What questions should newborn screening long-term follow-up be able to answer? A statement of the US Secretary for Health and Human Services' Advisory Committee on Heritable Disorders in Newborns and Children

Cynthia F. Hinton, PhD, MPH[1], Lisa Feuchtbaum, DrPH, MPH[2], Christopher A. Kus, MD, MPH[3], Alex R. Kemper, MD, MPH[4], Susan A. Berry, MD[5], Jill Levy-Fisch, BA[6], Julie Luedtke, BS[7], Celia Kaye, MD, PhD[8], and Coleen A. Boyle, PhD, MS[1]

Abstract: The US Secretary of Health and Human Services' Advisory Committee on Heritable Disorders in Newborns and Children provides guidance on reducing the morbidity and mortality associated with heritable disorders detectable through newborn screening. Efforts to systematically evaluate health outcomes, beyond long-term survival, with a few exceptions, are just beginning. To facilitate these nascent efforts, the US Secretary of Health and Human Services' Advisory Committee on Heritable Disorders in Newborns and Children initiated a project to define the major overarching questions to be answered to assure that newborn screening is meeting its goal of achieving the best quality outcome for the affected children and their families. The questions identified follow the central components of long-term follow-up—care coordination, evidence-based treatment, continuous quality improvement, and new knowledge discovery—and are framed from the perspectives of the state and nation, primary and specialty healthcare providers, and the impacted families. These overarching questions should be used to guide the development of long-term follow-up data systems, quality health indicators, and specific data elements for evaluating the newborn screening system. ***Genet Med*** **2011:13(10): 861–865.**

Key Words: *newborn screening, long-term-follow-up, quality assurance, health outcomes, data collection*

Newborn screening (NBS) is a highly successful and essential public health system that reduces death and disability in newborns with a wide range of disorders including hemoglobinopathies, endocrinopathies, inherited metabolic conditions, and congenital hearing loss. Assuring that all children and their families experience optimum outcomes necessitates a coordinated effort to improve tracking and monitoring of healthcare delivery (e.g., services used, clinical care received, and health-related outcomes). Efforts to systematically evaluate health outcomes, beyond long-term survival, with a few exceptions, are just beginning. To facilitate these nascent efforts, the US Secretary of Health and Human Services' Advisory Committee on Heritable Disorders in Newborns and Children (SACHDNC) initiated a project to define the major overarching questions to be answered to assure that NBS is meeting its goal of achieving the best quality outcome for the affected children and their families. Long-term follow-up (LTFU) begins after a newborn with an out of range screening result has diagnostic confirmation, and treatment or intervention has been initiated (e.g., short-term follow-up). LTFU "includes assurance and provision of quality chronic disease management, condition-specific treatment, and age-appropriate preventive care throughout the lifespan of individuals identified with a condition included in newborn screening."[1] The SACHDNC developed a conceptual model for LTFU that includes the key components—care coordination through a medical home; treatments and services with proven effectiveness using evidence based medicine; continuous quality improvement of the LTFU system; and new knowledge discovery to improve child health outcomes.

NBS tracking and monitoring efforts have traditionally focused on the short-term follow-up process, and limited systems currently exist to track the care and management of the child over time. The SACHDNC sought to identify the most important questions and issues that could be used to inform the development of a NBS-LTFU data system. National efforts are underway to standardize data collection categories for LTFU and facilitate sharing of information across organizations. The questions and issues presented in this report could guide these data standardization activities, leading to quality measures by which LTFU programs can evolve and improve.

WORKSHOP

The Follow-up and Treatment Subcommittee of the SACHDNC convened a workshop entitled "Overarching Questions in Long-Term Follow-up and Treatment in Newborn Screening" on September 23, 2009. The subcommittee invited individuals with expertise from various sectors of the public health and healthcare systems that interface with, or are critical to, LTFU after NBS to help define critical questions. (A list of workshop participants is provided in the Appendix, Supplemental Digital Content, http://links.lww.com/GIM/A214).

From the [1]Centers for Disease Control and Prevention, Atlanta, Georgia; [2]California Department of Health Services, Richmond, California; [3]New York State Department of Health, Albany, New York, representing the Association of State and Territorial Health Officials (ASTHO); [4]Department of Pediatrics, Duke Clinical Research Institute, Duke University, Durham, North Carolina; [5]Department of Pediatrics, University of Minnesota, Minneapolis, Minnesota; [6]Save Babies Through Screening Foundation, Scarsdale, New York; [7]Nebraska Department of Health and Human Services, Lincoln, Nebraska; and [8]Department of Pediatrics, University of Colorado at Denver School of Medicine, Aurora, Colorado.

