NEW YORK STATE OF OPPORTUNITY. Department of Health | Wadsworth Center

Newborn Screening: The RUSP and Beyond

APHL/CDC Molecular Workshop
Michele Caggana, Sc.D., FACMG
February 24, 2020

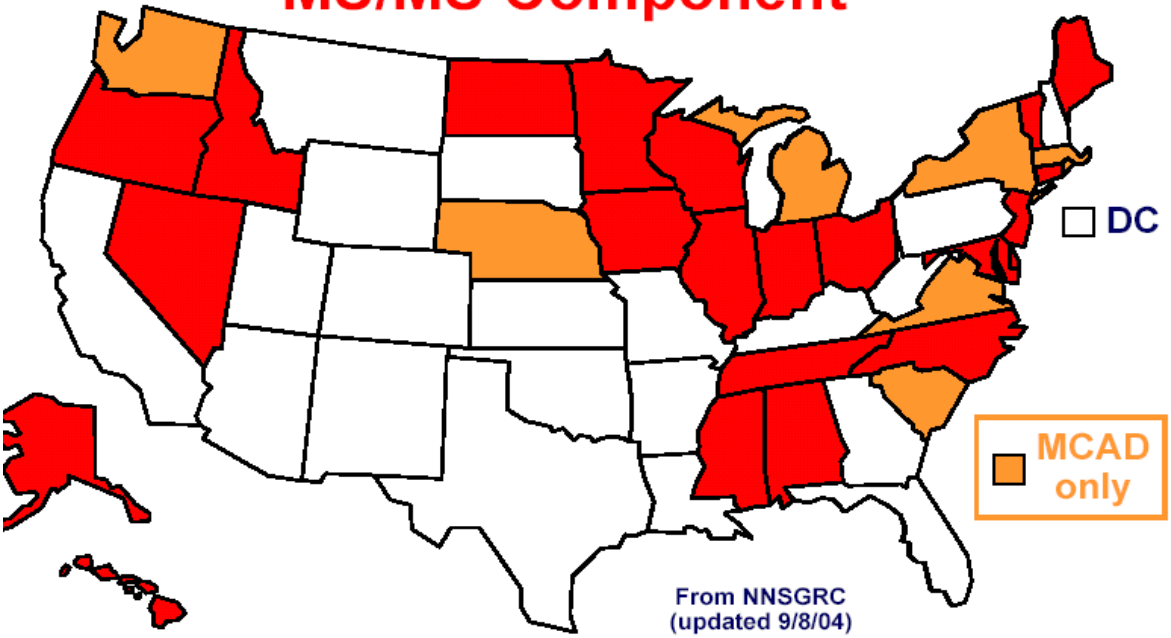
Newborn Screening Tests by U.S. State 2003

March of Dimes
Saving babies, together

07/03

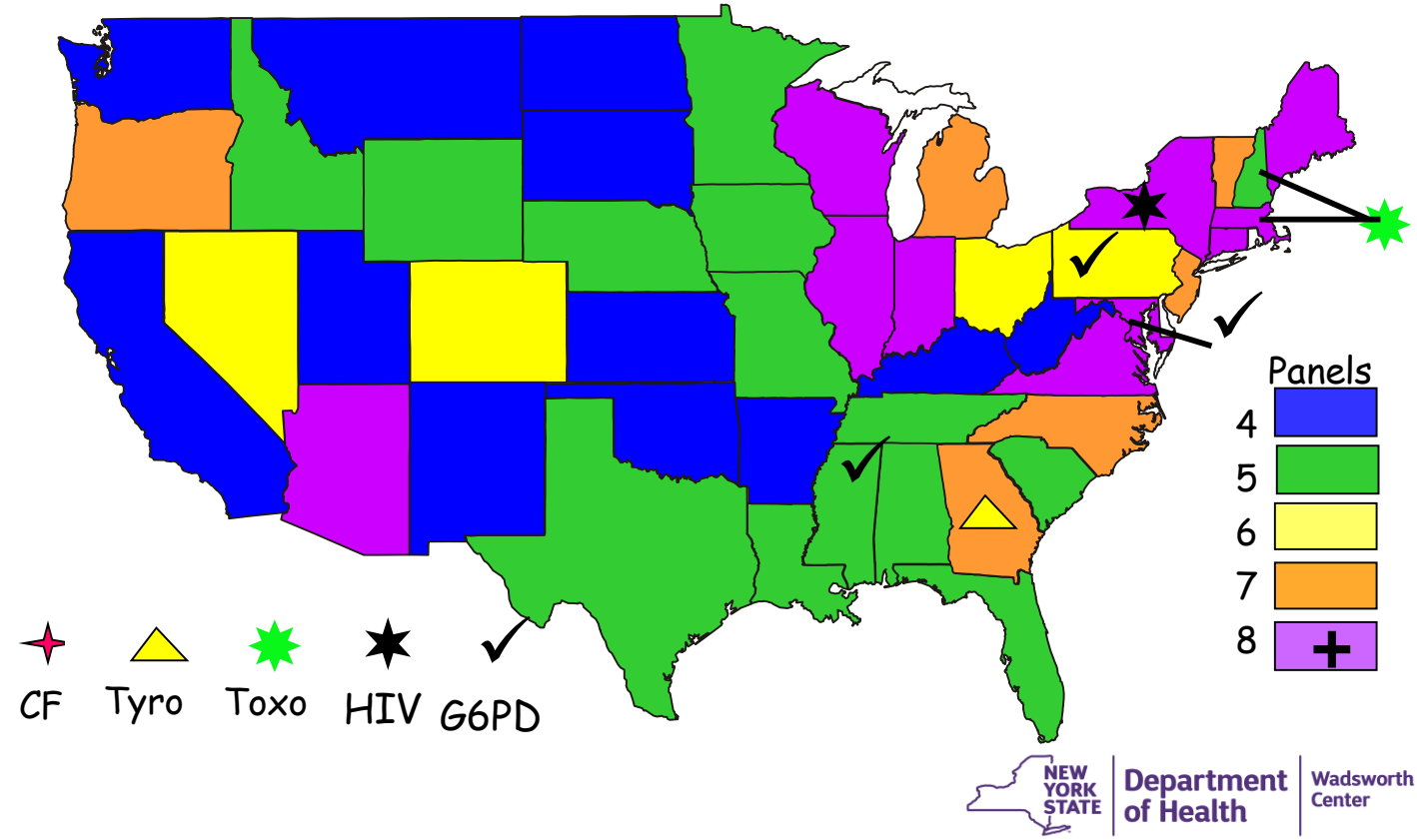
NEW YORK STATE Department of Health | Wadsworth Center

Programs with Mandated and ACTIVE MS/MS Component

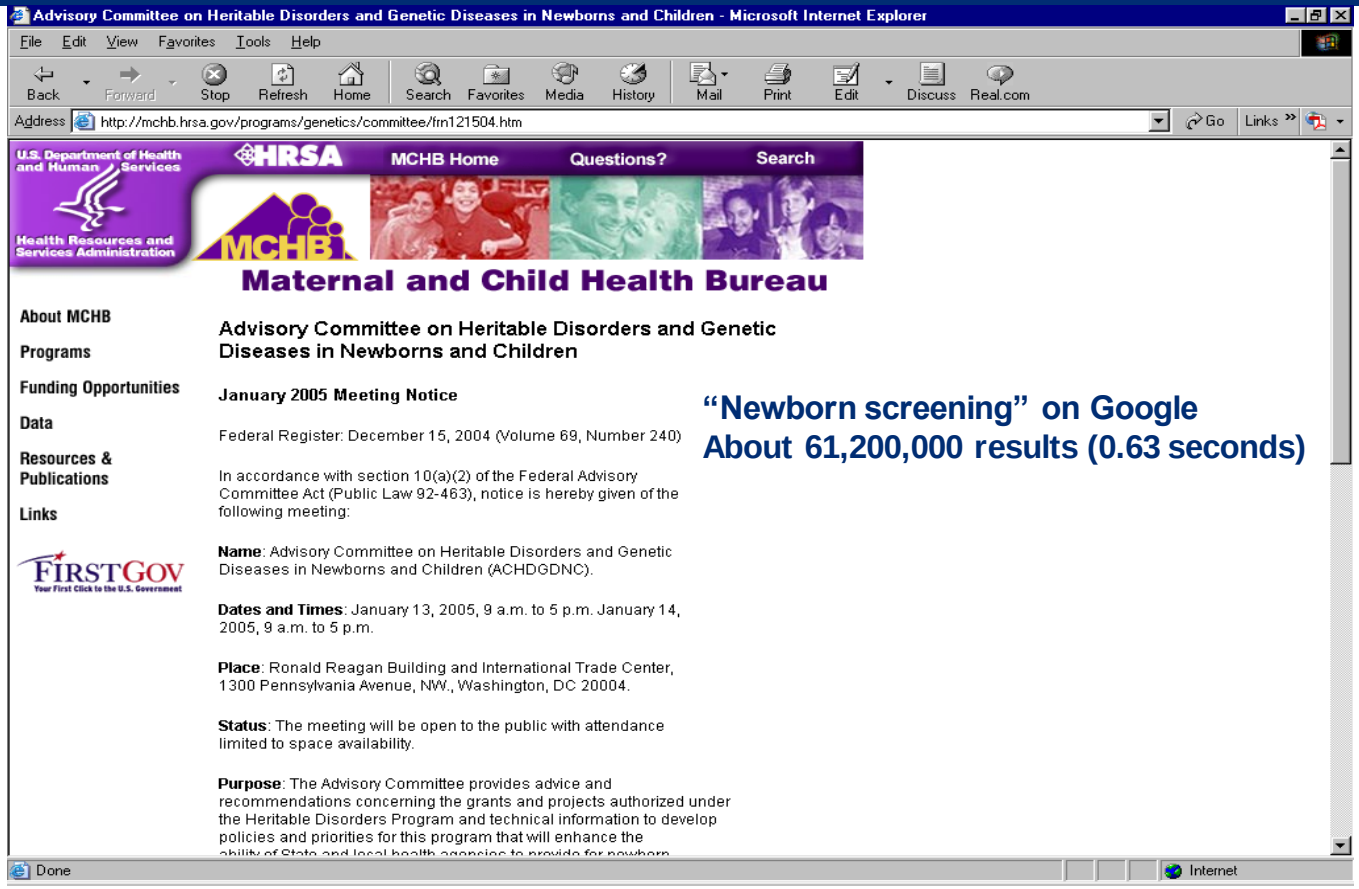


13/51 States (25%), 41% of US births

Newborn Screening in the US - 2004



NEW YORK STATE Department of Health | Wadsworth Center



"Newborn screening" on Google
About 61,200,000 results (0.63 seconds)

