Family planning decisions for parents of children with a rare genetic condition: a scoping review

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Abstract

Expansion of newborn screening programmes increases the complexity around reproductive choices, both in terms of the increased number of parents faced with making reproductive decisions from the earliest days of their affected child's life, and the number of conditions for which such decisions have to be made.

We conducted a scoping review to explore: (i) reproductive decision-making among parents of children with recessive genetic conditions; and, (ii) the involvement of healthcare services in facilitating and supporting those decisions. Systematic search processes involved seven bibliographic databases, citation, and grey literature searches. From an initial total of 311 identified articles, seven met the inclusion criteria and were included in the review.

The extracted data were organised around three themes: factors influencing reproductive decisions taken by parents, how those factors changed over time, and the involvement of healthcare services in supporting and facilitating reproductive decisions.

Most studies focused on attitudes towards, and uptake of, pre-natal diagnosis (PND) and termination. None of the studies considered the wider range of reproductive choices facing all parents, including those of children with conditions for whom PND and termination is not available or where good health outcomes make these options less justifiable. The literature provided little insight into the role of healthcare staff in providing family planning support for these parents. There is a need to better understand the support parents need in their decision-making, and who is best placed to provide that support.

Key words

Scoping review; recessive genetic conditions; family planning; reproductive decisions; reproductive services

Abbreviations

CF: Cystic Fibrosis; MCADD: Medium Chain Acyl-CoA dehydrogenase deficiency; NBS: Newborn bloodspot screening; PIHM: pre-implantation genetic diagnosis; PND: pre-natal diagnosis; SCD: Sickle Cell Disease; SMA: Spinal Muscular Atrophy

Introduction

~~Developments in newborn screening technologies, with T~~the expansion of newborn bloodspot screening programmes (NBS)~~,~~ has ~~have~~ brought a substantial increase in the early detection of rare inherited disorders (1). In the USA, the NBS routinely tests for over thirty conditions (2), and a similar expansion has occurred in other countries including the Netherlands, Denmark and Germany (3). In the United Kingdom (UK), more modest expansions have resulted in the inclusion of six inherited metabolic conditions (Box 1) (4).

Box 1: Conditions currently screened by the newborn bloodspot screening (NBS) programme in the UK

(Conditions in **bold** were included in the database search strategy.)

sickle cell disease (SCD)
cystic fibrosis (CF)
congenital hypothyroidism (CHT)
inherited metabolic diseases (IMDs):
- **phenylketonuria (PKU)**
- **medium-chain acyl-CoA dehydrogenase deficiency (MCADD)**
- **maple syrup urine disease (MSUD)**
- **isovaleric acidaemia (IVA)**
- **glutaric aciduria type 1 (GA1)**
- **homocystinuria (HCU)**

Screening and early detection of rare conditions enable treatment to be initiated before significant morbidity has occurred, and can result in substantially improved health outcomes and reduced likelihood of mortality (5). For example, the benefits of early detection and active management for phenylketonuria are well established (6), and more recent evidence indicates the benefits for medium chain Acyl-CoA dehydrogenase deficiency (MCADD) (7-11). The responsibility for managing these conditions, however, rests primarily with parents. The associated family burden may be substantial (12), although there is some evidence that this can be mediated by adequate support (13,14).

When a child is diagnosed with a recessive genetic condition, parents need to decide whether or not to have subsequent children. Their reproductive choices are made within ~~a~~ highly complex and changing healthcare, social, and technological context~~s~~. ~~Their decisions are informed by various factors, such as the severity of the condition, and its impact on the child~~

~~and the family. Furthermore, technological developments make the decision-making process even more complex.~~ The severity of the condition, and its effect on the child and the family, are likely to play a key role in parents' decisions.

