Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

A Practical Guide to

Newborn Bloodspot Screening

in Ireland

National Newborn Bloodspot Screening Laboratory
Children's University Hospital
Temple Street, Dublin

5th Edition – June 2011

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1 INTRODUCTION

The newborn screening programme for phenylketonuria was started in Ireland on behalf of the Department of Health by Drs Seamus Cahalane and Doreen Murphy at the Children's University Hospital, Temple Street in February 1966, approximately four years after the first newborn screening programme was started in the State of Massachusetts (USA) in 1962. The Irish programme was one of the first national programmes in the world. Since 1966, a number of other conditions have been added. Some of these have been discontinued and others will be added in the future. All babies born on or after 1st July 2011 are screened for Cystic Fibrosis. In 2011, the Health Service Executive (HSE) agreed a Governance Structure for Newborn Screening and will be implementing national agreed procedures and standards for the Newborn Bloodspot Screening Programme.

The screening programme involves many healthcare professionals, each with their own expertise and responsibilities. It is co-ordinated through the National Newborn Bloodspot Screening Laboratory at the Children's University Hospital. The Screening laboratory is fully integrated with the Hospital's Pathology Department thus ensuring rapid confirmatory testing of abnormal test results. The majority of babies diagnosed with metabolic disorders are transferred to the clinical services of the National Centre for Inherited Metabolic Disorders and those with congenital hypothyroidism to the Department of Endocrinology within the Hospital. Babies suspected of having Cystic Fibrosis are referred to one of six HSE designated CF specialist centres in Dublin, Cork, Limerick or Galway depending on the baby's address.

The Newborn Bloodspot Screening Programme will continue to develop. Discussions are underway to standardise screening across Europe and in due course this will undoubtedly lead to further expansion of the Irish programme. This expansion, whenever agreed, will be announced well in advance of implementation.

We would like to acknowledge the dedication and commitment that so many different health professionals put into this programme to make it such a success for the benefit of the few babiess that are affected by one of these conditions.

We would welcome any comments and feedback that individuals may have on this Edition. More information about the programme may be obtained at www.newbornscreening.ie and www.hse.ie/go/newbornscreeening

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Children's University Hospital, Temple Street, Dublin 1

1.1 Telephone Numbers

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National Newborn Bloodspot Screening Laboratory Children's University Hospital	
Enquiries	01 878 4277
FAX	01 878 4596
Prof Philip D Mayne (Director)	01 878 4266
Ms Geraldine Roche (Chief Medical Scientist)	01 878 4277
National Centre for Inherited Metabolic Disorders Children's University Hospital	
Enquiries	01 878 4317

1.2 Laboratory Opening Hours

Monday to Friday Analysis including Beutler tests and reporting of results	09.00 to 17.00
Saturday Morning Reporting of results and Beutler Assay – samples must be in laboratory before 10.00	09.00 to 12.00
Christmas and Easter holidays	Opening hours will be circulated well in advance and posted on the website.

Samples should be sent daily and should NOT be batched.

1.3 Conditions Tested

All conditions, which form part of the Newborn Bloodspot Screening Programme, fulfill, in part or in full, the criteria which have been set out internationally for newborn screening. These include:

- the conditions screened are treatable;
- there is a test available which is easily applied to large population groups;
- there are few false positives and false negatives i.e. the test is reliable;
- the incidence of the conditions in the community is sufficiently high to warrant screening;
- the cost of screening makes the process cost-effective.

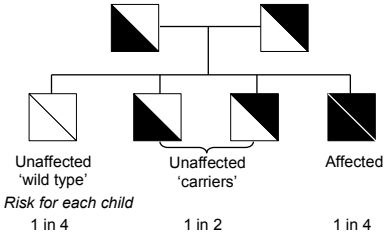
For all of the conditions, early diagnosis and treatment significantly improves the clinical outcome. Some of the conditions, for example, Classical Galactosaemia and Maple Syrup Urine Disease, benefit from the earliest detection possible. Unfortunately, as with all screening programmes, not all individuals with a condition will be detected. This is particularly true for Homocystinuria where about one in five babies may not be detected by screening and for Cystic Fibrosis where milder variants of the condition may not be detected.

Table 1: Conditions included in the Newborn Bloodspot Screening Programme

Condition	Date Started	Irish Incidence	Worldwide Incidence
Phenylketonuria (PKU)	1966	1 : 4,500	1 : 12,000
Homocystinuria (HCU)	1971	1 : 65,000	1 : 200,000
Classical Galactosaemia	1972	1 : 19,000	1 : 60,000
Maple Syrup Urine Disease (MSUD)	1972	1 : 125,000	1 : 216,000
Congenital Hypothyroidism (CHT)	1979	1 : 3,500	1 : 4,500
Cystic Fibrosis	2011	1 : 1,350	1 : 3,500

1.3.1 Inheritance

The majority of the conditions involve a defect in a metabolic process and are inherited as autosomal conditions. Each step in the metabolic pathway is governed by an enzyme protein produced by a set (two) of genes. If one of these genes is defective (mutated), the metabolic process continues, albeit at a reduced rate. These individuals, or carriers, do not have symptoms of the condition but carry a defective gene. If both genes are defective then the metabolic process may be significantly impaired or may stop and the individual will present clinically with the condition. Each parent transfers to their off-spring one set of genes so that the off-spring has a set from each parent. For autosomal recessively inherited, if both parents are carriers of a defective gene, their off-spring has a one in four chance of having the condition. Therefore to have a baby with one of the conditions included in the screening programme, both parents must be carriers of a defective gene for that condition, but neither parent will usually know that they are a carrier.



Congenital hypothyroidism is slightly different in that for 90% of cases the condition just occurs, for reasons which are not fully understood; it is twice as common in girls as in boys. However, for one in ten babies (10%) it is inherited as described above.

1.3.2 Phenylketonuria (PKU)

Phenylketonuria is an inherited autosomal recessive condition as described above. Approximately one in every 4,500 babies born in Ireland will have PKU or a milder form called hyperphenylalaninaemia. When diagnosed within the newborn period and started on treatment, these babies grow up healthy and well. However, without treatment this condition may cause intellectual or physical disability.

The condition is caused by a lack of the enzyme phenylalanine hydroxylase, which normally converts the amino acid phenylalanine into tyrosine. In its absence phenylalanine accumulates and high levels have a direct toxic effect on the brain.

Early treatment is beneficial and aims at giving a low intake of phenylalanine but a normal intake of all the other amino acids. This diet has to be continued for life. Early detection leads to early treatment.

The screening test depends on detecting a high level of phenylalanine in the blood. If the test is carried out before about 72 hours after birth there is a possibility that the level of phenylalanine in blood may not be sufficiently elevated for the condition to be detected.

The treatment for PKU has been one of the major successes in medicine since it was first introduced in early 1950s. There is substantial evidence to show that the earlier treatment is started and the better the biochemical control throughout life, the better the outcome will be for the affected individual.

1.3.3 Maple Syrup Urine Disease (MSUD)

Maple Syrup Urine Disease is a life threatening condition if it is not detected and treated early. It too is an autosomal recessive condition caused by a defect in the metabolism of the three branched-chain amino acids. Approximately one in every 125,000 babies born in Ireland may have this condition or about one baby every two years. The disorder is so called because the urine may have an odour similar to that of maple syrup.

Screening was originally justified on the basis that chronic handicap and even premature death had occurred in a number of families where this condition had gone undetected. Certain branched-chain amino acids accumulate in the blood following the establishment of feeding towards the end of the first days of life, causing brain damage. Some babies may present with signs similar to that of infection or collapse.

A diet similar to that for PKU but with low levels of the branched-chain amino acids is started as soon as the diagnosis is made. Normal brain development and good health result from early treatment; life long adherence to the diet is necessary. Urgent medical intervention may be required during illness, which may be precipitated by infection or by 'stress'.

Some variant forms of Maple Syrup Urine Disease may not be detectable in the newborn period and may present clinically later in life.

1.3.4 Homocystinuria

Homocystinuria results from the accumulation in blood of the essential amino acid methionine and one of its metabolic products homocysteine. Homocysteine accumulates due to a deficiency of the enzyme cystathionine β-synthase. Homocysteine is toxic to the lining of the blood vessels and predisposes the individual to thrombus formation and blood clots and a number of other complications including osteoporosis (thinning of the bones) and eye complication. Again the treatment is similar to that for PKU and for those individuals who stick to the diet the risk of developing any of the complications is greatly reduced. Approximately one in every 65,000 babies born in Ireland may have the condition or one every year.