Establishes the "RUSP" = Recommended Uniform Screening Panel

May 2006 · Vol. 8 · No. 5, Supplement

executive summary

Michael S. Watson, PhD, Marie Y. Mann, MD, MPH, Michele A. Lloyd-Puryear, MD, PhD, Piero Rinaldo, MD, PhD, and R. Rodney Howell, MD, editors

The Maternal and Child Health Bureau commissioned the American College of Medical Genetics to outline a process for the standardization of outcomes and guidelines for state newborn screening programs and to define responsibilities for collecting and evaluating outcome data, including a recommended uniform panel of conditions to include in state newborn screening programs. The expert panel identified 29 conditions for which screening should be mandated. An additional 25 conditions were identified because they are part of the differential diagnosis of a condition in the core panel, they are clinically significant and revealed with screening technology but lack an efficacious treatment, or they represent incidental findings for which there is potential clinical significance. The process of identification is described, and recommendations are provided. ***Genet Med* 2006:8(5, Supplement): 1S–11S.**

Key Words: *Newborn screening, genetics, public health, congenital, metabolic disease*

INTRODUCTION

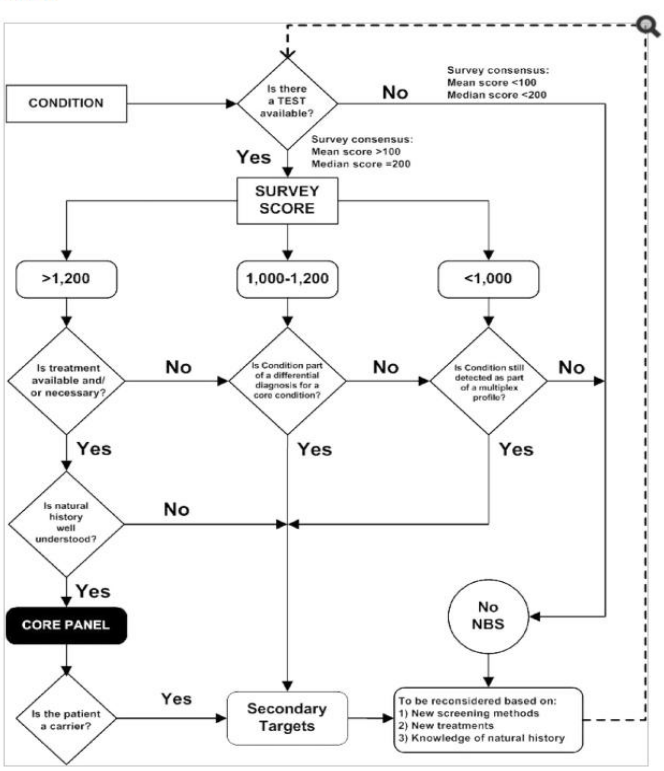
In the United States, newborn screening is a highly visible and important state-based public health program that began over 40 years ago. States and territories mandate newborn screening of all infants born within their jurisdiction for certain disorders that may not otherwise be detected before developmental disability or death occurs. Newborns with these disorders typically appear normal at birth. Appropriate compliance with the medical management prescribed can allow most affected newborns to develop normally. As the model for public health-based population genetic screening, newborn screening is nationally recognized as an essential program that aims to ensure the best outcome for the nation's newborn population.

Aside from the National Committee for Clinical Laboratory Standards (NCCLS) "Standard on Blood Collection on Filter Paper" and guidance from the Council of Regional Networks for Genetic Services (CORN), funded by the Health Resources and Services Administration (HRSA), there are no national newborn screening standards, and limited advice is available from national advisory committees and national medical or public health professional organizations regarding newborn

icant disparities in screening services available to infants. Indeed, in 1999, the American Academy of Pediatrics (AAP) Newborn Screening Task Force indicated that greater uniformity among programs would benefit families, professionals, and public health agencies.

The public health system faces many challenges as newborn screening capabilities continue to evolve. The health care service infrastructure is limited with regard to the interconnections among primary care professionals and subspecialists, particularly in rural areas, a problem complicated by the number and diversity of very rare conditions identified in newborn screening programs. There are geographic limitations in the availability of specific expertise for many of the rare conditions, and considerable needs exist in the areas of training and education about the disorders detected through newborn screening programs throughout the health care system. Furthermore, improvements in the newborn screening system and the expansion of the number of conditions for which screening is offered have costs, and these costs and the associated benefits seem to accrue independently of the public and private health care delivery systems, which complicates their integration. Many states provide the programs necessary to ensure that

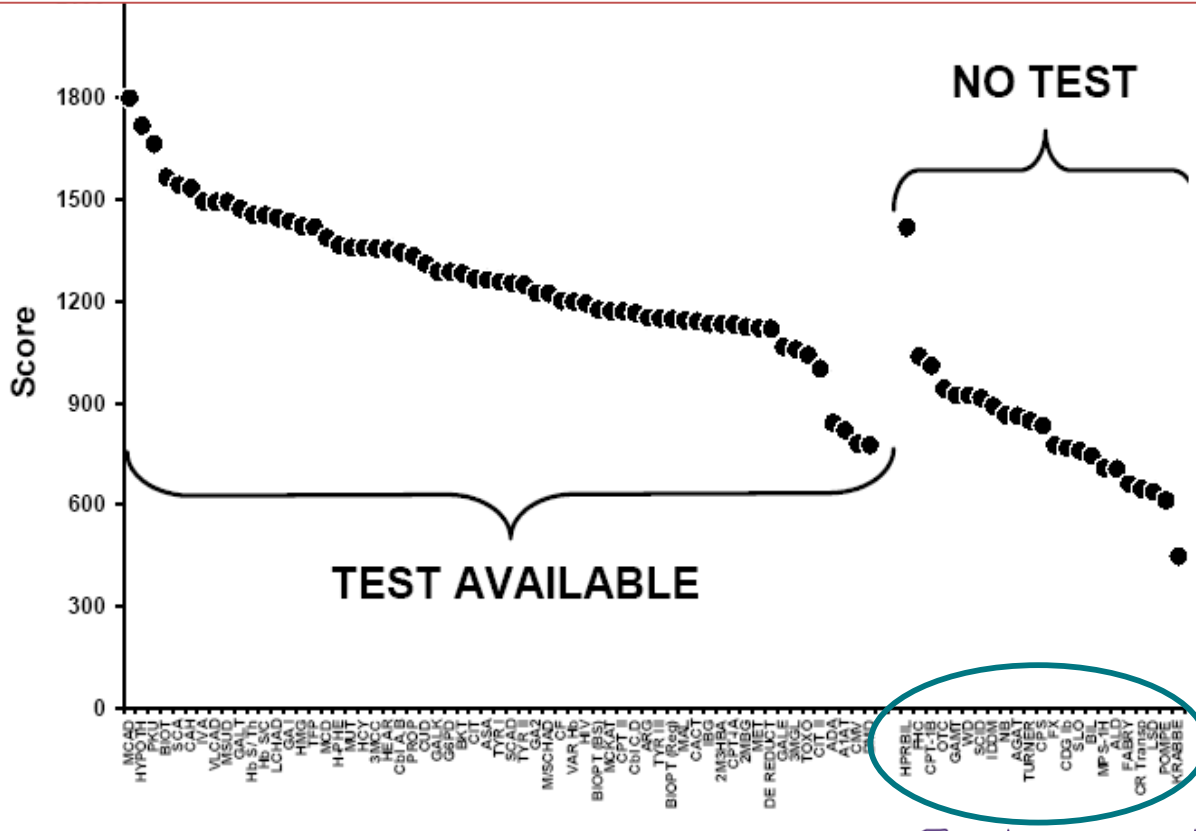
http://mchb.hrsa.gov/programs/newbornscreening/screeningreportpdf.pdf



Algorithm to Assess Suitability for the RUSP

- Test available?
- Treatment available?
- Natural history?

From: Newborn Screening: Toward a Uniform Screening Panel and System
American College of Medical Genetics for the Maternal Child Health Bureau
http://mchb.hrsa.gov/screening/



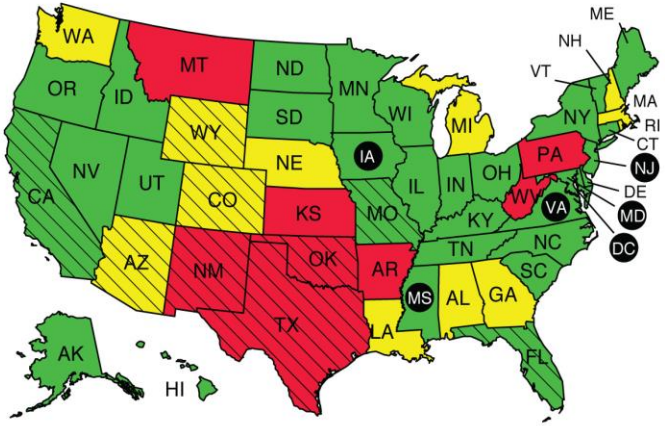
NEW YORK STATE | Department of Health | Wadsworth Center

UNIFORM PANEL				
MS/MS				
Acylcarnitines		Amino acids		
(9) OA	(5) FAO	(6) AA	(4) Hematology	(6) Others

IVA	MCAD	PKU	SCA	HYPOTH
GA-I	VLCAD	MSUD	Hb S/ Th	BIOT
HMG	LCHAD	HCY	Hb S/C	CAH
MCD	TFP	TYR I	[illegible]	GALT
MUT	CUD	ASA		HEAR
Cbl A,B		CIT		CF
3MCC				
PROP				
BKT				

Newborn Screening Tests by U.S. States, 2006

March of Dimes
Saving babies, together



More than 20 core conditions (31)

10–20 core conditions (12)

Fewer than 10 core conditions (8)

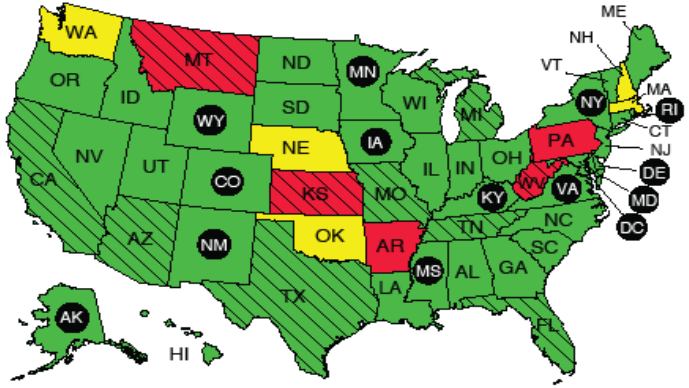
Hatch marks indicate testing for some conditions required but not yet implemented.

