

## Publications

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# 2022-2026 NIDA Strategic Plan

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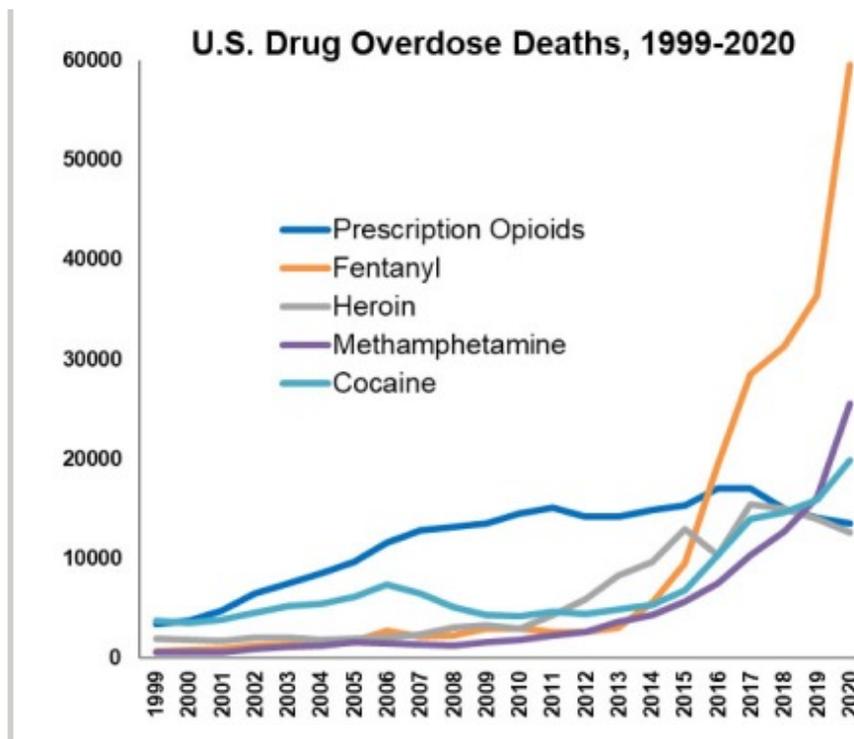
Strategic Planning Process

# 2022-2026 NIDA Strategic Plan

## Director's Message

The National Institute on Drug Abuse (NIDA) is the lead federal agency supporting scientific research on drug use and addiction. After decades of research, we now understand substance use disorders (SUDs) to be chronic but treatable brain disorders that emerge from the complex interplay of biological, social, and developmental factors. Adverse social determinants of health enable biological vulnerabilities to SUDs to emerge, just as protective factors in one's social environment reduce the risk of substance use and addiction. NIDA-supported research has illuminated these risk and protective factors and led to the development of effective prevention and treatment interventions, providing hope for the more than 40 million people in the United States with SUDs and their loved ones. Yet, NIDA's mission remains critical, given the challenges that SUDs present to the nation today.

Drug overdoses in the United States have been increasing exponentially for at least 40 years, but different substances have driven this increase over time.<sup>1</sup> Opioids have been involved in most overdoses over the past two decades. The opioid overdose crisis was initially driven by misuse of prescription opioids and later by heroin use. However, since 2016, synthetic opioids, such as fentanyl, have accounted for the largest fraction of overdose deaths. Provisional data from the Centers for



Disease Control and Prevention show a record high of close to 109,000 overdose deaths in 2021, with more than 75 percent involving

opioids.<sup>2</sup> Stimulants also have reemerged as an overdose threat. From 2012 through 2021, the number of deaths involving methamphetamine increased nearly 13-fold (from ~2,600 to nearly 33,500); the number involving cocaine increased nearly six-fold (from ~4,400 to nearly 25,000).<sup>3</sup> The alarming increase in stimulant-involved overdose deaths is a stark illustration that we face an evolving addiction and overdose crisis characterized by shifting use of different substances and use of multiple drugs and drug classes together.<sup>4</sup>

The collision of the overdose crisis with the coronavirus disease 2019 (COVID-19) pandemic puts people with SUDs at particular risk. Drug use and overdose markedly increased after the pandemic began;<sup>5</sup> the 34 percent increase in overdose deaths between 2019 and 2020 was the largest one-year increase ever recorded.<sup>6</sup> Individuals with SUDs are at higher risk for COVID-19 and its adverse outcomes.<sup>7</sup> Social isolation and stress—factors long known to drive substance use and relapse—are likely contributing factors.

In the face of an ongoing addiction and overdose crisis and a global pandemic, NIDA's FY 2022-2026 Strategic Plan represents an opportunity to take stock of how far we have come in drug addiction research while also redoubling our focus on the priorities and values that will move our mission forward. The strategic plan reflects our commitment to advancing all aspects of addiction science in the service of improving people's lives. Today's landscape of substance use poses both unique challenges and unprecedented opportunities to leverage the amazing potential of science toward that goal. While we have made impressive progress, there is more to be done.

I profoundly thank all those who contributed their thoughts and expertise to this strategic plan. I look forward to continuing to work together to achieve NIDA's ambitious goals.

Nora D. Volkow, M.D.

Director, National Institute on Drug Abuse

#### Sources

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## Executive Summary

### NIDA's Mission

NIDA's mission is to advance science on drug use and addiction and to apply that knowledge to improve individual and public health through:

- Strategically supporting and conducting basic, clinical, and epidemiological research on drug use, its consequences, and the underlying neurobiological, behavioral, and social mechanisms involved.
- Ensuring the effective translation, implementation, and dissemination of scientific research findings to improve the prevention and treatment of SUDs, reduce the harms associated with drug use, guide policies, enhance public awareness of addiction as a chronic but treatable medical illness and reduce stigma.

### Overview

This strategic plan reflects NIDA's commitment to advancing all aspects of addiction science - from basic to translational, clinical, and health services research - in the service of enhancing fundamental knowledge and improving people's lives. Today's landscape of substance use poses both unique challenges and unprecedented opportunities to leverage the profound potential of science toward those goals. While we have made impressive progress, there is more to be done.

Over the next five years, NIDA will continue to support cutting-edge research informed by people with lived experience across all facets of our scientific portfolio, while remaining nimble enough to take advantage of new scientific opportunities and address emerging public health needs.

### Strategic Plan Framework

- **Cross-Cutting Priorities (inner circle)** reflect key priorities that are critical across NIDA's scientific portfolio.
- **Priority Scientific Areas (outer circles)** articulate how NIDA will advance research across its portfolio to build fundamental knowledge and address the evolving addiction and overdose crisis.

## FY 2022-2026 NIDA Strategic Plan



[See long description below for accessible description of this figure](#)

## Cross-Cutting Priorities

[Cross-cutting Priorities](#) span NIDA's portfolio and will contribute substantially to our mission over the next five years:

- [Train the Next Generation of Scientists](#)
- [Identify and Develop Approaches to Reduce Stigma](#)
- [Understand Sex, Sexual Orientation, and Gender Differences](#)
- [Identify and Develop Approaches to Reduce Health Disparities](#)
- [Understand Interactions Between Substance Use, HIV, and other Comorbidities](#)
- [Leverage Data Science and Analytics to Understand Real-World Complexity](#)

- [Develop Personalized Interventions Informed by People with Lived Experience](#)

## Priority Scientific Area 1: Understand Drugs, the Brain, and Behavior

Basic and behavioral research are transforming our understanding of drug use and addiction. Research has made significant advances in understanding how the brain functions, how drugs interact with brain processes, and how SUDs develop and resolve. Epidemiological studies have provided insight into how substance use patterns evolve and relate to risk and protective factors, while policy research has illuminated how laws and regulations related to drug use impact health. NIDA will continue to support research in each of these areas, with a focus on the following goals:

- [Priority Scientific Area 1: Understand Drugs, the Brain, and Behavior](#)
  - [Goal 1.1: Expand our understanding of the biological mechanisms underlying drug use, addiction, diverse treatment responses, and their impact on health and behavior throughout the lifespan](#)
  - [Goal 1.2: Advance research on the social determinants of health related to brain development, substance use, and addiction](#)
  - [Goal 1.3: Enhance our knowledge of the real-world landscape of drug use patterns and trends, and trajectories to addiction](#)

## Priority Scientific Area 2: Develop and Test Novel Prevention, Treatment, Harm Reduction, and Recovery Support Strategies

Developing new and improved pharmacological and non-pharmacological strategies to prevent and treat SUDs, reduce adverse outcomes associated with drug use, and support long-term recovery of people following treatment are top priorities for NIDA research. As our understanding of addiction evolves, there are increasing opportunities to make interventions more holistic, nuanced, and dynamic, similar to interventions for other medical illnesses. NIDA's goals for intervention research include:

- [Priority Scientific Area 2: Develop and Test Novel Prevention, Treatment, Harm Reduction, and Recovery Support Strategies](#)

- [-Goal 2.1: Develop and test novel strategies for preventing drug use, SUDs, and their consequences](#)
- [-Goal 2.2: Accelerate the science of harm reduction](#)
- [-Goal 2.3: Expand the range of treatment options for SUDs and their consequences](#)
- [-Goal 2.4: Advance the science of recovery support](#)

## Priority Scientific 3: Accelerate Research on the Intersection of Substance Use, HIV, and Related Comorbidities

Despite scientific advances, rates of HIV remain unacceptably high. Substance use plays a significant role in HIV transmission, and indeed the opioid crisis has been associated with marked increases in the number of people who inject drugs in the U.S. and with localized HIV outbreaks. NIDA has long recognized the intertwined nature of substance use and HIV and will continue to support innovative and multidisciplinary research in this area. NIDA goals for HIV research include:

- [\*\*Priority Scientific 3: Accelerate Research on the Intersection of Substance Use, HIV, and Related Comorbidities\*\*](#)
  - [Goal 3.1: Increase understanding of the etiology, pathogenesis, spread, and persistence of HIV/AIDS among people who use drugs](#)
  - [Goal 3.2: Prevent new infections and transmission of HIV among people who use drugs and their sexual and/or injection partners](#)
  - [Goal 3.3: Address comorbidities and improve health outcomes among people living with HIV who use drugs](#)

## Priority Scientific Area 4: Improve the Implementation of Evidence-Based Strategies in Real-World Settings

Although effective interventions exist for preventing and treating substance use and SUDs, their reach has been limited. To scale up research-based interventions in diverse settings, it is essential to understand and address the many factors that promote or impede implementation. NIDA will continue to support a robust implementation science portfolio aimed at bridging the gaps among research,

practice, and policy with a focus on the following goals:

- **Priority Scientific Area 4: Improve the Implementation of Evidence-Based Strategies in Real-World Settings**
  - Goal 4.1: Study approaches to improve the integration of SUD care into medical practice
  - Goal 4.2: Develop and test strategies for overcoming barriers to access and ensuring continuity of care
  - Goal 4.3: Support research to scale up the application of evidence-based interventions for SUDs including in justice settings