Cynthia F. Hinton, Centers for Disease Control and Prevention, 1600 Clifton Road, Mailstop E-86, Atlanta, GA 30333. E-mail: chinton@cdc.gov.

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An extensive list of potential overarching questions for LTFU was distributed to workshop participants before the workshop. The objective of the workshop was for participants to refine and prioritize the questions. The questions were to align along two axes: (1) four major components of LTFU (care coordination, evidence-based treatment, continuous quality improvement, and new knowledge discovery); and (2) stakeholders in LTFU after NBS (children and families; primary care providers; specialists and clinical researchers; and national and state entities). Participants were divided by stakeholder group, and each group worked with a facilitator to identify no more than five to seven important questions for each component. Groups came back together to present questions. These questions were subsequently summarized using the two axes: LTFU component and stakeholder perspective (Table 1).

This document summarizes the workshop, identifies overarching themes, and specifies the most important issues that workshop experts identified as key to achieving a high-quality NBS LTFU system.

SUMMARY OF THE QUESTIONS AND MOST IMPORTANT ISSUES FOR LTFU

Care coordination for LTFU through the medical home

The workgroup emphasized the importance of a child's or an adolescent's medical home in providing coordinated LTFU and treatment. Less than half of children with special healthcare needs have access to a medical home, and the percentage decreases for children with special healthcare needs whose families live in poverty, have no health insurance, or are from an ethnic minority.[2] The workgroup recognized the challenges inherent in defining and measuring care coordination through a medical home, especially if primary care physicians or specialty care providers are not well versed in the concept and implementation of medical home. Also, concern exists that there will not be enough medical geneticists and other genetics professionals to adequately integrate into a medical home practice model.[3]

Population-level data collected at the state or national level should be able to document the capacity, such as distribution and physical accessibility of providers, within the healthcare system to provide LTFU services to children diagnosed with disorders through NBS and if children/adolescents have financial access to these services. States should be able to ascertain the number of children lost to follow-up after a diagnosis has been firmly established. The availability of ongoing treatment and management services should be assessed for newborns and for older children as they transition into adulthood. This assessment should include documentation of the utilization of follow-up services including the type of providers actually providing care and documentation of the use of care coordination plans throughout the lifespan. Care coordination plans outline important health information and must contain a medical summary, a treatment plan, an emergency medical treatment plan, a working care plan that outlines the role of all providers involved in the child's care, information that was discussed with the family or caregivers, information about the next appointment, and information that the plan was given to the family or caregiver.[4] State NBS programs and practitioners should be able to quantify the number of children receiving care through a medical home and whether individual care plans are updated, at minimum, annually. Furthermore, explicit arrangements are needed to enable primary care providers and specialists to comanage the complicated issues related to children with conditions detected through NBS.

Care coordination through the medical home is family centered. Therefore, questions of interest include do families have the knowledge, skills, resources, and supports to successfully adhere to treatment regimens and self-advocate, including age appropriate genetic counseling that should address the psychosocial implications of the diagnosis? Are families and children prepared for life transitions from pediatric to adult care? Are office staff and allied health providers, working in concert with the primary care physician, providing assistance to the family for the transition? Overall, LTFU delivered and/or coordinated by the medical home model should be able to track individuals through the life course and assure the continuity and quality of care over time.

Evidence-based clinical practice

Best practices for clinical care and other service provision for many of the NBS disorders still require definition and subsequent refinement as new knowledge about treatment effectiveness accumulates. Ideally, families must have access to the most up-to-date information about evidence-based treatments. Specialists and primary care providers want to know that children diagnosed through NBS and immediately enrolled in long-term care are achieving better outcomes than children diagnosed clinically. State public health programs want to know whether physicians are using the most up-to-date clinical information. The identification of best practices or clinical guidelines for NBS conditions remains in development and is ongoing within the Regional Genetics and Newborn Screening Collaborative funded by the Health Resources and Services Administration. In addition, examples of expert consensus exist in the literature for some conditions.[5–8]