The screening programme detects high blood levels of methionine. This is one of the more difficult conditions to screen for, as methionine is low in most baby foods, particularly in breast milk. The screening programme may not detect approximately one in every five babies born with this condition. There are a variety of reasons why this may occur. These include:

- breast fed babies as there may be an inadequate intake of methionine in the feed to enable detection;
- a milder vitamin B_6 responsive form of the condition.

Consequently all babies or children who present clinically in later life with signs and symptoms suggestive of homocystinuria, such as dislocation of lenses, osteoporosis or inappropriate tall stature should have the disorder excluded formally by measuring plasma levels of total homocysteine.

1.3.5 Classical Galactosaemia

Classical Galactosaemia is an autosomal recessive condition caused by a deficiency of an enzyme galactose-1-phosphate uridyl transferase. This enzyme is important for the breakdown of galactose, one of the two sugars that make up lactose in human and cow's milk. Approximately one in every 19,000 babies born in Ireland may have this condition. However, it is particularly common among babies born to Traveller parents in whom the incidence is approximately 1 in 450 births. Consequently in the non-traveller Irish community the incidence occurs in about one in every 36,000 births.

If not detected and treated during infancy the disorder may cause damage to the liver and may occasionally be life threatening. As a result of the condition, galactose and its metabolite galactose-1-phosphate accumulate in blood; galactose-1-phosphate is extremely toxic. The baby may present with jaundice. There may be a bleeding disorder with a tendency to bleed spontaneously; this may cause a brain haemorrhage. The affected baby may also develop an *E coli* septicaemia or present with cataracts in the eyes. Early detection and treatment with a galactose-free diet will prevent the early clinical symptoms of the disorder; some of the longer term complications, such a dyspraxia, ataxia or reduced fertility in women, may still occur in older children and adults despite treatment.

Because the condition is relatively common in babies born to Traveller parents, a special screening test, the Beutler test, is offered to all these babies at birth (Day 1 of life). They are advised to go on a galactose free feed (Soya-based) until the result of the test is available. This protects the baby should he/she have the condition. For those mother's wishing to breast feed, they should discuss this with their midwife – they can express their milk until the result of the test is available.

Clinicians should never depend upon the general population screening for the diagnosis of Classical Galactosaemia, but should query this condition in any baby who presents early with jaundice and other symptoms e.g. vomiting or floppiness.

1.3.6 Cystic Fibrosis (CF)

Approximately one in every 1,500 babies born in the Ireland may have Cystic Fibrosis (CF). CF is also an autosomally inherited condition, both parents carrying an abnormal CF gene. As a consequence of the condition thick mucous secretions are produced by a number of organs including the lungs and the pancreas; it is this thick, mucous secretion which causes the problems. The thick secretions in the lungs may become infected causing damage ultimately and in the pancreas causing digestive problems and malabsorption. Consequently babies with CF may not gain weight appropriately and have frequent chest infections.

Newborn screening means that babies with CF are identified earlier; they can be treated with a high energy diet to improve weight gain, and medicines and physiotherapy to improve lung function. Although a child with CF may still become ill, early treatment does improve their quality of life, significantly reduces the time that they have to spend in hospital and they live healthier and longer lives.

The screening programme for CF measures the plasma level of immunoreactive trypsinogen (IRT). IRT is normally excreted by the pancreas but in individuals with CF this is 'regurgitated' back into the blood due to the thick mucous secretions blocking the pancreatic ducts. Levels of IRT may remain high in blood for about the first six months of life. If the blood IRT level is high the sample will be referred for CF mutational analysis. This DNA test screens for the presence of 38 mutations on the original bloodspot.

- If two mutations are detected then the baby probably has CF and this will be confirmed by a Sweat Test.
- If one mutation is identified then a sweat test will be performed to determine whether the baby is a carrier of CF or has the condition. If the sweat test is positive, further DNA analysis will be undertaken to identify the second mutation.

As with some of the other conditions included in the screening programme, not all babies with CF will be detected by the newborn bloodspot screening programme. Milder variants of the condition may not be detected and some of these individuals may have a very benign clinical course which may not require treatment.

1.3.7 Congenital Hypothyroidism

Unlike the other conditions, hypothyroidism is a congenital rather than an inherited condition in the majority of cases. This is an endocrine condition, which results from failure of the thyroid gland to produce thyroxine. There are a number of different forms of the condition. Some babies may have a very small thyroid gland or no gland at all while others may not be able to synthesise thyroxine. It is important to know the cause and this can be done by performing a thyroid scan soon after the diagnosis has been made and usually before treatment is started. Approximately one in every 3,500 babies born in Ireland may have the condition; early detection allows for early treatment and the prevention of the onset of symptoms.

The diagnosis is made by measuring blood thyroid stimulating hormone (TSH), high levels of which are suggestive of the condition. However, TSH rises in blood immediately after birth and then falls to normal by about the second day of life. This is one of the reasons why the heel-prick sample should not be taken before about 72 hours after birth, otherwise a false-positive result could be produced.

The majority of babies with congenital hypothyroidism require thyroid hormone replacement. Some babies will be reviewed between two and three years of age at which time a small number may be able to discontinue treatment under medical supervision. Otherwise treatment is for life and the dose of thyroxine adjusted as the baby grows.

Compared to some of the other conditions the frequency of false positive results for CHT is relatively high. Consequently the number of requests for repeat blood samples is also high. Possible reasons include:

- a transiently raised plasma TSH concentration which returns to normal in time. These babies may require a number of repeat samples to be collected. As hypothyroidism is more common in babies and children with Down syndrome, a disproportionate number of repeat samples may be requested from these babies as they too may have a transiently

elevated plasma TSH level during the newborn period before developing hypothyroidism later;

- babies who may have had surgery before having the screening sample taken, may have a transiently elevated plasma TSH level. This may occur as the antiseptic skin preparation solution may contain iodine which may be absorbed through the skin and cause transient hypothyroidism.

1.4 Consent for Newborn Screening

The newborn bloodspot screening or 'heel-prick' test should be offered to parents/guardians of all babies who are born in Ireland or who enter the country before the test would have been performed in their country of origin. At present, under the Irish Constitution, parents have the right to opt-out of newborn screening on behalf of their child. Therefore, parents must be given the appropriate information on which to make a decision. HSE Parent Information leaflets are available and should be given to parents during the third trimester of pregnancy and again at the time of sample collection. Parents should also be given the Top page of the Newborn Screening Card which contains some information about the programme.

1.4.1 Parental Consent

As parents have a right to opt out, it is essential that they are informed fully of the benefits of the newborn bloodspot screening programme. They should be told:

- about the nature of the conditions which are being screened for;
  - If these conditions are detected soon after birth, treatment can be started early and significant handicap and possibly premature death can be prevented. Treatment is essentially by modification of the diet under careful medical supervision or by drugs, as for congenital hypothyroidism or the prevention or treatment of complications as for CF
- that a further sample may be required, either to check the first result or because of an equivocal result or a technical problem in the first analysis, such as a borderline result, an insufficient quantity of blood collected or assay interference;
- that parents of baby with a positive result will be contacted directly, usually by the maternity unit; clear instructions will be given.
  - Depending on the condition, the parents may be asked to bring their baby immediately to hospital, usually to the Children's University Hospital, Temple Street, where the baby may be kept in hospital for a period of time while treatment is commenced; this is dependent on the condition diagnosed. If the baby is suspected of having CF they will be contacted by a CF Nurse specialist from one of the six HSE designated CF centres and asked to bring their baby in the following day for further tests.

NB Parents must be reassured that, with early detection and treatment of most of the conditions, their baby will develop essentially normally provided that the parents and then the child/adolescent adheres to the medical advice given. For those with Cystic Fibrosis, early detection and management significantly improved the nutritional state of the child and reduced the number of admissions to hospital.

If parents consent to their baby being screened, one parent must sign the Newborn Screening card, preferably the mother as under the *Guardianship of Baby's Act, 1964* she has automatic parental responsibility for the newborn. The parent signs the Newborn Screening Card to;

- verify that the details for her baby are correct;
- verify that she has received and read the Parent Information Leaflet;
- consent to her child being screened.

The parents must be informed that the newborn screening card will be retained for 10 years for the benefit of their child, thereafter the card will be disposed of.

The appropriate newborn screening leaflet should be given to the parents and the Nurse Copy filed in the babies clinical notes as a record that consent for newborn bloodspot screening has been given.

If the parent has literacy difficulties he/she can be asked to make a mark on the form – this mark must be witnessed by an adult other than the sample taker.