## Priority Scientific Area 5: Translate Research into Innovative Health Applications

NIDA is a leader in leveraging the power of small-business innovation to develop new tools and technologies for preventing, diagnosing, and treating SUD. To continue to innovate in this space, NIDA's goals include:

- **Priority Scientific Area 5: Translate Research into Innovative Health Applications**
  - Goal 5.1: Facilitate research translation through education and partnerships
  - Goal 5.2: Capitalize on new technologies to deliver novel prevention, treatment, and recovery interventions

### Description of Strategic Plan Graphic

A series of circles referencing the Priority Areas surrounding a center circle describing the Cross Cutting Priorities of:

- Research Training
- Stigma
- Sex and Gender Differences
- Health Disparities

- Comorbidities
- Data Science
- Personalized Interventions

Top Priority Circle - Understanding Drugs, the Brain and Behavior references:

- Neuroscience
- Neurocircuitry
- Behavior
- Social Determinants
- Epidemiology
- Genetics/Epigenetics
- Development
- Pharmacology

Next Priority Circle - Prevention, Treatment and Recovery references:

- Prevention
- Treatment
  - Medications
  - Biologicals
  - Neuromodulation
  - Behavioral Therapeutics
- Recovery
- Harm Reduction

Next Priority Circle - Intersection of Substance Use and HIV references:

- Mechanisms of HIV and SUD
- HIV Prevention
- SUD and HIV Treatment
- Comorbidities

Next Priority Circle - Implementation Science references:

- Service Delivery
- Models of Care
- Access to Care
- Sustainability
- Implementation
- Policy
- Health Economics

Final Priority Circle - Innovative Health Applications references:

- Product Development
- Tools and Technologies
- Public-Private Partnerships

## NIDA's Organizational Structure

The National Institute on Drug Abuse (NIDA) is the lead federal agency supporting scientific research on drug use and addiction and was established as an Institute within the National Institutes of Health (NIH) as part of the Alcohol, Drug Abuse, and Mental Health Reorganization Act of 1992 (P.L. 102-321).

NIDA's organizational structure comprises the [Office of the NIDA Director](#), the [Office of Management](#), the [Office of Science Policy and Communications](#), the [Intramural Research Program](#), the [Division of Extramural Research](#), and three extramural funding divisions: the [Division of Neuroscience and Behavior](#); the [Division of Therapeutics and Medical Consequences](#); and the [Division of Epidemiology, Services and Prevention Research](#). NIDA is also home to the [Center for Clinical Trials Network](#), which manages the [National Drug Abuse Treatment Clinical Trials Network](#); the [Office of Translational Initiatives and Program Innovations](#), which provides leadership to speed the translation of research discoveries into health applications; and the [HIV Research Program](#), which is responsible for developing, planning, and coordinating high-priority research at the intersection of HIV, substance use, and SUDs. Through a wide range of programs, workshops, and funding mechanisms, the [Office of Research Training, Diversity, and Disparities](#) supports researchers at multiple stages of their careers, aims to enhance the diversity of the addiction science workforce, and promotes research to address health inequities.

Through grants and contracts awarded to investigators at research institutions around the country and overseas, as well as through its Intramural Research Program, NIDA addresses the most fundamental and essential questions about substance use. This includes detecting and responding to emerging substance use trends, understanding how drugs work in the brain and body, identifying social determinants of substance use risk and SUDs, and developing and testing new approaches to prevention, treatment, and recovery.

## Introduction

NIDA's mission is to advance science on drug use and addiction and to apply that knowledge to improve individual and public health through:

- Strategically supporting and conducting basic, clinical, and epidemiological research on drug use, its consequences, and the underlying neurobiological, behavioral, and social mechanisms involved.
- Ensuring the effective translation, implementation, and dissemination of scientific research findings to improve the prevention and treatment of SUDs, reduce the harms associated with drug use, guide policies, enhance public awareness of addiction as a chronic but treatable medical illness,

and reduce stigma.

NIDA's research advances fundamental knowledge and provides scientific evidence to inform individual and public health, including the policies and practices of other federal agencies; state and local health, education, and human services; and the legal system. As such, the FY 2022-2026 NIDA Strategic Plan was developed with multiple audiences in mind, including academic researchers, small businesses and other industry partners, federal and state policymakers, providers, individuals affected by SUDs and their families, and other stakeholders.

The strategic plan focuses on scientific opportunities to meet current public health needs, yet NIDA acknowledges that the landscape of drug use and addiction is always changing and that scientific breakthroughs can alter the course of research. Over the next five years, NIDA will continue to support cutting-edge research across all facets of our scientific portfolio, informed by people with lived experience with drug use and addiction, while remaining nimble enough to take advantage of new scientific opportunities and address emerging public health challenges. Recognizing the deep racial health inequities that exist in the field of addiction, NIDA is redoubling its focus on reducing—and ultimately, eliminating—these disparities. Understanding the role of racism on substance use and its outcomes is essential to our mission and will continue to be a key focus of our research and policy efforts (see callout box below - "*NIDA's Racial Equity Initiative*".)

## NIDA's Racial Equity Initiative

From racist violence to the disproportionate impact of COVID-19 on Black Americans, racial injustice persists in our society and is particularly evident in the field of addiction, where punitive approaches to drug use are unevenly applied to Black individuals and other communities of color, and racial discrimination and trauma are significant contributors to substance use, addiction, and suboptimal treatment.

Science is not immune to racial injustice. People of color face an array of unique challenges beginning early in their education, and fewer ultimately pursue scientific careers. Structural inequities in scientific institutions can produce unexamined biases in research and exclude people of color from the scientific workforce, both of which contribute to health disparities.

In July 2020, NIDA established [NIDA's Racial Equity Initiative](#) (REI) to organize NIDA's efforts to eliminate racial inequities in NIDA's research portfolio, the addiction science workforce, and the NIDA workplace, and NIDA will be dedicating at least \$100 million in addition to existing investments over 10 years to this work. Based on the efforts of NIDA's REI workgroups, NIDA is increasing its support for highly meritorious projects carried out by scientists from underrepresented groups; supporting research to understand and address the impact of racism on risk for substance use, drug use outcomes, and disparities in SUD care; and implementing culturally tailored interventions and solutions to address digital inequalities in communities heavily impacted by addiction. NIDA's REI is also developing programs to engage underrepresented groups in science, starting in kindergarten and providing training and career development throughout their scientific careers.

NIDA's strategic plan includes five **Priority Scientific Areas** that address NIDA's priorities in basic science and behavioral research, intervention development, implementation science, and translational research:

- [Priority Scientific Area #1: Understand Drugs, the Brain, and Behavior](#)
- [Priority Scientific Area #2: Develop and Test Novel Prevention, Treatment, Harm Reduction, and Recovery Support Strategies](#)
- [Priority Scientific Area #3: Accelerate Research on the Intersection of Substance Use and HIV](#)
- [Priority Scientific Area #4: Improve the Implementation of Evidence-Based Strategies in Real-World Settings](#)
- [Priority Scientific Area #5: Translate Research into Innovative Health Applications](#)

Within each Priority Scientific Area, **Goals** reflect targeted areas of emphasis to grow our portfolio and speed progress toward achieving our mission. Each Goal is broken down into **Key Focus Areas**, which reflect research opportunities as well as concrete activities NIDA will undertake in pursuit of that Goal.

[Scientific Stewardship](#) and [Management and Accountability Priorities](#) focus on how NIDA as a federal agency fosters excellent stewardship of the public funds it receives and effectively administers its research and training programs, including cultivating a highly skilled and diverse research workforce.

NIDA's strategic plan also includes the following [Cross-Cutting Priorities](#), which span NIDA's diverse portfolio and will contribute substantially to our mission over the next 5 years.

## Cross-Cutting Priorities

### Train the Next Generation of Scientists

NIDA is committed to educating and inspiring the next generation of researchers. NIDA training programs are designed to cultivate and retain a diverse workforce capable of advancing all aspects of addiction science, capitalizing on scientific breakthroughs, and meeting emergent public health needs. NIDA's innovative training programs, which are designed to attract scientists at all stages of the career continuum, include the NIDA Summer Research Internship Program for students at an early career stage; the NIH and NIDA diversity supplement program for postbaccalaureate and graduate students, postdoctoral fellows, and investigators from underrepresented backgrounds; and the NIDA Diversity Scholars Network Program for postdoctoral, early-stage, and new investigators. NIDA's Intramural Research Program (IRP) also has programs to support and train post-baccalaureate and postdoctoral fellows from all backgrounds. We also provide resources and training through the NIDAMED Initiative to help health care providers care for people with, and at risk for, SUDs. NIDA will continue to implement innovative approaches to attract and retain scientists and clinicians, including those from underrepresented backgrounds, who can meet future challenges in addiction research.

### Identify and Develop Approaches to Reduce Stigma

People with SUDs are often viewed negatively and unsympathetically by other members of society, including their own families, colleagues, and health care providers. The continued criminalization of drug use—unevenly applied to Black people and other people of color—creates a form of social sanctioning of stigma, legitimizing not only negative portrayals of drug use and addiction but also tangible expressions of social rejection in the form of punishment and other dangers. Stigma can

prevent people from disclosing their drug use to health care providers and engaging in care. When care is sought, the stigmatizing views of providers may prevent an individual from receiving adequate care. For these reasons, NIDA is prioritizing research to combat stigma and improve engagement in treatment.

## Understand Sex, Sexual Orientation, and Gender Differences

SUDs can manifest differently among cis-gender heterosexual women and men, and individuals who identify as lesbian, gay, bisexual, transgender, or questioning (LGBTQ+). Women typically proceed to addiction faster than men and are more likely to take drugs to relieve stress or pain, and women who use substances have comorbid mental illnesses more often. During the pregnancy and postpartum periods, women are more vulnerable to substance use and its consequences, including long-lasting impacts on their infants. Women also respond differently to certain treatments than men. There is a vital need to better understand how biological differences translate to sex differences in addiction phenotypes and treatment response, and to translate these findings into interventions tailored for women. In addition, it is imperative to consider the unique experiences that arise from marginalizing people based on gender identity and sexual orientation. People who identify as LGBTQ+ face forms of discrimination and other challenges not encountered by people who identify as cis-gender heterosexual. As a result of these and other stressors, individuals in these communities are at increased risk for substance use. NIDA will continue to prioritize research to understand substance use risk factors among LGBTQ+ individuals and to develop evidence-based interventions specialized for these communities.

## Identify and Develop Approaches to Reduce Health Disparities

Disparities in substance use and access to interventions are tied to social, economic, and/or environmental disadvantages. Disparities affect many groups, including people living in rural settings characterized by vast stretches of land and few treatment options, low-resource communities where costs of transportation or child care may be prohibitive, and racial and ethnic groups who face discrimination on a broader scale. Racial disparities in access to SUD care are particularly striking, adversely affecting people who already face systemic racism and other barriers to health care. NIDA has renewed its focus in this area through our [Racial Equity Initiative](#), and NIDA-supported research must focus on solutions to reduce—and ultimately eliminate—all health disparities. This includes foundational research to identify specialized needs and intervention targets to inform the development

of culturally responsive and tailored interventions that can be implemented equitably.

