.1.1 Mapping exercise

Extensive searching revealed 24 reports addressing the disclosure of carrier status to parents following newborn screening. None of the studies rigorously addressed the impact of that disclosure. Fifteen were intervention studies. Most of these addressed communication at the time of results disclosure (11) or later (9). Between them these were fairly evenly spread across the two conditions of interest and a broad spectrum of policy or practice that varied in terms of: the type of intervention (information/ education only, advice/ counselling or a combination); the intervention site (community/ primary care or secondary care); the health professionals involved (both specialists and non-specialists); and communication about the full range of possible test results.

5.1.2 Nature of studies selected for in-depth review

Ten of the intervention reports were from the USA, although the five from elsewhere (England and Wales) were more recent.

However, none of these studies rigorously addressed the impact for parents of

disclosing to them their newborn infant's carrier status, or compared this with the impact of alternative tests (in the case of CF) that did not identify newborn carriers. Neither did any of them address the views of health professionals.

The six studies eligible for in-depth review were not so evenly spread across the range of policy or practice options as the reports in the map. Only one addressed screening for sickle cell disorders. Between them, the remainder addressed communication about CF screening at the stages of requesting a second blood sample; reporting carrier status following early DNA and requesting a sweat test; and explaining false positives and disclosing carrier status after a sweat test.

5.1.3 Synthesis of findings from studies in in-depth review

Disclosing carrier status for sickle cell was addressed by only one study over twenty years ago in the USA, where parents of newborns were part of a larger study population. This notable lack of research literature suggests that sickle cell counselling services serve parents of newborn carriers on the basis of shared practitioner knowledge rather than formal research about parents' views or evidence of impact.

Five studies addressed universal screening for cystic fibrosis and were evenly split between information and education interventions and genetic counselling. Studies set in specialist clinics were more common than those in the community or primary care. We found no reports addressing the sensitive issue of non-paternity, despite this being regularly raised in policy and practice discussions convened by the UK Newborn Screening Programme Centre.

Parents of newborn infants who are identified as CF carriers favoured newborn screening and knowing carrier status, and anticipated telling their child in due course. This was despite some parents experiencing the discovery of their own carrier status as another emotional event, albeit temporarily. In contrast, raised IRT test results began an emotionally disruptive experience for parents; this could also be difficult for the wider family who were simultaneously trying to be supportive. For some parents, false positive results could be a continuing cause for concern, while cystic fibrosis carrier status led to problems with insurance companies with some families in the USA. Taken together, learning of a raised IRT test results appears to be more of an emotional experience for parents than learning of a newborn's carrier status. However, this conclusion is drawn from parents' responses to unequivocal carrier status, with no apparent residual risk of the newborn having CF.

A minority of parents used carrier status to inform reproductive planning, although when raised IRT results were withheld for four years as part of the Wisconsin trial parents felt misled and robbed of the opportunity to make decisions regarding reproduction. As antenatal screening becomes increasingly routine in the UK, more parents may use carrier information for reproductive planning.

Our literature review suggests that few parents appeared to change their behaviour towards their carrier child, although evidence is weak. Discussing carrier status with the wider family was perceived as difficult, but necessary. There appears to be a need for follow-up information specifically to support

parents passing on this information to their wider family.

Our literature review suggests that parents would like some forewarning of possible results, but not to have 'too much' information. Parents favoured having familiar, non-specialists report test results to them; with these non-specialists being sufficiently briefed and not alarmist. The presence of cystic fibrosis specialists to discuss raised IRT test results alarmed parents; as did being given information about cystic fibrosis at that stage. There is clearly a sensitive balance to be found between informing parents and worrying them unduly; and a need to provide non-specialists with sufficient information and skills to perform well in a situation they may rarely, if ever, encounter.

There is little or no evidence about how outcomes are influenced by: parents' previous knowledge of the screened conditions; the methods of communicating test results; or follow-up support. There is no reliable evidence about the implications for parents of an unclear diagnosis for cystic fibrosis.

