NATIONAL SCREENING PROGRAMME FOR CONGENITAL HYPOTHYROIDISM

FAMILY HEALTH DEVELOPMENT DIVISION
MINISTRY OF HEALTH
2011
1. **INTRODUCTION**

Priorities for health care in children in Malaysia have in the past largely centered around infectious diseases (diarrhoeal diseases and immunisable conditions), malnutrition and curative services. Growth in the economy and lifestyle changes has led to improvements in the health which in turn has played a role in redefining health priorities. Attention is increasingly focused on preventative issues and on reducing the burden of conditions that result in disability. This includes congenital hypothyroidism.

Congenital Hypothyroidism is an uncommon but clearly identified and preventable cause of mental retardation. Studies have shown that if is detected and treated within the first week of life will result, on average normal or near normal intellectual performance and growth at ages 6-12 years.

National screening programme have been well established in industrialised countries. Screening programmes were started in Canada, Western Europe and United States in 1974. In Southeast Asia, screening for Congenital Hypothyroidism has been initiated in Hong Kong in 1978 and Singapore in 1981.

2. **WHAT IS CONGENITAL HYPOTHYROIDISM**

Congenital Hypothyroidism is a disorder that affects infant at birth. Children born with congenital hypothyroidism have either absent, partially formed or poorly functioning thyroid gland. This results in inadequate amounts of thyroxin being produced and the child's brain cannot develop to its full potential.
Table 1: Causes and Birth Prevalence of Neonatal Thyroid Dysfunction

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permanent Disorders</strong></td>
<td></td>
</tr>
<tr>
<td>1. Thyroid dysgenesis (agenesis, hypoplasia, ectopia)</td>
<td>1:4,500</td>
</tr>
<tr>
<td>2. Thyroid dyshormonogenesis</td>
<td>1:30,000</td>
</tr>
<tr>
<td>3. Hypothalamic-pituitary hypothyroidism</td>
<td>1:100,000</td>
</tr>
<tr>
<td>4. Generalised resistance to thyroid hormone</td>
<td>very rare</td>
</tr>
<tr>
<td><strong>Transient Disorders</strong></td>
<td></td>
</tr>
<tr>
<td>1. Transient hypothyroxinemia (mainly premature infants)</td>
<td>1:200</td>
</tr>
<tr>
<td>2. Transient primary hypothyroidism</td>
<td>Variable</td>
</tr>
<tr>
<td>(common in areas of iodine deficiency)</td>
<td></td>
</tr>
<tr>
<td>3. Transient hyperthyrotropinemia (predominately seen in Japanese Populations)</td>
<td>very rare</td>
</tr>
</tbody>
</table>

Often babies with congenital hypothyroidism appear normal at birth. However, the early features include umbilical hernia, constipation, prolonged jaundice, poor feeding, inactivity and delayed bone age. Late features of untreated congenital hypothyroidism are macroglossia, coarse features, dry skin and hair, hoarse cry, delayed development, poor growth and mental retardation.

3. **BURDEN OF ILLNESS/BIRTH PREVALENCE**

The burden of illness or size of the problem that congenital hypothyroidism poses to the society is an important consideration in the discussion of establishing a screening programme. A number of
issues are relevant here: how common is congenital hypothyroidism (birth prevalence) and what are the impact of early treatment of the condition? This discussion relates to the birth prevalence of congenital hypothyroidism. The phrase “birth prevalence” is used instead of just “prevalence” because the true prevalence cannot be known as some births will end up as still births and others as early as neonatal deaths.

Local data on the birth prevalence of congenital hypothyroidism though still limited began to become available since the early 1990s. Data from four Malaysian studies showed a local birth prevalence of 1 in 2410\(^2\), 1/2983\(^3\), 1/3666\(^4\) and 1/3065\(^5\). The “pooled” rate from these four studies is 1/3029. Pooled data from published studies in the Asian region suggest a birth prevalence of 1 in 3093 for the South East Asian region as a whole\(^6\).

The number of newborns screened in the various Malaysian studies quoted ranges from 9,000 to 20,000 with majority being around 10,000. As the birth prevalence of congenital hypothyroidism is low, statistical analysis of the screening data would show that the number of newborns screened determines the validity of the figures quoted i.e. the 95% confidence interval for the range of the “true” prevalence is wide\(^6,7\). Hence the “true” birth prevalence of congenital hypothyroidism for Malaysia has yet to be determined accurately but will be in the region of 1 in 2500 to 1 in 3500.