1.4.2 Right to Opt-out of Newborn Screening

Parents do have the right to opt-out from the programme on behalf of their baby. However, parents should be actively discouraged from so doing in the best interest of their baby's well-being; opting-out does conflict with the provisions of the Child Care Act (1991; 2001). In such cases, PHNs should consult with the General Practitioner and midwives or children's nurses with the consultant paediatrician. If parents do decide to opt-out, it is essential that they are fully informed of the potential clinical consequences to their baby. The benefits of screening are explained in the Parent Information Leaflet and the consequences of not detecting a case summarized on the Opt-out Form.

Parents must sign the HSE Opt-out Form; this must be witnessed by an adult other than the potential sample taker and signed by all parties. A copy of the Opt-out Form must be given to the parents and a copies sent to the Directors of Public Health Nursing and Midwifery or Nursing and to the National Newborn Bloodspot Screening Laboratory. A copy must also be sent to the baby's General Practitioner.

Parents should be informed that they may change their mind in the future. However, it is their responsibility to make their change of mind known either to the PHN or to their General Practitioner. Copies of the Opt-out Form are available at www.newbornscreening.ie. Refer to Appendix No. 1 for a copy of this form.
Ref.: Appendix No. 1 Opt-Out Form

1.4.3 Retention of the Newborn Screening Card

After screening the Newborn Screening Card is stored as part of the baby's health record for 10 years, after which it is disposed of. After screening the sample may be used to:-

- check the results of the screening test or to perform other investigations recommended by a doctor and for which the parents must be informed.
- for quality control purposes and to help improve the screening programme as approved by the HSE. In such circumstances all samples will be completely anonymised and it will not be possible to trace any result back to the individual baby's.

1.4.4 Data Protection Legislation and Newborn Screening

Under the Governance arrangements between the HSE and National Newborn Bloodspot Screening Laboratory, the laboratory retains the patient demographic details and a copy of the results as part of the baby record and retains the Newborn Screening Card for 10 years.

Parents/guardians may request that the blood portion of the Newborn Screening Card be destroyed after one year. Such requests must be made in writing to the Director of the National Newborn Bloodspot Screening Laboratory, the Children's University Hospital, Temple Street, Dublin 1. Parents/guardians will be asked to provide proof of identity, a copy of the passport or driving license *and* a recent utility bill.

1.5 Sample Collection

1.5.1 Time of Collection

1.5.1.1 All Baby's

Samples on all newborn babies should be collected by heel-prick:

1.5.1.2 After 72 Hours and Before 120 Hours from Birth

- Before 72 hours – it is essential that all babies should receive an adequate protein intake before the sample is taken, otherwise a false negative result may occur. Therefore, the sample is taken after 72 hours. Blood TSH levels, the test used to screen for congenital hypothyroidism, may be transiently elevated immediately after birth; consequently if the sample is taken too early, some baby's may have a false positive test result for congenital hypothyroidism.
- After 120 hours – because the programme includes screening for Classical Galactosaemia and MSUD, it is essential that samples are not collected too long after birth, otherwise some babies may present clinically before the results of the screening test are available.

1.5.1.3 Baby's Feeding

Babies should be on oral or parental feeds for at least 24 hours before the newborn sample is collected.

1.5.2 Breast Fed Babies

Babies who are being solely breast fed should have the sample taken towards the end of the 72 to 120 hour time window. If protein intake is deemed to be suboptimal a further sample should be taken on or about Day 10 after birth.

This is to ensure that protein intake has been adequate to reveal a positive test; breast milk contains less protein than formula feeds. This is particularly important when screening for Homocystinuria or some of the milder variants of the other conditions.

1.5.2.1 Total Parental Nutrition

This should be clearly indicated on the Card; because these babies may not be on any galactose containing feed a Beutler test will need to be performed to rule-out Classical Galactosaemia.

1.5.2.2 Transfusion – Blood

A newborn screening sample should be taken before any baby is given a transfusion before the normal newborn screening sample should have been taken. If a transfusion has been given then sample collection should be delayed for 72 hours.

1.5.3 Premature Babies

All premature babies should have the sample taken after 72 hours and before 120 hours from birth. Further samples should be collected at weekly intervals until the baby's has been established on full oral or parental feeds. TPN must be indicated on the Newborn Screening card.

1.5.4 High Risk Screening

Family history must be stated clearly on the Newborn Screening Card, if present and the condition indicated.

1.5.4.1 Sibs of Known Cases of Phenylketonuria (PKU)

A newborn screening sample AND a liquid sample should be taken between 72 and 120 hours following birth AND another newborn screening card sample on Day 10 if the initial sample was reported as <PKU not suspected>.

1.5.4.2 Sibs of Known Cases of Homocystinuria (HCU)

A newborn screening sample should be taken between 72 and 120 hours following birth AND a liquid sample taken on Day 3 and Day 10 for plasma total homocysteine, and free homocystine (after deproteinisation), methionine and cystine determination. This may be repeated on further occasions on advice from laboratory staff, depending of the initial results.

1.5.4.3 Sibs of Known Cases of Maple Syrup Urine Disease (MSUD)

A liquid sample should be taken on Day 1 after the second feed and then daily until established on full feeds. Urine should be tested daily for ketones. A newborn screening sample should be taken between 72 and 120 hours to test for the other conditions. Laboratory staff and/or staff at the National Centre for Inherited Metabolic Disorders, Temple Street must be informed prior to delivery of the baby.

1.5.4.4 Sibs of Known Cases of Cystic Fibrosis (CF)

An EDTA sample should be sent directly to the National Centre for Medical Genetics (OLCH) at birth, clearly stating the name and DoB of the affected sibling.

1.5.4.5 Sibs of Known Cases of Congenital Hypothyroidism (CHT)

Thyroid function test should be performed on Day 3 of life on a liquid sample. The risks are dependent on the type of CHT. For those with dyshormonogenesis the risks are one in 4 while with agenesis or dysgenesis the risk is about one in 2000, depending on the gender of the baby as agenesis/dysgenesis CHT is more common in girls than in boys.

1.5.4.6 Sibs of Known Cases of Classical Galactosaemia and All Babies Born to Traveller Parents (Travellers and Settled Travellers)

Both these groups are at particularly high risk of having Classical Galactosaemia. The incidence of Classical Galactosaemia among Travellers is high at one in 480 births.

A newborn screening sample should be taken immediately after birth and *before any blood transfusion has been given.* A cord blood sample is NOT recommended. The sample should be sent to the Newborn Bloodspot Screening Laboratory for a Beutler Test. This test measures the enzyme activity in red blood cells and is NOT dependent of feeds. The card should be clearly marked "FOR BEUTLER TEST". The Beutler assay is not performed as an emergency on-call investigation. However, they are performed on a Saturday morning providing that the newborn screening card is received in the laboratory by 10.00. Special provision will be made for Bank Holidays and long weekends; this information will be circulated in advance.

All these *at-risk* babies should be fed with a lactose/galactose-free feed until the result of the Beutler test is known.
The normal newborn screening sample should be taken between 72 and 120 hours following birth to test for the other conditions.

1.5.4.7 Cousin Marriages within the Traveller Community

Some members of the Traveller community might wish to seek genetic counseling advice; this can be arranged through the National Centre for Medical Genetics at OLCH, Crumlin.

1.5.5 Maternal Phenylketonuria

Phenylalanine is actively transported across the placenta; the blood level in the foetus is about twice that of the mother. Therefore, women who themselves have phenylketonuria, should plan conception, so that their condition is under optimum control at the time of conception. Regular and frequent monitoring of blood levels of phenylalanine and tyrosine are required throughout pregnancy in order to safe-guard the well-being of their foetus.

1.5.5.1 Babies Presenting with Meconium Ileus

Cystic Fibrosis should be considered in those babies who present with meconium ileus within the first days of life. Send an ETDA sample to National Centre for Medical Genetics for CF mutation analysis, with full clinical information.

1.5.6 Babies of Immigrant Parents or Refugees

All babies of immigrant parents who arrive in Ireland before any newborn screening test has been performed should have the full screen performed. PKU, HCU, congenital hypothyroidism and CF may present late with minimal clinical signs. The decision to screen for other disorders is a local decision, made by the local clinicians and dependent on the family history and the country of origin of the parents.

1.6 Responsibility for Ensuring that all Babies are offered Newborn Screening

Newborn bloodspot screening is an integral part of the management of newborn babies. Screening involves the co-operation of many agencies involved in sample collection and transport, sample analysis and recording of results to ensure complete uptake and the management of babies diagnosed with a condition. In 2011, the HSE put in place a Governance structure to manage the newborn bloodspot screening programme. This is available in Appendix No. 2.

