DRUG CONTROL PROGRAMS

	Budget Authority (in millions)		
	FY 2016 Final	FY 2017 Annualized CR	FY 2018 Request
Drug Resources by Budget Decision Unit and Function:			
Decision Unit 1: National Institute on Drug Abuse			
Research and Development: Prevention	$356.650	$365.650	$294.099
Research and Development: Treatment	$692.321	$709.790	$570.899
Total, Decision Unit 1	$1,048.971	$1,075.440	$864.998
Decision Unit 2: National Institute on Alcohol Abuse and Alcoholism			
Research and Development: Prevention	$48.783	$48.783	$37.763
Research and Development: Treatment	$6.394	$6.394	$4.950
Total, Decision Unit 2	$55.177	$55.177	$42.713
Total Funding	$1,104.148	$1,130.617	$907.711
Drug Resources Personnel Summary			
Total FTEs (direct only)	383	382	382
Drug Resources as a Percent of Budget			
Total Agency Budget (in Billions)	$32.31	$32.59	$26.92
Drug Resources percentage	3.42%	3.47%	3.37%

Program Summary

MISSION

The NIDA and the NIAAA, two of the twenty-seven Institutes and Centers of the NIH, support the *Strategy*: NIDA, by funding research on the prevention and treatment of drug use, addiction, and its harmful consequences; and NIAAA, by funding research on the prevention and treatment of underage drinking and its harmful consequences.

The societal impact of the misuse of illicit drugs in 2007 was estimated at $193 billion in health care, crime-related, and productivity losses[91]. Knowledge is the foundation of the transformative agenda needed to strike at the heart of this stubborn and costly challenge. To provide a comprehensive public health response, NIDA will continue to build on science advances from the Institute's investments in genetics, neuroscience, pharmacotherapy, and behavioral and health services research that have led to innovative strategies for preventing and treating substance use disorders (SUDs) in this country and worldwide.

Studying drug use, SUDs, and their causes is a complex challenge compounded by societal stigma and misunderstanding that most other illnesses do not face. The landscape of drug addiction in America evolves from year to year; we are currently seeing the terrible results of a decades-long epidemic of prescription drug misuse that is leading to a rise in heroin use as well as new HIV and Hepatitis C outbreaks. A growing number of states are legalizing marijuana for medical or recreational use, producing natural experiments whose outcomes cannot yet be predicted. New synthetic drugs as well as new delivery systems such as electronic cigarettes (e-cigarettes) are changing how people use drugs. On the bright side, healthcare reform and parity regulations are poised to deliver effective prevention and treatment interventions to larger numbers of Americans. NIDA is supporting research to address today's drug use-related challenges in several key areas, including supporting the Secretary of HHS to respond to opioid abuse and overdose; spearheading a landmark longitudinal study of adolescent substance use and brain development; studying the impact of the changing marijuana landscape; studying the impact of new synthetic drugs; and contributing to scientific and public understanding of the brain mechanisms underlying addiction.

Alcohol misuse has profound effects on the health and well-being of individuals, families, and communities, and costs the United States $249 billion per year. Since its creation, NIAAA has led the national effort to define alcohol problems as medical in nature and address them using evidence-based findings. The research supported by the Institute has transformed the understanding and treatment of alcohol misuse and its consequences, including alcohol use disorder (AUD). NIAAA is working to reduce the considerable burden of alcohol misuse for individuals at all stages of life by supporting research on: the neurobiological mechanisms underlying alcohol misuse, AUD, and co-occurring disorders; fetal alcohol spectrum disorders; the effects of alcohol misuse on the developing adolescent brain and on other tissues and organs; the development of strategies to prevent and treat alcohol misuse and its consequences. NIAAA also supports efforts to translate and implement research findings into improved health care for

[91] U.S. DOJ National Drug Intelligence Center. The Economic Impact of Drug Use in American Society. April 2011

individuals with AUD and with co-occurring conditions, as well as to disseminate research-based information to health care providers, researchers, policy makers, and the public.

METHODOLOGY

NIDA's entire budget is drug-related and scored as a part of the National Drug Control Budget.

The prevention and treatment components of NIAAA's underage drinking research program are scored as a part of the national drug control budget. Underage drinking research is defined as research that focuses on alcohol use by youth (individuals under the legal drinking age of 21), as well as the negative consequences of underage alcohol use (e.g., alcohol-related injuries, impact on adolescent development, including on the developing brain, and risk for AUD). It includes basic research, epidemiological studies, behavioral research, screening and intervention studies, and the development and testing of preventive interventions. NIAAA's methodology for developing budget estimates for the *Budget and Performance Summary* is a two-step process. First, NIAAA identifies its underage drinking projects using NIH's automated, electronic text mining system for research, condition, and disease categorization. Once all underage drinking projects are identified through this process, NIAAA conducts a manual review of the project listing and identifies only those projects and amounts that are relevant to prevention and treatment. This is used to generate the NIAAA drug control budget estimate.

BUDGET SUMMARY

The FY 2018 President's Budget request for drug-related activities at NIH is $907.711 million ($864.998 million for NIDA and $42.7 million for NIAAA), a decrease of $222.906 compared with the FY 2017 Annualized CR level.

NIH-supported research has and will continue to provide the scientific basis for budget policy. For example, NIH continues to explore the many biological, behavioral, and environmental influences on drug addiction vulnerability, which will allow the development of more targeted and effective prevention approaches. Research reveals that universal prevention programs not only reduce drug use, underage drinking, and other risky behaviors that can lead to HIV and other adverse outcomes, but can also promote other positive outcomes, such as strengthening young people's sense of community or "connection" to school—key to reducing substance misuse, violence, and mental health problems.

