



Inova Translational Medicine Institute Update

**Fairfax County
Economic Advisory Commission**

Dr. John Deeken
October 31, 2017



To improve the health of the diverse communities we serve through the application of genomics and associated molecular science to drive intelligent individualized care.

STARTED

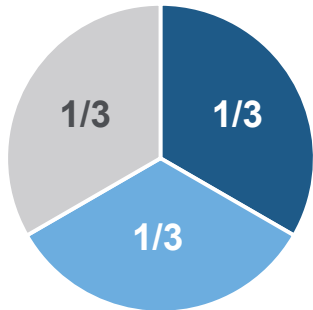
2010

GOAL


Research on integration of genomic information into the practice of medicine

STAFFING

78 Employees



 **clinical care & clinical research**

 **bioinformatic / IT**
(includes epidemiology)

 **laboratory**



Themes

- Trio-based whole genomic sequencing (WGS)
- Other 'omics
- Every tissue
- Comprehensive clinical data
- Unified database



Major Studies

- Pre-term Birth Study
- Congenital Abnormality Study
- Childhood Longitudinal Study

Smaller Studies

- Heart Failure (adults)
- Microbiome (pediatric)

Data

- WGS + 'omics + clinical data + patient reported data
- Biobank: blood, saliva, other tissues

Molecular associations with preterm birth

- 363 preterm trios, 589 full term trios
- WGS + 'omics + clinical data
- Biobank: blood, buccal mucosa, saliva, cord blood, placenta
- Completed enrollment in 2015
- Research results as manuscript submitted for review to leading journal



For patients with undiagnosed congenital / genetic abnormality

- NICU / newborn OR Adolescent / Adult
- Trio-based whole genome sequencing approach
- More than **125 families** helped thus far

Example

Vici Syndrome

Impacts children early in life with profound developmental delay, progressive microencephaly, neonatal cataracts, progressive cardiomyopathy, and immunodeficiency.

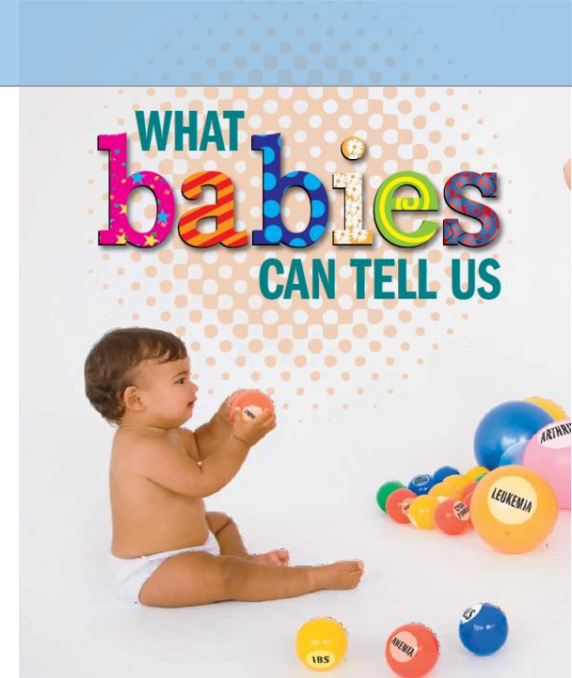
We discovered a genomic basis.

Now working with the NIH, Kansas University, and King's College of London to perform large scale drug screening to see if we can find a medicine that someday may help these children.



Whole genome + 'omics + clinical data + parent reported data on more than 3,400 children

- Longitudinal study
 - Original vision of first 1,000 days now extended to 18 years
 - Oldest turn 5 this year, youngest born this week
- Parents surveyed every 6 months
 - Diet & nutrition, growth & development, overall health
 - Specific health issues (autism risk, asthma, allergies)
 - Multiple metrics of familial psychological/psychosocial well-being
- Clinical data updated when care received at Inova
- Biobank
 - Prenatal and delivery: Blood, saliva, urine, cord blood, placenta
 - Longitudinal: blood, urine, hair, teeth, toenails



ITMI along with a team from Harvard University, University of North Carolina, and Mount Sinai Hospital (NYC) won a large grant to study the impact of nutrition, environmental factors, and genomics on neurocognitive development

