Every morning Layla’s mother wakes her up at 6:00 a.m. and hands her a pill and glass of water. Layla plays with her siblings for half an hour before eating breakfast. She spends the rest of her day as would any typical three year old child: picking out her own mismatched outfit, running recklessly around the apartment and learning to mimic her siblings.

Layla’s daily pill is a result of an early diagnosis of congenital hypothyroidism shortly after her birth. In the Middle East, one study found the occurrence of this condition in approximately one out of every 1,400 to 2,000 children.\(^1\) If left untreated within the first few weeks of life, it can lead to short stature and mental retardation. The treatment is relatively simple and inexpensive. When the condition is diagnosed and treated early, it can keep children physically and mentally healthy for the rest of their lives.

The key to successful treatment is catching this condition in time. Layla was fortunate. The Egyptian Ministry of Health and Population has been screening newborns for congenital hypothyroidism for many years. Shortly after birth, following collection of blood from a simple heel prick and subsequent testing, doctors were able to inform Layla’s mother of her diagnosis and instruct her on the importance of making sure her daughter took a daily pill. Thanks to this early diagnosis and her mother’s careful treatment, Layla has the same chance at a happy, healthy life as millions of other children in Egypt.

Newborns in only a few countries receive screening for all of the more than 30 conditions known to have good outcomes when detected and diagnosed early through newborn screening. Of the 134 million babies born in the world each year, only about one third receive screening of any type, and many babies are only screened for one or two conditions.

**Newborn Screening Plays a Crucial Role in Saving and Improving Babies’ Lives**

Newborn screening is a quick and minimally invasive process. An easy prick of the heel provides the necessary blood for an initial screening analysis and early detection of presumptive cases for follow-up confirmatory testing. Screening results can indicate increased risk for conditions that can be diagnosed with additional testing. Doctors can determine whether a newborn has a genetic, endocrine or metabolic disorder that requires immediate treatment. As is the situation with congenital hypothyroidism, many of these otherwise serious conditions can be rendered practically harmless with early diagnosis and intervention. Other examples of disorders include:

- **Phenylketonuria (PKU):** PKU is a condition in which the essential amino acid phenylalanine that results from consumed protein cannot be broken down. This condition, if untreated, leads to irreversible brain damage and a marked loss of mental capacity beginning in the first few months of life, as well as behavioral problems and seizures in older children. Dietary restrictions are often adequate to manage PKU. Some individuals may also benefit from taking a dietary supplement.

- **Medium-Chain Acyl-CoA Dehydrogenase (MCAD) Deficiency:** MCAD is a condition that prevents the body from converting certain fats to energy, especially during periods of fasting. Symptoms of MCAD deficiency typically appear during infancy and include vomiting, lack of energy (lethargy), and low blood sugar (hypoglycemia). Newborns with MCAD deficiency are at risk for seizures, breathing difficulties, liver problems, brain damage, coma and sudden death.

- **Severe Combined Immunodeficiency (SCID):** SCID, which is more generally known as the “bubble boy” disease, was depicted in a 1970s film about a boy with this condition. SCID is an inherited genetic disorder characterized by the absence of an immune system, meaning SCID children cannot fight off infections. A bone marrow transplant may effectively cure SCID in most cases if the condition is caught and treated early.

The quality of available, cost-effective screening tests for these and other conditions is better than ever. The tests are highly accurate, leading to fewer patient recalls and costly follow-up tests. The solution to protecting our newborns now lies in expanding access to newborn screening on a global scale.
Expanding Access to Newborn Screening: A Global Imperative

A broad disparity exists around the globe regarding access to newborn screening. In the developing world, resource limitations have affected countries’ ability to implement robust screening programs. It is important to remember that a comprehensive screening program is more than just the heel prick and blood analysis. It includes other key components such as education, counseling, treatment, follow-up and quality assurance.