Ref.: Appendix No. 2 Governance Structure for the National Newborn Bloodspot Screening Programme

1.6.1 Responsibility of the Health Service Executive

The ultimate responsibility for ensuring that all babies are offered screening in accordance with agreed protocols and procedures rests with the Health Service Executive and the Assistant Director of Health Protection and Child Health. The operation of the programme is the responsibility of the Director of National Childhood Screening who chairs the National Newborn Bloodspot Screening Programme Governance Group. The Director of the National Newborn Bloodspot Screening Laboratory is responsible for the day to day coordination of the programme.

1.6.2 Responsibility of Regional Leads of Child Health

The Regional Leads of Child Health are responsible for ensuring that all babies born in their Region and all newborns residing in their Region are offered screening and that structures for the timely checking and recording of the test results are in place. The Regional Leads are responsible for reporting newborn screening uptake and coverage to the National Newborn Bloodspot Screening Programme (NBSP) Governance Group

1.6.3 Responsibility of Maternity Units and Maternity Hospitals

Directors of Nursing/Midwifery of maternity units/hospitals are responsible for ensuring that all babies born in hospital are offered screening. If the test is not performed in the maternity unit/hospital before discharge, hospital staff are responsible for ensuring that the baby is screened either by returning to the unit/hospital or in the community by public health nurses. The maternity unit/hospital is responsible for informing the Director of Public Health Nursing or her assistant that the baby has been discharged prior to the test being carried out. The maternity unit/hospital must also inform the Director of Public Health Nursing if the newborn screening sample is not exempt from the packaging transport regulations due to infection either in the mother or baby.

If the maternity unit/hospital does not receive any results from the National Newborn Bloodspot Screening Laboratory, the maternity unit/hospital staff are responsible for ensuring that omissions are notified to the Director of Public Health Nursing.

1.6.4 Responsibility of HSE Local Health Organisations

Directors of Public Health Nursing are responsible for ensuring that the test is carried out in the local health area following notification from the maternity unit/hospital and that all babies residing in their area have been offered screening. The Directors of Public Health Nursing are also responsible for the timely recording of results in the NBS Register and for the follow-up of babies requiring further investigation.

1.6.5 Responsibility of General Practitioners and Independent Midwives

Independent midwives and general practitioners performing home deliveries are responsible for performing the test in accordance to agreed protocols and procedures and for dispatching the newborn screening card to the National Newborn Bloodspot Screening Laboratory as soon as possible after collection in accordance with packaging transport regulations.

1.6.6 Responsibility of Parents/Guardians

In the case of parents/guardians who opt-out from allowing their baby to be screened, on being informed of the potential consequences to their baby in so doing, the responsibility for the possible adverse consequences of their decision shifts to them. The parents/guardians must be requested to signify their decision to opt-out in writing and a copy of the completed Opt-out Form given to the parents/guardians and a copy forwarded to the Directors of Midwifery/Nursing

and Public Health Nursing, the National Newborn Bloodspot Screening Laboratory and the baby's general practitioner. Parents may change their mind in the future but it is their responsibility to bring this 'change of mind' to the attention of the PHN or their general practitioner.

In the case of babies born outside the jurisdiction to parents/guardians who reside in the jurisdiction, the parents/guardians are responsible for ensuring that the baby's is screened. If the parents notify the PHN of the birth on their return to this jurisdiction, the PHN is responsible for ensuring that the test is carried out.

1.7 Recording of Information

It is anticipated that the National Maternal and Baby's Clinical Management Information System will be introduced across the 19 HSE obstetric units by approximately 2013 and that this system will issue a unique HSE number that will be used across all health sectors. However, during the interim period, a Unique Prenatal Identifier (UPI) number will be issued by the maternity units/hospitals from 1st July 2011 and that this UPI will be used for all newborn screening requests to ensure that newborn bloodspot screening samples can be traced throughout the screening process.

The UPI will be consist of the 3 digit Hospital HIPE code of the maternity unit/hospital of the birth hospital followed by the Healthcare Record Number (HCRN) of the baby. Babies born either at home or in a maternity hospital outside Ireland will be issued with a UPI by the Director of Public Health Nursing in the area in which their birth is registered following notification of the birth.

Table HIPE Code Numbers for Maternity Units/Hospitals in Ireland

HIPE Code	Maternity Hospital / Unit	HIPE Code	Maternity Hospital / Unit
202	Mullingar General Hospital	607	St. Joseph's Hospital, Clonmel
203	Tullamore General Hospital	724	Cork University Hospital incl CUMH
301	Midwestern Regional Maternity Hospital, Limerick	726	Kerry General Hospital
402	Cavan General Hospital	800	University College Hospital Galway (UCHG)
403	Our Lady's County Hospital, Navan	802	Castlebar County Hospital
404	Monaghan County Hospital	919	Portiuncula Hospital, Ballinasloe
500	Letterkenny General Hospital	922	Our Lady of Lourdes Hospital, Drogheda
501	Sligo General Hospital	930	Coombe Women's Hospital, Dublin
600	Waterford Regional Hospital (Ardkeen)	931	National Maternity Hospital, Holles St, Dublin
601	St. Luke's Hospital, Kilkenny	932	Rotunda Hospital, Dublin
605	Wexford General Hospital	920	Mount Carmel Hospital

The following steps must be adhered to ensure that adequate records are maintained in the hospital. This will help identify any baby who has not been screened before discharge:

(a) a person should be nominated by the hospital to take responsibility for checking records;
(b) details of each baby should be recorded in a single register;
(c) the register must indicate whether or not the test has been carried out;
(d) when the results of the test are returned from the National Newborn Bloodspot Screening Laboratory, the entry should be ticked in a different colour pen (if a manual procedure is used) or entered into the electronic register – therefore, any case where there is no report received from the Laboratory is noticeable at a glance;
(e) the person who checks the register to identify possible omissions should initial the entries to indicate that he/she has undertaken the exercise.

1.7.1 Early Discharges from Hospital

The nurse/midwife discharging the baby from hospital before the test has been carried out must ensure that the mother understands the following:

- the importance of the test;
- when it should be done;
- that the test should be carried out either:
  - at the maternity unit/hospital, or
  - by a public health nurse, or
  - by a general practitioner or independent midwife in the community.

If it is not appropriate to carry out the test before discharge from hospital, the nurse/midwife should ensure that the baby is screened either:

- by returning to the hospital
- or in the community. The nurse/midwife should notify the Director of Public Health Nursing that the baby's has been discharged prior to the test being carried out to enable the public health nurse to give priority to these babies.

The Director of Public Health Nursing in the area in which the parents live is responsible for ensuring that babies, discharged from hospital prior to having the test performed, have the test carried out subsequently.

If the test is to be performed by a PHN, the following procedures should be followed:

(a) the ward sister should ensure that the appropriate Director of Public Health Nursing has been notified that the test is to be carried out. The Director should be provided with the full details of the baby, including the UPI. She should also be informed if either the baby or mother harbours an infection which would mean that the heel-prick sample was not exempt from the postal transport regulations.
(b) the Director of Public Health Nursing should:
  - keep a register of requests from hospital/s;
  - request the appropriate PHN to perform the test and send the sample with the baby's UPI by registered post (and obtain a receipt of postage) to the National Newborn Bloodspot Screening Laboratory at the Children's University Hospital, Temple Street, Dublin 1;

- notify the maternity unit/hospital where the birth took place that the test has been carried out.

(c) the National Newborn Bloodspot Screening Laboratory will send a copy of all results to the maternity unit/hospital and to the Director of Public Health Nursing.

If the test is to be performed by a general practitioner or an independent midwife, the following procedures should be followed:

(a) the Director of Public Health Nursing must contact the general practitioner or the independent midwife to ensure that the test will be performed and sample sent by registered post with the UPI (and obtain a receipt of postage) to the National Newborn Bloodspot Screening Laboratory;
   - it is the responsibility of the General Practitioner/independent midwife to arrange the transport of the sample and this should NOT be delegated to the parents

(b) the National Newborn Bloodspot Screening Laboratory will send a copy of all results to the maternity unit, the Director of Public Health Nursing and to the general practitioner/independent midwife;

(c) the general practitioner must contact the Director of Public Health Nursing in cases of non-attendance by the parents.

In the case of Traveller babies, the baby may have moved out of the area before the test has been carried out. The Director of Public Health Nursing must be informed of the circumstances as early as possible so that alternative arrangements may be made.

1.7.2 Transfer from Maternity Unit/Hospital to Tertiary Referral Hospital

The nurse/midwife responsible for the transfer of a baby from a maternity unit/hospital to a tertiary referral paediatric unit for continuing medical or surgical treatment before the newborn screening sample has been taken MUST inform the receiving unit and give them the baby's UPI.

