Policy

Title
Newborn bloodspot testing

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Recommended screening policy for the Australasian newborn blood spots screening programs has been developed by a joint subcommittee of the Human Genetics Society of Australasia and the Division of Paediatrics of the Royal Australasian College of Physicians.

Program policies including which disorders are included are decided by each jurisdiction (individual States in Australia, and New Zealand). Newborn screening services for Australia are coordinated from the five centralised screening laboratories (Western Australia, South Australia, New South Wales, Victoria and Queensland). There is a single laboratory service for New Zealand, funded by the New Zealand Ministry of Health All Australasian programs are voluntary and fully publically funded.

Newborn blood-spot screening for inborn errors of metabolism is a public health activity aimed at the early identification of infants who are affected by certain congenital disorders. Timely intervention in these disorders significantly reduces morbidity, mortality and associated disabilities. Newborn screening is an accepted part of neonatal healthcare in all developed countries, established in Australasia since the late 1960’s.

1. General Recommendations

   Newborn screening is recommended provided that:
   1.1 There is benefit to the baby from early diagnosis (benefit to the family may also benefit the baby).
   1.2 The benefit is reasonably balanced against financial and other costs.
   1.3 There is a reliable test suitable for newborn screening.
   1.4 There is a satisfactory system in operation to deal with diagnostic testing, counselling, treatment and follow-up of patients identified by the test.
2 Organisation of Programs

2.1 The screening program comprises the sum of the operations necessary to ensure that all babies are offered testing, all necessary follow-up is done, all cases found are adequately treated and there are appropriate quality management and program evaluation processes in place.

2.2 The current policy of public funding for newborn screening programs should be retained. They should be organised and controlled within the public health sector.

2.3 Screening programs should facilitate development and implementation of nationally recognised newborn screening standards, policies and guidelines. They should take advice about the general operation of the screening program from multidisciplinary expert sources.

2.4 Screening programs should provide a seamless system of care that coordinates and involves community and hospital based providers, tertiary care centres and paediatric sub-speciality clinics.

2.5 Health professionals and the public should be kept well informed about screening programs. Specifically, written information and the opportunity for discussion must be provided for parents before testing, and health professionals should be provided with comprehensive guidelines describing all aspects of the screening program including correct sample collection procedure.

2.6 Healthcare authorities have a responsibility to ensure tests are available to all babies born in their region.

2.7 For each baby born, an individual or individuals must be identified as responsible for providing information about the test, offering the test, obtaining appropriate consent, collecting the sample and completing any requested follow-up.

2.8 A system should be in place to ensure that community- and hospital-based providers know which samples have been received by the screening laboratory. Special care must be taken to ensure that a sample is collected from each baby or refusal of testing is documented and notified to the screening laboratory. An acceptable way of achieving this is for the empty screening test card (with demographic information but no blood sample) to be returned to the laboratory with the documented refusal.

2.9 Programs should regularly assess the screened disorders with the aim of stopping screening for conditions where blood spot screening no longer has clinical utility, and adding new disorders. A framework for assessment of disorders is given in Appendix 1.

2.10 Regular assessments of screening program performance should be undertaken and must include sensitivity, specificity, positive predictive value, timeliness of reporting and outcome of diagnosed patients. Outcome assessment should include short and long term evaluation and may be based on surrogate measures in disorders that are well understood.

3 Laboratory Services

3.1 Screening tests should be carried out in large centralised laboratories, so that costs can be kept low, expertise rapidly gained and kept, and for low prevalence disorders, sufficient data are available for assessment of assay performance.

3.2 Laboratories should contribute to an Australasian data set (see appendix 2).
3.3 Laboratories should have appropriate accreditation. External assessors should review programs to ensure that suitable tests, quality assurance, cut-off points, follow-up procedures and screening audit processes are in operation.

3.4 The HGSA should ensure that quality control programs are available Australasia-wide for each test employed on a routine service basis.

3.5 The screening laboratory director is responsible for ensuring the correct performance and interpretation of the tests, ensuring the baby’s doctor, treating midwife or parents are informed of any abnormal result and of the appropriate action to be taken. The director should ensure that responsibility for further action is formally handed over to an appropriate healthcare professional.

4 Legal and Ethical Considerations

4.1 Participation in a newborn screening program should not be mandatory. Parents should be informed of the availability of testing. If after discussion the parents refuse to have their newborn tested, they should sign a statement that they are fully informed about the test and the consequences of not testing.