Another top priority continues to be the development of therapeutic interventions to treat SUDs, including medications, biologics, and non-pharmacological interventions such as transcranial magnetic stimulation or neurofeedback. NIH is now poised to capitalize on a greater understanding of the neurobiology underlying addiction, and of newly identified candidate molecules and brain circuits that show promise as potential targets for the treatment of SUDs. NIH is also exploring ways of improving the dissemination and implementation of evidence-based practices (implementation science) in real world settings to improve the prevention and treatment of SUDs and co-occurring conditions such as HIV, thereby enhancing the public health impact of NIH-supported research.

National Institute on Drug Abuse

FY 2018 Request: $864.998 million

($210.4 million below the FY 2017 Annualized CR level)

NIDA's efforts consist of Neuroscience and Behavioral Research; Epidemiology, Services and Prevention Research; Pharmacotherapies and Medical Consequences; Clinical Trials Network; Intramural Research Program (IRP); and Research Management and Support (RMS).

Neuroscience and Behavior Research

FY 2018 Request: $286.3 million

($73.3 million below the FY 2017 Annualized CR level)

The Neuroscience and Behavior portfolio seeks to expand our understanding of the fundamental neurological, genetic/epigenetic, and behavioral processes that underlie SUDs. Central to this goal are efforts to tease apart the multiple factors that contribute to drug use and addiction risk, with particular emphasis on individual differences in risk and responses to drugs. NIDA is working to expanding our basic understanding of the brain from the molecular to the behavioral level. NIDA is supporting research to develop advanced technologies that improve our ability to study the organization and function of the living brain that will help us to better understand the interactions of complex neural circuits including those that mediate reward, aversion to drug effects, and related decision making; and develop novel strategies to therapeutically influence SUD-relevant brain circuits including transcranial magnetic stimulation (TMS), transcranial direct current stimulation (tDCS), deep brain stimulation (DBS), and neurofeedback. Other key projects are investigating the effects of drugs on gene expression and brain development and function; the interactions of an individual's genes with environmental conditions, such as stress and early exposure to drugs, that influence risk for addiction; the role of epigenetic changes that can influence long-term patterns of gene expression in specific brain cells (neuron and glia) without changing DNA sequence; basic processes underlying resilience against SUDs in childhood and adolescence; and exploring gender-related differences in these effects. NIDA is also working to develop the capacity to support big data science to promote efficient analysis of large, diverse data sets on a scale not previously possible. Collectively, this research will provide new perspective on effects of drugs on multiple biological systems to improve our understanding of the basic neural and genetic mechanisms that underlie drug use and addiction.

In addition, under the Collaborative Research on Addiction at the NIH (CRAN) initiative, NIDA and NIAAA, along with other components of NIH and the Centers for Disease Control and Prevention, are supporting a longitudinal study to examine the neurodevelopmental consequences of substance use. The Adolescent Brain Cognitive Development (ABCD) study will follow the biological and behavioral development of more than 11,000 children beginning at ages 9-10 through adolescence into early adulthood. Over the course of the next decade, scientists will use advanced brain imaging, interviews, and behavioral testing to determine how childhood experiences interact with each other and with a child's changing biology to affect brain development and—ultimately—social, behavioral, academic, health and other outcomes. Understanding these relationships may help reveal the biological and environmental building

blocks that contribute to successful and resilient young adults. This enhanced knowledge also may lead to ways to predict potential developmental problems including mental illness and SUD so that they can be prevented or reversed. Families that volunteer will be part of groundbreaking research that promises to inform future substance use prevention strategies, educational priorities, child development innovations, research priorities, and public health interventions.

Epidemiology, Services, and Prevention Research

FY 2018 Request: $263.6 million

($67.5 million below the FY 2017 Annualized CR level)

This NIDA Division supports integrated approaches to understanding and developing strategies to address the interactions between individuals and environments that contribute to drug use and related problems. With a focus on research to inform public health, the Division supports the annual Monitoring the Future survey, which tracks drug use and related attitudes among teens, as well as surveillance networks to monitor local and national drug trends. NIDA's National Drug Early Warning System (NDEWS) monitors emerging trends related to illicit drug use, including designer synthetic compounds and fentanyl, around the country so that rapid, informed, and effective public health responses can be developed and implemented precisely where and when they are needed. NIDA's Division of Epidemiology, Services, and Prevention Research also supports research related to more effectively integrating prevention and treatment services into healthcare and community systems. For example, NIDA research is exploring treatment of SUDs in the criminal justice system, including studies on implementation of medication-assisted treatment (MAT) and seek, test, treat, and retain (STTR) strategies for people with SUDs at risk for HIV. NIDA also funds research into the efficacy of screening brief intervention and referral to treatment (SBIRT) in primary care settings for reducing drug use and SUD. Program efforts also focus on research to optimize implementation of evidence-based prevention interventions and treatment services in real-world settings.

Therapeutic and Medical Consequences

FY 2018 Request: $145.9 million

($37.4 million below the FY 2017 Annualized CR level)

NIDA's Division of Therapeutics and Medical Consequences is focused on developing therapeutics for the treatment of SUDs. Since the pharmaceutical industry has traditionally made limited investment in the development of medications to treat SUDs, the responsibility for their development has rested largely with NIDA. To most effectively leverage NIDA resources, this program encourages the formation of alliances between strategic partners (pharmaceutical and biotechnology companies as well as academic institutions) with the common goal of advancing medications through the development pipeline toward FDA approval in a timely manner. NIDA conducts research to decrease the risks associated with medications development to make it more appealing for pharmaceutical companies to complete costly phase IIb and III clinical studies. An example of such a project is a partnership with AstraZeneca to explore a novel medication that modulates the activity of glutamate – an excitatory neurotransmitter – to treat drug addiction.