Generally the birth prevalence of congenital hypothyroidism appears to be higher in Malaysia when compared with Europe or America. There are three possible reasons for this increase. It could be partially explained by consanguinity which is more common among certain ethnic groups in the region. However, the majority of cases are not due to inherited defects (thyroid dyshormonogenesis) but due to thyroid dysgenesis. A second explanation is transient primary hypothyroidism due to iodine deficiency. It is well recognised that iodine deficiency can affect the results of screening tests\(^8\). Malaysia has to varying degrees, the problem of iodine deficiency in Sabah and Sarawak and isolated district in Peninsular Malaysia. Finally the higher prevalence rates could be reflecting the true genetic situation in the region.
What does the burden of disease mean in real terms? Using the estimate from pooled data of studies in Malaysia (1 in 3029) together with the number of total registered births of 496,947 in Malaysia for 1998, 164 children would have been born with congenital hypothyroidism in that year. Without a screening programme the majority of these children would have been detected late and develop moderate to severe mental retardation.

4. **WHY DO WE NEED TO SCREEN FOR CONGENITAL HYPOTHYROIDISM**

Congenital hypothyroidism cannot be detected at birth and it is the most common preventable cause of mental retardation. The child is usually discovered to have congenital hypothyroidism at around 2-6 months of age and by this time there may be some amount of brain damage. Recent prospective studies show that screening neonates and treating the affected babies within the first week of life results, on average, in normal or near normal intellectual performance and growth at ages 6-12 years. Hence without screening programme a large number of children cannot be detected as early and will become mentally retarded.

Two detailed cost-benefit analysis conducted in France and in the United States revealed an overall cost-benefit ratio of between 1:8.9 - 13.8 for screening. A recent local health technology assessment (HTA) on congenital hypothyroidism screening has recommended that screening be carried as a routine programme.

5. **THE TEST STRATEGY**

The strategy adopted in Malaysia is primary TSH measurement supplemented by T4 determination in borderline samples. Infants with elevated TSH values, and those with borderline TSH values & low FT4, are recalled for testing. This approach does run the possibility of missing secondary and tertiary hypothyroidism (1:100,000 births). However it is the least expensive option with the lowest recall rates.
This screening approach is especially effective in view of the development of newer TSH assays (enzyme linked immunoassays, chemiluminescent assays and fluoroimmunoassays) which offer greater sensitivity and better separation between normal and abnormal TSH values\textsuperscript{12,13} Using a combined TSH and FT4 screening approach would be too expensive. Using a primary FT4 approach would involve a large recall of up to 2%.

The blood sample for the screening of Congenital Hypothyroidism will be collected from cord blood at birth for the following reasons:

- A much higher coverage of infants as 98.6\% of deliveries are conducted by trained personnel (2010).
- Can be done together with the established newborn cord blood screening programmes for glucose 6 phosphate dehydrogenase (G6PD) deficiency.
- Cord blood sampling is simple, non-invasive and offers the earliest postnatal diagnosis.\textsuperscript{11} Screening at birth will allow early treatment of cases, hence minimising the effects of delayed therapy.

6. NATIONAL SCREENING PROGRAMME FOR CONGENITAL HYPOTHYROIDISM IN MALAYSIA

6.1 OBJECTIVE

6.1.1 General Objective:

All newborns with congenital hypothyroidism will be detected early and managed appropriately to prevent mental disability.

6.1.2 Specific Objectives:

i) To screen all newborns for congenital hypothyroidism.

ii) To ensure the use of appropriate screening technology which meets quality standards.
iii) To ensure all newborns with congenital hypothyroidism will receive treatment within the first 2 weeks of life.

iv) To promote community awareness of congenital hypothyroidism.

6.2 METHODOLOGY

6.2.1 Collection of Blood samples for TSH in Hospital

i) Immediately after delivery, clean the maternal side of the cord with sterile gauze and collect the blood sample. (Appendix 1)

ii) Allow free flow of blood from the cord directly to the tube (if you need to ‘milk’, do it gently to prevent hemolysis).

iii) The tube should be filled with a minimum of 3 ml of blood. (Allow space for the cap to be pushed in)

iv) Label the tube immediately. Complete the investigation form.

v) Send the sample to the laboratory with the form at the normal routine intervals within 24 hours.

vi) See Appendix 2 for the handling of blood samples at the laboratory.