5.2 Strengths and limitations of this systematic review

This is the first systematic review specifically about disclosing carrier status to parents following newborn screening. As such it provides valuable evidence of parents' views to inform policy and practice. Previous systematic reviews have focused mainly on the efficacy of screening rather than communication about screening (Murray *et al.*, 1999); (Pollitt *et al.*, 1997). Although these earlier reviews did report some studies about disclosing carrier status (Baroni *et al.*, 1997; Farrell *et al.*, 2001; Laird *et al.*, 1996; Rao *et al.*, 1996; 1991; Tluczek *et al.*, 1992), the current review also reviewed in-depth five other studies (Ciske *et al.*, 2001; Moran and Quirk, 2002; Parsons *et al.*, 2003; Wheeler *et al.*, 2001; Whitten *et al.*, 1981). The current review also included relevant studies not included in a systematic review of psychosocial aspects of genetic screening (Green *et al.*, 2004).

Although inclusion of more studies is a strength of this review, the studies included are weak in terms of the number and selection of participants and reporting of socio-demographic data. Evidence about parents' views of their children's sickle cell status was drawn from 113 parents (Whitten *et al.* 1981). Evidence about disclosing raised IRT results was drawn from 242 Americans with an education level higher than average (Ciske *et al.*, 2001; Tluczek *et al.*, 1991) and 31 parents from the UK for whom there is no reported socio-demographic data (Moran and Quirk, 2002; Parsons *et al.*, 2003). Evidence about parents' views of disclosing newborn CF carrier status is from 138 US families, with a higher than average education (Ciske *et al.*, 2001) and 10 parents in Wales, for which no socio-demographic data is reported (Parsons *et al.*, 2003).

As with all secondary research, it is possible that this review has been unable to identify other relevant literature and it is not possible to gauge the impact that absence of this literature may have had. Though the searches were as extensive as possible, there was no extensive search of grey literature. This may be a particularly rich source of practice knowledge about counselling following sickle cell carrier results; an area that is poorly represented in the literature identified by this review. Other sources of evidence may be non-English language databases in addition to LILACS, searched for this review.

5.3 Other literature

The current review confirms the suggestions from previous reviews (Stewart and Oliver, 2003) that, despite counselling, receiving a false-positive screening result for cystic fibrosis can be difficult to understand and lead to anxiety, confusion and depression. Even after a normal sweat test some parents still worry about the health of their child. Few parents appeared to change their reproductive plans.

The current review adds to previous knowledge by documenting widespread parental acceptance of newborn screening despite largely temporary difficulties experienced with raised IRT test results and disclosure of newborn carrier status; the former appearing more traumatic than the latter. It also provides evidence of parents' preference for well-briefed non-specialists reporting raised IRT test result or carrier status, and the difficulties parents experience when discussing screening results with their wider family. This supports the findings of a similar study about parental responses to repeat testing of infants with 'false positive' results when screening for other conditions within a blood spot programme. Sorenson *et al.* (1984) reported that parents who were aware that the initial test was abnormal were no more anxious or depressed than other parents while waiting for repeat test results. Over one-third of parents of these normal infants subsequently expressed concern about the health of their infant because of the repeat testing. This concern was not related to a parent's knowledge that the initial test result was abnormal, but was greater in parents reporting that they had not received sufficient information about the screening process and its significance for the health of their infant.

The review reported here has revealed a lack of evidence about the impact of disclosing carrier status to parents following newborn screening. In addition, conclusions about parents' positive views about disclosing carrier status need to be interpreted with caution for three reasons. First, the relative low numbers involved, the poor reporting of socio-demographic data in some studies, and the biased inclusion of better educated parents in other studies, precludes generalising the findings to wider populations. Second, none of the relevant studies addressed the possibility of carriers of a single identified mutation being at risk of having CF. Third, it is possible that more literature is available in languages other than English, especially about screening for sickle cell disorders.

We did not review in depth studies that did not address parents' views. These included an American survey of screening programmes (Farrell *et al.*, 2001); an economic evaluation (1998); and an assessment of needs for educational provision about haemoglobinopathies for midwives in England (1996). Each of these studies has been followed-up in different ways elsewhere. The American survey informed a survey of cystic fibrosis screening services in the UK undertaken in parallel with the current review (Lempert *et al.*, 2004). The economic evaluation has been reviewed by the Centre for Reviews and Dissemination (<http://www.york.ac.uk/inst/crd/>). The needs assessment has been followed by the commissioning of a training programme for sickle cell and thalassaemia screening in England and Wales (<http://www-phm.umds.ac.uk/haemscreening/>).