~~Another set of factors that may affect the parents' decision are concerned~~ Their decisions may also be affected by ~~with~~ the genetic risk (1 in 4) of another affected pregnancy~~, and~~ the availability ~~and acceptability~~ of reproductive technologies including prenatal diagnosis (PND), or pre-implantation genetic diagnosis (PIGM), to manage that risk; and willingness to use those technologies. Advances in non-invasive PND increase the acceptability of these techniques to parents (15,16), although ethical concerns about their availability and use have been identified (17). Expansion of the NBS has increased the number of parents faced with making more complicated reproductive decisions from the earliest days of their affected child's life, and the number of conditions for which such decisions have to be made. This indicates the need to understand how parents make decisions about subsequent pregnancies and the involvement of healthcare services in facilitating and supporting those decisions.

Previous reviews (18,19) have focused on reproductive outcomes in this population but have not considered reproductive decision-making. In this scoping review we identified and mapped all studies that explored reproductive decision-making amongst parents of children with recessive genetic conditions, with respect to the following questions:

1. What factors influence these decisions?

2. How do these factors change over time?

3. What is the involvement of healthcare services in supporting and facilitating these decisions?

Methods

We used scoping review methodology (20,21), with robust literature searching and study selection, coupled with data charting and a thematic narrative summary. We did not formally assess the quality of included studies.

Search strategy

Searches in the following databases were carried out in April 2014 and updated in January 2017: ASSIA (ProQuest), CINAHL Complete (EBSCOHost), HMIC (NICE Evidence Search), Medline (EBSCOHost), PsycINFO (ProQuest), Scopus (Elsevier), and Web of Science (Thomson Reuters).

We combined search words/phrases and indexing terms related to autosomal recessive conditions (named disorders with synonyms, and generic terms) with search words/phrases and indexing terms related to reproductive decision-making. The named disorders searched are shown in bold in Box 1. A sensitivity search in Scopus established that none of the disorders additionally screened for in the US (2) were worth searching for explicitly.

Results were restricted to items published from 2000 onwards, as we were interested in family planning decision-making within the modern context of an availability of genetic testing procedures. No language or study design restrictions were applied to the searches, but non-human studies were removed from the results. An indicative search strategy is provided in supplementary file 1.

Social Care Online (SCIE) was searched for each disorder of interest separately, screening the results for relevance to reproductive decision-making. ~~Other websites~~Grey literature sources known to the review team were also searched: see Box 2. ~~searched are shown in Box 2.~~ Reference and citation searches were carried out in respect of included studies.

Box 2: ~~Websites~~ Grey literature searched

NHS Evidence search (https://www.evidence.nhs.uk/) - search terms: "family planning rare genetic disorder". The first 100 results (ordered by relevance) were checked

The Genetic Alliance UK Website (http://www.geneticalliance.org.uk/) - browsed for relevant publications

The Ottawa Hospital Research Institute Website (http://204.187.39.28/index.html) - browsed for relevant decision aids

Study selection

Inclusion and exclusion criteria were independently applied by two reviewers, with any disagreements resolved through discussion within the review team. ~~.~~Papers were included if

they related to reproductive decision-making by couples who had a child with a recessive genetic condition and were considering having more children. We excluded papers relating to couples who did not have an affected child, or papers focusing on: (i) women with a genetic condition; (ii) the uptake of genetic technologies without exploring the decision-making process; or (iii) attitudes towards parental screening or (hypothetical) non-invasive prenatal diagnosis. Included conditions of interest were those shown in bold in Box 1. We excluded studies relating to autosomal dominant conditions (e.g. Huntingdon's), or other non-genetic conditions (e.g. hypothyroidism).

We only included studies set in countries whose reproductive health services included well-developed early detection technologies, i.e. Europe, USA, Canada, Australia, and New Zealand. We included papers that reported any original empirical study, but the reference lists of retrieved reviews were consulted.

Data extraction and synthesis

~~We developed a data extraction form for~~ We charted~~charting~~ the key study characteristics of the included studies and findings of relevance to our review, which were further thematically analysed according to our review questions.

