

UK Newborn Screening  
Programme Centre



Newborn blood spot screening in the UK  
**Policies and standards**

April 2005

*Quality through partnership in newborn blood spot screening*

A partnership between Great Ormond Street Hospital for Children NHS Trust,  
The Institute of Child Health, and The Institute of Education.

Funded by the Department of Health on behalf of the UK.



This document is intended to inform health professionals of the UK standards and policies for newborn blood spot screening and to illustrate their important role in providing high quality screening services. It will be of particular use to Directors of Public Health, Antenatal and Child Health Screening Co-ordinators, Child Health Records, Departments, Departmental Screening Leads, Laboratory Directors, Heads of Midwifery, and Specialist Commissioners.

Contact point	<i>UK Newborn Screening Programme Centre</i>
Further copies	<i><a href="http://www.newbornscreening-bloodspot.org.uk">www.newbornscreening-bloodspot.org.uk</a></i>
Date of issue	<i>April 2005</i>
Review date	<i>March 2006</i>

### **Acknowledgements**

The work has been funded by the Department of Health on behalf of all four UK countries. It has depended on valuable contributions both from professionals and parents, on the Expert Groups and in the areas where the standards were piloted.





<b>Foreword</b>	5
<b>Introduction</b>	7
<b>Background</b>	8
<b>The Screening Process</b>	10
<b>The Policy Areas</b>	11
1. The Process Standards	12
2. Consent and Communication	20
3. Blood Sampling Guidelines	22
4. Phenylketonuria: Initial Clinical Referral Standards	25
5. Congenital Hypothyroidism: Initial Clinical Referral Standards	27
6. Code of Practice for the Retention and Storage of Residual Spots	30
<b>Appendices</b>	32
1. Development of the Policies	32
2. The Process Standards – including Data Sources	34
3. Membership of Programme Centre Board	35
4. References	36
5. Abbreviations	39





## Foreword

I am delighted to introduce this document produced by the UK Newborn Screening Programme Centre detailing the Policies and Standards for the Newborn Blood Spot Programme.

Blood spot screening has, since its inception some 30 years ago, successfully delivered screening to the vast majority of newborn babies in a timely fashion, enabling the prevention of severe disability associated with phenylketonuria (PKU) and congenital hypothyroidism (CHT). But it has been recognised that some changes are necessary particularly as the programme is being expanded to screen for additional conditions including sickle cell disorders and cystic fibrosis. In addition an increasingly mobile and diverse population, who have different expectations of health care delivery, means that some change is required.

The current position is that parents often don't know what the blood spot is for. Consent to take the blood spot, test it and use it afterwards has always been implied rather than specifically discussed with parents who have not necessarily been able to make informed decisions about what they want for their baby. Throughout the work both professionals and parents have felt it was important to make it clear that newborn blood spot screening is recommended. No news about the result usually does mean good news but again parents' expectations have changed and they want to know the result.

This document builds on what is working well, setting out standards with underpinning guidance to help implement the changes that are necessary to ensure the ongoing quality of the programme as well as meeting expectations of parents.

During 2005 monitoring will start against these standards, which will enable the UK as a whole to see how the programme is performing. Problems can be identified and dealt with so that the public can be assured that this programme is performing to the level and in the way they should reasonably be able to expect.

Dr Muir Gray  
Director  
National Screening Committee





This document is the first of a series produced by the UK Newborn Screening Programme Centre. The full series forms a comprehensive pack entitled ‘Newborn Blood Spot Screening in the UK’ and includes the following:

1. Implementation and Reporting Guidance
2. Policies and Standards for Newborn Blood Spot Screening
3. Health Professional Handbook
4. Information for Parents
5. Training Resources

This first document *Policies and Standards for Newborn Blood Spot Screening* forms the ‘core’ of the series, setting out the policy position on each aspect of newborn blood spot screening and the standards to be implemented across the UK. It is intended to provide the key policy information and will be a useful resource for a variety of health professionals but of particular benefit to Directors of Public Health at Strategic Health Authority (or Health Board) and Primary Care Trust level, Departmental Screening Leads, Laboratory Directors, Heads of Midwifery, Heads of Midwifery Schools, Child Health Records Departments, and Specialist Commissioners. It concentrates on screening for phenylketonuria and congenital hypothyroidism. Standards for cystic fibrosis are being developed and will be included in the next version to be published in 2006. Condition-specific standards and policies have been produced by the NHS Sickle Cell and Thalassaemia Screening Programme.

The other documents in the series provide more detailed practical guidance on implementation and achievement of the policies and standards and are targeted at differing professional groups:

- *Health Professional Handbook* expands on the content of this document and will support midwives and other health professionals involved in the practical aspects of screening.
- *Implementation and Reporting Guidance* is intended to support Directors of Public Health, screening co-ordinators, and nominated screening leads in establishing performance management arrangements for their populations and to report performance against the standards.
- *Information for Parents* has been developed to enable parents to be able to make informed decisions about newborn blood spot screening and support them through the screening pathway.
- *Training Resources* includes a series of presentations and teaching resources to support health professional training. These resources will facilitate the delivery of high quality screening services to parents and their babies.

All five documents have been developed with the help of many professionals from different disciplines and parents, working both in the Expert Groups and where the standards and leaflets were piloted. This inclusive process has also been informed by laboratory, clinical and social research.



### Newborn Screening

The national newborn screening programme for phenylketonuria (PKU) was introduced in 1969<sup>a</sup> and, for congenital hypothyroidism (CHT) in 1981. Today newborn screening is one of the largest such programmes in the UK and each year over 600,000 newborns are screened. The newborn blood spot screening programme has been and remains a very successful one and the uptake of screening tests is high with local audits showing that more than 99% of the babies born each year are being screened. Thus each year approximately 250 babies with phenylketonuria or congenital hypothyroidism are identified through screening, allowing effective treatments to be started before irreversible neurological damage has occurred, preventing lifelong disability. More recently, screening for sickle cell disorders has commenced under the NHS Sickle Cell and Thalassaemia Screening Programme and a national cystic fibrosis screening programme has been established to support the introduction of universal screening for this condition. Screening for both of these additional conditions utilises the same blood sample used for PKU and CHT screening.

The historical success of the blood spot screening programme has depended upon the diligence and dedication of many health professionals, particularly laboratory directors and midwives. This success has been despite an absence of performance indicators governing the *overall* programme. In light of the current and planned expansion of the programme, a more joined up approach to assuring its quality is now required. Greater collaboration between professionals undertaking key roles in screening is required to ensure that the expanding programme can be delivered to a high standard. To support this collaboration the UK Newborn Screening Programme Centre has developed clear policies to guide the programme and has set out a framework for its performance management.

### UK Newborn Screening Programme Centre

The UK Newborn Screening Programme Centre was established in 2002 with the overall objective of assuring high quality screening services for babies and their parents through the development of a quality assurance programme and performance management framework for the blood spot screening programmes. Funded by the Department for Health of England, on behalf of all four UK countries, the Programme Centre is a collaboration between Great Ormond Street Hospital for Children NHS Trust, the Institute of Child Health and the Institute of Education. The Centre has a remit to co-ordinate a UK-wide quality assurance programme in partnership with health professionals and parents, to monitor and facilitate improvement in the quality of screening processes and their outcomes for parents and babies and to create a coherent focus and identity for newborn blood spot screening services.

By building on a highly successful existing service, the Programme Centre will be able to ensure that an infrastructure is in place to meet the demands of the new screening programmes being introduced over the next few years. Standards covering all aspects of the journey undertaken by babies and their parents through the newborn screening process have been developed collaboratively with parents, health professionals and laboratory directors.

Developing standards for information and communication is a key part of this work and is led by the Centre's Parent Support Research Team. This reflects wider trends in the NHS which emphasise the importance of ensuring that patients, or in the case of babies and young children, parents, have information and are given the opportunity to make informed choices about what they want for themselves or their baby.

<sup>a</sup> In Scotland screening for phenylketonuria commenced in 1965

The Programme Centre is managerially accountable to the Department of Health through the Programme Centre Board chaired by Dr Roddy MacFaul and incorporating national expertise in relevant scientific disciplines, professional and stakeholder organisations. The Programme Centre also provides updates and reports to the National Screening Committee (NSC).



All four UK countries already have a set of common screening policies developed through the NSC, chaired by the CMO for Northern Ireland. There are differences in health service needs and they have different health departments. This will naturally lead to some variations in the rate of implementation and the precise approach taken. The Programme Centre has been mandated to ensure that there is alignment across the UK countries in relation to standards sufficient that any UK parent has access to the same high quality screening services, irrespective of where they live. In line with recommendations made in a review of quality management for screening the Programme Centre's remit supports combining data across countries to allow quality and performance to be assessed across the UK while at the same time ensuring each country and centre can consider their own performance in a wider context. This approach is supported by each of the UK Health Departments.

### **The Work of the UK Newborn Screening Programme Centre**

Over the last two years, the Programme Centre has reviewed the screening journey for parents and their babies and developed standards relevant to the different processes within newborn screening. The focus has been on generic processes as well as those specific to PKU and CHT.

The draft policies and standards were piloted<sup>2</sup> and widely disseminated for consultation<sup>1</sup>. Following the consultation they were revised to produce the final versions for this series. It is intended that in future they will be reviewed and, if necessary, updated annually.

The Programme Centre has recently been given the task of managing the implementation of newborn screening for cystic fibrosis in England. It is anticipated that specific standards for cystic fibrosis will be developed and incorporated into a revised version of this document, to be published in 2006.

In carrying out its work, the Programme Centre works closely with the NHS Sickle Cell and Thalassaemia Screening Programme who are introducing newborn screening for sickle cell disorders and thalassaemia<sup>3</sup>. This collaboration is particularly important as it ensures these are universal standards for the general processes of the newborn blood spot screening programme and that parents receive integrated information to support their informed choices. Condition-specific standards and policies have been produced by The NHS Sickle Cell and Thalassaemia Screening Programme<sup>4</sup>.