- 3,000 of the children in the Fairfax Study will be enrolled in this study
- Grant to ITMI: \$9.3 million over 7 years

Impact of NIH funding

- Every dollar in NIH funding generates double that in economic development
- Every \$1 million in NIH funding creates 11.1 new jobs



ECHO

Environmental influences
on Child Health Outcomes

A program supported by the NIH

ECHO & Inova: Childhood Health Outcome

Family Enrollment
(Trio-based Enrollment)



Data Analysis
Return of Results



Longitudinal Follow-up
(Survey, clinical)



Sample Collection
(Prenatal and Delivery)

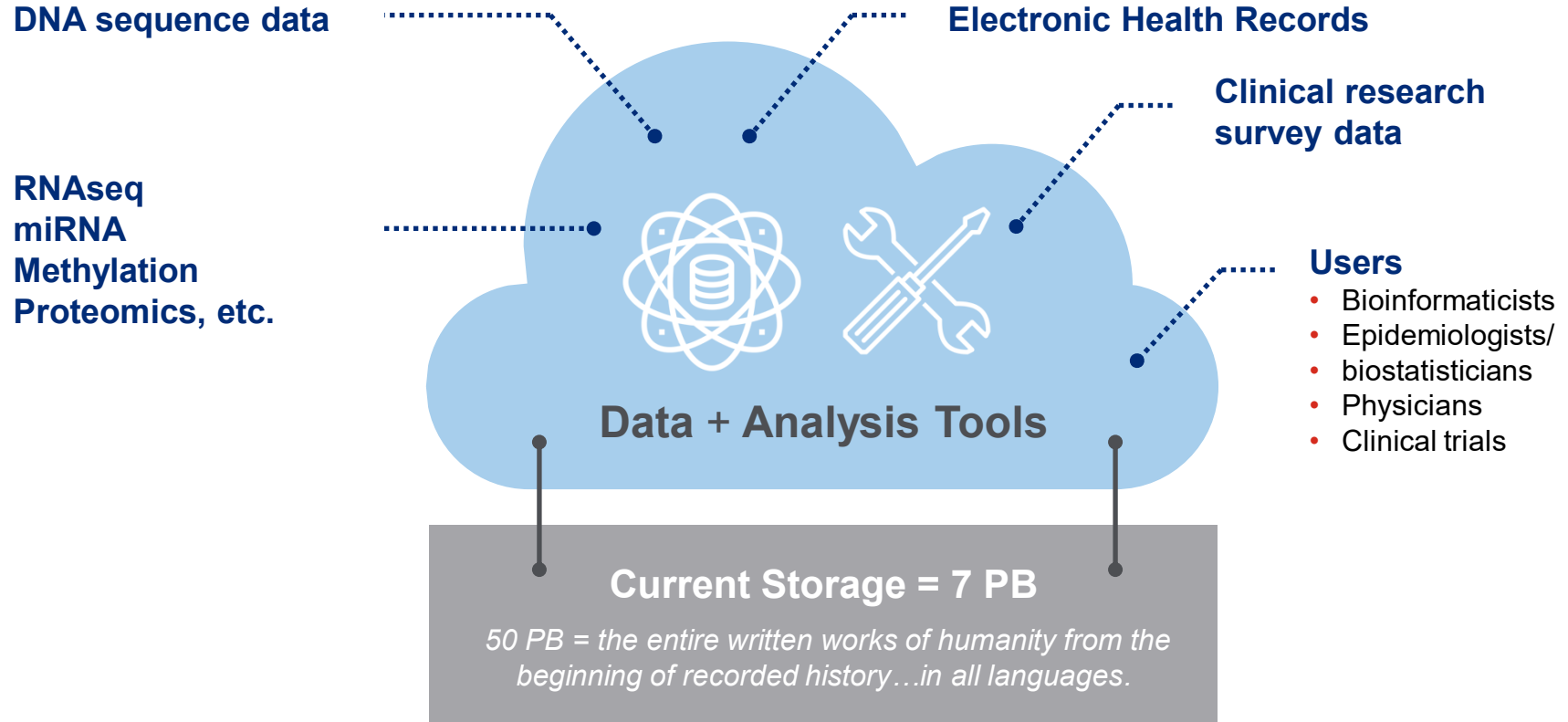


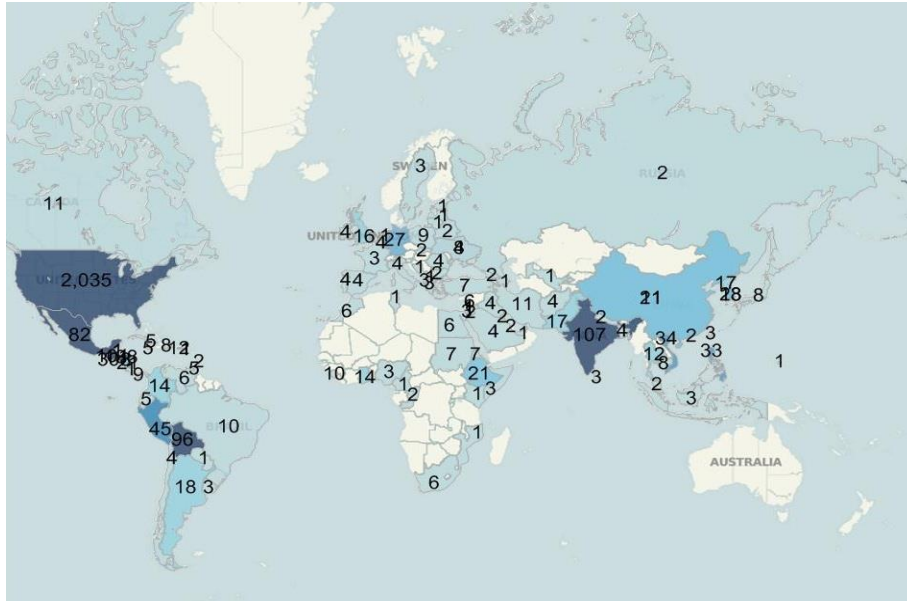
Health and Medical History Data



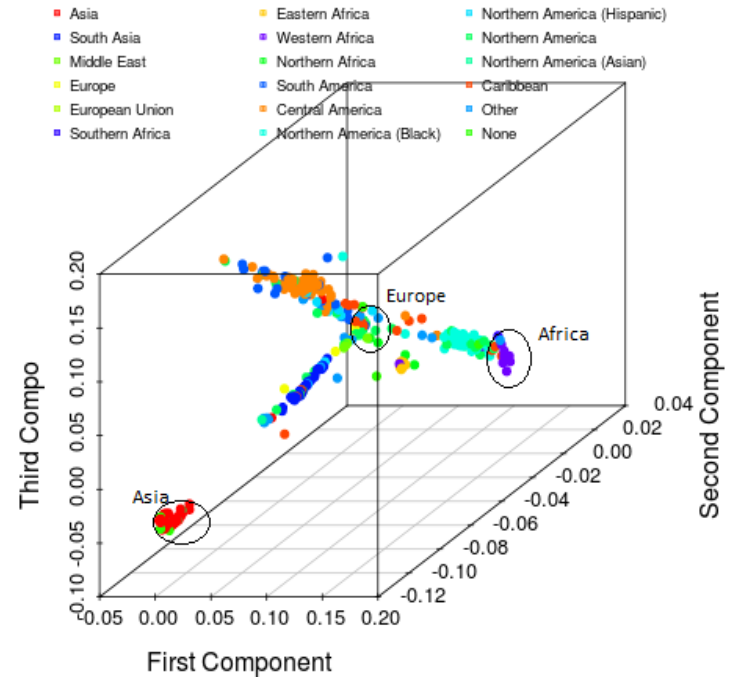
Genetic (WGS, RNA, Seq) and Epigenetic (Methylation, miRNA)







>110 Countries of birth (parents)



- Childhood obesity has more than **doubled** in children in the past 30 years.*
- Obesity is a **multifactorial** condition.*
- Obesity prevalence differs among **racial/ethnic** groups.*
- In 2011-2012, the prevalence among children and adolescents was higher among **Hispanics (22.4%)** and non-Hispanic blacks (20.2%) than among non-Hispanic whites (14.1%).*
- **Multiple genetic variants** have been associated with adult obesity and **a few** with severe obesity in childhood; however, less progress has been made in establishing genetic influences on common early-onset obesity.**

*<http://www.cdc.gov/obesity/data/childhood.html>

**Early Growth Genetics (EGG) Consortium. "A genome-wide association meta-analysis identifies new childhood obesity loci." *Nature genetics* 44.5 (2012): 526-531.