Results

Characteristics of included studies

From 311 unique records from the original database searches, plus two further records from the search update, seven records were included in this review (see Figure 1).

All were peer-reviewed journal articles apart from one conference abstract (22). The main characteristics of the included studies are provided in Table 1.

Four studies related to reproductive decision-making for parents of children with Cystic Fibrosis (CF) (23-26), and one each to Sickle Cell Disease (SCD) (22), Spinal Muscular Atrophy (SMA) (27), and rare metabolic disorders (28). In most of the studies the participants were recruited from populations using, or known to, health services (22-26,28); one study recruited predominantly via an advocacy group for the condition (SMA) (27). Four studies used quantitative (23,24,26,28), and three qualitative research methods (22,25,27).

Most of the studies explored decisions concerning whether to have more children following the birth of an affected child (22-27), and focused almost exclusively on parental attitudes

towards use of reproductive technologies to avoid having further affected children. Six of the studies (22-26,28) focussed on parental attitudes towards PND and termination of affected pregnancies, with two of these (22,26) also exploring the use of assisted reproductive technologies such as donor-In Vitro Fertilisation (IVF), and preimplantation genetic diagnosis (PGD), but provided minimal information about this to inform our review.

In just one study the separate opinions of mothers and fathers in participating couples were explicitly sought (25). Most studies recruited predominantly mothers (over 87% in three (22,27,28) and 100% in one (24). One study (23) reported a 'poor response' from fathers in the baseline survey and only surveyed mothers in the follow-up. The genders of the parent participants were not reported in one study using data from a national survey (26).

Ethnicity was reported in four of the seven studies. Three included all or mainly white/ Caucasian participants (24,25,28) and the fourth which focused on SCD included parents of black or African American origin (22).

Findings: reproductive decision-making

What factors influence the reproductive decisions taken by parents of a child with a recessive genetic condition?

In most studies, parental perceptions of coping with their affected child were key to decisions about having any further children, and decisions about the use of reproductive technologies to avoid having further affected children. Decisions were based on factors centred both on the child, and on the parent and their wider family and social network, which~~. They~~ included perceptions around their current and future situation~~, which shifted over time as the parents adapted to caring for their affected child.~~.

Factors centred on the child included the perceived severity (or otherwise) of the condition (23,26), concerns about the child's current health (23), worry about the child's future and their future health (23,28), the (poor) quality of life of the child and the family (23), the potential impact of another affected child on the existing child and family life, including concern for increased infection risk (25), and having experienced suffering and death of previous children(27). In one study, some parents considered their existing child as a role model or support system for a hypothetical future child having the same condition (22), and in another

study (23) one mother believed that termination of an affected pregnancy would devalue the life of their existing child with CF.

Factors centred on the parents included parental stress (28), the impact of caring for the child on the parents' daily activities (26), the perceived difficulty of meeting the child's care needs (28), the size of the parents' social support network (28), and the physical strain of caring for a child with a condition involving a physical disability (27). In one study, the parents' experience caring for their affected child gave them confidence in their abilities to look after another child with the same condition (25); indeed, one father was quoted as saying they had considered adopting another child with CF because of their experiences (25).

Some parents did plan future pregnancies but were prepared to take the risk of having a further affected child, trusting to chance. In one study (23), some parents believed that the odds were more likely to be in favour of having a healthy child in the next pregnancy. One study found that some parents appeared not to make active reproductive choices, but rather were 'overtaken by events' (25) p.409, which the authors described as a 'decision *not to decide*'. Conversely, in another study (26) some parents of children with CF had decided not to have more children as this was 'easier to decide', obviating potential engagement with reproductive technologies.

Moral issues were of lesser importance in decision-making: lack of religious conviction was found to correlate with intention to use PND and consideration of termination (26), and 2/16 mothers cited 'religious reasons' for not terminating a hypothetical affected pregnancy in one study (23). One study found that for some parents the decision not to have any further children was driven by a desire not to have any more affected children and unwillingness to terminate an affected pregnancy (24).