The paediatric unit must have written procedures for:

- performing the test between 72 and 120 hours after birth;
- sending the sample to the National Newborn Bloodspot Screening Laboratory;
- recording the results in the baby's medical records;
- informing the maternity unit/hospital of the results of the tests.

1.8 Procedure for Taking the Routine Blood Sample

Ref.: Appendix No. 5: Guide for Sample Takers

The blood sample should be taken not earlier than 72 hours and not later than 120 hours after the baby's birth and when feeding has been established.

1.8.1 Equipment Needed

- sterile lancet (metered tip no more than 2.5mm in depth);
- latex free gloves;
- cotton wool;
- newborn screening card;

- envelope (water resistant, tear-proof – Tyvek® or equivalent).

1.8.2 Technique

1. Explain to the parents the reason for the test and its importance to the baby's well-being
2. Obtain consent (see above) if not already obtained.
3. Ask the parents to keep the baby's feet warm prior to the visit by the PHN, by applying two sets of socks or placing a set of socks beneath the babygro
4. Complete ALL sections of the newborn screening card in clear print using a black ballpoint pen.
   - Read the instructions printed on the back of the card carefully.
5. Tear of the Top Information sheet and the Parent Copy on signed from the Newborn Screening card and give them along with the Parent Information leaflet to the parent; retain the Nurse Copy of the NSC
6. Assemble equipment and put on gloves. Do NOT touch the printed rings on the card with gloves.
   - Latex interferes with the Beutler Test and may cause a false positive result.
7. Preferably take the sample from the baby while the mother cuddles the baby on her knee, or on her shoulder; this not only assists you but also comforts the baby. It also allows the mother the opportunity ask questions about the test.
8. Place a paper towel on the lap of the individual holding the baby.
9. Ensure that the heel is warm:
   - warm water tested by the elbow of the sample taker may be sued
   - rub the skin for 1-2 minutes to increase blood supply;
10. Cleanse the heel thoroughly with warm (to touch) soapy water.
11. Air dry the heel or wipe dry with cotton gauze.
12. Encircle the heel with finger(s) and thumb and squeeze gently until the skin looks taut and suffused with blood.
13. Press the lancet firmly against the side of the ball of the heel and trigger the sterile lancet.
14. Hold the foot downwards and gently massage the heel to encourage blood flow.
15. Touch the circle marked on the card gently to the hanging drop so that the blood soaks through from the back of the card to the front:
    - fill the outer two circles first;
    - blood drops must be soaked through from the back to the front of the card, filling all circles completely.
    - check that the blood has soaked completely through the circle on the front as well as the rear of the card
16. Wipe away excess blood with cotton gauze. Press clean gauze firmly onto wound until bleeding stops.
    - It is not recommended that a plaster is used as this may be picked off by the baby's and swallowed.
17. Air-dry the newborn screening card before putting it into the envelope. This may take up to two hours. Do not use excessive heating as this may invalidate the test.
18. Send the card by registered post or by courier to the Newborn Bloodspot Screening Laboratory using the yellow fluorescent address labels, to reach the laboratory <u>as soon as possible</u> after collection.
    - If more than one Newborn Screening card is placed in a Tyvek® envelope, they should be

placed at 180^{O} to each other so that blood does not touch blood
    - The sender MUST indicate how many cards have been placed in each envelope and preferable provide a separate list of the names of the baby's whose specimens have been included in each envelope.
19. Please read the section on the transport of *Pathological Specimens by Post* and make sure that the newborn screening card has been packed according to the current regulations.
20. Keep a record of all samples sent in each envelope.

1.8.3 General Tips on Blood Collection

- Alcohol wipes are not recommended for very premature babies – use soap and water
- The use of a very thin smear of Vaseline over the puncture site might improve the quality of the blood drop by increasing the meniscus effect
- The heel must be clean prior to skin puncture to prevent skin infection
- Blood will flow more easily if the limb is lowered and warm
- Alternative releasing of pressure for several seconds between squeezes should maintain blood flow
- If blood flow stops, release pressure, lower the limb, wipe the puncture site firmly with cotton wool, wait ten seconds and then squeeze gently again
- Do not use plasters over the puncture site – babies may swallow them; if they are used the mother must been warned of the potential risk.

1.8.4 Why Repeat Blood Samples may be Requested

1. Insufficient blood on Newborn screening card for all the tests to be performed.
2. Unsatisfactory analysis:
    - test needs to be repeated (rechecked);
    - test difficult to interpret because specimen was contaminated or had deteriorated during transit.
3. Equivocal or borderline test result.
4. Baby's too young when blood sample was collected.
5. Sample on the Newborn Screening Card had not been dried properly before being put into a plastic coated (Tyvek®) envelope causing 'serum rings'.

1.8.5 Problems with Sample Collection

1. Unlabelled or inadequately labelled specimens cannot be accepted for analysis.
2. Biohazards – babies whose mothers are known or suspected of being infected with HIV or Hepatitis B should have the screen performed. The Newborn Screening Card MUST be identified as a Biohazard, not the outer envelope; the card must be packaged according to the regulations.
3. Blood transfusion or exchange transfusions may invalidate the screening test. All samples for a Beutler assay MUST be taken before a transfusion is given; this must be clearly stated on the card. If a blood transfusion has been given before the sample has been taken for the Beutler assay, it may not be possible to exclude Classical Galactosaemia and therefore lactose containing feeds should be introduced with caution.

1.8.6 Completion of Newborn Screening Card at Time of Discharge

It is the practice of some maternity units/hospitals to give the newborn screening card to the parents either completed or blank at the time of discharge from hospital. It is the responsibility of the individual who subsequently takes the sample to check that ALL the details are correct including the Day of Collection and Local Health Area. In addition, the name of the baby, both surname and first name, might have been changed by the parents since discharge and these corrections MUST also be made. The parents must sign the card to verify that the information is correct and that they consent to the screen process being performed. The parents must be given the Parent Leaflet from the newborn screening card and instructed to keep it in a secure location; the Nurse should retain the Nurses' Leaflet.

1.8.6.1 Surname Change

Change of surname is one of the principal reasons why it may not be possible to check that a sample has been taken or report received. The Newborn Bloodspot Screening Laboratory now records a surname change as a double-barrel name with the mother's surname first.

1.9 Transport / Drying Boxes

The Newborn Bloodspot Screening Laboratory has designed drying/transport boxes in conjunction with Mega-Pak Ltd. These cardboard boxes can contain two newborn screening cards. They have been designed specifically to facilitate the transport of the card from the baby's home to the PHN's car in a safe manner. Once the blood spot is dry it should be removed from the box and packaged according to the regulations.

The boxes are reusable. However, if they become contaminated with blood they should be disposed of either by incineration or through the accepted procedure for disposal of hazardous waste.

These boxes can be ordered directly from Mega-Pak Ltd at 01 8402063 – the minimum order is 150 packaged in boxes of 50.
Ref.: Appendix No. 4: Transport/Drying Box

1.9.1 Procedure for Transporting Samples

The sender of Newborn Screening Cards by registered post or by courier is responsible for ensuring that the packaging and transportation of the sample complies with current transport regulations regarding Health and Safety as laid down in the European Directive (ADR 2011) Packaging Regulations P650 as applied to UN No. 3373 under Clause 2.2.62.1.5 in the absence of a Category A or B infection in either the baby or the mother. Because of the low hazard they present, the following substances of biological origin are exempted from dangerous goods requirements and regulations:

- substances that do not contain infectious substances or will not cause disease in humans or animals

- substances containing microorganisms that are not pathogenic to humans or animals
- substances in a form in which any pathogens present have been neutralized or inactivated such that they no longer pose a health risk
- environmental samples (including food and water samples) that are not considered to pose a significant risk of infection
- blood and/or blood components collected and shipped for the purposes of transfusion and/or transplantation
- dried blood spots and faecal occult blood screening tests
- decontaminated medical or clinical wastes.

Newborn Screening cards, taken from the majority of babies are exempt from the current regulations.

For Exempt Newborn Screening Cards, the National Newborn Bloodspot Screening Laboratory recommends that:

- Senders of Dried Blood Spots (newborn screening cards) that fulfil the exemption criteria must make sure that the sample is completely dry on the primary receptacle (NSC) before packaging and that the primary receptacle should be placed in a tear-proof, water resistant outer package (Tyvek® envelope or equivalent). The yellow fluorescent address label should be fixed to the outer envelope

For NON-Exempt Newborn Screening Cards. Newborn Screening cards are NOT exempt from Packaging Instruction P650 of UN3373 if the sample (baby's) contains, or mother is infected by, a Category A or B pathogen. The National Newborn Screening Laboratory recommends that:

- Senders of Dried Blood Spots (newborn screening cards) that are NOT exempt should assign the package to UN No. 3373 and pack the sample in accordance to Packaging Instruction P650.