WHO: Weight & Length

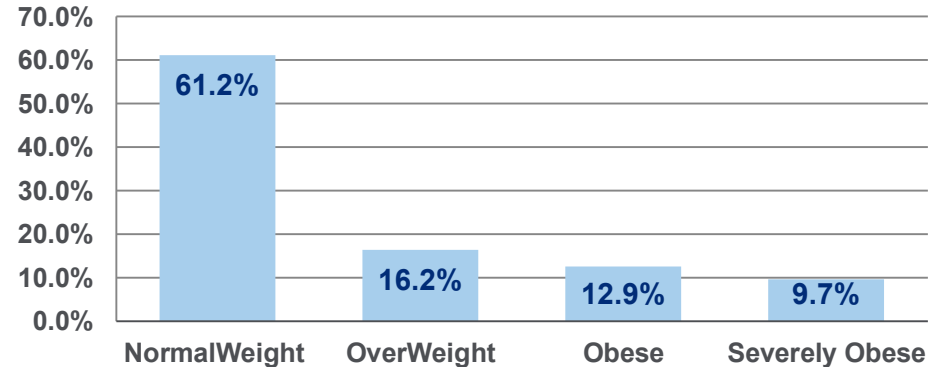
Categories

- Normal Weight (<85th)
- Overweight (85th to <95th)
- Obese (95th to <99th)
- Severely Obese (>= 99th)

Risk factors

- Paternal BMI, weight gain during pregnancy
- Breast feeding at 6 months, juice consumption, french fry consumption
- Genomic risk variants identified (especially in Hispanic children)
- Project ongoing

Prevalence of Childhood Obesity in the Longitudinal Study (at 12M)



Pharmacogenomics = using genetics to help pick right drug and right dose for each patient

In 2016, Inova Health System through ITMI began providing pharmacogenomic testing at no cost to all newborns born at Inova Fairfax Hospital

- More than 7,000 have been tested
- 97% had some genomic finding that impacts what medications they should — and shouldn't — receive.
- This year we are expanding this to Fair Oaks, Alexandria, and Loudoun Hospitals (no OB ward at Mt Vernon)



ITMI Employs Clinical Geneticists and Genetic Counselors

- Pediatric / NICU Care
- Cancer Genetics Clinic
- Cardiology Genetics
- All patients seen regardless of insurance status

Challenge: Genetic Counselors hard to find

- In the U.S., there are 5 open positions for every 1 Counselor
- We are in discussions with George Mason University to develop a training program for our region

Internships

- College students during the summer
 - Inova policy: with patient care or in the laboratory, interns have to be >18 years

Medical Students

- Part of lectures VCU students receive at the Inova campus
- Research clerkships offered to interested students (month-long)

