



PEDSNET AND PATIENT CENTERED OUTCOMES RESEARCH IN CHILDREN

PRECISION MEDICINE AND PRECISION PREVENTION: A PATIENT CENTERED PERSPECTIVE

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DISCLOSURES

F. Sessions Cole, M.D., serves on the Reproductive and Genetic Health Clinical Expert Panel of Illumina, Inc., and on the Scientific Advisory Board for ClearLine MD.

BACKGROUND: CHILD HEALTH

I. Pediatric population in the United States

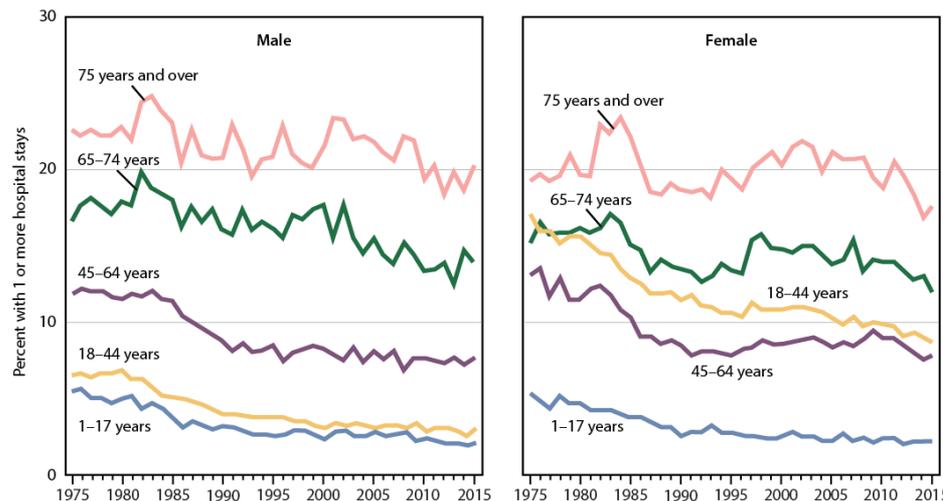
a. Pediatric population trends

Number (in millions)	1950	1970	1990	2010	2015	2020
All children	47.3	69.8	64.2	74.1	73.6	74.1
Age						
Ages 0-5	19.1	20.9	22.5	24.3	23.9	24.6
Ages 6-11	15.3	24.6	21.6	24.6	24.7	24.3
Ages 12-17	12.9	24.3	20.1	25.3	25.0	25.2