Ref.: http://www2.dft.gov.uk/426155/425453/800_300/infectioussubstances.pdf
The sample must be completely dry on the primary receptacle (NSC) before packaging into an inner container (sealed plastic envelope) and then placed in a tear-proof, water resistant outer package (Tyvek® envelope or equivalent). A label showing the UN3373 symbol should be placed on the outer package (envelope) to which the yellow fluorescent address label should also be fixed.

1.9.2 Penalties

Criminal
A person or corporate body that fails to take all practical steps to prevent injury to person or damage to property or procures the carriage of a dangerous goods by road without disclosing their precise nature or that they are dangerous shall be guilty of a criminal offence under the Carriage or Dangerous Goods By Road Act 1998.

Civil
A person transporting diagnostic specimens using the An Post service shall be liable for damage for injury to staff or disruption to services caused by the specimens or their leakage.

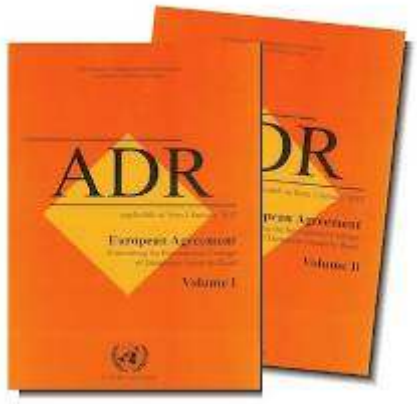
It is also an offence to declare that a package contains a dangerous pathogen by using the symbol UN3373 when the package is exempt from the Regulations.

1.9.3 Responsibility of Sender

If more than one card is placed in an envelope, these cards should be placed at 180° to each other (i.e. the bloodspots should not overlap and therefore not touch). The sender should state in writing how many newborn screening cards are in each envelope and include a list the names of the babies on a separate page.

Newborn screening cards, appropriately packaged, should be sent daily and not batched. It is the responsibility of the sender to dispatch the sample as soon as possible after collection either by registered post or by courier.

It is not appropriate to put the package into the post knowing that there may be a delay in it arriving at the Newborn Bloodspot Screening Laboratory due to either a postal dispute (local or national) or over the Christmas period when the post is delayed due to volume.



1.10 Procedure for Reporting of Results

1.10.1 Reporting Results

Because results are posted to both the maternity unit/hospital and the Local Health office, it is essential that the correct Local Health office is inserted into the box on the Newborn Screening card.

1.10.2 Normal Results

A list of all individuals on whom the newborn screening tests are normal is issued approximately twice per week. Copies are sent by post for the attention of the liaison person within the respective maternity unit/hospital and to the appropriate Local Health office, the Independent Midwife or General Practitioner when the appropriate and the relevant information has been put on the Newborn Screening card. These results must be checked against the Newborn Bloodspot Screening Registers - outstanding results at Day 18 in babies who have not been excluded from the screening cohort for the following reasons (opted-out of screening, RIP, or moved to another

LHO who have taken over responsibility for screening) require follow up. From 2012 each LHO will provide quarterly reports on screening coverage and uptake.

Some maternity units/hospitals receive their reports electronically. This is available for all centres. For further information please contact the National Newborn Bloodspot Screening Laboratory.

1.10.3 Requests for Repeat Sampling

It is important to minimise the time taken to collect a repeat sample when the laboratory fails to get a clear result from the first sample. An individual request for repeat sampling is sent by post on the day that the newborn screening card is received, for the attention of the liaison person within the respective maternity unit/hospital or Local Health office. The reason for requesting a repeat sample will be indicated on the individual report form.

1. The liaison person should either:
    - contact the parents directly and arrange for the parents to bring their baby into the maternity unit/hospital to have a repeat sample taken. The liaison person must:
        - explain to the parents why a repeat sample is required;
        - reassure the parents on the phone that this is a precaution and that the test is being repeated in the best interests of their baby.

or

- contact the Director of Public Health Nursing and inform her of:
    - the name, date of birth and address of the baby;
    - the result of the test and the disorder suspected;
    - the reason why a repeat sample is required.

2. Director of Public Health Nursing must then arrange for a PHN to visit the parents and take a further sample

The PHN must:

- explain to the parents why a repeat sample has been requested;
- inform the parents which condition is being investigated;
- reassure the parents that if the repeat test should prove positive, which is unlikely, that they will be contacted immediately either by herself or by the maternity unit/hospital liaison person.

Having taken the sample, the PHN must allow the sample to dry adequately before placing it in the envelope. The sample should then be delivered immediately to the National Newborn Bloodspot Screening Laboratory either by registered post or by courier. Please indicate clearly on the newborn screening card that it is a repeat sample and why and for which test a repeat sample was requested.

1.10.4 Query Positive Results

The response to these cases is immediate and direct:

- The liaison person in the maternity unit/hospital is contacted by telephone and the following information is given:

- the name, date of birth and address of the baby;
- the result of the test and the disorder suspected;

- The liaison person will be asked to:
  - locate the baby and parents;
  - explain to the parents:
    - why a further blood sample is required;
    - why the baby has to be referred to hospital;
    - what disorder has been suspected in their baby.
  - arrange for the baby to be brought directly to the Children's University Hospital, Temple Street or to the local Paediatric Unit as requested by the Newborn Bloodspot Screening Laboratory. The parents should be advised that their baby might be kept in hospital for a number of days depending on the result of the repeat investigation. Therefore they should bring a change of clothes for the baby and possibly for themselves.
- The liaison person will be given the mobile number of the Director of the National Newborn Bloodspot Screening Laboratory or his deputy. This number can be given to the parents; they can be invited to contact the Director if they require more information before they arrive in the hospital
- Special arrangements have been put in place to contact parents with suspected CF

At all times the liaison person must not instill a degree of anxiety or panic for the parents but must impart the information in a calm and professional manner, being fully informed of all the facts.

1.10.5 Query Positive Cases for PKU or HCU

The response to these cases is immediate and direct:

- The liaison person in the maternity unit/hospital is contacted by telephone –
- The following information is given:
  - the name, date of birth and address of the baby;
  - the result of the blood phenylalanine (PKU) or methionine (HCU).
- The contact person will be asked to:
  - locate the baby and parents;
  - explain to the parents why a further blood sample is required and what disorder the baby is suspected of having;
  - arrange for the baby's:
    - either to have a repeat blood sample taken (1.3mL of whole blood collected into a lithium heparin tube); These samples will be analysed for the appropriate amino acids and for HCU total and free homocysteine and liver functions tests. The sample for the former must be de-proteinised immediately by the local laboratory staff; instructions will be given over the telephone.

    or

    - to come directly to the Children's University Hospital, Temple Street. If the baby's has to come directly to the Children's University Hospital, the parents MUST be informed that, if the repeat investigation is positive, then the baby will probably be kept in hospital for up to about four days. During this time the baby will be started on lifelong treatment and the parents will receive instruction in the monitoring and dietary management of their baby.

1.10.6 Query Positive Cases for MSUD

The response to these cases is immediate and direct:

- In cases of possible MSUD the paediatric SHO or Registrar will be informed directly;
- The following information is given:
  - the name, date of birth and address of the baby;
  - the result of the blood leucine (MSUD).
- The contact person will be asked to:
  - locate the baby and parents as a matter of urgency;
  - explain to the parents why a further blood sample is required and what disorder the baby is suspected of having;
  - arrange for the baby's either:
    - to be examined in the local hospital and to check the urine for the presence of ketones and to have a repeat blood sample taken (1.3mL of whole blood collected into a lithium heparin tube (orange colour));

    or
    - to come directly to the Children's University Hospital, Temple Street. The parents must be informed that the baby will be admitted to hospital until the results of the test are known. If the test is positive the baby's will remain in hospital until the paediatricians are satisfied that the baby's condition is under control and that the parents will be able to cope at home.

1.10.7 Query Positive Cases for Classical Galactosaemia

The response to these cases is immediate and direct:

- The liaison person and the paediatric SHO or Registrar in the maternity unit/hospital is contacted by telephone;
- The following information is given:
  - the name, date of birth and address of the baby;
  - the result of the blood galactose level and the result of the confirmatory Beutler assay.
- The contact person will be asked to:
  - locate the baby and parents as a matter of urgency
  - explain to the parents the nature of the condition (Galactosaemia) and to bring their baby directly into the local paediatric unit where the baby will be admitted to hospital for further investigations.