6.2.2 Missed, Insufficient, Blood Clot Samples & Born Before Arrival Cases

i) If for some reason the blood sample has not been taken from the cord then it should be taken from the baby as soon as possible after the third day of life. This is to avoid the TSH surge that occurs from 1/2 hour after birth to about 72 hours of age and to ensure early treatment before 2 weeks of life for better prognosis.
ii) Fill up the data collection form (Appendix 3) and send this to the Paediatric doctor in charge. In addition give parents the instruction sheet and the date to return for a blood sample (after the 3rd day of life).

iii) The Paediatric Department is responsible to collect the blood sample. Blood samples collected after the 3rd day of life should be venous samples of at least 2 mls.

6.3 FILLING UP OF INVESTIGATION FORM (Appendix 3)

Labelling and completion of the data collection form are as follows.

i) Biodata of the newborn as in item 1-8 should be filled in by labour room staff.

ii) Items 9-10 are to be filled by the lab staff.

6.4 FLOW CHART FOR INVESTIGATION

See Appendix 4 and 5

6.5 LEVEL OF TSH AND FT4

TSH level of $< 21$ or use 97.5th percentile value as determine by the local laboratory or laboratory that used the same analyzer mIU/L is normal, $21 - 60$ mIU/L is borderline and $> 60$mIU/L is high. FT4 level of $> 15$ pmol/l is normal and $< 15$ pmol/l is low.

6.6 RETESTING OF PATIENTS (CONFIRMATION)

Blood samples for confirmation (re-testing) should be venous samples and can ONLY be taken from the baby after the third day of life. This is to avoid the TSH surge that occurs from $\frac{1}{2}$ hour after birth to 72 hours of age.
7. **MANAGEMENT OF CONGENITAL HYPOTHYROIDISM**

   The guidelines for the management of Congenital Hypothyroidism and follow-up is as in Appendix 6.

8. **MONITORING AND EVALUATION**

   See Appendix 7.

9. **RESPONSIBILITIES OF DEPARTMENTS INVOLVED**

   As in Appendix 8.
Appendix 1

Technique of Cord Blood Collection

Blood for TSH (Thyroid Stimulating Hormone) evaluation should be collected immediately after birth from the maternal side of the cord. From studies done in Singapore & Finland it is noted that there is a rapid admixture of maternal blood with foetal blood in the placenta immediately after births. This means that the TSH from cord blood can be 'contaminated' by maternal TSH levels. To overcome this problem, we would like cord blood to be collected for TSH in the manner described below:

Please note:

1. For vaginal deliveries, the 2nd metal clamp is applied to the umbilical cord as close to the vulva as possible. Only blood between the 1st and 2nd metal is to be collected for TSH. Even if the volume of blood is small (i.e. less than 10 mls), do not be tempted to release the 2nd metal clamp.
2. For LSCS deliveries (where the plastic clamp is not used), please apply a 3rd metal clamp or artery forceps to the umbilical cord just before the placenta. Collect blood for TSH from the segment of cord between the 2nd and 3rd mental clamps. Even if the volume of blood is small (i.e. less than 10 mls), do not be tempted to release the 3rd metal clamp.
CONGENITAL HYPOTHYROIDISM
FLOW CHART FOR CORD BLOOD ASSAY

Collect cord blood into plain/heparinised or gel tubes.
Sent samples to hospital laboratory within 24 hours.
Keep sample at room temperature if sending to lab is delayed

Sample unsuitable
Inform pediatric clinic immediately

Sample and form do not tally
Check sample and forms
Inform labour room staff

Centrifuge sample

Testing done in the same hospital
No
Keep serum/plasma at 2-8°C not more than 72 hours
Send to testing laboratory

Yes
Analysis of specimen (Refer to work instruction)

Insufficient sample
Invalid

Validate results
Valid
Decision

Inform staff in charge in Paed Dept

Abnormal/borderline results
Dispatch results and form to Pediatric Clinic

normal results
**CONGENITAL HYPOTHYROIDISM CORD BLOOD SCREENING TEST**

**HOSPITAL**

**Appendix 3**

Ref No.