As a result of resource constraints, many countries have been forced to make difficult choices as to which newborn health conditions they wish to prioritize. This often leads to a selection of infectious disease control over treatment of chronic conditions that newborn screening can detect. Emerging markets, however, are proving screening can be implemented alongside vaccination and other prevention programs, regardless of income levels. For example:

• In China, 90 percent of the 16 million babies born each year are screened for two conditions (PKU and congenital hypothyroidism). The National Health and Family Planning Commission (NHFPC), in collaboration with PerkinElmer, recently developed and implemented a three-year newborn screening training program to reach the remaining 10 percent of babies located in rural provinces. The program will train more than 3,000 doctors, clinicians and laboratory technicians across 600 rural counties on the early detection of life-threatening chronic conditions. It will also increase the number of disorders for which all newborns are screened from two to four.

• Brazil is working toward implementing a country-wide, standardized testing panel for six disorders for population-based screening. Legislators, advocacy groups and key opinion leaders there are helping to raise awareness of the need for newborn screening in the country.

• The Philippines has increased government newborn screening efforts since the passage of the Newborn Screening Act in 2004. Hospitals and collection centers across the country send their newborn samples to one of five laboratories that screen for six disorders. Comprehensive follow-up centers now exist in each of the 17 administrative regions. Beginning in 2015, families can choose to have their babies screened for a number of additional conditions. This ‘voluntary’ screening will make the Philippines’ program the largest in the world for detecting thalassemia in newborns.

• For many years, newborns in Indonesia have been screened for congenital hypothyroidism at two national centers. A passionate group of clinicians are now working with the government to expand screening to cover more disorders in additional hospitals.

Limitations Stretch Across Continents

Many countries are on track to provide access to newborn screening, but tough questions still remain for both developing and developed countries: Which disorders should be prioritized for inclusion in the screening panel? What resources are needed? How can countries ensure newborn screening programs are sustainable?

Throughout Africa, countless examples of these concerns are evident. Each year, more than 30 million babies are born in African countries, yet few have access to newborn screening. Partnerships with non-governmental organizations can be helpful, although countries often must contribute initial setup costs. Such partnerships need to include an agreement for assumption of responsibility for the ongoing costs following the initial partnership period. Where resources are limited, “soft” costs for training can be absorbed locally. African medical professionals who have trained and practiced in other countries may be able to lead training programs in their native countries. These individuals will need additional resources to develop the necessary technical and logistical support for long term success. Screening requires a great deal of knowledge regarding specimen collection, transportation and analysis.

Missed newborn screening opportunities are also not limited to developing countries. Some developed countries fail to take full advantage of the benefits of a complete screening test panel and comprehensive screening program. SCID, for example, is often not included in a test panel.

Any new screening program requires both careful planning and inspired leadership, dedicated to improving the lives of babies in their countries. If implemented correctly, the potential impact of these programs on saving lives is immense. Based on the U.S. panel of more than 30 conditions, about one in 750 births would have a condition detected by screening. Over 55,000 more newborns could be saved globally from death or life-altering ailments each year if proper screening tests and treatment were in place.

“Developing countries can least afford the financial burdens that result from caring for mentally and physically handicapped individuals who could have been identified through newborn screening. Early identification and treatment benefits the individual, their family and the society in which they can function as a healthy citizen. The cost effectiveness of newborn screening is continually demonstrated each time a new program has begun.” — Bradford L. Therrell, Jr., Ph.D., Director of the National Newborn Screening and Global Resource Center in Austin, Texas (U.S.)

Newborn Screening is Only Half the Battle

Screening for inherited congenital conditions is most helpful if effective treatments are available. Such treatments exist for more than 30 conditions. If implemented soon after birth, fewer complications, disabilities and deaths can result. For many governments the decision to implement screening depends on the ability to operate a follow-up of cost-effective treatment programs for identified cases.

The value of investing in a newborn screening program is often in the eye of the beholder. Many variables can impact the outcome of a country’s cost effectiveness analysis including:
“The cost effectiveness of newborn screening is continually demonstrated each time a new program has begun.”