Screening 29 Core Conditions
District of Columbia
Iowa
Maryland
Mississippi
New Jersey
Virginia

Source: March of Dimes. Data reported from NNSGRC as of June 1, 2006.

Newborn Screening Tests by U.S. States, 2007

March of Dimes



More than 20 core conditions (41)

10 – 20 core conditions (5)

Fewer than 10 core conditions (5)

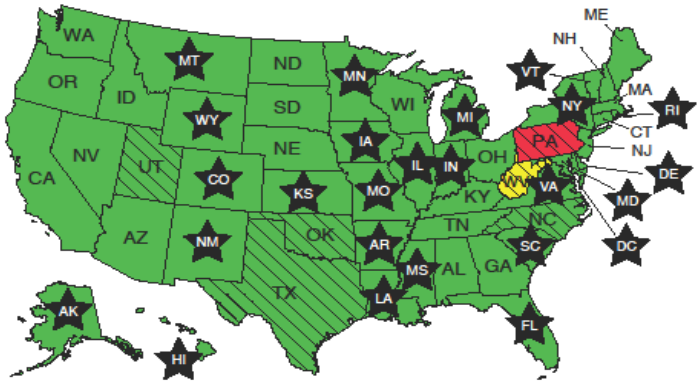
Hatch marks indicate screening for additional core conditions required but not yet implemented.

Screening 29 Core Conditions

Alaska	Minnesota
Colorado	Mississippi
Delaware	New Mexico
District of Columbia	New York
Iowa	Rhode Island
Kentucky	Virginia
Maryland	Wyoming

Source: March of Dimes.
Data reported from NNSGRC as of June 1, 2007.

Newborn Screening Tests by U.S. States, 2008



21 or more core conditions (49)

10 – 20 core conditions (1)

Fewer than 10 core conditions (1)

Hatch marks indicate screening for additional core conditions required but not yet implemented.

Screening 29 Core Conditions

Source: March of Dimes.
Data reported from NNSGRC as of December 31, 2008.

Sec 1: NBS Saves Lives Act (2007) Public Law 110-204; 110th Congress

- Section 2: Improved NB and child screening for heritable conditions
- Section 3: $$ "Evaluating the effectiveness…"
- Section 4: ACHDNC
- Section 5: Information Clearinghouse (Baby's First Test)
- Section 6: Lab quality and surveillance (our friends at CDC) and IAC (CDC, AHRQ, NIH)
- Section 7: Contingency planning "CONPLAN"; Hunter Kelly Research Program

Reauthorized in 2014; signed by President Obama; now famous Section 12; up for reauthorization again in 2019; Common Rule Issue – not reauthorized

Advisory Committee

- **Secretary's Advisory Committee on Heritable Disorders in Newborns and Children**

  SACHDNC -- *(SACK´ - DUNK)*

- **Discretionary Status when NBS SLA expired, 4/23/2013**

  DACHDNC -- (*DACK´ - DUNK*)

- **NBS SLA Reauthorization signed 12/8/2014; re-chartered May 7, 2015**

  ACHDNC -- *(ACK' – DUNK)*

(S)ACHDNC

Secretary's Advisory Committee on Heritable Disorders in Newborns and Children

- Chartered in February, 2003
- First meeting June 7, 2004
- Newborn Screening Saves Lives Act, 2007
  - Section 4 reads:
- *"(3) make systematic evidence-based and peer-reviewed recommendations that include the heritable disorders that have the potential to significantly impact public health for which all newborns should be screened, including secondary conditions that may be identified as a result of the laboratory methods used for screening"*

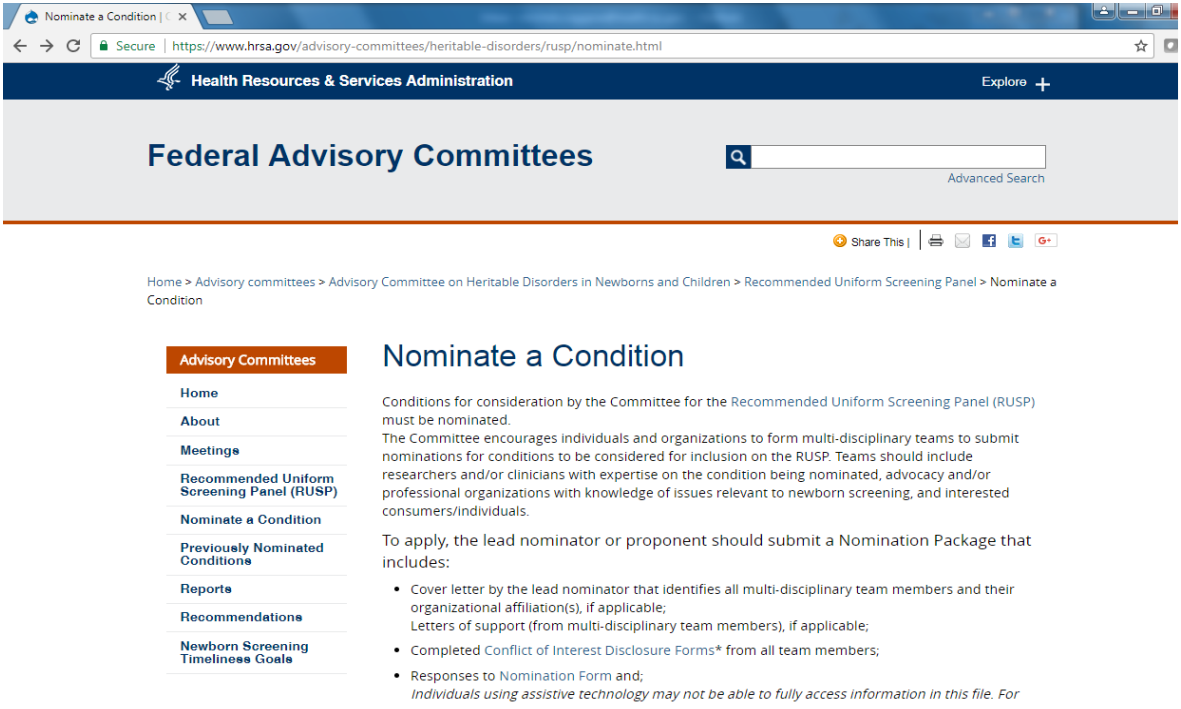
ACHDNC

- Provides guidance to the Secretary, HHS, about the conditions that should be included in newborn screening
- If endorsed by the Secretary, the conditions become part of the RUSP
- Although newborn screening programs are operated at the state level, many strive to follow the RUSP

https://www.hrsa.gov/advisory-committees/heritable-disorders/index.html

Composition of ACHDNC

- Members approved by HHS
- 1/10 Committee members is from a State NBS Program
- Liaisons from AAP, ASTHO, AAFP, ACMG, ACOG, AMCHP, APHL, Genetic Alliance, MOD, NSGC, SIMD, even DOD
- Ex Officio members: AHRQ, CDC, FDA, HRSA, NIH, designated federal official



https://www.hrsa.gov/sites/default/files/hrsa/advisory-committees/heritable-disorders/rusp/Nominate-condition/nomination-form.pdf

Nomination Process

- Condition, Treatment, NBS information
- Confirmatory testing information
- Pilot data (an N of 1)
- References

Generally advocacy, clinicians, and scientists work together

Condition Review Process

- **After prioritization, based on 3 reports:**
  - **Systematic evidence review**
  - **Assessment of the bounds of benefit and harm**
  - **Evaluation of the capability of states to implement universal screening**

Process is being revisited

Principles for Making Recommendations

- Evidence-based; published/gray literature
- Health benefit to screened individual is the chief outcome
- Account for feasibility and readiness of State Programs for screening; complex
- Recommendations not impacted or modified based on insurance, medico-legal liability or legislation

ACHDNC
Secretary's Advisory Committee on Heritable Disorders in Newborns and Children

NET BENEFIT/ CERTAINTY			READINESS: Ready	READINESS: Developmental	READINESS: Unprepared	FEASIBILITY: Feasibility	FEASIBILITY: HIGH or MODERATE	FEASIBILITY: LOW
SIGNIFICANT Benefit	Certainty	HIGH	**A1** Screening for the condition has a high certainty of significant net benefits, screening has high or moderate feasibility. Most public health departments are ready to screen.	**A2** Screening for the condition has a high certainty of significant net benefits and screening has high or moderate feasibility. Public health departments have only developmental readiness.	**A3** Screening for the condition has a high certainty of significant net benefits and screening has high or moderate feasibility. Public health departments are unprepared for screening.			
			A4 There is high certainty that screening would have a significant benefit; however, most health departments have low feasibility of implementing population screening.					
		MOD	**B 1-4** There is moderate certainty that screening would have a significant benefit.					
Small to ZERO Benefit	Certainty	MOD/HIGH	**C 1-4** There is high or moderate certainty that adoption of screening for the targeted condition would have a small to zero net benefit.					
NEG Benefit	Certainty	MOD/HIGH	**D 1-4** There is high or moderate certainty that adoption of screening for the targeted condition would have a negative net benefit.					
—	Certainty	LOW	**L 1-4** There is low certainty regarding the potential net benefit from screening.					