Preclinical studies with this class of molecule indicate that it could be effective for treating nicotine and cocaine use disorders. Another example is the partnership with Lightlake Pharmaceuticals and Adapt Pharma that led to the successful development of Nasal Narcan®, the only FDA approved intranasal naloxone product to treat opioid overdose. Further, US World Meds, funded in part through NIDA grants, is in late stage development of lofexidine, a medication for the treatment of opioid withdrawal symptoms that might also hold promise for the treatment of other addictions. NIDA has also invested in research supporting the development of vaccines and monoclonal antibodies for the treatment of SUDs. For example, an ongoing collaboration with Selecta Biosciences is working to develop a novel nicotine vaccine and another with InterveXion Therapeutics is working to develop a monoclonal antibody to treat methamphetamine addiction. The latter program is currently in clinical trials**.**

Clinical Trials Network

FY 2018 Request: $35.2 million

($9.0 million below the FY 2017 Annualized CR level)

The CTN comprises 13 research nodes, two research coordinating centers, and more than 240 community treatment programs and/or medical settings in over 40 States plus the District of Columbia and Puerto Rico. Current initiatives are emphasizing research to develop and test strategies for the integration of SUD treatment, particularly for opioid use disorder (OUD), into mainstream general medical settings, embedding research in clinical practice, and enhancing capacity to leverage electronic health record data in research studies. Through collaborations with clinical investigators, the CTN evaluates research based strategies needed for the integrated management of patients with substance misuse/SUD in general medical settings and linked specialty care treatment settings. The CTN develops and tests the feasibility and effectiveness, as well as implementation strategies and health system approaches for addressing SUDs and related disorders, such as comorbid mental health disorders and HIV, in diverse patient populations. The CTN is currently conducting studies that: 1) compare Vivitrol® (extended-release naltrexone) to Suboxone® (buprenorphine and naloxone) Sublingual Film for patients addicted to heroin or other opioids, including prescription pain relievers; 2) evaluate a linkage-to-care intervention for HIV/HCV co-infected patients with SUDs; and 3) incorporate common data elements for SUD screening and assessment into a widely used electronic health record system. Research under development includes a trial to investigate the effectiveness and safety of a combination therapy of Vivitrol® plus Wellbutrin XL® (bupropion hydrochloride, extended-release tablets) for treatment of methamphetamine use disorder, as well as three studies to evaluate strategies for integrating OUD screening and treatment interventions into routine practice in emergency departments, primary care clinics, and pharmacies, respectively.

Intramural Research Program

FY 2018 Request: $75.4 million

($16.7 million below the FY 2017 Annualized CR level)

In addition to funding extramural scientists, NIDA also conducts research in high priority areas through our IRP. Intramural research at NIDA focuses on conducting cutting-edge research within a coordinated multidisciplinary framework to: 1) elucidate the nature of the addictive process; 2) evaluate the potential of emerging new therapies for SUDs, including pharmacological and non-pharmacological (e.g. psychosocial, biofeedback, brain stimulation technologies); and 3) describe the long-term consequences of drug use on systems and organs, with particular emphasis on the brain and its development, maturation, function, and structure. For example, the IRP is furthering SUD research by collaborating with pharmaceutical industry partners to study a potential medication that can decrease methamphetamine craving and by collaborating with researchers in Italy to study the efficacy of TMS for treatment of cocaine use disorders. In addition, the IRP is working to understand the impact of long lasting deficits in the prefrontal cortex – an area of the brain that mediates decision making – caused by cocaine and heroin use. In an animal model, scientists can reverse this deficit by hyper-stimulating the prefrontal cortex for brief periods. This intervention is being developed as a possible therapy for addiction. The IRP is also working to develop clinically useful indicators (biomarkers) of addiction severity or treatment efficacy that will support the development of more effective treatments and discovery of novel treatment targets. IRP scientists are also working to better understand factors that contribute to cravings and relapse. Memories of items, people, or environments that are present when addicted individuals take drugs become powerful cues that trigger them to relapse again and again. Scientists have shown that these memories are stored in specific patterns of neurons called neuronal ensembles in the brain. Researchers have been successful in inactivating these drug-related ensembles and related memories in animal models, and are developing similar procedures that might be used in humans to selectively impair harmful addiction memories. In addition, IRP scientists are developing a mobile health toolbox to collect data on the daily-life reality of addiction. These tools can support intensive assessments to help identify individual and environmental influences on drug craving and to understand when people are most vulnerable to relapse. One of the goals of this research is to deploy a mobile intervention that will automatically predict imminent drug use and deliver help just when a person needs it.

Research Management and Support

FY 2018 Request: $58.5 million

($6.5 million below the FY 2017 Annualized CR level)

RMS activities provide administrative, budgetary, logistical, and scientific support in the review, award, and monitoring of research grants, training awards, and research and development contracts. Additionally, the functions of RMS encompass strategic planning, coordination, and evaluation of NIDA's programs, regulatory compliance, international coordination, and liaison with other Federal agencies, Congress, and the public. NIDA currently oversees more than 1,300 research grants and more than 70 research and development contracts. In addition to the

infrastructure required to support research and training, NIDA also strives to provide evidence-based resources and educational materials about SUDs and to raise awareness of the science relating to cutting-edge issues such as opioid overdose prevention, marijuana research, synthetic drug trends, and medication-assisted treatment for opioid use and addiction.

The RMS portfolio also incorporates education and outreach activities to inform public health policy and practice by ensuring the institute is the primary trusted source for scientific information on drug use and addiction. NIDA is also committed to being at the forefront of training the next generation of innovative researchers by supporting both pre-doctoral and postdoctoral-level scientists interested in drug use and addiction research. NIDA leads the NIH Pain Consortium Centers of Excellence in Pain Education (CoEPEs); these twelve centers work to enhance patient outcomes by improving the education of healthcare professionals about pain and its treatment. The CoEPEs act as hubs for the development, evaluation, and distribution of pain management curriculum resources for medical, dental, nursing and pharmacy schools to improve how health care professionals are taught about pain and its treatment.

National Institute on Alcohol Abuse and Alcoholism

FY 2018 Request: $42.7 million

($12.5 million below the FY 2017 Annualized CR level)

Alcohol screening and brief intervention in primary care has been recognized as a leading preventive service for reducing harmful alcohol use in adults, and a growing body of evidence demonstrates its effectiveness in preventing and reducing alcohol misuse in youth. Yet research indicates that adolescents are not routinely asked about drinking when they interface with the health care system. NIAAA supports research on the implementation of alcohol screening and brief intervention among youth and young adult populations, including those disproportionally affected by alcohol misuse. NIAAA also supports efforts to encourage the adoption of alcohol screening and brief intervention in healthcare and other appropriate settings.