On admission to hospital, all lactose and galactose containing feeds should be replaced by soya-based feeds. The baby should be examined and the following investigations performed:

- liver function tests;
- coagulation studies PT, PTTK;
- blood cultures (to exclude, for example, *E coli* septicaemia).

Additional samples will be requested by the NNBSL at Temple Street for a repeat Beutler assay and these should be sent by courier the following day as requested by telephone.

1.10.8 Query Positive Cases for Cystic Fibrosis

The results of the screening test will be available by approximately the third week of life:

- The liaison person in the maternity unit/hospital will be contacted to verify the details on the Newborn Screening card and to obtain the parents contact details.
- The Clinical Liaison Officer within the National Newborn Bloodspot Screening Laboratory will then contact the CF Nurse specialist in one of the 6 HSE designated CF centres, appropriate to the baby's address, giving the nurse the full contact details.
- The nurse will be given details of the test results, including the bloodspot IRT level and the results of the CFTR DNA test. Depending on whether one or two CFTR mutations were identified, the CF nurse specialist will implement the appropriate management protocol; she will inform the CF Paediatric Consultant, book a Sweat test appointment, and then contact the parents to arrange for the baby to attend the CF centre the following day.

On arrival, the parents will be fully informed as to what will happen; the baby will have a Sweat test performed. Depending on the results of the Sweat test, the parents will be informed that their baby has CF, is a carrier of the condition and therefore unlikely to have the condition. If the baby is considered to be a carrier the parents will be referred for genetic counseling.
Ref.: Appendix No. 5 Algorithm for CF Screening

1.10.8.1 HSE Designated CF Centres

- Dublin North: Children's University Hospital, Temple Street
- Dublin South: Our Lady's Children's Hospital, Crumlin
  National Children's Hospital (AMNCH), Tallaght
- Cork: Cork University Hospital
- Limerick: Mid Western Regional Hospital, Limerick
- Galway: University College Hospital, Galway

1.10.9 Query Positive Cases for Congenital Hypothyroidism

The response to these cases is immediate and direct:

- The liaison person in the maternity unit/hospital is contacted by telephone;
- The following information is given:
  - the name, date of birth and address of the baby;
  - the result of the blood TSH level and the nature of congenital hypothyroidism.
- The contact person will be asked to:
  - locate the baby and parents;
  - explain to the parents why a further blood sample is required and what disorder the baby is suspected of having;
  - arrange for a repeat blood test to be performed on 2mL of whole blood collected into a lithium heparin tube (orange colour).

If the blood TSH level is very high and if the baby is approaching 10 days of age the liaison person might be requested by the laboratory to arrange for the baby to go directly to one of

several hospitals for a thyroid scan and to be started on treatment pending the results of further tests. These instructions will be given clearly. The parents will be asked to bring their baby directly to the Children's University Hospital, Temple Street or to Cork University Hospital or occasionally to one of the local Paediatric Units.

Arrangements will be made by the staff in the Newborn Bloodspot Screening Laboratory for the baby:

- to have repeat thyroid function tests performed;
- to be examined by a paediatrician;
- to have a thyroid scan performed;
- to start on thyroid hormone replacement if indicated

The parents will be advised of the results and if positive on the nature of the condition. Under normal circumstances the baby will NOT be kept in hospital overnight.

1.11 Appendices

1. Appendix No. 1 Opt-Out Form
2. Appendix No. 2: Governance Structure for the National Newborn Bloodspot Screening Programme
3. Appendix No. 3: Transport/Drying Box
4. Appendix No. 4 Algorithm for CF Screening
5. Appendix No. 5: Guide for Sample Takers

Appendix No. 1 Opt-Out Form

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

NATIONAL NEWBORN BLOODSPOT SCREENING PROGRAMME

OPT- OUT FORM

Baby's Surname | **Baby's First Name**

Date of Birth (D D / M M / Y Y Y Y) | **Baby's Unique Identifier**

Hospital/Place of Birth

Local Health Office

Baby's Address

Mother's Surname | **Mother's First Name**

- I _____ being the parent/guardian of Baby _____, do not consent to allow the Newborn Bloodspot Screening Test (Heel-prick) to be carried out on my baby.
- I have read the Information leaflet on Newborn Bloodspot Screening and the test has also been explained to me.
- I fully understand the importance of the decision that I am taking by not allowing my baby to be tested.
- I understand that not detecting or treating one of the conditions, should baby have one, may result in severe intellectual or physical disability which could require long term care or result in premature death.

Signed (Parent/Guardian): _____

Full Name (PRINT): _____ **Date:** _____
(BLOCK CAPITALS)

Signed in the presence of (Midwife/PHN): _____ **Date:** _____

Position/Job Title: _____ **Local Health Office:** _____

OFFICIAL USE ONLY

6 copies of the completed form, signed by parent/guardian and midwife/PHN should be made. A copy to be given to the parent/guardian and a copy kept by the Midwife/PHN.

Copies are to be posted to the following:-
• The Director of Nursing/Midwifery • Director of Public Health Nursing • National Newborn Bloodspot Screening Laboratory
• the Baby's General Practitioner

	Director of Nursing/Midwifery	Director of Public Health Nursing	National Newborn Bloodspot Screening Laboratory	General Practitioner
Name:				
Address:			Children's University Hospital, Temple Street, Dublin 1	
Date Sent:				