SMA vote

Question

- **The Advisory Committee and state programs are more and more interested in molecular testing and its role in newborn *screening*.**
- **What are the decision points and various ways to implement molecular into newborn screening programs??**

Does Molecular Testing Add Value??

OR

- Increase in sensitivity of a primary test, effect on specificity
- Identification of carriers; teaching moments
- Predictions regarding phenotype
- Clinicians' perception, diagnostic tool
- Timeliness??

When / Why Use a Molecular Test?

- To increase sensitivity without compromising specificity
  - -- Lower IRT cutoff to avoid missing CF cases
  - -- Example of Krabbe disease; LSDs?
- To increase specificity of a complex assay
  - -- Allow differentiation of hemoglobinopathies & thalassemias (e.g. Hb S/β-thalassemia)

When / Why Use a Molecular Test?

- When the primary analyte is transient
  - -- The primary analyte is present for only a limited time after birth and analysis of a second specimen could result in a false negative. (e.g. VLCAD / CPT2)
- To speed diagnosis in order to avoid serious medical consequences
  - -- GALT enzyme activity is decreased by heat & humidity, increase in false positive screens
  - -- Genotyping helps sort out the true positives for faster diagnosis.

When / Why Use a Molecular Test?

- When there are significant founder variants in a population

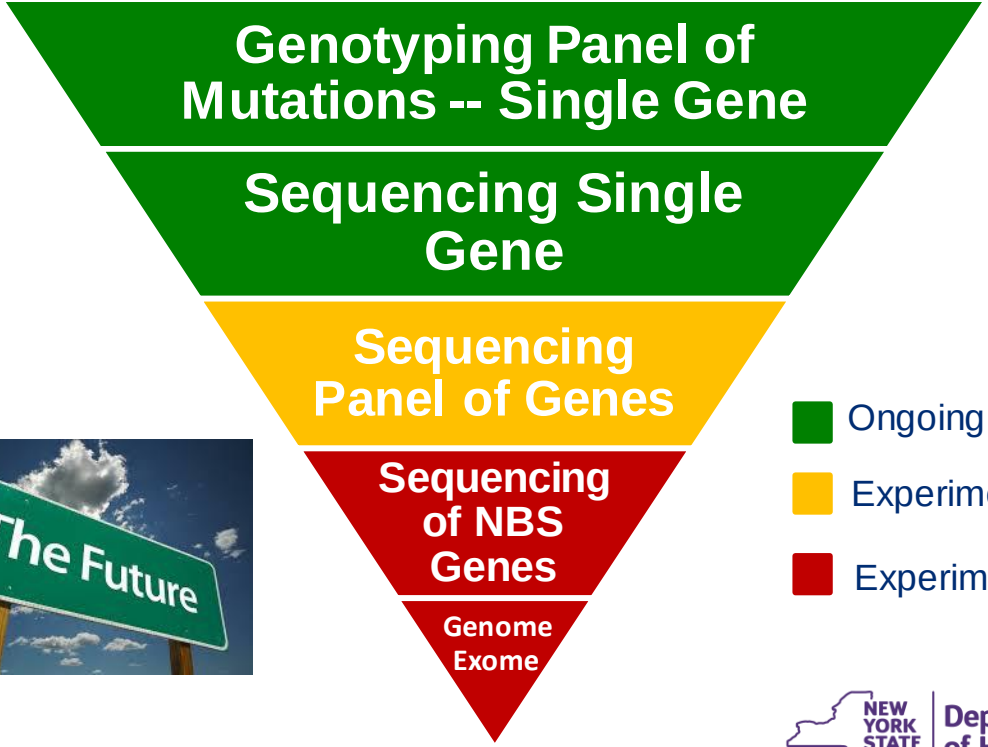
  -- Due to high frequency (1 in 176 live births) of MSUD in Mennonite population in WI, variant analysis for p.Y438N serves as primary screen for MSUD for Mennonites.

  -- CPT1a in Alaskan Inuit (p.P479L) & Hutterite populations (p.G710E)

When / Why Use a Molecular Test?

- **When diagnostic testing is slow and/or invasive**
  - -- Traditional confirmatory testing for VLCAD & CPT1a involves skin biopsy (invasive to collect and slow to grow)
- **When no other test exists for the analyte**
  - -- Severe combined immunodeficiency – screen is the TREC assay, not genomic DNA; 2010 added to the RUSP – by end of 2018, all states screening for this condition

Molecular Analysis in Newborn Screening
A Staged Approach



Ongoing in routine NBS

Experimental in NBS

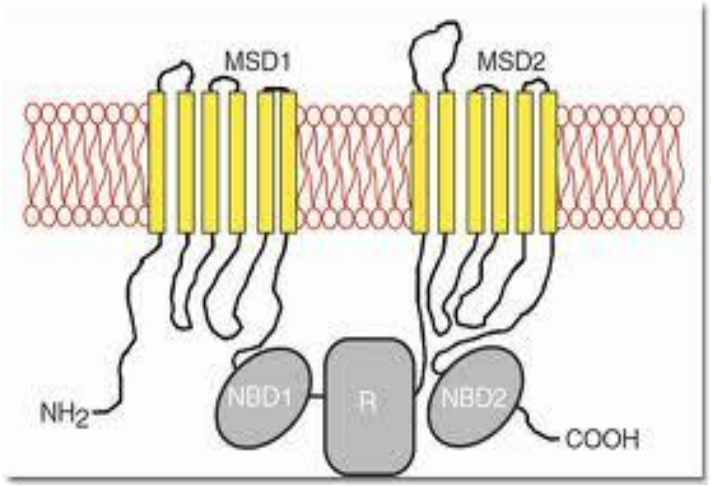
Experimental in NBS

NEW YORK STATE Department of Health | Wadsworth Center

S. Cordovado, Ph.D.

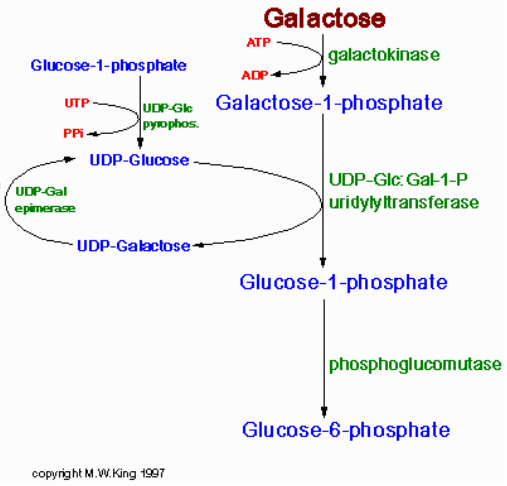
Targeted Panels – Population-Specific?

Cystic Fibrosis



CFTR2 panel of disease causing variants

Galactosemia

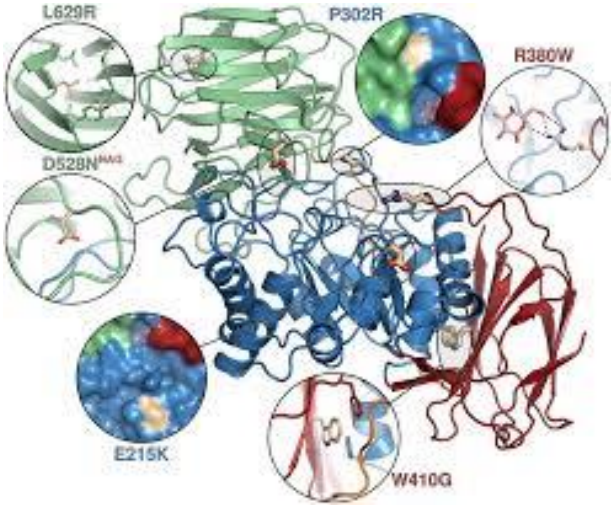


5-9 variants commonly tested

First Level

NEW YORK STATE | Department of Health | Wadsworth Center

Example: Increasing Specificity – DNA Sequence Analysis Without A Loss of Timeliness



Molecular Subcommittee sequencing matrix

Second Level

KRABBE DISEASE

emergent results

- **VOUS**
- **Biochemistry first**
- **Molecular second**
- **Phenotype predictions**
- **41.3% reduction in referrals**

Familial anxiety decreases with increased specificity

NEW YORK STATE | Department of Health | Wadsworth Center

Example: Increasing Specificity – DNA Sequence Analysis With A Loss of Timeliness

Issue: Most referrals for cystic fibrosis don't have disease – high rate of false positive results (94%)

Screen positive – ↑Immunoreactive trypsin (IRT) and at least 1 CF causing pathogenic variants

Most assays detect a panel of 39-100+ variants that cause CF

>2000 known variants in CFTR gene

… And not all CFTR variants cause classic CF

Will identify CF related metabolic syndrome (CRMS) or unknown variants; will miss cases if limited to known variants; how many are tolerable?

Hughes EE et al., Hum Mutat, (2016), 37:201-208.
S. Cordovado, Ph.D.