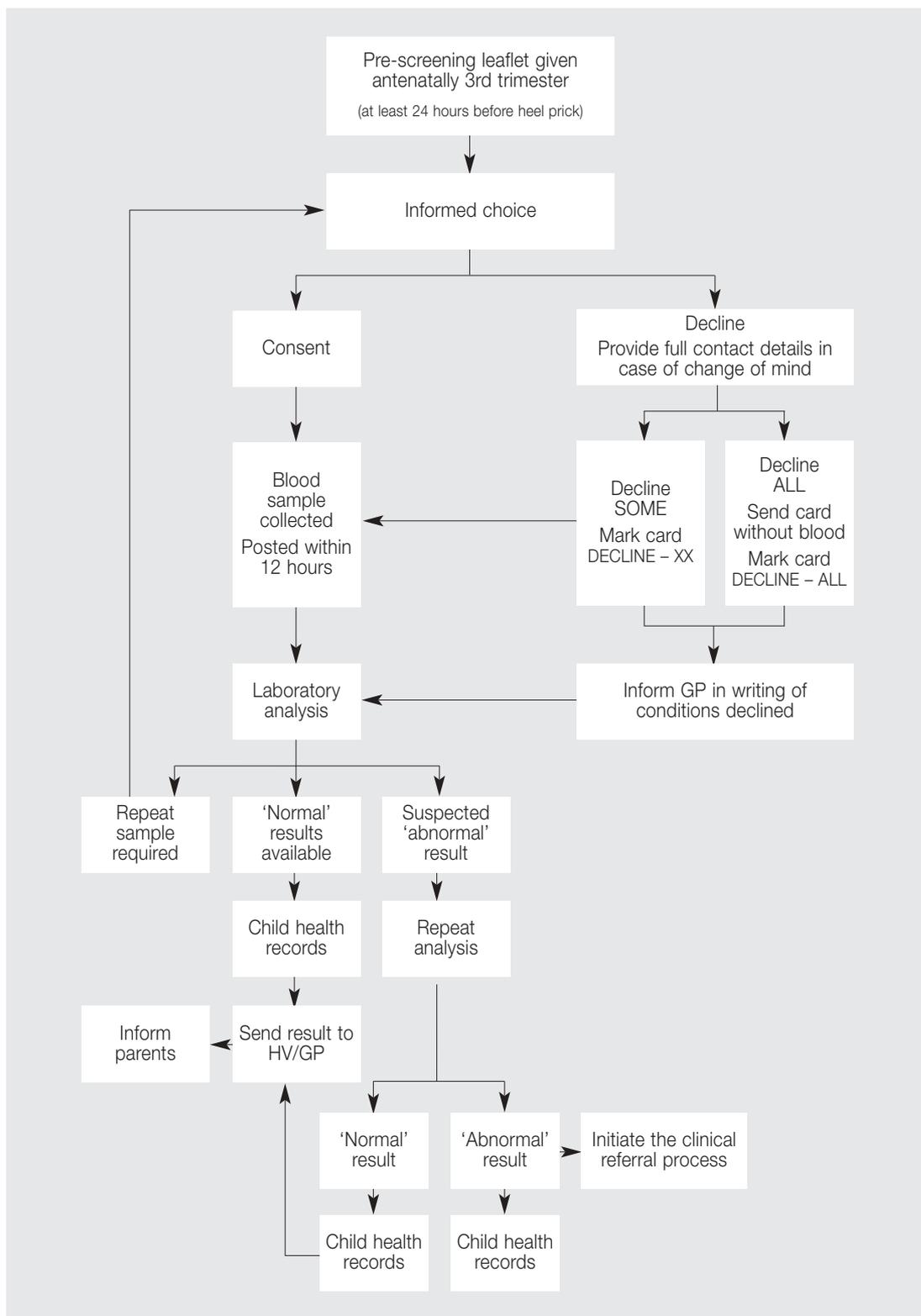
It is recognised that the development of policies and standards should be an iterative process, ensuring continuous evidence-based improvement. Where possible the Programme Centre has taken account of systematic reviews and literature combined with expert consensus. Appendix 1 describes how these policies and standards have been developed.

During the course of the work to inform these policies and standards issues requiring further research were identified and these are highlighted within this document. Further work will commence in the coming year and will be informed, where possible, through further systematic reviews, analysis of registers or collection of new data as appropriate. This, in turn, will inform future versions of the policies and standards.



The newborn blood spot screening programme consists of a series of stages with involvement of different health professionals at each stage. The figure below provides a simplified description of the process. Good communication and co-ordination are essential if the programme is to operate effectively as these professionals work in different organisations and specialties.

## The Screening Pathway





# The Policy Areas

## 1. The Process Standards



'Newborn screening programmes can only be successful when all components of the system function with comprehensive excellence.' FARRELL<sup>5</sup>

### The Purpose

Six key standards have been developed to underpin the performance management framework. Their purpose is to assure the quality of the screening process and ensure that babies, who may have one of the conditions for which screening is offered, receive timely medical treatment. The timeliness of treatment is particularly vital where PKU or CHT are detected as early treatment can prevent lifelong disability. Evidence suggests that treatment should commence by the time the baby is 21 days old.<sup>6, 7, 8</sup>

Screening is applied to apparently healthy people in order that a small number with the potential to develop disease might be diagnosed and receive treatment. These standards therefore only assure the quality of the process to the point of onward referral for diagnosis and subsequent treatment. For those small number of babies thought to have one of the conditions the Initial Clinical Referral Guidelines & Standards (p.25-29) ensure that the transition from screening into diagnostic and clinical care is sensitive, timely and effective.

### The Format

The Process Standards are measured at 2 levels; core and developmental. This is in line with recent Department of Health guidance on standard setting<sup>9</sup> intended to provide a coherent framework which brings together current achievements and puts quality at the forefront of the agenda for the NHS. The core standards set out the expected level of performance to deliver an acceptable level of quality. The developmental standards depict a level of performance that delivers enhanced quality. The latter are unlikely to be met currently but are standards towards which the UK needs to work. Achieving these will require collaboration between professional and organisational groups, coupled with increased technological, particularly IT, developments.

### The Approach

To keep the number of standards to a manageable minimum we have included only those that are fundamental and measurable. There are a number of best practice guidelines which support their implementation, which will assist the delivery of high quality screening processes and the meeting of the standards. Detailed local guidelines will also be needed to support implementation and achievement of the standards. There are already excellent examples of these and the Programme Centre will disseminate them on its website.

It is not possible, nor desirable, to prescribe the exact implementation mechanisms to suit the different configurations of screening services across the UK.<sup>10,11</sup> What is important however is that the same high quality screening services are offered to parents and babies, regardless of where they live. The *Implementation and Reporting Guidance* will support health professionals in implementing these standards which will be monitored annually.

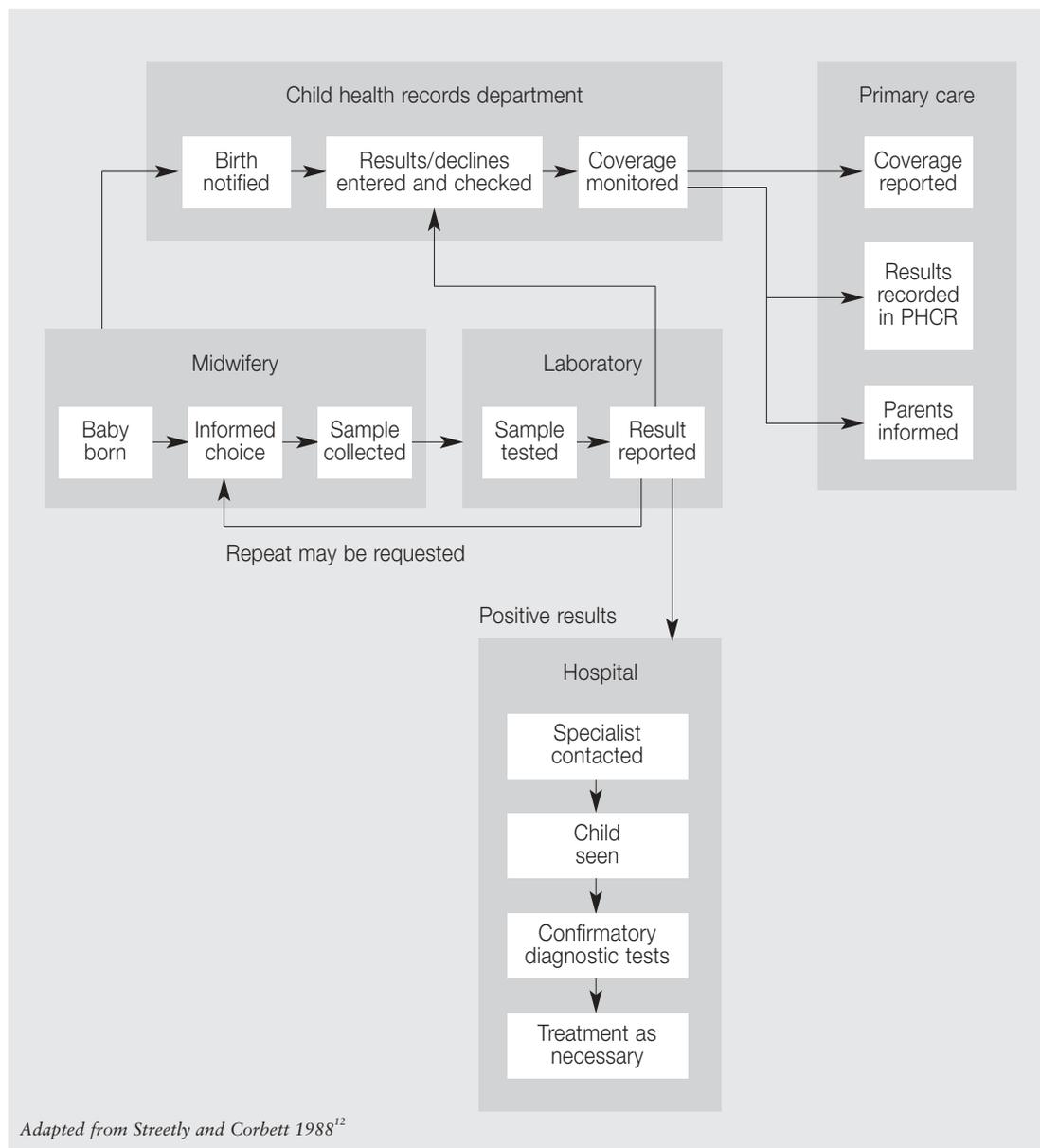
The standards showing responsibilities for data collection and outlining whose performance is being measured are available at Appendix 2.

## Key assumptions

- The baby's date of birth is counted as day 0<sup>b</sup>
- Local development of clear responsibilities and accountability will be essential
- The Programme Centre strongly recommends newborn blood spot screening



## Role of different organisations in newborn screening



<sup>b</sup>There have been different practices in how day 0 and day 1 of life have been defined. The recommendation here is that the date of birth is defined as day 0.



## Standard 1 – Timely sample collection

### The Purpose

Beginning the process promptly gives each baby the best possible chance of receiving early treatment, where necessary. It is equally important that the blood sample is of high quality and the card is completed correctly as this reduces the likelihood of later delays in the process associated with inadequate samples and situations where the baby and/or the responsible health professional cannot be identified. The health professional responsible for taking the blood sample can thus make a real difference to the timeliness of the screening process.