4.2 The screening program should have appropriate policies and procedures to ensure that the privacy and confidentiality of the patient and family are carefully protected.

4.3 If a newborn screening test is investigational or being developed and the benefits and risks are yet to be demonstrated, separate consent and/or more detailed information may be required and this should be discussed with appropriate ethics and advisory committees.

4.4 A separate HGSA policy covers the storage and use of residual material on newborn screening cards. All programs should develop their own detailed policy following the instructions in the HGSA policy, and include:

   i. Following completion of newborn screening testing, cards should be stored securely for such period of time as is determined by the screening program, taking into account legal requirements and local pathology service guidelines for samples.

   ii. Further use of the stored samples for purposes other than screening program audit requires either written permission from the individual, the parents or guardian, or a legally binding directive, or appropriate ethics committee approval for research studies.

   iii. The written information for parents should include information about the storage and potential uses of residual samples.

5 Research and Audit

5.1 Screening programs should support collaborative research related to current and potential newborn screening. Such research should be conducted in line with local ethics and advisory committee recommendations and particularly consider the benefit to families which can arise from non-anonymised studies and what permission might be required for such studies.

5.2 Pilot studies may be required to demonstrate the safety, effectiveness validity and clinical utility of tests for additional disorders and new testing technologies.

5.3 Screening programs must facilitate program audit against agreed standards covering all program aspects including short and long-term follow-up.
5.4 Programs must contribute to Australasian data sharing and benchmarking of quality indicators.
5.5 Programs are encouraged to contribute to appropriate international collaborative efforts.

Appendix 1
Framework for Assessment of Current and Potential Disorders

Within Australia, there is an urgent need for the development of a national evidence-based process to evaluate proposals for changes to the conditions covered by newborn screening programs.

There are several published criteria for judging if a condition is suitable for newborn screening. The best known discussion of screening in general, and which has stood the test of time, is the Wilson and Jungner paper, which incorporates ten major criteria1, not all entirely applicable to newborn screening. More recently there have been attempts to systematise the consideration of new disorders from the United States2 and the United Kingdom3.

There are many problems in devising a useful assessment tool. A major one is that disorders suited to newborn screening have so far been very rare, with little evidence of the highest quality to demonstrate the efficacy of early, pre-symptomatic, diagnosis and treatment. Also, some tests either current or proposed are multiplex tests: for a negligible up-front cost a new disorder can be added. This may lead to a less rigorous consideration of potential harms.

The possible advantages of early detection by newborn screening are not only reduction in mortality and morbidity but may be simply the ability to make a definitive diagnosis in an untreatable condition where such a diagnosis may be missed clinically. The possible disadvantages are the over-diagnosis of mild disease, resulting in unnecessary medicalisation, and the costs of testing, diagnosis and early management.

Different issues arise for different conditions. For some conditions cost and availability of treatment is the most important consideration, for others, the brief time-frame available for effective management. The Human Genetics Society of Australasia, through its joint Newborn Screening Committee, has attempted to produce a common framework for presenting new disorders for consideration by jurisdictions, taking ideas from the USA, UK, and from the Wilson and Jungner WHO paper1,2,3. The form presented here asks for published evidence in three domains: the condition proposed, the screening test, and the treatment available and its efficacy. The evidence should be graded according to a modification of that proposed by Harbour and Miller, outlined below4.

NEWBORN SCREENING FOR XXXX: ASSESSMENT FORM

AUTHOR
DATE

Please add appendix of search strategy, numbers of papers retrieved and numbers reviewed and date of search. Please quote references and grade the evidence following the attached guidance.

<table>
<thead>
<tr>
<th>Criteria:</th>
<th>Supporting Evidence (with references)</th>
<th>Grade of evidence*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>THE CONDITION:</strong> The condition should be an important health problem potentially leading to significant morbidity or mortality, and for which early identification appears likely to be of benefit to the infant. In some disorders able to be included in a multiplex test, a benefit for the family may be important, where the condition is untreatable and may lead to early mortality, but where a definitive diagnosis might be aided by the performance of the screening test.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incidence: How determined: (screening/clinical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timing of clinical onset: (when condition would usually be detected clinically)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severity: Morbidity, disability Mortality Spectrum of disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likely or known health gains from early diagnosis and treatment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible harms from screening / early diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE TEST:</td>
<td>The proposed test should be simple, safe, reliable, validated.</td>
<td>Grade of evidence</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Proposed test:</td>
<td>Sample Test; Clinical validation Laboratory performance Sensitivity, false +ve rate, PPV Is it multiplex? What else may be detected?</td>
<td></td>
</tr>
<tr>
<td>Confirmatory testing:</td>
<td>Availability Reliability Laboratory performance</td>
<td></td>
</tr>
<tr>
<td>DNA analysis: If proposed. Which mutations to be included? Laboratory performance Reason for inclusion: (Confirmatory testing; part of screening; prediction of severity?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible harms as a direct result of proposed tests:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## THE TREATMENT:

There should be established treatment or intervention which has the potential to prevent or ameliorate the clinical consequences of the disease.