5.3 Implications

Implications for policy must be cautious, considering the low numbers and selective nature of the study populations.

5.3.1 Policy

The findings of this review provide some support for a policy decision to include DNA testing early in the screening protocol in order to reduce the numbers of parents experiencing excessive anxiety between hearing of a positive screening result (raised IRT test) and a confirmed result. However this is based on specialist outreach models of care; little is known about how to support non-specialists in this work. There is no support for not disclosing newborn carrier status or raised IRT test results to parents.

Little is known about the views of parents with less formal education.

Other parents prefer positive screening results or requests for repeat tests to be communicated by a familiar, non-specialist community/ primary care practitioner. Investment is needed in materials and training to support these health professionals to undertake well a task they may rarely, if ever, encounter. There is a particular need for interventions to support parents who wish to discuss screening results with their wider family.

Parents, other family members and practitioners should be involved in developing these interventions.

5.3.2 Practice

Individual practitioners have a responsibility to forewarn parents about the possibility of positive screening results or requests for repeat tests and, when they occur, to discuss these with parents themselves rather than referring them to specialist services prematurely.

5.3.3 Research

With a dearth of published research findings about disclosing sickle cell carrier status, we recommend seeking grey literature through practitioner networks.

We found no research addressing the issue of disclosing non-paternity through identification of carrier status in newborn screening. This should be addressed with primary research.

Research is particularly needed about the implications for parents of an unclear diagnosis for cystic fibrosis and how to provide appropriate follow-up care.

More particularly needs to be known about the views and experiences of parents with less formal education.

Some parents would like to be offered cascade carrier testing for other children. As this contradicts current guidelines, we recommend research to explore the views of parents and children, and the possible implications.

Parents, other family members and practitioners should be involved in guiding this research.

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APPENDICES

APPENDIX 2.2: Search strategy for electronic databases

Strategy created for MEDLINE (OVID online) and adapted for other databases.

1 – 17: Newborn Screening and Blood Spot Test

- 1 exp neonatal screening/ (2232)
- 2 exp "sensitivity and specificity"/ (120680)
- 3 specificity.ti,ab,kw. (148030)
- 4 false negative.mp. (10791)
- 5 false positive.mp. (17255)
- 6 ((infant or newborn or baby or neonat\$ or perinat\$) adj3 screen\$).ti,ab,kw. (3469)
- 7 exp predictive value of tests/ (42877)
- 8 exp ROC curve/ (5247)
- 9 exp diagnosis/ (2913675)
- 10 mass screening/ (39096)
- 11 exp blood specimen collection/ (7770)
- 12 exp fetal blood/ (16439)
- 13 (heel adj3 prick).ti,ab,kw. (83)
- 14 heel/ (1339)
- 15 guthrie.ti,ab,kw. (351)
- 16 (screen\$ adj3 card).ti,ab,kw. (54)
- 17 "blood spot".ti,ab,kw. (345)

18 or/1-17 (3055534)

19 – 47: Screening / Diagnostic Tests and Results

- 19 heterozygote/ (20976)
- 20 exp heterozygote detection/ (5582)
- 21 carrier state/ (12401)
- 22 carrier.ti,ab,kw. (35185)
- 23 trypsin/ (31003)
- 24 trypsinogen/ (1165)
- 25 (sweat adj3 test).ti,ab,kw. (386)
- 26 skin temperature/ (6277)
- 27 cystic fibrosis/ (16711)
- 28 (immunoreactive adj3 trypsin\$).ti,ab,kw. (415)
- 29 irt.ti,ab,kw. (432)
- 30 exp hemoglobinopathies/ (22375)
- 31 exp electrophoresis/ (249400)
- 32 hemoglobin electrophoresis.ti,ab,kw. (208)
- 33 haemoglobin electrophoresis.ti,ab,kw. (84)

