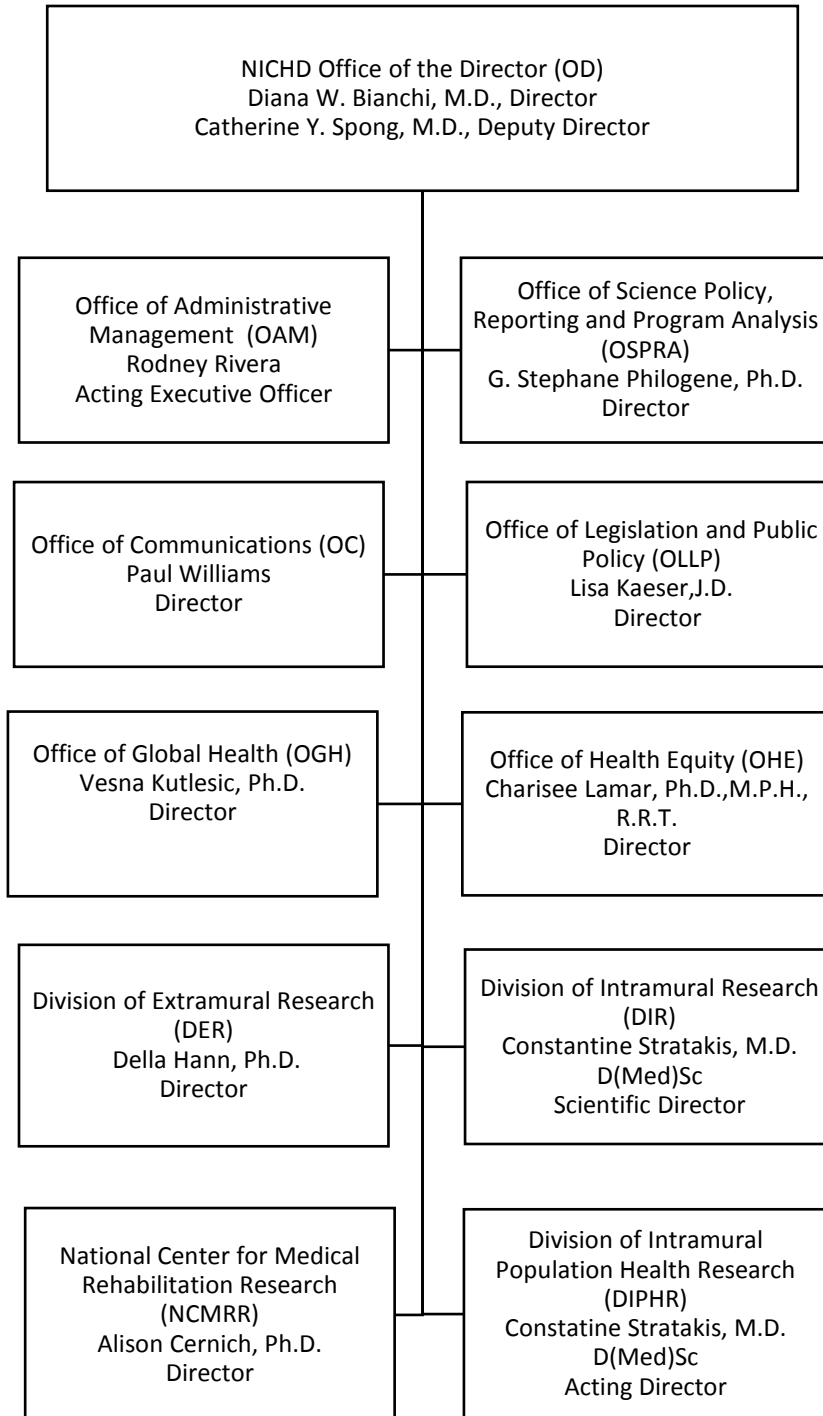


DEPARTMENT OF HEALTH AND HUMAN SERVICES
NATIONAL INSTITUTES OF HEALTH

Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)

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NATIONAL INSTITUTES OF HEALTH
National Institute of Child Health and Human Development



NATIONAL INSTITUTES OF HEALTH

Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)

For carrying out section 301 and title IV of the PHS Act with respect to child health and human development, \$1,339,592,000.

NATIONAL INSTITUTES OF HEALTH
National Institute of Child Health and Human Development