Reducing alcohol misuse among college students, many of who are underage, continues to be a high priority for NIAAA. Binge drinking (drinking 4 or more drinks for women and 5 or more drinks for men, in approximately two hours) and extreme binge drinking (drinking at levels two or more times the binge drinking threshold) are especially pervasive among college students; these practices are particularly troubling as they increase risks for alcohol-related blackouts, alcohol overdoses, sexual assault, sexually transmitted diseases, AUD, and other detrimental consequences. To assist college and university officials in addressing alcohol misuse on their campuses, NIAAA developed the College Alcohol Intervention Matrix (*CollegeAIM*), a user-friendly guide and website that rates nearly 60 evidence-based alcohol interventions in terms of effectiveness, costs, and other factors. With this tool, school officials can use research-based information to choose wisely among the many potential interventions to address harmful and underage student drinking.

NIAAA's investment in underage drinking research also includes studies to understand how alcohol affects the developing brain. For example, NIAAA supports the National Consortium on Alcohol and Neurodevelopment in Adolescence (NCANDA), an accelerated longitudinal study

of more than 800 youth ages 12-21 to assess the vulnerability of the adolescent brain to alcohol exposure. NCANDA has laid the methodological foundation for the NIH Adolescent Brain Cognitive Development (ABCD) study, the largest long-term study of brain development and child health in the United States. Over 11,000 9- to 10-year olds are being invited to participate in the ABCD study, which will use brain imaging and neuropsychological and behavioral assessments to track the biological and behavioral development of youth before and after they start to use alcohol and/or other addictive substances. These two studies are expected to illuminate the neurobiological, cognitive, and behavioral precursors of alcohol and other drug misuse and ultimately inform preventive and treatment strategies. Complementing NCANDA and ABCD, NIAAA's Neurobiology of Adolescent Drinking in Adulthood initiative is enabling investigators to examine, in animal models, the molecular, cellular, and circuit-level mechanisms by which adolescent drinking affects brain structure and function in the short- and long-term and how the changes observed during this critical period persist into adulthood.

PERFORMANCE

Information regarding the performance of the drug control efforts of NIH is based on agency GPRMA documents and other information that measures the agency's contribution to the *Strategy*. NIH's performance measures are representative of Institute contributions to NIH's priorities regarding specific scientific opportunities, identified public health needs, and Presidential priorities. Such measures, reflecting NIH's broad and balanced research portfolio, are not Institute-specific. Many measures are trans-NIH, encompassing lead and contributing institutes and centers. This approach reflects NIH's commitment to supporting the best possible research and coordination of research efforts across its institutes and centers. All performance results reported were achieved in FY 2016.

NIDA and NIAAA lead and support a number of trans-NIH measures in the Scientific Research Outcome (SRO) functional area. While NIDA and NIAAA engage in many research and related activities, three measures best reflect the breadth of their efforts in the prevention and treatment of substance use, misuse, addiction, and its consequences.

One of these measures, led by NIAAA and supported by NIDA, is SRO-5.15: "By 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance misuse and substance use disorders and their consequences in underage populations." This measure, which began in FY 2014, is indicative of NIDA's and NIAAA's efforts to support research to foster the development and implementation of prevention-based strategies for reducing substance misuse and addiction. NIH's prevention portfolio encompasses a broad range of research on the efficacy and cost effectiveness of primary prevention programs—designed to prevent substance use before it starts, or prevent escalation to misuse or addiction—and how these programs can be enhanced by targeting prevention efforts toward populations with specific vulnerabilities (genetic, psychosocial, or environmental) that affect their likelihood of substance use or SUDs.

NIDA created and leads SRO-7.3: "By 2020, develop and/or evaluate two treatment interventions using health information technology (HIT) to improve patient identification,

treatment delivery and adherence for substance use disorders and related health consequences." This measure began in FY 2014 and has been updated to reflect NIDA's current focus in exploring and leveraging technological advances to improve the efficiency and quality of health care delivery for SUDs.

In addition to developing and leading SRO-5.15, NIAAA contributes to SRO-8.7: "By 2018, identify three effective system interventions generating the implementation, sustainability, and ongoing improvement of research-tested interventions across health care systems." This measure, which began in FY 2008 and has been updated over time, reflects NIH's ongoing commitment to supporting research on the implementation of preventive and treatment interventions and improving the translation of research into practice.

National Institute on Drug Abuse		
Selected Measures of Performance	**FY 2016 Target**	**FY 2016 Achieved**
» Scientific Research Outcome-5.15: By 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance misuse and substance use disorders and their consequences in underage populations.	Assess the efficacy/ effectiveness of brief interventions to prevent substance use and other risk behaviors in a variety of settings.	41 research articles were published examining the efficacy of a variety of prevention interventions to protect youths from initiation or escalation of substance use and associated negative health outcomes.
» Scientific Research Outcome-7.3: By 2020, develop and/or evaluate two treatment interventions using health information technology (HIT) to improve patient identification, treatment delivery and adherence for substance use disorders and related health consequences.	Identify next steps for testing or deployment of 2-4 substance abuse treatment or medication adherence interventions using mobile technology.	Five interventions utilizing HIT, including mobile health technology, addressing five research priority areas were developed. All interventions were found to be feasible and will undergo additional revision and efficacy testing in preparation for broad dissemination and implementation.

Prevention – Scientific Research Outcome-5.15

NIDA continues to fund a robust prevention portfolio that builds upon solid epidemiological findings and insights from genetics and neuroscience and applies this knowledge to develop effective strategies to prevent initiation of drug use and escalation of use to addiction in underage youth. The performance target for SRO-5.15 was met for FY 2016. Prevention of the initiation of drug use and escalation to addiction continues to be one of NIDA's primary strategic goals (see NIDA's Strategic Plan).