**CONGENITAL HYPOTHYROIDISM CORD BLOOD SCREENING TEST**

Items 1-8 are to be filled in by labour room staff:

1. Mother's IC number:
2. RN:
3. Mother's name:
4. Home Address:
   a) Permanent address
   b) During confinement period/maternity leave
5. Home Telephone No:
6. Place of birth:
7. DOB: Time:
8. Date sample taken:

Items 9-10 are to be filled in by laboratory staff:

9. Date sample received:
10. Result:
   a) TSH (mIU/l):
   b) FT4 (pmol/L)

**Collection of blood samples for TSH in hospital**

i) Immediately after delivery, clean the maternal side of the cord with a sterile gauze and collect the blood sample. (Appendix 1)

ii) Allow free flow of blood from the cord directly to the tube (if you need to "milk", do it gently to prevent hemolysis).

iii) The tube should be filled with a minimum of 3 ml of blood. (Allow space for the cap to be pushed in)

iv) Label the tube immediately. Complete the investigation form.

v) Send the sample to the laboratory with the form at the normal routine intervals within 24 hours.

vi) See Appendix 2 for the handling of blood samples at the laboratory.

**Flow of Investigations**

Cord blood sample collected at Birth

Screening for TSH

- TSH < 2 mIU/l
- TSH 2-60 mIU/l
- TSH > 60 mIU/l

- (Normal)
- (Borderline)
- (High)

Do FT4

- FT4 > 15 pmol/l
- FT4 ≤ 15 pmol/l

- No recall

Recall babies urgently for repeat TSH & FT4

**Missed, Insufficient, Blood Clot Samples & Born Before Arrival Cases**

i) If for some reason the blood sample has not been taken from the cord then it should be taken from the baby as soon as possible after the third day of life. This is to avoid the TSH surge that occurs from ½ hour after birth to about 72 hours of age and to ensure early treatment before 2 weeks of life for better prognosis.

ii) Fill up the data collection form (Appendix 3) and send this to the Paediatric doctor in charge. In addition give parents the instruction sheet and the date to return for a blood sample (after the 3rd day of life).

iii) The Paediatric Department is responsible to collect the blood sample. Blood samples collected after the 3rd day of life should be venous samples of at least 2 mls.

*Note:
Lab is encourage to determine own 97.5th percentile (use log TSH for its determination) for TSH to be used as cut off value

Source: KKM Congenital Hypothyroidism Screening Programme (Revised Nov 2008)
Appendix 4

FLOW CHART FOR SCREENING OF CONGENITAL HYPOTHYROIDISM AT HOSPITAL WITH T4/TSH SCREENING FACILITIES

Cord blood sample collected at birth in labour room¹

Sent to screening hospital lab for inv. of TSH

- Normal² (<21 mU/L)
- Borderline²,³ (21-60mU/L)
- High²,³ (> 60mU/L)

Missed cases

FT4 analysis (on cord blood)

- FT4 Normal (>15pmol/l)
- FT4 Low³ (≤15pmol/l)

Babies not discharged

Babies discharged

Recall babies urgently
- By phone
- Through nearest Health clinic/office⁴

Refer baby to Paediatric Clinic⁵

Take blood for inv. of FT4/TSH⁶

Blood to lab for inv. of Se FT4/TSH

Result to Paediatric Clinic

Further management by Pediatrician

¹ Blood taken by staff who conducts the delivery. Investigation form for screening of TSH to be filled up by attending staff.
² Result to be sent to paediatric clinic and compiled by staff in charge.
³ Lab to inform relevant officer/staff at Pediatric Clinic to recall for cases either by phone or to inform sisters/PHN at health districts/clinics.
⁴ Sister/PHN to recall babies.
⁵ Urgent referral and appointment to pediatric clinic.
⁶ Blood to be taken at Pediatric Clinic.

*For asphyxiated neonates, repeat screening test should be done after 3rd day of life when hemodynamically stable.
Appendix 5

FLOW CHART FOR SCREENING FOR CONGENITAL HYPOTHYROIDISM AT HOSPITAL WITHOUT SCREENING FACILITIES

Cord blood sample collected at birth in labour room

Sent to designated hospital/MKA screening lab for inv. of TSH

Normal\(^2\) (\(< 21 \text{ mIU/L}\))

Borderline\(^2,3\) (21-60mIU/L)

High TSH\(^2,3\) (\(> 60 \text{ mIU/L}\))

Missed cases

FT4 analysis (on cord blood sample)

FT4 Normal (\(> 15 \text{ pmol/l}\))

FT4 Low\(^3\) (\(< 15 \text{ pmol/l}\))

Babies not discharged

Babies discharged

Recall babies urgently
- By phone
- Through nearest Health clinic/office\(^4\)

Refer baby to Pediatric Clinic\(^5\)

Take blood for inv. of FT4/TSH\(^6\)

Result to Paediatric Clinic/designated staff

Further management by Pediatrician

\(^1\)Blood taken by staff who conducts the delivery. Investigation form for screening of TSH to be filled by attending staff

\(^2\)Result sent to paediatric clinic & compiled by staff in charge.