### Core Standard

95% of first samples taken 5-8 days after birth (ideally on day 5).

### Developmental Standard

100% of first samples taken 5-8 days after birth (ideally on day 5).

### Guidelines

1. At least 24 hours before taking the heel prick, the midwife should ensure parents have a copy of the pre-screening information leaflet. This should have been given to them in the third trimester. This is available via [www.newbornscreening-bloodspot.org.uk](http://www.newbornscreening-bloodspot.org.uk)
2. Consent for screening should be sought in accordance with the policy set out on page 23.
3. Samples should be taken on day 5 where possible.
4. For audit purposes blood sampling within the range of 5-8 days will be measured to assess timely sample collection.
5. Where the baby is a new sibling of a child known to have PKU it is advantageous to take the sample earlier as part of standard clinical practice. It will still be necessary to repeat the sample between 5-8 days, indicating on the card that a sample has already been sent for PKU testing.
6. Samples should be taken on day 5-8 irrespective of current medical condition, prematurity or feeding status.<sup>c</sup>
7. In premature infants a repeat heelprick sample should be taken when the baby reaches the equivalent of 36 weeks gestation.<sup>d</sup>
8. Where possible blood spots should be taken prior to transfusion for sickle cell screening. Where this is not possible and a baby has already had a transfusion by the time the blood spots are taken, repeat samples are needed 72 hours after the transfusion (for PKU, CHT and CF) as well as at 3 months of age (for sickle cell disorders).<sup>5</sup>  
If blood spots are taken before a transfusion and the baby is not yet 5 days of age, a further sample may be requested at the discretion of the newborn screening laboratory.
9. The sample should be taken in accordance with the blood sampling guidelines set out on page 22.
10. It is imperative that the details on the card are complete and legible and include data to identify the relevant population denominator (for example in England this would be the Primary Care Trust and in Northern Ireland the Area Health and Social Services Board).<sup>e</sup>
11. If the parent(s) decline screening for their baby, either for specific conditions or the full programme, the blood spot screening card should be clearly marked 'DECLINE' (in accordance with the blood sampling guidelines on page 22) and sent to the laboratory in the normal way. This enables the decline to be noted in the laboratory and passed on to the Child Health Records Department for recording.
12. Where the parents decline screening, either for specific conditions or the full programme, the health professional should ensure that the parents have full information on who to contact and how, should they change their mind.
13. It is important that both the family GP and Health Visitor are informed of the decline in writing by the head of midwifery as this information may be of clinical importance in the future care of the child.

<sup>c</sup> Feeding data are collected at the time of the sample for other public health purposes in some UK countries; this should continue.

<sup>d</sup> Immaturity of the hypothalamic-pituitary axis in very low birth weight and preterm infants may initially mask primary congenital hypothyroidism. At present the expert advisory group recommends repeat sampling based on gestational age rather than birth weight. This recommendation applies to all infants under 35 completed weeks gestation.

<sup>e</sup> The Programme Centre will continue to work with the UKNSLN to redesign the blood spot screening card, as required to ensure that the design of the blood spot screening card can meet all the requirements placed upon it.



## Standard 2 – Timely sample despatch

### The Purpose

The success of the screening process depends heavily on timeliness. Eliminating delays in despatching the blood spot screening cards between the health professional responsible for taking the sample and the screening laboratory is vital. Achieving, or exceeding, this standard will allow the laboratory to carry out the analysis of the sample at the earliest opportunity. This means that where a positive screening result is suspected there is sufficient time for follow-up action and clinical referral, if indicated.

### Core Standard

100% of samples received by laboratory within 4 working days of blood sample being taken.

### Developmental Standard

100% of samples received by laboratory within 2 working days of blood sample being taken.

### Guidelines

1. Blood spot screening cards should be sent to the screening laboratory within 24 hours of being taken.
2. Where postal methods<sup>f</sup> are used the blood spot screening cards should be posted first class, in pre-paid clearly identifiable 'screening' envelopes.
3. Where this standard cannot be met through traditional postage systems alternative despatch mechanisms should be explored and implemented.
4. Despatch of blood spot screening cards should not be delayed in order to batch cards together in one envelope.
5. The professional taking and posting the sample should record the sample date and the posting/despatch date. In the event that a sample is delayed/missing this information may be required to audit the process as part of ongoing quality improvements.
6. Maternity units should also put in place robust systems whereby births are matched with babies tested to ensure untested babies, or those that need retesting, are identified as early as possible.
7. Steps should be taken to avoid posted samples being delayed in hospital internal mail processes by establishing mechanisms to ensure samples are delivered directly to the laboratory.
8. Laboratories receiving samples should record the date the sample was taken and the date it was received in the laboratory.

<sup>f</sup> Some areas employ successful local collection and transport mechanisms to deliver the screening cards to the laboratory. Examples of best practices are available on the website.



## Standard 3 – Completeness of coverage

### The Purpose

A key objective of the programme is to ensure that every newborn baby<sup>g</sup> resident in the UK is offered blood spot screening. An important measure of how well the screening process is working is its availability to each baby in the UK. This programme coverage will be measured annually to provide data on whether the programme is successfully being offered for every baby.

### Core Standard

Screening test result or decline of screening recorded for 100% of resident babies alive at 8 days.

### Guidelines

1. All available results or interim results to be notified<sup>h</sup> to Child Health Records Departments by screening laboratories within 24 hours of being available.
2. All declined screening tests, either for an individual condition or the full programme, should be notified to Child Health Records Departments by the screening laboratories within 24 hours of being known.
3. It is the responsibility of the Child Health Records Department to ensure that the results are notified to the health visitors for reporting to parents and inclusion in the Personal Child Health Record.
4. It is an absolute requirement that the screening result is documented in the Personal Child Health Record so that it is available at the 6-8 week check. The health visitor receiving the results from the Child Health Records Departments should ensure that this is completed. The exception to this guide is when a second blood spot sample has been requested because a result was borderline. In these circumstances parents may be anxious about the result, and so the results should be given to parents as quickly as possible.
5. Child Health Records Departments should carry out an annual coverage count. This should be performed on the 1st April each year.
6. The annual count should be carried out in accordance with the guidelines set out in the Implementation and Reporting Guidance. The coverage calculation should identify the percentage of babies (between 28 days and 1 year of age who are resident in the Child Health Record Department catchment area on the day of count) with a recorded screening result or decline notification.
7. For babies under 1 year of age who have moved into the area and are reported to have been screened, evidence of testing is required. This may take the form of a faxed or written confirmation of the results. Where no proof of testing is available it should be assumed that the baby is untested and re-testing discussed with the parents and arranged<sup>g</sup>.

<sup>g</sup> Although 5-8 days of age is the recommended sampling period it is recommended that newborn blood spot screening is still carried out for untested babies up to 1 year of age.

<sup>h</sup> Notification in this instance refers to the printing and posting of the results or interim results, if further investigations are being carried out, from the laboratory (where postal methods are used) or their electronic transmission from the laboratory system (where computerised notification methods are employed).



## Standard 4 – Enhanced tracking abilities

### The Purpose

The standard is intended to provide the incentive to make use of the NHS number within the newborn screening process<sup>i</sup>. This NHS number, or equivalent in other UK countries, is a unique identifier that will aid the identification and tracking of babies as they progress through the screening process. The developmental standard includes the use of the NHS number in a bar-coded format. This not only saves health professionals time in data entry but also minimises errors of incorrect transcription.

While the technical capacity to deliver this developmental standard is awaited, steps can be taken to make use of the NHS number in the screening process without the barcode. The recent piloting of these standards supported the manual use of the NHS number. Steps should be taken locally to minimise transcription error. Guidelines supporting interim use of the NHS number to meet the core standard are set out below. More detailed guidance on progressing towards the developmental standard is provided within the Implementation and Reporting Guidance.

### Core Standard

95% of blood spot cards received by a laboratory include the babies' NHS Number.

### Developmental Standard

By April 2006 – 95% of blood spot cards received by laboratory should have a bar-coded label including the babies' NHS number.

### Guidelines

1. Where available, NHS number bar-coded labels should be given to the parents on discharge to be available for blood spot screening. Local arrangements need to be made for home births (including deliveries by independent midwives) and births in private hospitals.
2. At the time of blood sampling the health professional should request a NHS number bar-coded label from the parent and confirm that the details on the label are those of the baby.
3. Where the NHS number bar-coded label fits on the blood spot screening card (and it does not obscure important data fields) it should be stuck on to the card by the health professional during blood sampling<sup>j</sup>.
4. Blood spot cards should never be pre-labelled. (This practice increases the risk of putting the blood from one baby on to the card of another.)
5. Where the facility to produce NHS number bar-coded labels does not yet exist the number should be carefully and clearly written on the blood spot card by the professional taking the sample.
6. On receipt of blood spot cards on which the NHS number has been handwritten the number should be entered into the laboratory system manually. Although this incurs additional data-entry time it enhances identification of babies, thus saving time later.<sup>k</sup>

<sup>i</sup> Or equivalent unique identifier used in each UK country.

<sup>j</sup> The Programme Centre will continue to work with the UKNSLN to redesign the blood spot screening card, as required.

<sup>k</sup> The concept of manual entry of the NHS number was supported during the piloting of the standards and is in keeping with the requirements of the implementation of the NHS Care Record from June 2004



## Standard 5 – Timely identification of babies for whom the laboratory has not received a decline notification or a blood sample

### The Purpose

This is a crucial stage in the screening process. If untested babies are not identified promptly they will be unable to access treatment at an optimal time, should they require it. It is therefore important that they are identified in time to enable samples to be taken, analysed and action taken, to facilitate treatment (for PKU and CHT) by the time the baby is 21 days old. Piloting of the standards revealed this to be a challenging standard. Identification of untested babies will require locally agreed 'fast-track' procedures to be developed.

### Core Standard

100% of untested babies (including declines) identified by 19<sup>l</sup> days of age.

### Developmental Standard

100% of untested babies (including declines) identified by 14 days of age.

### Guidelines

1. Untested babies are defined as those babies who do not have a screening result or a decline notification for each of the conditions for which screening is offered.
2. Child Health Records Departments should perform a *daily* search to identify babies 19 days old or over (core standard) who have not yet been issued with a result or identified as declining screening.
3. In areas where daily Child Health Records Departments searches are not current practice there will be an expectation to establish search mechanisms within an agreed period of time.
4. On identification of untested babies the screening process should be 'fast-tracked' according to locally agreed procedures to enable the sample to be taken and transferred to the laboratory for priority analysis and action.
5. The initiation of this fast track process requires that the Child Health Records Department contact the agreed maternity lead for the area in which the baby resides, and inform the Director of Public Health of the baby's Primary Care Trust (or equivalent organisation)<sup>m</sup>. The date and details of this contact should be recorded within the child health record.
6. For babies under 1 year of age that have moved into the area and are reported to have been screened, evidence of testing is required. This may take the form of a faxed or written copy of the results. Where no proof of testing is available it should be assumed that the baby is untested and re-testing discussed with the parents and arranged.

