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Ensuring the Life-Span Benefits of Newborn Screening

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Newborn screening is a highly successful public health program that has led to major improvements in outcomes for a variety of conditions otherwise associated with long-term disability and even death.[1] In the United States, newborn screening is provided to every newborn, regardless of circumstance, leading to the identification of >13 000 newborns with a significant condition each year.[1] Most of these individuals require specialized care over their life span. However, public health involvement in newborn screening typically ends once the condition has been diagnosed. This can lead to gaps in care and impede the ability to collect the data necessary for quality improvement and assess treatment effectiveness.

The public health activities in newborn screening include choosing which conditions to screen for, implementing screening and monitoring quality, and ensuring follow-up testing and referrals after positive screen results. After referral for diagnosis, the public health mandate for most states ends, and the responsibility for care rests with pediatricians and other clinicians. Unfortunately, the lifelong management of the rare conditions identified through newborn screening can break down at multiple points, even for conditions that have been included in newborn screening for decades. For example, many children with sickle cell disease do not receive life-saving antibiotic prophylaxis[2]; the management of children with congenital hypothyroidism may be inconsistent with recommended care, undermining optimal cognitive development[3]; and adults with phenylketonuria often have limited access to the specialists and medical foods necessary to protect against neurocognitive impairment.[4] The complexity of follow-up care has increased with the expansion of newborn screening. Not only are some treatments more complex and expensive (eg, enzyme replacement therapy and stem-cell transplant) but newborn screening now identifies individuals with health problems that might not require treatment until later in childhood or adulthood (eg, X-linked

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adrenoleukodystrophy and Pompe disease). The degree to which individuals with later-onset conditions receive appropriate clinical monitoring and treatment when medically indicated is unknown. Clinical management algorithms are still being developed for asymptomatic patients with potential late-onset disease, and the specialized resources that might be needed for these patients might not be locally available or accessible because of insurance or other cost barriers.

One approach to improve the quality of care after newborn screening is referral to disease-specific centers of excellence. However, given the rarity of the newborn screening conditions and the small numbers of experts, ensuring ongoing access to high-quality health care can be difficult even with adequate insurance coverage.[5] Although primary care clinicians and subspecialists can collaborate, even when subspecialists are distant, the effectiveness of this approach for long-term follow-up after newborn screening is yet to be determined.[6]

The Advisory Committee on Heritable Disorders in Newborns and Children makes recommendations to the US Secretary of Health and Human Services to improve newborn screening. More than a decade ago, the Advisory Committee outlined 4 components of long-term follow-up care: care coordination through a medical home, evidence-based treatment, continuous quality improvement, and new knowledge discovery.[7] These components serve a dual function by improving care delivery and expanding the evidence base for treatment.

State public health agencies have a limited ability to meet these objectives because they do not usually provide care beyond certain preventive services, frequently lack the authority to collect postdiagnosis data, and have limited resources to build the surveillance and tracking systems necessary for quality assurance or research. However, state public health agencies have successfully developed robust longitudinal data systems for other important public health concerns (eg, immunization registries, cancer surveillance, and infectious disease monitoring), suggesting that systems could be developed for newborn screening.

Disease-specific registries are valuable tools for both research and ongoing clinical quality improvement. The dramatic improvements in outcomes for patients with cystic fibrosis are largely due to the prospective national patient registry supported by the Cystic Fibrosis Foundation in the United States.[8] Pharmaceutical companies have developed proprietary registries for some of the conditions recently recommended for newborn screening (eg, Pompe disease and spinal muscular atrophy). These registries have made important contributions to care delivery. The National Institutes of Health support a platform, the Longitudinal Pediatric Data Resource (https://nbstrn.org/research-tools/longitudinal-pediatric-data-resource), to build and maintain registries for conditions that are identifiable through newborn screening to evaluate treatment outcomes. Although disease-specific registries can be powerful tools, their generalizability is limited if participants are not representative of the population. Factors that independently influence disease outcome, such as more severe illness, better access to specialists, and higher socioeconomic status, might also predict willingness to participate in a registry. Registries are often expensive to maintain, with significant costs being related to ensuring data completeness and validity.

Another approach used to evaluate outcomes has been to link data across multiple settings by using existing databases. Investigators have conducted retrospective record linkages of newborn screening records to vital records, health care administrative data, and educational records. Linkages have allowed researchers to evaluate how children with specific conditions, diagnosed through newborn screening, compare with other children in survival and use of special education services associated with developmental disabilities.[9,10] Such retrospective population-based analyses have documented the successful attainment of improved outcomes in many cases and have identified gaps in outcomes and opportunities for improvement in other situations.

One approach to improve individual-level care and address the need for population-level monitoring would be through real-time linkage of health care data. Individuals with conditions identified through newborn screening receive care in multiple settings. Aggregating data from electronic medical records maintained by primary care providers, subspecialists, urgent care centers, emergency departments, and hospitals, combined with linkage to other relevant data sources (such as laboratory information systems, pharmacy dispensing data, and public health information [eg, newborn screening results and immunization registries]), could potentially support the clinical mission of long-term follow-up and facilitate prospective research. Despite significant investments in health information exchanges, which would allow data to follow individuals wherever they receive health care services, significant barriers related to cost, privacy and legal concerns, patient record matching, and data interoperability in clinical and laboratory systems remain.[11] However, some relevant data can be linked within large health care systems (eg, health maintenance organizations and accountable care organizations). In addition, individuals can access their health care information, and systems are being developed to facilitate a consumer-mediated exchange of health information.[12,13] Although such limited approaches to information sharing might improve outcomes for individuals, the population-level impact would be minimal unless data were aggregated with those of many others who are affected by similar conditions.

More than 50 years after newborn screening programs began, almost every infant born in the United States is tested for an impressive range of serious conditions each year, often without explicit consent because of the benefits of early detection. Newborn screening programs do a remarkable job in detecting serious conditions in otherwise asymptomatic newborns.[1] However, a lack of comprehensive long-term follow-up care after newborn screening can lead to suboptimal outcomes. That we lack systems to monitor long-term effectiveness of newborn screening is particularly ironic given the transparent evidence-based process that must be followed for a condition to be added to the Recommended Uniform Screening Panel for newborns, let alone the resources committed to ensure that all newborns are screened.

We feel there is a special obligation to the children identified through newborn screening and their families because we have decided, as public policy, that early identification is crucial. The fundamental question is how to develop systems to ensure that the public health mandate of early screening and detection for all[1] leads to meaningful and equitable improvements in outcomes through effective and coordinated care. Comprehensive health care data sharing for all individuals identified with a condition through newborn screening

would be ideal. In the meantime, a systematic approach that relies on registries and longitudinal data linkage can fill some of the data gaps. Public health practitioners could play a key role in facilitating long-term surveillance activities, and pediatricians and other health care providers are critical for maintaining a medical home, synthesizing relevant health care data, and working to ensure comprehensive care. Pediatricians can also encourage families to participate in registries that could improve long-term health outcomes for their own children and other similarly affected individuals.

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