NIH's prevention portfolio encompasses a broad range of research to increase our understanding of factors that enhance or mitigate an individual's propensity to initiate drug use or to escalate from use to SUDs across different developmental stages. Information about these contributors to substance use and addiction and the different ways biological, psychosocial, and environmental factors operate across individuals is critical to designing more effective prevention messages. NIH's growing knowledge about substance use and addiction (including tobacco, alcohol, illicit, and nonmedical prescription drug use) is helping to inform the development of prevention strategies that are evidence-based and rooted in a growing understanding of the biological (e.g., genetics, neurobiology), psychosocial (e.g., support systems, stress resilience), and environmental (e.g., socioeconomic, cultural) factors that influence risk for substance use and

related disorders. NIH-supported research is building the scientific knowledge base needed to advance our goal of developing effective tailored prevention strategies for youth.

A number of genetic markers have been identified that influence risk for addiction and recent research has shown that genetic risk factors can influence the effectiveness of school based prevention interventions.[92] In addition, individual differences seen in response to medications for nicotine and AUD suggest that genetic predictors of treatment response could lead to more efficacious and cost-effective relapse prevention strategies.[93] This information can be harnessed for improving prevention by personalizing interventions for optimal benefit. Such strategies would enable substance use prevention programs to target programs more precisely based on individual or group vulnerability markers, ultimately increasing their impact and cost-effectiveness. Combined with improved educational efforts to increase an individual's awareness of his or her personal risk, this preemptive prevention approach can empower people to make decisions that ultimately prevent substance use from starting or escalating.

The information gained from research on the factors that influence risk and resilience to SUDs will lay the foundation for improved and tailored prevention efforts in the future. As personalized risk factors for substance use and addiction vulnerability (or protection) are identified, NIH will encourage researchers to use that information to better understand how biological factors, combined with environmental ones, contribute to substance use disorder vulnerability, thereby enhancing its prevention portfolio. NIH will also encourage the scientific community to use this knowledge to develop and test targeted prevention interventions for populations with differing vulnerabilities to improve our Nation's intervention efforts, similar to the strategy now being used to prevent substance use in high sensation-seeking youth.

The efficacy and cost-effectiveness of primary prevention programs—designed to prevent substance use before it starts, or prevent escalation to substance use disorders—including their severest form, addiction—can be enhanced by targeting prevention efforts toward populations with specific vulnerabilities (genetic, psychosocial, or environmental) that affect their likelihood of taking drugs or becoming addicted. For example, prevention programs designed for sensation-seeking youth are effective for these youth, but not for their peers who do not demonstrate a high level of sensation seeking. High levels of sensation-seeking, and other traits known to be risk factors for substance misuse, may be identified early using genetic markers.

From FY 2016 to the present (FY 2017), multiple studies have been funded to develop and test interventions to prevent drug use, drug use problems, and risk behaviors and to improve the implementation of these evidence-based interventions. NIDA is supporting research to test culturally and developmentally appropriate strategies to prevent drug use and addiction across the lifespan: for all developmental stages, from birth through adulthood and older age; for diverse racial/ethnic populations, targeted to various settings such as family, school, community, and health care settings; and for high risk populations, such as LGBT, homeless, child welfare involved, juvenile justice system involved, criminal justice involved, individuals with comorbid conditions, and populations at risk for HIV/AIDS.

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[92] Vandenbergh DJ, Schlomer GL, Cleveland HH et al. *An adolescent substance prevention model blocks the effect of CHRNA5 genotype on smoking during high school.* Nicotine Tob Research. 2016;18(2):212-20.
[93] Sturgess JE, George TP, Kennedy JL, Heinz A, Muller J. *Pharmacogenetics of alcohol, nicotine, and drug addiction treatments.* Addict Biol. 2011;16(3):357-76.

In FY 2016, 41 studies examining the efficacy of prevention interventions within adolescent populations were published. One recent study examined the efficacy of the Family Check-Up (FCU) intervention on conduct problems (CPs) and antisocial behavior (AB) in children living in high risk, deprived neighborhoods—characterized by poverty, violence, deviant peers and adults, toxic air, and lack of community resources—that are associated with increased risk for poor health outcomes including substance use disorders.[94] FCU is an annual, three-session, family-centered intervention that motivates parents to promote positive child adjustment and to participate in parent management training that is adapted for their specific needs. CPs and AB were identified from school-based teacher reports. The study found that for most families eligible for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) that were not seeking help for CP with their children, FCU resulted in significant reductions in CP; however, these results did not extend to children living in the most deprived neighborhoods. It was observed, however, that caregivers and children living in extremely deprived neighborhoods that developed particularly positive relationships during early childhood (toddler years) received fewer reports of CP from teachers. Researchers suggested that one reason FCU may not have provided more long-term efficacy for families living in extremely deprived neighborhoods could be linked to their inability to access mental health services. Although continued research is needed, these findings suggest that there is hope for delivering effective preventive interventions to children and families living in vulnerable environments by using innovative methods to reach families isolated by their economic status.

Implementation of effective prevention interventions within community settings is very low due to a variety of factors including community readiness or resistance to change, lack of infrastructure and technical support, as well as poor fidelity to evidence-based prevention interventions (EBPIs).[95,96,97,98] A recent study examined the implementation of PROmoting School-community-university Partnerships to Enhance Resilience (PROSPER)—a delivery model designed to support dissemination and sustained implementation of evidence based practices that prevent substance misuse and promote healthy adolescent development through the creation of partnerships between a land-grant university's Cooperative Extension System (CES) and local community organizations. The PROSPER model has demonstrated multiple positive impacts on youth and their families which include reduced rates of substance use[99] and problem behaviors[100], as well as improved family bonding and parenting quality.

