

## **Newborn Screening Fact Sheet: The Role of the Laboratory in Newborn Screening Programs**

Over the last 40 years, Newborn Screening (NBS) programs have become well established in every state health agency, and are highly effective at preventing disease and disability from inherited metabolic and genetic disorders. NBS programs provide or oversee medical intervention based on the results of laboratory tests performed on dried blood spots from newborn infants. While each state determines the exact diseases and policies to be included in its program, this Fact Sheet describes program components generally found throughout the U.S.

NBS programs have been demonstrated to work best as centralized systems within the state public health agency, overseen and operated by dedicated public health professionals. The laboratories performing newborn screening tests are a fully integrated part of this system. The laboratory fulfills additional roles, such as training hospital staff in specimen collection, ensuring accuracy of test results. Most importantly, the laboratory makes absolutely certain that abnormal results are conveyed to the medical professional who can intervene to change the affected child's life.

### ***Background***

Initially, programs were decentralized, with hospital-collected samples being sent to multiple laboratories, and the test results returned for physicians to interpret and diagnose. Over time, as babies with identifiable disorders were "missed" due to the fragmentation of that process, states consolidated their NBS into a centralized program within the health agency. At the turn of the century, a complete NBS program involves sample collection and submission, laboratory analysis and reporting, follow-up of abnormal or incomplete results, and confirmation of diagnosis and prompt implementation of necessary treatment. NBS programs also assure long term follow-up, and make continuing medical advice available.

Laboratory testing is a vital component of NBS programs; mistakes can be lethal. Abnormal test results are immediately reported to the person who can assure intervention. Since mothers' hospital stays have been minimized, the NBS program staff must sometimes, literally, track down the mother and child.

A confirmatory test will always be performed when an abnormal result appears, although intervention may be initiated before confirmation.

### ***The Newborn Screening Continuum***

NBS programs are universally staffed by dedicated public servants who recognize that rapid and continuous communication among program components is imperative. Because some disorders begin damaging the infant within the first few days of life, it is crucial that medical interventions be initiated promptly, and that round-the-clock laboratory and programmatic support be available. Chronic illness, physical disability, mental retardation, or death may result from delay. The birthing hospital, the attending physician, the NBS program staff, and the laboratory MUST interact seamlessly to avoid those consequences, so that care of affected infants can rapidly begin.

### ***The Principles Behind NBS Programs***

Consistent with public health principles, newborn screening programs are typically implemented when 1) the disease exceeds a minimum level of frequency in the population; 2) the disease is easily diagnosable by dried blood spot testing; and 3) the disease is reasonably and readily treatable. Sampling is performed before the infant leaves the hospital, and it is commonly recommended that another sample be obtained and tested a few weeks later, since some disorders do not manifest immediately.

States generally mandate testing for syndromes when the incidence in the population is greater than 1 in 100,000. The laboratory tests look for abnormal levels of normal blood components, or biomarkers not normally found in blood. Treatment may be as simple as providing a modified diet and monitoring the child's development, or it may be more complex, depending on the diagnosis. Mandatory screening is not considered for diseases where no therapeutic intervention has been identified, and a screening mandate would not be implemented until the NBS program is prepared to implement an effective intervention program.

## ***Public Involvement and Oversight***

Often, state NBS Programs have Newborn Screening Advisory Boards to recommend what diseases the state's NBS program should include. These Boards may report to the legislature or the executive branch, and normally are comprised of medical experts, including pediatric geneticists, endocrinologists, and pediatricians. The incidence of NBS diseases appears to vary state-by-state since populations are not homogeneous. National screening mandates have not been advised. State mandates generally derive from Advisory Board recommendations, but may be implemented through legislation, rule-making, or administrative order, depending on the particular state.

## ***Fiscal Considerations***

Fees charged for Newborn Screening services generally support the entire NBS program -- from the cost of testing and laboratory expertise, program staff, as well as treatment materials (*e.g.*, special formula). Such a fee-based program ensures that newborns are protected from shifting priorities and budget appropriations.

## ***Quality Assurance***

Unlike many clinical laboratory tests, and because of the limited number of laboratories performing NBS testing of dried blood spots, preparation of proficiency testing samples ("check samples") is not commercially viable. For this reason, the National Center for Environmental Health's Division of Laboratory Sciences at the Centers for Disease Control and Prevention, continues to operate the Newborn Screening Quality Assurance Program (NBSQAP). This program provides proficiency testing samples for laboratories performing newborn screening tests. More importantly, NBSQAP is an essential resource for the laboratorians performing these tests; it provides consultation and even on-site assistance in resolving difficult analytical problems.

The laboratory also provides resources and quality assurance both before and after the analytical stages of testing. The laboratory role includes services such as sample collection, ensuring adherence to strict turn-around times, and when needed, arranging for sample transport from inaccessible areas (or during shipper strikes). Proper sample collection is critical; if the blood spot is not of proper size and placement on the filter paper, the analytical sample, when punched-out of the paper, may not contain the correct quantity of blood. The public health laboratories provide training for hospital nurses in sample collection.

After the actual analysis is completed, the laboratory role is not done. In addition to reporting the test results, the lab must address retention and storage of both samples and test results. Due to liability concerns, test records must be retained for more than 21 years, since a "missed" child could conceivably initiate legal action once reaching adulthood.

## ***Variations of NBS Programs***

Certain economies of scale and quality have led to regional laboratory services for NBS programs in some areas of the country. New technologies are emerging, such as tandem mass spectrometry, but at present, there is no single technology that can detect all diseases for which screening is mandated by states.

## ***State Specific Information***

NBS programs in the United States have allowed thousands of children born in the US to grow up healthy and lead normal lives, children who otherwise would have required chronic care if they had survived at all. For example, in Colorado, identifying each child with phenylketonuria (PKU) costs about \$45,000; providing this child with special formula costs between \$2,000 and \$10,000 per year more than "normal" costs of child-rearing<sup>1</sup>. But, the state avoids costs of supportive services and custodial care during ages 20 to 40, due to the inevitable mental retardation that would have occurred without intervention. In Colorado, these would total \$3,000,000 to \$6,000,000; in Illinois, these costs are estimated at \$75,000 per year<sup>2</sup>, or \$1,500,000 during that 20-year period.

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<sup>1</sup> Carol Greene, MD, Congressional Fellow, Staff to Senator Edward M. Kennedy (D-MA), as presented to the Second National Conference on Genetics and Disease Prevention, December 6, 1999, Baltimore, MD.

<sup>2</sup> Personal communication, David Carpenter, PhD, Chief, Division of Laboratories, IL Department of Public Health