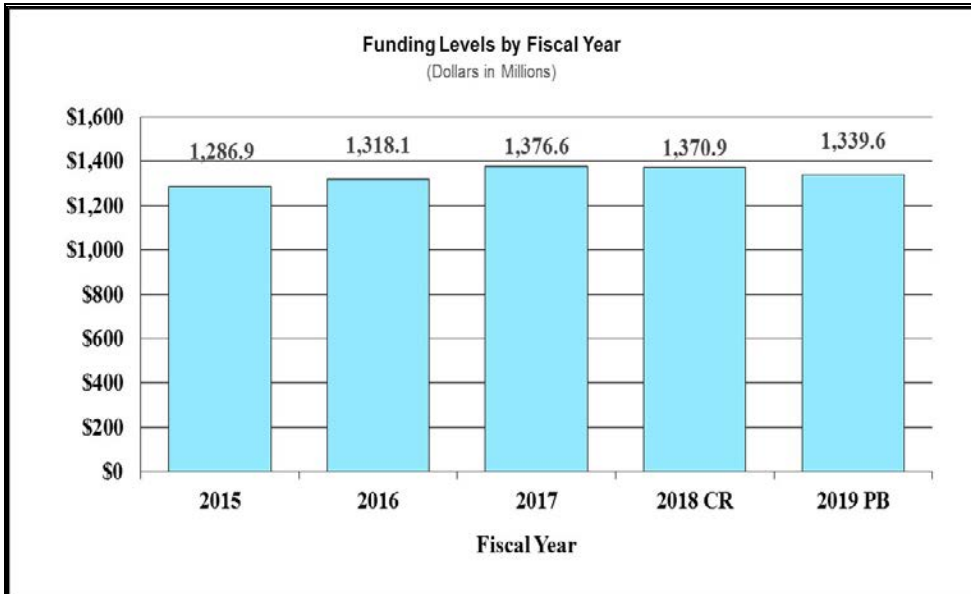
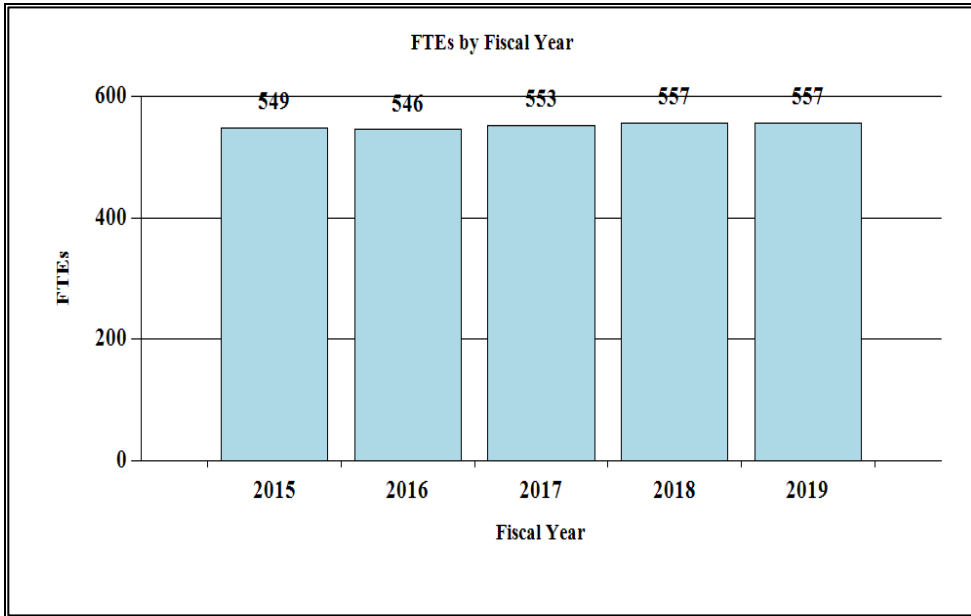
Amounts Available for Obligation¹
(Dollars in Thousands)

Source of Funding	FY 2017 Final	FY 2018 Annualized CR	FY 2019 President's Budget
Appropriation	\$1,380,295	\$1,380,295	\$1,339,592
Mandatory Appropriation: (non-add)			
<i>Type 1 Diabetes</i>	(0)	(0)	(0)
<i>Other Mandatory financing</i>	(0)	(0)	(0)
Rescission	0	-9,374	0
Sequestration	0	0	0
Secretary's Transfer	-3,076	-	-
Subtotal, adjusted appropriation	\$1,377,219	\$1,370,921	\$1,339,592
OAR HIV/AIDS Transfers	-611	0	0
Subtotal, adjusted budget authority	\$1,376,608	\$1,370,921	\$1,339,592
Unobligated balance, start of year	0	0	0
Unobligated balance, end of year	0	0	0
Subtotal, adjusted budget authority	\$1,376,608	\$1,370,921	\$1,339,592
Unobligated balance lapsing	-67	0	0
Total obligations	\$1,376,541	\$1,370,921	\$1,339,592

¹ Excludes the following amounts (in thousand) for reimbursable activities carried out by this account:
FY 2017 - \$29,237 FY 2018 - \$30,000 FY 2019 - \$30,000

Fiscal Year 2019 Budget Graphs

History of Budget Authority and FTEs:



**NATIONAL INSTITUTES OF HEALTH
National Institute of Child Health and Human Development**

Authorizing Legislation

	PHS Act/ Other Citation	U.S. Code Citation	2018 Amount Authorized	FY 2018 Annualized CR	2019 Amount Authorized	FY 2019 President's Budget
Research and Investigation	Section 301	42§241	Indefinite	\$1,370,921,417	Indefinite	\$1,339,592,000
National Institute of Child Health and Human Development	Section 401(a)	42§281	Indefinite		Indefinite	
Total, Budget Authority				\$1,370,921,417		\$1,339,592,000

NATIONAL INSTITUTES OF HEALTH
National Institute of Child Health and Human Development

Appropriations History

Fiscal Year	Budget Estimate to Congress	House Allowance	Senate Allowance	Appropriation
2009	\$1,255,920,000	\$1,299,059,000	\$1,290,873,000	\$1,294,894,000
Rescission	-	-	-	\$0
2010	\$1,313,674,000	\$1,341,120,000	\$1,316,822,000	\$1,329,528,000
Rescission	-	-	-	\$0
2011	\$1,368,894,000	-	\$1,366,750,000	\$1,329,528,000
Rescission	-	-	-	\$11,674,048
2012	\$1,352,189,000	\$1,352,189,000	\$1,303,016,000	\$1,323,900,000
Rescission	-	-	-	\$2,502,171
2013	\$1,320,600,000	-	\$1,324,603,000	\$1,321,397,829
Rescission	-	-	-	\$2,642,796
Sequestration	-	-	-	(\$66,325,085)
2014	\$1,339,360,000	-	\$1,330,459,000	\$1,282,595,000
Rescission	-	-	-	\$0
2015	\$1,283,487,000	-	-	\$1,286,571,000
Rescission	-	-	-	\$0
2016	\$1,318,061,000	\$1,305,586,000	\$1,345,355,000	\$1,339,802,000
Rescission	-	-	-	\$0
2017 ¹	\$1,338,348,000	\$1,373,408,000	\$1,395,811,000	\$1,380,295,000
Rescission	-	-	-	\$0
2018	\$1,032,029,000	\$1,401,727,000	\$1,426,092,000	\$1,380,295,000
Rescission	-	-	-	\$9,373,584
2019	\$1,339,592,000	-	-	-

¹ Budget Estimate to Congress includes mandatory financing.