- 34 hypertrypsin?emic.mp. (2)
- 35 sickle cell.mp. (8773)
- 36 exp anemia, sickle cell/ (10591)
- 37 hemoglobin sc disease/ (404)
- 38 sickle cell trait/ (1280)
- 39 exp hemoglobin c disease/ (389)
- 40 ((haemoglobin or hemoglobin) adj2 (d or e or o)).mp. (978)
- 41 "haemoglobin a".ti,ab,kw. (11392)
- 42 "hemoglobin a".ti,ab,kw. (32038)
- 43 "haemoglobin as".ti,ab,kw. (13359)
- 44 "hemoglobin as".ti,ab,kw. (38920)
- 45 hereditary persistence of fetal haemoglobin.mp. (58)
- 46 hereditary persistence of fetal hemoglobin.mp. (233)
- 47 hpfh.mp. (274)

48 or/19-47 (424345)

49 – 59: Disclosure of Results

- 49 disclos\$.mp. (29726)
- 50 exp disclosure/ (11850)
- 51 non-disclosure.ti,ab,kw. (33)
- 52 "non disclosure".ti,ab,kw. (33)
- 53 exp truth disclosure/ (7074)
- 54 exp confidentiality/ (12749)
- 55 exp communication/ (162227)
- 56 exp duty to warn/ (976)
- 57 ((disclos\$ or communicat\$ or break\$ or deliver\$ or tell\$) adj3 (bad news or result\$ or test\$ or state or status or diagnosis)).ti,ab,kw. (14936)
- 58 ((disclos\$ or communicat\$ or break\$ or deliver\$ or tell\$) adj3 (parent\$ or patient\$ or famil\$ or guardian\$ or mother or father)).ti,ab,kw. (21115)
- 59 ((patient or user or parent or consumer or mother or father) adj3 (informat\$ or leaflet\$ or pamphlet\$ or letter\$ or telephone or phone)).ti,ab,kw. (9110)

60 or/49-59 (229216)

61 – 109: Possible Outcomes and Factors of Screening / Disclosure

- 61 ((psychosocial or psychological or emotion\$ or social or educat\$ or famil\$) adj3 (impact\$ or factor\$ or effect\$ or outcome\$ or implicat\$ or state or status)).ti,ab,kw. (71765)
- 62 Stress, Psychological/et [Etiology] (3077)
- 63 anxiety/et (2250)
- 64 exp paternity/ (1873)
- 65 ((non or false) adj3 paternity).ti,ab,kw. (93)
- 66 biological father.ti,kw,ab. (69)

67 reproduction/ (18896)
 68 ((reproduct\$ or pregnan\$) adj3 (choice\$ or plan\$ or future\$ or issue\$ or implicat\$ or behavio\$ or decision\$)).ti,ab,kw. (7345)
 69 parents/ (18576)
 70 exp parent-child relations/ (26225)
 71 exp family relations/ (35377)
 72 exp false positive reactions/ (15150)
 73 exp false negative reactions/ (10612)
 74 professional family relations/ (5916)
 75 physician patient relations/ (33285)
 76 nurse patient relations/ (16848)
 77 ethics/ (8069)
 78 exp principle-based ethics/ (9813)
 79 patient education/ (33279)
 80 language/ (10133)
 81 translat\$.mp. (74513)
 82 exp patient acceptance of healthcare/ (59956)
 83 genetic privacy/ (532)
 84 genetic counseling/ (7811)
 85 (referral or refer or consult\$).ti,ab,kw. (36913)
 86 exp patient care management/ (225785)
 87 exp "health care quality access and evaluation"/ (2237642)
 88 (insurance or employment or education or pension\$ or morgage).mp. (159776)
 89 "social\$ exclus\$".mp. (60)
 90 carrier.ti,ab,kw. (35185)
 91 heterozygote detection/ (5582)
 92 awareness/ (4463)
 93 risk/ (64162)
 94 family health/ (8093)
 95 midwife.ti,ab,kw. (1802)
 96 informed consent/ (18411)
 97 patient advocacy/ (16846)
 98 (informed adj3 (choice or decision)).ti,ab,kw. (883)
 99 time factors/ (577731)
 100 "lifetime health".kw,ti,ab. (40)
 101 knowledge attitudes practice/ (17826)
 102 attitude of health personnel/ (40350)
 103 "Referral and Consultation"/ (28568)
 104 carrier state/ (12401)
 105 counsel\$.ti,ab,kw. (26648)
 106 exp community health services/ (274882)
 107 heterozygote/ (20976)
 108 social support/ (17896)
 109 ((patient or user or parent or consumer or mother or father) adj3 (informat\$ or leaflet\$ or pamphlet\$ or letter\$ or telephone or phone)).ti,kw,ab. (9110)
 110 or/61-109 (3160825)
 111 and/18,48,60,110 (630)