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[94] Shaw, D.S., et al., *The long-term effectiveness of the Family Check-Up on school-age conduct problems: Moderation by neighborhood deprivation.* Dev Psychopathol, 2016. 28(4pt2): p. 1471-1486.

[95] Bumbarger, B. and D. Perkins, *After randomised trials: Issues related to dissemination of evidence-based interventions.* Journal of Children's Services, 2008. 3(2): p. 55-64.

[96] Akerlund, K.M., *Prevention program sustainability: The state's perspective.* Journal of Community Psychology, 2000. 28(3): p. 353-362.

[97] Fixsen, D.L., et al., *Implementation research: A synthesis of the literature.* . 2005, The National Implementation Research Network: Tampa, FL.

[98] Spoth, R., et al., *Longitudinal Effects of Universal Preventive Intervention on Prescription Drug Misuse: Three Randomized Controlled Trials With Late Adolescents and Young Adults.* American Journal of Public Health, 2013. 103(4): p. 665-672.

[99] Spoth, R., et al., *Substance-use outcomes at 18 months past baseline - The PROSPER community-university partnership trial.* American Journal of Preventive Medicine, 2007. 32(5): p. 395-402.

[100] Spoth, R.L., et al., *PROSPER partnership delivery system: Effects on adolescent conduct problem behavior outcomes through 6.5 years past baseline.* J Adolesc, 2015. 45: p. 44-55.

The current study compared implementation of PROSPER in two states eight years after the discontinuation of grant funding[101] and examined the methods used by 14 community teams in two different states (Iowa and Pennsylvania, seven teams per state) to effectively implement and disseminate EBPIs using the PROSPER model as well as to achieve sustained financial independence for their programs. While successful implementation of EBPIs can be achieved by a variety of methods, this study demonstrated that the sustainability of PROSPER was significantly tied to streamlined fundraising efforts that built long-term partnerships with school districts, social service agencies and other partners, and increasing state-level financial resources over time. A striking difference between the diffusion of EBPIs in Iowa and Pennsylvania can be attributed to the Pennsylvania Commission on Crime and Delinquency (PCCD). The PCCD provides grants and implementation support to promote successful community-based dissemination of EBPIs, and consequently PROSPER teams in Pennsylvania were able to achieve sustained, state-based funding and Pennsylvania communities were able to more successfully implement EBPIs.

In addition, the infrastructure provided by the PCCD altered PROSPER team dynamics: Iowa team leaders were much more focused on securing funding than were Pennsylvania team leaders. Ongoing technical assistance in the form of access to expertise in marketing, communications, grant writing, program evaluation, and dissemination skills was also critical for enabling communities to transition from seed funding to sustained financial independence. Overall this study demonstrates that effective dissemination and implementation of EBPIs can be achieved with high quality if community teams actively plan for it, community and state-level resources are available to support it, and teams receive ongoing technical assistance.

Universal prevention programs, while effective, do not work for everyone. NIDA-funded researchers investigated whether particular gene variations associated with nicotine sensitivity influenced the efficacy of universal prevention programs delivered using the PROSPER model to prevent smoking in high school students.[102] Nicotine produces its addictive effects by binding to nicotinic acetylcholine receptors in the brain. Individuals with specific genetic variants in the nicotine receptor allele (rs16969968) exhibit a heightened sensitivity to nicotine, and are at increased risk of becoming daily smokers. This study analyzed 424 DNA samples from a subset of adolescents participating in school-delivered and in-home prevention interventions to determine if their genotype influenced their smoking behavior or the efficacy of universal prevention interventions to prevent smoking. Students with the risk allele smoked more than students that lacked this allele, but surprisingly, the universal prevention programs were equally effective at preventing smoking regardless of the presence of the risk allele. These results suggest that the effect of this prevention intervention lie in reducing smoking initiation rather than smoking escalation because those who possess the risk allele would experience enhanced nicotine sensitivity and would be predicted to be more likely to continue smoking.

Collectively these findings demonstrate strategies for effective dissemination and implementation of evidence-based substance use prevention programs and further support key prevention lessons and principles that have emerged from NIDA-funded studies: prevention

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[101] Welsh, J.A., et al., *Pathways to Sustainability: 8-Year Follow-Up From the PROSPER Project.* J Prim Prev, 2016. 37(3): p. 263-86.

[102] Vandenbergh, D.J., et al., *An Adolescent Substance Prevention Model Blocks the Effect of CHRNA5 Genotype on Smoking During High School.* Nicotine Tob Res, 2016. 18(2): p. 212-20.

interventions implemented in early childhood can have positive effects into young adulthood; universal interventions can protect higher risk, vulnerable youth; and universal substance use prevention interventions are effective in individuals with high-risk genotypes.

Treatment—Scientific Research Outcome-7.3

SRO-7.3 is focused on developing and testing treatment interventions using HIT tools to improve patient identification, treatment delivery, or adherence to treatment for substance use disorders and related health problems. This goal contributes to NIDA's long-term strategy for improving drug use disorder treatment nationwide, thereby contributing to the National Drug Control Strategy's Goals of: Seeking Early Intervention Opportunities in Health Care (Chapter 2) by supporting screening for substance use and substance use disorders in healthcare settings using mobile technologies; and Increasing Access to Treatment and Supporting Long Term Recovery (Chapter 3) by supporting innovative research to develop and test mobile technologies to support the delivery of treatment and recovery services.

Addiction is a complex but treatable disorder that affects brain function and behavior. Unfortunately, we have a significant and ongoing treatment gap in our Nation. Among those who need treatment for a SUD, few receive it. In 2015, 21.7 million Americans needed treatment for a SUD, but less than 11% received specialty treatment.[103] Further, many treatment programs do not deliver current evidence based practices—for example, less than 50% provide access to medication assisted treatment for opioid use disorders, and they typically do not coordinate care with the patient's general health care providers. In addition, patients receiving treatment for SUD or related health conditions—such as HIV or mental health disorders—often do not fully adhere to the treatment plan recommended by their doctor. NIDA is committed to supporting health services and implementation research to develop and test technologies that aim to reduce these gaps.