The studies highlight much ambivalence around the use of PND to make decisions about continuation of pregnancy. Three studies (23,26,28) explored parents' decision making and reasoning in relation to hypothetical future pregnancies. In one study (26), 13/97 and 26/97 parents of children with CF who were planning more children did not know whether they would *consider* terminating or *decide to* terminate a hypothetical subsequent affected pregnancy respectively. Two studies (23, 28) found a disjoint between parents wanting to undergo prenatal diagnosis and their intention to terminate a pregnancy on the basis of that diagnosis. Among parents of children with CF who had embarked on subsequent pregnancies,

uptake of PND was largely justified in terms of enabling them to adjust to a positive result, although all five CF-affected pregnancies had resulted in termination (23).

How do those factors change over time?

Reproductive decisions may change as the situation of caring for a child with a rare genetic condition unfolds. This has been explored only with respect to parents of children with CF. In one study, participants describing their evolving response to having a child with CF (25) reported that ~~One of the studies invited participants to describe their evolving response to having a child with CF (25). Participants reported that~~ after the initial shock of diagnosis, they took some time to adapt and learn how to manage the condition, but once they had adapted, they felt able to cope and could consider having another child.

~~As decisions can change over time, hypothetical decisions may not necessarily translate to actual behaviour.~~ Only one study followed up participants over time to explore ~~this~~ how hypothetical decisions translated to actual behaviour (23). They found that 16 of the 27 mothers of young children with CF who had at baseline reported not wanting any more children, had changed their mind at a five-year follow-up. Again, coping was cited as a main reason for this, along with the child's good health and being more comfortable with the diagnosis. Conversely, four of the six mothers who originally wanted more children had changed their mind due to concerns over the child's health. Overall, the study found that in 67% of mothers, the hypothetically reported behaviour regarding the use of PND was the same as the actual behaviour, but 'mothers not uncommonly changed their minds, and in both directions' (23) (pe654).

What is the involvement of healthcare services in supporting and facilitating these decisions?

Four studies (23-25, 28) considered the role of healthcare services and all confined their attention to genetic counselling services and their availability, uptake and acceptability. Some of the studies reported that some or all the participants had received genetic counselling, mostly by specialist genetic counselling services (23-25); in the study of reproductive decisions of parents of children with metabolic disorders (28), the author provided a breakdown of professional groups which provided genetic counselling, and less than 4% of genetic counselling was provided by a specialist genetic counsellor either within or outside the metabolic centre. One study (23) reported that 72% of mothers had rated consultations

with genetic counsellors as 'extremely useful' or 'very useful'. Other than reporting the availability and uptake of genetic counselling services, however, the studies did not explore the role of these or other services in supporting and facilitating reproductive decisions.

Discussion

We found a dearth of recent studies exploring reproductive decision-making of parents of children with recessive genetic conditions, as previously highlighted (29); the collective scope of the studies was narrow. Only a small number of conditions were considered, with the majority focusing on CF, whose findings will have limited applicability to other conditions. Most studies focused on attitudes towards, and uptake of, PND and termination. None of the studies considered the wider range of reproductive choices facing all parents (including those of children with conditions for whom PND and termination is not available or where good health outcomes make these options less justifiable), and the extent to which those choices are facilitated. With regard to familial relationships, only one of our included studies (25) explored the role of both mothers and fathers in couples' reproductive decision-making; for most of the others, mothers were the focus. More generally, this literature base failed to recognise that reproductive decisions take place in a wide~~r~~ social arena that extends beyond the confines of PND (30). ~~, and outside the confines of consideration of, and engagement with, PND.~~

The reviewed literature did reveal a number of factors which seem to affect reproductive decisions for this particular population and their relative importance. Many of those revolved around parental perceptions of coping, now and in the future, with some parents using scenario-based thinking as a decision-making strategy (25). Moral and religious considerations seemed to be less significant which is consistent with findings from Atkin et al. (3~~0~~1).