\(^3\)Lab to inform relevant officer/staff at Pediatric Clinic/designated staff to recall cases or to inform sisters/PHN at health districts/clinics.

\(^4\)Sister/PHN to recall babies.

\(^5\)Urgent referral and appointment to pediatric clinic.

\(^6\)Blood to be taken at Pediatric Clinic.

*For asphyxiated neonates, repeat screening test should be done after 3rd day of life when hemodynamically stable.*
Appendix 5 (a)

FLOW CHART FOR SCREENING FOR CONGENITAL HYPOTHYROIDISM FOR HOME DELIVERY

1. Cord blood sample collected at birth
   - Sent to lab hospital/health clinic
   - Spin and separate sample/storage
   - Sent to designated hospital/MKA screening lab for inv. of TSH

2. Normal (≤21mU/L)
   - FT4 analysis (on cord blood sample)
     - FT4 Normal (>15pmol/l)
       - Inform Pediatric Department (designated staff)
       - Recall babies urgently
     - FT4 Low (≤15pmol/l)
       - Take blood for inv. of FT4/TSH
       - Blood to lab for inv. of Se FT4/TSH (MKA/screening hospital lab)
       - Inform abnormal results to designated staff and Pediatrician

3. Borderline (21-60mU/L)
   - FT4 analysis (on cord blood sample)
     - FT4 Normal (>15pmol/l)
       - Inform Pediatric Department (designated staff)
       - Recall babies urgently
     - FT4 Low (≤15pmol/l)
       - Take blood for inv. of FT4/TSH
       - Blood to lab for inv. of Se FT4/TSH (MKA/screening hospital lab)
       - Inform abnormal results to designated staff and Pediatrician

4. High TSH (> 60mU/L)
   - Missed cases

5. Blood taken by staff who conducts the delivery. Investigation form for screening of TSH to be filled up by attending staff

6. Lab to inform abnormal result to Pediatric Department (designated staff) to recall cases

7. All result to be sent to Pediatric Clinic and compiled by designated staff.

8. Designated staff to make arrangement to recall babies

Appendix 6

MANAGEMENT PRINCIPLES FOR CONGENITAL HYPOTHYROIDISM

Substitution therapy for congenital hypothyroidism is a paediatric emergency. Every effort needs to be taken to initiate therapy as soon as possible after birth. With the cord blood screening programme most neonates can be treated within the first 14 days of life.

Since the focus of screening is early and adequate treatment, the dosage of FT4 should be such that the serum FT4 concentration is normalised as quickly as possible. It has been recognised that there may be a 1.6-3 month delay in the normalisation of serum free thyroxine (FT4) levels with low doses of Thyroxine[^1]. To ensure adequate hormone replacement it is desirable to maintain serum FT4 in the upper half of the normal range during therapy, especially in the first year of life[^2,3]. The target range for FT4 concentration is 12-24 pmol/L and TSH <5 mIU/L.

An initial dose of L-thyroxine of 10-15 ug/kg/day is recommended. There are suggestions that this improves the final IQ outcome[^4,5]. Only thyroxine tablets, crushed in milk or water, should be used[^5,6]. Infants should be initially assessed at 2 to 4 weekly intervals until thyroid function is stable.

A failure of serum FT4 concentration to increase into the upper half of the normal range by 2-4 weeks and/or TSH concentration to decrease to less than 20 mIU/l within 6-9 weeks after initiation of L-thyroxine should serve to alert the clinician that the child may not be receiving adequate doses regularly. Serum TSH concentrations, however, have been noted to remain elevated for weeks despite normalised levels of FT4[^2,3] in some cases.

Possible early features of prognostic value with respect to intelligence include[^4,6]:

- clinical features of congenital hypothyroidism
- poor compliance with treatment early in life
- low pretreatment FT4
- thyroid agenesis on radionuclide scan
The degree of bone age retardation does not appear to correlate well to intelligence outcome. Parents need to be counseled that poor compliance in the infancy may cancel the benefits of screening.

Subsequent review is at 4-6 weekly intervals during the first 6 months and at 2-3 month intervals during the 6-18th month period to maintain serum FT4 levels in the range mentioned above. Doses in the range of 50-62.5 ug/day will probably be required at one year of life and up to 100 ug/day between the ages 3-5 years. While trying to achieve optimal FT4 levels it is important to avoid overtreatment which can result in premature craniosynostosis. Treatment is monitored by measuring FT4, thyroid stimulating hormone (TSH), bone age, growth parameters and psychomotor development. See Appendix 7.