<table>
<thead>
<tr>
<th>Established interventions:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Which patients need a treatment/intervention?</td>
<td></td>
</tr>
<tr>
<td>Efficacy:</td>
<td></td>
</tr>
<tr>
<td>Urgency:</td>
<td></td>
</tr>
<tr>
<td>Evidence for benefit or likely benefit from neonatal diagnosis and treatment</td>
<td></td>
</tr>
<tr>
<td>Availability:</td>
<td></td>
</tr>
<tr>
<td>Costs: (direct and infrastructure)</td>
<td></td>
</tr>
<tr>
<td>Possible harms from treatment:</td>
<td></td>
</tr>
</tbody>
</table>

### GRADES OF EVIDENCE:

A: At least one high-quality meta-analysis, systematic review, or RCT directly applicable to the target population or a systematic review of RCTs or a body of evidence consisting principally of well-conducted studies directly applicable to the target population and demonstrating overall consistency of results.

B: A body of evidence including high-quality case-control or cohort studies with a very low risk of confounding, bias or chance, a high probability that the relationship is causal, directly applicable to the target population and demonstrating overall consistency of results.

C: A body of evidence including well-conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal, directly applicable to the target population and demonstrating overall consistency of results.

D: Non-analytical studies, cohort or case-control studies with a significant risk of confounding, bias or chance, case reports, or case series. Expert opinion.

E. No evidence available.

Appendix 2
Recommendations for Screening for Specific Disorders
Consideration of adding a particular disorder to the screening program should include the cost of adding it vs the cost of not adding it.

1 Screening is highly recommended for the following conditions, because there is a demonstrated benefit from early diagnosis, the benefit is balanced against financial and other costs, there are suitable tests, and follow-up services are available.
- Congenital adrenal hyperplasia (CAH)
- Primary congenital hypothyroidism (CH)
- Cystic fibrosis (CF)
- Disorders of amino acid, organic acid and fatty acid metabolism covered by analysis of aminoacids and acylcarnitines by tandem mass spectrometry.
  - Amino Acid Disorders
    - Argininemia (arginase deficiency)
    - Argininosuccinic aciduria (ASA lyase deficiency)
    - Citrullinemia (argininosuccinate synthase deficiency, citrin deficiency)
    - Fumaryl acetoacetase deficiency (tyrosinemia Type 1)
    - Homocystinuria (cystathionine beta-synthase deficiency)
    - Maple Syrup Urine Disease (classical and variant)
    - Phenylketonuria (classical and intermediate)
    - Pterin defects
    - Tyrosine aminotransferase deficiency (tyrosinemia Type 2)
  - Fatty Acid Oxidation Disorders
    - Carnitine/acylcarnitine translocase deficiency
    - Carnitine transporter defect
    - CPT-1 deficiency (carnitine palmityl transferase deficiency 1)
    - CPT-2 deficiency (carnitine palmityl transferase deficiency 2)
    - LCHADD (3-hydroxy long chain acyl-CoA-dehydrogenase deficiency)
    - MCADD (medium chain acyl-CoA-dehydrogenase deficiency)
    - MADD (multiple acyl-CoA-dehydrogenase deficiency)
    - TFP (trifunctional protein deficiency)
    - VLCADD (very long chain acyl-CoA-dehydrogenase deficiency)
  - Organic acid disorders
    - Beta-ketothiolase deficiency (mitochondrial acetoacetyl-CoA thiolase deficiency)
    - Cobalamin C defect (homocystinuria with methylmalonic aciduria)
    - Glutaryl-CoA dehydrogenase deficiency (glutaria acidemia Type 1)
    - Holocarboxylase synthase deficiency
    - 3-hydroxy-3-methylglutaryl-CoA lyase (HMGCoA lyase deficiency)
    - Isovaleric acidemia
    - Methylmalonic acidurias (mutase deficiency, CblA and CblB defects)
    - Propionic acidemia
    - 3-methylcrotonyl-CoA carboxylase deficiency
- 2-methylbutyryl-CoA dehydrogenase deficiency
- 3-methylglutaconyl-CoA hydratase deficiency

Note that markers of other disorders may be found at abnormal levels during screening, and followup may be warranted in some circumstances.