Justification of Budget Request

Eunice Kennedy Shriver National Institute of Child Health and Human Development

Authorizing Legislation: Section 301 and Title IV of the Public Health Service Act, as amended.

Budget Authority (BA):

	FY 2017 Final	FY 2018 Annualized C.R.	FY 2019 President's Budget	FY 2019 +/- FY 2018
BA	\$1,376,608,000	\$1,370,921,417	\$1,339,592,000	-\$31,329,417
FTE	553	557	557	0

Program funds are allocated as follows: Competitive Grants/Cooperative Agreements; Contracts; Direct Federal/Intramural and Other.

Director's Overview

For over five decades, the *Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD)* has provided dedicated national leadership and scientific expertise for research involving children, pregnant women, and people with disabilities. In scientific domains encompassing developmental biology, reproductive health, pediatrics, population health, and medical rehabilitation, NICHD's research portfolio has advanced the biomedical and behavioral health of many Americans. Today, the United States faces an array of both emerging and long-standing challenges that threaten to erode previous gains in public health. Fortunately, the NICHD is well-positioned to accelerate the science needed to address these challenges.

Among the top public health threats for 2017 is the epidemic of opioid addiction. An estimated two million individuals in the United States have an opioid use disorder associated with prescription opioids.¹ Unfortunately, thousands of pregnant women are among this number². Neonatal opioid withdrawal syndrome (NOWS), a condition caused by exposure to opioids during pregnancy, is now widespread in neonatal intensive care units all across the country. However, health care providers lack standard, evidence-based treatments for pregnant women with opioid use disorder and newborns affected by NOWS. NICHD has established key partnerships to mobilize researchers and clinical experts to address this epidemic. The Institute held a groundbreaking scientific workshop, bringing together experts to identify the new research needed to improve clinical outcomes for affected women, their newborn infants, and their families.³ NICHD is spearheading a large trans-NIH collaborative study to address critical gaps on how best to treat and manage opioid withdrawal syndrome in newborns.⁴ NICHD has also supported population health researchers who are studying the spread of the opioid epidemic

¹ <https://www.ncbi.nlm.nih.gov/pubmed/28687823>.

² SAMHSA, Center for Behavioral Health Statistics and Quality, National Surveys on Drug Use and Health (NSDUHs), 2007 to 2012. https://www.samhsa.gov/data/sites/default/files/report_2724/ShortReport-2724.html.

³ <https://www.ncbi.nlm.nih.gov/pubmed/28594753>.

⁴ <https://www.nichd.nih.gov/news/releases/Pages/100217-ACTNOW.aspx>.

in young people. Researchers analyzed nationally representative population survey data and found that between 2002 and 2014, opioid use disorder increased substantially among young adults (age 18-34), but did not increase significantly among adolescents (age 12-17).⁵

Public health threats from infectious diseases can emerge suddenly and unexpectedly, as in the case of the outbreak of the mosquito-borne Zika virus. NICHD's expertise in fundamental, clinical, and translational research in pregnancy and early childhood brings advanced scientific knowledge to bear on these challenges. Infection in pregnant women can lead to birth defects in developing fetuses and newborns, but long-term outcomes for children exposed to the virus in the womb are largely unknown. In partnership with other NIH institutes and organizations around the world, NICHD has undertaken a study to evaluate the health risks that Zika virus infection poses to pregnant women and their developing fetuses and infants. The Zika in Infants and Pregnancy Study includes women and infants in 6 areas around the world, including Puerto Rico and Brazil.

NICHD is also supporting fundamental research on the Zika virus' mechanisms of action and how it reaches the fetus. Researchers are studying how Zika penetrates the barriers that stop most viruses from reaching a developing fetus, advancing research that could help the medical community fight the virus and others like it. NICHD-supported scientists have developed a mouse model that shows how gestational age affects Zika transmission through the placenta. Although the Zika virus appears to be subsiding after a worldwide outbreak in 2016, the infection brought new attention to how little researchers know about the placenta and underscored the need for further research in this area in preparation for future infectious disease outbreaks. NICHD's Human Placenta Project aims to improve understanding of the structure and function of the placenta, by supporting scientists in obtaining real-time data on how the placenta works to protect the fetus from a variety of threats, including infection.

Some of the most intractable public health problems are those that are deeply rooted in both biology and behavior. Childhood obesity is a stark example; although rates of obesity in children have been rising for several decades, efforts to address the problem have met with limited success. NICHD scientists are investigating both the metabolic and behavioral underpinnings of the rise in obesity to develop and refine intervention strategies. For example, researchers are comparing a panel of metabolomic biomarkers to conventional biomarkers of glycemia, for identifying the progression of glucose tolerance (normal to prediabetes or prediabetes to diabetes) in overweight and obese children. The goal is to develop clearer targets for measuring intervention effects. A group of behavioral science researchers is also developing and testing an intervention designed for the fathers of young children to promote healthy eating and physical activity for both father and child.