Infants with congenital hypothyroidism who had diagnostic problems at birth should ideally be referred to a Paediatric Endocrinology Unit at the age of two to three years to have the diagnosis reassessed for these patients for these patient therapy should be stopped for 4-6 weeks. A repeat analysis of TSH and FT4 should then be carried out to exclude cases of transient hypothyroidism together with a radionuclide scanning and ultrasound for aetiological assessment.

**Follow-up and Thyroid Function Tests**

<table>
<thead>
<tr>
<th>After initiation of L-thyroxine</th>
<th>2 weeks, 4 weeks (until normalization of results)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 12 months</td>
<td>1 – 2 monthly</td>
</tr>
<tr>
<td>1 - 3 years</td>
<td>2 – 3 monthly</td>
</tr>
<tr>
<td>&gt;3 years until growth is complete</td>
<td>6 – 12 monthly</td>
</tr>
</tbody>
</table>

- At more frequent interval if compliance is queried
- FT4 & TSH repeated 2 weeks after any change in L-thyroxine dosage
Follow-up Assessment

- Growth
- Development
- Mental and cognitive function
- Symptoms of over and under treatment
- Hearing test
- Bone age – normalization by 1-2 years.

Useful articles on management issues:


FOLLOW-UP PROTOCOL FOR CONGENITAL HYPOTHYROIDISM

All infants diagnosed as congenital hypothyroidism should have regular monitoring of progress, with special attention to growth, psychomotor development and symptoms or signs of thyroid dysfunction. Biochemical thyroid function tests are useful to assess the adequacy of the dose and to check on compliance.

To ensure that all aspects are covered during follow up and to allow for the ease of evaluation, data should be recorded as follows:

I. Introductory data:

1. Identification number (mother's IC number)
2. Child's name
3. Home address
4. Date of birth
5. Place of birth
6. Birth weight
7. Sex
8. Ethnic group
9. Age at presentation
10. Age at commencing therapy
11. Initial:
   a. Serum FT4 screening : ......... pmol/L
      confirmatory .......... pmol/L
   b. Serum TSH screening : ..........mIU/L
      confirmatory .......... mIU/L
   c. Bone age (x-ray knee AP)
   d. Clinical features at presentation (including goitre)
e. Neurodevelopment assessment  
f. Associated congenital abnormality (cardiac [PS. ASD], trisomies, spina bifida, Pierre Robin, spastic diplegia/quadriplegia)

12. Family history of thyroid disorder
13. Mother on antithyroid medications

II. **Data to be recorded at each follow up visit:**

1. Date of visit  
2. Age at visit  
3. Weight (kg) - to be plotted on a standard growth chart  
4. Height/length (cm) - to be plotted on a standard growth chart  
5. Head circumference (cm) - to be plotted on a standard growth chart  
6. L-Thyroxine dose (ug)  
7. Serum FT4 and TSH values - serum samples to be done as scheduled (refer to page 16)  
8. Clinical examination:  
   a. Signs of hypo or hyperthyroidism  
   b. Development  
   c. Behavioural problems  
   d. School performance (if relevant)  
   e. Pubertal development (if relevant)  
   f. Compliance with therapy  
10. Bone age – X-rays to be done only if necessary
Appendix G

RESPONSIBILITIES OF DEPARTMENTS INVOLVED

Administrative Department
1. Printing of investigation forms

Obstetric Department/Labour Room
1. To assign staff responsible for coordinating Congenital Hypothyroidism screening
2. To indent investigation form and test tubes
3. Collection of specimen
4. Fill up investigation form (appendix 3)
5. Dispatch of specimen to the laboratory
6. Record of no. of specimen taken/not taken (reason)
7. BBA cases – explain to mothers regarding the screening, fill up the investigation form (appendix 3) and to get appointment for mothers to take the baby to the pediatric clinic.
8. Antenatal education

Pathology Department
1. Purchasing of reagents and consumables
2. Receiving specimen and keep records
3. Perform laboratory investigation/procedure
4. Inform cases that need to be recalled (high/borderline TSH with low FT4 and rejected samples) to Pediatric clinic/designated staff
5. Dispatch all results to Pediatric Clinic/designated staff
6. To participate in external Quality Assurance Programme
Pediatric Department