2 Screening is recommended for the following conditions, depending on local circumstances. There is a demonstrated benefit or likely benefit from early diagnosis, there are suitable tests and treatment, and follow-up services are available. The benefit may, or may not, be balanced against financial and other costs depending on the available technology, the frequency of the disorder in the region and other factors.
  - Biotinidase deficiency
  - Galactosemias
  - Haemoglobinopathies

3 Screening is currently not recommended for the following conditions where screening tests are not available, or, tests are available but proof of advantage from early diagnosis is absent or uncertain, or the test is unsuitable or does not detect those cases in which there might be an advantage. New knowledge about screening and screening outcome in these conditions should be monitored regularly.
  - Bile acid disorders
  - Cytomegalovirus
  - Duchenne muscular dystrophy
  - Familial hypercholesterolemia II
  - Fragile X
  - G6PD deficiency
  - Haemochromatosis
  - Lysosomal storage disorders
  - SCID
  - Toxoplasmosis
Appendix 3
Australasian Data Set

1 Coverage - Numbers and Percentage of Babies Screened

1.1 Number of livebirths: The number of livebirths should be derived from the mandatory perinatal data collection systems operating in each State and Territory. The data are analysed for each calendar year and include all pregnancies resulting in a final product of conception of 20 weeks or more gestation and/or a birthweight equal to or greater than 400 grams, according to national reporting methods. This information should be made available to the screening program no later than 30 June (see para above) for the preceding year.

1.2 Number of infants screened: This number should be reflective of the number of infants who have had an adequate screen and should exclude refusals and unsatisfactory samples when no follow-up has been achieved. Notwithstanding the problems of name changes and repeat tests not requested by the laboratory these data ensure that babies are all offered screening and that any systematic gaps can be corrected. The best available data should be reported with an estimate of accuracy.

1.3 Percentage of infants screened: The data from 1.1 livebirths and 1.2 number of infants screened should be combined to give a figure for % coverage. Ideally all infants should be screened.

1.4 Number of refusals for screening: The number of refusals and if available the reason for refusal should be recorded. This applies to the offer of screening, i.e. first test only.

1.5 Summary of reporting - Coverage

<table>
<thead>
<tr>
<th>Section</th>
<th>Indicator</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2</td>
<td>Number of infants screened</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>*Percentage of infants screened</td>
<td>100%</td>
</tr>
<tr>
<td>1.4</td>
<td>Number of refusals</td>
<td>0%</td>
</tr>
</tbody>
</table>

2 Timeliness of Sampling and Testing.

The timeliness of sampling and transport to the laboratory impacts on the effectiveness of the screening program in early detection of screened disorders. The days in the following section are calendar days, because this reflects the clinical impact of diagnosis on the infant and because
practically it is the simplest to determine. However, all screening laboratories in Australasia have work schedules determined by postal delivery of incoming samples and work only weekdays excluding public holidays. In reality most testing and reporting of results should be completed at least two days earlier than those stated. The following information should be collected for reporting.

2.1 **Specimen collection**: Both the date and time of specimen collection and the date and time of birth must be known in order to determine the age of the baby, in hours, at the time of specimen collection. The recommended time for first screens is 48–72 hours. The reportable indicator for time of specimen collection is the % of samples collected 48—72 hours. As this information is not currently available to some programs % collected on the second or third day of life will be used (the day of birth is day 0). NB Samples collected under 24h of age are unsuitable for analysis.

2.2 **Specimen transport**: Timely specimen collection is less effective in ensuring early treatment of affected infants if transport is slow. The target is for all samples to be received by the laboratory within four days of collection. The reportable indicator is % received within four days.

2.3 **Specimen testing**: Significantly abnormal test results should be confirmed and the infant referred for diagnostic testing in a timeframe consistent with reasonable laboratory practices and the clinical course of the screened disorder. Maximum timeframes are below in days from receipt of the sample in laboratory (Tables 1 and 2). Recall for a second sample occurs usually when the results are marginal or the clinical condition is not likely to need urgent treatment. Following this protocol, an affected child would have a “late” time of referral and start to treatment, but this may be entirely appropriate. This complicates an assessment of the age at referral and start of treatment. For clarity and simplicity the initial reportable indicator is the percentage of abnormal results notified to doctors/hospitals occurring within the agreed timeframes (Tables 1 and 2), from receipt in laboratory, with the target being 95%. 