Genetic Counselors

- Trainees from NIH program rotate to Inova as part of their clinical clerkships

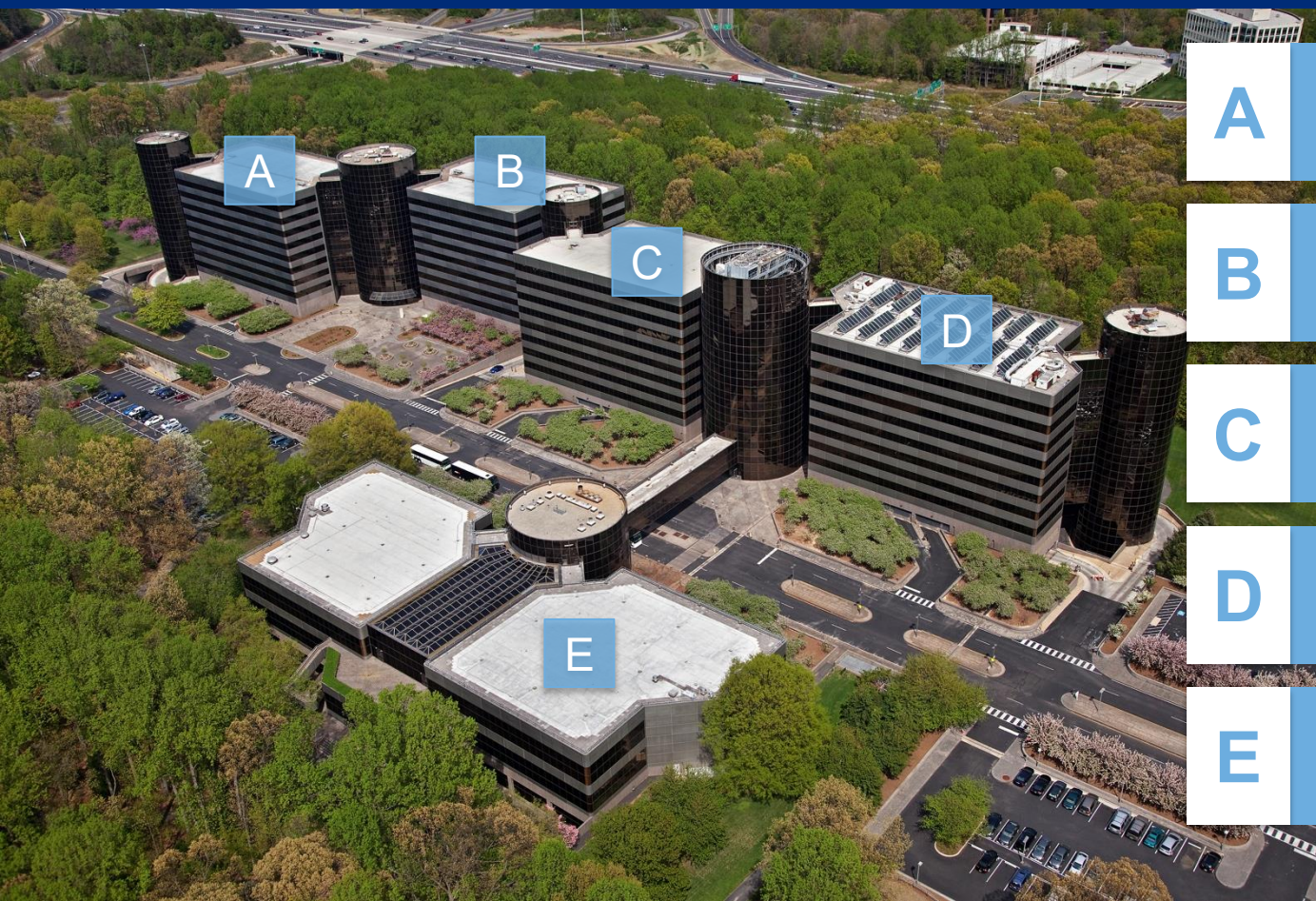
- County has provided portion of ITMI's research budget every year for past 4 years
- Critical for the Fairfax Childhood Longitudinal Study and our other research and clinical programs
- As we pursue funding from state and federal agencies, as well as from foundations and philanthropy, this funding shows our local government's and community's support for the mission and research being done at ITMI
- Our success would not have been possible without this critical County support

- More than 60 articles published over the past 4 years
- More than 90 presentations at scientific conferences around the country and the world
- More than two dozen companies have expressed interest in research collaborations, even locating to ICPH
- Leveraged the County's support with philanthropic giving, including more than \$1 million for ITMI
- Laying the foundation for ICPH campus ... and more than \$60 million in philanthropic support for the Schar Cancer Institute



Inova Schar Cancer Institute

Inova Center for Personalized Health Campus Usage



A

Inova Clinic

B

Inova Schar Cancer Institute

C

Global Genomics
& Bioinformatics
Research Institute

D

Virtual Health, ISI, IPHA

E

Conference and
Wellness Center

Virginia state-funded research plan for ICPH campus

Capital funding approved summer 2017

- Commonwealth of Virginia: \$20M
- University of Virginia: \$45M
- Inova \$45M
- George Mason University: \$1M

Operation Budget to recruit eminent scientists and researchers

- Commonwealth of Virginia: \$8M
- UVa: \$8M +
- Inova: \$8M

Partnerships with Virginia Universities



...and more

ITMI is initial building block for this new joint Institute