APPENDIX 4.1: Details of studies included in in-depth review

Author	Screening Programme			Study design and data collection
	Country	Condition and setting of communication	Population	
Ciske, D.J. et al (2001)	USA <i>Wisconsin</i>	CF: specialist clinic	Parents of 138 families: educational background diverse, but better educated than comparable population of Wisconsin young adults	Post-test only outcome evaluation: one to one interview (face to face or by phone) and self-completion questionnaire
Moran, J. et al (2003)	UK <i>England</i>	CF: home	21 Parents; no socio-demographic data, only 36 of 168 eligible families 'contactable'	Cross-sectional survey - qualitative study: One to one interview (face to face or by phone)
Parsons, E.P. et al (2003)	Wales	CF: home and specialist clinic	10 parents of carrier babies; 82 mothers from general population. No socio-demographic data	Case control study: One to one interview (face to face or by phone)
Tluczek, A. et al (1991)	USA	CF: specialist CF centre; home by telephone	Parents of 104 infants with false positive IRT test results: 78% white; 64% married; 40% of mothers and 43% of fathers had education beyond high school.	Outcome evaluation: One to one interview (face to face or by phone) and self-completion questionnaire
Wheeler, P.G. et al (2001)	USA <i>Massachusetts</i>	CF: specialist clinic in academic centre	Parents of 95 families; no socio-demographic data	Case series: no methods reported
Whitten, C.F. et al (1981)	USA	Sickle cell disorders: community site - <i>a mobile unit in a variety of settings: schools, churches, supermarkets, at public meetings and the State Fair.</i>	192 adults/ parents <i>Counselees were adults who were sickle cell carriers or were parents of a child who was a sickle cell carrier. 153 women, 62 married, 97 under 30, 34 of the respondents had no children, 110 had between 1 and 3 children and 36 had more than 3; In 79 instances the counsellee had sickle cell trait, in 80 the child did, and in 33 both the counsellee and their child were carriers.</i>	outcome evaluation - <i>post test only:</i>

APPENDIX 4.2: Details of interventions included in in-depth review

Author	Type of intervention	Health professional communicating	Timing of the communication
Ciske, D.J. et al (2001)	Advice/counselling <i>Immediately after the sweat test that revealed the child did not have CF, and therefore the screening result was 'false positive', a communication session occurred with the parents that included a description of the sweat chloride result and its interpretation, information about the genetics of CF, an offer to arrange additional CFTR analysis in parents and family members, and information about the implications of CF heterozygote status for further reproduction.</i>	specified <i>genetic counsellors; nurse practitioners; physician</i>	at time of heel-prick test result disclosure
Moran, J. et al (2002)	Advice/counselling Information/education <i>CF nurse and HV visited parents at home after raised IRT to explain the need for a further test - providing information and counselling. Blood test taken and results provided within one to two weeks. Family informed as soon as possible by telephone if result normal. Copies of letter to GP, HV and parents.</i>	specified <i>health visitor; CF nurse</i>	at time of subsequent test <i>requesting second blood sample</i> result disclosure
Parsons, E.P. et al (2003)	Information/education	specified <i>Health visitor and GP to inform them about sweat testing.</i> <i>Paediatrician, specialist CF nurse and health visitor to arrange the date for the sweat test.</i> <i>Paediatrician for giving results of sweat test on the same day.</i>	result disclosure
Tluczek, A. et al (1991)	Information/education <i>the intervention was disclosing results to parents</i>	specified <i>physician (sweat test); CF centre physician</i>	result disclosure <i>at un-blinding when baby 4 yrs</i>