NIH's health services research portfolio encompasses a broad array of studies exploring the use of HIT tools to deliver evidence based treatments, support coordination of care, improve the organization and delivery of treatment services, educate patients to prevent common comorbidities such as HIV or Hepatitis C, improve adherence to treatment for both substance use disorders and comorbid health conditions, increase treatment engagement, and provide recovery support. Research in this area will lay the foundation for leveraging technology to improve health outcomes related to substance use and substance use disorders. As these technologies advance, NIH will continue to encourage innovative research to determine how they can best be applied to address gaps in access to and quality of care as well as treatment engagement to improve public health.

An unacceptable gap also separates scientific discoveries from their implementation into community health care settings. A scientific approach must be brought to bear on effectively testing and disseminating research-based treatments and understanding how health service systems and settings influence treatment implementation. Ultimately, NIH strives to make research-based treatments user friendly, cost effective, and available to a broad range of

[103] *2015 National Survey on Drug Use and Health: Detailed Tables.*, C.f.B.H.S.a. Quality, Editor. 2016, Substance Abuse and Mental Health Services Administration: Rockville, MD.

practitioners and their patients. HIT tools, including mobile technologies, represent one promising mechanism to achieve this goal.

The last few years have seen tremendous advances in the development and implementation of HIT tools that have great promise for improving the efficiency and quality of health care delivery for substance use disorders – ranging from electronic health records, telehealth, wearable sensors, and mobile health technologies. These advances are revolutionizing health services research and presenting new opportunities to deliver innovative treatment and recovery interventions. HIT has the power to drive new treatment delivery models by supporting more effective integration of care, extending the reach of the SUD treatment workforce, enabling real-time patient monitoring and support, and engaging patients who are hesitant to participate in traditional behavioral health treatment systems. NIH-supported research is exploring how technology can best be leveraged to increase access to and quality of care to improve patient outcomes.

The FY 2016 target for SRO-7.1 was met. NIDA funds a broad portfolio of research on the potential of HIT tools to improve health care delivery and health outcomes related to SUDs as described in over 12 publications released in FY 2016. Research findings leveraging HIT to address five NIDA research priority areas are reported below:

Improving medication adherence using mHealth technologies – A recent NIDA-funded study examined the efficacy of a bidirectional text messaging intervention (TEXT) to improve antiretroviral medication (ART) adherence, improve attendance at health care visits, and reduce substance use among people living with HIV.[104] Text messaging is an ideal platform to collect and deliver real time health information because it can reach patients living in remote areas even when cellular service is weak. The automated TEXT intervention can send daily queries to patients checking on medication dosing, mood, and substance use, and can generate appropriate intervention messages based on patient responses. The pilot randomized clinical trial demonstrated that TEXT improved ART adherence and reduced missed HIV care visits; however, TEXT did not significantly improve substance use behaviors as compared to individuals receiving treatment as usual. Study authors are now considering utilizing mobile applications instead of text messages to provide enhanced privacy.

Integration of SUD treatment within broader health care management using health IT – Individuals with SUDs have high rates of medical and psychiatric comorbidities and exhibit poor uptake of health services, resulting in poor treatment compliance. Integration of SUD treatment within general health care not only improves overall health outcomes, including SUD outcomes, but also lowers overall health care costs. The NIDA supported LINKAGE Clinical Trial examined the feasibility and efficacy of a linkage intervention that utilizes patient portals to facilitate SUD patients' engagement with specialized health care providers to treat comorbid health conditions.[105] The LINKAGE intervention educates patients receiving SUD treatment how to proactively engage in their own health care management by using patient portals, accessing online treatment programs (e.g., coping with pain), obtaining medical information, and

[104] Ingersoll, K.S., et al., *Pilot RCT of bidirectional text messaging for ART adherence among nonurban substance users with HIV.* Health Psychol, 2015. 34 Suppl: p. 1305-15.
[105] Weisner, C.M., et al., *Examination of the Effects of an Intervention Aiming to Link Patients Receiving Addiction Treatment With Health Care: The LINKAGE Clinical Trial.* JAMA Psychiatry, 2016. 73(8): p. 804-14.

scheduling appointments. Although there were no significant differences at six months regarding SUD and depression outcomes between patients receiving the LINKAGE intervention compared to those receiving treatment as usual, it is expected that the LINKAGE intervention will demonstrate superior health benefits at later time points allowing patients more time to fully benefit from the intervention.

Preventing substance use using health IT – RealTeen is a gender-specific, web-based substance use prevention intervention tailored to meet the specific concerns of 13-14 year old adolescent girls to delay onset and reduce overall rates of substance use.[106] The intervention consists of nine sessions that address body image, decision making, peer pressure, drug knowledge, communication, and assertiveness. The intervention has undergone initial feasibility testing and is currently being revised to include hypothetical scenarios to allow users to practice skills acquisition in addition to improving enhanced content delivery for the web. Once complete, the intervention will be tested for acceptability with the target audience, feasibility, and efficacy for SUD prevention in adolescent girls.

Utilizing mHealth to improve smoking cessation interventions – My Mobile Advice Program (MyMAP) is a mobile optimized website accessed via smartphone, but designed to be accessible on a variety of mobile platforms to improve medication adherence and provide tailored advice to manage symptoms to help users quit smoking.[107] An initial pilot study determined that MyMAP is a feasible, acceptable, and potentially effective means to support varenicline use to quit smoking. Future studies are planned to determine the efficacy of this intervention for smoking cessation.

Improving health outcomes in people living with HIV using mHealth – African-American adolescent girls are disproportionately at risk for HIV infection. While HIV prevention interventions exist, dissemination and effective implementation remain limited and are often inaccessible to this high risk population. SiHLE*Web* is an internet version of the evidence-based, culturally informed HIV prevention program traditionally delivered to female African-American adolescents in an in-person group format that has been adapted for the web to overcome accessibility barriers. A recent pilot study determined that SiHLE*Web* improved knowledge, was easy to use, and generally attractive; however, users reported some difficulties with website navigation.[108] Further work is underway to improve this prevention intervention and determine the efficacy in preventing HIV infection within this vulnerable population.