In presenting factors which may be important in reproductive decision-making, it is important to recognise the complex interplay between them (25), and the ways in which parents manage the complexity of decisions related to use of reproductive technologies. In some cases, this is done using simplifying heuristics (25). Some who find reproductive decisions too overwhelming choose *not* to choose, leaving future children to chance, rejecting PND and therefore any subsequent, potentially stressful decisions (32~~1~~). Others elect to eliminate the possibility of future pregnancies altogether, as Kelly (29) found in her qualitative study of parents of children affected with various genetic conditions.

The literature provided little insight into the role of healthcare staff in providing family planning support for these parents. In those studies where it was considered (23-25, 28), it was confined to the role of metabolic physicians or genetic counsellors in offering genetic technologies and explaining them, if appropriate. There is a lack of consideration of specialist reproductive services in the published literature.

A lack of access to acceptable contraception, and inconsistent or incorrect use of contraceptives, are major contributors to unplanned pregnancies (3~~2~~3,3~~3~~4). Early initiation of effective postpartum contraception including long-acting reversible methods substantially improves the odds of an inter-pregnancy interval of greater than 18 months (3~~5~~4,3~~5~~6). Access to high-quality reproductive healthcare from the point of diagnosis of the affected child is therefore particularly important. As our review has highlighted, reproductive decisions may alter over time, as parents adjust to their role or in response to the changing health status of their child (23,25). It is therefore important to recognise that decisions about whether or not to have children are not isolated events; they take place over time and need to be underpinned by a deliberative approach to contraceptive decision-making and access to effective contraceptive methods including long-acting reversible contraceptives, in order to both prevent unplanned pregnancy, and to enable planned pregnancy. The parents of younger children with genetic conditions are vulnerable to stress associated with caring and treatment management (14). However, there is a lack of literature to indicate the situation regarding contraceptive related decisions and the ways in which they impact on and contribute to wider reproductive decision-making processes.

Limitations

Our review has benefited from rigorous database searches and study selection processes. The grey literature searches, however, were not exhaustive.~~, therefore some potentially relevant materials may have been missed. It could be argued that o~~One limitation was a decision not to quality assess the included studies. However the role of quality assessment in scoping reviews has been debated (36,37), and in our review we were not synthesising the evidence

on the basis of its strength and quality, but rather identifying emergent themes and identifying gaps where research is lacking (387).

Conclusion

We found an overall paucity of research evidence on reproductive decision-making and the role of reproductive health services. The evidence base was confined to a limited number of conditions (predominantly CF). Although the studies were largely concerned with decisions about the use of reproductive technologies, these decisions were secondary to fundamental decisions about whether to have a further child. These decisions, which changed over time, centred on the reality of caring for the affected child and its implications on the family unit. There is a need to better understand what support parents need in their decision-making, how and when best to provide it, and by whom. Mothers' voices dominated the current literature, therefore subsequent research should focus more on the whole family unit.