Wheeler, P.G. et al (2001)	Advice/counselling	specified genetic counsellor	at time of subsequent test <i>Results of DNA testing and the implications were discussed prior to giving the results of the sweat test.</i> post-result disclosure <i>24 hours after sweat test</i>
Whitten, C.F. et al (1981)	Advice/counselling <i>Counselling sessions about carrier status were recorded and analysed in terms of counsellors' performance and counsellee's response to carrier status.</i>	specified sickle cell counsellors	post-result disclosure

APPENDIX 5: Glossary

All terms in bold are included within the glossary

affected	When someone has a condition, it is said that they are affected . A child who is affected with cystic fibrosis , is a child who has cystic fibrosis .
antenatal screening	Antenatal screening , is screening which is carried out before a baby is born. This can include doing tests on the pregnant mother, her partner or the unborn baby. Antenatal screening includes tests for a wide range of conditions.
audit	A systematic monitoring of screening and treatment procedures.
blood sampling	This refers to the collecting of small amounts of blood. In the case of newborn screening it refers to the collection of small amounts of blood from the baby's heel when they are about a week old. This is done by pricking the heel.
blood spot	When newborn babies are about a week old a sample of blood is taken from their heel. The blood spot is stored on a special type of filter paper, called a Guthrie card . A number of tests are then carried out on this blood spot . These tests are often called newborn blood spot screening .
carrier	An individual who carries a single gene for a condition where two genes are required for an individual to be affected . The carrier can pass on the gene to their offspring who may be affected if they also inherit another gene from their other parent. A carrier is a heterozygote for the gene carried.
case	An individual with a health condition .
Child Health Department (often referred to as 'child health')	The Child Health Department monitors each child who is born. When a mother gives birth the Child Health Department is notified of the birth. The results of newborn screening tests are also reported to Child Health .

Child Health Record (also called PCHR)	Personal Child Health Record - this is the child health record which is held by the parent. It is normally issued by the health visitor.
clinical standards	Agreed standards that should be attained by health professionals in caring for individuals.
condition	There are lots of different word used to describe illnesses. They are sometimes called diseases , or disorders , or conditions .
congenital hypothyroidism (CHT)	Congenital hypothyroidism - a condition which is tested for in newborn babies. People with congenital hypothyroidism don't produce thyroid hormones properly. This can affect the development of the baby's organs, in particular the brain. If identified early the baby can be treated and can lead a healthy life. CHT has been screened for throughout the UK since the 1980s.
confirmed result	A confirmed result is one which has been confirmed. The results of initial screening tests are not usually 100% certain, and are often called presumptive results . The results of screening tests are NOT confirmed results. They are often confirmed later, with further tests.
consent	Agreement to a plan of action or particular treatment.
coverage	When talking about screening programmes, people often talk about coverage . This is the number of people actually screened. For example there are sometimes concerns that coverage is poor amongst families from particular backgrounds, or religions. The success of screening programmes is sometimes measured by the coverage achieved.
cystic fibrosis	Cystic fibrosis - this is a condition which affects the organs in the body, especially the lungs and pancreas, by clogging them with thick sticky mucus. New treatments mean people with cystic fibrosis can live relatively healthy lives. Their standard of life is improved if the condition is detected and treated in the first months of life. Cystic fibrosis is more common in some populations within the UK than others. Some areas have been screening for CF in the UK since the 1980's. Within the next few years all newborn babies will be screened for cystic fibrosis.