Signed: *(Midwife/PHN)* _____ **Date:** _____

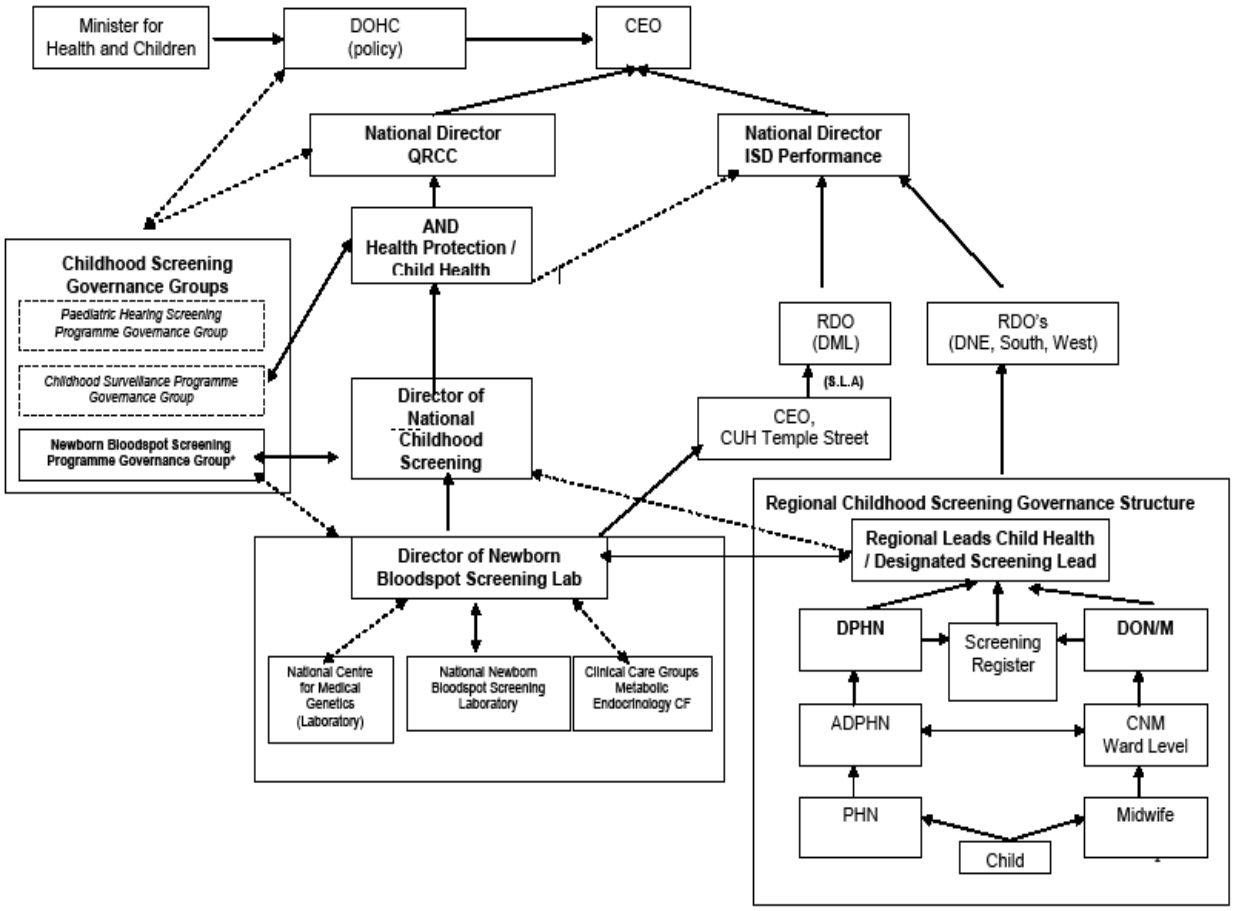
Name: *(Block Capitals)* _____

NNBSP April 2011

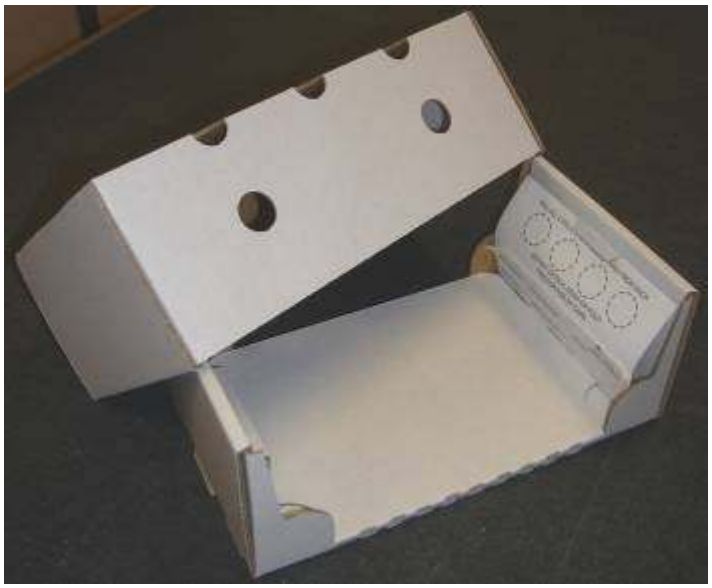
Parents have the right to opt-out from the programme on behalf of their baby and must sign this HSE Opt-out Form; this must be witnessed and signed by all parties.

The Opt-out form can be downloaded from www.newbornscreening.ie or www.hse.ie/go/newbornscreening

Appendix No. 2: Governance Structure for the National Newborn Bloodspot Screening Programme



Appendix No. 3: Transport/Drying Box



The box has been designed to contain two newborn screening cards in order to facilitate the transport of the card from the baby's home to the PHN's car in a safe manner. Once the blood spot is dry it should be removed from the box and packaged according to the regulations.

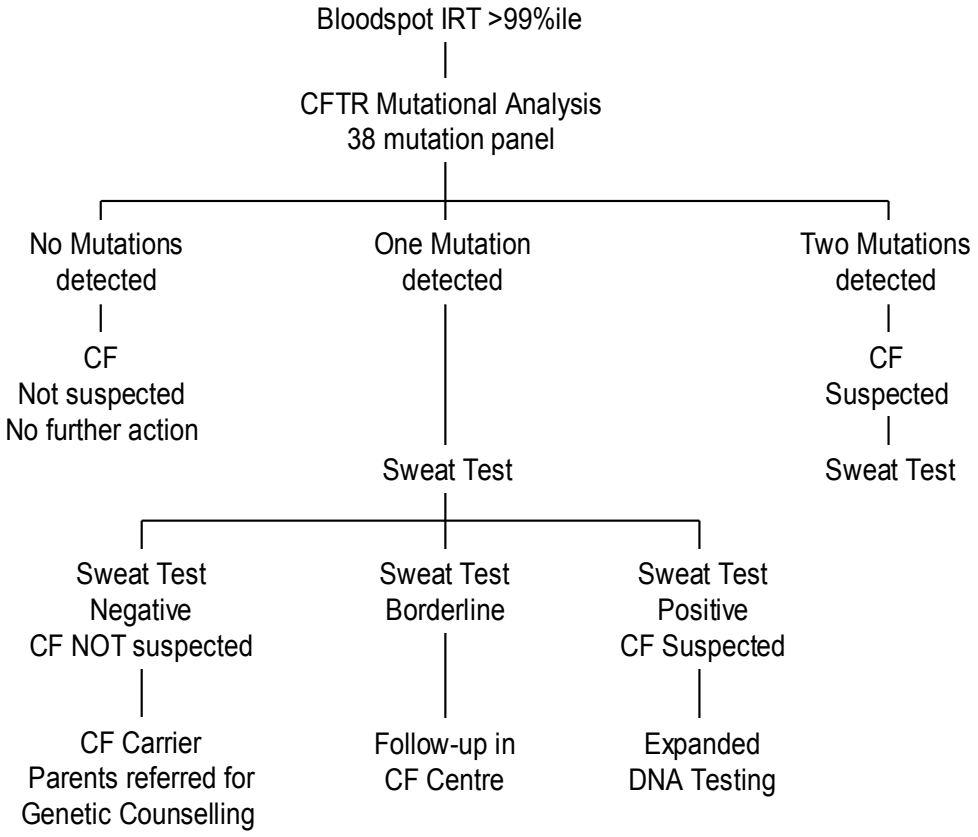
These boxes can be ordered directly from Mega-Pak Ltd at 01 8402063 – the minimum order is 150 packaged in boxes of 50.

Mega-Pak LTD

Telephone: 01 8402063

Website: www.mega-pak.com

Appendix No. 4 Algorithm for CF Screening



The results of the screening test will be available by approximately the third week of life:

Depending on the results of the Sweat test, the parents will be informed that their baby has CF, is a carrier of the condition or is most unlikely to have the condition and therefore will be discharged

Appendix No. 5: Guide for Sample Takers

NEWBORN BLOODSPOT SCREENING TEST
10 STEP GUIDE FOR SAMPLE TAKERS

1

Equipment: Metered sterile lancet with tip no more than 2.5mm in depth, latex free gloves, cotton wool, newborn screening card, envelope, sharps bucket, paper towel, bowl of warm water and soap or cleansing heal.

2

Explain to the parents the reason for the test and its importance. Obtain written consent. Complete all sections of the newborn screening card in clear print using a black ballpoint pen. Do not contaminate filter paper circles by allowing circles to come in contact with spillage or by touching before or after blood collection.

3

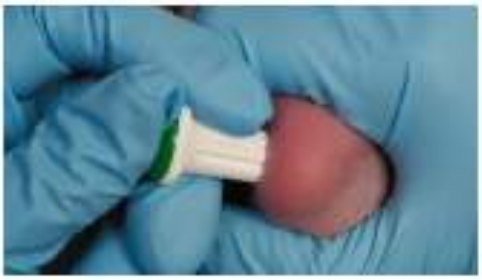
Instruct parents to keep baby's feet warm prior to test by applying two sets of socks or placing a set of socks beneath babygrow.

4

Select the puncture site on the heel. The preferred puncture and least hazardous site are indicated by the shaded areas. Warm the site prior to sampling by rubbing the skin for 1-2 minutes to increase blood supply. Preferably take the sample from the infant while the parent cuddles the baby, the test may be taken while the baby is breastfeeding. Breastfeeding during a painful procedure effectively reduces the response to pain in the newborn infants. Non-nurtive sucking e.g. pacifier and skin-to-skin contact reduce procedural pain in newborn infants. Current pharmacological treatments are not appropriate for pain relief during minor procedures like the heel prick in newborn infants.

5

Cleanse the heel with warm soapy water. Pat dry.

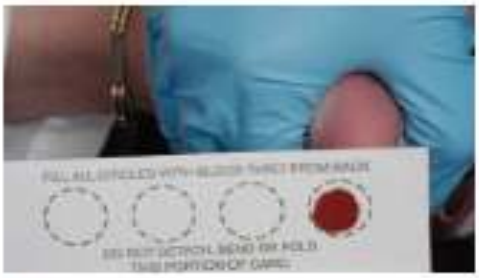


6

Puncture heel. Wipe away first drop of blood with cotton wool. Allow another large blood drop to form.

7

Touch the circle marked on the card gently to the hanging drop of blood so that the blood soaks through from back of the card to the other side.



8

Fill the two outer circles first; blood drops must be soaked through from the rear to the front of the card, filling all circles completely. Check that the blood has soaked completely through completing the circle on the front as well as the rear of the card.
To enhance blood flow, very gentle intermittent pressure may be applied to area surrounding puncture site.

9

Wipe away any excess blood with cotton wool. Press cotton wool firmly onto wound until bleeding stops. Do not use plaster over puncture sites as babies may swallow them. Air dry the newborn screening card before putting into the envelope. This may take up to two hours. Do not use excessive heating as this may invalidate the test.

10

Send the card by Registered post or by Courier to the newborn Screening Laboratory using the yellow fluorescent address labels to reach the Laboratory as soon as possible after collection. Keep a record of all samples sent in each envelope.