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[106] Schwinn, T.M., J.E. Hopkins, and S.P. Schinke, *Developing a Web-Based Intervention to Prevent Drug Use among Adolescent Girls.* Res Soc Work Pract, 2016. 26(1): p. 8-13.
[107] McClure, J.B., et al., *Evaluating an Adaptive and Interactive mHealth Smoking Cessation and Medication Adherence Program: A Randomized Pilot Feasibility Study.* JMIR Mhealth Uhealth, 2016. 4(3): p. e94.
[108] Danielson, C.K., et al., *SiHLEWeb.com: Development and usability testing of an evidence-based HIV prevention website for female African-American adolescents.* Health Informatics J, 2016. 22(2): p. 194-208.

National Institute on Alcohol Abuse and Alcoholism		
Selected Measures of Performance	**FY 2016 Target**	**FY 2016 Achieved**
» Scientific Research Outcome-5.15: By 2018, develop, refine and evaluate evidence-based intervention strategies and promote their use to prevent substance misuse and substance use disorders and their consequences in underage populations.	Disseminate the newly released College Alcohol Intervention Matrix (CollegeAIM) and continue to disseminate the youth screening guide.	NIAAA promoted and disseminated the College Alcohol Intervention Matrix (CollegeAIM), and disseminated the youth screening guide through print and electronic media.
» Scientific Research Outcome-8.7: By 2018, identify three effective system interventions generating the implementation, sustainability and ongoing improvement of research-tested interventions across health care systems.	Continue to encourage alcohol screening for all youth, and referral to treatment for those who need it, by disseminating the youth screening guide. Continue to support online training on the use of the guide that allows healthcare providers to earn continuing medical education credits.	NIAAA encouraged youth alcohol screening and referral to treatment by supporting and promoting continuing medical education training on the use of the guide, organizing or participating in symposia addressing youth alcohol screening, and supporting studies to evaluate the youth screening guide in various settings and populations.

Prevention – Scientific Research Outcome-5.15

NIAAA embarked on a multifaceted effort to promote and disseminate the College Alcohol Intervention Matrix (CollegeAIM) throughout FY 2016. To introduce *CollegeAIM* to college and university officials, NIAAA senior staff and selected researchers from the *CollegeAIM* development team made numerous presentations, including at meetings of: the National Prevention Network; the Student Affairs Administrators in Higher Education, the American College Health Association; Community Anti-Drug Coalitions of America; Higher Education Center for Alcohol and Drug Misuse, Prevention, and Recovery; and the Campus Safety National Forum. NIAAA also collaborated with the NIAAA College Presidents Working Group to Address Harmful and Underage Drinking to organize two regional workshops which introduced *CollegeAIM* to college staff and offered step by step instructions on using the guide and website.

Treatment – Scientific Research Outcome-8.7

NIAAA's *Alcohol Screening and Brief Intervention for Youth: A Practitioner's Guide* was devised to help health care providers identify alcohol use and AUD in children and adolescents, as well as identify risk for alcohol use, especially in younger children. It includes a brief two-question screener and support materials about brief intervention and referral to treatment that are designed to help surmount common obstacles to youth alcohol screening in primary care. To encourage youth alcohol screening and referral to treatment, NIAAA partnered with Medscape to develop an online continuing medical education (CME) training course based on the guide to familiarize clinicians with the screening and brief intervention process and increase their skill and comfort level with it. NIAAA promoted this CME training and organized or participated in symposia addressing youth alcohol screening at professional meetings. In addition, NIAAA has supported six studies to evaluate the effectiveness of its youth guide as an initial screen for drug use and other behavioral health problems primary care, emergency department, juvenile justice setting, and school settings, as well as with youth who have a chronic health condition (e.g., asthma, diabetes).

Research Highlights

Alcohol Screening Among Youth with Chronic Conditions.[109] In a recent NIAAA-funded study, investigators compared the use of NIAAA's two question youth screening tool with a standard 53 question instrument for assessing alcohol use and substance use disorders—the Diagnostic Interview Schedule for Children (DISC)—with children aged 9-18 who were being treated for Type 1 diabetes, asthma, cystic fibrosis, inflammatory bowel disease, or juvenile idiopathic arthritis at a large children's hospital. They found that NIAAA's youth alcohol screening tool is highly efficient for detecting alcohol use and AUD among these populations.

Screening for Underage Drinking and Alcohol Use Disorder in Rural Primary Care Practice.[110] This NIAAA-funded study used a computer-administered assessment to examine alcohol involvement, including patterns of alcohol consumption and presence of AUD in a large sample of adolescents seen in rural primary care settings. The study found that 10 percent of these youth over age 14 years had past-year AUD. When they examined various alcohol use patterns in this population as a screen for AUD, the researchers found that a single question on past year drinking frequency as recommended in NIAAA's youth guide was effective at identifying youth at moderate risk for AUD and those at the highest risk. These and other studies demonstrating the utility of the youth screening guide are expected to encourage further adoption of youth alcohol screening in healthcare and other appropriate settings.

[109] Levy S, Dedeoglu F, Gaffin JM, Garvey KC, Harstad E, MacGinnitie A, Rufo P, Huang Q, Ziemnik RE, Wisk LE, Weitzman ER. *A Screening Tool for Assessing Alcohol Use Risk among Medically Vulnerable Youth.* PLOS One. 2016. Doi:10.1371/journalpone.0156240

[110] Clark DB, Martin CS, Chung T, Gordon AJ, Fiorentino L, Tootell M, Rubio DM. Screening for Underage Drinking and *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* Alcohol Use Disorder in Rural Primary Care Practice. J Pediat. 2016; 173:214-20. doi: 10.1016/j.jpeds.2016.02.047.