diagnosis / diagnostic test	A diagnostic test is one which tests for a specific condition , and allows doctors to make a diagnosis , confirming whether or not someone has a condition. Diagnostic tests often follow screening tests. For example a newborn baby might be screened for cystic fibrosis . The screening result is that the baby probably has the condition. Further diagnostic tests will then be carried out to find out whether the child definitely has cystic fibrosis . This is then considered the confirmed result.
disease	There are lots of different words used to describe illnesses. They are sometimes called diseases , or disorders , or conditions .
disorder	There are lots of different words used to describe illnesses. They are sometimes called diseases , or disorders , or conditions .
false-negative	A false-negative result is one which is thought to be negative , but this turns out to be false. Children who have a false-negative results for PKU are those who are told that they don't have the condition, and then it turns out that they do have PKU . Depending on the condition, this can be very serious. If a child is not treated quickly for PKU their brain will not develop properly.
false-positive	A false-positive result, is one where the result is thought to be positive, but this turns out to be false. A child who has a false-positive result for PKU , is a child who has been told they have the condition, and then it turns out that this is not the case. For parents, receiving a false-positive result can mean that they think that their child is sick, when actually they are healthy.
Guthrie Card	When the midwife collects small drops of blood from a newborn baby, she puts them on a special piece of filter paper called a Guthrie Card . This special card allows the blood to be stored while it is sent to the laboratory for testing.

haemoglobinopathies	Haemoglobinopathies - disorders of the haemoglobin. Haemoglobin is the part of our blood which carries oxygen. There a large number of different haemoglobinopathies, some are more serious than others. Sickle cell disease is a haemoglobinopathy. Haemoglobinopathies are more common in some populations within the UK than others. Haemoglobinopathies can be tested for in pregnant mothers, and unborn babies, as well as newborn babies. Some areas have been screening newborn babies for haemoglobinopathies in newborn babies since the 1980s. In many areas only those babies thought to be at high risk are tested. This is changing and over the next few years all newborn babies will be screened for haemoglobinopathies.
heel prick	When a baby is about a week old, the midwife will prick the baby's heel and collect some small drops of blood. This blood is then used for screening .
heterozygote	A heterozygote carries two different versions of the same gene. Where the health condition requires two versions of the same gene the heterozygote is a carrier .
informatics	Health informatics is an evolving scientific discipline that deals with the responsible collection, storage, retrieval, communication and optimal use of health related data, information and knowledge. to improve patient care, medical education, and health sciences research.
National Screening Committee	The UK National Screening Committee - this is a national advisory body which makes recommendations about screening to the Department of Health.
negative result	A negative result is a result which shows that the child does not have (or is unlikely to have) the condition which is tested for. Sometimes people will say that the result is normal .
neonatal screening	Neonatal screening can also be called newborn screening. All screening on a newborn baby is called newborn (or neonatal) screening. There are different newborn screening tests, for example includes hearing screening, hips screening and blood spot screening.
normal (result)	Sometimes when the result of the test shows that the child does not have (or is unlikely to have) the condition tested for, people say the result is normal . In general it is best to avoid using this term, as it is not always clear what normal is meant to be. Its meaning may be unclear to both parents and health professionals.

notification	When talking about screening people often refer to notification of results. This can mean a number of slightly different things. Sometimes notification means the <i>reporting of a screening result to a register, or a health monitoring group</i> , such as the child health record. Sometimes notification refers to <i>telling parents or patients the results of their tests</i> . When talking about notification, it is important to be clear about <i>what information is being notified, and who is being notified about this information</i> .
Parent Support Research Team	The Parent Support Research Team is part of the UK Newborn Screening Programme Centre . It is based at the Institute of Education, University of London. It is their responsibility to support parents involved in the Programme Centre's work. Working with parents and health professionals, it will be designing parent information about newborn screening , and communication guidelines and training for health professionals.
PHCR (Also called the Child Health Record)	Personal Child Health Record - this is the child health record which is held by the parent. It is normally issued by the health visitor.
phenylketonuria (PKU)	Phenylketonuria - a condition which is tested for in newborn babies. It affects how protein is broken down in the body. If untreated this leads to poor brain development. If it identified early then the child can be put on a special diet and the brain can develop normally. PKU has been screened for throughout the UK since 1969.
positive result	A positive result is a result which shows that the child does have (or is likely to have) the condition which is tested for. Sometimes people will say that the child is affected .
presumptive results	Presumptive results are results which are not yet confirmed, but which are considered highly likely. A presumptive positive for PKU means that is very likely, or assumed that the child has PKU. This result is then confirmed using a diagnostic test. Screening results are described as presumptive. A presumptive positive can also be described as a screen positive . A presumptive negative can also be described as a screen negative .
process standards	Agreed standards that should be achieved at each stage of the screening process: informing parents, taking the sample, laboratory testing, informing clinicians and parents of the results, starting treatment of affected newborns as soon as it is beneficial.