Table 1: Recommended maximum timeframes for notification of screen positive results to responsible/nominated doctor/midwife/hospital from sample receipt.

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Referral timeframe* (laboratory turnaround time), days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galactosemia</td>
<td>3</td>
</tr>
<tr>
<td>Maple syrup urine disease (MSUD)</td>
<td>3</td>
</tr>
<tr>
<td>Medium-chain acyl-CoA dehydrogenase deficiency (MCAD)</td>
<td>3</td>
</tr>
<tr>
<td>Phenylketonuria (PKU)</td>
<td>3</td>
</tr>
<tr>
<td>Congenital primary hypothyroidism (CH)</td>
<td>3</td>
</tr>
<tr>
<td>Cystic Fibrosis (CF)</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 2: Age of infant at notification of screen positive results to responsible/nominated doctor/midwife/hospital

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galactosemia</td>
<td>10</td>
</tr>
<tr>
<td>MSUD</td>
<td>10</td>
</tr>
<tr>
<td>MCAD</td>
<td>10</td>
</tr>
<tr>
<td>PKU</td>
<td>10</td>
</tr>
<tr>
<td>CH</td>
<td>10</td>
</tr>
<tr>
<td>CF</td>
<td>28</td>
</tr>
</tbody>
</table>

2.4 **Unsuitable sample** rate: An unsuitable sample is one that cannot be assayed reliably, because it is too small, not soaked through the paper, is contaminated with another substance, or other problem. This measure will assess the skill and compliance of hospitals and other maternity service providers in the collection of samples, and the screening program in its role in the education of hospital staff in collection procedures.

Target "Unsuitable sample" rate is less than 0.5%.

2.5 **Age at first clinical assessment**: Standards have yet to be developed for the different disorders. Report median time for each condition (with max and min) and explanation of outliers.

2.6 **Summary of reporting** – Timeliness of sampling and testing
<table>
<thead>
<tr>
<th>Section</th>
<th>Indicator</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Percentage of specimens collected between 48 and 72 hours after birth</td>
<td>95%</td>
</tr>
<tr>
<td>2.2</td>
<td>Percentage of specimens in transit for 4 days or less</td>
<td>95%</td>
</tr>
<tr>
<td>2.3</td>
<td>Percentage of abnormal results confirmed and notified within the agreed timeframe (see Tables 1 and 2).</td>
<td>95%</td>
</tr>
<tr>
<td>2.4</td>
<td>Percentage of unsuitable samples</td>
<td>less than 0.5%</td>
</tr>
<tr>
<td>2.5</td>
<td>Timely, effective early treatment</td>
<td>To be developed</td>
</tr>
</tbody>
</table>

### 3 Screening Performance:

3.1 **Babies detected with confirmed condition**: Numbers of babies with each condition tested for should be reported. The conditions for reporting are covered above with definitions of the disorders. It is acknowledged that definitions and formal reporting for many conditions needs to be developed but the disorders will be covered by narrative reporting in the interim.

3.2 **Birth prevalence**: This needs to be assessed over a number of years (5) because of small numbers of cases. This should not be reported on as an annual figure. A cumulative figure could be reported for conditions for which sufficiently large numbers have been screened provided the case definition remains constant.

3.3 **Missed cases**: Any missed cases arising during the reporting period should be notified with detected cases, with narrative explaining the circumstances. Note that this would include babies not screened, babies whose parents refused screening and false negative test results.

In order to have both timely reporting and accurate statistics, reporting should be of cases found within the previous calendar year and in whom diagnosis is made by six months of age (or treatment by six months of age as in definitions). Cases missed, those in whom treatment is started later should be mentioned in the narrative report. For all disorders the
individual programs should reassign cases as further information becomes available and these changes mentioned in narrative in each report.

3.4 **Sensitivity:** The sensitivity is taken to be the proportion of true cases (aged up to ten years at the time of diagnosis) detected by the test. Sensitivity is difficult to assess accurately over a short period of time, and assessment needs to be ongoing hence reporting should be of the sensitivity over the previous 5-10 years. There should be a narrative report of missed cases, see above in reporting.