Second Level

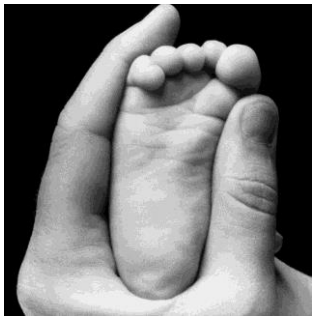
Cystic Fibrosis Newborn Screening Summary

NY Annual birth rate: ~250,000

1st tier — Babies in upper 5% IRT: ~12,500

2nd tier — Babies with 1 or 2 *CFTR* variants or VHIRT: ~900

3rd tier — Babies with 2 *CFTR variants*: ~100



⇦ Only these babies are sent for diagnostic evaluation and testing

NEW YORK STATE | Department of Health | Wadsworth Center

Increased Turnaround Time
80-90% Decrease in Referrals

- Accessioning (1)
- IRT test (1)
- Abnormal (2)
- Repeat IRT test (2)
- Extract DNA (2)
- 39-mutation screen (3)
- Extract fresh punch (3)
- 39-mutation screen (3)
- Enter results (4)
- Mailer (5)

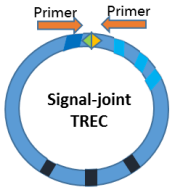
- Accessioning (1)
- IRT test (1)
- Abnormal (2)
- Repeat IRT test (2)
- Extract DNA (2)
- 39-mutation screen (3)
- Extract fresh punch (3)
- Next Gen (3-5)
- Sanger / Suppl (5-6)
- Enter results (6)
- Mailer (7)*

*These times don't account for any batching

Next Gen Sequencing and SCID Newborn Screening – Post-analytic to Analytic?

Severe Combined Immunodeficiency (SCID) is a spectrum of disorders that can only be differentiated by identifying pathogenic variants

- Many genes involved in SCID
- Immunologists can provide better care when SCID causative pathogenic variants are known quickly; now done post-analytically
- Screening labs can provide timely molecular analysis
- When public health does this work, health care quality ensured



S. Cordovado, Ph.D.

Third Level

NEW YORK STATE | Department of Health | Wadsworth Center

Moving DNA Analysis to the Analytic Phase – Impact on Timeliness; Improved Clinical Sensitivity

Current NBS for severe combined immunodeficiency:

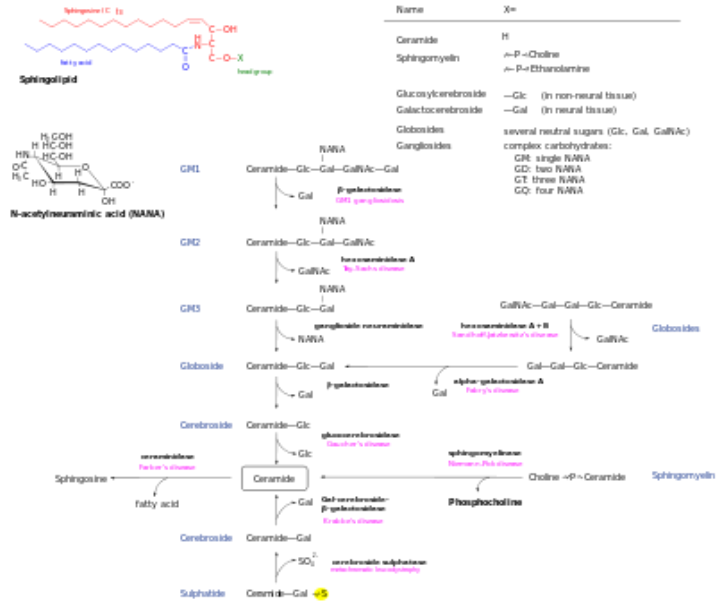
- **Measure T-cell receptor excision circles (TRECs)**
- **<125 TRECs constitutes a referral**
- **Immunologists order CBC, flow, mitogen studies**
- **Molecular tests order by candidacy, multi-gene panel(s), insurance issues, available labs**
- **Becomes iterative, slow, stressful process**

Third Level

Specific Aims

- Validate 2 platforms for 39-gene NGS immunodeficiency panel
- Evaluate Next Gen Sequencing Utility and TAT
  - Shortened time to diagnosis?
  - Fewer visits to Specialist?
  - Earlier, targeted treatment?
  - Long-term follow-up
- Create and disseminate educational materials for parents and providers to state programs
- CDC materials

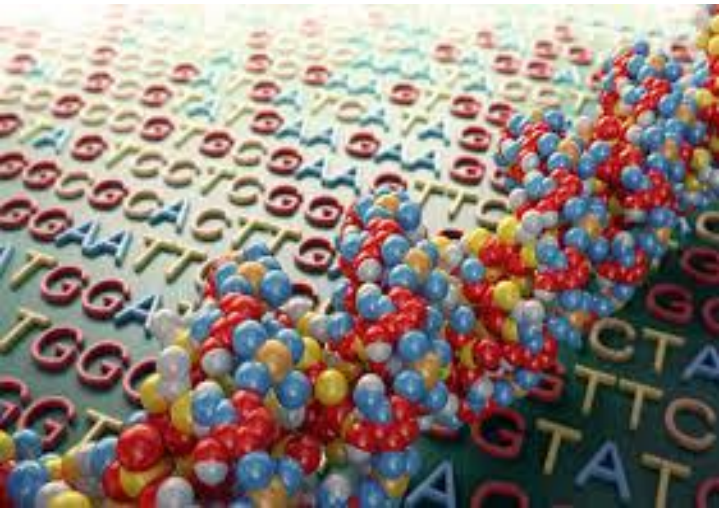
Entire Coding Sequence of All Known Genes in a Given Biochemical Pathway



- Modifiers
- Phenotype predictions
- Infantile, juvenile, late

Third Level

Entire Coding Sequence of All Known NBS Genes



- Complete
- Only looking at NBS
- Can turn off analysis
- Easily modifiable
- Similar information
- Economy of scale
- Still ‘manageable’

- *Under consideration in NY*
- *Establishment of NBS core*

Fourth Level

NEW YORK STATE | Department of Health | Wadsworth Center

Whole Exome or Whole Genome Analyses

- Complete
- All disease / onset
- VOUS
- Screening v. diagnostic
- No phenotype yet
- Consent
- No longer ‘manageable’ currently

Fifth Level

Points to Consider

- Will we make it easier for families?
- Will we alleviate or increase burden?
- Variants of unknown significance
- Misclassified variants
- Screening programs become diagnostic
- Molecular diagnosis may not result in phenotype – patients in waiting
- Providers need education to relay information
- Availability of genetic counseling

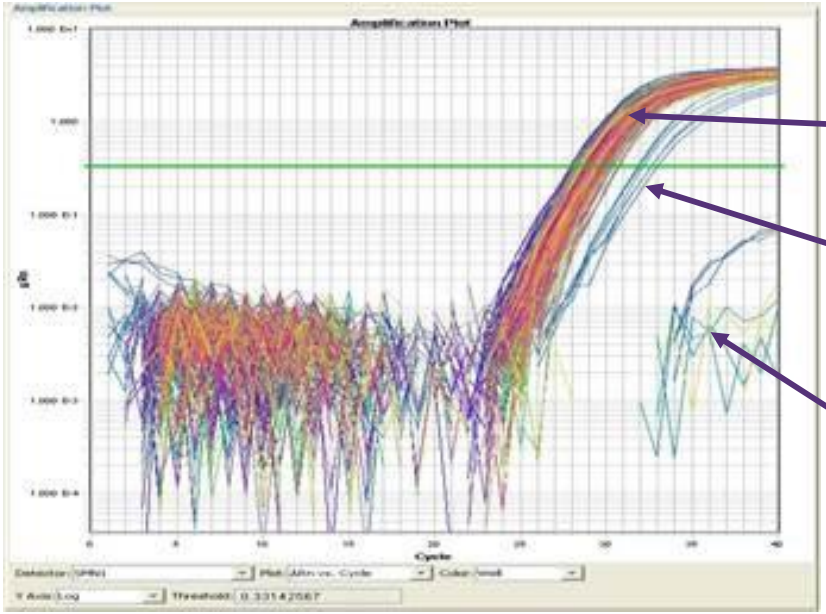
What Else is Being Discussed for Addition to the RUSP?

- Fragile X syndrome – CGG repeat (>200); AGG
- Duchenne muscular dystrophy – creatine kinase followed by deletion/duplication; DNA sequence – specificity; other conditions
- Other LSDs (MPS's, Gaucher disease/Niemann-Pick disease, Fabry disease – mild/severe variants, frequency issues)
- Guanidinoacetate methyltransferase deficiency
- Wilson's disease / Menke's disease
- Metachromatic leukodystrophy
- Cerebrotendinous xanthomatosis
- Congenital CMV infection

Spinal Muscular Atrophy

- 1 in 6,000-10,000 frequency
- Four types, type I is most severe
- Deletion (most often) of *SMN1*
- #copies of *SMN2* important
- FDA approval of nusinersen (Spinraza) *12/23/2016; children and adults*
- FDA approval for Zolgensma *05/24/2019; <2 years of age*
- Biogen Idec funded Columbia/NY Presbyterian pilot study prior to universal screening

SMA Pilot Study



SMN1 – 2 copies

SMN1 – 1 copy

Blanks or
0 copies

Combining with
TRECs and KRECs

10,362	screened
10,217	2 normal copies of SMN1
144	1 normal copy of SMN1 (1/72)
1	homozygous deletion (sample #116)

Carriers

- Over 50% were aware of their carrier status before they are called; low stress
- Those not aware of carrier status also typically have low concern.
- Participants did not make appointment for genetic counseling.
- Concern that families are forgetting about results and recommendations to have the partner tested before next pregnancy

Universal screening: "presence of SMN1"; No copy number analysis

Universal SMA Screening

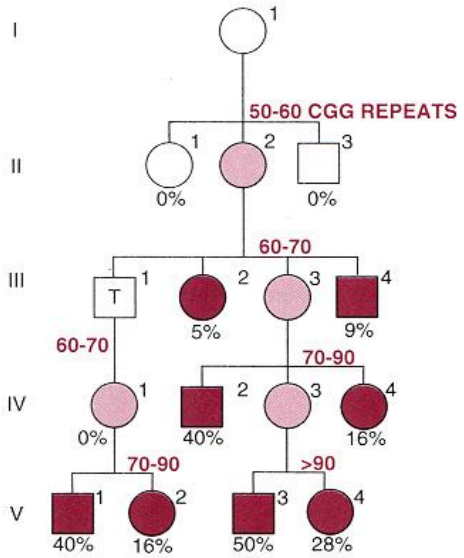
~297,000 infants screened since October 1, 2018