## Understand Interactions Between Substance Use, HIV, and Other Comorbidities

SUDs rarely occur in isolation: Many individuals who use drugs use multiple substances and have other co-occurring mental illnesses or other health conditions such as HIV and the hepatitis C virus (HCV), chronic pain, cardiovascular disease, and cancer. Foundational research is needed to identify shared risk factors for SUDs and mental illnesses, as well as biological and environmental mechanisms that contribute to mental health and other comorbid conditions as these can become targets for treatment or prevention. Clinical and health services research is needed to better integrate substance use treatment into general medical and specialty care, to retain individuals in treatment once they begin, and to develop effective new strategies for delivering care for substance use and co-occurring illnesses.

## Leverage Data Science and Analytics to Understand Real-World Complexity

The interdisciplinary field of data science uses quantitative and analytical approaches, processes, and systems to extract knowledge and insights from increasingly large and complex data sets, providing unprecedented opportunities to improve our understanding of drug use and addiction. Advances in data science, computational science, and other relevant disciplines allow researchers to find meaningful trends within these data, including understanding patterns within genetic or neural activity data, identifying candidate drug targets and therapeutic molecules, and processing behavioral and health care utilization data. Statistical analyses, computational modeling and machine learning are being used to fuel predictive findings, which can help anticipate and respond to future crises.

However, the standardization, analysis, interpretation, and quality control of big data sets present formidable challenges that require new infrastructure, training paradigms, interdisciplinary teams, and a culture of data sharing. There is also increasing recognition of the importance of detecting—and mitigating—bias within data sets and the statistical methods, artificial intelligence, and machine learning algorithms applied to them. Such bias may cloud the interpretation of results and has the potential to inadvertently contribute to racism and racial disparities (e.g., by attributing certain findings

to race without considering underlying societal causes), a particular concern for the field of addiction, where stigma and discrimination are entrenched.

For these reasons, NIDA is committed to the FAIR (Findable, Accessible, Interoperable, Reusable) principles, which are a cornerstone of data stewardship and ensure the reusability of digital assets. NIDA will also continue to support research to develop bibliometric tools and citation analyses for assessing the rigor and reproducibility of scientific publications; tools for facilitating rigorous study design and analysis; and resources for promoting best data practices. This includes training for graduate students and postdoctoral fellows in experimental design and data analysis. As the field of data science moves forward, NIDA will continue to promote cutting-edge technologies, create or enhance programs that include diverse perspectives, address gaps and opportunities in training and workforce development, foster data stewardship and sustainability, encourage broad research use of clinical health care data, and engage communities to develop new partnerships and enhance data science activities. NIDA's investment in this "science of science" is aimed at improving the practice of science itself.

## Develop Personalized Interventions Informed by People with Lived Experience

An individual's environment, experience, and biology together determine that person's risk for developing SUDs and related conditions, the trajectory the person will take, and the interventions that will be the most effective treatment. For example, genome-wide association studies (GWAS) have revealed genetic variants associated with the effectiveness of particular methadone doses in certain populations, responsivity to smoking cessation treatments, and even to smoking prevention interventions. As our understanding of how individual variability affects health outcomes grows, so does the potential to develop individually tailored interventions based on these data.

Personalized addiction medicine must consider a person's treatment goals as well as that person's unique and changing life circumstances. For example, it is now recognized that while abstinence may be a desired outcome for some, others may benefit from interventions that reduce drug use, alleviate withdrawal symptoms such as insomnia or depression, or lead to safer drug use practices.

Perspectives from people with lived experience laid the foundation for this understanding and their voices should be included in the process of new intervention development.

This work will be aided by large-scale research initiatives such as the NIDA-led [Adolescent Brain Cognitive Development \(ABCD\) Study®](#) and [HEALthy Brain Child Development \(HBCD\) Study](#), and the [NIH All of Us research program](#); the expanding use of electronic medical records; and advances in information science and analytics that make it possible to harness the vast quantities of data collected. Likewise, digital therapeutics, an area in which NIDA has made a significant investment, have the potential to provide comprehensive, personalized health care services where and when patients need them. NIDA will continue to support research to further illuminate the factors that contribute to heterogeneity in drug use, SUD, and related outcomes and to develop tailored, patient-centered interventions to prevent and treat them.

## Priority Scientific Area #1: Understand Drug Use, Behavior, and the Brain

NIDA's investment in basic science is transforming our understanding of drug use and addiction. The fields of neuroscience, medicinal chemistry, pharmacology, genetics and epigenetics, behavioral science, and epidemiology have illuminated how the brain functions; how drugs interact with brain circuits; the factors that influence drug use; and how SUDs develop, manifest over time, and resolve. This research has led to the understanding that addiction is a medical condition that is strongly influenced by social circumstances, affects the brain, changes behavior, and negatively impacts health. It has also provided the foundational knowledge upon which effective interventions have been developed. While tremendous strides have been made, to address the evolving crises of drug use and addiction it is essential to develop a deeper understanding of the brain and how it is affected by substance use. This means further interrogating the molecular signals and neural circuits that are modified by drug use; finding gene-environment interactions that could guide the development of powerful new treatments; and developing new models to understand how biological mechanisms drive behavior across the continuum of addiction, from initial drug use to treatment and recovery. Creating a full picture of drug use and addiction also requires understanding the contextual landscape and trajectory of drug use in the United States, including how drugs are used and by whom, and how risk and protective factors interact over an individual's lifespan to influence drug-related outcomes.

Goal 1.1: Expand our understanding of the biological mechanisms underlying drug use, addiction, diverse treatment responses, and their impact on health and behavior throughout the lifespan

A significant portion of NIDA's research portfolio will continue to be dedicated to advancing our knowledge of the basic biological mechanisms that underlie drug use and addiction, and their effects on the body throughout the lifespan.

Although the protein targets and signal transduction pathways relevant to substances with addiction liability have been known for some time, NIDA-supported research is resolving the structure and dynamics of these proteins at an atomic level and identifying how the binding of specific drugs initiates the distinct signaling cascades that become the cellular basis of their physiological and behavioral effects. Recent studies using newly developed genetically encoded biosensors revealed that opioid receptors do not just function at the cell membrane as previously thought but can move into the cell and can be functional at different cellular locations, depending on the opioid type. This could be related to the distinct profiles of drugs in producing tolerance or dependence. Genetic screens in model organisms have identified an orphan receptor—a receptor for which the ligand or signaling molecule has not been identified—that has anti-opioid activity. This could be a target for treating the adverse consequences of opioids. These examples demonstrate how advances in our knowledge of opioid receptor signaling and function can lead to new approaches to treatments.

NIDA-supported research is leveraging cutting-edge tools developed through the [NIH Brain Research Through Advancing Innovative Neurotechnologies<sup>®</sup> \(NIH BRAIN Initiative<sup>®</sup>\)](#) and other efforts to accelerate our understanding of brain function and addiction at a multidimensional level. For example, single-cell transcriptional profiling approaches identified gene expression changes in specific brain cell types that occur in response to specific drugs. New approaches in neural circuit dissection are elucidating how the circuits engaged by different drugs underlie cognitive dimensions of addiction. In addition, new chemogenomic and chemoproteomic approaches are accelerating the discovery of targets that can be modified and used for therapeutic purposes.

Not everyone who uses substances goes on to develop an SUD. Addiction science has made strides in identifying biological risk factors for substance use, SUD, and related outcomes. Genetic studies—including GWAS—have identified genes that can protect or predispose an individual to developing addiction, including genes that modulate responses to adverse social environments. GWAS are also identifying genes relevant to addiction treatment, including genetic variants associated with heroin use outcomes and effective doses of methadone for different populations. Advances in brain imaging are beginning to delineate the role of genes in brain development and are helping researchers identify key periods of development during which exposure to socio-environmental factors can disrupt the trajectory of brain development and impact long-term outcomes, including substance use behaviors. Combined with the power of big data analytics and supercomputers that can integrate and predict causal relationships from genetic, molecular, cellular, systems, and behavioral data, these tools offer the promise of elucidating addiction biology at an unprecedented level of detail, ultimately guiding the development of improved prevention and treatment interventions.

## Key Focus Areas

- Identify the genes and networks of genes that modulate drug responses, risk for addiction, and treatment responses.
- Characterize how the genetic, epigenetic, and molecular profiles of individual cells change in response to different substances across the trajectory of drug use by leveraging novel approaches for single-cell analysis.
- Identify novel targets for therapeutics through new knowledge of receptor structure combined with high-throughput screening studies and related approaches.
- Further elucidate the neural circuits and mechanisms underlying SUDs, including the progression from initial to compulsive substance use and the recovery process.
- Determine the complex relationship between neural activity and behavior using novel tools for cell manipulation and observation and computational modeling.
- Identify the biological bases for individual differences in substance use and SUD vulnerability and resilience.
- Characterize the chemistry, pharmacology, toxicology, and addictive potential of emerging drugs and drug combinations.

Goal 1.2: Advance research on the social determinants of health related to brain development, substance use, and addiction

Individual health is inextricably linked to one's social environment and living conditions. NIDA-supported research has identified multiple social determinants of health—risk and resilience factors related to an individual's life experiences—that contribute to substance use initiation and progression to addiction as well as to key comorbidities like other mental illnesses. Lack of strong relationships and community support—including adverse childhood experiences and exposure to drug use, violence, trauma, poverty, homelessness, incarceration, and racism—confer risk for drug use and addiction, comorbidities, and other adverse health outcomes. Conversely, strong family relationships, healthy role models, and a safe, supportive community are protective factors, especially in children. NIDA research is elucidating how these social determinants of health increase or decrease risk for addiction over the lifespan.

Understanding how risk and protective factors in one's environment can influence individual drug use trajectories and comorbidities is essential for informing the development of interventions. NIDA is prioritizing studies to help us better understand how social determinants of health impact substance use, treatment utilization, outcomes, and recovery, as well as research on interventions targeting these determinants. Findings from NIDA-led prospective, longitudinal [ABCD Study](#)<sup>®</sup> and [HBCD Study](#) data will inform our understanding of healthy development—including brain and cognitive development—and how drugs and other exposures affect it (see callout box below, "*Longitudinal Studies of Child Brain Development*"). NIDA is exploring opportunities to leverage these data and to connect the fields of epidemiology, developmental neuroscience, and prevention to inform interventions for a wider range of youth.

## Longitudinal Studies of Child Brain Development

The first few years of life are a period of exponential brain growth and development, and the long-term effects of early environmental exposures—including in utero drug exposures—on infant and child development are not well understood. The brain continues to develop during adolescence and young adulthood when risk-taking behaviors, such as drug use, can emerge. It is vital to understand the effects of drugs and other environmental exposures

during these key developmental windows to ameliorate negative outcomes and promote resilience.

NIDA is leading two large trans-NIH research initiatives, the [Adolescent Brain Cognitive Development \(ABCD\) Study<sup>®</sup>](#) and the [HEALthy Brain and Child Development \(HBCD\) Study](#), that aim to do just that. Launched in 2015, the ABCD Study<sup>®</sup> is the largest long-term study of brain development and child health ever conducted in the United States.