<sup>l</sup> We recognise that this identification is later than ideal. However, until the IT systems are in place, daily checking at an earlier stage may be impossible without significant extra resources. Where it is possible to identify untested babies at an earlier stage progress towards the developmental standard should be made.

<sup>m</sup> Depending on the UK country.



## Standard 6 – Timely processing of positive screening samples

### The Purpose

This final standard specifically relates to PKU and CHT analysis and subsequent action on positive screening results. It is intended to measure the timeliness of the screening laboratory processing and the clinical referral. The clinical referral forms the final stage of the screening process and data from this standard will create the initial data entry in the blood spot screening register for babies with PKU and CHT. It will incorporate babies with sickle cell disorders and cystic fibrosis in the future.

### Core Standard

PKU & CHT<sup>n</sup>

100% of positive screening results available and *clinical referral initiated* within 4 working days of sample receipt by screening laboratory.

### Developmental Standard

PKU & CHT

100% of positive screening results available and *clinical referral initiated* within 3 working days of sample receipt by screening laboratory.

### Guidelines

1. It is recommended that screening laboratories undertaking newborn blood spot screening analyse and report on a daily basis.<sup>o</sup>
2. The screening laboratory should notify a positive screening result<sup>p</sup> verbally (by telephone) as well as in writing (by fax/email) and record the date that the referral was made.
3. The screening laboratory should refer babies with positive PKU screening results to the appropriate PKU designated team according to the Initial Clinical Referral Guidelines and Standards for PKU – page 25.
4. The screening laboratory should notify a positive CHT screening result to a designated clinician and either the GP and health professional, or the health professional responsible for communicating results according to the Initial Clinical Referral Guidelines and Standards for CHT – page 27.
5. Data from this standard will populate the newborn blood spot screening registers for PKU and CHT which are currently under development.

<sup>n</sup> These standards specifically refer to the timeliness of processing positive PKU and CHT results. The reason for this is that the effective treatment of these conditions must start before day 21. In due course, timeliness standards for cystic fibrosis will be added. The NHS Sickle Cell and Thalassaemia Screening Programme recommends that affected children should be vaccinated by eight weeks and attend a specialist clinic by 12 weeks of age.

<sup>o</sup> It is recognised that daily analysis is only carried out on working days.

<sup>p</sup> In accordance with the clinical referral guidance for the condition detected.

## 2. Consent & Communication



*'It's giving information first and then asking if parents would agree to have this done.'* MIDWIFE

*'I think it should be available as a choice really, with a lot of information available to back it up.'* PARENT

### Principles

The UK Newborn Screening Programme Centre strongly recommends that newborn babies be screened.

Parents are entitled to choose whether or not they want their baby screened. This includes the right to accept screening for some conditions, whilst declining screening for others.

Parents are entitled to high quality information to inform their choice, in written and other formats.<sup>13</sup> Parents must be given time to make their choice.<sup>14</sup>

Both the communication with parents and their decision must be recorded in the maternity notes. A signature is not required.<sup>15</sup>

Parents have a right to information about their baby's screening result including: the reason for any repeat samples;<sup>9</sup> and 'normal' as well as 'abnormal' screening results.

### Guidelines

*NB The national pre-screening leaflet and accompanying communication guidelines can be accessed via our website at [www.newbornscreening-bloodspot.org.uk](http://www.newbornscreening-bloodspot.org.uk)*

We recommend that in the third trimester of pregnancy, parents are told about newborn blood spot screening and provided with a copy of the national pre-screening leaflet.<sup>f</sup> Their midwife should confirm which conditions are screened for in their area.

After birth, at least 24 hours before taking the heel prick, their midwife should check parents have a copy of the national pre-screening leaflet and discuss newborn blood spot screening with them. This discussion should include:

- The conditions and how screening can help babies with these conditions
- How the blood sample is taken, and that sometimes a second sample is needed
- When parents should receive the results (usually by the 6-to-8 week check)
- That screening for sickle cell disorders and cystic fibrosis can identify babies who are carriers
- That screening results are not 100% accurate
- A chance to ask questions

The discussion should be recorded in the maternity notes.

The parents' decision should be recorded in the maternity notes.

<sup>9</sup> Research has shown that parents who are told the reason for the repeat sample feel more satisfied with the screening process.<sup>16</sup>

<sup>f</sup> Communication during pregnancy is recommended because it is recognised that after birth can be a difficult time for parents to make an informed choice.<sup>17;18</sup>



If parents decline screening for all or any of the conditions, the reason for their decision should be explored and further information offered. However, parents should not be unduly pressured.

If parents choose to have their baby screened the blood sampling procedure should be explained.

If a repeat blood sample is required parents have a right to know the reason for this. The health professional approaching the parents about this second sample should ensure they have this information.

Parents need to receive all their baby's screening results.<sup>s</sup> Where possible, all results should be reported to parents by the 6-8 week check, if not before. Local arrangements should be made for results of second samples tested to be conveyed to parents as quickly as possible, as their levels of anxiety will have been raised.

In the future there is a small chance researchers may want to invite parents or their children to take part in research linked to the blood spot programme. Parents are entitled to decline the receipt of these invitations. If a parent does not wish to be contacted about future research, the health professional collecting the blood sample should indicate 'NO RESEARCH CONTACT' on the blood spot card.

<sup>s</sup> We are aware that currently not all parents receive the results of their baby's screen. Research suggests that delays in receiving results, in particular after a second sample is taken, cause parents anxiety. <sup>19, 20</sup>

### 3. Blood Sampling Guidelines



These clinical guidelines have been developed to support best practice in obtaining blood from the heel of the baby for newborn blood spot screening.

An expanded version including rationale and references is available for health professionals within the *Health Professional Handbook*.

#### Aims

- To achieve early detection, referral and treatment of screen-positive babies
- To support midwives and nurses in obtaining good quality samples and reduce the need for repeat samples
- To reduce pain during heel puncture<sup>21</sup>
- To support parents and encourage uptake of newborn blood spot screening through evidence-based information
- To provide a consistent approach to newborn blood spot sampling

#### Equipment

- Parent pre-screening leaflet, blood spot card and glassine envelope, non-sterile protective gloves, automated newborn lancet device, cotton wool/gauze, spot plaster, sharps box, maternity record, Personal Child Health Record.

#### Time frame

- The sample should ideally be taken on **day 5<sup>t</sup>** (but between day 5 and day 8) by the health professional responsible for the baby. This should be irrespective of prematurity, illness, transfusion and milk feeding status.<sup>u</sup>

#### Communication guidelines

- Provide a copy of the national pre-screening information leaflet in the third trimester of pregnancy and discuss with parents at least 24 hours before undertaking the screening to enable parents to make an informed choice.
- Record in the notes (maternity notes and Personal Child Health Record ('Red Book') where available) that newborn blood spot screening has been discussed and recommended and the leaflet given.
- Record the parents' decision in the notes.

<sup>t</sup> Date of birth is day 0.

<sup>u</sup> Where blood transfusion is planned the sample should be taken if possible prior to transfusing the baby.



**Parents who consent**

1. Complete all boxes on the blood spot card and apply baby's barcode label (when available). If label unavailable the NHS number should be handwritten on card.



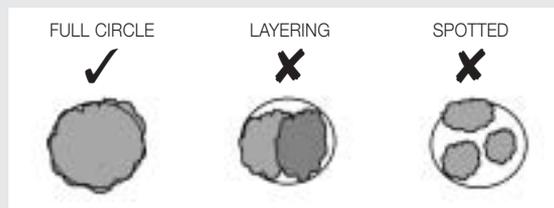
2. Confirm baby's name, D.O.B and parents' contact details.
3. Explain the procedure.
4. Recommend measures to comfort the baby and reduce pain. Feeding, and sucking, engaging the baby through face-to-face contact, voice and touch, are beneficial.<sup>v,w</sup>
5. Disinfecting clean skin pre-test is unnecessary. If skin is visibly soiled it should be washed with plain water or disinfected with an alcohol swab for 30 seconds, and allowed to dry.
6. Wash hands and apply gloves.<sup>26</sup>
7. Perform the test using a newborn automated device.<sup>27-30</sup> (Depth of incision to be  $\leq 2.4$ mm). Manual lancets must not be used.

8. Allow foot to hang to increase blood flow. Before activation, place automated device firmly against the heel. Heel puncture should be performed on the plantar surface of the heel, beyond the lateral and medial limits of the calcaneus. Marked by diagonal lines. Avoid posterior curvature of the heel.



Arrows represent areas from where samples should be taken

9. Wait up to 15 seconds to allow blood to flow. Apply the blood drop to one side of the card. Allow the blood to fill the circle by natural flow, and seep through to the back of card. Fill the circle completely and avoid layering blood.



<sup>v</sup> Pre-warming of the foot is not essential.<sup>23;24</sup>

<sup>w</sup> Topical pain relief cannot be given as this may contaminate the sample.



10. Repeat procedure for each circle; each drop should permeate through to the back of the card.
11. Wipe excess blood from heel and apply gentle pressure to the wound with cotton wool ball.
12. If the blood flow ceases:
  - The congealed blood should be wiped away firmly with cotton wool or gauze.
  - Gently 'massage' the foot, avoid squeezing, and drop the blood onto the card.
13. If the baby is not bleeding a second prick is necessary.
  - The second prick should be taken from a different part of the same foot (within area illustrated on page 23) or the other foot.
14. Apply a spot plaster, if required.
15. Allow blood spots to air-dry before placing the card in glassine envelope.<sup>31</sup> Despatch in accordance with guidelines supporting standard 2, within 24 hours of taking the sample.
16. Record taking the test in the mother's maternity record (and Personal Child Health Record where available), complying with local protocols for recording the test.<sup>32</sup>
17. Inform parents how and when they will receive results.

### **Parents who decline screening**

18. Complete all boxes on the blood spot card and apply baby's barcode label (when available). If label unavailable the NHS number should be handwritten on card.
19. Confirm baby's name, D.O.B and parents' contact details.
20. Parents may decline screening for any or all of the conditions.
  - If screening is declined for all conditions send completed card (without blood sample) clearly marked 'DECLINE – ALL'.
  - If declining screening for individual conditions the card, the blood spots should be collected as normal, and the card should be clearly marked with the condition declined e.g. 'DECLINE – XX'.
21. Record decline, including reasons for decision, in maternity record (and PCHR where available).
22. Confirm the parents understand the risks of baby not being screened.
23. Offer further information and who to contact if they change their minds.
24. Inform GP and HV in writing of the conditions that the baby has not been screened for.
25. If a parent does not wish to be contacted about future research, the health professional collecting the blood sample should write 'NO RESEARCH CONTACT' on the blood spot card.<sup>x</sup>

<sup>x</sup> The blood spot card may be re-designed in the next year to include a tickbox, to be completed if parent does not want research contact.