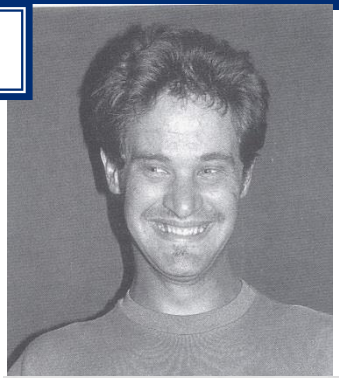
15 referrals

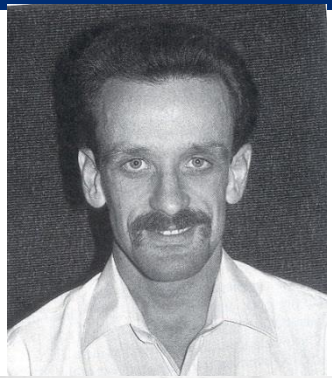
- **2 copies *SMN2* (8 infants; 5 gene therapy; 1 Spinraza; 2 pending)**
- **3 copies *SMN2* – (5 infants; 3 gene therapy; 1 Spinraza; 1 pending)**
- **4+ copies *SMN2* – (2 infants; 1 gene therapy; 1 monitoring)**

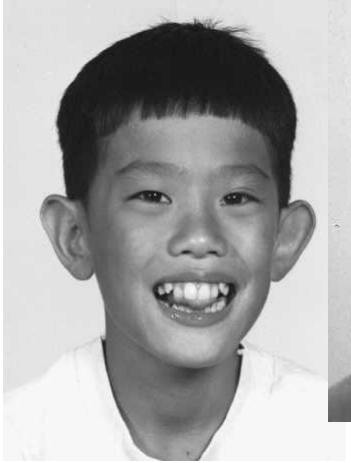
Incidence: ~1 in 19,800

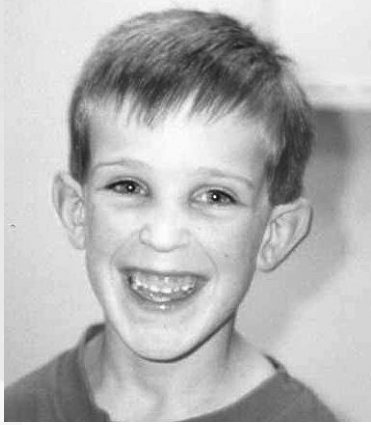
FRAGILE X SYNDROME











5' UTR CGGCGGCGG repeat

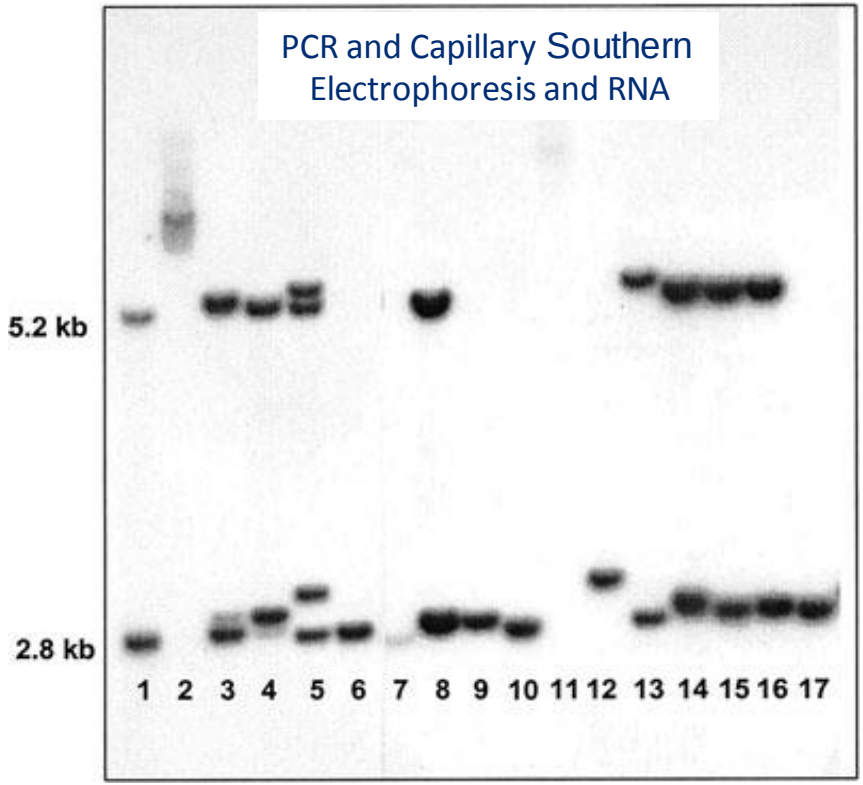
- 5-44 normal
- 45-54 grey zone
- 55-200 premutation
- >200 full mutation

Gelehrter, 1999

http://medgen.genetics.utah.edu/photographs/diseases/high/514a.gif

Hagerman and Silverman, 1991

ACMG-Standards and Guidelines for Fragile X Testing, 2006



1. NF
2. AM
3. F 28&52 repeats
4. F 26&52 repeats
5. F 18& ~80 repeats
6. NM
7. NM, underloaded
8. NF
9. NM
10. NM
11. AF, underloaded
12. NTM
13. F 20&70 repeats
14. F 27&42 repeats
15. NF
16. NF
17. NM

NEW YORK STATE | Department of Health | Wadsworth Center

This method still would require Southern blots—hard if not impossible to do from a DBS

How would that fit in a screening laboratory workflow?

Intervention?

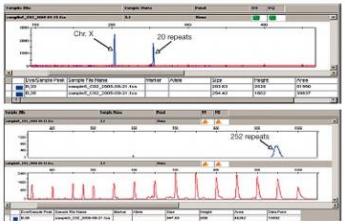
Amplification and accurate sizing of CGG repeats

CGG repeats	Detect with Abbott PCR	Detection method	Size accuracy
5–70	YES	Capillary electrophoresis	± 1 CGG repeat
71–230	YES	Capillary electrophoresis	± 3 CGG repeats
>231*	YES	Agarose gel	Subjective

* The provided ROX™ 1000 Size Standard allows sizing of up to 230 CGG repeats. Samples with expansions up to 645 CGG repeats and beyond have been amplified with sizing on agarose gel.

Sample 1: Male, 118 repeats

Sample 2: Female, 20/~200 repeats



Fragile X-Tremor Associated Syndrome

Three Generations: The young man and woman on the right both carry the full mutation for fragile X syndrome. Their grandfather is now affected by FXTAS and is the fragile X syndrome carrier who passed on the carrier status to his daughter, their mother.

- Described in 2001
- Tremor, PD, brain atrophy
- Affects NTMs
- Same test as FRAX
- Came to attention via grandsons
- Excess mRNA
- ~20-30% of NTMs
- Brain inclusions
- NBS and late onset

Paul and Randi Hagerman
UCDavis

Duchenne Muscular Dystrophy (DMD)

- Parental attitudes for screening (6-12 month olds); they want to know; health benefit for the infant?
- Muscle CK levels; dystrophin pathogenic variants
- Cohort identified for treatment / trials -- efficacy not yet proven
- CDC working on quality assurance
- Perkin-Elmer GSP test under FDA review; creatine : creatinine & CLIR?; other data analytics methods?

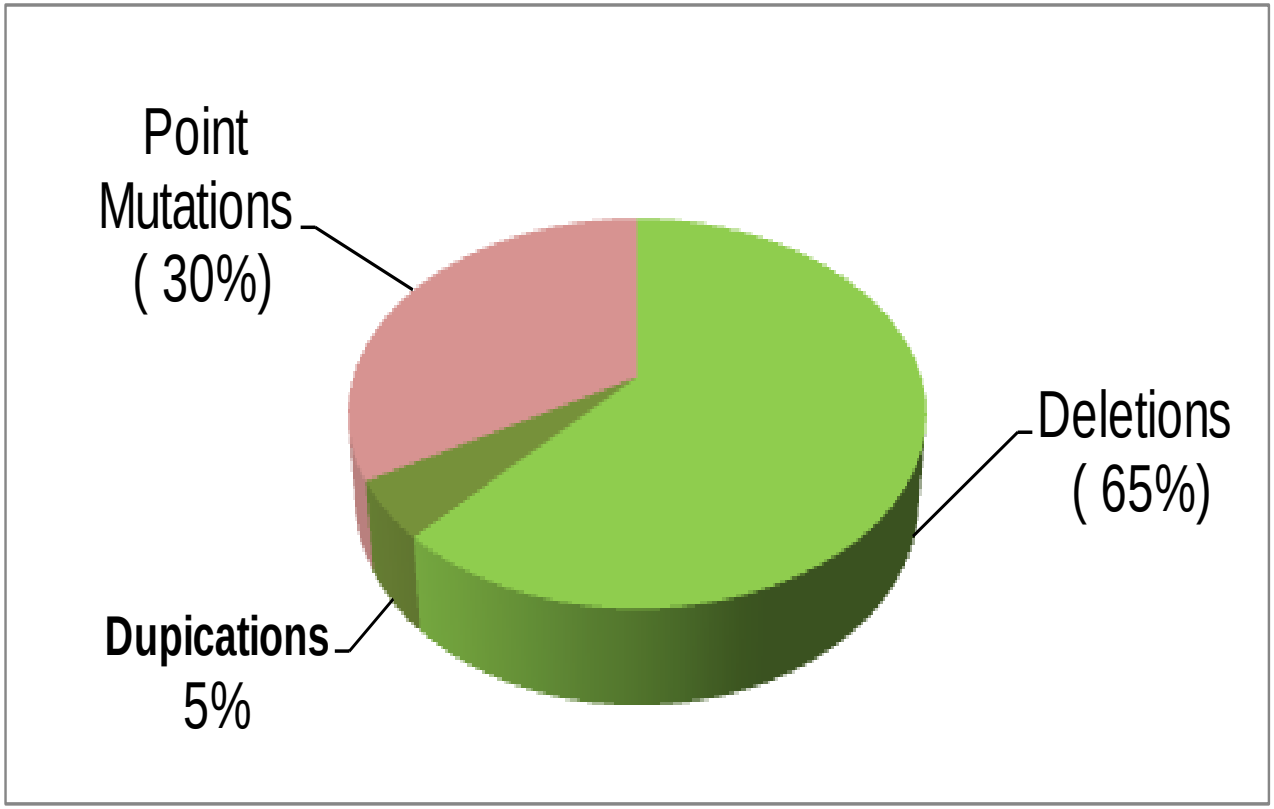
Tortorelli et al., GIM epub: doi 10.1038/gim2017.190