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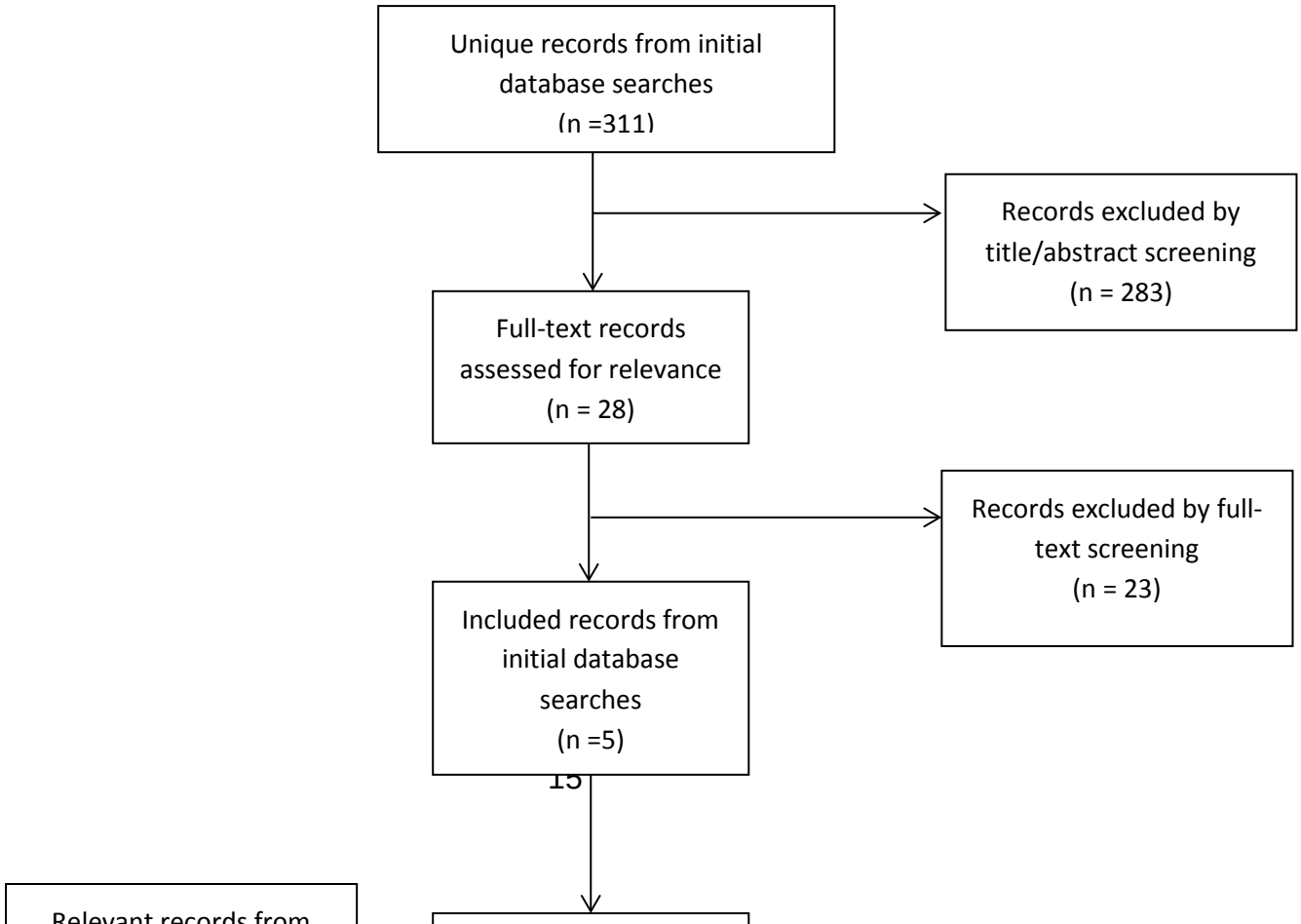
Figure 1. Document flow diagram



Supplementary file 1: Search strategy in Medline and CINAHL Complete (EBSCOHost)

TI = title words
AB = abstract words
MH = database subject headings
n4 = proximity operator