The 21st Century Cures Act established the Department of Health and Human Services (HHS) Task Force on Research Specific to Pregnant Women and Lactating Women to advise the Secretary of HHS about addressing the gaps in knowledge and research on safe and effective therapies for pregnant and lactating women. NICHD was asked to lead the trans-agency Task Force, which will submit its recommendations to the Secretary of HHS by September 2018.

⁵ <https://www.ncbi.nlm.nih.gov/pubmed/27614657>.

Future progress in research depends on a diverse and talented workforce of new scientists with new ideas. NICHD will build on its successful training and career development programs to recruit and mentor the next generation of scientists. The Institute's training and career development programs have allowed early career scientists to bring new perspectives to developmental biology, pediatrics, reproductive health, medical rehabilitation, and other fields. For example, one of NICHD's career development awardees recently showed how a non-traditional model of group prenatal care affected pregnancy weight gain.

NICHD recognizes that many scientific domains central to its mission are again entering a period of unprecedented challenges and new opportunities. To capitalize on new opportunities for scientific exploration and address emerging challenges for child health and human development research, the Institute plans to develop a new five-year strategic plan beginning in 2018. This plan will be developed with input from a wide array of internal and external scientific advisers and stakeholders, and in collaboration with leadership and staff of NIH. As this new strategic plan is established, NICHD will continue to support research across the lifespan positioning the Institute to more effectively address many of the public health challenges we face as a nation.

Program Descriptions and Accomplishments

Reproductive Health, Pregnancy, and Perinatology

The program in reproductive health, pregnancy, and perinatology supports basic, clinical, and translational research on gynecologic disorders, fertility and infertility, pregnancy, and newborn care. NICHD manages a broad research portfolio to understand, treat, and prevent common, painful, and costly reproductive health conditions, including uterine fibroids, vulvodynia, pelvic floor disorders, and endometriosis. For example, scientists recently compared two minimally invasive uterine fibroid procedures to assess their advantages and disadvantages from a patient perspective. Women undergoing one procedure reported experiencing more post-procedure pain, using more prescription medications, and having longer total recovery times. In addition, the other procedure had a shorter treatment time, often requiring only one visit.

Millions of couples across the United States have difficulty conceiving or carrying a child, yet only limited information is available to understand the causes of infertility, minimize risk factors, and improve treatment options. For example, although there has been little research to support their use, tests to predict ovarian reserve (the number of a woman's remaining eggs before menopause) are routinely offered in many fertility clinics on the assumption that women with a lower ovarian reserve would be less likely to respond to treatment. However, researchers supported by both NICHD and the National Institute of Environmental Health Sciences (NIEHS) recently found that these tests do not appear to predict the short-term probability of conception among women from 30 to 44 years of age.

NICHD-funded research is helping to save infants' lives not only in the United States but also around the world. Recently, NICHD-supported researchers demonstrated that daily doses of beneficial bacteria, or probiotics, reduced the rate of sepsis—a life-threatening infection of the bloodstream—among newborns in India by 40 percent. The study is the first to show that probiotics therapy can prevent disease on a large scale, which could provide an inexpensive and effective way to reduce serious, widespread infection among newborns in developing countries.

NICHD supports prevention research to help reduce rates of high-risk pregnancies and preterm birth, as well as the associated lifelong morbidities for mother and child. Preeclampsia, for example, is a dangerous condition that leads to high blood pressure in pregnant women, and can cause maternal mortality. It is a major cause of preterm birth, and is associated with long-term risk of heart disease in women. NICHD-supported scientists visualized and isolated individual cells of four different types in placental tissue from women who had had preterm births or severe preeclampsia, and subsequently compared the RNA molecules that the various cell types produced. In the placentas from women with preeclampsia, the researchers found abnormal levels of RNA molecules associated with immune function, cell growth, cell movement, hormone response, growth factors, formation of blood vessels, and molecular transport. These differences provide clues about molecular changes and altered cell functions associated with preeclampsia. In the future, developing new tests for these changes might help identify pregnant women who are at greater risk for this serious condition.

Program Portrait: Maternal Health

The United States is the only developed nation in which the maternal mortality rate has been rising since 2000. Direct obstetric causes accounted for about 86 percent of all maternal deaths globally in 2015, led by maternal hemorrhage, maternal hypertensive disorders, and other maternal disorders⁶. Further, severe maternal morbidity is also increasing. NICHD supports an array of clinical research networks, epidemiological studies, and other research efforts to counter these alarming trends. The leading scientific research networks with specialized clinical expertise in maternal-fetal medicine were established and are funded by NICHD.

- The Maternal-Fetal Medicine Units Network studies a range of conditions related to pregnancy and maternal health, including preeclampsia, thyroid dysfunction during pregnancy, and gestational diabetes.
- The Obstetric-Fetal Pharmacology Research Unit (OPRU) Network provides the expert infrastructure needed to test therapeutic drugs during pregnancy. The OPRU allows researchers to conduct safe, technically sophisticated, and complex studies that will help clinicians protect women's health, improve birth outcomes, and reduce infant mortality.

Epidemiological studies also help us understand risk factors that threaten maternal health. The B-WELL-Mom Study aims to increase understanding of factors that predict poor asthma control during pregnancy, as well as add to scientific knowledge of the basic immunology of pregnancy. Recent results from another NICHD-supported study could help identify women at risk for placental abruption, a dangerous condition that happens when the placenta separates from the uterus before the baby is born. Using data from a previous study of more than 35,000 pregnant women, NICHD-supported researchers found that women who had a placental abruption were about twice as likely to have abnormal levels of specific proteins in their blood. The results may ultimately help physicians identify women at risk for this dangerous condition.