Newborn Screening for DMD - Past

- NBS programs existed during two decades in at least 8 countries (UK, Germany, France, Belgium, USA, Australia, New Zealand, Canada), Wales had a false negative rate that was unacceptable 66 affected and 15 false negatives
- Pilot program models all involved a single-tier analysis using Creatine Kinase (CK) in 2 steps: CK activity testing from DBS, confirmation from serum sample + DNA analysis from samples with high CK concentrations
- CDC-Mendell collaboration/pilot study in US 2008-2013
  - Two-tier system of analysis for newborn screening - initial biochemical CK from DBS sample -> direct molecular analysis from same DBS; 2 cut off levels studied
  - Low false positive rate (< 0.2%)
  - No data on false negative rate

Newborn Screening for DMD

- Spectrum of variants known
- No “common” variants- required to screen full gene (deletion/duplication; reflex to DNA sequence analysis)
- New therapy – earlier treatment beneficial- ataluren for exon skipping; variant specific
- Current option is earlier steroid treatment; not studied in newborns
- Avoid another pregnancy
- 100K pilot study ongoing

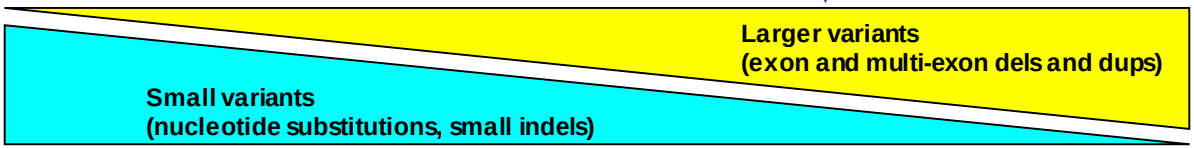

Point Mutations (30%)
Deletions (65%)
Dupications 5%

Variant Spectrum

Duchenne Muscular Dystrophy (*DMD*)