## 4. Phenylketonuria: Initial Clinical Referral Guidelines and Standards



STAGE OF PROCESS	NO	GUIDELINES AND STANDARDS
Defining a positive screening result	1	If a sample from a baby is found to have a phenylalanine concentration greater than 240umol/l <sup>y</sup> , a repeat test should be performed on the original blood spot card.
	2	If both results are above 240umol/l this should be considered a positive screening result PKU.
Referral of babies with positive screening results	3	Babies with positive screening results should be referred to the appropriate PKU designated team <sup>31,32</sup> verbally (by telephone) as well as in writing (by fax/email). This initiates the clinical referral as measured within standard 6 of the process standards. This PKU designated team should comprise: <ul style="list-style-type: none"> <li>a. A consultant paediatrician with the relevant expertise who is currently managing at least 20 cases</li> <li>b. A dietician with specialist training in PKU</li> <li>c. Nursing input</li> </ul>
Communication flows	4	The PKU designated team should contact the baby's GP to: <ul style="list-style-type: none"> <li>a. Co-ordinate local support</li> <li>b. Obtain a telephone number for the family and inform local health professionals that contact with the family will be made</li> <li>c. Fax or Email information about PKU to the GP and health visitor</li> </ul>
	5	The PKU designated team should make contact with the family to inform them of the positive screening result. If this is by telephone it should be followed up with a face-to-face appointment or visit by a health professional within 24 hours.
	6	The GP, health visitor or midwife making subsequent contact with the family should be provided with: <ul style="list-style-type: none"> <li>a. Standardised information – for parents and local health professionals</li> <li>b. The contact numbers for the PKU designated team / nominated local clinician, local health professionals and UK Newborn Screening Programme Centre web address (which includes up-to-date links to parent support groups)</li> </ul>
	7	Parents should be offered an appointment with the designated clinician on the next working day of hearing about a positive screening result. They therefore should not normally be informed of a positive screening result on Fridays, Saturdays, or Sundays preceding Bank Holidays.
	8	Once a diagnosis is confirmed, the screening laboratory or PKU designated team should inform the midwife.
	9	The family should have access to confirmatory diagnostic tests within 3 days of first contact.
	10	For confirmatory diagnostic tests, the family should be given the choice of visiting a PKU designated team, or being jointly managed between a local team of health professionals and a PKU designated team
	11	If it is not possible for the family to visit a PKU Specialist Team, they will be seen by their local team who will liaise with the appropriate PKU designated team.
Clinical Evaluation and Confirmatory Diagnostic Tests	12	Diet should be commenced on this initial visit. <sup>33,34</sup> Developmental Standard: by 18 days of age (100% of infants) Core Standard: by 21 days of age (100% of infants)
	13	Results of confirmatory diagnostic tests should be available within 24 hours of being taken and ideally on the same visit.

<sup>y</sup> Samples with concentrations greater than 240 umol/L always require further investigation; however as there is a range of methods for measurement of phenylalanine in use at the present time, some individual laboratories currently use a lower threshold than this. A goal for the Programme Centre in the coming year is to start some work with the newborn screening laboratories to support the adoption of a common protocol and threshold.



	<p>14 When a baby is seen with a positive screening result, the following should be performed to confirm diagnosis and exclude other possible metabolic disorders:</p> <ol style="list-style-type: none"><li>A full clinical examination</li><li>Confirmatory amino acid tests</li><li>Tests to exclude other disorders which may be associated with raised phenylalanine. This includes galactosaemia, tyrosinaemia and bipterin defects. Detection of these disorders is not the objective of the PKU screening programme and all such cases will not be reliably detected.</li></ol>
Upon confirmation of diagnosis	<p>15 Dietary treatment should begin (if not already commenced)</p> <p>16 Immediate management should include:</p> <ol style="list-style-type: none"><li>Verbal explanation of the condition including introduction to inheritance, with written information</li><li>Introduction to diet, management and monitoring</li><li>Support information – including contact details of parent support organisations<sup>z</sup></li><li>Contact with specialist dietician</li></ol> <p>17 A specialist nurse should be available if possible to provide advice and support.<sup>34,35</sup></p> <p>18 When they feel ready, parents should be taught how to perform the heel-prick on their baby using UK Newborn Screening Programme Centre Guidelines.</p>
Contact with dieticians	<p>19 The specialist dietician should make contact with the local dietician (telemedicine may be helpful).</p> <p>20 A home visit by the specialist dietician (and nurse if available) is desirable.</p> <p>21 Parents should be given the opportunity to have ongoing access to a specialist dietician and should be provided with appropriate contact details.</p> <p>22 The initial discussion between parents and the dietician should cover:</p> <ol style="list-style-type: none"><li>Preparing the feeds</li><li>Advice on initial feeding</li><li>Breast-feeding</li></ol>

## NOTES

### 1. Definitions of thresholds for treatment

- Classical PKU: concentrations of phenylalanine above 1200  $\mu\text{mol/L}$  on normal diet are considered diagnostic of classical PKU and treatment is required.<sup>33</sup>
- Hyperphenylalaninaemia (HPA) that requires treatment: conventionally this is indicated for phenylalanine concentrations in the range 600–1200  $\mu\text{mol/L}$ .<sup>33</sup>
- Mild hyperphenylalaninaemia which may not require treatment: conventionally this is indicated where phenylalanine concentrations are below 600  $\mu\text{mol/L}$ .<sup>33</sup>
- It is recognised that the definition of these thresholds depends on age at test, method used and evidence for benefit of treatment.<sup>32,35</sup>
- The Expert group considered that further work to address these uncertainties should be started in 2005 between the British Inherited Metabolic Disease Group (BIMDG), the UKNSLN and the Programme Centre, using information from the PKU register where appropriate. This should include:
  - Review of the evidence for different treatment thresholds for girls and boys in relation to hyperphenylalaninaemia.
  - Review of the evidence for test and treatment thresholds for premature babies.
  - Consideration of the undesirable impact on the family of mild HPA being treated as a positive result.
  - Review of the impact, or otherwise, of blood transfusions on the result.

### 2. Milk feeding at the time the blood sample is obtained from the baby

The Expert group was of the unanimous view that the presence or absence of milk feeding at the time of the blood sample should be disregarded. Although historically midwives have been asked to inform laboratories about infant feeding out of concerns for false-negative results, subsequent studies have shown that milk feeding is not necessary to detect abnormally elevated phenylalanine concentrations.<sup>36,37</sup> Blood spots should therefore be collected from all babies between 5-8 days of age irrespective of milk feeds.

Feeding data are collected at the time of the sample for other public health purposes in some UK countries; this should continue.

<sup>z</sup> Available via the UK Newborn Screening Programme Centre website: [www.newbornscreening-bloodspot.org.uk](http://www.newbornscreening-bloodspot.org.uk)

## 5. Congenital Hypothyroidism: Initial Clinical Referral Standards



STAGE OF PROCESS	NO	GUIDELINES AND STANDARDS
Defining a positive screening result	1	Babies in whom the TSH concentration is greater than 20 mU/L whole blood on the initial screening sample should be considered to have a positive screening result for CHT. <sup>38</sup>
	2	Babies in whom the TSH concentration lies between 10 and 20 mU/L whole blood on the initial screening sample should be considered to have a borderline result for CHT.
	3	Babies in whom the thyroid stimulating hormone (TSH) concentration is less than 10mU/L whole blood <sup>aa</sup> in the initial screening sample should be considered to have a negative screening result for congenital hypothyroidism (CHT). Collection and assay of the blood spot sample should not be delayed in premature infants for whom it should be repeated when the baby attains the equivalent of 36 weeks gestation. <sup>bb,39</sup> Similarly it should not be delayed in babies who have received a blood transfusion for whom the sample should be repeated 72 hours later.
Borderline screening result	4	On detecting a borderline screening result, a repeat assay should be performed on the original blood spot card before a second blood spot sample is requested.
	5	If the TSH concentration is less than 10 mU/L whole blood in this second assay, the baby should be considered to have a negative screening result for CHT.
	6	If the TSH concentration is greater than or equal to 10 mU/L whole blood in this second assay, a second blood spot sample should be requested.
	7	This second blood spot sample should be taken by a midwife or, if the baby is still in hospital, by the clinician responsible for their clinical care.
Timeliness of obtaining and processing second blood spot samples	8	Parents of babies with borderline results, irrespective of whether the baby is at home or in hospital, should be informed of the reason for a second blood spot sample and given appropriate information about how and when they will hear the result of repeat tests.
	9	After being informed of the need for a second blood spot by the screening laboratory, the designated maternity screening lead for that area is responsible for notifying the appropriate health professional and ensuring that the second blood spot sample is taken as a matter of urgency. In the case of second blood samples for initially borderline results (as defined above) this should be no sooner than one week from the date of the original blood spot sample.
Referral of babies with positive screening results	10	The result of the second blood spot sample should be available within 2–4 working days of receipt by the screening laboratory and, if the TSH concentration is greater than or equal to 10 mU/L whole blood, the screening result should be considered positive.
	11	Babies with positive screening results for CHT should be referred to a designated clinician as defined by the British Society for Paediatric Endocrinology and Diabetes who has access to the full range of diagnostic investigations recommended.
Communication Flows	12	Parents should be offered an appointment with a designated clinician within at least 3 days of being informed about their baby's positive screening result.
	13	Laboratories should notify a positive screening result verbally (by telephone) as well as in writing (by fax/email) to a designated clinician and either the GP and health visitor, or the health professional responsible for communicating results. This initiates the clinical referral as measured within standard 6 of the process standards.

<sup>aa</sup> Samples with concentrations greater than or equal to 10 mU/L whole blood require further investigation; however, as there is a range of methods for measurement of TSH in use at the present time, currently some individual laboratories may use different thresholds to define borderline and positive results. A goal for the Programme Centre in the coming year is to start some work with the newborn screening laboratories and paediatric endocrinologists to define and adopt a common protocol and threshold for laboratories using similar equipment and methods to define appropriate cut offs more closely.

<sup>bb</sup> Immaturity of the hypothalamic-pituitary axis in very low birth weight and preterm infants may initially mask primary congenital hypothyroidism. At present the expert advisory group recommend repeat sampling based on gestational age rather than birth weight. This recommendation applies to all infants under 35 completed weeks gestation. This standard will be reviewed as part of the work towards common protocols.