Researchers are following nearly 12,000 children from ages 9 to 10, prior to substance use initiation, through adolescence into young adulthood, the period of highest risk. This study will identify risk and resilience factors for substance use and help us understand how substance exposures and other experiences shape brain, cognitive, social, and emotional development. ABCD Study<sup>®</sup> data are available to the broad scientific community, allowing researchers all over the world to ask questions and gain insights that may not have even been imagined at the study's inception. Benefiting from open data sharing and sophisticated data analysis methods, the ABCD Study<sup>®</sup> has provided the world with a promising and highly productive research approach that has already resulted in [numerous publications that span a wide array of topics](#), including substance use, psychiatric conditions, screen time, neighborhood disadvantage, obesity/weight gain, genetics, and their interactions with brain structure and function.

Using similar methods as the ABCD Study<sup>®</sup>, and with partial funding from the [NIH Helping to End Addiction Long-Term<sup>®</sup> \(HEAL\) Initiative](#), the HBCD Study will follow approximately 7,500 children from the prenatal period through ages 9-10. Launched in 2021, this study will help us understand normative variation in brain development and how it contributes to cognitive, behavioral, social, and emotional functioning. The HBCD Study will also provide critical data on how exposure to drugs and other environmental influences affect development through early childhood.

The longitudinal design and scientific rigor of these studies will provide unprecedented opportunities to examine and draw causal inferences from a multitude of factors about how the relationships among them affect developmental outcomes. NIDA is also encouraging

prevention, treatment, and implementation scientists to take advantage of these findings as they emerge to facilitate the translation of developmental neuroscience into interventions, policies, and practices to help youth reach their full potential.

## Key Focus Areas

- Elucidate the social determinants of vulnerability to substance use and addiction, including the role of racism and other forms of discrimination.
- Examine the mechanisms whereby social determinants of health interact with biological factors, including genetics, to influence risk or resilience for substance use and SUDs, and other comorbid mental health conditions.
- Support longitudinal research on the impacts of substance use and other socio-environmental influences on development throughout the lifespan.
- Model how these complex factors interact to contribute to substance use and SUDs.

Goal 1.3: Enhance our knowledge of the real-world landscape of drug use patterns and trends, and trajectories to addiction

Epidemiological and policy research are essential for improving our understanding of the real-world landscape of drug use. This includes determining which drugs are used (alone and in combination) and by whom; the incidence and prevalence of drug use disorders, key comorbidities such as other mental illnesses, viral infections, and other conditions (see callout box below, “*Collision of COVID-19 and Substance Use Disorders*”), other precursors and consequences of drug use; and how these all shift over time.

NIDA has long supported epidemiological studies that monitor trends in drug use and related outcomes. The annual [Monitoring the Future](#) survey measures substance use and related attitudes among adolescent students, and the longitudinal [Population Assessment of Tobacco and Health \(PATH\) Study](#)—a collaboration with the U.S. Food and Drug Administration’s (FDA) Center for Tobacco Products—assesses how tobacco use affects behavior and health outcomes. Findings from these studies showed that flavored e-cigarette products particularly appeal to youth and helped inform a 2020 FDA guidance prioritizing

enforcement against certain unauthorized flavored cartridge-based products that appeal to youth.<sup>8,9</sup> In addition to annual studies like these, other approaches are needed to more rapidly detect trends related to drugs and drug use. NIDA's [National Drug Early Warning System](#) provides near real-time data on indicators of emerging drug use, availability, and consequences by leveraging existing data from law enforcement, public health, and research sources, in combination with novel data available via the internet and media. NIDA is placing a high priority on innovative research that utilizes novel data collection and sophisticated analysis methods that integrate information from multiple sources and reduce lag times in data reporting.

NIDA also plays a key role in evaluating the effects of national and state-level drug policies aimed at reducing drug use and misuse. Such research has shown that higher taxes on cigarettes and smoke-free workplace laws result in significant reductions in smoking, and naloxone distribution programs prevent overdose, increase quality-adjusted life years, and are cost-effective. This research has bolstered support for these public health strategies. In the era of rapidly shifting state cannabis policies, it will be essential to research how increased availability and use of cannabis impacts educational outcomes, job productivity, health conditions, and other outcomes. As the COVID-19 pandemic brought about significant drug treatment policy changes that expanded telehealth and access to medications for opioid use disorder (MOUD), research is also needed on the impact of these changes and how they can be leveraged to further improve treatment access. NIDA-supported epidemiological and policy research will remain critical to inform addiction science broadly, along with evolving policy and practice.

## Key Focus Areas

- Develop and test novel data collection and analysis methods to improve the timeliness of data on drug use, addiction, and related consequences.
- Encourage study designs, data formats, and measurements that directly address the needs of patients, providers, and policymakers.
- Evaluate the effects of local, state, and national drug policies on public health.
- Advance research on the impact of comorbid mental and physical conditions on substance use and addiction.

- Understand the social, behavioral, and economic effects of the COVID-19 pandemic on substance use and addiction.
- Examine the use of cannabis for medicinal purposes, including different products, reasons for use, timing, and outcomes on non-cannabis medication use.

## Collision of COVID-19 and Substance Use Disorders

The addiction and overdose crisis has collided with the COVID-19 pandemic, each exacerbating the deleterious effects of the other. People who use drugs are more vulnerable to SARS-CoV-2 infection, more vulnerable to worse outcomes, and at higher risk for breakthrough infections in vaccinated individuals. Smoking or vaping drugs—including tobacco/nicotine, marijuana, heroin, or crack cocaine—worsens chronic lung conditions, which can make a person more likely to get severely ill from SARS-CoV-2. People with opioid use disorder (OUD) are also vulnerable because opioids act in the brainstem to slow breathing, increasing the risk for long-term damage to the lungs, heart, brain, and other organs that are also affected by SARS-CoV-2. In addition, the use of stimulants constricts the blood vessels and may increase the risk for stroke, heart attacks, abnormal heart rhythm, seizures, and other conditions that may lead to more severe consequences of SARS-CoV-2 infection.

Researchers have long recognized the strong correlation between stress and substance use, particularly in prompting relapse, and pandemic-related stress likely contributes to the dramatic increases in drug use and overdose. There have been increased reports of mental distress since the onset of the pandemic, including among individuals with no history of mental disorders, younger adults, essential workers, unpaid adult caregivers, and people from diverse racial and ethnic communities. Social isolation, as occurred with earlier COVID-19 mitigation policies, also made people with SUDs more vulnerable to negative outcomes because it interfered with many of the support systems that can help them to reach and sustain recovery.

Other contributing factors to mental distress include job loss, underemployment, and risk of COVID-19 exposure among low-income essential workers, who are more likely to be racial and ethnic minorities. In fact, Black Americans and other communities of color report greater mental distress and COVID-19-related discrimination than their white counterparts, and experience worse pandemic-related outcomes than white people. Moreover, children from communities of color bear the greatest burden of caregiver loss to COVID-19-related deaths. Indeed, the COVID-19 pandemic has exposed and exacerbated deep racial health inequities that are particularly stark in the field of addiction. As U.S. overdose death counts continue to skyrocket, overdose rates are increasing fastest among Black Americans and Native American/Alaska Native women, although overdose numbers remain highest among white people.

Shortly after COVID-19 mitigation guidelines were released, NIDA issued a Notice of Special Interest for research on the intersection of COVID-19 and SUDs and is funding research under this and other NIH funding opportunities. This includes basic research on SARS-CoV-2 transmission and infection; impacts of the COVID-19 pandemic on people who use drugs and on child and adolescent development; effects of pandemic-related policy changes on SUD treatment; research to expand COVID-19 testing and vaccine uptake among underserved populations, including those with SUDs; and research aimed at understanding and addressing vaccine hesitancy, comorbid and co-occurring medical and psychiatric conditions, and many others. Under an NIH-wide program, NIDA is also leading research to detect SARS-CoV-2 in wastewater, a project that takes advantage of NIDA expertise developed through research to detect the presence of drugs in wastewater.

## Sources

8. [pubmed.ncbi.nlm.nih.gov/31783934/](https://pubmed.ncbi.nlm.nih.gov/31783934/)
9. [pubmed.ncbi.nlm.nih.gov/31688891/](https://pubmed.ncbi.nlm.nih.gov/31688891/)

## Priority Scientific Area #2: Develop and Test Novel Prevention, Treatment, Harm Reduction, and Recovery Support Strategies

Developing evidence-based interventions to prevent substance use initiation or escalation to SUDs, treat those who have already developed SUDs, reduce adverse outcomes associated with drug use, and support long-term recovery of people following treatment are top priorities for NIDA research. To speed progress toward these goals, interventions must not only be feasible and cost-effective to implement but they must also be informed by the lived experience of the people who will benefit from them. Given the increasingly contaminated illicit drug market, it is more urgent than ever to prevent, or even delay, early drug experimentation to reduce the risk of adverse outcomes.

A similar harm reduction mentality should apply to drug treatment and recovery. While abstinence may be a goal for some individuals in SUD treatment, approaches that reduce use, minimize harms, and address related symptoms can contribute in important ways to improving health and quality of life. NIDA will continue to support research to evaluate effective harm reduction approaches, such as preventing and reversing drug overdoses as well as mitigating the spread of HIV and other infections. Further, there is an urgent need for science to inform evidence-based approaches to recovery support, which can take multiple forms and may require different supports at different times—from behavioral coping strategies to secure housing, employment, and transportation. Prevention, harm reduction, treatment, and recovery are all central to national and community-level efforts to address the current drug crisis, and NIDA is committed to advancing innovative research in each of these areas.

Expand All

Goal 2.1: Develop and test novel strategies for preventing drug use, SUDs, and their consequences

Decades of NIDA-supported research have illuminated biological, developmental, and social-environmental factors that increase the risk of substance use as well as the many factors that can be protective. Knowledge about risk and protective factors has informed the development of an array of effective interventions for preventing substance use initiation and the transition from use to SUDs.

Early substance use can create problems in school and with family, make it difficult to meet the increasing demands of maturation, and increase the risk of developing SUDs as a young adult. Data show that some effective interventions can be delivered in early childhood and even during the prenatal period (e.g., nurse home visitation of pregnant women). Because substance use often begins during adolescence and young adulthood, this is also a critical period for prevention. Indeed, for youth, prevention interventions aimed at reducing risk, promoting resilience, and identifying and addressing substance misuse at an early stage can have effects that go well beyond reducing later substance use to encompass many other behavioral health benefits. Moreover, longitudinal studies that track the effects of preventive interventions across the lifespan and even across generations evince the long-term positive impact of preventive approaches early in life. NIDA has a robust prevention portfolio and leads programs within the NIH [Helping to End Addiction Long-Term<sup>®</sup> \(HEAL\)](#) Initiative focused on preventing opioid use or escalation to OUD among students in school settings and in justice settings where substance use is a significant factor for reinvolvement with the legal system.