Child Health

Research on child health explores basic biological processes that control healthy or atypical development, translational research from the bench to the bedside, behavioral and social science research, and clinical studies in pediatric pharmacology, infectious diseases, nutrition, endocrinology, trauma and critical illness, and other aspects of pediatric medicine.

NICHD's basic research portfolio on developmental biology has led to a better understanding of normal embryonic development, as well as mechanisms that underlie causes of structural and functional birth defects. For example, 22q11.2 deletion syndrome is a rare disorder that occurs

⁶ Lancet 2016; 388: 1775–812

when a small portion of chromosome 22 is missing. Individuals with 22q11.2 deletion syndrome may experience a variety of symptoms, including intellectual disability, psychiatric disorders, and defects in the kidney and urinary tract systems. Scientists studied the genetic makeup of over 2,000 patients with kidney and urinary tract anomalies, compared to over 22,000 control subjects. The researchers found a particular gene that was missing. The researchers then used zebrafish and mouse models to show how this gene plays an important role in urinary tract development, pinpointing dysfunctional processes and ultimately paving the way for new treatments that may benefit both patients with 22q11.2 syndrome and other kidney conditions.

NICHD supports and conducts domestic and international research related to the epidemiology, diagnosis, clinical manifestations, pathogenesis, transmission, treatment, and prevention of HIV infection, its complications, and other significant infectious diseases in infants, children, adolescents, and pregnant and non-pregnant women. Based on NICHD's initial work, current treatment regimens have all but eliminated HIV transmission from women to their offspring in the United States. However, children and youth who are infected must still take medications daily to control the virus. Many in this group have now reached adolescence or young adulthood and are transitioning into adult care. Researchers studied over 1,400 youth at different ages (7-12 years old, 13-17 years old, and 18-30 years old) who were infected with HIV at birth, measuring the participants' immune systems and amount of virus in their bodies. Over the following five-year period, the participants' immune systems declined, amount of viral load increased, and they became sicker. These findings suggest that healthcare providers need new ways to provide better, continuous care for these young people as they become young adults.

Because children and infants differ physiologically from adults, medications developed and tested in adults often work differently in children. For example, health care providers often use combined antibiotics, such as piperacillin-tazobactam, to treat hospital-acquired severe infections in newborns. This combination is relatively safe in adults, but its effects on infants are unclear. Measuring the level of antibiotics in the blood provides information on exposure and clearance of the antibiotic from the baby. This is essential to determine the medication's relative safety. However, the small circulating blood volume in a baby makes measuring these levels difficult. Researchers examined data from over 700 infants who received piperacillin-tazobactam while hospitalized, used a mathematical model to simulate how the antibiotics were processed by the infants, and examined hospital medical records for adverse reactions. Their findings supported the safety of these antibiotics for infants.

NICHD's child health program also supports research on child maltreatment and associated interventions. Child maltreatment may have lifelong effects, but removal from the abusive environment may also have negative effects. Researchers compared a home-visit program that videotaped parent-child interactions, reviewed the footage, and coached parents to become more sensitive to their child's social and emotional cues, with a telephone-based service and packets of information. Parents who received the video intervention scored higher on measures of engagement and sensitivity, compared to parents who received the telephone-based service. Foster care placements also were lower by more than double among parents who received the home-based intervention.

Training and career development efforts are crucial for sustaining the child health research workforce. NICHD brings young scientists into pediatric research, including physician-

scientists, behavioral and social science researchers, and basic scientists, through both individual and institutional training programs. In addition, loan repayment programs for pediatric research are an important mechanism for retaining clinical scientists in research careers. NICHD's efforts to support science training begin early in the career pipeline, including programs to enhance developmental biology research training for undergraduates. Former postdoctoral trainees from NICHD's pediatrics training programs are now researching ways to help children with learning disabilities, identify genetic causes of specific rare birth defects, and improve treatment for preterm babies.

Program Portrait: Childhood Obesity

Over 17 percent of American youth are overweight or obese, and childhood obesity rates have been rising for several decades. Hispanic and non-Hispanic black communities have the highest rates of overweight and obese youth, and an estimated one in three low-income children can be classified as obese before their fifth birthday. Chronic health conditions associated with obesity were once uncommon in children, but that is no longer the case. High blood pressure, type 2 diabetes, non-alcoholic fatty liver disease, and sleep apnea are now appearing in children and adolescents, setting them up for lifelong health complications.

NICHD research on childhood obesity includes efforts to identify key genetic, environmental, and behavioral risk factors (especially for infants and very young children). One scientific team has been exploring possible links between a mother's diet during pregnancy and the child's future obesity risk, for children born to women who had gestational diabetes. The results showed that these children were more likely to be overweight or obese at age seven if their mothers drank artificially-sweetened beverages during pregnancy or had a pregnancy diet high in refined grains. Other NICHD-supported scientists are investigating possible links between infant feeding and pediatric obesity, including an assessment about how some infants may be fed beyond the point of satiety. In older children, longitudinal studies like the NEXT Generation cohort study can offer valuable and ongoing insight into the obesity epidemic. Researchers are following the same group of children from early adolescence to young adulthood, documenting key points of change in their diet, sleep, exercise, and other lifestyle and biological markers.

Intellectual and Developmental Disabilities

Part of NICHD's legislative mandate is to encourage investigations of human development throughout the lifespan, with an emphasis on understanding intellectual and developmental disabilities (IDDs). The program on IDDs supports research and research training aimed at preventing and ameliorating common and rare neuromuscular and neurodevelopmental disorders, such as Down syndrome, Fragile X syndrome, and Rett syndrome; inborn errors of metabolism; autism spectrum disorders; conditions currently or potentially detectable through newborn screening; and IDDs that have no identified cause that are not associated with a specific syndrome.