STAGE OF PROCESS	NO	GUIDELINES AND STANDARDS
	14	The GP, health visitor, midwife or other health professional responsible for making initial contact with the family to explain the positive screening result should be provided with: <ol style="list-style-type: none"> <li>Standardised information – for parents and local health professionals</li> <li>The contact numbers of the designated clinician, local health professionals as appropriate and details of parent support groups<sup>cc</sup></li> <li>Details of the time and date of an appointment with the designated clinician</li> </ol>
	15	Parents should be offered an appointment with the designated clinician on the next working day of hearing about a positive screening result. They therefore should not normally be informed of a positive screening result on Fridays, Saturdays, or Sundays preceding Bank Holidays.
Clinical Evaluation and Confirmatory Diagnostic Tests	16	The designated clinician responsible for assessing the baby with a positive screening result should take a clinical history and perform a clinical examination (see notes 1 and 2).
	17	Diagnostic tests considered essential <sup>38</sup> are: <ol style="list-style-type: none"> <li>Free T4 (plasma or serum)</li> <li>TSH (plasma or serum)</li> </ol>
	18	Diagnosis using Free T4 should be performed on a plasma or serum sample using the appropriate age-related reference range as defined by the laboratory in relation to the equipment used.
Desirable Additional Diagnostic Tests	19	Clinicians may, using appropriate imaging techniques <sup>41</sup> , investigate whether the thyroid gland is: <ol style="list-style-type: none"> <li>Normally situated</li> <li>Of a normal size</li> <li>Of a normal shape</li> <li>Present at all (see note 3)</li> </ol>
	20	In addition, the following tests may be helpful: <ol style="list-style-type: none"> <li>Thyroid antibodies</li> <li>Thyroglobulin (if the radiological imaging indicated that there is no thyroid present, thyroglobulin analysis should be requested)</li> </ol>
	21	The following tests may be performed on the mother to aid diagnosis: <sup>41</sup> <ol style="list-style-type: none"> <li>Thyroid antibodies</li> <li>TSH</li> <li>Free T4</li> </ol>
Treatment	22	A baby in whom the essential confirmatory diagnostic tests are positive on the initial screening sample <sup>dd</sup> should commence treatment by: Developmental Standard: 18 days of age (100% of infants) Core Standard: 21 days of age (100% of infants)
	23	Starting dose of levothyroxine sodium should be 10 microg per kilogram per day. <sup>ee,38,42</sup>
	24	Suspensions should not be used as the dosage may be unreliable. Parents should be given verbal and written information about how to give the tablets to their baby.
Follow up	25	Once treatment has been started, a baby should be reviewed, with a blood test at each visit. <sup>41</sup> The timing of such visits may vary according to local circumstances but it is suggested should occur at 2 weeks, 6 weeks, 3 months, 6 months, 12 months after treatment is started, and thereafter as indicated, with management complying with BSPED recommendations for interpretation of tests and dosage. Visits may occur more frequently as necessary.

<sup>cc</sup> Available via the UK Newborn Screening Programme Centre website.

<sup>dd</sup> This standard may not be achievable in those babies in whom a positive screening result is only confirmed following a second blood sample for prematurity, blood transfusion, or borderline results.

<sup>ee</sup> The Expert group recognised the problems of exact dosage given current available doses in tablet forms.



## NOTES

1. Babies with CHT are more likely to have associated anomalies, including congenital heart defects (pulmonary stenosis, atrial septal defects, ventricular septal defects) and congenital sensorineural hearing loss (notably those with dyshormonogenesis or Pendred's syndrome).<sup>40,41</sup> Babies with CHT should receive a careful clinical examination at assessment.<sup>38</sup> Hearing should be evaluated by appropriate tests at 4-8 weeks in those with relevant underlying causes of hypothyroidism and irrespective of a negative newborn hearing screening result.
2. The Expert group considered early diagnosis of the cause of the child's CHT as important. It determines prognosis, increases awareness and recognition of potentially related problems such as deafness, and provides useful information for the family about recurrence risk for subsequent children.<sup>39,43-47</sup> Although recurrence is very unlikely in the case of thyroid dysgenesis, there is likely to be an autosomal recessive inheritance with a 1:4 recurrence risk for families of babies with permanent thyroid dyshormonogenesis. Some families may wish to receive genetic counseling.
3. A radioisotope scan is advised,<sup>41</sup> as it gives desirable diagnostic information and allows the family to be given an explanation of the cause of their child's CHT. It also identifies those babies with possible dyshormonogenesis. The scan can be performed within a few days of starting therapy (up to five days) if there are difficulties with arrangements. Treatment should not be delayed while waiting for a scan. This may be supplemented by an ultrasound scan, particularly in those babies with apparent thyroid agenesis on radioisotope scan, to allow identification of babies with trapping defects.



### Background to recommendations

Newborn blood spot screening programmes are highly effective public health programmes, which have enabled earlier treatment and prevented life-long disability. Blood spots left over once screening tests have been completed ('residual' newborn blood spots) have also provided a valuable research resource. Testing of residual newborn blood spot cards, which may have been stored for many years, has allowed molecular genetic diagnosis, carrier testing and prenatal diagnosis for at-risk relatives of individuals who may have died many years previously of suspected genetic conditions and for whom the blood spot is the only remaining sample. They have also been used to diagnose congenital infection in children who present with signs compatible with congenital infection at an age when it cannot otherwise be distinguished from acquired infection. In addition, research and surveillance based on residual newborn blood spots has answered important public health questions and led to advances in antenatal and newborn screening which are to the benefit of children and their families. It is important to enable this to continue.

This code of practice sets out arrangements for the retention, storage, use and release of residual newborn blood spots and related information and communication requirements. It has been established to reflect current thinking in relation to information and governance concerning the use of biological specimens for research, while at the same time safeguarding the newborn blood spot screening programme, which is of major public health importance to the lives of children and their families. It was developed by an Expert group, including parent representatives, and in consultation with legal and other experts, to reflect policies and laws regarding the use of human biological material, genetic testing and confidentiality of data. It has drawn on existing models for similar collections internationally as well as a wider literature on use of biological samples for research and genetic testing<sup>48-53</sup>. The 1999 statement of the Working Party of the Royal College of Pathologists and the Institute of Biomedical Science<sup>54</sup> is currently under review and this code of practice will be incorporated into new guidance anticipated in 2005.

The code of practice gives broad guidance to the Directors of Newborn Screening Laboratories who, together with their respective Departments of Health, are the custodians of the blood spot samples during and after the immediate screening procedure. The UK Newborn Screening Programme Centre will make this code of practice available to members of the public and to health professionals through its website. The Programme Centre will include information on the use of blood spots as part of its annual report to the Programme Centre Board to which it is accountable. The Programme Centre Board is in turn accountable to the UK Health Departments. The Programme Centre Board will review the code of practice periodically, taking into account any interim changes in legislation or ethical perspectives.

### Retention

Failure to diagnose an affected child through screening may require investigation by re-testing of the original blood spots and is part of quality management. All newborn blood spots will be retained for a minimum of five years as part of quality management. Retention thereafter will depend on the resources and requirements of the screening laboratory and/or health department.

### Storage

Conditions for storage should adhere to standard operating procedures to be developed by the Programme Centre in partnership with the UK Newborn Screening Laboratory Network and



other appropriate laboratory networks. These will specify the storage conditions required to maintain appropriate specimen quality, to provide security of access and to retrieve filter paper cards efficiently. In the longer term, conformity with these standard operating procedures will be included in the accreditation of a newborn screening laboratory. Resources to comply with these standard operating procedures will be incorporated into the commissioning process.

Blood spot cards stored after the immediate testing and quality assurance period will be physically separated from personal information including the NHS number but will keep the laboratory identification. Linkage of blood spot cards to personal information will only be possible through the laboratory identification. This linkage will be carried out only by authorised individuals.

## Uses

Residual newborn blood spots may be used for testing at the request of the child's doctor acting on behalf of the family, should the baby or another family member become ill.

Residual newborn blood spots may be used for audit, training, improvement and development of laboratory methods relevant to screening, public health monitoring and other uses as allowed under the provisions of the Human Tissue Act 2004.<sup>55</sup>

Residual newborn blood spots may also be used for research where the samples have been anonymised and the research project has ethical approval, as outlined in the Human Tissue Act and in MRC Guidance,<sup>56</sup> without individual informed consent.

Very occasionally, research may involve contacting parents or their children, inviting them to take part. In these circumstances, parents and/or their children will be informed about this research and allowed time to decide whether or not to accept such an invitation. At the time of the initial heel prick, parents may choose not to be contacted with such future invitations (see page 24).

All research projects should have been approved by an ethics committee and be subject to peer review to ensure that the research is of high quality.

Existing holdings at the time the Human Tissue Act came into effect are exempt. The legislation for Scotland is under revision at the time of writing.

## Release

Residual newborn blood spots may be released for uses as specified above. An appropriate legal permission (court order) is required for the release of residual newborn blood spots from specific dead or missing people for forensic purposes. Samples from individuals who are alive and not missing should not be released for this purpose since alternatives are available.

An appropriate legal permission (court order) is required for the release of residual newborn blood spots from deceased children for the purposes of establishing maternity or paternity. Samples from individuals who are alive should not be released for this purpose since alternatives are available.

Newborn screening laboratories may not sell, or grant exclusive access to, residual newborn blood spots to commercial organisations. Some commercial partnerships may be required to develop screening methods that may benefit the screening service and public health more generally. These arrangements will be subject to scrutiny by the Programme Centre Board and will be documented in the Programme Centre's annual report.



### The policy development process

The Programme Centre is managerially accountable to its Programme Centre Board, through which it reports to the UK Health Departments. The membership of the Board is listed at Appendix 3. In addition to its accountability function, the Board guides the direction of the Programme Centre's work and provides expert advice.

Much of the Programme Centre's work has been executed through Expert groups established for each work stream. This enables the Programme Centre to draw from a range of expert opinion and a wealth of experience and knowledge in the formulation of policies and standards, and development of resources.

### Expert groups

These groups brought together, as appropriate to the work, members from the following: parents of children who are and are not affected by the conditions for which screening is offered so have experience of all the outcomes of the newborn screening processes; midwives; paediatricians, dieticians and other health professionals; screening laboratory directors; information/informatics specialists; public health professionals; and staff of child health records departments. In setting up expert groups, the Programme Centre has ensured a spread of representation from across and within all four countries of the United Kingdom and have invited nominations from key professional bodies such as the UK Newborn Screening Laboratories Network (UKNSLN), Royal College of Midwives, specialist groups of the Royal College of Paediatrics and Child Health (for example the British Society of Paediatric Endocrinology and Diabetes and the British Inherited Metabolic Disease Group) the NHS Information Authority (NHSIA) and patient/family organisations such as the National Society for PKU, CLIMB and the British Thyroid Association.