U.S. Census Bureau, *Current Population Reports*

II. Hospital stays

a. By age and sex



Children are healthier and less likely to require hospitalization than adults

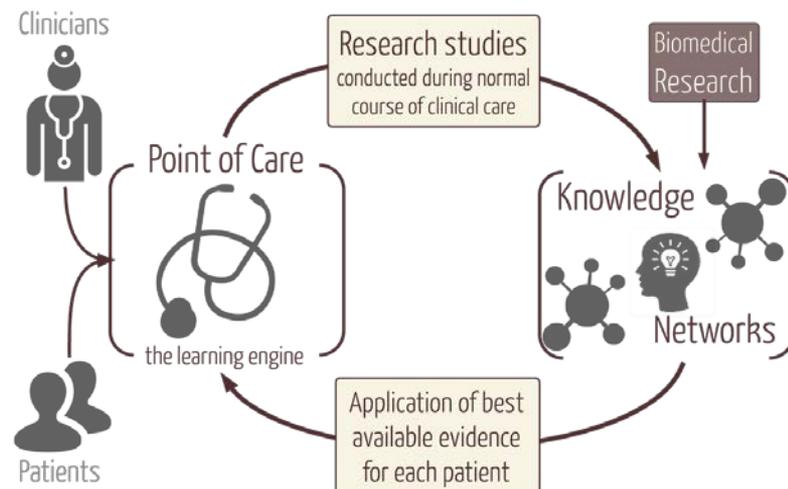
BACKGROUND: CHILD HEALTH

- III. Rapid developmental changes make precision medicine not only genome-specific but also age-specific in children
 - a. Genomic susceptibility to disease may be developmentally regulated
 - b. **Precision medicine for children:** each child's individual genomic, developmental, and environmental variability taken into account when deciding on a diagnostic or treatment strategy
- IV. PEDSnet launched in 2014 funded by the Patient-Centered Outcomes Research Institute (PCORI) as 1 of 13 Clinical Data Research Networks (CDRNs) and 20 Patient Powered Research Networks (PPRNs)
 - c. CDRNs represent partnerships among health clinics, hospitals, and other health systems with ability to collect and use information from multiple data sources such as electronic health records, claims data, and pharmacy benefits management data
 - d. PPRNs formed by patients/participants to promote information exchange on a specific health issue or disease and find answer to improve health outcomes that are important to patients and families
 - e. Large networks of hospitalized or ambulatory pediatric patients required for statistically meaningful cohort size to compare treatments (e.g., pharmaceuticals)
 - i. PEDSnet provides access to electronic health record data in a common data model from >6,000,000 children seen in 8 geographically dispersed Children's Hospitals gathered since 2009
 - f. PEDSnet is a national community of hospitals, health care organizations, researchers, clinicians, patients, and families whose goal is to identify and study the most important research questions that can reduce child suffering and support healthy development as quickly and inexpensively as possible

PEDSNET STRATEGIES TO ADVANCE PATIENT-CENTERED, PRECISION MEDICINE FOCUSED RESEARCH IN CHILDREN

- I. PEdSnet is a learning health system focused on children
 - I. Organized around communities of patients, families, front-line clinicians, researchers, and health system leaders who collaborate to produce and use pediatric healthcare data
 - II. Creates large electronic health and healthcare data sets
 - III. Conducts observational research, clinical trials, and population health studies in clinical care settings to provide better information for health and healthcare decision-making
 - IV. Strives to improve quality of care for each patient by applying relevant new knowledge generated through research at the point of care

Institute of Medicine. 2007. *The Learning Healthcare System: Workshop Summary*. Washington, DC: The National Academies Press



PRECISION MEDICINE FOR CHILDREN EXAMPLE: MEDICATION DOSING IN CHILDREN

- I. Children are underrepresented in clinical trials including pharmaceutical testing
 - a. In 2015 (ClinicalTrials.gov), 6% of 19,239 trials focused on children (birth to 17 years) although this age group represents ~25% of the U.S. population (JAMA 2017;317:259)
 - b. Off-label prescribing estimated to involve 85% of 57,000 hospitalized children nationally (J Pediatr Pharmacol Ther 2015;20:186)
- II. PEDSnet: provides infrastructure through which the results and outcomes of clinical decision inform best practices, implementation science, and new research directions for children
 - a. Because serious illness is uncommon in children, generating and applying new knowledge require networks of institutions
 - b. PCORI common data model required adaptation to optimize standardized data relevant to children (e.g., gestational age, immunization records, growth charts)
 - c. PEDSnet also empowers patients and families to be involved in research design and decision-making
 - I. Patient and family engagement strategies may be unique to specific disease cohorts
- III. Improved pediatric medication efficacy and safety through therapeutic drug monitoring: development of drug dosing dashboards that are disease-, age-, sex-, and race-specific
 - a. Drug monitoring (pharmacodynamics, pharmacokinetics) difficult and expensive – pooling data from multiple patients across institutions required

PRECISION MEDICINE FOR CHILDREN EXAMPLE: THE LEARN FROM EVERY PATIENT PROGRAM

- I. A pilot program at Nationwide Children’s Hospital designed to integrate fully research, clinical care, and quality improvement to improve care for children with cerebral palsy (JAMA 2016;316:2481)
 - a. Program included: (1) implementation of standardized care (evidence- and expert opinion–based), (2) systematic discrete collection of research data as part of all clinical visits, designed specifically to answer physicians’ clinical questions to improve patients care
 - b. 131 children at a single center compared to 689 children with cerebral palsy at the same center who received standard of care (but not standardized care) during same period

c. Results:

	LFEP Program ¹	Comparison group ¹
Inpatient admissions	0.75 to 0.55 (27%)	0.48 to 0.46 (4%)
Total inpatient days	4.67 to 2.68 (43%)	4.54 to 2.79 (38%)
Emergency dept. visits	1.18 to 0.83 (30%)	0.67 to 0.68 (2%)
Urgent care visits	0.50 to 0.35 (29%)	0.31 to 0.28 (10%)
Total health care charges	\$42 045 to \$31 700 (25%)	\$42 845 to \$39096 (9%)
¹ per child year		
Dev Med Child Neurol 2017 59:183		

SUMMARY

- I. PEDI-net provides the PCORI-compatible infrastructure of a national learning health system focused on child health
- II. PEDI-net permits evaluation of strategies to individualize care for each child with statistically appropriate cohorts, access to electronic health record data, and engagement of patients and families in development of research questions
- III. PEDI-net also addresses relevant regulatory, legal, and data use agreements required for exchange of child health data