3.5 **Specificity:** The specificity is taken to be the proportion of babies without the condition in question who receive a normal test result. False positive results should be categorized as (i) those which require only a repeat sample for clarification and (ii) those where further sampling or clinical assessment is requested.

3.6 **Positive predictive value:** This reflects the percentage of positive test results that are true positives. A positive test includes reports of both ‘disorder probable’ (often phoned, urgent) and ‘disorder possible (usually request for second dried blood spot. Targets will be developed for this after the initial reporting period. Similarly with a negative predictive value, which is the likelihood that a negative test result defines an unaffected person.

3.7 **Recall rates:** This may be a more useful indicator than specificity for comparing screening program noise. Recalls are to be expressed in numbers and as a percentage of samples tested. Infants are recalled when the first test is presumptive positive requiring a second dried blood spot or referred directly for paediatric assessment. Recalls should be stratified by the type of further action request made.

3.8 **Follow-up achieved:** This is an important indicator for ensuring infants with positive or incomplete screening tests receive appropriate intervention. Programs differ by how assiduously they track these. Follow-up for positive screening results and follow-up for incomplete screening tests should be reported separately.

Babies who had abnormal screening results and subsequently died in the neonatal period should not be counted as not being followed up but should be recorded.

3.9 **False positives:** False positives for each condition should be reported as a percentage of babies tested for that condition and should be subdivided according to whether they require a repeat dried sample only or whether further sampling and clinical assessment is requested.

3.10 **Summary reporting requirements by condition** – screening performance
<table>
<thead>
<tr>
<th>Section</th>
<th>Indicator</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Number of cases detected</td>
<td>By disorder using definitions in Part II</td>
</tr>
<tr>
<td>3.2</td>
<td>Birth prevalence, 1:xxxxx</td>
<td>As agreed</td>
</tr>
<tr>
<td>3.3</td>
<td>Number of missed cases: Cases tested and not detected Cases missed through not screening Cases missed through refusal</td>
<td>In narrative and summary</td>
</tr>
<tr>
<td>3.4</td>
<td>Sensitivity</td>
<td>Rolling, over 5 years</td>
</tr>
<tr>
<td>3.5</td>
<td>Specificity</td>
<td>If available see below.</td>
</tr>
<tr>
<td>3.6</td>
<td>Positive predictive value</td>
<td>Stratified as for recall rate</td>
</tr>
<tr>
<td>3.7</td>
<td>Recall rate: Further assessment and/or testing (dbs) Clinical review</td>
<td>% of samples tested</td>
</tr>
<tr>
<td>3.8</td>
<td>Follow-up achieved</td>
<td></td>
</tr>
<tr>
<td>3.9</td>
<td>Number of false positives</td>
<td>% of babies tested</td>
</tr>
</tbody>
</table>

Sensitivity and specificity are simple to calculate when the other is available; it gives a perspective on this screening in comparison with other healthcare screening although of limited use in comparing newborn metabolic screening programs.

In reporting on sensitivity, there should be a narrative account of missed cases, for the year, AND for previous years, of cases newly come to light. For conditions where screening has occurred for a sufficiently long time, prevalence, sensitivity and specificity information should be included.

## 4 Reporting by Newborn Screening Laboratories

4.1 Annual Reporting by Newborn Screening Laboratories to State Health Departments

Annual reporting to State Health Departments (or similar) should include number of babies screened and number of cases diagnosed for each condition and the data described in the summary of reporting tables 1.5, 2.6, 3.10. These cover population health measures.

Information should be reported to a designated officer/section in the State Health Departments.

The newborn screening community is encouraged to develop a mechanism for collating and sharing data under the auspices of a professional society such as the HGSA.
Release of information by State Health Departments to other bodies may be subject to local requirements and approval processes, particularly where the information is to be published.

4.2 Release of Information by Newborn Screening Laboratories

Release of information by Newborn Screening Laboratories should comply with State Health Department requirements and approval processes.

4.2.1 Sharing of information between Newborn Screening Laboratories: For the purpose of benchmarking and developing performance standards, newborn screening laboratories should share information in the summary of reporting tables 1.5, 2.6, 3.10. This information should be collated to enable reporting as in 4.2.2.

4.2.2 Release/reporting of information for publication via the medical literature (e.g., a letter to the Medical Journal of Australia, the HGSA website, the College of Physicians Division of Paediatrics) should comply with State Health Department requirements. It would normally include, but not be limited to, numbers of babies screened, numbers of cases detected, cases known to be missed, and the number of false positives.