#	Query	Results
S1	TI "family planning" OR AB "family planning"	14,206
S2	TI ((decid* OR decision* OR choos* OR choice* OR plan* OR inten* OR options) n4 reproduct*) OR AB ((decid* OR decision* OR choos* OR choice* OR plan* OR inten* OR options) n4 reproduct*)	5,387
S3	TI ((decid* OR decision OR choos* OR choice* OR plan* OR inten* OR options) n4 (contracept* OR "birth control")) OR AB ((decid* OR decision OR choos* OR choice* OR plan* OR inten* OR options) n4 (contracept* OR "birth control"))	3,778
S4	TI ((decid* OR decision OR choos* OR choice* OR plan* OR inten* OR options) AND (pregnan* n4 (further OR subsequent OR later))) OR AB ((decid* OR decision OR choos* OR choice* OR plan* OR inten* OR options) AND (pregnan* n4 (further OR subsequent OR later)))	1,381
S5	TI ((decid* OR decision OR choos* OR choice* OR plan* OR inten* OR options) AND (preconceptual OR "pre fertili?ation" OR prefertili?ation OR PIGM OR CVS OR "antenatal diagnosis" OR FTS OR "first trimester screening" OR "noninvasive genetic testing" OR "prenatal screening" OR "antenatal screening")) OR AB ((decid* OR decision OR choos* OR choice* OR plan* OR inten* OR options) AND (preconceptual OR "pre fertili?ation" OR prefertili?ation OR PIGM OR CVS OR "antenatal diagnosis" OR FTS OR "first trimester screening" OR "noninvasive genetic testing" OR "prenatal screening" OR "antenatal screening"))	1,852
S6	(MH "Family Planning+")	6,614
S7	(MH "Contraception+")	27,895
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	51,665
S9	TI (Huntingdon* OR HD) OR AB (Huntingdon* OR HD)	28,847
S10	(MH "Huntington's Disease")	1,071
S11	(MH "Huntington Disease")	9,032
S12	S9 OR S10 OR S11	34,882
S13	S8 AND S12	110

S14	TI (PKU OR phenylketonuria OR hyperphenylalaninemia OR "PAH deficiency" OR "phenylalanine hydroxylase deficiency" OR H-PHE) OR AB (PKU OR phenylketonuria OR hyperphenylalaninemia OR "PAH deficiency" OR "phenylalanine hydroxylase deficiency" OR H-PHE)	6,379
S15	(MH "Phenylketonuria+")	518
S16	(MH "Phenylketonurias+")	6,102
S17	S14 OR S15 OR S16	8,193
S18	S8 AND S17	40
S19	TI "congenital hypothyroidism" OR AB "congenital hypothyroidism"	2,767
S20	(MH "Congenital Hypothyroidism")	3,728
S21	S19 OR S20	4,610
S22	S8 AND S21	3
S23	TI sickle OR AB sickle	21,310
S24	(MH "Anemia, Sickle Cell+")	20,605
S25	TI "cystic fibrosis" OR AB "cystic fibrosis"	36,723
S26	(MH "Cystic Fibrosis")	32,496
S27	TI (MCAD OR MCADD OR ("medium chain" AND "dehydrogenase deficiency")) OR AB (MCAD OR MCADD OR ("medium chain" AND "dehydrogenase deficiency"))	869
S28	TI (MSUD OR "maple syrup urine disease" OR "BCKD deficiency" OR "branched-chain ketoaciduria" OR ketoacidemia) OR AB (MSUD OR "maple syrup urine disease" OR "BCKD deficiency" OR "branched-chain ketoaciduria" OR ketoacidemia)	957
S29	TI (IVA OR IVE OR "isovaleric acidemia" OR "IVD deficiency" OR (isovaleric n3 deficiency) OR (isovaleryl n3 deficiency)) OR AB (IVA OR IVE OR "isovaleric acidemia" OR "IVD deficiency" OR (isovaleric n3 deficiency) OR (isovaleryl n3 deficiency))	5,250
S30	TI (GA-1 OR GA1 OR GA-2 OR GA2 OR "glutaric acidemia" OR "glutaric aciduria" OR (glutaryl n4 deficiency) OR (glutarate n4 defect) OR "dicarboxcylic aminoaciduria") OR AB (GA-1 OR GA1 OR GA-2 OR GA2 OR "glutaric acidemia" OR "glutaric aciduria" OR (glutaryl n4 deficiency) OR (glutarate n4 defect) OR "dicarboxcylic aminoaciduria")	2,980
S31	TI (HCU OR HCY OR homocystinemia OR homocystinuria OR "CBS deficiency" OR (cystathionine n3 deficiency)) OR AB (HCU OR HCY OR homocystinemia OR homocystinuria OR "CBS deficiency" OR (cystathionine n3 deficiency))	4,314
S32	TI (LCHAD OR LCHADD OR "trifunctional protein deficiency") OR AB (LCHAD OR LCHADD OR "trifunctional protein deficiency")	184
S33	TI ("phenotype-genotype correlation" OR "genotype-phenotype correlation") OR AB ("phenotype-genotype correlation" OR "genotype-phenotype correlation")	2,709