1. Coordination of the screening programme
2. Collection of all results
3. Recall of cases for high/borderline TSH with low FT4 and rejected samples.
4. Further management of cases as in Appendix 6
5. Handle BBA cases (liaise with post-natal ward)
6. Monitoring and evaluating of the programme with QA indicators
7. Annual return of the programme to State Health Department (via State Pediatrician)

State Health Department

1. To set up Congenital Hypothyroidism committee at state level
2. Assist in recalling babies and follow-up
3. To establish mechanism for documenting results in Child Health Home-based card
4. Monitoring and evaluation of the overall programme
   - Budget
   - Planning
   - To finalized return and submit to Family Health Development Division, MOH
5. Responsible for public health education.
6. Responsible for training for screening programme (eg: blood collection)
EVALUATION (MONITORING) OF THE NATIONAL CONGENITAL HYPOTHYROIDISM SCREENING PROGRAMME

It would be useful to have a computerised registry of all neonates screened but this may not be possible in all centres. The simplest way to keep data for monitoring of the programme is for the Paediatrician in charge to keep a copy of ALL the screening forms (i.e. for normal children and those found to have abnormal TSH results).

The data listed below is to be used for the monitoring of the programme:

1. Number of births registered by month (from the labour room book)
2. Number of cases screened by month
3. Outcome of screening sample results by month (TSH high, borderline and low.)
4. Number of children recalled for testing by month (TSH high and TSH borderline with low FT4)
5. Number of cases confirmed as congenital hypothyroidism
### Borang Ujian Saringan "Congenital Hypothyroidism"

#### Hospital

<table>
<thead>
<tr>
<th>Perkara 1-8 hendaklah diisi oleh kakitangan bilik bersalin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Kad Pengenalan ibu :</td>
</tr>
<tr>
<td>2. Anak ke berapa? :</td>
</tr>
<tr>
<td>3. No daftar:</td>
</tr>
<tr>
<td>4. Nama Ibu:</td>
</tr>
<tr>
<td>5. Alamat Rumah:</td>
</tr>
<tr>
<td>a) Tetap</td>
</tr>
<tr>
<td>b) Semasa dalam pantang (jika tidak sama)</td>
</tr>
<tr>
<td>6. No. Telefon:</td>
</tr>
<tr>
<td>No Telefon Bimbit:</td>
</tr>
<tr>
<td>7. Tempat lahir anak:</td>
</tr>
<tr>
<td>8. Tarikh lahir anak:</td>
</tr>
<tr>
<td>Waktu lahir:</td>
</tr>
<tr>
<td>9. Tarikh sampel di ambil:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perkara 10-11 hendaklah diisi oleh kakitangan makmal</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Tarikh sampel di terima :</td>
</tr>
<tr>
<td>11. Keputusan :</td>
</tr>
<tr>
<td>a) TSH (mIU/l) :</td>
</tr>
<tr>
<td>b) FT4 (µmol/l):</td>
</tr>
</tbody>
</table>
### Appendix 11

**QA Indicators for National Congenital Hypothyroidism Screening Programme**

<table>
<thead>
<tr>
<th>Monitoring Data</th>
<th>QA Indicator</th>
</tr>
</thead>
</table>
| **1. Coverage of screening programme**
  
  - No. of newborn screened (including BBA) / month x 100
  - No. of live births + BBA / month
  
  \[ \frac{c}{(a+b)} x 100 \]
| Reflect process in labour room | > 99% for hospital |
| **2. Screening Sample rejection rate**
  
  - No of rejected samples / Total no. of screened samples received x 100
  
  \[ \frac{d}{c} x 100 \]
| Birth Collection Despatch to Lab Received at lab Analysis Despatch to Paeds | < 1% |
| **3. Total turn around time (for lab)**
  
  - Time from collection of sample to despatch of result to Pediatric Department should be less than 2 working days.
  
  (to be monitored 6 monthly)
| Reflect process by Paed. | > 90% |
| **4. Recalled rate**
  
  - No. of patients with abnormal results retested / Total number recalled back x 100
  
  \[ \frac{f}{(f+h)} x 100 \]
  
  (Patient with abnormal results = High TSH + Borderline TSH with low FT4)
| Reflect process by Paed. | < 0.1% |
| **5. Duration from birth to treatment of confirmed cases <14 days**
  
  (ongoing)
| Reflect process by Paed. | 100% |
| **6. External Quality Assurance Programme**
  