quality assurance	A system for monitoring and maintaining high standards in every aspect of the screening programme.
registers / disease registers	There are a number of disease registers in the UK which keep a record of the number of people with particular conditions. These registers can serve different purposes: ensuring people with the condition are followed up, and treated and helping us to understand more about these conditions and how they effect people etc. There are different registers which collect slightly different information about different conditions. One of the tasks of the Programme Centre is to develop and maintain national registers for conditions which are screened for in newborn blood spot screening.
screen negative (results)	Screening results are not 100% conclusive. Instead they provide presumptive results , which are then confirmed using diagnostic tests . A screen negative result for CF means that it is highly likely that the child does NOT have CF . This screen negative result is NOT usually confirmed using further tests, but it is assumed the child is not affected .
screen positive (results)	Screening results are not 100% conclusive. Instead they provide presumptive results , which are then confirmed using diagnostic tests . A screen positive result for CHT means that it is highly likely that the child has CHT , but that this must still be confirmed by further tests.
screening	Screening is when healthy children and adults are tested to see if they are likely to develop a condition. Screening tests don't generally confirm that people have a disease. Usually they will not feel ill from these conditions in any way at the time when they're screened. Screening allows diseases to be identified early, before any signs of illness. This means people can be treated quickly, and hopefully avoid getting seriously ill. Screening can happen at different stages, and for different conditions. Newborn screening in this country includes tests for phenylketonuria (PKU), congenital hypothyroidism (CHT), cystic fibrosis (CF), and haemoglobinopathies .
Screening protocol	A screening protocol lists the procedures and tests for collecting and testing a sample when screening for a health condition .

sensitivity	When discussing how good a particular test is, people talk about sensitivity . Sensitivity is a way of measuring how sensitive a test is to the condition ; how good it is at finding the condition. When a test is very sensitive it will pick up all the cases of the disease. When a test is not very sensitive it will miss some of the cases. This means that screening test which is not very sensitive will show that some people do not have the condition, when actually they do but the test wasn't sensitive enough to pick them up. When people are told that they do not have a condition, but really they do, this is called a false-negative result. Tests that are not very sensitive produce more false-negative results.
setting standards	The process by which minimum acceptable standards, achievable standards and optimal standards are agreed. This is usually through discussion and review of current practice and research.
sickle cell disorders	Sickle Cell disorders are conditions which affect the way that our blood carries oxygen. The part of the blood which carries oxygen is called haemoglobin, which is found inside our red blood cells. Sickle Cell disorders can also be called haemoglobinopathies . The name sickle cell disease , is also used, usually used to describe one particular type of sickle cell disorder. A person who has sickle cell disease has some red blood cells which are shaped like sickles. These cells cannot carry oxygen properly. The condition can be very painful and can cause various health problems.
specificity	When discussing how good a particular test is, people talk about specificity . Specificity is a way of measuring how good a test is at picking up only the people who have the condition. A test with poor specificity is one which isn't very specific, and identifies people with disease, but also some other people who don't have the disease. A screening test which is not very specific will have some results which show a person has an illness, when actually they don't. This kind of result is called a false-positive result. Tests which are not very specific produce more false-positive results.
true-negative	A true-negative result is one which is thought to be negative, and this is true. A person with a true negative result for a CHT , is someone who does not have CHT .
true-positive	A true-positive result is one which is thought to be positive, and this is true. A person with a true positive result for a condition, is someone who has that condition.

UK

The **UK** includes England, Wales, Scotland and Northern Ireland.

UK Newborn Screening
Programme Centre

The **UK Newborn Screening Programme Centre** has been funded by the Department of Health to develop national standards for newborn blood spot screening. The Programme Centre is made up of a team of people from Great Ormond Street Hospital for Children, the Institute of Child Health and the Institute of Education.

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