The *Eunice Kennedy Shriver* Intellectual and Developmental Disabilities Research Centers employ research technologies such as bioinformatics, biostatistics, genomics, proteomics, metabolomics, imaging, and behavioral testing to support a broad range of projects. The Centers for Collaborative Research in Fragile X, also known as the Fragile X Syndrome Research Centers, support research to improve the diagnosis and treatment of Fragile X syndrome (FXS) by stimulating multidisciplinary and multi-institutional research from the bench to the community. FXS is the most common inherited form of intellectual disability, occurring in about 1 in 4,000 males and 1 in 8,000 females. One Fragile X Center conducted a clinical trial of ganaxolone, a compound that has been used to reduce anxiety in animal models and to treat epilepsy and traumatic stress disorders in both adults and children. The researchers found that children with FXS who had a higher baseline anxiety or lower cognitive abilities showed

improvements in attention, hyperactivity, and anxiety while taking ganaxolone, with no serious adverse effects.

Autism spectrum disorder (ASD) is one of the more common IDD, affecting as many as 1 in 68 children. NICHD supports a broad portfolio of research on ASD, encompassing research on genetic and other causes, especially including the interaction between genes and environmental exposures; comorbid conditions, including gastrointestinal dysfunction and mental illness; early screening and diagnosis; and developing effective interventions. An important component of NICHD's portfolio is the NIH Autism Centers of Excellence (ACE) Program, supported by NICHD along with National Institute on Deafness and Other Communication Disorders (NIDCD), NIEHS, National Institute of Mental Health (NIMH), and National Institute of Neurological Disorders and Stroke (NINDS). The ACE program is designed to build on discoveries from the last 10 years by supporting innovative, multi-disciplinary research that promises to yield interventions and services for people with ASD. For instance, siblings of children diagnosed with autism spectrum disorder have a higher risk of developing the disorder compared to those in the general population. Using MRI and a field of computer science called machine learning, ACE researchers have found that structural differences in the brains of 6 or 12-month old infants may help predict the development of autism spectrum disorder by two years of age among infants with a high familial risk.

The IDD program emphasizes bringing resources, patients, and researchers together. DS-Connect® is a research registry where people with Down syndrome (DS) and their families can connect with researchers and healthcare providers; express interest in participating in clinical studies on DS, including studies of new medications and other treatments; and take confidential health-related surveys aimed at understanding the health of people with DS across their lifespans.

In searching for causes underlying IDDs, biomedical research has uncovered several diseases that could be related to a decrease in myelin in the brain. Vital to brain function, myelin is a substance that allows regions of the brain to communicate with each other. Angelman syndrome results in delays in development, speech impairment, problems with balance, and microcephaly, a condition in which a child's head is much smaller than expected. Analyzing brain structure with MRI in a mouse model of Angelman syndrome, researchers found that the overall volume of white matter was decreased, which can lead to microcephaly. A mouse model of tuberous sclerosis complex (TSC), which affects 1 in 6,000 newborns worldwide, showed that deleting the genes affecting TSC stops the development of oligodendrocytes, the cells that produce myelin in the brain. Comparing the postmortem brains of individuals who did or did not have DS, researchers found differences in over 1,400 genes; many genes that were less expressed in individuals with DS were involved in the development of oligodendrocytes and production of myelin.

Program Portrait: Newborn Screening

Soon after babies are born, they routinely receive a simple heel stick to collect a few drops of blood. With advanced technology, laboratory tests can identify babies that appear healthy but may have any one of over 30 serious disorders. Newborn screening programs enable doctors to act quickly to provide life-saving treatment in situations where early intervention is crucial. For example, one of the newest additions to the newborn screening panel is an inherited condition that makes a child's body unable to fight off infections, called Severe Combined Immunodeficiency (SCID). This condition is also known as "bubble boy syndrome." In infants born with this condition, certain portions of the immune system do not work properly. If untreated, children with SCID rarely live past the age of two years old. However, when SCID is identified and treated early, children can live longer, healthier lives.

NICHD research support has been behind many of the life-saving newborn screening tests that are in use today. The Institute continues efforts to identify additional conditions to screen for, develop and test better ways to screen for conditions, and study treatments and ways to improve outcomes. For example, lysosomal storage disorders, which injure the brain and nervous system, are caused by enzyme deficiencies that lead to the buildup of toxins within cells. Early screening and detection can help physicians treat these disorders before they cause irreparable harm. In the past year, a newborn screening device, called SEEKER™, received *de novo* clearance from the United States Food and Drug Administration (FDA) for the detection of four types of lysosomal disorders: mucopolysaccharidosis type I, Pompe disease, Gaucher disease, and Fabry disease. Development of this device was supported with early funding from NICHD.

Demography and Behavior

The program in demography and behavior includes NICHD's portfolio on behavioral and social influences on health. Results from an NICHD-supported study of youth aging out of foster care suggest that foster children's experiences vary significantly in the type and number of adverse events that happen to them early in life, and these variations could help predict different pathways for subsequent health, psychosocial, and other outcomes. Researchers found that youth who had large numbers of adverse events related to their parents or caregivers – such as physical or sexual abuse, neglect, or mental illness of a caregiver – had significantly higher rates of mental health treatment than children without these specific experiences. In contrast, children who had large numbers of adverse events related to emotional trauma from events in their environment – such as witnessing violence or experiencing a fire or natural disaster – were more likely to report drug and alcohol abuse symptoms and criminal behavior. Both types of adverse events in childhood were associated with poorer outcomes in adulthood, but the trajectories differed depending on the types of events experienced in childhood.