Preventive interventions can also be effective for other groups, including adults and pregnant women. Yet despite strong evidence for the effectiveness of individual-, family-, and community-level prevention strategies, relatively few such interventions have been widely adopted or faithfully implemented, and thus their potential to positively impact public health has been limited. Further, research shows that how a program is implemented can determine its effectiveness and that prevention interventions must be tailored to meet the needs of specific populations in various settings. Therefore, NIDA is prioritizing research on new interventions to target these factors in diverse systems, including education, human services, and health care, where there is greater potential for uptake, scalability, and sustainability.

We've got to create spaces in our schools where we can train people to talk to our children, because they want to talk... When I shut my mouth and open my ears, these kids tell me what they need. Until

## Key Focus Areas

- Identify and target pathways or mechanisms for preventing substance use and SUDs, including those common to SUDs and other mental illnesses, across the lifespan.
- Develop interventions that enhance resilience and buffer against stressors to prevent substance use and promote healthy behavior across the lifespan.
- Develop and evaluate preventive interventions in settings where they are intended to be delivered to decrease the research-to-practice gap.
- Evaluate the sustainability of prevention interventions.
- Develop interventions for populations who are at especially high risk for drug use and SUDs.
- Develop interventions to prevent the progression of substance use to more harmful use or SUDs.
- Support studies to address knowledge gaps identified by the [U.S. Preventive Services Task Force](#), including research on screening and interventions for unhealthy drug use.

we can start just asking 'Why?' and not 'What's the matter with you?' we're not going to solve it. And I think the school is the best place to solve this." - Michelle Lipinski, Principal at a Recovery High School

### Goal 2.2: Accelerate the science of harm reduction

Abundant research shows the value of interventions and services aimed at reducing harms associated with drug use. Overdose deaths are significantly reduced in communities that distribute naloxone to people who use drugs and to their families or other potential bystanders, and syringe-services programs (SSPs) reduce the spread of HIV and other infectious diseases like HCV, and they help link people to addiction and infectious disease screening and treatment.

NIDA supports extensive research on SSPs, including on the expanded provision of sterile syringes, HIV/HCV testing and linkage to care, and integrated pre-exposure prophylaxis (PrEP) delivery and highly active antiretroviral therapy (HAART) to reduce HIV/HCV transmission as well as to prevent overdose. Through the [HEALing Communities Study](#), researchers are using novel community-based approaches to deliver opioid treatment and overdose education, combined with naloxone distribution to prevent opioid overdose. Other studies are exploring

models to initiate buprenorphine maintenance treatment in SSPs, implement SSPs in rural communities vulnerable to opioid injection-related HIV outbreaks, and examine whether integrated health services delivered through mobile clinics improve outcomes for both HIV and SUDs. Still other studies are examining the effects of harm reduction policies on public health. NIDA will continue to support research to examine how best to implement effective harm reduction strategies and to explore the effectiveness of novel approaches such as overdose prevention centers and drug-checking technologies.

## Key Focus Areas

- Identify and address individual-, policy- and system-level barriers to harm reduction services.
- Evaluate the effectiveness and safety of novel harm reduction approaches such as overdose prevention centers and drug-checking technologies.
- Determine the effectiveness of harm reduction education and service provision in novel settings.
- Develop and evaluate harm reduction strategies for stimulant use disorders and polysubstance use.
- Evaluate the role of stigma and other social determinants of health on harm reduction services.

### Goal 2.3: Expand the range of treatment options for SUDs and their consequences

NIDA supports research on pharmacological and non-pharmacological approaches for treating SUDs and overdose, including the development of medications, immunotherapies, digital therapeutics, neuromodulation, and behavioral treatments. This work has led to several effective interventions, including the nasal formulation of naloxone to reverse opioid overdose; buprenorphine and naltrexone, which along with methadone, are FDA-approved medications for treating OUD; lofexidine to treat the symptoms of opioid withdrawal; and nicotine replacement

"I am... in recovery and one reason I am alive today is because of Narcan/Naloxone. I am able to share my story of addiction and my recovery because Naloxone gave me a second chance at life." -  
Christina, individual in recovery

therapy, bupropion, and varenicline for treating tobacco use disorder.

Despite these successes, a much wider array of treatments for SUDs and overdose is still needed. Due in part to the complex nature of addiction and the unique needs of patients, medications for OUD and tobacco use disorder do not work for everyone who needs them. Moreover, no FDA-approved medications exist for stimulant use disorders, cannabis use disorder, or concurrent SUDs, making these important areas of research focus. Developing new overdose-reversal drugs that are effective against fentanyl and opioids used in combination with stimulants and other drug will also be vital for combating the drug overdose crisis. In addition to exploring novel therapeutic strategies—including the use of psychedelic, cannabinoid, and kratom compounds as potential SUD treatments, NIDA will continue to support research to repurpose existing FDA-approved compounds as SUD treatments, an approach that could significantly expedite the drug development process (see callout box below, *“Medications Development for Opioid and Stimulant Use Disorders and Overdose”*)

Non-pharmacological treatments are also valuable, alone and in combination with medications, and decades of NIDA-supported research have led to the development of effective interventions. For example, NIDA-funded research established the efficacy and cost-effectiveness of contingency management for methamphetamine use disorder, led to the first “digital medicines” to receive FDA approval for the treatment of addiction, and supported the development of other commercial products to intervene on SUDs and their consequences (see table “Health Technologies Developed with NIDA Support”). NIDA is also leveraging neuromodulation techniques, such as transcranial magnetic stimulation, direct current stimulation, peripheral nerve stimulation, and deep brain stimulation, to develop treatments for reducing cravings, withdrawal, and drug use.

"Buprenorphine saved my life. I struggled with heroin for 16 more years than I wanted to, until I found buprenorphine. I'm a huge believer in it." - David, person in recovery and advocate

## Medications Development for Opioid and Stimulant Use Disorders and Overdose

While effective medications exist for OUD (e.g., buprenorphine, methadone, naltrexone), these medications are underutilized. Suboptimal patient retention in treatment regimens, policy barriers that limit prescribing, and stigma around opioid agonist medications all contribute to their underutilization. More options are needed to help people with OUD achieve long-term recovery, and NIDA is funding innovative projects to develop improved formulations, such as extended-release methadone and buprenorphine that could improve treatment retention, reduce diversion, and help address the stigma associated with medications for OUD. In addition, NIDA is supporting basic science research that could lead to novel pain management medications with reduced addiction liability.

NIDA leads the [Novel Therapeutic Options for Opioid Use Disorder and Overdose program](#) with funding from the NIH HEAL Initiative®, which has already resulted in more than 30 Investigational New Drug applications filed with the FDA and authorized for human studies. These studies focus on a variety of drug targets as well as vaccines and monoclonal antibodies. Others are repurposing existing medications for OUD indications, such as the FDA-approved insomnia medication suvorexant, based on known overlaps between brain signaling systems involved in sleep and addiction. Due to the increased prevalence of fentanyl in the United States and its uniquely dangerous properties, NIDA is leading research to develop treatments specifically for fentanyl addiction and overdose, including a vaccine to prevent fentanyl from entering the brain. Research into non-opioid medications is also ongoing to increase available treatment options, with a new focus on polysubstance use to address the reality that most people with OUD also use other substances.

Overdose deaths involving stimulants continue to climb, yet there are currently no FDA-approved medications for stimulant use disorders. NIDA's Clinical Trials Network (CTN) demonstrated that bupropion plus naltrexone was effective for reducing methamphetamine use and craving in individuals with moderate to severe methamphetamine use disorder. This is one of NIDA's highest priorities, with current research spanning novel biological targets for new medications, anti-cocaine and anti-meth vaccines, and the repurposing of

existing medications.

As NIDA's portfolio evolves, there are increasing opportunities to make SUD treatment more holistic, nuanced, and dynamic, similar to current approaches for other mental and physical disorders. This includes identifying additional endpoints in clinical trials, beyond abstinence, to define successful treatment. Reducing opioid use, for example, would lessen the risk of overdose even if an underlying OUD persists. Reducing cravings, withdrawal symptoms, depressive symptoms, and anxiety or improving poor sleep are other approaches that could reduce substance use. Treating medical consequences of substance use, such as neonatal abstinence syndrome, is also essential to addressing the addiction public health crisis and is a key priority for NIDA. Developing personalized approaches to treatment that account for individual preferences and needs as they may change over time is also key.

## Key Focus Areas

- Develop new overdose-reversal medications for fentanyl and stimulants as well as devices to detect and rapidly reverse overdose.
- Develop new formulations of existing medications to improve the treatment of OUD.
- Develop novel medications for the treatment of all SUDs and concurrent SUDs, including concurrent alcohol use disorder.
- Advance immunotherapies, including vaccines, monoclonal antibodies, and other biologics.
- Explore neuromodulation techniques, such as transcranial magnetic stimulation, peripheral nerve stimulation, and deep brain stimulation.
- Identify and validate new patient-centered endpoints for clinical trials, including those that address symptoms of SUDs.
- Develop and evaluate personalized treatments.
- Develop treatment strategies for adolescents across the continuum of care
- Accelerate research on medical consequences of drug use, including neonatal abstinence syndrome, pain, and co-occurring infections.

- Apply cutting-edge data science methods to capture and analyze patient data and develop new diagnostic, prognostic, and clinical decision support tools.
- Develop and test new digital health technologies to deliver novel prevention, treatment, and recovery interventions.

Goal 2.4: Advance the science of recovery support

Recovery from SUDs means different things to different people. Broadly speaking, it is a process of change through which people improve their health and well-being while abstaining from or lessening their substance use or by switching to less risky drug use. For some, this may mean complete abstinence; for others, recovery could be ceasing problematic drug use, developing effective coping strategies, improving physical and mental health, or experiencing some combination of those or other outcomes.

Recognizing that there are potentially many different paths to recovery, NIDA research is exploring numerous recovery strategies, such as family-based support networks for youth, peer recovery support models, virtual reality-based mindfulness, and other digital health approaches, as well as strategies tailored to specific populations and settings. NIDA is also working to enhance infrastructure to study recovery support services by supporting recovery research

networks that include researchers, payors, individuals in recovery, and other stakeholders. The [HEALing Communities Study](#) is implementing training for peer recovery support and enhancing linkages to recovery support services (see callout box, "[Testing and Implementing Evidence-Based Strategies in Diverse Settings](#)"). In addition to developing effective recovery strategies, it

"He was ashamed of his addiction and always thought he could beat it on his own... He used alone and died alone." - Betsy, mother who lost son to overdose.

"After 20 years of keeping secrets, recovery did not automatically start when I got sober. I had to start opening up about it." - David, individual in recovery

"The stigma of having a child struggling with addiction caused us to withdraw rather than seek help. We learned how to live life with the truth hidden in the back of our hearts." - Darlene, mother who lost son to overdose.

is necessary to address stigma, racial inequities, housing instability, legal system barriers, and other barriers that keep people with SUDs from receiving the ancillary services and care that they need to achieve and sustain long-term recovery.