S34	TI "rare genetic disorder*" OR AB "rare genetic disorder*"	1,037
S35	TI "rare genetic condition*" OR AB "rare genetic condition*"	155
S36	TI "rare metabolic disorder*" OR AB "rare metabolic disorder*"	209
S37	TI "autosomal recessive disorder*" OR AB "autosomal recessive disorder*"	5,635
S38	TI "autosomal recessive condition*" OR AB "autosomal recessive condition*"	672
S39	TI "cinderella condition*" OR AB "cinderella condition*"	1
S40	(MH "Maple Syrup Urine Disease")	981
S41	S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40	92,357
S42	S8 AND S41	484

Table 1: Characteristics of included studies

Citation	Country	Study aim* and design	Study population* and sample size*
Schultz et al. 2014 (22)	US	To explore how having a child with SCD affects parents' future reproductive decisions or acceptability of alternative family planning options Qualitative/Semi-structured Interview and grounded theory informed analysis	Parents of children < 6 years diagnosed with SCD n=20
Sawyer et al. 2006 (23)	Australia	To assess the attitudes of parents of children with CF to PND and abortion, and to explore how attitudes and behaviours change over time Quantitative/Interview, repeated after 5 years	Mothers of children 2-7 years diagnosed with CF n=56 at baseline n=43 at follow-up
Dudding et al.2000 (24)	Australia	To document the reproductive choices made in a subsequent pregnancy after the birth of a child with CF identified by neonatal screening; and to determine which factors influence these decisions Quantitative/Interview and Statistical Analysis	Mothers of children diagnosed with CF by neonatal screening between 1981-1996 n=124
Myring et al. 2011 (25)	UK	To explore the reproductive decision making in a sample of CF carriers with partners who are also CF carriers, and the views of male and female participants about the decision-making process Qualitative/Semi- structured Interview and grounded theory informed analysis	Parents of children diagnosed with CF n=19
Henneman et al. 2001 (26)	Netherlands	To investigate attitudes of parents of children with CF to use of PND and abortion, and their family planning and reproductive behaviours Quantitative/Postal Survey (part of a national study)	Parents of children <16 years diagnosed with CF n=288
Boardman 2014 (27)	UK	To present an analysis of the ways in which 'experiences with disability', 'embodied experiences of impairment' and 'embodied experiences of illness, death and bereavement' emerged in families' accounts of living with, and making reproductive decisions around, SMA Qualitative/In-depth Interview and grounded theory informed analysis	Parents of children diagnosed with SMA n=24
Read et al. 2002 (28)	US	To quantify and identify correlates of receptivity to PND, likelihood of terminating a future affected pregnancy, and whether measures had been taken to prevent a future affected pregnancy in parents of children with rare metabolic disorders Quantitative/Interview and Statistical Modelling	Parents of children aged 6 months-18 years diagnosed with a rare metabolic disorder n=230

*__Study aim, Study population, Sample size__: Some studies addressed several research questions; only those pertinent to this review have been included in the table. The table only includes population and sample size data pertinent to the parents of affected children. **SCD** = Sickle Cell Disease; **CF** = Cystic Fibrosis; **SMA** = Spinal Muscular Atrophy; **PND** = pre-

natal diagnosis