Health disparities research cuts across all NICHD's programs, and is a key component of many of the Institute's demographic and behavioral studies. A recent NICHD-supported study documented disparities in race and family income in the use of early intervention services among toddlers with developmental delays.

The NICHD's Learning Disabilities Research Centers support research to identify genetic and neurobiological characteristics of children, adolescents, and adults with learning disabilities; develop and validate classification systems for learning disabilities; expand knowledge about ways to improve comprehension for individuals who struggle with reading; assess the impact of attention-deficit/hyperactivity disorder (ADHD) on reading; and investigate the relationship between executive function skills and learning. Complementing the Centers, the NICHD's

Learning Disabilities Innovation Hubs focus on understudied research topics that address the causes, symptoms, and treatments of learning disabilities that impact reading, writing, and mathematical reasoning. Recently, NICHD-supported researchers compared the effects of ADHD treatment alone, intensive reading intervention alone, and a combined treatment for children with both ADHD and reading disability (RD). The results indicated that children with co-occurring ADHD and RD require disorder-specific treatments, and that combining treatments does not enhance their effectiveness.

Rehabilitation

Through the National Center for Medical Rehabilitation Research (NCMRR), NICHD fosters research and research training to enhance the health, productivity, independence, and quality of life of people with disabilities at all ages. This program supports a broad range of research, including efforts to understand the underlying biology of injury and disability, and the body's mechanisms of recovery and adaptation.

Rehabilitation research investments are guided by the comprehensive five-year NIH Research Plan on Rehabilitation, developed in 2016. The plan was developed under the leadership of NCMRR in collaboration with stakeholders across NIH and other Federal agencies, as well as researchers and representatives of individuals with disabilities and practitioners. The plan identifies six priority areas:

- *Rehabilitation across the lifespan*, to ensure that interventions are designed and tested appropriately – for example, including play-based rehabilitation approaches for young children and adaptive physical exercise programs for seniors;
- *Family and community*, to promote rehabilitation from hospital to home, with the full involvement of caregivers;
- *Technology use and development*, to take advantage of state of the art technology in fields including computational science, robotics, and prosthetics;
- *Research design and methodology*, to improve research approaches and study designs to help researchers generate consistent clinical data from individuals with a variety of underlying conditions;
- *Translational science*, to capitalize on advances in fundamental science and take advantage of better understanding of genomic and other cell-based, process-level contributors to plasticity and healing;
- *Building research capacity and infrastructure*, to develop the next generation of rehabilitation scientists and support interdisciplinary collaborations.

NCMRR places a special emphasis on translational research to apply gains in fundamental science to creating real-world interventions that can help people with disabilities where they live and work. Two new technologies that assist in rehabilitation from disabilities, injuries or stroke now have Class II medical device clearance from the FDA. The first, an upper arm prosthetic interface, uses pattern-recognition technology to strengthen and improve the analysis of electric signals in remaining muscles after amputation; this gives an amputee greater control and movement of the prosthetic limb. The second, a Virtual Occupational Therapy Assistant software system, helps stroke survivors and others with neurological impairments with daily living tasks, such as cooking, cleaning or shopping, thus helping to reacquaint these patients with once-routine activities.

NCMRR takes a collaborative approach to rehabilitation science, working with other NIH ICs, Federal agencies, the business community, advocates, and other stakeholders. Recently, researchers supported by NCMRR and Centers of Disease Control and Prevention (CDC) used a large national database funded in part by other HHS agencies to assess whether children seeking mental health care after a mild Traumatic Brain Injury (mTBI) had previous mental health diagnoses, or whether the onset of the disorders was new. The scientists found that 27 percent of the total number of children in the study had a mental health diagnosis before their injury, and that an mTBI injury was associated with increased use of mental health services in all of the children, whether or not they had a previous diagnosis.

Intramural Research

NICHD's Division of Intramural Research (DIR) conducts interdisciplinary research to answer basic biomedical research questions and to solve difficult clinical problems in human health and development, with special attention to translational research. DIR investigators use a range of model systems – zebrafish, fruit flies, rats, mice, and others – to study developmental biology, molecular and cellular biology, neurosciences, structural biology, imaging, behavior, and biophysics. DIR scientists conduct clinical research in reproductive health; child development; rare diseases; and pregnancy and its most frequent complications such as preterm labor and preeclampsia. DIR clinical researchers, working with the NIH Clinical Center, conduct innovative trials for a wide range of diseases. For example, scientists recently demonstrated that an experimental drug appears to slow the progression of Niemann-Pick disease type C1 (NPC1), a rare and fatal neurological disorder.

DIR scientists in the Bone Matrix Biology in Development and Disease affinity group focus on translational studies of skeletal dysplasias and related bone disorders. The group has identified and characterized molecular mechanisms of several novel skeletal development disorders in this spectrum. In addition to expanding our knowledge of mechanisms and pathology of skeletal development, these scientists are developing novel approaches to therapeutic intervention, which will be translated to clinical trials.

DIR's Physical Biology and Medicine affinity group supports interdisciplinary collaborations among mathematically minded physical scientists and biomedical researchers. Recently, these researchers identified new targets for anti-malaria drugs that may help overcome drug resistance in the species of parasite that causes the most malaria deaths worldwide. DIR's neuroscientists study the developmental aspects of many of the processes that underlie normal human brain development and have developed pioneering brain imaging techniques.