30% small variants

65-70% deletions/duplications



Limb Girdle Muscular Dystrophy

>90% small variants

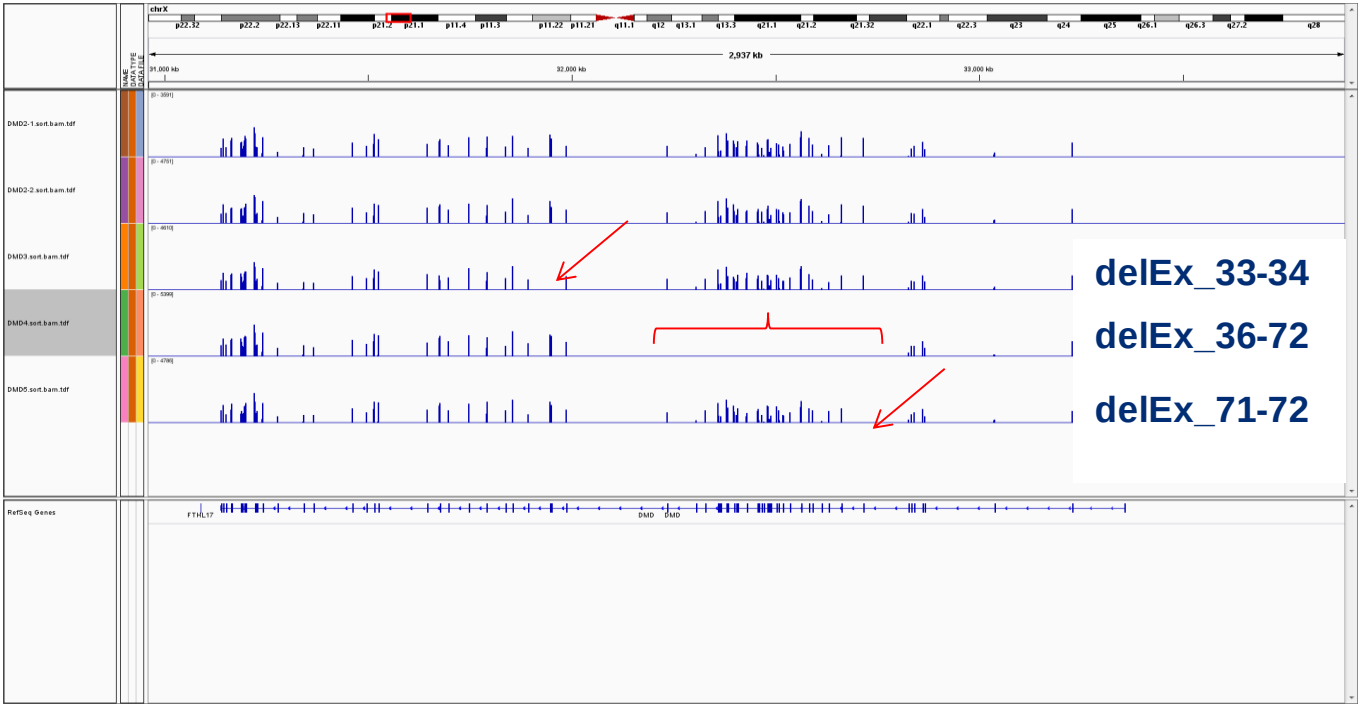
<10% deletions/duplications

Pompe disease

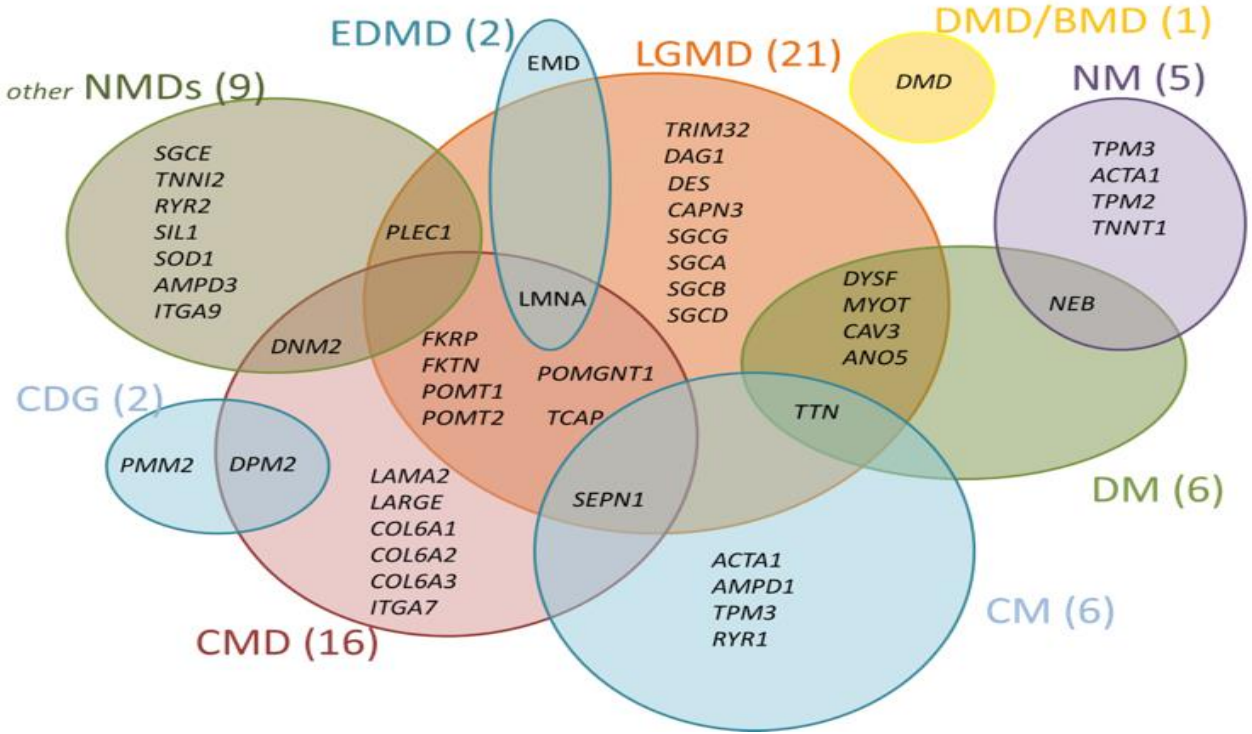
Common variants- c.-45T>C

Exon 18 deletion

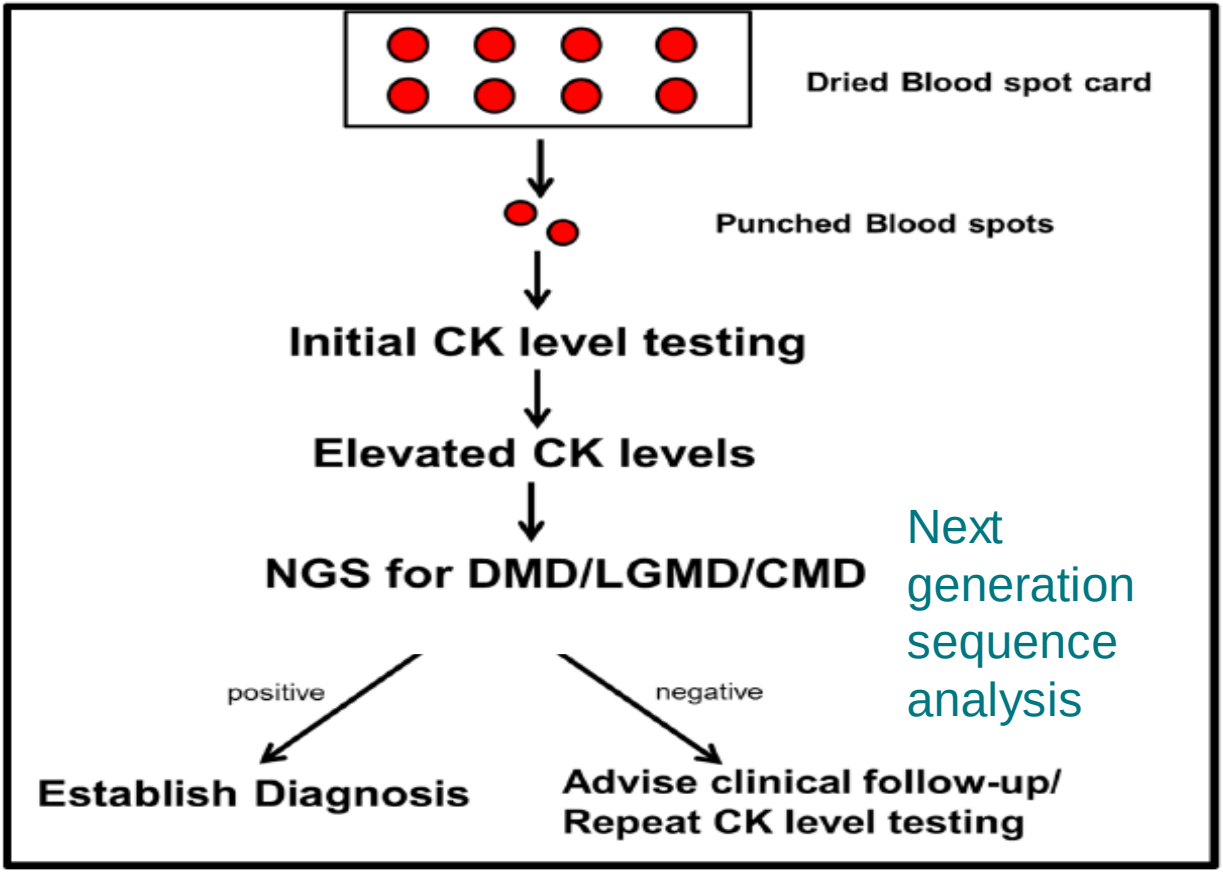
Copy Number Variant (CNV) Analysis



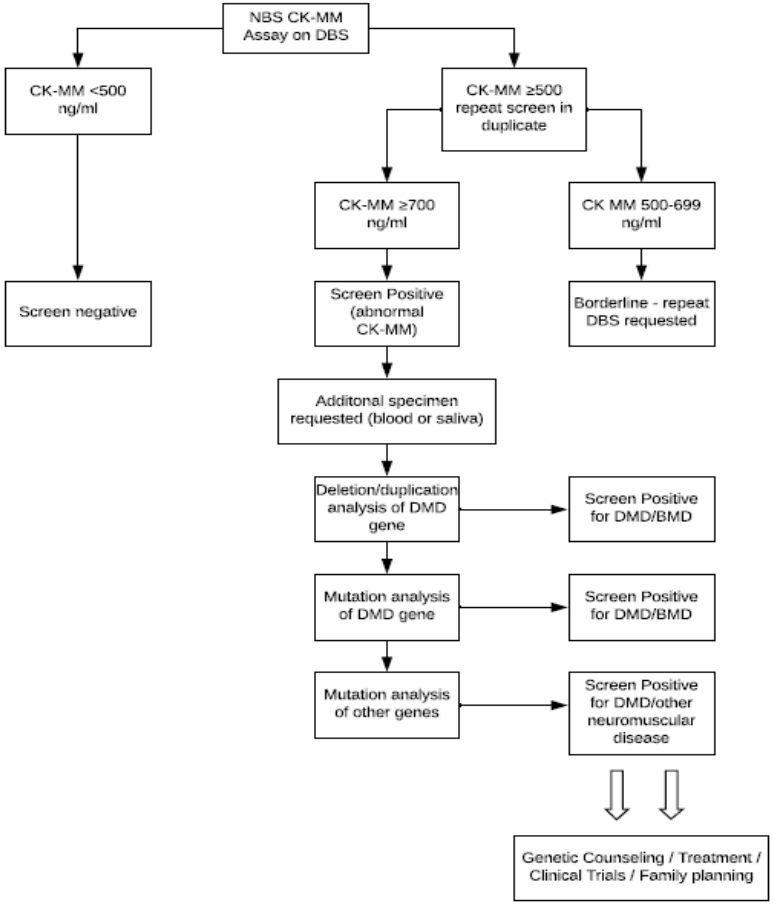
LGMD and Other Muscular Dystrophies



More than 25 LGMD types are linked to specific gene loci



Next generation sequence analysis



Testing Strategy For DMD for NY Pilot

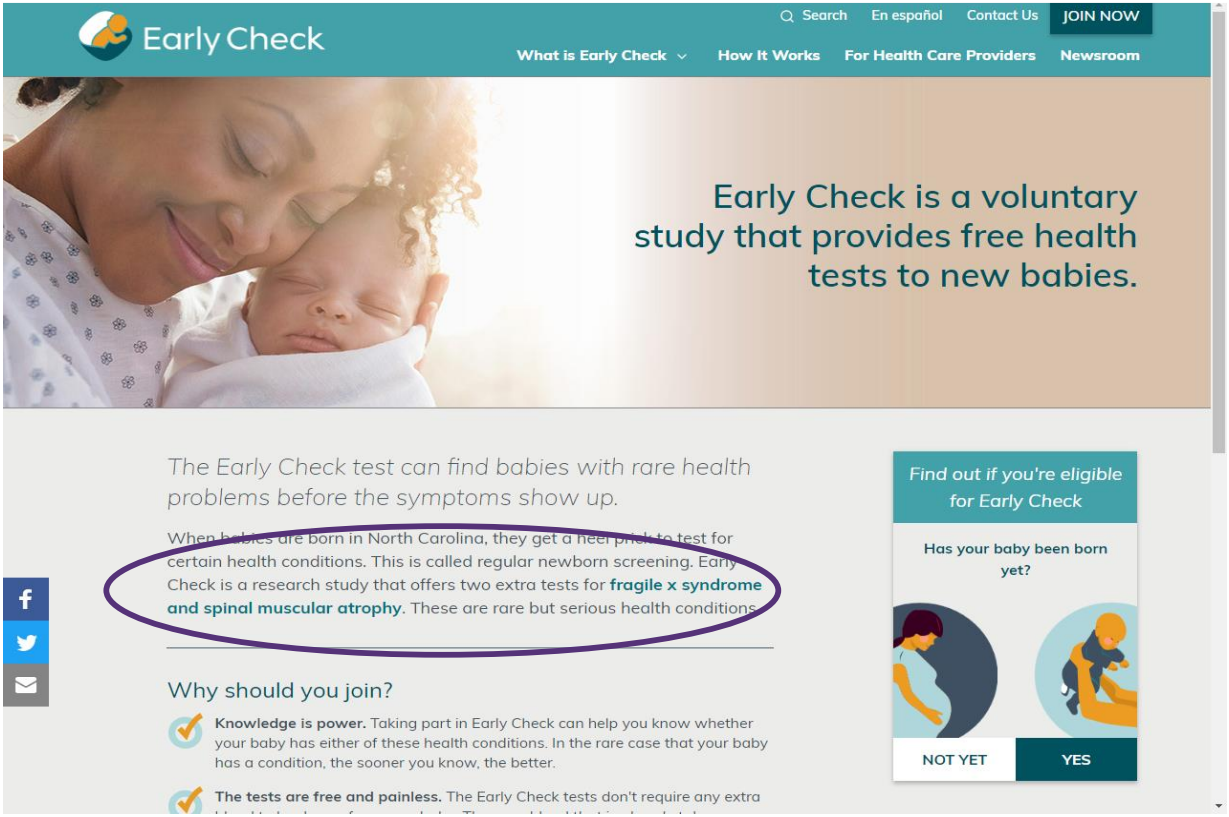
NEW YORK STATE Department of Health | Wadsworth Center

Growing List

- SCID – CDC funded study—39 gene panel
- Pompe disease
- Hemoglobinopathies
- Adrenoleukodystrophy
- Mucopolysaccharidosis type 1
- Krabbe disease
- Galactosemia
- Medium-chain and very long-chain acyl-CoA dehydrogenase deficiencies
- Cystic fibrosis – tiered approach with full gene
- Spinal muscular atrophy
- 21+ gene panel

Lysosomal Disease Pilot

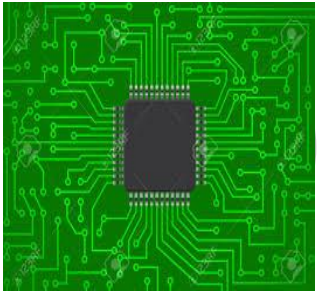
- Mucopolysaccharidosis Type 1
- Gaucher disease
- Fabry disease
- Niemann-Pick disease
- NICHD funded; ELSI component
- Moving to NYScreenPlus; 13 conditions starting in July, 2020
- Funding to Dr. Melissa Wasserstein


Early Check
Search
En español
Contact Us
JOIN NOW
What is Early Check
How It Works
For Health Care Providers
Newsroom
Early Check is a voluntary study that provides free health tests to new babies.
The Early Check test can find babies with rare health problems before the symptoms show up.
When babies are born in North Carolina, they get a heel prick to test for certain health conditions. This is called regular newborn screening. Early Check is a research study that offers two extra tests for fragile x syndrome and spinal muscular atrophy. These are rare but serious health conditions.
Why should you join?
Knowledge is power. Taking part in Early Check can help you know whether your baby has either of these health conditions. In the rare case that your baby has a condition, the sooner you know, the better.
The tests are free and painless. The Early Check tests don't require any extra
Find out if you're eligible for Early Check
Has your baby been born yet?
NOT YET
YES

Dogma is Changing

- **Need for Information (move to pilot testing)**
- **Technology**
- **Rapid Clinical Advances –**
- **Personalized Medicine growing list of new treatments**

atccggacttaatcg
atcctttgatac……..



Thank You !!


CAGTA
CAGCAAT
CAATTCAGT
AATATGCTCTAT
CTAAGCATCCTCC
GTGCTATGAATC
INFANT'S