- Bradford L. Therrell, Jr., Ph.D.,
  Director of the National Newborn Screening
  and Global Resource Center in Austin, Texas (U.S.)

- Factors to consider: The researcher developing the cost effectiveness model must make decisions related to which factors to include, from the projected mortality rate in an untreated population to the expected severity of an untreated condition over the lifetime. For example, the early detection and treatment of congenital hypothyroidism is considered by most to be cost saving. This means a country could save money by screening and treating the condition rather than incurring the lifetime cost of caring for a mentally retarded individual. Other researchers, however, argue these analyses do not take into consideration cases of congenital hypothyroidism that result in milder cognitive impairment.

- Patient compliance: Patient compliance with treatment over his or her lifetime also affects analyses. How easily accessible will treatment be? How difficult is it to administer (e.g. is it a pill or an injection)? How dedicated are parents to administering the treatment before the patient can administer it him or herself? A researcher must determine how to account for likely compliance.

- Cost efficiencies: Some tests can detect multiple conditions. A researcher should consider whether other conditions are being simultaneously detected in order to identify additional cost efficiencies in a single screening procedure.

- Indirect costs: Other evaluations look only at direct costs and ignore indirect costs, such as lost future earnings and the out-of-pocket costs to families for patient care. These may include special education courses, additional care givers, costs of necessary dietary foods, alterations to homes and vehicles to make them wheelchair accessible, costs associated with going from one medical facility to another attempting to obtain a diagnosis of a condition, or even the cost of relocating to another country in order to receive proper care.

- Country-to-country differences: Further complicating matters, each country requires a different model depending on its unique circumstances. For example, each country may calculate the cost of an untreated disorder differently, depending upon average lifetime earnings, taxable contributions, and other contributions to the economy of the particular country.

These are just some of the factors that make a “simple” cost effectiveness analysis challenging. Dozens of governments around the world have conducted their own assessments and have deemed newborn screening to be an important part of routine pediatric care. Other countries can and should turn to these studies as examples of what is possible.

Closing the Newborn Screening Gap

More countries, along with industry and non-profit partners, must acknowledge the importance of screening and take steps to ensure all newborns have the same access to testing and life-changing treatments regardless of where they are born. Several organizational entities play an important role in the implementation of these programs:

- Non-governmental organizations can, if large enough, provide start-up and sustainable funding for screening programs. More important, however, is their ability to advocate within countries for government support. Many of these groups see firsthand the devastation of these medical conditions when left undetected and untreated. Their voices are vital for understanding the depth of a country’s need for a screening program.

- Local governments often lead the way in new health initiatives. It is in these states or municipalities that an opportunity exists to test new programs and determine the best methods for implementation and sustainability. Piloting screening programs at the local level can often provide the best practices and support central governments’ need to create country-wide population-based programs.

- Central governments are the final critical player. Their involvement in decisions takes both time and input from all stakeholders, but we can only successfully save lives across the country’s population if central governments support the sustainable implementation of universal newborn screening programs as essential public health initiatives.

- Newborn screening experts with operational experience in many developed and developing countries are available to assist in the development of new programs, and they have worked hand-in-hand with many local and central governments who have paved the way for protecting their newborns. Experience in setting up programs has led to the development of a number of solutions for governments who are unsure of the path forward.

The impact of newborn screening can increase as population coverage expands to new regions, as tests for more disorders are implemented, as the appropriate infrastructure to support a screening program is developed, and as healthcare workers are trained in specimen collection, clinical diagnostics and treatment, including site inspections and overall program management. Only through comprehensive, sustainable screening programs can we protect our newborns. If each partner works together, we have the ability to improve or save the lives of at least 100 newborns every day (more than one baby every 30 minutes). I urge each of us to examine our responsibilities in establishing these crucial newborn screening efforts around the world.
References