  - Reflect comparability of result between participating lab
  
  Lab
| Reflect Quality of result | All Screening lab |
| **7. Internal QC long term QC monitoring to report CV of Iqc involving 1 year QC data/QC data of the same lot number and calculation of total Error and MU**
| Reflect Quality of result | All screening lab & Target to achieve at least EQA criteria |
## Appendix 12

### Data collection at each screening center (Hospital & State Level)

<table>
<thead>
<tr>
<th>Year :</th>
<th>J</th>
<th>F</th>
<th>M</th>
<th>A</th>
<th>M</th>
<th>J</th>
<th>J</th>
<th>A</th>
<th>S</th>
<th>O</th>
<th>N</th>
<th>D</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month :</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>g</td>
<td>h</td>
<td>i</td>
<td>j</td>
<td>k</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- a: No. of live births
- b: No. of BBA
- c: No. of samples screened
- d: No. of rejected samples
- e: No. of normal TSH
- f: No. of samples with high TSH (>60mlU/l)
- g: No. of samples with borderline TSH (21-60 mlU/l)
- h: No. of samples with borderline TSH (21-60 mlU/l) and low FT4 (<15pmol/l)
- i: No. of retested (venous sample done after 72 hrs)
- j: Recall rate [(f+h)/c]
- k: No. of confirmed cases

### Data collection for Confirmed Cases (Hospital: __________ Year: __________)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of patient</th>
<th>RN</th>
<th>Date of birth</th>
<th>Date of screening</th>
<th>Date of retesting</th>
<th>Date treatment started</th>
<th>Duration from birth to treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


### Definition Of Indicators For Monitoring And Evaluation

**National Screening For Congenital Hypothyroidism**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. No. of live births</td>
<td>Number of live birth in the hospital in that particular year</td>
</tr>
<tr>
<td>b. No. of BBA</td>
<td>Number of baby delivered on the way to hospital not attended by trained health workers and cord blood not taken at birth.</td>
</tr>
<tr>
<td>c. No. of samples screened</td>
<td>Number of samples screened by lab (hospital/public health)</td>
</tr>
<tr>
<td>d. No. of rejected samples</td>
<td>Number of samples rejected (not able to perform appropriate test) by lab</td>
</tr>
<tr>
<td>e. No. of normal TSH</td>
<td>Number of samples with normal TSH level</td>
</tr>
<tr>
<td>f. No. of samples with high TSH (&gt;60mIU/l)</td>
<td>Number of samples with high TSH level</td>
</tr>
<tr>
<td>g. No. of samples with borderline TSH (21-60 mIU/l)</td>
<td>Number of samples with borderline TSH level</td>
</tr>
<tr>
<td>h. No. of samples with borderline TSH (21-60 mIU/l) and low FT4 (&lt;15 pmol/l)</td>
<td>Number of samples with borderline TSH and low FT4 level</td>
</tr>
<tr>
<td>i. No. of retested (venous sample done after 72 hrs)</td>
<td>( f + h )</td>
</tr>
<tr>
<td>j. Recall rate</td>
<td>Number of samples with high TSH and borderline TSH &amp; low FT4 per number of samples send and screened by hospital lab ([f+h]/(f+g))</td>
</tr>
<tr>
<td>k. No. of confirmed cases</td>
<td>Number of cases with low FT4 (&lt;15pmol/l) of retested sample</td>
</tr>
</tbody>
</table>
Appendix 13

Revised Data Capture
State: ____________________________
Hospital: ____________________________

(Separate form for each hospital. Separate form for home deliveries & private deliveries)
(Report government achievement separately from private at state level & at national level)

Total Live Births

- Born in hospital
  - Samples screened
    - Samples with high TSH (>60 mIU/l)
      [These babies should be recalled immediately & re-tested after 72 hours]
    - Samples with Borderline TSH (21-60 mIU/l)
      [These babies should have the screening sample tested for FT4]
    - Normal TSH

- Born before arrival
  - Samples missed
  - Rejected samples
    - Babies given appointment for screening
      [These babies should return after 72 hours & have a venous TSH & FT4]

- No. who return for screening

Recalled & retested cases

- Confirmed Cases

**Important note:**
1. Recalled cases can only be retested after 72 hours. Otherwise results are not valid due to TSH surge.
2. Recalled cases must have a venous TSH & FT4 and be seen at a Paediatric Department.
3. __________ - please put the value
References:


4. Wu LL, Sazali BS, Adeeb N, Khalid BAK. Congenital hypothyroidism screening using cord blood TSH. (Submitted for publication 1998) Sample size 11,000 (3 detected cases).