In general, the link between best practices and clinical outcomes needs to be further explored, and data systems need to adequately capture the relationships among treatments, health outcomes, and quality of life. At the state and national level, it would be useful to know what NBS disorders have best practices available for ongoing disease management, and how frequently these best practices are disseminated to, and used by, local practitioners. Morbidity and mortality data by specific disorder would be useful for states to monitor whether quality of care is improving over time. Providers should be able to document the types of treatments being used and the complications children experience over time, including periodic developmental and physical status assessments. Data on treatments and outcomes should be available to state and federal agencies on an aggregated level, so that best practices can be assessed, updated, and redisseminated. Families should be adequately informed about what treatment options are available for their children; they should have a clear understanding of what steps they need to take to improve or maintain the health status of their child; and they should thoroughly understand the medical needs and issues related to their child's care.

Continuous quality improvement

LTFU provides an opportunity to evaluate treatment efficacy and determine the benefits and deficiencies of treatment leading to opportunities for improvement.[9] Continuous quality improvement occurs along several dimensions: adherence to clinical guidelines or best practices, evaluation of effectiveness of treatments, and assessment of individuals' and families' experience of care.[1] Important questions include whether families believe that they have ongoing access to age-appropriate education about their child's disease and treatment options. Are they equal

Table 1 Overarching questions for long-term follow-up for newborn screening

Long-term follow-up goal	Families	Medical home/primary care provider/specialists/clinical investigators	State/nation
Care coordination through a medical home	**Is my child receiving coordinated care through a medical home?** Does the child have a family-centered medical home? Is the family/child knowledgeable about the specific diagnosis? What do families need to facilitate follow through with treatment and care plans? Does the family/child have the skills and tools to self-advocate? Is the family/child prepared for transition to adolescent or adult system of care? What percentage of families/individuals receives carrier identification and age-appropriate genetic counseling that also addresses psychosocial implications?	**Are children/adolescents receiving coordinated care through a medical home?** What percentage of children (combined and by specific disease) identified by the newborn screening program have an individual health/care coordination plan that is updated at regular intervals?	**Do children/adolescents receive coordinated care through a medical home?** What percentage of children/adolescents has a family-centered medical home? What percentage of children/adolescents has a care coordination plan that is regularly reviewed? Is there capacity to provide services and do children/adolescents have financial access to services? What percentage of youth has successfully transitioned from a pediatric to an adult system of care? How many children are lost to follow-up?
Evidence-based treatment	**How is my child doing clinically?** What percentage of families reports a good understanding of their child's treatment regimen, options, and other medical and nonmedical needs and resources?	**How are the children/adolescents doing clinically? Are children identified through NBS and enrolled in care doing better than those identified clinically?** Are best practices used appropriately in treatment? How are these best practices communicated to the family?	**How are the children/adolescents doing clinically?** What are developmental, physical, and mental outcomes among affected children? Are service providers using best practices?
Continuous Quality Improvement (QI)	**Is my child getting the best care and treatment? How can I improve my child's outcome?** Is up-to-date information on treatment made available to families? What percentage of families feels they have ongoing access to age-appropriate education? Do families have the opportunity to be in communication with a medical team for effective management of their child's care?	**Am I doing the best for my patients?** Is there an annual review of best practices and care plan for each child across all levels of the care continuum?	**How do we assure ongoing QI?** Is there a coordinated ongoing process for collecting and synthesizing information about effective treatments? Is there a coordinated mechanism for connecting affected individuals with the most effective treatments or clinical research trials if the appropriate management is uncertain? Is there ongoing evaluation of the effectiveness of various treatment protocols/regimens? Are there policies in place at the state/national level that facilitate collection and exchange of information among all components of the NBS system?
New knowledge discovery	**Is my child able to enroll in clinical research related to his/her disorder?** What percentages of families are engaged in the development of disease-specific registries, standardization of best practices, and research studies?	**Do children in my care have the opportunity to enroll in clinical research?** What percentage of children is enrolled in clinical research related to their disorder and does enrollment in research influence outcome? Is knowledge gained from longitudinal studies informing clinical care and treatment development for children with these conditions?	**What clinical and observational long-term follow-up research efforts are being performed at the state and national levels?** Are high-quality NBS surveillance and tracking systems in place at the state and national level? Do states use national data standards to collect data and link systems? Are safeguards in place to protect the privacy of children and families enrolled in clinical research? Are the results of basic, clinical, and translational research incorporated into best practices for the care of children?