We have in addition consulted a range of departments within the UK Health Departments including legal, genetics, screening, public health, information systems and those responsible for drafting new and relevant legislation, as well as international experts where relevant. Important links have been developed with those commissioning screening services, those responsible for implementation including directors of public health, antenatal screening co-ordinators and their child health counterparts who are now being appointed. We are very grateful to all members of our Expert groups for their time and commitment to this work. Clearly some individuals have contributed to more than one Expert group for which we are particularly grateful.

### Piloting of the standards

Having developed the standards they were piloted in four different geographical areas of England<sup>hh</sup>, and also in Northern Ireland. This involved the setting up of local pilot steering groups, bringing together representatives of those delivering newborn blood spot screening. The data collected from the pilots in February – March 2004 enabled the Programme Centre to assess whether the draft standards were achievable, measurable and described without ambiguities. The analysis of results and feedback from members of the Pilot Steering Groups enabled appropriate refinements to be made<sup>2</sup>.

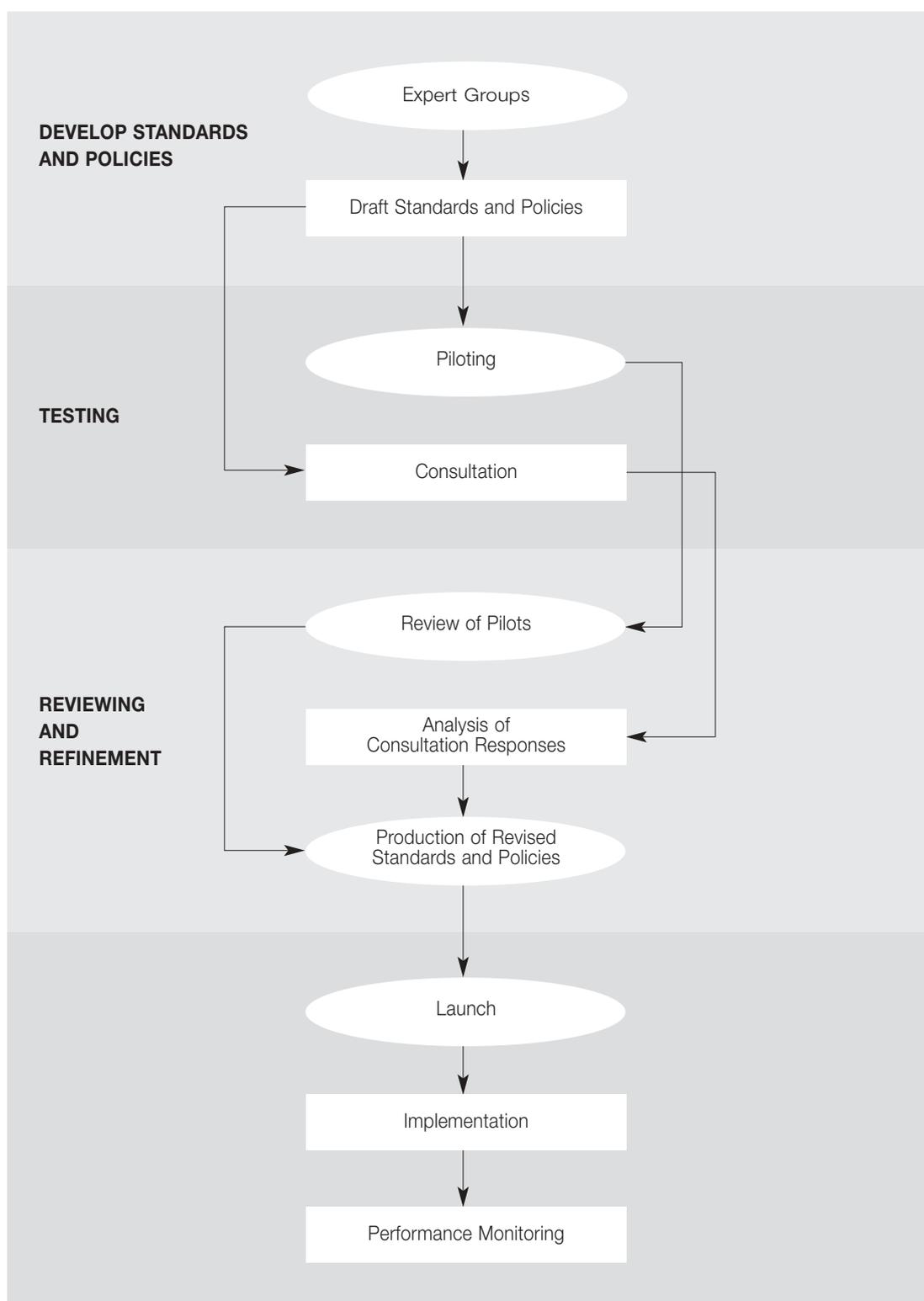
<sup>hh</sup>King's Lynn, Peterborough, Bromley, Lambeth, Southwark, Lewisham

## Draft polices and standards – consultation



The Expert groups each met a number of times with additional email or teleconference-based discussions to review evidence, present and discuss current best practice and draft these policies and standards.

The draft versions of the policies and standards were disseminated for consultation in August 2004. Particular thanks are extended to those who provided feedback and enabled the Programme Centre to improve upon the standards and policies to produce this version. The figure below depicts the process adopted for the development of the policies and standards.



## Appendix 2: The Process Standards – including data sources



NO	STANDARD	DATA COLLECTED BY	MONITORING PERFORMANCE OF	AGGREGATED BY
1	Timely sample collection C 95% of first samples taken 5-8 days after birth (ideally on day 5). D 100% of first samples taken 5-8 days after birth (ideally on day 5).	Screening Laboratory	Midwifery	Maternity Unit
2	Timely sample despatch C 100% of samples received by laboratory within 4 working days of blood sample being taken. D 100% of samples received by laboratory within 3 working days of blood sample being taken.	Screening Laboratory	Midwifery, despatch process	Maternity Unit and Screening Laboratory
3	Completeness of coverage C Screening test result or decline of screening recorded for 100% of resident babies alive at 8 days.	Screening Laboratory	Midwifery, Laboratories, CHRDs	CHRD
4	Enhanced tracking abilities C 95% of blood spot cards received by a laboratory include the babies' NHS number (or UK country equivalent). D By April 2006 – 95% of blood spot cards received by laboratory should have a bar-coded label including babies' NHS number (or UK country equivalent).	Screening Laboratory	Midwifery	Maternity Unit
5	Timely identification of babies for whom the laboratory has not received a decline notification or a blood sample C 100% of untested babies (including declines) identified by 19 days of age. D 100% of untested babies (including declines) identified by 14 days of age.	CHRDs	Midwifery, CHRDs	Maternity Unit
6	Timely processing of positive screening samples C PKU & CHT 100% of positive screening results available <i>and clinical referral initiated</i> within 4 working days of sample receipt by Screening laboratory. D PKU & CHT 100% of positive screening results available and <i>clinical referral initiated</i> within 3 working days of sample receipt by Screening laboratory.	Screening Laboratory	Screening Laboratory	Screening Laboratory

C – Core Standard D – Developmental Standard



### Programme Centre Board Members

Dr Roddy MacFaul	<i>Chair</i>
Dr Lorna Bennett	<i>Sickle Cell Counsellor</i>
Dr Margaret Boyle	<i>DHSSPS – (Northern Ireland)</i>
Dr Dennis Carson	<i>Endocrine Clinician</i>
Professor Sally Davies <i>(December 2002 - May 2004)</i>	<i>Sickle Cell Clinician</i>
Dr Celia Duff <i>(December 2002 - February 2004)</i>	<i>Public Health</i>
Dr David Elliman	<i>NSC Child Health Sub-Group</i>
Dr Sue Halliday <i>(May 2004 onwards)</i>	<i>Public Health</i>
Dr Mick Henderson	<i>UKNSLN</i>
Mervi Jokinen	<i>Royal College of Midwifery</i>
Dr Fred Kavalier	<i>General Practitioner</i>
Dr Simon Lenton <i>(December 2002 - February 2004)</i>	<i>Department of Health for England</i>
Dr Jane Ludlow	<i>Welsh Assembly Government</i>
Dr As’aha Nkohkwo	<i>Sickle Cell Society. Parent</i>
Dr James Paton	<i>Cystic Fibrosis Clinician</i>
Dr Graham Shortland	<i>Metabolic Clinician</i>
Dr Ros Skinner	<i>Scottish Executive</i>
Professor Stuart Tanner <i>(May 2004 onwards)</i>	<i>Department of Health for England</i>
Professor Brent Taylor	<i>Child Health</i>
Jeremy Thorp	<i>NHSIA</i>
Jacquie Westwood	<i>Specialist Commissioner</i>
Carol Youngs	<i>Formerly Contact a Family</i>