## Key Focus Areas

- Understand the mechanisms by which recovery support groups exert their effects.
- Support research on different pathways by which people recover from SUDs.
- Incorporate a broader range of clinical outcomes in recovery research beyond abstinence and reduced drug use, such as improved quality of life and health or reduction in risk behaviors and medical consequences.
- Develop and refine research methods for evaluating recovery support services, and support research on the efficacy of these services.
- Develop novel interventions for sustained recovery that target factors that increase vulnerability for relapse.
- Investigate the impact of stigma and other social determinants of health on recovery.

## Priority Scientific Area #3: Accelerate Research on the Intersection of Substance Use and HIV

Substance use plays a significant role in HIV transmission and health outcomes for people living with HIV. The opioid crisis has been associated with marked increases in the number of people who inject drugs in the United States. This has resulted in several localized HIV transmission hot spots, driven by risky injection practices, poor support for syringe exchange programs, and limited access to OUD treatment. In addition, the resurgence in the use of psychostimulants, including methamphetamine, is associated with high-risk sexual behaviors that increase HIV infection.

NIDA has long recognized the intertwined nature of substance use and HIV and for decades has supported innovative and multidisciplinary research in this area through traditional funding mechanisms, and through the Avant-Garde Award Program for HIV/AIDS and Substance Use

Disorder Research and the Avenir Award Program for Research on Substance Use Disorders and HIV/AIDS, to drive exceptional research. These mechanisms encourage cutting-edge, high-risk, high-payoff research with the potential to open new avenues of science and/or lead to breakthroughs in HIV/AIDS prevention and treatment interventions for people using drugs.

This work has led to significant scientific advances, including a seminal study demonstrating that scaling up HIV treatment in people who inject drugs results in reductions in community-level viral load and HIV transmission, and the finding that addiction treatment, especially medications for OUD, is a necessary part of HIV care for those with SUDs and leads to reduced viral load, increased infection-fighting CD4 cell count, and greater retention in HIV care.

Despite scientific advances, rates of HIV in the United States and globally remain unacceptably high. Additional research is needed to understand the relationship between HIV, substance use, and SUD. This includes research to improve surveillance of HIV and its relation to drug use practices; mechanistic studies to determine how substance use affects HIV transmission and progression; development of combination therapies for HIV and SUDs; and identification and implementation of strategies scaling up evidence-based interventions, including SSPs and improved access to medications for OUD and HIV in diverse settings.

Expand All

Goal 3.1: Increase understanding of the etiology, pathogenesis, spread, and persistence of HIV/AIDS among people who use drugs

It is imperative to identify mechanisms by which drug use interacts with HIV to affect disease progression and pathology. For example, while HAART has reduced the prevalence of HIV-associated dementia, milder forms of neurological complications occur in people living with HIV, and emerging evidence suggests a relationship between drug use and accelerated or more severe nervous system complications in the presence of HIV. We also know that inflammation and immune activation are consequences of drug use and key drivers of neurological disorders and psychiatric comorbidities linked to HIV. Both HIV and HAART have been shown to alter gut microbial composition and thereby influence inflammation and immune activation in HIV-infected individuals. NIDA is focused on expanding knowledge to better understand how drug use, SUDs,

HIV, HAART, and treatment for SUDs impact neuroinflammatory processes. Such research has the potential to yield new therapeutic targets and enhance treatment outcomes in people living with HIV and SUDs.

NIDA also encourages research in the areas of systems biology, epigenomics, nucleomics, and transcriptomics to address important questions related to mechanisms of HIV persistence in the presence of drug use or SUDs. Little is known about the impact of drug use on HIV reservoirs, including how drugs modulate epigenetic mechanisms that regulate HIV latency in the brain and lymphoid tissue, making this an important area of investigation. These efforts can provide foundational knowledge for the development of strategies to effectively treat or cure HIV/AIDS in people using drugs. Novel approaches are also needed to develop HIV and SUD drugs that can cross the blood-brain barrier and reach brain targets.

## Key Focus Areas

- Assess the role of drug use in HIV infection and pathology in the central nervous system.
- Determine how drug use or substance use therapies interact with HIV and HAART to affect inflammation and immune responses.
- Elucidate mechanisms by which drug use affects HIV latency.
- Use basic science findings to guide therapeutic strategies.

### Goal 3.2: Prevent new infections and transmission of HIV among people who use drugs and their sexual and/or injection partners

People who inject drugs are more likely to be living with HIV compared with the general population. Indeed, Joint United Nations Programme on HIV and AIDS UNAIDS data based on relative HIV incidence in the global population indicate that people who inject drugs are 22 times more at risk for acquiring HIV. In the United States, the federal [End the HIV Epidemic \(EHE\)](#) initiative includes priorities for expanding evidence-based strategies for HIV prevention and treatment, which are critical for reducing the spread of HIV among people who use and/or inject drugs. The use of HAART—such as tenofovir/emtricitabine—by people who are at elevated risk but do not have HIV is an effective primary prevention strategy for reducing the transmission of HIV. However, little is known about the use of PrEP by people who use drugs; therefore,

developing evidence-based primary and secondary prevention strategies to avert HIV acquisition in this population is a key priority. This includes research to understand the acceptability and access to PrEP among people who use drugs; the extent to which health care providers prescribe PrEP to at-risk people who use drugs; how drug use affects PrEP adherence; how to integrate PrEP into substance use treatment and harm reduction programs; and the feasibility and impact of new long-acting PrEP.

The idea of “treatment as prevention” is an important component of *secondary prevention strategies*. When people living with HIV are on antiretroviral treatment with an undetectable viral load, they have a negligible risk of transmitting HIV to their partners. This awareness informed a HIV care cascade model to facilitate testing, treatment, retention in care, and viral suppression—a model that has also been applied to OUD. Despite evidence that providing HIV and SUD treatment impacts HIV incidence at a population level and enhances the care cascade for people with SUDs, barriers to implementation remain. Moving forward, research approaches will need to focus on developing personalized treatments that meet the needs of patients; retaining and re-engaging people in HIV and SUD care; ensuring that antiretroviral therapy and SUD treatment (including MOUD) are available immediately upon diagnosis; reducing provider stigma, which marginalizes individuals and prevents treatment seeking and retention; and addressing unequal access to treatment to eliminate health disparities. Research is also needed to bring effective interventions to scale across settings where they will be most impactful. NIDA will continue supporting research to support EHE domestically and eliminate HIV transmission globally.

## Key Focus Areas

- Improve access to PrEP and emerging prevention interventions.
- Optimize HIV and substance use care cascades—especially those associated with EHE.
- Develop strategies for reducing stigma by health care providers against people with HIV who use drugs.
- Develop strategies to integrate and scale HIV and SUD care in justice settings and to ensure continued care after transition back to the community.
- Develop approaches to expand HIV and SUD care into hard-to-reach areas, such as rural settings, where access to care is limited.

### Goal 3.3: Address comorbidities and improve health outcomes among people living with HIV who use drugs

SUDs and HIV frequently co-occur with HCV, psychiatric conditions, COVID-19, and other conditions, and research is needed to develop an evidence base for understanding and addressing these comorbidities.

NIDA continues to foster basic research to identify mechanisms that underlie HIV-related comorbidities and use this information to develop therapies that improve the lives of people living with HIV who use drugs. For example, a better understanding of the relationships among comorbid conditions may point to shared biological substrates, environmental influences, and social conditions that could become targets for intervention. As therapeutics for SUDs, HIV, and HCV are developed, testing for interactions between these medications and addictive drugs is important to understand the impact of drug use on HIV/HCV progression, determine drug-drug interactions, and ensure the most effective combination therapy approaches.

Additional research is also needed to determine how best to provide high-quality, integrated care to address drug use, SUDs, HIV, and other comorbidities. Integrated care models are needed to enhance the adoption and integration of effective SUD treatment, including screening, MOUD, and smoking cessation, into HIV care settings. Likewise, research is needed to increase the adoption and integration of effective HIV treatment (including linkage and long-term retention in HIV care) in substance use treatment settings. In both HIV and addiction treatment settings, research is needed to enhance the adoption and integration of treatment services to identify and address other common comorbidities. Organizational and systems-level interventions, and implementation science, can also develop generalizable approaches to deliver integrated care in other settings, including primary care and other general medical settings, mental health care settings, Federally Qualified Health Centers, and the justice system. Finally, developing effective ways to modify social determinants of health are needed to fully address HIV, substance use, and co-occurring conditions.

### Key Focus Areas

- Identify common underlying mechanistic substrates for neurological comorbidities.
- Understand interactions of drug use, HIV/AIDS, HCV, and medications used in treatment.
- Elucidate mechanisms by which drug use affects clinical outcomes in HIV, including progression and mortality.
- Develop integrated models to address SUDs, HIV, HCV, and other comorbidities in multiple health care and community settings.

## Priority Scientific Area #4: Study the Implementation of Evidence-Based Strategies in Real-World Settings

Although effective interventions exist for preventing and treating substance use and SUDs, their reach has been limited. Only 11 percent of people with OUD receive one of the three medications approved by the FDA to treat it. To scale up research-based interventions in diverse settings, it is essential to understand and address the many individual, cultural, societal, and system-level factors that promote or impede prevention, treatment, and recovery. To this end, NIDA supports a portfolio of implementation research informed by stakeholder input to bridge the gaps among research, practice, and policy. Through this portfolio, NIDA is advancing scientific knowledge about how health information, effective interventions, and new clinical practices, guidelines, and policies can be optimally integrated and communicated across settings—including primary care, emergency departments, pharmacies, and community and justice settings—to ensure continuity of care.

Expand All

Goal 4.1: Study approaches to improve the integration of SUD care into medical practice

"There is a newer group of doctors throughout the country that have a much better understanding of SUD

Despite the progress that has been made in recognizing addiction as a treatable medical disorder, addiction care remains isolated from other aspects of health care, ranging from primary care where comorbid somatic conditions like HIV/HCV are treated to specialty care for other mental illnesses. As a result, health care providers often fail to detect early treatable symptoms of SUDs or recognize individuals with SUDs and refer them to needed specialty care. This segregation of care can also result in difficulties paying for effective treatment.

and how it should be treated, versus old-school tough love and 'just say no.' It's refreshing to see, and there is hope. Medication treatment should be the Gold Standard, without judgement." - Shawn, individual in recovery

NIDA's portfolio in implementation science includes studies focused on increasing access to SUD care by better integrating it into medical practice. Through NIDA's Clinical Trials Network, NIDA funds studies on strategies for incorporating SUD screening and management into settings such as emergency departments and primary care (see callout box below [\*Testing and Implementing Evidence-Based Strategies in Diverse Settings\*](#)). Given the complex nature of addiction, NIDA funds trials testing models of collaborative care. Collaborative care is a service delivery model that facilitates the provision of behavioral health treatment in primary and specialty care through a treatment team comprising the primary care or specialty care provider, a care manager, and a behavioral health specialty consultant. NIDA also supports studies that examine how best to integrate SUD care into the insurance and reimbursement process, including those that allow researchers to take advantage of opportunities arising from health care reforms, such as insurance reimbursement mandates and laws authorizing practitioners with a broader array of credentials to provide substance use treatment.