partners in communication regarding their child's medical care? Knowing the barriers to care from the patients' and families' perspectives may help healthcare providers, the healthcare and public health systems, and healthcare payer policy makers and administrators to address issues that can result in improved adherence to treatment regimens to maximize health outcomes. For the practitioner, is there an annual review of best practices and each child's individual care plan? Is this review done with family involvement? At the state and national levels, do informatics systems exist that will allow for the flow of information among parts of the NBS system to allow for continuous quality improvement? In addition to the factors that are found to promote improved health outcomes and better quality of life, data systems need to capture information about nonsystematic or process factors, such as variations in practice patterns by geographic region, socioeconomic status of patient population, and health insurance status.[10] Finally, data systems need to capture individual health status measures, health utilization patterns, and temporal trends, so that factors associated with increased emergency department visits and hospitalizations can be further explored.

New knowledge discovery

There are many unknowns in NBS clinical outcomes, and these gaps will be addressed by new knowledge discovery through clinical research. Funding, technical assistance for research and surveillance, and setting of standards for information systems are functions that should be performed at the national level. States' role in developing new knowledge should focus on facilitating access to LTFU data and families' participation in research, and the protection of privacy, although state laws and practices regarding access to data for research and surveillance vary widely.[11,12] Given the rarity of many conditions identified by NBS, national data will be required for most surveillance and research purposes. New knowledge discovery can be best achieved through the sharing of data collected by individual states with specialty care provider groups engaged in the data collection process and investigators engaged in studying conditions identified by NBS.

Knowledge gained from LTFU programs can inform basic science and clinical research efforts that can then positively impact clinical practice and treatment development in an iterative process that is mutually beneficial. For example, it is well known that acquisition of new knowledge obtained from research efforts in the basic science setting (so-called "bench" science) can inform clinical care, help establish "best practices," and lead to drug development for children identified by NBS (i.e., "translational" research). However, it is also the case that investigators learn from their patients, and the knowledge gained from LTFU programs can help researchers identify molecular regulatory pathways, understand disease mechanisms, and identify potential targets for development of novel therapeutics and interventions. Programs such as the Newborn Screening Translational Research Network funded by the National Institutes of Health are designed to support investigators engaging in basic, clinical, and translational research in disorders identified by NBS for the ultimate goal of improving the diagnosis, treatment, and management of children with these conditions, and the availability of data from LTFU programs is an essential component of these efforts. In this way, the new knowledge discovered by NBS LTFU programs also ultimately advances the other three central components of LTFU, including care coordination, evidence-based treatments, and continuous quality improvement.

Family members participating in the workgroup expressed an interest in being involved in research-related endeavors. A growing body of literature examines the promise of participatory action research to include families and community partners in all aspects of the research process.[13–15] In the case of NBS LTFU, these aspects include, but are not limited to, development of registries and subsequent research studies, and development of standardized best practices. A successful model of LTFU new knowledge discovery should engage, educate, empower, and reengage families from the outset and across the model.

FUTURE DIRECTIONS

Data standards for NBS LTFU are under development. The overarching questions and most important issues for LTFU presented herein serve as a guide for current and future data projects. LTFU data systems may then achieve a level of uniformity and incorporate measures to assess whether the goals of care coordination; use of evidence based medicine; continuous quality improvement; and new knowledge discovery have been met. Another important next step will be the assurance of adequate resources to accomplish the goals of LTFU care after NBS and to ensure continuing resources for LTFU care in the future. One possible model to achieve the goals for LTFU may be found in the experience of cystic fibrosis clinical centers that are overseen by the Cystic Fibrosis Foundation. Through regular review processes, the cystic fibrosis centers have established best practices and defined quality measures[16] or have used outcomes data to improve transition from childhood to adult care.[17]

This document presents broad questions and important issues for consideration when LTFU is assessed to determine whether it is meeting the goal of achieving the best possible outcomes for affected children and families. Several LTFU data pilot projects are ongoing, funded by the National Institutes of Health, the Centers for Disease Control and Prevention (CDC), and Health Resources and Services Administration.[18,19] These LTFU projects aim to address new knowledge discovery, public health surveillance, and service assurance. The promise of NBS is that it saves lives and improves health. Agencies examining that assertion can encourage uniform data collection to address these overarching questions. By adoption of data sets that address these considerations, our nation can achieve the promise anticipated by initiation of NBS efforts. These questions provide the means for initiating comprehensive, uniform data collection to assess that promise.

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