1. UK Newborn Screening Programme Centre. Proposed standards and policies for newborn blood spot screening – an integrated consultation. 2004.  
<http://www.newbornscreening-bloodspot.org.uk>
2. UK Newborn Screening Programme Centre. Standards for performance management of newborn blood spot screening – pilot project report. 2004.  
<http://www.newbornscreening-bloodspot.org.uk>
3. NHS Sickle Cell and Thalassaemia Screening Programme. Standard Operating Procedure Guidance. 2004. [http://www-phm.umds.ac.uk/haemscreening/Documents/Newborn\\_SOP.pdf](http://www-phm.umds.ac.uk/haemscreening/Documents/Newborn_SOP.pdf)
4. The NHS Sickle Cell and Thalassaemia Screening Programme. 2004.  
<http://www-phm.umds.ac.uk/haemscreening/>
5. Farrell PM. Improving the health of patients with cystic fibrosis through newborn screening. Wisconsin Cystic Fibrosis Screening Study Group. *Adv Paediatr* 2000;**47**:79-115.
6. Medical Research Council. Recommendations on the dietary management of phenylketonuria. Report of the MRC Working Party on Phenylketonuria. *Arch Dis Child* 1993;**68**:426-7.
7. Smith I. Treatment of phenylalanine hydroxylase deficiency. *Acta Paediatr Suppl* 1994;**72**:60-5.
8. Virtanen M, Maenpaa J, Santavouri P, *et al*. Congenital hypothyroidism: age at start of treatment versus outcome. *Act Paediatr Scand* 1983;**72**:197-201.
9. Department of Health. Standards for better health. 2004.  
<http://www.dh.gov.uk/assetRoot/o4/08/66/66/04086666.pdf>
10. Department of Health. Shifting the balance of power. 1999. London: Department of Health
11. Department of Health. Shifting the balance of power: the next steps. 2002.  
<http://www.dh.gov.uk/assetRoot/04/07/35/54/04073554.pdf>
12. Streetly A, Corbett V. The national newborn screening programme: an audit of phenylketonuria and congenital hypothyroidism screening in England and Wales. 1988. London, Department of Public Health Medicine, UMDS Guy's and St Thomas' Medical Schools.
13. National Screening Committee. Second Report of the National Screening Committee. 2002. <http://www.nsc.nhs.uk/pdfs/secondreport.pdf>
14. Marteau TM. Reducing the psychological costs. *Br Med J* 1990;**301**:26-8.
15. Department of Health. Reference Guide to Consent for Examination or Treatment. 2001.  
<http://www.dh.gov.uk/assetRoot/04/01/90/79/04019079.pdf>
16. Sorenson JR, Levy HL, Mangione TW, *et al*. Parental response to repeat testing of infants with 'false-positive' results in a newborn screening program. *Pediatrics* 1984;**73**:183-7.
17. Hurst D. Newborn screening for sickle cell and other hemoglobinopathies. Northern California's experience. *Pediatrics* 1989;**83**:868-71.
18. Zeuner D, Ades AE, Karnon J, *et al*. Antenatal and neonatal haemoglobinopathy screening in the UK: review and economic analysis. *Health Technol Assess* 1999;**3**.
19. Al-Jader LN, Goodchild MC, Ryley HC, *et al*. Attitudes of parents of cystic fibrosis children towards neonatal screening and antenatal diagnosis. *Clin Genet* 1990;**38**:460-5.
20. Bastian H, Keirse MJNC, Searle J. Influencing people's experiences of screening (protocol). Issue 2. 2002. The Cochrane Library, Oxford: Update Software.
21. Cologna M, Sperandio L. The effect of two different methods of heel lancing on pain reaction in pre-term neonates. *Assist Inferm Ric* 1999;**18**:185-92.



- 22 Franck L, Gilbert R. Reducing pain during blood sampling in infants. *Clin Evid* 2003;9:419-35.
- 23 Barker DB, Willetts B, Cappendijk VC, *et al.* Capillary blood sampling: should the heel be warmed? *Arch Dis Child Fetal Neonatal Ed* 1996;74:F139-F140.
- 24 Janes M, Pinelli J. Comparison of blood sampling using an automated incision device with and without warming the heel. *J Perinatol* 2002;22:154-8.
- 25 Centre for Disease Control. Recommendations for the prevention of HIV transmission in health-care settings. *Morb Mort Wkly Rep* 1987;36:1-85.
- 26 Harpin VA, Rutter N. Making heel pricks less painful. *Arch Dis Child* 1983;58:226-8.
- 27 Paes B, Janes M, Vegh P, *et al.* Comparative studies of heel-stick devices for infant blood collection. *Am J Dis Child* 1983;147:346-8.
- 28 Vertamen H, Fellman V, Brommels M, *et al.* An automatic incision device for obtaining blood samples from the heels of pre-term infants causes less damage than a conventional lancet. *Arch Dis Child Fetal Neonatal Ed* 2001;84:F53-F55.
29. Ades AE, Walker J, Jones R, *et al.* Obstacles to timely neonatal screening in North Thames. *J Med Screen* 1998;5:183-6.
30. Nursing and Midwifery Council Guidelines for records and record keeping. 2002. NMC. <http://www.nmc-uk.org/nmc/main/publications/guidelinesForRecordskeep.pdf>
31. British Inherited Metabolic Disease Group. Inherited Metabolic Disorders – A Service Vision for Setting Standards of Care and their Provision. 2003; Draft III.
32. Burgard P, Smith I. British and German recommendations on the management of phenylketonuria. *European PKU News. E.S.PKU Newsletter.* 1999; 13: 6-7
33. Recommendations on the dietary management of PKU, Report of Medical Research Council Working Party on Phenylketonuria. *Arch Dis Child* 1993; 68(3): 426-7.
34. Wappner R, Cho S, Knonmal RA, *et al.* Management of Phenylketonuria for Optimal Outcome: A Review of Guidelines for Phenylketonuria Management and a Report of Surveys of Parents, Patients, and Clinic Directors. *Pediatrics.* 1999; 104(6):68.
35. Seashore MR, Wappner R, Cho S, *et al.* Development of Guidelines for Treatment of Children With Phenylketonuria: Report of a Meeting at the National Institute of Child Health and Human Development Held August 15, 1995, National Institutes of Health, Bethesda, Maryland. *Pediatrics.* 1999; 104:67-9.
36. Dontanville VK, Cunningham GC. Effect of feeding on screening for PKU in infants. *Pediatrics* 1973;51:531-8.
37. Ponzzone A, Spada M, Ferrero GB, *et al.* Newborn feeding and screening for phenylketonuria. *Acta Paediatr* 1999;88:347-8.
38. Toublanc JE. Guidelines for neonatal screening programs for congenital hypothyroidism. Working Group for Neonatal Screening in Paediatric Endocrinology of the European Society for Paediatric Endocrinology. *Acta Paediatr Suppl.* 1999;88:13-4.
39. Fuggle PW, Grant DB, Smith I, *et al.* Intelligence, motor skills and behaviour at 5 years in early-treated congenital hypothyroidism. *Eur J Pediatr.* 1991;150:570-4.
40. American Academy of Pediatrics AAP Section on Endocrinology and Committee on Genetics, and American Thyroid Association Committee on Public Health: Newborn screening for congenital hypothyroidism: recommended guidelines. *Pediatrics.* 1993;91:1203-9.
41. Australasian Paediatric Endocrine Group. Guidelines for Diagnosis, Management and Follow-Up of Children with Congenital Primary Hypothyroidism. <http://www.racp.edu.au/apeg/cph.htm>



42. Hrytsiuk I, Gilbert R, Logan S, *et al.* Starting dose of levothyroxine for the treatment of congenital hypothyroidism: a systematic review. *Arch.Pediatr.Adolesc.Med.* 2002;156:485-91.
43. Beaulieu M-D. Canadian Guide to Clinical Preventive Health Care. Chapter 18: Screening for Congenital Hypothyroidism.  
[http://www.hc-sc.gc.ca/hppb/healthcare/pdf/clinical\\_preventive/s2c18e.pdf](http://www.hc-sc.gc.ca/hppb/healthcare/pdf/clinical_preventive/s2c18e.pdf)
44. Murphy G, Hulse JA, Jackson D, *et al.* Early treated hypothyroidism: development at 3 years. *Arch Dis Child.* 1986;61:761-5.
45. Simons WF, Fuggle PW, Grant DB, *et al.* Educational progress, behaviour, and motor skills at 10 years in early treated congenital hypothyroidism. *Arch Dis Child.* 1997;77:219-22.
46. Simons WF, Fuggle PW, Grant DB, *et al.* Intellectual development at 10 years in early treated congenital hypothyroidism. *Arch Dis Child.* 1994;71:232-4.
47. Tillotson SL, Fuggle PW, Smith I, *et al.* Relation between biochemical severity and intelligence in early treated congenital hypothyroidism: a threshold effect. *Br Med J.* 1994;309:440-5.
48. Human Genetics Society of Australasia. Policy Statement on the Retention, Storage and Use of Sample Cards from Newborn Screening Programs.  
[http://www.hgsa.com.au/policy/d\\_psruscns.html](http://www.hgsa.com.au/policy/d_psruscns.html)
49. Nørgaard-Pederson B, Simonsen H. Biological specimen banks in neonatal screening. *Acta Paediatr Suppl.* 1999;88:106-9.
50. Therrell BL, Hannon WH, Pass KA, *et al.* Guidelines for the retention, storage, and use of residual dried blood spot samples after newborn screening analysis: statement of the Council of Regional Networks for Genetic Services. *Biochem Mol Med.* 1996;57:116-24.
51. Human tissue and biological samples for use in research – Operational and Ethical Guidelines. Medical Research Council, 2001.  
[http://www.mrc.ac.uk/pdf-tissue\\_guide\\_fin.pdf](http://www.mrc.ac.uk/pdf-tissue_guide_fin.pdf)
52. Inside Information, Balancing interests in the use of personal genetic data. A report by the Human Genetics Commission. May 2002.  
[http://www.hgc.gov.uk/UploadDocs/DocPub/Document/insideinformation\\_summary.pdf](http://www.hgc.gov.uk/UploadDocs/DocPub/Document/insideinformation_summary.pdf)
53. Human Bodies, Human choices. The Law on Human Organs and Tissue in England and Wales. A consultation report. The Department of Health & Welsh Assembly Government, July 2002. <http://www.dh.gov.uk/assetRoot/04/06/93/68/04069368.pdf>
54. The Retention and Storage of Pathological Records and Archives, Report of the Working Party of the Royal College of Pathologists and the Institute of Biomedical Science, Second Edition, 1999.
55. Human Tissue Act 2004: Elizabeth II. Chapter 30. ISBN 0105430048.  
<http://www.legislation.hmso.gov.uk/acts/acts2004/20040030.htm>
56. Human Tissue and biological samples for use in research, MRC Operational and Ethical Guidelines. Addendum following passage of the Human Tissue Act 2004. London: MRC

## Appendix 5: Abbreviations



BIMDG	British Inherited Metabolic Disease Group
BSPED	British Society for Paediatric Endocrinology and Diabetes
C	Core Standard
CF	Cystic Fibrosis
CHRD	Child Health Records Department
CHSG	Child Health Screening Sub-Group
CHT	Congenital Hypothyroidism
CLIMB	Children Living with Inherited Metabolic Diseases
CMO	Chief Medical Officer
COREC	Central Office for Research Ethics
D	Developmental Standard
DH	Department of Health
DHSSPS	Department of Health Social Services and Public Safety
GP	General Practitioner
HGC	Human Genetics Commission
HV	Health Visitor
MCADD	Medium chain acyl-coA dehydrogenase deficiency
MRC	Medical Research Council
NCT	National Childbirth Trust
NHSIA	NHS Information Authority
NHSP	Newborn Hearing Screening Programme
NHSSCTSP	NHS Sickle Cell and Thalassaemia Screening Programme
NPfIT	National Programme for Information Technology
NPSA	National Patient Safety Agency
NSC	National Screening Committee
NSPKU	National Society for Phenylketonuria UK Ltd (NSPKU)
PCT	Primary Care Trust
PCHR	Personal Child Health Record
PKU	Phenylketonuria
RCM	Royal College of Midwives
RCPCH	Royal College of Paediatrics and Child Health
SCD	Sickle Cell Disorder
UKNSLN	UK Newborn Screening Laboratories Network
UKNSPC	UK Newborn Screening Programme Centre