## Key Focus Areas

- Evaluate the integration of substance use treatment with general medical care, including primary care, emergency services, and other specialty care.
- Develop and test innovative and pragmatic treatment models that have high potential for adoption and sustainability, including engagement of pharmacists, dentists, and nurses.

- Determine the effectiveness of adjuncts to clinical care to improve treatment engagement and outcomes.
- Evaluate optimal telehealth delivery and care models that ensure quality and equity.
- Evaluate the effectiveness of integrated prevention and collaborative care treatment interventions for individuals with SUDs and co-occurring health conditions.
- Study the effectiveness of interventions for managing subthreshold symptoms of SUDs.
- Leverage multiple data sources and artificial intelligence to predict risk and guide clinical decisions for substance use interventions across settings.

#### Goal 4.2 Develop and test strategies for overcoming barriers to access and continuity of care

Barriers to health care services can take many forms, and NIDA is prioritizing research to understand and address these barriers. Some are logistical, such as difficulties accessing care for people who are experiencing homelessness, living in rural communities, or lack reliable access to transportation. Others may involve policy or regulatory impediments that limit or slow the deployment of an intervention. Legal systems pose particular challenges, as evidence-based treatments are often not the standard of practice in prisons and jails.

Stigma contributes to these barriers. Indeed, despite the well-established effectiveness of medications for treating OUD, only a fraction of people with OUD receives them, partly because they have long been stigmatized within health care and even within the addiction treatment world. Other barriers may be the result of discrimination or systemic racism and may require both a systemic intervention and a rebuilding of trust with the affected groups. For example, while the OUD medications buprenorphine and methadone are equally effective, Black and Hispanic/Latinx people are more likely to receive daily at-clinic methadone while white people are more likely to receive oral at-home buprenorphine, a racial inequity that contributes to significant health disparities in treatment and recovery. NIDA is supporting projects to study ways to help underserved populations by connecting individuals to care, with approaches ranging from utilizing telemedicine to leveraging partnerships with schools, legal systems, community organizations, and others.

In addition, even when services are available, they are often fractured. Research demonstrates that people who receive continuity of care (i.e., quality care over time), such as supportive services beyond initial treatment, have better outcomes. Yet, continuity of care is not standard practice, and barriers exist in terms of lack of standard models and insurance reimbursement. It is vital that we establish standards and models of care that meet the evidence needs of payors. This will require development of close partnerships with the Substance Abuse and Mental Health Services Administration, the Centers for Medicare and Medicaid Services, and insurance companies to ensure that measures of success can be tied to reimbursement practices.

## Key Focus Areas

- Evaluate policies for enhancing access to SUD treatment that were implemented during the COVID-19 pandemic, such as increased telemedicine and take-home doses of medications to treat OUD.
- Test the implementation of telemedicine-based approaches and digital technologies for expanding the reach of effective SUD treatment.
- Develop strategies for overcoming barriers to delivering preventive care and treatment for individuals with SUDs and HIV and other infectious illnesses.
- Support research on the effects of racial inequity, cultural differences, and social structures on health disparities in SUD care, and develop tools for ameliorating these disparities.
- Develop interventions to reduce the stigma that impedes access to health care for people with SUDs and co-occurring conditions.

Goal 4.3: Support research to scale up the application of evidence-based interventions for SUDs, including in justice settings

"I have people who are behind me like my probation officer, [who] is crazily understanding. It is really helpful not having to hide and be able to ask for help...." - Amanda,

While effective interventions exist, they are underutilized, not implemented across settings, and not always implemented with fidelity. To

individual in recovery

reduce drug use and addiction and to address patients' other health needs, it is crucial to scale up science-based interventions and extend their reach. NIDA's implementation science portfolio includes studying ways to improve the effectiveness of SUD screening and the quality of treatment in real-life settings, as well as approaches to increase acceptance and adoption of systems-, structural-, and provider-level interventions. For example, NIDA's [Clinical Trials Network](#) supports research on ways to optimize and expand access to current treatments for OUD; the [Justice Community Opioid Innovation Network](#) tests approaches to expand effective OUD treatment in justice settings; and the [HEALing Communities Study](#) is evaluating the implementation of community-based interventions for reducing opioid overdose deaths (see callout box below, "*Testing and Implementing Evidence-Based Strategies in Diverse Settings*").



A critical component of implementing and sustaining effective interventions is sufficient reimbursement via health insurance or public payment. NIDA supports economic research to demonstrate the added value of novel interventions, research on the impact of insurance coverage and benefit design, and research on other aspects of financing on the quality, utilization, and outcomes of interventions. Continued scientific

advancement in these areas will be needed to promote the efficient delivery of care, as new interventions are found efficacious and as novel financing mechanisms are developed. Another key issue affecting effective implementation is understanding which interventions work best for which patients, the intensity of services needed for each patient, and when it might be safe and appropriate to consider stepping down or discontinuing treatment. Such knowledge could enhance patient-centered care, prevent overdoses, and improve the efficiency of care delivery.

## Testing and Implementing Evidence-Based Strategies in Diverse Settings

Effectively providing services across health care, legal, and community settings is key to addressing SUDs and is the most promising way to improve access to treatment. NIDA provides major infrastructure for research in these settings through our [Clinical Trials Network \(CTN\)](#), [Justice Community Opioid Innovation Network \(JCOIN\)](#), and [HEALing Communities Study](#).

NIDA's CTN allows medical and specialty treatment providers, treatment researchers, patients, and NIDA to cooperatively develop, validate, refine, and deliver new treatment options to patients. The CTN comprises 16 research nodes across the country in academic medical centers and large health care networks, and more than 240 community-anchored treatment programs. The CTN is conducting studies to evaluate strategies for integrating OUD screening and treatment into emergency departments, primary care clinics, infectious disease programs, and rural and American Indian/Alaska Native communities. It tests alternative models of care for SUDs, such as the use of pharmacies for delivering medication for OUD and the integration of digital tools to support and facilitate treatment. The CTN also leverages big health care data (e.g., electronic health record systems data) to create new clinical decision support tools.

NIDA's JCOIN, funded through the NIH HEAL Initiative<sup>®</sup>, is testing strategies to expand effective OUD treatment and care for people in justice settings in partnership with local and state justice systems and community-based treatment providers. JCOIN includes a national survey of addiction treatment delivery services within justice systems; studies on the effectiveness and adoption of new medications, prevention and treatment interventions, and technologies; use of existing data sources in novel ways to understand SUD care in justice settings; and research on COVID-19 testing protocols in carceral settings where the risk of SARS-CoV-2 transmission is high. JCOIN is generating real-world data to inform policies and practices to reduce opioid use upon re-entry, a significant risk factor for overdose and a major predictor of reinvolvement with the legal system.

The HEALing Communities Study, also funded through the NIH HEAL Initiative<sup>®</sup>, is implementing coordinated approaches, tailored to the needs of local communities, to prevent and treat opioid misuse and OUD. Research sites are partnering with 67 communities highly affected by the opioid crisis in four states to measure the impact of these efforts and reduce opioid-related overdose. The HEALing Communities study includes a diverse communications campaign to increase awareness and demand for evidence-based practices and to reduce stigma against people with OUD and those taking medications for OUD.

## Key Focus Areas

- Determine the effectiveness of evidence-based interventions for treating OUD and preventing opioid overdose implemented in medical, justice, and community settings.
- Build capacity to conduct addiction treatment research in legal- and community-based service settings.
- Develop approaches for scaling up effective harm reduction strategies.
- Encourage efforts to develop the addiction treatment and research workforce across practice settings.
- Develop and evaluate approaches to address barriers to SUD treatment uptake, access, and sustainability.
- Inform and assess the effects of novel coverage, benefit, and other financing strategies designed to improve care quality, access, and delivery.
- Conduct research to determine individual characteristics that predict outcomes associated with various OUD treatments.

## Priority Scientific Area #5: Translate Research into Innovative Health Applications

NIDA has been a leader in leveraging the power of small-business innovation to develop new tools and technologies for preventing, diagnosing, and treating drug-related problems and for advancing research. Through significant investment in its Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, NIDA has supported the development of FDA-regulated therapeutic and diagnostic devices, mobile health and general wellness products, research tools, and health information technology solutions. In some cases, NIDA’s role involves helping academic scientists better understand how to turn a promising finding into a product ready for commercialization. In other cases, NIDA supports small businesses that are in a position to create such technologies but may not be aware of their potential to help with problems related to drug use and addiction. Sometimes, startups have already developed and marketed a technology for a different health care purpose; modifying these technologies to serve the needs of people with SUDs has great potential to benefit this famously underserved patient population. NIDA supports this work through targeting investment in projects with translational potential, facilitating partnerships with public and private stakeholders, and promoting translational research education and training. NIDA also maximizes the impact of its research by working directly with diverse stakeholders to disseminate research findings and facilitate the rapid uptake of evidence-based practices and policy.

Expand All

#### Goal 5.1: Facilitate research translation through education and partnerships

Although there has been tremendous growth in the addiction science workforce, the traditional training academic researchers receive does not always prepare them to transform their research into a usable product—the “development” piece of “research and development.” Therefore, NIDA invests in education and training programs to equip scientists with the competence to turn their ideas into products. For example, NIDA offers an intensive training course to teach entrepreneurship and product development skills through case studies and dynamic presentations from leaders in the SUD field. Through the [NIDA Challenges Program](#), the [“Start a SUD Startup Challenge”](#) is a Shark Tank-style opportunity that provides technical assistance and mentorship as part of a larger award aimed at helping winners determine whether their research ideas can be fostered into a biotech startup. In addition, NIDA offers a comprehensive suite of other resources to help small businesses improve the commercial success of products, obtain training and technical assistance, and locate other resources and funding.

Effective partnerships are also an essential component of translational research. NIDA helps connect researchers with collaborators, including investigators from other fields, health care providers and payors, other federal agencies, not-for-profit organizations, and people with lived experience with SUDs and their families. NIDA is committed to incorporating the perspectives of people for whom the products are intended and the contexts in which they will be used into how we prioritize, design, and report our research. For example, through the [“Mapping Patient Journeys in Drug Addiction Treatment Challenge,”](#) launched in partnership with the Foundation for the National Institutes of Health, NIDA solicited the creation of actionable patient journey maps to further the understanding of the obstacles that patients face in getting treatment for drug addiction. The maps are intended to identify specific points in the process where patients encounter the most difficulty, enabling NIDA to focus new research efforts on alleviating those areas of difficulty. NIDA will continue to foster partnerships to bolster research on all aspects of drug use and addiction.

## Key Focus Areas

- Incorporate patient perspectives into research to facilitate its adoption into practice.
- Leverage and expand strategic alliances in areas of product development, entrepreneurship, and innovation.
- Provide educational opportunities for the addiction science workforce in translational research, product development, and commercialization.
- Offer NIDA expertise in helping researchers navigate developing research into products.
- Develop, establish, and maintain collaborative relationships with organizations that sponsor collecting addiction-related data or host related data repositories.