In the last few years, intramural researchers have uncovered the complex molecular causes underlying genetic diseases from osteogenesis imperfecta to gigantism and Carney complex, and identified the complex genetics of several types of endocrine tumors, such as adenomas of the pituitary and adrenal glands. These new discoveries have led to better diagnostic tests and treatment plans. For example, DIR researchers studied two related types of tumors, called paraganglioma and pheochromocytoma. A significant number of these rare tumors resulted from an inherited genetic defect, and around 10 percent of people diagnosed with them were children. Children had a higher prevalence of tumor susceptibility gene mutations compared with adults. The children's tumors were more likely to form outside the adrenal gland and to have tumor susceptibility gene mutations that blocked epinephrine production. This pattern of mutation was

also associated with cancer that spread to other parts of the body, which was more prevalent in children than in adults. The researchers urge that medical monitoring programs be tailored to the patient's age, diagnosis and genetic background, with diligent follow-up during the transition from pediatric to adult care for children with inherited traits.

Within NICHD's Intramural Research Program, the Division of Intramural Population Health Research (DIPHR) studies health and disease outcomes in populations rather than individuals. With the population as its observational laboratory, DIPHR uses collaboration, discovery, ethics, innovation, interdisciplinary teamwork, and mentoring as core values in fulfilling its mission and vision.

Research Management and Support (RMS)

RMS activities include the administrative and technical functions that support and enhance the accountability, transparency, and dissemination of the Institute's research investments. These functions include budget formulation and accounting, contracts, program management, grants management, peer review, and information technology. The RMS budget also supports NICHD's overall science planning and policy activities, public reporting, and health communications. The latter includes a range of activities to improve public health, targeting issues such as ways to reduce the risk of Sudden Infant Death Syndrome and other sleep-related causes of infant death, and ways to improve maternal and child outcomes. For example, the National Child and Maternal Health Education Program (NCMHEP), an NICHD-led consortium of over 30 national maternal health care provider associations, non-profit organizations, and Federal agencies, is spearheading efforts to disseminate information about pregnancy-related and postpartum depression and anxiety through the Moms' Mental Health Matters campaign. The Institute's extensive scientific review activities help to ensure that NICHD funds the most meritorious research, ongoing program analyses, scientific program evaluations, and review of administrative functions help to ensure the effectiveness and efficiency of NICHD activities.

NATIONAL INSTITUTES OF HEALTH
National Institute of Child Health and Human Development

Detail of Full-Time Equivalent Employment (FTE)

OFFICE/DIVISION	FY 2017 Final			FY 2018 Annualized CR			FY 2019 President's Budget		
	Civilian	Military	Total	Civilian	Military	Total	Civilian	Military	Total
DIPHR	-	-	-	-	-	-	-	-	-
Direct:	27	-	27	27	-	27	27	-	27
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	27	-	27	27	-	27	27	-	27
Division of Extramural Research	-	-	-	-	-	-	-	-	-
Direct:	130	-	130	133	-	133	133	-	133
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	130	-	130	133	-	133	133	-	133
Division of Intramural Programs	-	-	-	-	-	-	-	-	-
Direct:	278	10	288	278	10	288	278	10	288
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	278	10	288	278	10	288	278	10	288
National Center for Medical Rehabilitation Research	-	-	-	-	-	-	-	-	-
Direct:	8	-	8	8	-	8	8	-	8
Reimbursable:	-	-	-	-	-	-	-	-	-
Total:	8	-	8	8	-	8	8	-	8
Office of the Director	-	-	-	-	-	-	-	-	-
Direct:	89	-	89	90	-	90	90	-	90
Reimbursable:	11	-	11	11	-	11	11	-	11
Total:	100	-	100	101	-	101	101	-	101
Total	543	10	553	547	10	557	547	10	557
Includes FTEs whose payroll obligations are supported by the NIH Common Fund.									
FTEs supported by funds from Cooperative Research and Development Agreements.	0	0	0	0	0	0	0	0	0
FISCAL YEAR	Average GS Grade								
2015	12.2								
2016	12.2								
2017	12.3								
2018	12.3								
2019	12.3								

NATIONAL INSTITUTES OF HEALTH
National Institute of Child Health and Human Development

Detail of Positions¹

GRADE	FY 2017 Final	FY 2018 Annualized CR	FY 2019 President's Budget
Total, ES Positions	1	1	1
Total, ES Salary	187,000	175,000	175,000
GM/GS-15	51	54	54
GM/GS-14	76	77	77
GM/GS-13	82	82	82
GS-12	58	58	58
GS-11	29	29	29
GS-10	2	2	2
GS-9	13	13	13
GS-8	16	16	16
GS-7	19	19	19
GS-6	3	3	3
GS-5	2	2	2
GS-4	1	1	1
GS-3	1	1	1
GS-2	0	0	0
GS-1	0	0	0
Subtotal	353	357	357
Grades established by Act of July 1, 1944 (42 U.S.C. 207)	0	0	0
Assistant Surgeon General	0	0	0
Director Grade	9	9	9
Senior Grade	1	1	1
Full Grade	0	0	0
Senior Assistant Grade	0	0	0
Assistant Grade	0	0	0
Subtotal	10	10	10
Ungraded	204	204	204
Total permanent positions	359	369	369
Total positions, end of year	566	576	576
Total full-time equivalent (FTE) employment, end of year	553	557	557
Average ES salary	187,000	175,000	175,000
Average GM/GS grade	12.3	12.3	12.3
Average GM/GS salary	110,206	112,355	113,322

¹ Includes FTEs whose payroll obligations are supported by the NIH Common Fund.