Goal 5.2: Capitalize on new technologies to deliver prevention, treatment, and recovery interventions

"With this app, I can talk about what I feel or ask for help for anything and not feel dumb doing it." - Mary, individual in recovery

In recent years, personal devices and other digital technologies have created many new possibilities for delivering and facilitating interventions that could never have been envisioned before. Each year, through its SBIR and STTR programs, challenges and prize authorities, and other innovative funding opportunities, NIDA awards funding to assist with startup projects at various stages of product

development and company growth, from ideation to product development and sales and beyond. These products not only make a difference in the lives of the people who use them but they also become a resource to other small businesses seeking to follow a similar path or working in similar subject areas. NIDA has worked directly with small businesses to help them develop innovative and potentially transformative technologies based on NIDA-funded science and helped connect startups with venture capitalists able to provide funding. The results of these efforts have been a raft of new devices, smartphone apps, and other innovations that are improving the lives of people with addiction, potentially even saving lives (see table below *"Health Technologies Developed with NIDA Support"*). NIDA will continue to leverage its unique funding streams to spur innovation among academic scientists and small businesses and translate research into clinically meaningful and innovative health care and consumer products.

"I just want to say that having recovery support through technology is awesome. I am 14 months sober and it's been a long road but it's worth it to continue on my path of recovery." - Rocky, individual in recovery

## Key Focus Areas

- Develop technologies for safe and controlled methadone dispensing for use at home.
- Advance the development of medical devices for SUD applications.
- Develop digital health technologies to address stigma and other social determinants of health in the context of SUDs.
- Develop novel technological approaches for investigating, diagnosing, and certifying deaths related to drug overdose.
- Develop methods to facilitate detection of emerging substances.

- Develop and assess the efficacy and effectiveness of digital therapeutics to improve patient engagement and retention in treatment.
- Investigate computational psychiatry approaches that integrate multiple data sources and methods to study the digital phenotyping of people who use drugs and to optimize treatment delivery.

Health Technologies Developed with NIDA Support

Company	Product Description
<a href="#">AppliedVR</a>	RelieVRx™ is an FDA-approved virtual reality-based tool to treat people with chronic low-back pain by helping them learn how to better cope with pain. The goal is to reduce the need for opioids for many different pain indications and reduce the associated risk of developing an OUD.
<a href="#">Biobot Analytics</a>	Biobot developed a wastewater testing and analysis method to detect community exposure to opioids that could inform local opioid response efforts.
<a href="#">Boulder Care</a>	NIDA funded the research to test the usability, efficacy, and commercial utility of a digital platform to deliver comprehensive treatment for OUD.
<a href="#">Invistics</a>	Flowlytics is cloud-based data analysis software that allows a health care facility to track its inventory of controlled substances, such as opioids, helping to prevent drug theft (also known as drug diversion). The patented software can detect potential drug diversion incidents earlier than previous methods.
<a href="#">Prapela</a>	Prapela™ is a hospital bassinet pad that delivers gentle, random vibrations to treat newborns who were exposed to opioids before birth. The bassinet pad helps improve newborns' breathing and heart rate and may also be useful for infants with breathing issues due to premature birth.
<a href="#">Pear Therapeutics</a>	ReSET-O® is now a prescription digital therapeutic that provides behavioral therapy to individuals with OUD via a mobile app.
<a href="#">Spark Biomedical</a>	The (formerly known as the Roo™) was developed as a wearable brain stimulation device to treat babies born dependent on opioids. The device is designed to reduce symptoms such as distress, seizures, and digestive problems, and the company has recently expanded this to The Sparrow Therapy System to treat people experiencing opioid withdrawal.
<a href="#">Sound Life Sciences</a>	SecondChance is inaudible sonar pulses to detect changes in a person's breathing that may indicate a drug overdose or monitor other clinical indications. When the app detects changes in breathing, it has an emergency mode that is triggered to alert the patient's caregivers and health care providers.

Company	Product Description
<a href="#">Woebot Health™</a>	Woebot is a smartphone-based mental health chatbot that uses artificial intelligence and language processing technology to deliver personalized cognitive behavioral therapy for people with SUDs. Woebot is available 24 hours a day, 7 days a week and is being expanded for use in additional mental health indications.
<a href="#">We the Village</a>	We the Village provides online support for families or friends of someone who is struggling with substance use or has SUD. The online support includes a course that aims to teach people communication and support skills and an online Q&A to help people share what they've learned, with the overall aim of helping loved ones reduce substance use and get treatment.
<a href="#">Workit Health</a>	The Workit Health app uses video chat and messaging technology to bring trained experts directly to those with SUDs via a phone or computer. The company is working to develop a chatbot to improve patient engagement and is continually working to expand its services to treat additional disorders and co-occurring conditions.

## Scientific Stewardship Priorities

Scientific stewardship priorities describe how NIDA, as a federal agency, is accountable for the investment of public funds it receives. The Institute will continue to support a diverse research portfolio, the advancement of a diverse workforce, and rigor and reproducibility in the science we support. In addition, collaborations with public and private partners and effective communications strategies will enable NIDA research to inform policy and improve practice.

## Setting NIDA Research Priorities

NIDA supports a diverse portfolio encompassing basic, translational, clinical, epidemiological, policy, and systems-level research. In each of these domains, NIDA balances investigator-initiated research—allowing the Institute to capitalize on the most meritorious scientific ideas—with targeted research support to address emerging public health needs, take advantage of new scientific opportunities, and address key research gaps. NIDA research priorities are established in accordance

with NIH and Administration goals and with input from its leadership and staff, the National Advisory Council on Drug Abuse, the extramural research community, patients and families, and other public and private partners.

## Fostering Collaboration with Public and Private Partners

Addiction science can achieve maximum public health impact only through strong, strategic collaborations. NIDA has established effective partnerships with diverse stakeholders, including scientists from disparate fields, pharmaceutical and biotechnology companies, health care providers and payors, public health and community organizations, policymakers at all levels of government, people with lived experience of addiction, and others. NIDA works closely with the White House Office of National Drug Control Policy (ONDCP) on a range of issues, including development of the National Drug Control Strategy and Methamphetamine Response Plan. NIDA has also worked with ONDCP, the Drug Enforcement Administration (DEA), and FDA on a legislative proposal to facilitate obtaining a DEA Schedule I research registration, which, if adopted, would make it easier to conduct research on controlled substances.

NIDA has additional extensive collaborations across the U.S. Department of Health and Human Services (HHS). In addition to co-sponsoring the long-term PATH study, NIDA works with the FDA to explore opportunities to advance medical product development. NIDA's HEALing Communities Study is a close partnership between NIDA and the Substance Abuse and Mental Health Services Administration, which helps ensure that research is optimally poised to impact service delivery in order to reduce the impact of the opioid crisis in hard-hit areas. NIDA consults with the Centers for Medicare and Medicaid Services to identify evidence gaps in which research could inform coverage decisions, with priorities to build the evidence base on emergency department-focused strategies, non-pharmacological treatments, and other interventions for improving OUD care. Other partnerships include collaborations to improve the legal system response to people with SUD; community partnerships to enhance prevention and treatment; pharmaceutical industry partnerships to develop novel pharmacotherapies and devices; and collaborations among researchers, medical and treatment providers, patients, and NIH staff to develop, evaluate, and implement new interventions.

NIDA also recognizes that the problems associated with substance use know no boundaries and that every nation is affected by them. NIDA strengthens and stimulates international addiction research

networks through binational agreements; collaborations with intergovernmental organizations, including the United Nations Office on Drugs and Crime and the World Health Organization; and collaborations with international civil society organizations representing researchers, practitioners, and others. NIDA is committed to bolstering these partnerships and exploring new ones to ameliorate the impacts of substance use on individuals, families, and society.

## Communicating Research to Inform Policy and Practice

Communications with diverse audiences may improve the prevention and treatment of SUDs by enhancing public awareness about the causes of drug use and addiction and how they affect individuals and communities, emerging drug threats, vulnerable populations such as pregnant women and adolescents, and evidence-based interventions. Indeed, effective communications are essential to helping individuals, policymakers, and practitioners make evidence-based decisions. Leveraging traditional media and social media, in particular, can help change conversations to help people better understand drugs and addiction, and help alleviate the stigma that impedes efforts to improve health and well-being. Building trust and receptivity to accurate messaging is essential for the widespread adoption of research-based health guidance. NIDA reaches its global audience through tailored public-facing communications and by working with journalists, partners, and other national and community organizations with the ability to disseminate evidence-based messages broadly.

## Management and Accountability

### Supporting a Cutting-Edge Research Infrastructure

NIDA's support for research infrastructure includes dedicated Centers to support data collection, storage, and new methodologies and analytical tools; centralized core facilities that provide shared access to instruments, technologies, expert consultation, and other services to scientists and clinicians; and mission-driven partnerships with other relevant community, institutional, or governmental stakeholders.

### Promoting Workforce Development

NIDA values every member of its workforce and will continue to provide opportunities for staff members to grow their scientific, technical, and leadership skills and to be recognized for outstanding performance. In addition, NIDA is taking important steps to identify and eliminate harassment, discrimination, and racism in the workplace through listening sessions, surveys, staff education, and procedures to help staff members talk about their experiences (see callout box, "[NIDA's Racial Equity Initiative](#)").

## Reducing Administrative Burden

NIDA aims continually to streamline its business processes to enhance administrative efficiency while ensuring quality, consistency, and accountability. By conducting workflow analyses and utilizing standardized procedures, the Institute can adapt to shifting external and organizational needs.

## Managing Risk

NIDA strives to proactively identify and mitigate external and internal risks. Working with HHS and NIH leadership, NIDA will continue to evaluate its operations and programs to ensure appropriate management and evolve its risk-management procedures to quickly respond to emerging situations.

## Strategic Planning Process

The strategic planning process was coordinated by NIDA's Office of Science Policy and Communications. The process began in 2020 with a pre-planning phase during which Institute leadership identified broad priority scientific areas and the overall framework for the strategic plan. Listening sessions were then held with representatives from each of NIDA's Offices, Centers, and Divisions to identify research gaps and opportunities. Based on these internal consultations, an initial outline was developed and approved by NIDA leadership. In June 2020, NIDA issued a Request for Information (RFI) for public feedback on the initial outline, and more than 100 unique responses were received from a broad range of stakeholders, including private citizens, academic researchers, advocacy organizations, and professional societies. Key topics that emerged included health disparities, underrepresented populations, comorbid/co-occurring conditions, stigma, policy, and treatment models. In parallel with the release of the RFI, NIDA partnered with the Addiction Policy Forum to solicit quotes from people with lived experience for inclusion in the strategic plan. In 2021

and 2022, the strategic plan was drafted and reviewed by NIDA Offices and Divisions. The plan was submitted for review to the members of the National Advisory Council on Drug Abuse in June 2022. Their feedback and additional feedback from NIDA leadership were incorporated thereafter, and the final FY 2022-2026 NIDA Strategic Plan was released on September 21, 2022.